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## EDITORIAL

**Uchita de Zoysa**

Centre for Environment & Development

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# Millennium consumption goals: a fair proposal from the poor to the rich

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## Introduction

In preparation for another Earth Summit in 2012, Professor Mohan Munasinghe, a former vice-chair of the Intergovernmental Panel on Climate Change, has proposed establishing the Millennium Consumption Goals (MCGs) for the rich on the planet. This proposition has already gained considerable international support and the MCG Initiative is now gathering momentum in the United Nations and at many subsidiary levels (i.e., country, city, community, enterprise, and even individual) and is being pursued by a broad network of stakeholders from civil society, business, academia, and government.

The proposal states that the Millennium Development Goals (MDGs) were formulated by the United Nations on behalf of the poor and the MCGs would constitute a complementary process to facilitate sustainable development on Earth. The imminent failure of the MDGs in terms of poverty eradication might prompt some to question the value of the MCGs. At the same time, prior efforts to voluntarily regulate the behavior of the overconsuming 20% of the planet's population have not been successful and the MCGs will require serious political willpower and an international mandate to succeed. From another perspective, the MCGs may provide impetus to the MDGs by focusing on managing the consumption patterns of the rich, who continue to deprive the poor of consumption opportunities. In this context, the focus of the MCGs should be not only to shift the consumption of the rich toward sustainability, but also to ensure that the poor have adequate consumption opportunities and the growing consumer classes in the developing nations adopt more sustainable modes of consumption.

## The MCG Proposal

The MCG proposal was officially presented during the first intercessional of the United Nations Conference on Sustainable Development (or

UNCSD2012) in New York in January, 2011. At this time, Munasinghe introduced the proposal as follows:

Millennium consumption goals (MCGs) could help make our development path more sustainable, by focusing on the 1.4 billion people in the richest 20% of the world's population. They consume over 80% of global output, or 60 times more than the poorest 20%. Instead of viewing the rich as a problem, they should be persuaded to contribute to the solution. The MCGs will complement the Millennium Development Goals (MDGs) designed to help the world's poor. The MCGs need not be mandatory targets, but rather a set of benchmarks to be achieved by a combination of voluntary actions.

Munasinghe argues that a major obstacle to sustainable development is unsustainable consumption, production, and resource exploitation by the richest members of the global community, hinting that this is the cause of problems satisfying the MDGs. He continues, indicating that the same consumerist and exploitative behavior is responsible for climate change, which intensifies multiple threats such as poverty, hunger, illness, water and energy scarcity, and conflict.

## Climate Sustainability

Munasinghe provides not only a fair assessment of current challenges, but a welcome argument for climate justice and right-to-development forums. A small group of rich and powerful countries, companies, and people continue to drag the rest of us through great grief toward a dangerous destiny that will have devastating long-term consequences for all. However, the promoters and governors of the prevailing global system are still convinced that growth, capital accumulation, and free markets provide answers for human survival, or at least for the global

elite who largely control the Earth's resources, trade, and capital. The rest, especially the half of the world that lives in poverty, is insignificant in global decision making; the poor only constitute numbers in the system.

In my recent book (de Zoysa, 2009), entitled *It Has to be CLIMATE SUSTAINABILITY*, I argue that the global elite, both North and South, continue to drive the world away from sustainability and toward climate change: "Climate change is a destiny determining phenomenon and all people need to be aware of their rights and responsibilities. But, half of the world's population remains under poverty and is being deprived of their rights towards the basic human needs. Meanwhile, the wasteful lifestyles and irresponsible behavior of the rich and powerful continues to endanger the life of all humans."

### Regulating Consumption

Munasinghe argues that there are many advantages to a set of MCGs as a complementary path to global sustainability. He states,

First, the rich live in both developed and developing countries, so the idea cuts across country boundaries, thus reducing the potential for deadlock due to nationalistic self-interest. Second, since they account for over 80% of consumption and pollution (including carbon emissions), small shifts towards more sustainable consumption can significantly reduce the burden on the environment and free up more resources to raise the consumption of the poor. Third, by relying on influencing the behaviour of large numbers of individual households, the approach has the potential to yield quicker results compared to top down government policies and large, long term industrial investments. Fourth, it mobilizes, empowers and links up sustainable consumers and producers (many of whom operate global supply chains) into a virtuous cycle that could spread quickly.

Several researchers have responded positively to the call for a series of MCGs. Erik Assadourian (2011) from the Worldwatch Institute proposes five goals: halve obesity and overweight rates by 2020; halve the American work week from the current 40+ hours to 20 hours per week; better distribute wealth by raising taxes on the wealthiest; double the use of nonmotorized transport; and guarantee access to health care for all. Philip Vergragt (2011) of the Telus Institute offers ten goals: reduce the area of personal per capita living space by 25%; deep-energy retrofit residential houses to reduce heating and

cooling by 50%; reduce individual driving by 50%; reduce meat and dairy consumption by 80%; cook 80% of meals at home with fresh and possibly local ingredients; reduce working hours by 30%; conserve water by 50%; reduce shopping for new products by 80%; reduce waste by 90%; create progressive taxation of income and assets; create a universally accepted metric for well-being to replace gross domestic product (GDP); and create incentives and policies for living within our ecological and carbon footprint.

These proposals for radical reductions of consumption among the rich are quite acceptable. Yet, the list looks like a set of voluntary commitments by wealthy northern/western consumers and may not bring about the hoped for transformational change. The greatest damage to the planet is by industries consuming natural resources and that needs to be addressed broadly to ensure sustainable consumption.

### Greening the Economy or Sufficiency-based Prosperity?

I am not proposing just greening the existing industrial production system. Such efforts would clearly be insufficient to take us toward a carbon-neutral society and to drive us away from materially wasteful lifestyles. A new green world order has to be more authentic than green labeling and green procurement business; sufficiency-based considerations will need to become more pertinent. Sufficiency can first reduce desire for overconsumption through a state of adequacy and contentment. It can also innovate on indigenous knowledge systems, enabling efficient production with reduced waste, so that communities become more self-reliant and less dependent on external resources.

Current efforts promoting a green economy, too, are making civil society and alternative economic thinkers across the world uneasy. Southern activists for equity and justice and northern thinkers about zero-growth economies are increasingly coming to view recent calls for green-economy initiatives as an attempt to greenwash the prevailing brown economy. The critics also fear that the social pillar of sustainable development may be compromised, leading toward continued poverty and inequity. A "sustainable economy" is herewith proposed to be an economic system that ensures social equity, protects ecological balance, and creates economic sufficiency. In other words, a sustainable economy should replace the current economic order of inequity and excessive consumption that has kept half of the world's people in poverty and created a potential climate catastrophe. The core idea of a green economy, then, should be to enforce sustainability, as in the well-being of all people along with biodiversity. A sustainable econ-

omy, therefore, is a more mindful way forward than greening alone.

### **MCGs for the Poor**

Arguably, the affluent can maintain or improve their quality of life, while reducing environmental burdens and using greener technologies and policies, but the poor cannot be expected to do so. Therefore, the MCGs should apply the principle of equity in consumption opportunities, advocating the rights of current and future generations to access resources. The MDGs do not adequately address these equity dimensions, but instead attempt to provide the basic requirements needed to eradicate dollar poverty, and even that goal is set at only half current levels by 2015.

While multilateral financial and governance institutions continue to assess poverty on economic measures, the millions of communities that live outside official economic structures, in nonformal economies, continue to suffer in poverty. The MDGs need to provide a more comprehensive approach not only to how they seek to address poverty based on economic indicators or standard nutrition and goods-supply targets. They should consider in totality the inequities of a world order that continues to deny a decent quality of life for the poor and strives to eliminate poverty on Earth.

Today, in poverty-ridden communities where access to food is hard to come by, waste dumps are the greatest consolation for the poor. Not only do they seek any form of edible leftovers, but in some African neighborhoods people have found a livelihood as hunters of rats living in urban waste mountains. These rats are caught and placed in small cages and fed with more waste. Once the rats have grown to the size of the cage, they are slaughtered and sold in local markets. In communities where a meal is a struggle, a rat on a plate is a luxury. Poverty-eradication programs cannot simply target goals to elevate the poor from this level to consume the bare minimum for survival or nourishment. They, as well as all humans, should be entitled to similar consumption opportunities within a sustainable development framework.

Poverty is a result of a hypocritical global governance system that has promoted unsustainable production regimes and overconsuming societies. This system rewards exploitation by a few and obstructs access to resources by the majority. Ongoing debates over who is responsible for climate change and who should pay for mitigation and adaptation, where the unconcerned decide human destinies, are pointless.

### **MCGs for Emerging Consumerist Societies**

The rich who reside among the poor in the developing countries, just like the rich in the industrialized nations, are threatening to increase global climate change and to multiply the crises of poverty, hunger, illness, and conflict. The rising consumer classes in the developing countries, especially in emerging market leaders such as China, India, and other Asian countries, will become a serious challenge to global food and resource supplies in the future. They, too, will need consumption goals.

The consumerist and wasteful culture that is so prevalent in the North has already infected the South. The megamalls in south Asia and in countries like Malaysia, Singapore, and Thailand are living examples of how the market induces consumers to feverishly purchase “desire driven wants” more than their “sustainable living based needs.” These malls are parasites that attract us in a subconscious process of buying. The hypermalls and supermarkets—especially in conjunction with advertising—have an amazing power over the human mind, and can induce us into spending on things we do not need and trick us to consume according to the wishes of the market system. Any observer visiting such a gigantic mall would be amazed by the volumes of people flocking daily and hourly and the amount of unwanted consumption that takes place. Rapid economic growth, higher-consumption lifestyles, constant switching to modern and sophisticated technology and equipment, and flashy personal cars have all become indicators and guidelines for newly emerging economies. These are not just impulse actions by the growing number of consumers with purchasing power, but part and parcel of the structural adjustment policies enforced by governments under the influence of the multilateral donor regimes that cater to the agendas of the rich industrialized nations.

The way forward toward prosperity in the emerging nations and societies cannot be through wasteful consumerism. It has to be based on the foundations of sustainable development that can ensure peace, prosperity, well-being, and increased happiness spread more equitably.

### **Voluntary Commitments and Civil Action at Multiple Levels**

In the final analysis, Munasinghe proposes voluntary commitments and civil action to place pressure on governments. He says, “the focus is on setting targets for ACTION NOW by civil society and business, without having to wait for governments, which move glacially. This process also puts pressure

on leaders who lack the political will to act quickly and decisively.”

He further argues that,

[W]hile the initiative is pursued at the United Nations and international levels, progress can be made more rapidly at the grassroots. Many communities, companies, and cities have already announced targets for carbon emissions, energy and water conservation, etc., which constitute their own form of MCGs. Those who take early action will be at a competitive advantage, as we enter a future constrained by resource shortages.

Unfortunately, more voluntary commitments are needed from business, which continues to be the greatest obstacle to sustainable development. Just as the notion of corporate social responsibility has often been used simply as a promotional technique, firms have quickly jumped into advocating for an undefined green economy. Just as they benefitted from adopting small projects to support the MDGs, businesses may voluntarily take part only in the profit and public relations sides of the MCGs. To avoid having the MCGs become another attractive greenwash program for token feel-good action, a clear international agreement is needed. The two most readily accessible pathways are through the United Nations Ten-Year Framework of Programs on Sustainable Consumption and Production (10YFP) due to commence in 2012 and the United Nations Rio+20 Conference next year. The 10YFP, led by the United Nations Environment Program, after nine years of preparatory work has become a major disappointment. The effort has only resulted in loose voluntary commitments by governments and corporations in addition to an unimpressive assortment of conveniently sourced programs in a few parts of the world. The MCGs could serve as an instructive way to enhance the program's value. The Rio+20 process, too, is heading toward a low-commitment outcome. The theme of the Green Economy in Relation to Poverty Eradication and Sustainable Development being advanced for the event next year in Brazil could easily be bolstered by incorporation of the proposed MCGs.<sup>1</sup> In addition, the institutional framework for sustainable development could benefit from considering the possibilities of including a series of MCGs in the core of emergent global governance structures.

<sup>1</sup> See Earthsummit2012, Green Economy in the Context of Poverty Eradication and Sustainable Development <http://www.earthsummit2012.org/index.php/component/content/article/149-green-economy-poverty-sd-context/236-green-economy-landing>.

## Conclusion

The prevailing unsustainable consumption and production system is the largest contributing factor to climate change, poverty, and inequality on Earth and thus requires greater emphasis and regulatory focus at the international level. If anthropogenic climate change is to be controlled, then developing a regulatory framework for sustainable consumption and production must become a priority. In very simple terms, unsustainable consumption and production needs to be effectively managed on a global scale, in parallel to emission cuts, as a solution to both problems of climate change and poverty. It would be naïve to imagine at this moment that governments or the business community will voluntarily reduce their consumption and change their profitable and wasteful habits out of deference to the planetary health and the conditions of the poor. The MCGs, therefore, should not be a substitute for an international agreement on sustainable consumption and production, but a supplementary program with strong enforcement mechanisms to help advance the objectives of this international framework.

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## About the Author

Uchita de Zoysa is an internationally acclaimed thinker, writer, and speaker who is a frontline leader in mobilizing civil society for stakeholder alliances and a strategist shaping policy for the global sustainability movement. He is the author of several books, including *It Has to be CLIMATE SUSTAINABILITY*. De Zoysa began his professional life as an investigative environmental journalist, then moved on to creating a large civil society alliance in Sri Lanka. He also was a member of the International NGO Steering Committee of the United Nations Conference on Environment and Development in 1992 and subsequently served on the NGO steering committee of the United Nations Commission on Sustainable Development. He has authored several international and national reports and has played a leading role in the formulation of global independent sector collective

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ARTICLE

## Motives for and barriers to household adoption of small-scale production of electricity: examples from Sweden

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A new electricity-production concept attracted massive media attention in Sweden during 2008 when companies began marketing small-scale photovoltaic panels (PVs) and microwind turbines. The products were launched by their simplicity: the components are so easy to install that anyone can do it. How, then, do households perceive these products? Why would households choose to buy them? What do households think about producing their own electricity? Analysis of material from in-depth interviews with members of twenty households reveals that environmental concerns are the main motive for adopting PVs or microwind turbines. Some households have ecologically aware lifestyles and adoption represents a way to reduce fossil-fuel use. For others, this investment is symbolic and provides a way to display environmental consciousness or to set an example. For still others, adoption is a protest against “the system,” with its large dominant companies, or a step toward self-sufficiency. Moreover, some households reject these microgeneration installations because of financial considerations, respect for neighbors who might object, and/or difficulties finding an appropriate site.

**KEYWORDS:** electric power generation, solar cells, wind energy, electrical equipment, energy consumption, attitude measures, environmental awareness, renewable energy resources

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### Introduction

Renewable energy technologies such as solar cells and wind turbines are considered key to reducing the threat of global climate change. Such equipment is generally regarded as “sustainable” in the sense that it can be used into the future without causing irreversible damage to the Earth’s ecosystem. The Kyoto Protocol includes a provision that all ratifying states should increase their deployment of renewable energy technologies. The European Commission has further prioritized renewable energy issues and established the “20/20/20” goals: to obtain 20% of Europe’s overall energy mix from renewable sources, to reduce total primary energy consumption by 20%, and to cut greenhouse-gas emissions by at least 20% (all relative to the 1990 baseline) by 2020 (European Parliament, 2006; SOU, 2008). Another policy to encourage renewable energy technologies is the use of green certificates, a tradable commodity confirming that a specified unit amount of electricity is generated from renewable sources (SOU, 2008).

The rapid development of renewable energy technologies seems vital. However, these generating facilities face problems of becoming established market alternatives (Jacobsson & Lauber, 2006). This article focuses on small-scale electricity production from renewable sources in Sweden and looks specifically at systems in which households can buy grid-

connected photovoltaic panels (PVs) and wind turbines for home-electricity systems. We examine motives for and barriers to household adoption of these microgeneration technologies and how they are perceived by actual and prospective adopters. What do households think about producing their own electricity and what constraining and enabling factors have they encountered?

The article first discusses earlier research into user adoption of green innovations, specifically PVs and microwind turbines. We then briefly describe the Swedish market for this equipment and outline the methods for our field study. The results of interviews with households at different stages of the decision-making process regarding the adoption of PVs and microwind turbines are then presented. Finally, we offer conclusions concerning various motives for and barriers to household adoption of these technologies.

### Sociotechnical Transition and Household Adoption of New Technology

Frank Geels and his colleagues discuss how radical novelties develop in established sociotechnical configurations such as the electricity system. They suggest an evolutionary model for sociotechnical change, which focuses on the dynamics in changing artifacts, technologies, regimes, and overall society. Their transition model relies on the work of



science and technology studies which argues that technological and social change are interrelated. Their model proposes a multi-level perspective for transition, in which researchers analyze past episodes of transformational innovation at the macro-level (landscape), meso-level (regime) and micro-level (niche). The multi-level perspective attempts to explain processes of radical development of novel technologies. The diffusion pattern of this development produces a new set of sociotechnical relations that comes over time to largely replace the existing social practice. From this perspective, the stability of existing sociotechnical systems occurs through interaction among material aspects, embedded actors and organizational networks, and the rules and regimes that guide perceptions and actions.

In this model, innovations evolve in special spaces, or niches, where they are sheltered from mainstream competition (Schot & Geels, 2008). These domains can be small market niches, which is the case here, or technological niches, where public subsidies provide resources.

Niches form the micro-level at which radical novelties emerge. The meso-level is the regime level, and includes routines, knowledge, problem definition, and so forth that are embedded in institutions and infrastructures. The macro-level is the sociotechnical landscape, which is the larger policy and political context that normally evolves slowly, but at certain times confronts quite abrupt change (Geeles & Kemp, 2007). Verbong & Geels (2007) describe the relationship between the three levels—niches, regimes, and landscapes—as a “nested hierarchy.” New technologies have problems breaking through and gaining widespread diffusion because of deeply rooted established regimes. Transition only takes place when all three levels align and reinforce one another.

From the standpoint of promoting innovation, niches need protection because new technologies initially have low price-performance ratios. Small networks of actors can shield the niches, so when initiating new technologies, it is vital to build such insulated spaces (Verbong & Geels, 2007).

In our case, the niche actors are the modest-sized companies that have launched the concept of small-scale electricity production. To succeed, they need to enroll early adopters in their network. Spaargaren (2000) argues that individuals choose what products to consume within particular social arrangements and not in isolation; consumption thus must be seen in its social context. Spaargaren & van Vliet (2000) further claim that people seek to realize the partial integration of green practices into their daily lives. Actors prefer to bind their various social practices into a reasonably coherent unit. When a householder embraces

a green lifestyle, this corresponds to a life story in which the actor is expressing who s/he is or wants to be; the life story serves to express this person's identity and self-narrative. From this perspective, “lifestyle” is the degree of coherence found in a person's behavior, though modes of action in one context may differ from those adopted in others (Spaargaren, 2003).

Rohracher (2003) discusses how consumers may communicate various meanings and lifestyles through their product purchases. PVs and wind turbines offer individuals the opportunity to make statements about their environmental beliefs. Earlier studies have demonstrated that the environment is becoming increasingly important as a symbolic issue. People want to show that they are environmentally aware and think about climate problems (Pedersen, 2000; Hedrén, 2002; 2009; Skill, 2008). Investing in a fully visible PV or microwind turbine can be a symbolic way for households to communicate their values to their communities. Kaplan (1999), in a study of the process of PV adoption, found that, aside from knowledge of the existence of PVs, motivation, technical understanding, experience, and familiarity (e.g., whether the household has previously installed a similar technology, such as solar heating) were other critical factors.

Faiers & Neame (2006) considered whether early adopters develop internal reference prices based on their knowledge and competence. In other words, the actual cost of an innovation is unimportant; what matters is what it is worth to the adopters as individuals. At the same time, however, Faiers & Neame have detected inconsistencies in green consumption; for example, consumers who recycle materials do not necessarily favor green energy products. In this context, Spaargaren (2000) has emphasized that consumers' involvement in greening their lifestyles and domestic consumption patterns relate to more than the amount of money that they want to spend in specific ways. Additional aspects, such as material, social, and cultural efforts and rewards, are inherent in certain innovations. Sometimes people develop bottom-up forms of greener self-provisioning and want to be independent from the utility company, while in other cases they may simply want to be served, even though more sustainable arrangements are available.

If we see this new concept with small-scale electricity production as a niche market at the micro-level, then it is interesting to analyze how its advocates try to gain widespread diffusion and especially how early adopters are enrolled in the networks. In what context is the adoption done and how does this investment correspond to people's life stories, symbolic values, and reference prices? These issues are analyzed below in relation to household motivation

for and barriers to considering and adopting PVs and microwind turbines. The interviewees articulated an identifiable set of enabling and constraining factors with respect to these technologies that merit careful assessment. As the householders' reasoning shows, these considerations are related to a willingness to uphold and mediate a green lifestyle. Before presenting the household-interview results, we first briefly outline the Swedish market for small-scale electricity production and then introduce the case study.

### The Swedish Market for PVs and Wind Power

The market share of household PVs and wind power in Sweden is currently not very large. At the end of 2009, installed wind-power capacity was 1,440 MW, representing only 0.4% of total installed capacity, while PVs had an installed capacity of only 4.4 MW (SEA, 2010). However, the market is expanding and the installed capacity of both PVs and wind power continue to grow.

In Sweden, a "new" concept of small-scale electricity production, launched by companies such as Egen El and Home Energy, attracted massive media attention in 2008 (Palm & Tengvard, 2009). These companies market PVs and wind turbines to households, allowing householders to buy appropriately sized power plants that are easy to install and connect. What is new in this concept is how renewable sources of electricity are marketed as something designed for ordinary people. According to Egen El's website, the company's products are so straightforward to install that anyone can do it without expert help; in practice, however, this has not always been the case. While the concept launched by Egen El builds on the notions of simplicity and do-it-yourself ease, Home Energy, in contrast, provides free installation. The systems from Egen El and Home Energy

both include transformers, meaning the electricity produced from the new household sources can be directly accessed from a standard electrical outlet. Both companies further emphasize that householders do not need to secure building permits to legally install the equipment.

To get a picture of the market for microgeneration systems, we interviewed seven PV and microwind-turbine retailers that target households. The household respondents had bought products from these retailers whose product lines are presented in Table 1.

A third company included in this study, Windon, has a larger wind-turbine niche, but households (in rural areas) are still the firm's main customers. For its lower-priced products, Windon helps household purchasers negotiate contracts with installation companies, while systems costing over US\$35,000 include installation. Egen El and Home Energy source their products from external manufacturers, while Windon produces its own wind turbines. This article does not focus on the interviews with representatives of these companies. Briefly stated, however, these companies saw cost as the major factor keeping households from adopting their products. In addition, the manager of Home Energy noted that customers often have difficulties understanding the amount of electricity the equipment actually produces. Even though the company provides exhaustive information on production capacity, customers often become disappointed when they discuss the matter in depth with a sales representative because this is generally the first time they realize that they will be able to produce only a small amount of the electricity needed to supply their household. The decision-making process often ends at that point as householders rethink the merit of their prospective investment.

**Table 1** Retailers of PVs and microwind turbines whose products were purchased by the studied households.

Company	Product	Inquiries and number sold to households in October 2008
Egen El	Balcony PV: 300 W, €2700 PV: 540 W, €4400 Wind turbine: 1000W, €5000 Installation not included; no building permit needed	Inquiries: 847 Sold: 30 50/50 split between wind turbines and PVs
Windon	Wind turbine: 10 kW, €25,000 Installation included; municipal building permit needed	Inquiries: 12,000–13,000 Sold: 9
Home Energy	Wind turbine: v100 350–600 kWh, €4000–4500 Wind turbine: v200 700–1200 kWh, €9000–9500 Installation included; no building permit needed	Inquiries: data unavailable Sold: v100 – homeowner = 1; companies = 7 v200 – companies = 7

## Methods and Materials

The study was organized around semistructured in-depth interviews (Kvale & Brinkman, 2009). We interviewed representatives of seven retail companies, five grid companies, the industry organization (Swedenergy), and twenty households. This article focuses on our householder respondents who live in private homes and apartments throughout Sweden. The retail managers contacted them on our behalf and inquired whether they would be interested in participating in this study. Subsequently, the householders got in touch with us directly or we obtained their names and phone numbers from the managers. In general, we interviewed one family member per household, but on two occasions two adults were present. We normally contacted and interviewed the family member provided by the retailers; in some cases, however, the households chose a different adult family member to participate. Half of the interviews were done in the householders' home and half were done by phone. We visited all households that had invested in a PV or wind turbine. The respondents were in different phases of the decision-making process, some having already decided whether or not to adopt the technology, while others were still seeking information about their options. At the time of the interviews, nine households had bought a plant, eight were still deliberating, and three had decided not to make a purchase. Of the nine households that had made a commitment, five of them had already installed the systems at the time of our intervention.

As mentioned, the interviews were semistructured and employed an interview guide covering the following matters: 1) background data; 2) first contact with the concept of small-scale electricity production; 3) reasons the households were interested; 4) barriers to and enablers of product adoption; 5) information received on the various products; 6) advantages and disadvantages of the various solutions under consideration; 7) the stage of the decision-making process that they were currently in; and 8) energy use—awareness and efficiency measures implemented. We recorded all interviews using an MP3 recorder/player and then transcribed the resultant recordings. Our respondent householders are anonymized for purposes of this article and are referenced as Householders 1–20.<sup>1</sup> The householders were 30–75 years of age. The average household income was €65,000 (US\$88,000) per year. A total of seventeen of the interviewed householders had university degrees. Three households resided in rental apartments and seventeen owned their own homes. Their total

consumption of electricity and heat varied greatly, from 3,000 to 30,000 kWh per year. This is partly explained by the size of the homes and whether they used electricity for heat. But differences in lifestyle are also important in explaining these differences in electricity consumption. When analyzing the interviews, we discuss household perceptions of their energy use and stated motives for and barriers to adopting small-scale electrical production plants. Using an inductive method, we scanned the empirical material from the householder interviews to identify categories illustrating the various stated motives for and barriers to adopting such small-scale renewable energy technologies. While a household might express negative or skeptical opinions about such plants, it might have made the investment or still be considering it. In fact, and as shown above, at the time of the interviews only three households had definitely decided *not* to buy, while eight were still considering the pros and cons, which will be illustrated in these categories.

## Motives for and Barriers to Householder Adoption of Small-scale Electricity Production

This section presents an overview of expressed household motivations for adopting, rejecting, or delaying an investment in small-scale energy production. We have categorized the material according to the main intentions identified in the interviews.

### *Motives for Adoption*

Six partially interrelated motives were cited in the interviews and each is discussed in turn below. The motives were: concern for the environment, a way to set an example for others, as a protest against energy companies or the “Big Brother society,” to become independent, financial reasons, and technological grounds.

### *Concern for the Environment and Lifestyle Harmonization*

“It is the environment, we must think about it” (Householder 8)—most respondents emphasized such a sentiment. Many stressed the importance of living in harmony with nature, including living as ecologically sustainably as possible in all everyday activities. This desire included avoiding long-distance travel and saving energy “fanatically.” Producing one's own electricity was an important part of this sustainable way of life:

To me, it's quite clear that we should not leave “ecological footprints” on the earth, but treat the environment with respect and dignity. Not steal resources from others, but

<sup>1</sup> When two members of a single household were interviewed, this is indicated by appending “a” or “b” to the householder's number.

use what is given to us. This is a fundamental value for me (Householder 3a).

This notion was shared by several householders, who saw the investment in renewable energy equipment as an important part of a lifestyle they wanted to uphold. One householder, for example, elaborated on the subject in greater detail. This individual considered buying a wind turbine and believed this would be in harmony with the family's way of life:

In our family we discuss what we eat, who produces the food we eat, and all these things. We have had this environmental concern all our lives. We are members of Greenpeace and the Swedish Society for Nature Conservation and so on (Householder 17).

#### *Own Production as a Way to Act and to Set an Example for Others*

Investing in a small-scale power plant is a tangible act. Householder 3a, who had purchased PV panels, described the decision this way: "To me, it's like a manifestation of the thought." For this household, the investment was a way to transform its environmental awareness into an environmental act. Householder 9, who was considering investing in solar panels, said, "It would just feel good, like you would actually be doing something."

For other respondents, it was obvious that the investment was a social act and the emphasis was on its symbolism. It was a way to show neighbors and friends that it is possible to do something, even as an individual. Householder 5, who was thinking of investing in a balcony-mounted PV panel, expressed it in these terms:

If other people see that I have bought a [micropower] plant, then maybe they will follow my example. This way I can help spread the concept of producing one's own electricity and perhaps make it more common in the future.

The investment was a way to set an example for others and to exercise "consumer power" (cf. Holt, 2002; Denegri-Knott et al. 2006). A common conception was that, if household demand for micropower plants that produce environmentally friendly electricity grows steadily, eventually there will be a smaller market for nonrenewable alternatives sold by conventional electricity companies.

#### *As a Way to Protest Against Energy Companies or the "Big Brother" Society*

Self-production of energy is a way for households to distance themselves from energy companies and to contribute to producing clean, green energy.

The choice to go ahead and produce my own energy is also a way to take a stand against the big electricity companies and the dirty energy they produce. It's sort of like "No, I just won't have that" (Householder 4)!

The investment was a kind of protest against the Swedish system, with its large, energy dominant actors: "It would be fun to score points off Vattenfall" [a major Swedish energy company] (Household 6). Householder 8 said that his dream was to be completely disconnected from the grid company (cf. Spaargaren, 2000). Others saw their micropower investment as a statement against the whole social system:

Just to fight the "Big Brother" society. Definitely. Both Swedish and international power production and distribution are unfair, monopolistic, and counterproductive. The enterprises do not work in the interest of the people, but to earn money (Householder 1a).

Other households were more careful in their statements; for example, one respondent said that he just wanted to "annoy" the grid companies:

They are using our lifestyle in a speculative way that results in these big companies earning a lot of money from how we live and use our energy (Householder 9).

This individual apparently sees this dependency as something that the production of one's own electricity can help put right.

#### *Own Production as a Way to Become Independent*

For some respondents who live in rural areas, a major reason for investing in a micropower plant was the possibility of using the natural resources available in their everyday surroundings to produce energy. This was an option they considered both logical and practical. They emphasized that they actively had chosen to live in a rural area to be able to live near nature and, for example, grow their own vegetables. They described investing in a micropower plant as part of their strategy to use natural resources. One individual, who had decided to buy a plant and install it near his house in the Stockholm archipelago, expressed it in these terms:

Since I have my own land with extensive access to wind and sun, then, to me, it seems sensible to produce my own electricity. It's sort of like catching your own fish or growing your own potatoes. I find that awesome—it would make me more self-sufficient and I like the thought of that (Householder 12)!

Thus, producing one's own energy was linked to becoming more self-sufficient. In fact, many respondents stressed the benefits of becoming more independent and less vulnerable in case of temporary power failure or longer periods of blackout: "I could handle a long-term siege using wood and this turbine" (Householder 8).

In contrast, some householders emphasized that a benefit of a micropower system was that one was still connected to the grid in case something should happen to their personal power plant. Others described the advantages in terms of wanting to exercise more control over their own energy situation.

#### *Financial Reasons*

Some households articulated the aim of being completely energy self-sufficient. At present, the Swedish government is investigating whether to make it easier and less expensive for individuals to sell the electricity that they produce back to the grid, a practice so costly today that it is typically not feasible for small-scale producers to do so. Most respondents expect a change in legislation that will benefit small-scale producers. For instance, one householder commented:

What is so good about this [system] is that you can just send the electricity that you don't use back to the grid. I get more out of it that way. Like in the summertime, you don't use that much electricity anyway and then I might just as well sell it back...And then, maybe in ten years from now, it will be like a form of retirement pension. But for now, I'm waiting for Parliament to decide what's going to happen (Householder 14).

Despite the sentiments of this individual, most respondents expressed no intentions to earn money from producing energy; however, some still had financial motives. They reasoned that in the long run, the investment might pay off as electricity prices increased. The expectation is that the cost of measuring electricity delivered by small producers to the grid will decline substantially and it will become more beneficial for them to produce surplus electricity. Many households would welcome this as an extra incentive to invest in a micropower plant. In addition,

some respondents noted that this opportunity would encourage them to invest in *additional* power plants, which suggests that economic factors are not insignificant. Other respondents were more pragmatic and stated that, from a financial perspective, the investment was not viable: "I probably have the most expensive electricity bill in this neighborhood," explained Householder 2, due to the high investment cost of a wind turbine. This individual also noted that it was difficult to make the calculations connected with the investment because this entailed estimating the future electricity price—a methodologically challenging task. The respondents also said that they would rather invest in PVs and wind turbines than in luxury consumption items, such as swimming pools (an oft-cited example). One respondent even compared buying a PV panel to the purchase of a Mercedes, linking this acquisition with status and the symbolic aspects discussed above:

Why do people pay extra for expensive cars? You buy a BMW or a Mercedes because you want to show something; you pay an extra 50,000 kronor (US\$7,200) for that...Same thing with PV panels: in California they're proper status symbols that show that you've got money. And in Germany, they say, "Why don't you have PV panels on the roof? Haven't you realized how good they are?" Next to your Porsche you've got to have solar panels on the roof, otherwise you're not quite right in the head. Either you are not smart enough to know how good this is, or you are not environmentally aware enough or in tune with the times (Householder 16).

#### *Technological Reasons*

A final factor cited by respondents concerned the technology and the functioning of the power plant itself, namely, the delight of actually producing one's own electricity. Many householders claimed that being able to generate electricity was a "fun" concept. They enjoyed watching their electricity meters show the kilowatts they produced themselves. The Egen El and Home Energy concepts appeal to people interested in new technology without being experts. Some said that they would never invest in a "real" PV panel because they were too technically complicated. According to the respondents, the systems provided by this new generation of companies are easier to understand, install, and operate: once the plants are plugged in, they do not need maintenance, and one only watches them produce energy.

### ***Barriers to Adopting Small-Scale Production Plants***

When we asked our respondents about their reasons for rejecting, or at least postponing, the investment, we received four more or less interrelated arguments.

#### *Investment Costs and Production Efficiency*

The most frequently cited hindrance was the high upfront cost of the power plants and their low production efficiencies relative to price: "36,000 SEK (US\$5,200) for a solar panel is very expensive per kilowatt hour. For people working with energy, this idea is probably quite stupid," said one individual (Householder 16) who eventually invested in PV. He thought that the energy companies evaluated the energy system on a different basis than households, and that the company only saw it as irrational to invest so much money for so little output.

Another respondent, who was delaying the purchase of a microgeneration product, said, "If you lose some money, that is no big deal, but this is very expensive" (Householder 6). Another individual decided to buy shares in a local wind-energy project and stated that regarding microsystems:

The biggest disadvantage is the investment cost. To get a system that will produce any [practical amount of] electricity you will need to spend 45,000 SEK (US\$6,500) and even then it will not produce many kilowatt hours per year. The investment is simply too big and the payoff time too long for me to dare to go for it (Householder 15).

As well, another respondent calculated that the installation cost would be double that of buying shares in a community-owned wind farm, and still another individual bought wind shares because he realized that he would need five turbines (and somewhere to put them) to supply his family's electricity needs. Other householders thought that calculating payoff time and the like was at least very uncertain, because of the vagaries of estimating future electricity prices.

#### *Grid Companies and Regulations as a Hindrance*

A problem emphasized by several respondents was that the major energy companies have a monopoly on the grid and determine the connection fees. They thought that these firms were trying to hinder the installation of new net meters and that, by not giving clear answers, they were prolonging the per-

mission process.<sup>2</sup> "They cannot give a straight answer but refer to various paragraphs. It is very unclear...it is hard to move on in the process" (Householder 17).

Furthermore, respondents indicated that the new micropower concepts were so novel that the authorities had yet to develop routines for handling connection issues. One individual described it thus:

Because this is a so-called pilot plant, there are many decision makers in both the municipality and the grid company who do not know how to respond when you ask something or apply for a building permit (Householder 19).

This individual felt that both the grid company and local authorities were major hindrances to the spread of microgeneration.

#### *Finding a Place to Locate the Wind Turbine without Risking Relations with Neighbors*

Several respondents observed that the major obstacle was finding appropriate locations for wind turbines. As one individual noted,

Finances are not a problem for us...The problem is that the turbine needs to be installed near an electrical outlet. At the moment, we can't see such a suitable place here. The most suitable location for us is several hundred meters away from an outlet. And if we put it on the roof, yes, then the mast will be really, really high. So right now we don't know what to do (Householder 17).

Another problem was that the wind turbine could not be placed where the mast could fall into a neighbor's property, which for one householder meant that it could not be installed in the optimal location determined by a wind test. This respondent could have placed the two-meter tall mast on the roof, but his female companion objected and said that this would be disrespectful to the neighbors. She remarked that the couple lives in an environmentally protected area in the middle of a village and neighbors would see the wind turbine as "visual contamination."

Respondents who purchased shares in local wind cooperatives mentioned respect for neighbors as an important factor influencing their decision not to buy

<sup>2</sup> The companies said, for example, that they would contact the household again, but never did, or that they were waiting for state policy in the area before deciding on net metering.

their own microgeneration system, but to invest in community-based production instead.<sup>3</sup>

### *Technology and Installation*

Even though the concept was launched as simple and viable for anyone, the technology itself was viewed as a hindrance. One respondent emphasized that, from a consumption perspective, it was disadvantageous to buy a product when it was new on the market, even for a good cause:

It is a gadget. There is anxiety that it is there and can fall down and become damaged. What are we supposed to do if something happens (Householder 1a)?

This householder meant that from a consumer's point of view it is safer to invest in established products that many people have tried out. Then unexpected faults have already been found and corrected, they thought.

Respondents were also concerned that the power plants would need considerable maintenance, in spite of the companies' promises that the products should be simple and not need any care. In general, individuals were unsure as to whether they would be able to install the products themselves. They also thought that they would need some expert help with the electrical installation:

We would need to install the thing as well, and I am not a handyman and I don't have the time for it either. It must be easy to install and preferably it should work instantly (Householder 17).

As we discuss below, some of these worries were justified.

### *The Installation Process and Production Results*

As mentioned above, only five households had installed the energy systems. This section summarizes their experiences.

Egen El's products, as previously discussed, do not include installation. The equipment is easy to order over the Internet, which the households in this study had done. Information about both the products and their installation was available on the company's website. The description of the assembly process was clear according to the households, but some questions arose during installation. For example, some municipalities in Sweden require a building permit if a wind turbine is to be roof mounted, despite the manufac-

turer's claim that such permits are unnecessary. Furthermore, none of these five households could manage the electrical installation on their own, as they lacked specific information about connecting the wires and running the cables. "Try to fiddle with it," advised Egen El when contacted by one household. Cord lengths and missing parts were also noted as problems. In addition, the households lacked information on how to install the PVs for optimal functionality. For the wind turbines, raising the mast was difficult, not least because heavy parts had to be lifted high in the air.

### **Conclusion**

We have seen that niche markets for small-scale PV systems and microwind turbines overall attract people who manifest strong environmental concerns and embrace a "green" lifestyle. The households that the firms enrolled in their networks understood the threat of climate change and that mitigating it would entail changing how energy is generated and used. The householders we studied also wanted to integrate electricity production into a green lifestyle, and self-production represented an alternative to buying green electricity from energy companies. Notably, however, not all households have extensive knowledge of either the energy system or the associated technologies: they are interested in the products for other reasons.

If we look at the households that adopted the equipment, we can see that their main reasons were that the investment gave the householders a "better conscience"; moreover, the investment is symbolic, offering a way to demonstrate an ecological lifestyle to neighbors and friends. In these cases, the installation decision has nothing to do with economic rationality. The investment is also seen as practical or sensible, mainly because the respondents often live in rural areas and have suitable locations for wind-turbine installation. Additionally, these individuals often have a lifestyle that includes self-production or local provisioning of many goods as possible; they had long wanted to try the technology, but thought that the PV panels sold on the market would be too complex to handle. Egen El's and Home Energy's products, in contrast, were seen as easier to understand and adopt, which gave the households the confidence to commit to them.

For households still deliberating over the purchase, the environmental argument was central. This rationale was the main reason for even thinking about adoption. Another frequently cited motivation for this group was to protest the monopolistic ways of the energy companies. To become independent and less vulnerable to power failure was also a common fac-

<sup>3</sup> Sweden has around 70 wind cooperatives, with around 20,000 members; these facilities produce 10% of Swedish wind power.

tor. The main hindrance at the moment was cost—microgeneration is expensive and the offered systems have low production efficiencies. Another recurrent obstacle concerned whether the respondents could correctly install the products on their own. Several of the households still considering buying the equipment were also awaiting new regulations in Sweden that would make it cheaper to sell self-produced electricity to the grid.

The respondents who ultimately turned down the opportunity to purchase small-scale PV systems and microwind turbines still think that such an investment was consistent with their desired lifestyles. The barriers to adoption, however, were viewed at the time as being too high, so they often tried to find other ways to contribute to green electricity production without investing in production plants themselves. These households rejected the small-scale equipment for economic reasons, because they had not found anywhere to install them, or did not want to annoy their neighbors. In relation to the economic aspects, these households viewed this investment as unduly expensive and concluded that economically superior alternatives were available.

Installation was an impediment in two respects: the households would either have to pay someone to do it for them or spend considerable time on their own (often with help from friends). Furthermore, the product retailers have different strategies when it comes to installation. Egen El requires customers to install the products themselves, which is a major barrier for households and may prove to be a significant factor for the company's future sales growth. Some of our respondents also cited regard for their neighbors as the rationale for not adopting wind turbines. Though these households also saw many positive reasons for installing the micropower plants, the disadvantages were felt to be greater.

For the broader Swedish population to consider PVs and microwind turbines, both financial and institutional barriers need to be reduced. Sweden has long been reluctant to use financial assistance to speed up renewable energy adoption, but in July 2009 the government introduced subsidies for household installation of PVs. This measure has contributed to more general interest.

So far, promoters of the small-scale generation concept have mainly reached out to rural areas. To market the wind turbines to urban customers will probably be difficult because efficient use depends on placing the turbine high up in the air, and, at the same time, the equipment must not be at risk of falling into neighbors' yards. However, in urban areas PVs are more suitable.

Another issue in appealing to the broad public is the regulatory regime; regulations need to be more

widely disseminated so that people understand what to expect from existing grid companies when, for example, they want to sell electricity back to the grid. There is also a need for simpler regulations for measuring and selling such electricity, which would make the financial aspects more attractive and also appeal to customers who lack ecological motivations or an explicit interest in the technology. New regulations also need to address safety and insurance issues and a clause that forces the retailers of small-scale production to be up to date on, and to inform their customers about, existing rules.

The Swedish market for household PV systems and microwind turbines is still small, and there are no routine methods for marketing such products. One challenge of the current situation is manifest in the installation process, which the households are often expected to handle on their own. To reach wider markets, installation routines should be established in which households, when buying the products, are automatically offered professional assistance.

Although the amount of electricity produced by household-power plants might not be great in the near future, it is reasonable to suppose that they will become more common, not least due to rising electricity prices and greater demand for sustainable energy production.

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ARTICLE

## **The global prisoners' dilemma of unsustainability: why sustainable development cannot be achieved without resource security and eliminating the legacies of colonialism**

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Environmental and sustainable development advocates have a major blind spot in linking environmentalism to global security (resource protection) concerns. Though peace movements and environmental movements have begun to note the linkages between war and resource policies on the environment, and while antiglobalization (and some globalization) coalitions have sought multilateral frameworks that link peace and environmentalism, we theorize that the links between security and environmental concerns are deeper and have a more complex feedback relationship than these movements acknowledge. At the same time, we note that the current approach to globalization appears to have contradictions at the local level that make resources vulnerable to exploitation and human cultures unsustainable within their environmental niches. Paradoxically, the current approach to globalism will likely cause this global system to fail. We call on environmentalists and sustainability proponents to modify their approaches by incorporating security concerns and focusing on changing the legacies of colonial institutions in both the developed and developing worlds.

**KEYWORDS:** security, sustainable development, globalization, international standards, environmental protection, developing countries, market economy, peace movement, cultural rights

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### **Introduction**

During recent work to design easy measurement tools for development organizations seeking to meet international treaty commitments to “sustainable development,” we were surprised by the size of the gap that these tools revealed between the agreed international standards and their policies and practices. We were further dismayed by the many kinds of rhetoric that organizations currently use to redefine “sustainable development.” Despite what seems to be a relatively clear and scientific standard supported by international political agreement, organizations substituted a variety of other agendas (Lempert & Nguyen, 2008).

While some authors suggest that this gap is due to a lack of awareness or information (or to what some even call “slippage”), we start with the assumption used in contemporary economic and political science theory that international actors are perfectly rational. Given this assumption, the apparent behavioral contradictions logically suggest that sustainable development advocates and policy makers have been reluctant to acknowledge and address their actual motivations. We offer a theory as to the real motivations of different actors using participant observation field data from our work as an applied an-

thropologist and environmental policy practitioner, based on what some officials have confided to us regarding their personal fears, and we carry these assumptions to their logical conclusions. We do not seek to test the validity of the evidence or describe our methods in acquiring it in this conceptual article, but rather offer a logical test of the hypothesis itself within existing social science theory frameworks as a basis for future work and as a comparison with existing explanations. In future articles, we look forward to laying out a methodological agenda describing how various social science fields can use different types of data to challenge or confirm our hypothesis about fears and behaviors of government officials (information that is difficult to collect and verify, but that is informed by our fieldwork and scientific intuition from our respective fields) and for seeking proof to test the theory that follows from it.

We suggest that past experiences and fears of government leaders and officials in “developing” countries that have suffered international invasions and violence from more powerful countries largely influence their approaches to “sustainable development.” We draw on the statements that we have heard from officials in countries that were invaded by foreign powers and from officials in neighboring countries as to their anxieties about future incursions and

for their personal safety. We believe that these fears—which may be entirely rational—have led them to decisions that endanger their own cultures, undermine their countries' sustainable development, and put their minority cultures at continuing risk of extinction as they, themselves, were subject to exploitation under colonialism before their international recognition as leaders of nation states. At the same time, we suggest that the behaviors of actors in developing countries continue to play on or avoid addressing these fears.

We note that most development organizations currently focus on strategies of “raising awareness” on issues of sustainability, much as health campaigns centered on poor diet, smoking, and other risks focused on awareness. Yet, awareness may not really be the issue. There may be deeper psychological (cultural and cognitive) explanations for why both developed and developing countries appear unable to apply the standards they have agreed to, an explanation that is based either on self-interest or some distortion of self-protection and self-interest. If so, efforts would need to be redirected to the real source of the problem for change to occur.

In thinking through the issue, we apply the rational actor and game theoretic frameworks that economists and political choice theorists currently use. While these methods do not generate empirical results and are based on a set of logical assumptions of human behavior rather than on empirical confirmation, they offer a form of testing our hypothesis through modeling or thought experiment. They also generate additional hypotheses that other scholars and practitioners might further test. What makes our approach slightly different is that we link the rational actor approach with a psychological and anthropological framework. Rather than look at countries as similar actors pursuing merely economic self-interest, we suggest that countries and their leaders also make decisions based on their historical experiences, socialization, and fears. We draw from approaches like those of Graham Allison (1971) in seeking to explain national decisions using various frameworks, including the psychology of leaders as well as the socialization of individuals within different institutions. In examining the parallels between the colonial policies of European governments and the newly independent leaders with regard to their own “dependent” minorities (subject to hegemonic control), we also note how the training of current leaders under colonial rule often led to internal cultural continuities in many institutions after transference of authority to local leaders. These include policies of “internal colonization” and exploitation of the resources of minority communities, rather than support for independ-

ence, local sovereignty, and sustainable development (Wallerstein, 1974).

Though we take a bit of a tour of sustainable development approaches before coming back to our hypothesis, our goal is to look at the context and to try to eliminate some of the explanations that currently pass for common wisdom. We start by thinking through the different explanations that development actors have given for why they use different standards for sustainable development than the scientific consensus that was the basis for international agreement in the Rio Declaration in 1992. At a later point in the article, we offer explanations that individuals have given about their personal fears and motivations in governmental decisions. This qualitative methodological approach, which is the first step in generating hypotheses of social-cultural behaviors and a prelude to later quantitative work, is what anthropologists call the “emic,” the internal perspective of actors on their own behavior.

At the same time, we look at the structural patterns of behaviors of cultures and countries that carry forward from the colonial period and how different countries may be “locked in” to certain patterns of interaction based on how they view their interests. We show how this logic or system of behaviors may be overriding their legal commitments and long-term interests in sustainable development. This is what anthropologists call the “etic” or “deep structure,” an outside perspective on interests and logic, a second step in qualitative observations and hypothesis formation of social-cultural behaviors.

We follow this discussion with a hypothesis for how the belief system and the logic of interests might fit together, based on our experiences in Southeast Asia, Latin America, Eastern Europe, and elsewhere with government officials who are aid recipients. We seek to understand how they try to fit the ideas of “sustainable development” into the real-world pressures exerted on them, and within their own psychology of their needs (and fears) and how this patterns their actions. Using game theory, we put the different logics of the donor countries (and cultures) and the recipient countries (and cultures) into the structure of a model, to see what the different choices, beliefs, and outcomes are of the “two” sides and how they relate to each other in ways that undermine sustainable development policy.

This thinking leads us to the following: It may be that international approaches to sustainable development are, ironically, failing to address one of the key motivations preventing sustainable development: the insecurity that leaders and their publics (at the level of individual cultural/ethnic groups and of countries/nation states) feel as a result of real or imagined threats from more powerful groups. These insecuri-

ties create an incentive to more quickly exploit their resource base to save it from others, either to give it away as a “gift” (for instance through trade deals or even overt bribes) to prevent invasions or to use the profits for military might, economic power or prestige, or to expand population and consumption to generate larger, better resourced armies. Ironically, it appears that the “security” brought by globalism is hiding continued underlying fears regarding cultural and country resources. For the majority of the 6,000 cultures on the planet that were (by definition) sustainable within their resource bases and were not “dependent” on outside trade or imperialism to meet their consumption needs,<sup>1</sup> it actually preys on these insecurities in ways that promote sale and exploitation of resources rather than sustainable protections in each country or cultural ecosystem. The free flow of resources through globalism creates a downward spiral that makes resources more vulnerable and makes cultures and countries even less sustainable, thus undoing the “security” globalism is believed to be creating.

### **The Science of Sustainable Development and the Discrepancy between International Agreements and Actions**

Governments of developing countries, international development organizations, international non-governmental organizations (NGOs), and even scholars and scholarly journals that teach modern approaches to environmental protection, all use the word “sustainable development” today, but with widely varying (often directly contradictory) applications.

Our analyses of the agendas of several categories of international organizations, using an indicator we developed based on international standards, demonstrates that few of these actors actually apply the agreed principles of sustainable development in their country programs (Lempert & Nguyen, 2008). Indeed, we developed this sustainable development indicator for international development agencies—as well as several other accountability indicators that are now under review or in press—as ways of holding the international community accountable to its own agreements and standards. Our assumption was that a few organizations lacked awareness or knowledge. What we found was that lack of compliance was rampant and indicated widespread system failures (or undermining of the international system and stand-

ards on the basis of some other logic). In the area of sustainable development, this failure seems to be more out of an ideological blindness than a lack of understanding, because it extends to environmental organizations and to scholars teaching environmental policy that should have clear goals and targets. Even in the industrial world, others have noted that investment policies in new technologies have yet to be tied to sustainability goals and have had to call for approaches to education, research and development, and energy savings that should be obvious (Shellenberger & Nordhaus, 2004).

The principles that underlie the work of environmentalists and development experts, and that have long been rooted in international agreements, are easy to state and we briefly cite them again here for clarity.

The concept of sustainable development is a simple one. According to Principle 8 of the Rio Declaration, sustainability is a balance of consumption (the number of people and the amount of consumption per person) with resources (a fixed amount of resources and an amount of productivity per resource that ensures the resources are replenished and not used up for future generations) (United Nations, 1999). This equation is taught in the basic text of environmental science as the “IPAT” equation and is among its most fundamental precepts. We restate it in one of its simple forms (Ehrlich & Holdren, 1971; Commoner, 1972).

$$\text{Population} \times \text{Consumption} = \text{Resources} \times \text{Productivity} / \text{Resource}$$

The idea of a multigenerational balance is not only recognized in the Rio Treaty and in the scientific concept, but also in treaties on the rights of the child to resources and culture, along with other basic human-rights accords and declarations (United Nations, 1989).

At the same time, international laws recognize that there is no one kind of system or cultural approach that best meets this balance. The concept of “culture” is a protected right to choose the level of consumption and technology that achieves this balance consistently with a resource base. Some of the world’s 6,000 cultures have chosen to keep their productivity and consumption low. By international law, they are supposed to have the protected right to do that along with several other “guarantees” (United Nations, 1948; 1966; 2007; Lempert, 2010). Some cultures choose to maintain their technology without innovation and have a protected right to do so. At the same time, a few of the world’s cultures—those that are urban and the most powerful on the planet—choose to try to keep improving productivity, so that

<sup>1</sup> These 6,000 cultures are as measured twenty years ago using language as a proxy for culture, with possibly hundreds already disappeared since then according to measures and projections (Krauss, 1992).

productivity and consumption both grow. By international agreement, the rights of all cultures are equal, with neither type of approach to infringe on the rights of the others and with none qualitatively “better” than the others. This *culturally* pluralistic approach to sustainability and equity is a basic bedrock principle of the international legal system, not to be overridden by any other political or legal or ideological determination. Any other definition or understanding of the agreement would be contradictory to the principles and rights intrinsic to this framework.

It is also important to note that this definition of sustainability is not specific to any faction of the environmental movement or linked with a particular environmental ideology. This is not the viewpoint of the “dark” or “light” or “bright greens” or a part of the “deep ecology” movement or any other classification of actors in the environmental movement. The sustainability principle does not offer a blueprint for individual cultures on how to achieve sustainability and what kind of environmental quality each culture needs to protect. It simply sets the goal of balance and establishes the factors to be measured. It is a universal definition from the science of ecology and social science that is also recognized internationally as a common standard.

### **How Development Organizations and Others Interpret (Redefine) the Principles of Sustainable Development**

Despite the simple and clear scientific definition of these concepts, they are largely abandoned in application by development organizations, international donors, and wealthy countries. In many cases, the very words “sustainable” and “development” have been distorted well beyond the actual meaning as established by the international community in the Rio Declaration of 1992. Indeed, there may not be a single developing country in the world where an international organization (e.g., global development bank, development agency, donor, or NGO) actually offers a sustainable development plan for the country or for its cultures, following the guidelines of the Rio Treaty. In fields outside of the natural sciences, such as economics and political science, scholars have also offered arguments to justify the disregard for the scientific standards and the international agreements that support them based on cultural logics of imperialism and hegemony, psychological theories of leadership behavior, and other frameworks.

Many readers may already agree that the standards of sustainable development have been abandoned or twisted by nation states, international donors, implementing agencies (including those who claim to be doing sustainable development and envi-

ronmental protection), and scholars. Ingolfur Blühdorn (2007) and his colleagues have recently commented on this phenomenon as a pervasive attempt to create almost a religious belief in a technological “magic” that will lead to sustainability, with no scientific basis or actual plan based on empirical fact. They refer to it as the “politics of unsustainability” or “simulation.” Before considering why we think this has occurred, we offer this section to help readers to consider the extent of these gyrations. The efforts to distort approaches to sustainability seem so widespread (and so perverse) that they suggest an underlying psychological motivation at work, rather than simply a misunderstanding or lack of knowledge.

In international organizations like the United Nations Development Programme (UNDP), for example, where sustainable development is still defined as the target goal in current program statements and where the legal mandate to uphold international treaties resides, the standards behind the definition have largely been abandoned and replaced in recent years (UNDP & UNFPA, 2007; Lempert & Nguyen, 2008). Previous UNDP administrator James Gustave Speth, an environmentalist and lawyer, directed the agency during his tenure (1993–1999, immediately after the signing of the Rio Declaration) to follow treaty obligations to protect cultural choices and diversity to achieve sustainability at their culturally and environmentally appropriate levels of consumption and population. There were no requirements that cultures copy the approach of urbanization or international trade, since these would violate international rights laws (United Nations, 2000a). Yet these directives now appear to have been abandoned by UNDP leadership and by the United Nations (UN) system and replaced by a checklist of development goals that almost entirely focus on only one of four factors in the equation; productivity (and largely in short-term sales, measured by gross domestic product (GDP), rather than in actual productive efficiency in the use of resource wealth), using a common set of technologies. It appears that most other development organizations today reflect the same distorted understanding and reduce the equation to the same single factor.

The distortions among development organizations include the following three types of reinterpretations of what sustainability means in the context of development assistance.

First, many *international NGOs* now substitute a focus on short-term “poverty reduction” through high productivity for sustainability. They measure their target as relieving current symptoms of poverty or achieving equality by overcoming differences in relative consumption between different cultural groups. Or, they define the goal as employing foreign tech-

nology for more efficient use of resources. The NGOs' view of equality is one of homogenization, which, they suggest, is superior to upholding internationally protected cultural or environmental rights to promote long-term sustainability of cultures within their resource bases and their own technologies. The basis of the pluralistic principle of sustainability, and the reason it was originally chosen as the key goal by the international community and reiterated by UNDP under Speth, was that this priority approach actually eliminates long-term poverty within each cultural context through creating a balance of population, technology, and resources, but now even the UN abandons it. At best, organizations now include sustainability as just one of eight factors on a checklist of the UN system's new international Millennium Development Goals (MDGs) that are no longer linked in an equation. The priority is short-term poverty relief that may be funded through exploiting resources, making long-term poverty reduction and sustainability impossible. On the UN system's website for the MDGs, sustainable development is now listed as the seventh of eight goals and is redefined as "environmental sustainability" (United Nations, 2000b). There are no factors for reducing consumption or population or protecting cultural choice and rights anywhere on this list, though they were and are the guiding factors in achieving the other goals (United Nations, 2000b). Some of the most recognized NGOs, like Oxfam, also have abandoned the sustainability equation. They substitute the same single factor—short-term productivity growth through transferring foreign technologies into different cultural contexts—for sustainable development. Moreover, they do it at the expense of resources and cultural rights to choose levels of consumption and technology that fit resources. Oxfam's website for one of its major new initiatives, as but one example, even defines "[e]fficient uses of resources" as an economic productivity measure "per project dollar spent," no different from the terms a bank would use (Prosperity Initiative, 2008).

Second, *international donor organizations* have not only sought to focus on increased productivity of recipients rather than on sustainability or protection of rights, they have redefined the term "sustainability" such that it avoids the Rio Declaration and other treaties entirely. In most international development project documents of organizations such as those comprising the UN system, the European Commission, or country-donor agencies such as the United States Agency for International Development (USAID), sustainability is redefined as a measure of whether the "results of a project are sustainable" and continue in subsequent years for an indefinite period. This perverse logic is now at the basis of their ap-

proach even where that includes increasing productivity that causes natural resource depletion, and even where projects undermine sustainable development in accordance with international law.

Finally, *country governments* mistakenly redefine "sustainable development" in a third way. They refashion the term as "sustainable growth," meaning the continuation of profits for merely a few years, without any measure of long-term balance and protection or continuity of people and communities in their environments over generations. This is also in direct contradiction to the principles that they agreed to in the Rio Declaration.<sup>2</sup>

Academics in fields such as economics also now ignore and redefine the foundational scientific principle of sustainable development in ways that reinforce the justifications offered by international donors and development agents. Rather than recognize the international treaty obligations that respect the rights of all cultures to choose their own levels of technology and consumption that fit their individual environments and to achieve sustainability in ways that promote and protect human cultural diversity, they argue that there is really only one type of viable path toward sustainability. As other critiques have noted, many economists distort the concept of ecological modernization offered by sociologists to describe one possible sustainability solution for industrial societies (Huber, 1982; Mol, 1995). They make a single choice—industrialization, urbanization, and globalization in a common world-system monoculture—the objective of sustainability (Mol, 1995). Mainstream economists and political scientists continue to contend, in contradiction to the fundamentals of Darwinist evolutionary biology, human biology, and anthropology (Steward, 1955; Sahlins, 1960) that there is a single evolutionary path of development and of human systems.

This denial of the established principle of cultural adaptation (adaptive radiation) and evolution reasserts the nineteenth century view of a "linear" evolution of cultures in their relations with the environment. This rewriting of evolutionary biology and human cultural evolution mandates urbanization and industrialization as the only possible choice for all peoples. Development becomes a slogan justifying the role of technologically advanced and powerful actors to use their knowledge to push all other societies onto this single path. One might argue that this is a new form of the attack on evolutionary theory by

<sup>2</sup> In its current formulation of international development policy, for example, even Sweden makes the claim that "poverty" is the result of lack of economic growth rather than lack of sustainability. The country establishes "sustainable growth" as the basis of its development policy without even mentioning the term "sustainable development" (see Swedish Ministry for Foreign Affairs, 2010).

the church that helped to sustain the spread of European imperialism and its ideology of a "civilizing mission" over "primitive" natives, despite the rise of disciplines like ecology and anthropology that offer scientific explanations of how adaptation and survival are best promoted (Lempert, 2010).

A related argument offered mostly by economists is that there is only one acceptable choice for all the globe's cultures of how to balance the sustainability equation, through an approach called "weak" sustainability (Solow, 1993). In their view, balancing the equation requires a set of fixed choices for continuing growth of technology and consumption. It accepts human ability to mechanize and control the natural environment and all of its processes and implies the ability to measure all of them in monetary values. According to proponents of "weak" sustainability, "destroying" or "controlling" and monetizing nature is a political choice that is preferable to protecting nature itself; the goal of "strong" sustainability. They object to the "strong sustainability" approach that takes into account human qualitative valuations of nature, different methods of measuring value, and interaction with the natural environment as outside of their single measurement system predicated on monetization as the standard of value. In fact, monetization is also a political and ideological choice that empowers those who hold the money. These scholars consider the human construct of money and the way it defines value to be a more universal measure than the scientific equations from other fields that they say should be discarded as political (Ayres et al. 1998).

Generally, economists and political scientists frame these arguments using a theoretical basis rather than an empirical test of historical sustainability and collapse. They do not subject their theories to the evidence of multiple cultural and environmental contexts through human history demonstrating how population, consumption, and technology pattern the sustainability and the collapse of cultures and civilizations in their resource bases (Tainter, 1990; Wilson, 1998). Among the theories economists use to support their belief in sustainability without directly applying the IPAT equation is a posited relationship between economic growth and inequality applied to the environment as "the environmental Kuznets curve" (Kuznets, 1955; Stern, 2003). This curve suggests that initial increments of economic growth damage the environment, but ultimately in its intermediary and advanced phases leads to environmental improvement. In fact, Kuznets never wrote about the environment or about sustainability at all. Yet, economists have used his optimism about equality to apply this simple curve to defend against other criticisms of their monocultural model of economic

growth, including concerns about sustainability and economic collapse (see, e.g., Grossman & Krueger, 1991; World Bank, 1992). Economists who support globalization use the curve to suggest that all forms of economic growth that currently damage the environment and appear unsustainable will ultimately result in a return to equilibrium with the environment as economic growth and exploitation continue.

There have now been twenty years of argument over the environmental Kuznets curve with almost every empirical environmentalist and anthropologist demonstrating that it does not stand up to data. Recent studies by social scientists show that improvements in ecoefficiency (the ability of production technologies to exploit lower amounts of resources per unit of production) have so far proven insufficient to compensate for the overall increase in consumption that follows with higher levels of affluence (York et al. 2005). There also seems to be a fallacy in the thinking that higher consumption creates incentives for higher investment in research that then leads to efficiency improvements. The current incentive system in industrial societies appears to lead only to increased competition for the planet's resources under the cloak of spurring a future fantasy technological breakthrough that will lead to sustainability (Nguyen, 2008). These criticisms are also bolstered by a line of historical studies demonstrating how civilizations with a similar single-minded focus on productivity follow patterns of collapse rather than long-term sustainability (see, e.g., Tainter, 1990). While the principles of biology and physics suggest multiple levels of stability and sustainability that are context specific and suggest that single, homogeneous complex systems are the least sustainable, those supporting globalization along a single path use Kuznets to assert that their approach is the most robust and sustainable (Stern, 2003). It appears that continued support for Kuznets is based on wishes more akin to religious belief than scientific argument, since it is not grounded in empirical reality, as at least one group of leading economists has argued (Arrow et al. 1995).

We do not claim that the strong sustainability or the weak sustainability approach for an already industrialized culture is the correct one. Some types of economic growth are obviously sustainable since all human cultures represent some use of technology and there are still humans on the planet. We are simply noting that weak sustainability proponents are largely advancing arguments inconsistent with empirical science and the international legal agreements that uphold the rights of cultures to proceed in ways that promote human cultural diversity, competition, and adaptation. Most supporters of the strong sustainability approach whom we meet in our work at least respect the international treaty obligations and recog-

nize the scientific standard that the agreements protect as the one to follow. Meanwhile, most economists and political scientists who support the weak sustainability approach have chosen to substitute their own definition of sustainability in a single, uniform vision for the planet that discards the four factors in the sustainability equation and reduces the idea of balance to an ideological faith in productivity alone. Most civilizations and human cultures that have existed in human history are now extinct, a phenomenon often attributable to their inability to exist sustainably with their environments. Thus, we wonder what logic would lead both practitioners and many academics to unite in evading the Rio Treaty standard that reflects the scientific and technological view of progress that they claim to believe in and that is supported by the international legal system that they created to protect their own interests.

In our view, the distortion of the language of sustainability by many contemporary actors is Orwellian. We search deeper for explanations for what appears to be contradictory behavior.

### **A Logical Hypothesis for Why Development Actors Seem to Abandon the Agreed Standard of "Sustainability"**

Generally, when there is a conflict between a written law and its applications, the contradiction is attributable to discrepancies in the interests of different groups. In the case of sustainable development, however, almost all actors seem united in both supporting the scientific and political standards and in finding creative ways to evade them. Achieving sustainable development and dealing with international environmental crises seems, by its very definition, to be in the long-term interests of every actor, from the developed/urbanized countries and cultures to the nonurban, and including development organizations. How is it—with global warming and environmental pollution invading bodies with chemicals and radiation, flooding homes, and destroying the planet's natural systems—that the very organizations responsible for sustainability would turn their backs on their agreements and twist the concepts that they well understand into meanings never intended? The logical explanation is that a hidden or unexpressed set of beliefs is creating a contradiction. It may be a simple truth that is too difficult to openly express, perhaps even a taboo. In this case, the contradiction appears to be between an ideology of sustainability that requires a balance and one of productivity that undermines this balance. Can this contradiction be resolved?

Before offering our hypothesis of the actual motivations, it is important to examine what the different

international actors are doing in place of sustainable development. Since the actual behaviors that international organizations and countries are following are not random, they must presumably be following some kind of logic and pattern that can be modeled. If we can expose this "deep structure" of behaviors and listen to what actors say directly, in private conversations, about their actions, we can offer a hypothesis about this alternate logic.

Each of the three development actors (international NGOs, international donor organizations, and country governments) that have distorted the scientific definition of sustainable development appears to have a different motive, but their behaviors may also reflect a deeper reality. What they have in common today, as in the past, is their unwillingness to recognize the free choice of cultures/countries to their own development approaches and their internationally protected right to these choices. What appears to be underlying is an unwillingness to recognize a related right: that of protecting the full range of assets of each country/cultural unit (e.g., resources, people, cultural heritage, and social and political organization) that are the basis of sustainable human development.

*"Development" organizations (international NGOs)* have transformed the interrelated goals of equality and sustainability and have substituted another definition that distorts the objectives of sustainability. Their definition of equality is to bring everyone up to the same standards of consumption by replacing cultural differences with imported technologies that will increase productivity, keep population rising, and promote international trade and urbanization across the planet. In their view, the way to achieve equality is not to protect diversity or even to seek to reduce consumption while promoting economic distribution (sharing) from the wealthy. The aim is to raise everyone up to the same level. This is not very different from the historical goals of "Marxists" and the Soviet Union, or of China today, or of the western missionaries who spread throughout the Third World in the colonial era. It is a common ideological approach shared by global powers. For example, Gus Speth (2008), one of the original champions of the sustainable development standard, also falls into this contradiction. He links equality (through growth), democracy, and environmentalism as the three essential pillars of development, though he recognizes that they may actually be impossible through growth.

*International donor organizations and governments everywhere* appear to be following a different logic from the one of long-term economic benefit and cooperation that political scientists have long modeled. In the 1960s and 1970s, development scholars



created “dependency theory” to explain that “development” was really a new form of colonialism and external reliance, driven by the desire of major powers for markets for their goods, cheap labor, and ability to exploit resources (Gunder, 1967; Wallerstein, 1974). Contemporary proponents of this view contend that this pattern is still occurring today, and that this ideology continues to trump the dialogue on sustainability (Korten, 2007). These critics add that many experts who claim to promote sustainable development will never address consumption because the underlying goal of development is to promote interests antithetical to sustainability, to benefit business and increase aggregate consumption. They also contend that consumption is not addressed because higher population promotes greater consumption and keeps wages low for foreign investors seeking reduced product costs. They argue further that environmental standards will never really be enforced because the underlying logic of development is to shift production to poor countries that are too weak to impose environmental protections so that the result is to export pollution and environmental damage.

Those social scientists who accept the view of dependency theory recognize the motives of corporate interests and of empires whose very basis for survival undermines the concept of sustainability. These imperial cultures and interest groups within them exploit nonlocal resources rather than live sustainably within their own resource bases. Empires overuse their resources and dominate other cultures, until their empires ultimately collapse and are replaced (Tainter, 1990). What makes this model of the world difficult for sustainable development theorists to confront is that it does not fully explain the behaviors of developing countries or the global trade system that has emerged.

If the struggle is really between wealthy countries that are exploiting “developing” countries, what is hardest to explain is why the countries and cultures who fought against colonialism to protect their own cultural prerogatives and developmental priorities would also abandon the sustainable development standards and international laws that would protect them. Why would countries and cultures that fought against colonialism and which sought to eliminate colonial institutions and ideologies, now embrace a monolithic view of development? Why would they embrace the very institutions and ideologies that they fought in the past? Why would they avoid incorporating the simple sustainability planning mechanisms—the kinds of measures of assets and consumption needed to assure sustainable development as the very essence of what government planning is supposed to do at the local and national levels? Why do their agendas continue to be investment portfolios as

they were in the colonial era, and that are brought to them by international banks and organizations in the form of loans and policies that they should be free to refuse and to replace with more sustainable alternatives? Why do they still base success on sales and income measures (what they export) and on productivity, rather than assets, protection, wealth, or quality of life?

While we subscribe to dependency and world-systems theories (Lempert, 1995), we think a corollary may be needed to explain the fundamental internal contradiction between the growth and dependency model of the global system and the standards that it has simultaneously promoted for sustainable development but refused to follow.

One aspect we have considered is how power balances among different groups influence their motivations. Our previous research provided a clue to understanding contradictory national behaviors (Lempert, 1995; 1998; 2000; Lempert & Nguyen, 2009) and we draw from it as well as our field experiences in applied development work with governmental leaders over the past three decades. In looking at how international actors have redefined sustainability in terms of equality that homogenizes every culture to the same level of consumption and technology, in violation of international rights protections and sustainability principles, we noted how this distorted view of equality has been common to both capitalist and communist societies that have industrialized.<sup>3</sup>

### **An Hypothesis: The Missing Link between International Security and Sustainable Development Policy**

Before even addressing the motivations that might be at work in causing almost every country in the world to choose approaches that evade what is arguably in their long-term self-interest (sustainable

<sup>3</sup> An earlier article (Lempert 1998), explaining why Karl Marx sought an equality that was not simply economic but that destroyed cultural differences (and political choices) in mass society, offered a cultural explanation. This work suggested that Marx's personal experiences as a German Jew, fearing ethnic violence (and genocide), largely motivated him and other Jews in Europe to promote ideologies that would eliminate ethnic differences and thus the violence (and fear) that came with it. The article describes how similar fears by minority scholars and practitioners today have distorted their scholarship and motivated international agendas for “equality,” including suppression (and destruction) of cultural differences, even of one's own culture. Indeed, it is when describing the fears of leaders of developing countries of foreign invasion, and even assassination, if they do not agree to certain policies of globalization, that we hear direct echoes of the motivations of minorities advocating for “modernization” more than a century ago.

development), what struck us immediately is how well it could fit one existing social science framework of looking at seemingly contradictory behaviors that is applied to international actors as well as individuals in competition. That tool, coming out of game theory, explains what is described as the "Prisoners' Dilemma" and it seems to apply perfectly here. Moreover, what game theory does is show how seemingly illogical behaviors are actually perfectly rational when one understands that the motivation of international actors is actually fear of each other. Indeed, the missing link in understanding evasion of commitments to sustainable development seems to be the underlying but real fears that countries and cultures have of each other and that are only being addressed in the international system in an effort to make everyone "the same."

This may be the classic case for using a "Prisoners' Dilemma" framework. Two opposing logics of behavior appear to be at work and the contradiction is between long-term interests (environmental sustainability) and short-term interests (productivity, growth, and poverty reduction through short-term treatment of symptoms). The choice could work against the self-interest of some actors (i.e., less developed countries and cultures) and the logic seems driven not by positive choice but by an avoidance or fear-driven response. Political scientists have long modeled contradictory behaviors using a game-theory model in which actors make short-term choices that contradict their long-term goals because of their fears of what other actors might do (Morganstern & von Neumann, 1947).

This model seems to fit what is happening in the international system today with respect to sustainable development. Furthermore, we have heard statements, both in private conversations in our work and in closely reading the media and speeches from government leaders, that suggest their approach to sustainable development is actually driven by their short-term fears of actions by major international actors. In their view, short-term decisions to pursue unsustainable growth actually stem from concerns about what they must do to protect their short-term security. From the perspective of government leaders, and from citizens who may also fear more powerful countries, this behavior may actually be quite rational, though it may make sustainable development impossible.

Perhaps the best statement of what is happening and why comes from leaders of governments whose rhetoric has radically changed during the period prior to and after independence. We have worked for years with Southeast Asian, Latin American, and Eastern European governments and with NGOs. Their statements about their choices help to make the problem

clear. They suggest the security threats that countries still face in the global order really drive their choices on sustainability and that environmentalists and environmental policies are not addressing this concern.

For example, the Vietnamese government claimed to have fought a revolution to protect the rural way of life and the country's culture or spirituality and simplicity. Now, by contrast, the government stresses how urbanization, globalization, and trade will promote wealth and power and how these are its central goals. Public statements define economic growth as closely linked to higher military spending and security, with sustainable development not even mentioned (Communist Party of Vietnam Central Committee, 2006). If this is the goal of the leaders of the country whose majority nationality represents the thirteenth largest population group on the planet, and its priority is to keep expanding population and consumption, even at the risk of destroying its resources and traditional culture, they must have some other very important overriding motive. They make it clear that that motive is security. Undoubtedly, Vietnam's recent historical experience of being bombed by the French and the Americans and invaded by the Chinese is at work here.

Government documents, conversations, and press releases reiterate the fear of being invaded and having the country's resources taken or destroyed by more powerful outsiders. The opening sentences of national economic reports directly link economic policies with the need for security and the lack of international stability (see, e.g., Communist Party of Vietnam Central Committee, 2006). Though it might be easy to dismiss that motive as paranoia, Vietnamese leaders see a world where superpowers target foreign leaders and resources. Countries like Iraq that are similar in size to Vietnam, or Afghanistan that are even smaller and weaker, are not a direct military threat to the superpowers but are a source of resources and sites for the transit of resources for those countries to exploit. Those smaller countries are a threat only to the goals of the larger countries for consumption and resource exploitation (Sampson, 1975). Vietnamese leaders see a world where neighboring China continues to invest in weaponry, keeps its hold over Tibet, calls for control of Taiwan, and uses its military and economic power in Myanmar as well as in Africa where it seeks resources. In the view of Vietnamese leaders, their development choice is constrained to one of trade relations and the need to purchase weaponry in response to perceived threats, rather than sustainability. At the same time, these leaders today, as in the past, view population growth, particularly of males, as their greatest asset in long military conflicts and in ability to protect land (see,

e.g., Hendershot, 1973) despite the consumption of resources and competition that it also creates.

Meanwhile, in neighboring Laos and in small countries of Eastern Europe that have been bombed and overrun by larger powers in recent history, the incentive to join the World Trade Organization and to agree to the exploitation of their domestic resources has been described to us in private meetings as a way to appease foreign interests. Leaders constantly call for trade as part of their strategy of peace and friendship, stressing their fear of future attacks. The deals they make for mining, hydropower, and land sales for production of export crops like tobacco and coffee force their own minority peoples out of their ecosystems (agricultural land, waterways, and forests), sell their resources, and decimate their own industries as they open the door to foreign imports. They recognize that these are not strategies for sustainable development, or even for protection of their own cultures. At the same time, these leaders constantly note how much better off they are living in peace and without the fear of outside attack. This is not a return to trade systems of the past where local cultures maintained their resources and systems of production and traded in local products. Moreover, the leaders we meet with in our work advising on and in researching the history of policies and practices are very much aware of the difference. They see themselves accepting the return of foreign powers (and often seek to play off those powers against each other) as a forced choice in which their countries, and sometimes they themselves, are under risk if they do not agree. In many cases, they also recognize that they are in power in their own countries because larger powers want them there as intermediaries to extract resources or to serve foreign investment and they serve that role under pressure. They are giving away in sales and trade what they are unable to protect militarily, while turning their countries into production zones for rubber, coffee, and the very same exports demanded during the colonial era.

In this article, we focus on presenting our hypothesis and theory, rather than on recounting the numerous conversations we have had with government officials, many of whom suffered directly from foreign invasion of their countries.<sup>4</sup> Nor do we wish to

belabor the parallels between the statements of the countries that colonized them and their own statements with regard to exploitation of their minorities and resources now that they have taken over the former colonial systems. Among these meetings, however, perhaps the most poignant was one held with former Philippine President Diosdado Macapagal (and father of recent President Gloria Macapagal Arroyo) in private in his home. In describing decisions he made as President, he referred almost in tears to what the United States "could do" and did do, including assassinating leaders in neighboring countries and bombing millions of people from Indonesia, Vietnam, Cambodia, and Laos.

When looked at overall, across the globe, the irony of globalization is that it is presented as a way of reducing tensions and promoting security and choice (Deudney, 1990). Rather than decreased military spending, globalizing processes are correlated with the increase and continuation (if not exacerbation) of national (and cultural group) insecurities. For instance, global military spending is up 45% during the past decade and represents 2.5% of global GDP, while resources decline (Agence France Presse, 2008). Although exploitation of another country's oil or minerals or labor or markets is not the only motive for war, classic studies of war have recognized that resource exploitation is a motivating factor (Hobbes, 1902; Prebisch, 1950) and that even in countries that promote ideologies of technological growth, any kind of imbalance between consumption levels and resources, or between productive needs and resources, can be a cause of war even between trade partners (Kelly, 2000).

While the current dogma of those supporting globalization is that trade makes countries less likely to go to war and that it renders formerly unsustainable countries that were dependent on resources less militaristic, the debate reverses cause and effect. Countries may choose trade as a way of being protected against direct attack and of leaders maintaining their positions as intermediaries. It is not that they are freely and equally choosing trade to resolve the underlying conflicts. If this were the case, one would

<sup>4</sup> As a leading expert in legal development and governance, Dr. Lempert has worked as an advisor to government leaders including presidents, prime ministers, governors, parliamentarians, and judges in more than 25 countries over more than 30 years, both independently and for major international organizations and public and private donors. Prior to beginning professional work, he ran a number of university speaker series hosting active and retired international leaders and presidential candidates and also worked as a journalist interviewing national and international leaders on their personal histories and motivations. His professional work dates back to 1978, when he was on the staff of United

States Senator William Proxmire promoting passage of the UN convention on genocide and analyzed the different concerns of leaders to support and enforce such protections. He has had private meetings with international leaders dating back to 1980 when he advised the Prime Minister of Mauritius on the country's politics and ethnic balances. His first meeting in the Kremlin was in 1990 during the Soviet era.

Ms. Nguyen has worked professionally for a decade as a legal analyst within the Vietnamese government as well as with government leaders of several countries in the Mekong region on environmental policies. She did research on sustainable development issues in northern and central Europe and interviewed local government and business leaders.

expect globalization to reduce pressures on cultural extinctions by promoting more rights and freedoms that should come with trade, rather than accelerating internal colonialism and destruction of cultures.

While environmentalists and peace activists have linked the issues of environment and peace, they have not paid enough attention to the concerns of resource security as a basis for sustainable development.<sup>5</sup>

It is true that many "environmental" and "peace" activists have developed linkages with each other in their policies and ideologies, largely from the consumption side, and partly from the institutional side in looking at growth (Global Greens, 2001). They have called for moving toward renewable energy as a way to shift government policies away from the exploitation and capture of oil and other resources on which dependencies are linked with pressures for war. They have also called for lowering consumption as a way to limit demands and pressures on resources.<sup>6</sup> Some also link corporate behavior and motives for profit or control to environmental damage and seek to change the global ethic and behavior of corporations (Korten, 2007). The environmentalist ethic of peace, consumption, and fairness, linked to a love of nature, has also partly been presented to developing countries in seeking to change environmental consciousness. But the apparent rejection of this approach in developing countries suggests that other forces or psychological mindsets (cultural and cognitive factors) may be at work that environmentalists are not addressing, notably the need for security. Overall, environmentalists have not explicitly linked the idea of resource security with concepts of environmental justice, peace, or equity.

### Implications for Development Policy of the Delinking of Security and Sustainability Policies

The contradiction between the long-term goal of sustainable development, through cultural pluralism that allows cultures to choose ways to coexist with their environments, and the short-term goal of groups to protect themselves, through high productivity to fund militarism in ways that require abuse of their resources, seems aptly described and modeled within

the framework of the classic Prisoners' Dilemma, shown in the matrix (Box 1). Like other prisoners' dilemmas, there may not be a way to change the choices of international actors to support long-term systems and standards for sustainable development, because it is in their short-term interest to make the very choices that promote unsustainability. The implications of this are severe and ironic. The global system that proclaims a path to harmony, pluralism, and sustainability may actually be destabilizing itself.

Countries would choose sustainable development policies if they believed that they lived in a safe world. However, despite all of the rhetoric about how much safer the world is today because of globalization, the contemporary global trade regime seems to be a symptom of international threats as much as of a faith in the ability of countries and cultures to choose independent paths (Korten, 2007). The legacy of the twentieth century continues in global conquest by the major powers in Iraq, Chechnya and the Caucasus, Sudan, Papua, and elsewhere, and it maintains the reinforcing spiral of insecurity that leads to more militarism both to protect and to appropriate resources.

If this theory is true, the preferred solution to the Prisoners' Dilemma seems unlikely to be implemented. According to game theorists, cooperation results from repeated interactions by different parties in a way that recognizes and reinforces mutually shared interests (Axelrod, 1984). At the international level, there seems to be little precedent or movement toward this kind of cooperation or bargaining. The current global distribution of power is skewed and the international system has been unable to restrain the major global powers from using military force to expand their private interests. In fact, the most destructive and negative outcome can be described as a Nash equilibrium, a stable solution that no nation sees a benefit in trying to change, even though it ultimately leads to the worst possible outcome (Nash, 1951).

In our experience with governments in developing countries, their inability (or unwillingness) to protect the environment is not so much due to a lack of ecological consciousness, but an institutional framework of national security fears that remains linked to colonial institutions of resource exploitation and high consumption to fuel the military and police apparatus. Given the reality and/or the psychological depth of these security fears, as a legacy of colonialism and a continuation of global competition for resources, the appeal of environmentalism and sustainability may not only be weak motivators, but may actually be irrelevant.

The elephant in the room that is driving the dilemma appears to be the failure of the international system to provide any real security that natural and cultural resources will not be destroyed by invading

<sup>5</sup> While the rights of farmers to land and the urban poor to credit have been considered fundamental to their economic security, and this is indeed part of a new global donor initiative (for "Legal Empowerment of the Poor"), even this kind of effort fails to address the larger issue of security of ecosystems and national resource asset bases (UNDP, 2008).

<sup>6</sup> The ideology of the green movement has also linked food practices and peace by suggesting that vegetarian diets can promote more peaceful coexistence if not peaceful behaviors, drawing on the religious appeals of Hinduism and Buddhism (for animal rights and peace) as well as Judaism (Joseph Albo's *Book of Principles* from the fifteenth century).

# Box 1 "Prisoners' Dilemma" of Nation States

*Like the "prisoners" faced with the choice of cooperation or competition, countries (and cultural groups), big and small, are faced with the choice of sustainable development planning and policies or high consumption and militarism. The reality of the world today is that the best "protective" choice appears to be consumption and militarism, given the threat of invasion and pressures from major powers and neighbors. But that is also the path to the destruction of the planet. Unless the security issue is dealt with so that countries shift toward sustainable development planning, the Prisoners' Dilemma model suggests not only that globalism will lead to its own failure, but that the future of the planet is also in jeopardy.*

		<b>Large country, developed or developing</b>	
		Choose low consumption, low population, and investment in people not weapons	Choose high population, rapid consumption of resources, and high purchase of weapons to protect against others who might try to steal the resources
<b>Small country or population group, having to choose to protect its culture or to join the world system and industrialize</b>	Choose low consumption, low population, and investment in people not weapons	The <b>Ideal</b> and stated goal that none of the international agencies are promoting, of a multilateral system that protects cultural rights and sustainability and maintains the safety of the planet. <b>[Win-Win Equilibrium]</b>	Continued colonialism in many places—physical destruction and resource impoverishment of the smaller country or culture by the stronger country and continued high consumption and expansion of the large country in a way that is unsustainable.
	Choose high population, rapid consumption of resources, and high purchase of weapons to protect against others who might try to steal the resources	Loss of culture, destruction of resources, and a resultant transformation to unsustainability of the small country or population that at least protects people in the short run, but that also may promote destruction of weaker neighbors and lead to future internal instability.	The <b>Current Situation</b> in most places, fueled by continuing militarism (resource and climate wars and instability), and reinforcement of colonial economic and political institutions—leading to continued destruction of the planet and threat to human survival. <b>[Lose-Lose Temporary Equilibrium]</b>

armies, destabilization, or political systems of control. The only real resistance continues to be attempts at counterpower through the kind of destructive growth that can buy weaponry or decelerate the pace of destruction by giving away resources or accommodating foreign voracity as a form of slow appeasement.

In our view, the real problem that sustainable development experts have is not about convincing people to love the environment or to care about their children, which is the way that environmental awareness campaigns are now structured. All human beings have a natural inclination to revere nature. According to evolutionary biologists, not only have we co-evolved with nature, but we are biophilic and naturally seek to protect our own genes (our children) and our environments unless we are taught or conditioned by some other motive (Fromm, 1964; Wilson, 1984). There is not much sense in trying to tell people what they already know in the same way that many health campaigns seeking to make people aware of the harms of smoking or poor diets are ineffective. The problem may not be awareness. It instead may be a Prisoners' Dilemma in which choices are the most "rational," but nonetheless lead to the most destructive outcome.

## Theoretical Framework for Future Testing

If dependency and world-systems are extended to include the concept of resources, it appears that the current approach to globalization is a classic prisoners' dilemma that not only cannot lead to the long-term equilibrium of sustainability, but that may potentially worsen the planet's current environmental problems, thus leading, ironically, to the disintegration of the global system. If this is correct, can environmentalists or developed countries do anything to change this fate, or does it have to transpire in accordance with its own inevitable logic? This is the question that we pose. We restate our findings and some of the possible—and frightening—implications below.

Sustainable development by definition requires an approach that looks at the ability of cultural groups to subsist within a given resource (asset) base and that protects this right. It is these standards that have been established in international law. At the same time, the linkage between security and those asset bases has been blurred by ideologies of free mobility of resources (capital and labor) and specialization (comparative advantage), as well as ideologies of the current world order of globalism and trade that is seen as the way to overcome past nationalist conflicts and colonialism.

The global system is apparently locked into a set of choices that is leading to the outcome that no one would choose, a downward and irreversible spiral toward a perverse Nash equilibrium. Empirical evidence suggests a vicious cycle between military insecurity (fear over resource theft and the need to protect these assets) and environmental unsustainability. Militarism and appeasement feed environmental destruction by those seeking to take resources and those having to sacrifice part of those resources as the price of defense, while environmental (resource) crisis feeds war.

Rather than considering the destruction of the environment as a cause of war over dwindling resources, there may actually be a more complex relationship—a vicious cycle—in which the need to secure resources may actually be driving their overexploitation as a means to increase economic and military strength. This iterative process further drives competition over dwindling and disappearing resources. Moreover, this positive feedback loop, supported by ideologies and institutional structures that are the legacy of colonialism throughout the world, may itself be a Nash equilibrium that is now impossible to change because it is self-reinforcing through “rational” choices by governments and cultural groups. This outcome may also explain the “rational choice” of countries to begin to prepare for climate wars and further resource competition rather than to agree to the very frameworks for sustainability of the planet that are, ironically, also the key to maintaining globalization. In other words, the current approach to globalism does appear to be promoting its own breakdown because of a built-in contradiction in the approach to sustainable development.

While there is an emerging view among certain parts of the green political movement that sustainable environmental policies must be linked to movements for international peace, and a recognition that the endangerment of resources (productive resources and human populations) may provoke future climate and resource wars (Kaplan, 2001; Homer-Dixon, 2006), it does not go far enough. The important conceptual connection may not only be to peace, but to overall security for small countries and cultures so that they may psychologically perceive (both actually and in terms of overcoming any “irrational” fears) that their resource base is secure.

In development policies, the unaddressed root causes of unsustainability appear to be the institutions and the psychology of colonialism that remain in former colonial and former colonized countries. This legacy may be the real source (or symbol) of failure on the part of international development organizations to promote policies that can truly be called sustainable development, that could protect cultural di-

versity and ensure long-term balance between each cultural group's population and consumption with its environment and technological capacity. If our theory is correct, not only is the sustainable development policy approach wrong (or irrelevant), but there is considerable doubt whether these fundamental causes can be changed. It may be more likely that global environmental crises will only augment fears and insecurity in a vicious cycle that reinforces the problem rather than fosters a solution. Moreover, given this system, it may be “rational” behavior for nations and ethnic groups to exploit their resources as part of preparations for future resource and climate wars that the global system has made inevitable.

Unless sustainable development planners are willing to confront the elephant that remains in the room, and link global security issues and rights protections for small cultures and developing countries with sustainable development planning, there is little hope that approaches consistent with scientific standards will be adopted and few prospects for a sustainable human future. At the same time, there is a question as to whether those of us working in this field have the political acumen, skills, or courage (with donors and developing country governments) to add these approaches to our repertoire. Several recent studies of the United States and the former Soviet Union for example, suggest that militarism is so embedded in the culture of economic superpowers that they cannot transform themselves until the empire itself collapses (Lempert, 1995; Johnson, 2004; Bacevich, 2005).

The implications of these circumstances for the planet and for sustainable development approaches could be staggering.

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## ARTICLE

# The quality of sustainability science: a philosophical perspective

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Sustainability science does not fit easily with established criteria of the quality of science. Making explicit and justifying four features of sustainability science—normativity, inclusion of nonscientists, urgency, and cooperation of natural and social scientists—can promote deep and comprehensive questioning. In particular, because the inclusion of nonscientists into sustainability science has become a dogma, re-examining the epistemic, normative, and political reasons for inclusion is important for the quality of sustainability science. These reasons include providing a range of perspectives and helping to craft and implement policy in real-world social and ethical situations. To be included effectively, nonscientists must be understood within this demanding context rather than employed merely to satisfy a dogma. We situate our discussion in this article against a foundational controversy of sustainability science: the weak versus strong sustainability debate. According to our analysis, comprehensive consideration of the features of normativity, inclusion of nonscientists, urgency, and cooperation of natural and social scientists suggests a convincing case for strong sustainability.

KEYWORDS: sustainable development, interdisciplinary research, evaluation, participatory planning, culture (human)

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## Introduction

Sustainability science has become a recognizable domain for scientific funding. Two notable examples are the program *Forschung für Nachhaltigkeit* (Research for Sustainability) organized by the German Ministry of Education and Research and the Science and Technology for Sustainability Program of the National Academies in the United States. Funding by itself does not legitimize sustainability science. Rather, it calls for reflection on such scientific activities, their key features, and the reasons for them. There is also sustainability science in the sense that there are scientists who regard themselves as sustainability scientists and who claim to do such science. However, neither funding nor a mere presumption to do science is sufficient to establish a scientific field. Sustainability science must continuously reflect on its practice and its key features if dogmatism is to be avoided. To this end, we raise from a philosophical perspective four questions regarding key features of sustainability science. How these questions are dealt with strongly influences the quality of sustainability science. The respective choices and positions should be made explicit so as to avoid confusion and to improve understanding of the concept “sustainability science.”

This article examines key features of the projects and research activities of sustainability science—these features define our working concept of “sustainability science” or “science for sustainable development.”<sup>1</sup> These elements are normativity, the temporal character (urgency) of the research, the inclusion of nonscientists into sustainability science, and the task of understanding social and environmental interrelations. Put briefly, these four factors concern the explication and articulation of values and principles (normativity), addressing the temporal relation of the research to what is at stake (urgency), the justified inclusion of nonscientists (participation), and the joint research of natural and social scientists (interdisciplinarity).

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<sup>1</sup> In addition to this journal, contributions to sustainability science are regularly published in a special section of the *Proceedings of the National Academy of Sciences of the United States of America* as well as a numerous other journals (for a current list, as well as further resources, see <http://sustainabilityscience.org/document.html?type=journal>). Important, frequently overlapping research communities contributing to sustainability science include resilience research, common-pool research, socioecological research, transitions research, and vulnerability research. For the discussion in this article, the ecological economics community is particularly important, as one of the cofounders of the field, Herman Daly, made major contributions to the weak versus strong sustainability debate (see, e.g., Daly, 1996).

These features make sustainability science difficult to evaluate according to the standards of disciplinary science, especially of the natural sciences. The overall field of sustainability science, with its explicit inclusion of normative considerations, seems to rest on shaky ground by the standards of customary disciplinary approaches. However, since the challenges of sustainability are real and unresolved, and a high quality of scientific inquiry desirable, a deeper understanding of these features matters. Philosophical considerations, in particular from philosophy of science, can contribute to this task.<sup>2</sup> For the investigation of the quality of sustainability science, it is of primary importance to ask methodological questions and to examine ways of defining a problem. As important as the development of indicators and tool sets for evaluation is the philosophical task of examining major presuppositions of sustainability science and their justifications. Our approach aims at deep and comprehensive questioning in sustainability science: depth with respect to each feature, comprehensiveness as covering all major features.

We first introduce a famous example to demonstrate that philosophy of science plays a role by structuring the debate in sustainability science. Our illustration is the ongoing dispute between weak and strong sustainability. We show how Popperian and Kuhnian philosophy of science costructure Neumayer's (2010) classic contribution to the debate. In addition, we demonstrate this to be an uptake of philosophy of science that leads to a conceptually problematic way of framing the debate.<sup>3</sup> The article then discusses how a critical re-examination of the Kuhnian and Popperian views can inform an analysis of the four key features mentioned above—and with it shed a different light on the debate between strong and weak sustainability. Philosophy of science so conceived is enabling and its attempt to pose the relevant questions is one contribution to a critical self-understanding for sustainability scientists. Rather than uncritically stating certain features, we re-examine why and under what conditions features are justified, thereby improving the quality of the research. Finally, we draw some tentative conclusions for the emerging culture of sustainability science.

<sup>2</sup> It is in this respect that we hope to contribute to the discussion of the quality of sustainability science and thus pragmatically to its evaluation. We deliberately say “contribute” as we do not claim that philosophy of science somehow delivers “the” method of sustainability science. In our view, sustainability benefits from a diversity of methods. One contribution of philosophy of science is to make explicit and discuss the presuppositions about science that costructure fundamental disputes such as the one between strong and weak sustainability.

<sup>3</sup> There is probably a link here to the French tradition of epistemology and its examination of the role of philosophy of science as in Lecourt's (1969) account of a historical epistemology.

## Framing Issues—the Difficult Heritage of Philosophy of Science

The relevance of philosophy of science for the way questions are asked in sustainability science can be demonstrated via the discussion of weak and strong sustainability. This key debate revolves around the question of whether natural capital, in particular natural resources and natural sinks, should be regarded in principle as substitutable (“if we run out of coal or oil it does not matter, for we will be able to substitute another energy source”)—weak sustainability—or as complementary (“if we destroy or deplete natural capital such as the world freshwater supplies, there is no alternative for this essential service”)—strong sustainability. Here we focus on Eric Neumayer's (2010) seminal contribution to this debate.

*Weak sustainability* (WS) in Neumayer's definition requires “keeping total net investment [or total savings], suitably defined to encompass all relevant forms of capital, above zero.” In contrast, *strong sustainability* (SS) “calls for the preservation of the physical stock of those forms of natural capital that are regarded as nonsubstitutable (so-called critical natural capital).” Neumayer states his goal as follows: “It will be argued here that both paradigms are non-falsifiable under scientific standards. Therefore, there can be no unambiguous support for either weak sustainability or strong sustainability.” At the end of his extended debate, he states: “the contest between WS and SS cannot be settled by theoretical inquiry. Nor can it be settled by empirical inquiry.” For the present purpose, we need to pay attention to the way Neumayer frames the question: *Can the paradigms of WS or SS be falsified?* This question (as Neumayer indicates via his references) points directly to two seminal contributors to philosophy of science: Karl Popper and Thomas Kuhn. We will therefore very briefly introduce a few essential points pertaining to these respective philosophers so as to highlight the philosophical structure of Neumayer's question.<sup>4</sup>

### Karl Popper and Scientific Method

Karl Popper (1963) influentially argued for the idea that science is distinguished by a scientific method consisting of an evolutionary process of conjectures and refutations. Popper's work has been doubly influential: with respect to reinforcing the meta idea that science is distinguished by a method

<sup>4</sup> The secondary literature on Popper and Kuhn is enormous. Here we cannot discuss the many critical points that have been raised with respect to these philosophies, amendments, and refinements. Our only goal is to delineate as clearly as possible how they influence the way the question is posed in our case study.

and his specific idea of falsification, which has been endorsed by numerous scientists, as well as—suitably for a discussion of sustainability science—a wider public.

The specification of this scientific method, Popper argues, allows science to be distinguished from pseudoscience (the so-called demarcation problem). Popper believed fields such as psychoanalysis or scientific socialism belong in the domain of pseudoscience because they do not follow the scientific method. Popper did not describe how the fabric of science works in its day-to-day routines. His philosophy of science is prescriptive, since it tells courageous scientists how they should proceed, a method, Popper believed, that would bring about scientific progress in the long run. On the one hand, scientists (should) advance bold and risky hypotheses and, on the other hand, they (should) attempt to derive empirical predictions from these conjectures and seek to refute them. This process of conjectures and refutations is (or should be) in Popper's view at the core of the scientific method. A proposition is only scientific if it is possible to falsify it. Thus, if neither WS nor SS can be properly falsified, both concepts would not belong to the realm of scientific knowledge. If key approaches in sustainability science turned out to be nonfalsifiable pseudoscience, then this way of framing the problem could have serious consequences in general for sustainability science well beyond the focus of Neumayer's claim.

The situation looks less painful for sustainability science if empirical falsification is perceived as a special case of refutation. There are many controversies that cannot be settled by empirical falsification of risky predication derived from a theory. For example, ethicists may refute specific claims by means of analysis of the concepts and the internal coherence of a theory (Neumayer himself engages in this kind of logical argumentation). Here, nonempirical shortcomings such as circularity, nonsequitur, self contradiction, absurd implications, and so forth count as counterarguments. There are thus plausible refutations beyond empirical falsification.

### **Thomas Kuhn and Scientific Community**

Only Kuhn's (1996) paradigm account of science has been similar in scientific and popular influence in the twentieth century. Paradigms, in one key meaning of the definitive term in Kuhn's work,<sup>5</sup> offer a vision

of what scientific work ("puzzle solving") is worth performing in terms of theory articulation, empirical experimentation, and measurement, and which scientific work is secondary or even illegitimate. A paradigm in this sense includes generalizations along with preferred instruments and methods. It is furthermore structured by ontological commitments about elements and concepts and powered by the faith that nature can be fit into the box of the paradigm via puzzle solving (such as the often brilliant work of more elegant theory formulation and extension or more precise measurements).

Kuhn describes the social structure of science as one of particular scientific communities that are constituted by a shared faith in a paradigm. In his view, the scientific community is the supreme authority for validating and assessing scientific claims. Scientific claims are adopted and rejected according to criteria that stem from the paradigm itself. Students are initiated into the scientific community via textbooks, academic study programs, and laboratory training and they adopt basic axioms, concepts, and mindsets. Specialized conferences and peer-reviewed journals make it possible to assure the quality of research done within the community. In such ways, normal science becomes established.

### ***The Problematic Structure of Neumayer's Question***

In light of Popper's and Kuhn's views on science, the philosophical structure of Neumayer's question emerges—and is puzzling! From a Popperian perspective, the structural process of science is one of conjecture and refutation with falsification as the selection, or rather elimination, criterion. From a Kuhnian perspective, scientific work mostly takes place in paradigm-based normal science. There will be scientific revolutions and new paradigms will emerge and take hold according to Kuhn, but the selection criterion for the new paradigm is *not* one of falsification. Moreover, falsification plays little role for (faith-based) normal science. We thus face the following dilemma: either WS or SS really are genuine paradigms—but then we should not expect any attempts at falsification, rather "puzzle solving" (much of such puzzle solving is in evidence in the materials Neumayer cites)—or WS and SS are falsifiable. Paradigms are not falsifiable according to Kuhn's rich account of the history of science and arguably also for conceptual reasons (for example,

<sup>5</sup> Kuhn (1996) notably also uses the term in the sense of a scientific achievement: "research firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice". It is not clear that WS and SS are "paradigms" in this sense. Rather, they seem to depend on a wider dispute between the neoclassical growth model and ecological

economics. Underpinning these we have, respectively, Solow's growth model (1956) and Georgescu-Roegen's (1971) work on the entropy law and the economic process as scientific achievements on which other scientists built. We would like to thank an anonymous reviewer for identifying the need to clarify these different meanings of "paradigm."

the holism of paradigms makes it unclear what would have to be rejected if an experiment is to be falsified). In short, viewed in terms of these philosophies of science, Neumayer's guiding question is indeed a difficult one, not only because of empirical problems (missing or incomplete data on resource availability, substitution elasticities, and so forth), but because conceptually the question—can paradigms be falsified?—is problematically stated. That paradigms cannot be falsified is a conceptual truth and Neumayer's thesis is in this sense correct—but this of course is hardly what he meant to show.<sup>6</sup> No case studies or secondary literature are required for this result.

Moreover, this uptake of philosophy of science has further problematic implications. "Normative positions are nonrefutable," according to Neumayer. There are two readings of this claim. First, it can be justified in the sense that a person's violation of a normative proposition does not refute the proposition's validity. A corrupt politician does not falsify the validity of anticorruption legislation. Instead, he demonstrates the difficulty of its effective implementation. The Popperian language of risky predictions and falsifications, and its classic example (relativity theory), tempts us to exclude or ignore genuine ethical methods of refutation. An example is John Rawls' (1999) classic method of reaching a reflective equilibrium, which draws on ethical convictions as well as a procedural method ("the veil of ignorance") to reach an outcome motivated by a coherentist epistemology (see also Scanlon, 2003).<sup>7</sup> In a second reading, Neumayer seems to endorse some variant of metaethical noncognitivism. His claim that there might be a "persuasive case" in favor of a specific concept of sustainability could be informed by emotivism that regards normative statements as mere expressions of emotive attitudes. Emotivism is by no means an uncontested metaethical theory, as it cannot distinguish between the convincing force of reason

and the persuasive force of rhetoric (Ott, 1997). Under emotivist premises, the question of how the quality of ethical reflection within sustainability science might be assessed becomes somewhat pointless or must be replaced by interviews about how well and badly people feel within a given project. If the project were performed in a good mood, the ethical quality would be high. Given this consequence, we would not like to adopt an emotive approach to assess quality in the ethical dimension of sustainability science.<sup>8</sup>

If normative statements are not refutable in laboratories or on scientific expeditions, it does not follow that they are necessarily unscientific. But it would be unscientific not to use the methods proper to ethics. Because the debate between WS and SS depends strongly on ethical arguments about our responsibility to future generations, about precautionary motives, and about our relationship to the natural environment, excluding normative propositions from method-based investigation amounts to a problematic, and more precisely, to an insufficiently comprehensive way of posing the question.

This analysis of the structure of Neumayer's argument demonstrates that philosophical questions play a role in the analysis of sustainability science and the self-understanding of sustainability scientists. One might abstract them away in the routines of individual projects, but one should not overlook them in basic debates. If sustainability science is to stand for a distinctive way of doing science, the philosophical dimensions of this mode need to be considered. We submit that both Kuhn's focus on the scientific community and Popper's call for a scientific method continue to raise important questions. The point, however, is not to uncritically accept their philosophies, but to reconsider them in their respective contexts. In the next sections, we therefore discuss their utility for thinking about key features of sustainability science. By doing so, we follow the route Neumayer has opened, but add that there are different viable pathways for framing questions in sustainability science.

## Sustainability Science

In this section, we wish to deepen the understanding of our four key features of sustainability science that its practitioners have identified as distin-

<sup>6</sup> Note that Neumayer is well aware of the problem that any simple view of falsification is implausible and we therefore by no means want to charge him with this mistake. Rather, our goal is to draw the conclusion from this insight. If "simple falsification" is implausible, what is the implication for theory choice in sustainability science (or for a decision on "correctness" as Neumayer puts it)? Our response to these questions is the discussion of the four features of sustainability science and their justification.

<sup>7</sup> Rawls' method of reflective equilibrium is based on a) a hypothetical situation of choice ("the original position") that allows the comparison of various approaches to justice (Kantian, utilitarian, intuitionist, and so forth), and b) a consideration of our considered ethical judgments (for example: "racist discrimination is wrong"). Reflective equilibrium is a state of coherence between the conclusions arrived at in the original position and one's considered judgments. Achieving reflective equilibrium requires adjustments both in the formal reasoning of the original position and of (some) considered judgments or basic intuitions about justice.

<sup>8</sup> Also note that Neumayer relies on a Kantian approach to make the case why we should care about future generations. A Kantian perspective is not only inconsistent with emotivism, it also shows that performatively it is not possible to conceptually introduce the debate without drawing on ethical arguments (Neumayer's own skepticism elsewhere notwithstanding).

guishing the nascent field in a particular, and even peculiar, way.<sup>9</sup>

*Normativity:* Sustainability science explicitly acknowledges a normative context, that of sustainability or sustainable development (Clark & Dickinson, 2003). As “sustainability” and “sustainable development” are contested concepts, many definitions and approaches have been argued for. However, it seems fair to say that the so-called Brundtland definition—“sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”—defines a vague space of global intergenerational and intragenerational justice and development that, nevertheless, no specific or more rigorous definition can ignore (Jacobs, 1999). If so, any concept of sustainability must clarify notions and theories of justice with respect to development. This clarification is by no means an easy task and we will return to it below.

*Urgency:* A commitment to the fulfillment of human needs in a world where even the basic requirements of a large part of the human population are often not met implies a dimension of urgency. How can science and technology help move society toward a more sustainable future (Clark & Dickinson, 2003)? There is an ethical supposition in claims of urgency: as moral persons, we are not neutral to whether a specific problem might be addressed now, in some decades, or even in centuries. Fermat stated a theorem in the seventeenth century, but did not disclose the proof. It took three centuries until Andrew Wiles and Richard Taylor did so; in the intermediary time those interested simply had to wait and/or puzzle. The patience of the puzzle solver is a virtue. In puzzle-solving science, one might trust that all major problems will be solved in the longer run and that science will, in the end, discover some ultimate truth (Peirce’s “final opinion”) about how the universe is. Meanwhile, down on earth, there is suffering, injustice, and devastation of the biosphere. The puzzle-solving scientific attitude can abstract away from such pressing concerns, transforming them into private opinions a scientist may (or may not) hold. However, in the case of sustainability science these moral concerns are intrinsic. Those whose needs are to be met may simply no longer be alive in the long

run. There is still another aspect of urgency: in the case of climate change the risks associated with waiting for better science might simply be judged too high. A purely scientific attitude can become a source of risk in sustainability science. As Hiroshi Komiyama & Kazuhiko Takeuchi (2006) put it, “the search for solutions cannot wait.”

*Inclusion of nonscientists:* Sustainability science typically endorses a commitment to the inclusion of nonscientists in the process of research itself. Funding bodies might even require the satisfaction of this condition. As Kates et al. (2001) observe, “Combining different ways of knowing and learning will permit different social actors to work in concert, even with much uncertainty and limited information.” Sustainability science thus supposes that nonscientists can contribute to projects in the field in ways that the scientists involved cannot substitute for. The inclusion of nonscientists and its justification is further discussed below.

*Interrelation of environment and society:* Sustainability science seeks to “understand the fundamental character of interactions between nature and society” (Kates et al. 2001; see also Renn, 2008), to find joint ways in which natural and social scientists can improve the understanding of environment-society relations. Typical tools for such attempts are scenario techniques that depend on information and causal mechanisms from natural and social sciences. Another example might be coupled models that shed light on the interactions between human and natural systems.

In the subsequent sections, we discuss the questions raised by these features and their contribution to the quality of sustainability science. In doing so, we further engage with the weak and strong sustainability debate and its framing in our attempt to contribute to a critical and enabling philosophy of science.

### Why Include Nonscientists?

An important contribution, explicitly informed by philosophy of science, is the post-normal science proposed by Silvio Funtowicz, Jerome Ravetz, and others (Funtowicz & Ravetz, 1991; 1993; van der Sluijs & Funtowicz, 2008). This approach specifically focuses on the inclusion of nonscientists (as a matter of extended peer review). Post-normal science is explicitly situated in a sustainability context:

The new global environmental issues...are global in scale and long term in their impact.

<sup>9</sup> There are very close family ties between sustainability science and other research programs including integrative and transdisciplinary environmental research (Renn, 2008) or respectively social-ecological research (Jahn, 2008). This article does not compare these approaches. However, we believe that our conclusions regarding the quality of sustainability science by and large also pertain to these other “family members.”

Data are ... radically inadequate. Science ... can frequently only achieve at best mathematical models and computer simulations, which are essentially untestable. On the basis of such uncertain inputs, decisions must be made (Funtowicz & Ravetz, 1991).

This context of sustainability science calls for a revision of the organization of science;<sup>10</sup> the scientific community, in the context of sustainability issues, must open itself to extended peer review and the extended facts it might offer. Put differently, the Kuhnian community structure, which gives the scientific community supreme authority, no longer applies. As Funtowicz & Ravetz (1991) note, this can be observed as a simple matter of external pressure. To the extent that scientists are “manifestly incapable of providing effective conclusive answers to the many problems they confront,” administrators, politicians, and others are able to “force” their way into the dialogue. However, there is also a separate series of arguments for the inclusion of nonscientists in sustainability science.<sup>11</sup> We discuss first five epistemological, then three political, and finally one ethical argument for the inclusion of nonscientists in project-based sustainability science.

*1. Local Knowledge:* The inclusion of nonscientists opens sustainability science to local knowledge and tacit knowledge considerations. Ravetz & Funtowicz (1991) assert that “[k]nowledge of local conditions may not merely shape the policy problem, it can also determine which data is strong and relevant” (see also Renn, 2008). Thus, the inclusion of nonscientists might be relevant for both problem formulation and for contextual knowledge application. Local knowl-

edge is found in laypersons and it may also be stored in literature that does not count as scientific. According to contemporary standards of peer-reviewed journals, such literature is very often “dark grey.” Local knowledge often comes in “thick” narratives that are not “stored” in the same way as disciplinary knowledge.

*2. Bias:* Funtowicz & Ravetz (1991) contend that “[e]xperts lack practical knowledge and have their own forms of bias.” Normal science involves a process of initiation; assumptions have to be internalized, methods learned—in short, a paradigmatic view acquired. The result is a certain way of seeing the world; we see evidence of this, when, for example, laypersons strongly react to the economists’ point of view. Because biases need to be unnoticed to be biases, the antidote against biases tends to come from outside. The inclusion of nonscientists can serve as an antidote against specialization and can help expose the limits of science. For instance, scientists are often ignorant about history, while history plays an important role for local people.

*3. Self-criticism and normal science:* Precisely because academic science has a strong institutional character that involves hierarchies, careers, and hence people’s life prospects, internal criticism may be difficult or even rare (Betz, 2006). Again, outside perspectives not so constrained can be helpful in engaging in such criticism. Laypersons do not have blind faith in science and often challenge scientific claims. In this way, the scientific virtue of a critical attitude is turned against science from the outside.

*4. Alertness:* Normal science can be compared to a large tanker. It is the tanker of science at sea and it is difficult to change its course once it has picked up speed. Research programs involve significant human and monetary investments and paradigm work on measuring and theory articulation is likely to have a long-term perspective. As a result, scientists as a community may have difficulty being alert to novel challenges that do not easily fit into their prevailing theoretical outlook. Nonscientists are not so constrained; hence, they can serve the function of communicating novel issues, thereby possibly making the ship of science more responsive.

*5. Conjectures:* Conjectures require imagination. Imagination is, like prudence or even wisdom, not only found among scientists. The inclusion of nonscientists may open the scientific communities to new conjectures: wild ideas, naïve questions, and unexpected observations that the scientific community has the resources to state rigorously, refine, or refute.

<sup>10</sup> Funtowicz & Ravetz (1991) put much weight on the distinction of quality and certainty (as logically independent attributes of knowledge). However, we are not sure that this argument succeeds and, moreover, whether it does not unnecessarily overstate the role of certainty for science. For example, neither Popper’s risky predictions nor Kuhn’s normal science put fundamental weight on certainty.

<sup>11</sup> These arguments are not directly stated as such by Funtowicz & Ravetz (1991) but are, where indicated, inspired by them and others. In the following paragraphs, we use the language of inclusion of nonscientists rather than extended peer review because it is *prima facie* unclear in what sense a nonscientist is a “peer.” As the discussion will show, there is more than one reason for the inclusion of nonscientists and even for their equal standing in a scientific project. However, whether this makes them peers is debatable and possibly obscures the point that the relationship between scientists and nonscientists is by no means trivial, but is rather multifold and contextual. In their discussion of research evaluation, Bergmann & Schramm (2008) speak of “expert review.” The need for the inclusion of nonscientists has been widely recognized in sustainability science. For a review of major problems associated with the idea of sustainability scientists as “separate” researchers offering society the facts, see van Kerkhoff & Lebel (2006).

6. *Care and Concern*: Funtowicz & Ravetz (1991) write that “[t]hose whose lives and livelihood depend on solutions of the problems will have a keen awareness of how general principles are realized in their ‘back yards.’” Science that aims to have a practical influence must be especially cautious with respect to the real-world impacts it may have. To the extent that people most affected by environmental issues are not generally scientists, the care argument is sociologically plausible: those most affected are likely to care the most, and hence care that the policy instrument (or similar) is appropriate. In medicine, it is the patient who must live with the consequences of a physician’s recommendation for surgery. Because of this, the ultimate decision is up to her (informed consent). In similar ways, local stakeholders have to cope with the consequences of projects designed by scientific experts.

7. *Timing*: If sustainability science seeks to contribute to practical problem solving, then generally timing will be one component of successful science. For example, if a scientific report, however brilliant, misses the window of opportunity provided by an election cycle, it might be practically useless. Here, too, the inclusion of nonscientists may offer insight. Such inclusion also gives scientists a better understanding of the affected people’s perception of the pressure and urgency of a given problem (for example, a problem could be less urgent for local people than the scientists believe!).

8. *Power*: Nonscientists may not only offer insight, but they can also generate the power to help advance a proposal resulting from sustainability science. Nonscientists who are informed and have the necessary influence can help effectively communicate or even implement a policy proposal (Bergman, 2008).

9. *Normativity*: A normative science needs to take care with respect to the social values it seeks to achieve or promote. However, as Funtowicz & Ravetz (1991) note, values are in dispute. Precisely for this reason, it seems important to make this dispute public and not to leave science with the decision of which values to prioritize (Renn, 2008). The inclusion of nonscientists can contribute to this end. Scientists as such are not experts in value judgments. Ethicists may offer skills for the investigation of normative intuitions and their implications, historians may offer insight into the contexts of such intuitions, and so forth. However, here, too, bias and limited self criticism can pertain. Scientists should not have ultimate authority in moral matters.

These various arguments partly complement one another and may also be in many contexts quasi-independent. It is conceivable that in a context concerning basic needs, the value dimension is trivial and uncontroversial. This does not mean that there is no value dimension in this context, but only that it may justifiably fade into the background as far as the possible inclusion of nonscientists is concerned. More generally, it seems that some set of these arguments ought to be made explicit for the specific context of the sustainability project at hand. Put differently, for each sustainability science research project that includes nonscientists, the various epistemological, political, and normative relationships between the scientists and nonscientists ought in principle be made explicit. They are not always the same; they may not always have the same weight and the design consequences (the question of *how* nonscientists are included or participate) are accordingly also likely to vary.

These reasons indicate that one criterion for the quality of sustainability science is an explicit rationale for the inclusion of nonscientists in a given project. In terms of the evaluation of sustainability science projects, this point concerns especially *ex ante* and intermediary evaluations. That there are reasons for the inclusion of nonscientists is here not in doubt, but what is required is that these reasons are made explicit and are specified according to the design of a given project. In his discussion, Neumayer does not explicitly take this feature into account for his problem formulation, but where he implicitly notes it, it suggests a tendency in favor of strong sustainability. For example, discussing climate change, he notes that “voters and politicians who favour decisive and urgent action...are concerned that climate change is like no other and that its sheer scale and extent of damage threatens to create a new-biophysical world that either leaves the future worse off or violates the inalienable right to enjoy natural capital” (Neumayer, 2010).

### The Dogma of Participation

As noted above, the establishment of sustainability science has meant that some funders mandate the participation of nonscientists. In such cases, inclusion does not need to be justified, but becomes an expectation or simply a dogma of sustainability science. However, one can endorse the nine reasons just mentioned and remain critical of dogmatic ways to perform participation for the sake of funding requirements. We may face such dogma if participation and inclusion seem to be mere add-ons to a given project, are disconnected to the scientific objectives, or do not rely on a sound concept.

For this reason, Wolfgang Zierhofer & Paul Burger (2007) have a valid point when they question whether the inclusion of nonscientists in transdisciplinary research always serves epistemic ends. They define transdisciplinary research formally by interdisciplinarity and participation (of nonscientists), and they view problem-oriented research as its main epistemic end. Problem-oriented research in their understanding aims to reduce knowledge gaps that “hinder some stakeholders or institution to pursue certain actions.” Based on a survey of sixteen transdisciplinary research projects, they found that few projects really investigate goals or knowledge objectives. They conclude that transdisciplinary research should not be regarded as a distinct mode of knowledge production. Instead, it “should be considered rather a class of epistemically and methodologically heterogeneous research activities which are only formally unified by the two general properties ‘interdisciplinary’ and ‘participatory.’”

Skepticism as to the inclusion of nonscientists is reasonable in view of participation as dogma. However, Zierhofer & Burger’s (2007) conclusion that transdisciplinary research is “not a distinct mode of knowledge production” does not logically follow from the observation of a sample of empirical examples. Moreover, their conclusion seems to be the consequence of a formal description of transdisciplinary research that does not specify a domain of investigation, which could be numbers as in mathematics, life as in biology, the commitment to sustainability as in sustainability science, and so forth. These domains of investigation stand for distinct epistemic ends (What is number? What is life? What is sustainability?). Once we have stated these domains, we can ask whether transdisciplinary research contributes to the respective ends. For example, sustainability science focuses on the promotion of normative sustainability goals and to this end on an improved understanding of nature-society relations. The inclusion of nonscientists can serve this end (see the list of arguments above). Therefore, transdisciplinary research in conjunction with a domain of investigation does seem to yield distinct modes of knowledge production.

As Zierhofer & Burger’s (2007) survey of research projects shows, many of them relied in practice on nonscientists only for strategic reasons. They benefit from a dogma of participation and here the inclusion of nonscientists may not serve epistemic ends. But sustainability scientists should examine what relationships between scientists and nonscientists may promote the issue at hand. Therefore, in our view a criterion for the quality of sustainability science is an explicit statement why nonscientists are included and a clear concept of how participation

should be performed and how the results should contribute to the overall results.

### Why the Pathos of Urgency? The Temporal Horizon

We tend to think that whether a geometric proof is valid is independent from its discovery by Greek, Indian, or other mathematicians. The context of discovery is distinct from the context of justification. According to this view, it is the reasoning for a scientific claim that counts, not its timing. We say that a scientific claim is valid if it can be shown to be a condition of the world, according to a specific observation or laboratory method that verifies or confirms the claim (this method usually involves a specific community structure for confirmation and testimony of experiments and observations). Such conditions of the world can have a temporal reference. For example, the passenger pigeon—once an abundant species in North America—is supposed to have become extinct in the early twentieth century. A scientific claim (or entire set of claims) can involve a reference to a specific time or temporal dynamic (such as the once abundant passenger pigeon becoming extinct). However, such temporal references are irrelevant with respect to the validity of the scientific claims.

Many events and temporal dynamics are relevant within sustainability science. “Urgency” is determined by temporal considerations (how much time do we have?) as well as ethical stakes (how important is the event/dynamic?). For example, predictions and forecasts regarding single events and dynamics of stocks are frequently related to human options. If global temperature is likely to increase by two degrees within the next generation, this can affect environmental security (for example, shelter due to increased risks of floods). Accordingly, there can be questions of mitigation (fight temperature increase) and adaptation (improve shelter). As the adaptation example shows, the relevance of scientific claims is not dependent on the human capacity to influence the occurrence of an event or the pattern of a dynamic. In any case, sustainability science is interested in the dynamics of specific stocks and flows over time. These dynamics (Aristotle’s *kinesis*) are perceived from the normative perspective: in sustainability science one must, *ceteris paribus*, engage oneself against stocks of pollutants, declining stocks of resources, increasing stocks of greenhouse gases, and so forth. As in the case of atmospheric greenhouse gases, the dynamics of increase give reason to claim that mitigation is urgent. If a lake is close to collapse or a species is near extinction, action is urgent. Many stocks are goods that are components of the overall



fair bequest package we owe to future generations. If so, sustainability science must schedule the relationship between stocks and time. A normative approach to the kinetics of stocks is required. Quite often, there will be a window of opportunity. We can call this the *kairos*, the opportunity to act.

The quality of sustainability science is codependent on an explicit way of dealing with urgency: How do stocks change over time? What are the temporal windows? How can long-term objectives be combined prudently with first steps and a transition period? In our view, these questions do not necessitate a departure from sound scientific standards, but augment them. The pathos of urgency as such clearly does not make any claim a scientific one. Scenarios being presented in a context of urgency must *in principle* be open to disciplinary scrutiny and critique. Even the claims of urgency themselves must be open for refutation. What is required is the explicit contextualization of scientific claims (and practices) in a temporal framing of dynamics and events. Whether a scientific claim is considered as evidence and reason for action is ultimately an ethical question. (This establishes a double link to the inclusion of nonscientists: Who decides on ethical stakes? Who has knowledge of and influence on windows of opportunity for action?)

These questions, we submit, also need to be asked for the weak versus strong sustainability debate. Consider the example of energy substitution, such as the substitution of nonrenewable oil with renewable solar energy that Neumeyer discusses. There are optimistic scenarios that suggest substitution is possible and there are pessimistic scenarios that put the possibility of substitution into doubt. As Neumeyer notes, “Which of the two projections will be closer to reality we do not know.” Again, we need to pay attention to the formulation of the question. No doubt, there are energy optimists and energy pessimists, but what, in this context, is the meaning of “closer to reality?” The discussion above suggests that for a sustainability evaluation of these scenarios we would have to ask whose needs are likely to be affected and how and when they will be affected (with respect to the question of substituting oil with solar power). With regard to urgency, WS would likely rely on economic wisdom about how depreciation of a resource motivates the search for substitutes, while SS would recommend political measures to speed up such substitution. In such matters, there is no such thing as empirical “closeness to reality.” “Closeness to reality,” we submit, requires an account of these questions of needs and urgency without which a dimension of sustainability science is missing. Only with these questions addressed can we discuss and compare energy scenarios on which to base our decision. Ethical

cotemporal urgency is a condition of asking the question.

### Why Must Various Disciplines Work Together?

Sustainability science, it will be recalled, seeks to understand the “interactions between nature and society,” and it is in principle plausible that it needs to draw on the knowledge of both natural and social scientists, as well as the humanities and vocational disciplines (such as engineering, law, and medicine) to advance this understanding. As a minimum question of quality, the various scientists working on the respective issue should be included (Jahn, 2008). For example, research on a problem pertaining to floods requires hydrological (and possibly climatological) knowledge, but also political knowledge regarding the societal actors and their coalitions.

A closely related second question of quality is the hierarchy of the disciplines involved. Does one discipline define the problem and simply add the other disciplines so that the basic perspective on the problem is essentially disciplinary (compare the example below)? If there is a hierarchy, what is the reason? One nonhierarchical approach is to start from the societal problem (rather than the scientific puzzle of a discipline).<sup>12</sup> Working together is then a process of joint problem analysis (Wätzold, 2009). Scenario techniques and models can serve as tools for joint work in this sense. Scenario techniques are one example of a family of models, which suggests a joint method for various sciences. Moreover, scenarios and others tools can themselves be included in integrated sustainability approaches, such as the embedded case-study approach for sustainability learning (Scholz et al. 2006).

In light of the discussion of urgency and scientific validity, we need to recall that problem-oriented science is not something different from scientific practice (and its methods, data, observations, and so forth). In establishing a knowledge base, sustainability science consumes the results of scientific research. It frequently relies on normal science. Therefore, sustainability science is hard to reconcile with philosophies of science that are highly critical of modern science. A third question of quality in this category is whether sustainability science produces results that are communicable or translatable into specific disciplines and open to the critique and scrutiny.

<sup>12</sup> “Problem solving” will only acquire a social meaning if non-scientists are included in problem formulation. This is another instance of the codependence of the four features of sustainability science discussed here.

tiny of disciplinary science and its systems of peer review.

Again, the debate of weak versus strong sustainability can serve as an instructive illustration of this feature of sustainability science. Both paradigms presuppose some ideas of how humans and natural systems are related. We here make three observations with respect to nature-society relationships:

1. The definitions of weak sustainability, strong sustainability (see above), and natural capital<sup>13</sup> and their terminology originate in economic thought about investments, substitutes, complements, capital, and so forth. Thus, it is already a challenge to translate the weak versus strong debate into a genuine debate of social *and* natural science.

2. The debate issues from another debate between much wider paradigms: those of neoclassical economics and ecological economics.<sup>14</sup> Roughly put, the first paradigm conceives of the economy as an autonomous entity in which economic growth can be examined and explained without reference to exogenous variables. Endogenous growth is in principle unlimited. The second paradigm conceives of the economy as a subset of the biosphere and claims that economic growth cannot be explained without reference to the enveloping biophysical system that also limits economic growth. The anomaly in the Kuhnian sense is the problem of substitution (the old neoclassical paradigm is pushed to defend the increasingly contested claim that natural resources and services are substitutable). *Prima facie*, the paradigm of ecological economists necessitates nature-society integration due to its image of the economy as a subset of the biosphere. Its paradigmatic image is one that fits well with respect to sustainability science, whereas the same cannot be said, at least at first sight, with respect to neoclassical economics.

3. Precisely because the debate is in the first place one between economic paradigms, we need to pay attention to the structure of the argument and to the burden of proof. Here we find the following structure in Neumayer's discussion of the debate. He subjects the four premises of weak sustainability to the logical and empirical objections of opponents,<sup>15</sup> concluding that SS proponents cannot decisively refute WS be-

cause their objections are inconclusive or logically flawed. But there is no complementary examination of the premises of strong sustainability.<sup>16</sup> In short, Neumayer does not ask whether proponents of WS have good arguments to put the SS premises into doubt. Therefore, the burden of proof is not applied in an even-handed manner.

We submit that the normative considerations, along with the observation that this very debate has a disciplinary bias (it is in the first place posited as an economic debate, in which ecologists do not really have a say), suggest a reasonable argument in favor of strong sustainability. The evidence is that ecologists clearly tend toward the nonsubstitution view (see, e.g., MEA, 2005). Indeed, some of them might not accept the terms of the debate as meaningful to begin with. How could life-supporting ecosystems possibly be substitutable? Even minute artificial biosphere projects have failed.

### Why Do Ethical Considerations Matter?

Even for Popperians, as we noted above, the scientific method is not reduced to empirical falsification. It is all the more important not to simply ignore normative questions because they are not falsifiable via risky predictions. Normativity is a key feature of sustainability science. Under a broad conception of science (as in the continental tradition of *Wissenschaft*) this is not as problematic as under a narrow conception of science. Many disciplines are intrinsically related to and connected with ethical questions (e.g., medicine, technology, ecology, architecture, economics, psychology, history). Scientists might abstract away such ethical questions, but they should not be ignorant about the closeness of their discipline to ethics. It might be beneficial for specific research (experiments) to abstract away all social concerns; however, from this premise it cannot be inferred that such a move would be beneficial for whole disciplines. This rejection of value-free dogmatism often has been stated in critical theory of science and it can be supported even by Max Weber's critical analysis of the fact-value distinction (Ott, 1997).

Because sustainability science incorporates members of different disciplines, its general ethical

<sup>13</sup> Neumayer defines natural capital as "[t]he totality of nature—resources, plants, species and ecosystems—that is capable of providing human beings with material and nonmaterial utility."

<sup>14</sup> See also Footnote 5.

<sup>15</sup> As noted by Neumayer, natural resources can be substituted with other natural resources: price signals overcome resource constraints; man-made capital will substitute for natural resources; technical progress eases resource constraints.

<sup>16</sup> Neumayer himself notes the following key reasons (based on Spash, 2002): we are largely uncertain/ignorant about the detrimental consequences of depleting natural capital, natural capital loss is often irreversible, some forms of natural capital provide basic life-support functions, and individuals are highly adverse to losses in natural capital.

framework—with all its pitfalls—must become transparent. How can there be sound ethics within the realm of science and, especially, within the field of sustainability science? We define ethics as being a critical reflection and analysis of prescriptive claims of different kinds (e.g., metaethical, moral, axiological, prudential, legal-political). Ethical inquiry investigates how prescriptive claims (How should we act?) can be substantiated by means of argument. Given this definition, we would like to propose the following considerations regarding the quality of sustainability science with respect to normativity.

1. If science, in general, often comes close to ethics and implicitly has a normative dimension, then it is a minimum requirement to make norms and values explicit to both scientists and nonscientists. Clearly, this is not easy, since humans are always engaged in moral affairs and often the borderline between facts and values is passed unnoticed. This is simply human, but in science it is “all-too-human.” High quality in the ethical dimension of sustainability science implies a sharp awareness of the *haarfeine Linie* (Max Weber’s “capillary line”) between facts and values. Scrutiny and honesty in dealing with the fact-value distinction are required in sustainability science. Very often, sustainability science projects make use of specific concepts and measures (e.g., ecological footprint, ecosystem approach, safe biological limits, critical loads, environmental impact analysis, integrated water management) that entail values and objectives. The obligation of transparency applies to them as well. It also applies to hybrid concepts such as biodiversity (Potthast, 2006). This obligation is not specific to sustainability science, but is certainly very important for it.

2. An account of the various values at stake is also a matter of a more comprehensive theoretical articulation. On the general and vague level of sustainable development as a contested concept there are certain essential ethical questions regarding what to sustain and why to sustain (Dobson, 1998). These questions need to be substantiated and this quickly leads to difficult nontrivial questions. Does moral obligation diminish with temporal (and physical) distance and does it come close to zero after three generations? Do future persons hold rights in the present? Would strong care for posterity imply an individual duty for procreation? Moreover, values are in dispute—there are conflicting intuitions within the domain of sustainable development. In addition, sustainable development stands for value considerations among other value considerations. These difficult questions and challenges suggest that at least large-scale sustainability projects will need to draw on the tools of eth-

ics for the work of theoretical articulation and clarity (so important where there are activist urges)—with the above-noted qualification that professional ethicists and other scientists do not have ultimate moral authority. No doubt, in practice a tightrope walk.

3. Given a commonly shared vague commitment to sustainable development, how can we specify it according to concepts, temporal and spatial scales, guiding visions, objectives, measures, and implementation schemes? The underlying problem is that there are norms and values to be addressed all the way down from sophisticated ethical puzzles to very specific problems of, for instance, how to design catchment schemes for water in landscapes under some legal circumstances. For this reason, it seems useful to distinguish various theoretical layers (Schultz et al. 2008). At one end of the spectrum is a layer of principles of justice and development; at the other end are indicators and monitoring devices for very specific domains (e.g., local water management). These distinctions are *inter alia* useful for distinguishing different domains of refutation. For example, empirical falsification based on prediction is irrelevant on the level of principles of justice and development. On this level, various metaethical considerations and methods allow for a highly sophisticated discussion of normative ideas (including refutations, such as the refutation of utilitarianism in the reflective equilibrium).

Transparency as intrinsic ethos in science, metaethical explication of basic assumptions in any concept of sustainability, sustainability embedded in the system of ethical beliefs, and last but not least, specific conflict analysis within single projects are some parameters that define sustainability science’s overall ethical quality. This implies that more ambitious sustainability science projects should incorporate ethical expertise. Such expertise cannot be substituted by good will and political correctness.

Normativity as a key feature of sustainability science also has implications for the weak versus strong sustainability debate. As noted, the burden of proof in this debate should be even handed and thus the premises of weak *and* strong sustainability should both be critically examined.<sup>17</sup> For example, the premise that we are largely uncertain or ignorant about the detrimental consequences of depleting natural capital is not just a faith-based assumption, but a premise that has been justified. A key argument concerns the multifunctionality of many ecosystems. As soon as we move away from the economic focus on resources such as oil and the (seemingly) simple

<sup>17</sup> See footnote 15.

**Table 1** Comparison of approaches.

Perspective	Popper	Kuhn	Neumayer's Framing	Sustainability Science
Structure of science	Conjecture & refutation in open society	Paradigms of scientific communities	Paradigms	Conjecture and refutation (in a wide sense) in hybrid communities.
Selection criteria for the quality of scientific claims	Falsification	Sociological (scientific community as ultimate source of authority)	Falsification	Explicit normativity. Justified inclusion of non-scientists. Explicit temporal reference of research to what is at stake. Cooperation of relevant natural and social scientists based on joint problems.

substitution questions they pose, and as soon as we move to ecosystems and their services, then the premise that we are largely uncertain about the detrimental consequences of depleting natural capital is empirically the state of the art (MEA, 2005). As far as we know, WS proponents have no decisive objection to this premise and attempts to substitute ecosystems in artificial biosphere experiments have failed.

This argument is closely linked to the fact that ecosystems deliver a variety of benefits to humans and other living beings and thus provide a nexus of human values. Not just economic, but also aesthetic, recreational, and spiritual benefits are associated with cultural ecosystem services. Even if diverse groups do not value these services for the same normative reasons—not just preferences—there is still an overwhelming, if ill-defined, general support to sustain natural capital. These and other normative considerations suggest in our view a *prima facie* plausibility of strong sustainability for normative reasons.<sup>18</sup> They are all open to critical refutation. Note, however, that they do not yield any *a priori* decisions of what to sustain or how to sustain. Here thinking in levels of theory is useful. Ecosystem approaches and the ethical considerations they involve support a convincing case for strong sustainability *in general*. Thus, we reach exactly the opposite conclusion as Neumayer, who makes a persuasive case for *specific types* of natural capital. In our view, there is a convincing case that natural capital in general ought to be preserved, whereas turning to specific practical domains of application ensures much controversy with respect to specific issues of conservation or preservation, not least due to the many value considerations quite independent from sustainability.

## Conclusion

This article first explores the way in which philosophy of science constructs a key debate in sustainability science, showing how philosophy of science can thereby become a problematic heritage. We have also argued that a critical examination of this heritage points the way to an enabling, critical re-examination of the way sustainability science understands itself. Table 1 summarizes the central considerations of the respective views. The quality of sustainability science is in our view a matter of constantly stating and re-examining the reasons for the inclusion of nonscientists, the normative issues at stake (and in conflict), the temporal relation of the research to the stakes at hand, and finally, the cooperation of the relevant natural and social sciences based on joint problem formulation. Keeping in view the debate of weak versus strong sustainability throughout our discussion of these key features, we conclude that comprehensive questioning supports strong sustainability.

The key features of sustainability science do not yield indicators or evaluation tools that every sustainability science project has to meet. Rather, they concern background considerations that in different contexts are important and that scientists will have to judge as particularly relevant.<sup>19</sup> Arguably, only large research programs that have the resources can be expected to consider all features in depth.

The last point suggests that it could be useful to conclude in terms of a culture of sustainability science—in terms of a more general understanding shared by members who in any specific situation will have to make choices and focus on specific issues. If culture is understood as shared norms and values, the culture of sustainability science is a “thin culture;” the normative commitment is vague and more precise conceptions of sustainability and sustainable development are contested. Still, there is a general norma-

<sup>18</sup> We introduce here only one argument, but see Ott & Döring (2008) for an extended discussion.

<sup>19</sup> See Peterson (2006) on the importance of judgment for interdisciplinary environmental science.

tive commitment as well as a commitment to the inclusion of nonscientists, to the consideration of urgency, and to the cooperation of natural and social scientists.

In view of these criteria, the culture in question is not homogeneous but hybrid, bringing together natural and social scientists and nonscientists. If the Kuhnian view tends toward a homogeneous community of the “initiated,” and if the Popperian view tends toward a society of “atomistic” individuals, then the present perspective tends toward a third view of a methodologically heterogeneous culture with shared, thin values and in dialogue with nonscientists. The image of a seaport comes to mind where the adventures of “science at sea” (Neurath, 1932) meet with the people from the land and their needs.<sup>20</sup> A specific feature of this idea of culture is a commitment to bring together different perspectives. This diversity is the key “division of labor” for this culture and the key to the wealth it seeks to sustain and foster.

Culture also stands for cultivation and improvement. Taking seriously, not dogmatically, the key features of sustainability science can foster its cultivation, or so we would suggest. Questioning can be deep and comprehensive. For a specific project, the deep questioning of one or two features might be irrelevant (for example, because the relevant temporal and ethical questions are obvious). For sustainability science as a whole, however, questioning must be deep and comprehensive. The fulfillment of this requirement no doubt makes sustainability science as much an idea as a reality.

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<sup>20</sup> A point that is important for science as research just as much as for science as education (Ziegler, 2008).

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ARTICLE

## Looking for the role of nature experiences in planning and decision making: a perspective from the Helsinki Metropolitan Area

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Public experiences of everyday environments influence well-being and quality of life and effective planning for these environments can promote social sustainability. This article discusses how residents' values related to urban nature areas are as important as ecological and technical issues and can inform urban nature planning and decision making. We first provide a generic review of residents' values and meanings regarding urban nature. We then outline practices for obtaining data on these values and meanings and present examples from the Helsinki (Finland) Metropolitan Area. The article concludes with a discussion of the challenges that nature experiences bring to planning and decision making and highlights why and how insights generated as a result of residents' participation should be included in the knowledge base for planning decisions.

KEYWORDS: environmental planning, urban environments, quality of life, public involvement, public opinion

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### Introduction: Urban Nature as Everyday Landscape

The social aspects of sustainability are closely linked with the quality of human life, for which the experienced quality of the everyday environment is essential (Chiesura, 2004). Enjoyable and accessible nature environments, for instance, encourage people to spend their time outdoors and, according to surveys and physiological studies, these activities reduce stress and promote physical and mental well-being (Ulrich et al. 1991; Hartig et al. 2003; Tsunetsugu et al. 2007; Tyrväinen et al. 2007b). The strong link between natural environments and quality of life (Stubbs, 2008) has negative aspects as well—for instance, dark forests and poorly managed parks cause fear (Lyytimäki et al. 2008; Skår, 2010).

Experiencing the environment is at the heart of the interplay between the ecological and the social, the integration of which is fundamental for sustainability (Kemp & Martens, 2007). In urban environments, the links between local nature and the quality of life of current and future residents are bound up with the wider socioecological system, evolving with interrelated environmental and sociodemographic changes (James et al. 2009). To promote sustainability, planning and management of the everyday environment should follow principles of sufficiency

and equity, meaning that everyone should have resources and preconditions for a decent life, including opportunities for positive nature-based experiences, without gaps between population groups and current and future generations (see Kemp & Martens, 2007).

In Finland, urban nature typically includes forests and meadows that were left at the urban fringe or between districts when the city was built (e.g., Bell et al. 2005; Hirvensalo, 2006). In Central Europe, urban nature more often consists of constructed parks purposefully established to green the urban environment (Beatley, 1999; Forrest & Konijnendijk, 2005). Typical for such facilities are lawns, flower beds, single trees and bushes, and tree and bush groups, making intensive management more necessary than with, for instance, forests. In Finnish cities, constructed parks are part of urban nature together with forests, meadows, fields, water areas, and streams.

Residents' opportunities to maintain their well-being and quality of life in cities can be supported by understanding the experiences and values that they attach to urban nature (see Janse & Konijnendijk, 2007). What kinds of areas are experienced as attractive, what kinds of areas are avoided, and what kinds of nature experiences do people, in general, need to maintain or enhance their well-being? Obtaining this knowledge makes it possible, among other things, to identify commonly shared values that can serve as reference criteria for local planners to envision more

sustainable urban design strategies (Chiesura, 2004). Developing environments that encourage physical activity requires understanding about not only the ways people use different places, but also their perceptions of engaging with places and processes (Herrick, 2009).

In this article, we focus on public experiences and values related to urban nature and treat them as having equal value to the technical, economic, and ecological dimensions of planning for urban nature areas. Equity here means that the insights generated as a result of residents' participation should be treated as *knowledge* that is as important to the overall planning process as customary data on the technical, economic, and ecological qualities of urban nature. Consistent with Jensen (2005), we understand knowledge being built when information—organized data—is related to or used for a productive purpose in a certain context—in this case, a planning process. This article first looks at the experienced dimension of nature. Second, practices of planning for nature areas are reviewed with examples from the Helsinki Metropolitan Area. We study connections among different levels of planning and practices for obtaining information and discuss where, in planning processes, the experienced dimension of nature should be present. Finally, we sum up with a discussion of the challenges that considering the experienced dimension of nature brings to practices of planning and its information base.

In Finland, legislation has enabled residents to influence their living environments and has mandated opportunities to participate in decision making (see Kettunen, 2002; Jauhiainen & Niemenmaa, 2006). The national constitution (1999/731, 20§) requires public authorities to create mechanisms that allow residents to shape the future of their living environments and, by extension, their own well-being. The Land Use and Building Act that came into force in 2000 gives special attention to resident participation in land-use planning. These opportunities, however, differ substantially across cities (see Pikkala, 2006; Mikkola et al. 2008), which still, regardless of the legislation, continue to hold primary responsibility for organizing local participation. The practices of specific municipalities also reflect varying interpretations of dominant theories of planning and public participation. In the city of Espoo, for example, each district has a board that initiates open district-level forum activities. Espoo thus employs the approach that the stakeholders may agree on certain issues and respectfully agree to disagree on others, which is the idea of agonistic planning (Hillier, 2002; Bäcklund & Mäntysalo, 2010). The city of Vantaa, instead, has district boards based on party political representativeness, in line with aggregative planning relying on

voting as the central instrument of decision making. Helsinki does not have district boards and different sectoral departments have various orientations in relation to theoretical ideas about planning and democracy (Bäcklund & Mäntysalo, 2010).

Urban planning and decision making have traditionally been based on such factors as hydrology and soil conditions and the costs of municipal engineering, construction, and nature management (Taylor, 1998). In recent years, the ecological dimensions, such as the appearance of different species and endangered habitats, have increasingly been used in planning. This information has generally been available in relatively exact form (e.g., species lists, numbers of species, habitat descriptions) and has thus been easy to handle with various data-management tools. In the interviews by Yli-Pelkonen (2006), for instance, decision makers of the Helsinki Metropolitan Area regarded these data as most useful for decision making.

The dominant role of ecological, technical, and economic factors in planning can, however, bypass nature's experiential dimension. Quality criteria for a positive nature experience can arise from very different interpretative frames and also be internally contradictory (e.g., Bonnes et al. 2007; see also Van Herzele, 2004). In a study on the stream Rekolanoja in the city of Vantaa, for instance, some residents wanted the surrounding environment to be more natural, while other preferred a managed park (Yli-Pelkonen et al. 2006). Also, in a survey in Rome, residents appreciated the abundance of natural areas in their neighborhoods, but increasing biodiversity did not necessarily improve their perceived levels of satisfaction (Bonnes et al. 2007). In most cases, however, large natural areas can be preserved only on the basis of ecological arguments, and natural areas that hold unique significance for people's everyday lives are not equally valued. In contrast, recreation areas are often established exclusively on the basis of economic and technical arguments, without assessing their functionality and attractiveness in terms of users' experience. The fact that everyday experiences of urban nature are "ignored" can be partly explained by legislation that does not impose punishments for land-use decisions that dilute recreational or landscape values in the same way that it does for those diluting ecological and cultural values.

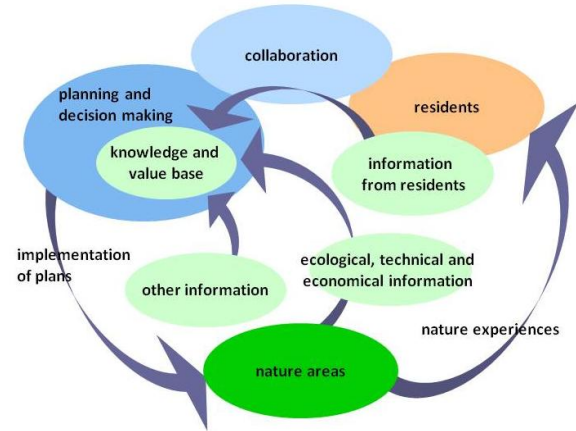
We define urban nature areas here as places, located in or close to a city, where people can experience nature: smell the scent of forest, listen to ducks play in a pond, or just revel in a green view. Nature and the built environment are bound up with each other: even a rock, a group of trees, or a green median strip can evoke feelings of nature and thus provide natural experiences, even in a densely built envi-



ronment (see McIntyre et al. 2000; Yli-Pelkonen & Niemelä, 2005; Ross, 2006). Opportunities for nature experiences can also be provided by sites reserved for construction that has not yet started, or by private yards and gardens. As experienced in the field, nature areas may appear to be continuous entities, but administratively they often are a complicated mix of various spheres of responsibilities under the jurisdiction of different landowners and authorities. In this article, the focus is on areas owned by municipal governments such as urban forests, parks, and shores, the future of which urban residents should have a say in determining. In Helsinki, for example, the municipal government owns about 70% of the land.

We conceptualize planning for urban nature areas as covering all decision-making processes knowingly aimed at influencing the development of such lands (see Burayidi, 2000; Staffans, 2004; Jauhiainen & Niemenmaa, 2006). The essential processes of planning for this purpose in Finland fall under the aegis of land-use and nature-area policy and include principles for land acquisition and the conversion of land to different uses, master planning and the development of detailed land-use plans, and specialized forms of planning focused on nature areas only, such as strategic nature-management planning. Planning in cities across the country is guided by goals set at the state, regional, and eventually sub-regional levels. In the Helsinki Metropolitan Area, this framework includes the national land-use guidelines, the land-use plan for the Uusimaa region, and the metropolitan policy set by the state government, each of which addresses the potential for nature experiences. Land-use planning influences, among other things, the quantity, type, and size of nature areas available in different parts of the city. The planning of nature areas, in turn, guides their management and development and shapes in more detail the specific natural features, for instance the formation of spaces, routes, and views in forests and parks.

Urban nature areas are especially complex entities for planning because of the need to consider the roles not only of people, but of other species, and the protection of biodiversity. These circumstances necessitate consideration of several types of data, varying from local ecological characteristics and residents' experiences to international agreements and climate forecasts (Figure 1). Planning for urban nature areas also has to fulfill requirements for biodiversity conservation (for instance the Finnish Nature Conservation Act 1096/1996 and the EC Council Directives 92/43/EEC and 79/409/EEC). Moreover, planning for nature areas needs to consider nature's functional ecological role in the urban environment more widely. For instance, changes in a vegetated



**Figure 1** Several types of information are needed in building the knowledge base for planning for urban nature areas. Collaboration with residents makes it possible to integrate the information on residents' values, needs, and experiences into the knowledge-building process.

area can influence the surrounding region by, for example, increasing the risk of flooding.

Even though built areas and urban nature areas are not clearly separable, it is somewhat different to try to influence built areas in comparison to nature areas. People can influence the development of nature only within the limits of nature itself: large trees cannot be created rapidly and bogs or rocky forests cannot easily be brought to a place where soil or local climate is unsuitable. The use of nature areas as building sites irreversibly changes the ecosystem and opportunities for human beings to experience nature. Certain kinds of nature can be reproduced with landscaping, but the opportunities of future generations to experience, for instance, untrammelled forests, can be ensured only if construction is prohibited from these areas.

### Experienced Values and Meanings of Nature

While being a part of nature themselves, people recognize nature in the first instance as trees, rocks, streams, birds, and other artifactual elements. This physical basis in turn provides the setting for nature as a field for human activities and as a symbolic world of experienced values and meanings (Figure 2). Although the tangible elements are linked with values and meanings, the latter cannot be mapped by inventories. Experienced nature can be understood as a third dimension, one that exists in addition to its physical and functional aspects.

The environment's experiential dimensions have been studied from the perspectives of human geography, environmental psychology, and public health. In human geography, for instance, the environment is constructed through (inter)subjective meanings: an



**Figure 2** Trees, footpaths, and other physical elements make up the setting in which nature can be experienced as a field for activities and as a world of values and meanings. (Photo: Maija Faehnle)

individual does not interpret an outside reality, but rather constructs the world as real through different experiences (Tuan, 1974; Schulman, 1990; Waitt et al. 2009). The reality—including urban nature—then consists of meanings that are assembled out of both material and mental culture. The city and its nature are parts of everyone's personal mindscape (Berger & Luckmann 1966; Tani, 1995; see also Van den Berg & Ter Heijne, 2005; Tyrväinen et al. 2007a).

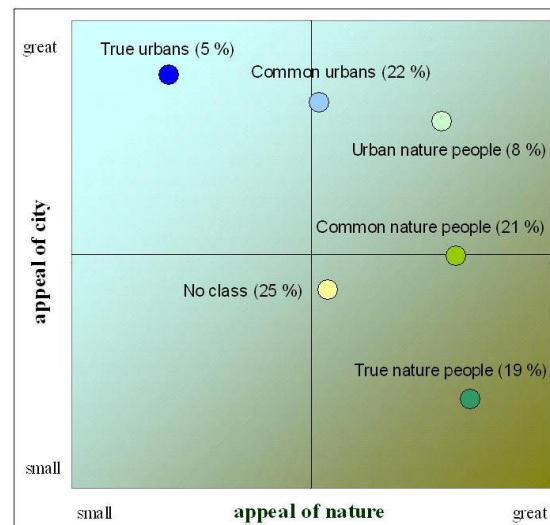
If the relationship between an individual and the environment is understood as constituting this kind of sociocultural "reading" (e.g., Lapintie, 2003; Karjalainen, 2004), a view of a certain physical environment always bears socially shared interpretations of, among other things, elements of a good living environment. The influence of the sociocultural context, thus, is inherently present in subjective experiences of the environment (Tani 1995; Karjalainen, 2004; Waitt et al. 2009). An implicit assumption of this article is that experiencing urban nature is an intersubjective action. This phenomenon makes collective, shared experiences possible: the experienced dimension of nature is a web of intersubjective meanings, bound with physical places and lived as real in one's personal everyday life.

Personal life history and values, however, reshape shared experiences. Different people can speak about the same things—forests, meadows, parks—but they still can have different meanings. Immigrants' experiences of nature in Finnish cities, for instance, can be very different from those of native Finns (e.g., Virtanen, 2007). Urban nature areas can be places for rest, recreation, camaraderie, social interaction, or discomfort and fear, depending on the situation and the particular person (e.g., Koskela, 2003; Van den

Berg & Ter Heijne, 2005; Seeland et al. 2009; Skår, 2010). The more diverse nature a city has, the better it can serve residents with various environmental preferences. Correspondingly, identifying groups of people with similar environmental preferences can help in planning the provision of different kinds of environments.

Tyrväinen et al. (2007b) classified the residents of two Finnish cities, Helsinki and Tampere, according to the appeal that natural environments hold for them compared to the attractions and services typically found in urban environments (Figure 3). According to this typology, residents can be true urbanites who strongly appreciate urban environments, normal urbanites, urban nature people, normal nature people, or true nature people who place a high value on natural environments. True urbanites especially appreciate proximity to the city center, and true nature people particularly appreciate peace and safety. The abundant nature valued by nature people can only be found at considerable distance from the urban core. Urbanites enjoy attractions that are easily accessible in the densely built environment.

In their study of the environmental preferences of urban residents in Italy, Scopelliti & Giuliani (2004) state that appreciation of urban environments is related to the lack of time in residents' everyday lives, highlighting rapid accessibility as a criterion for choosing a particular environment. The perceived appeal of urban or natural environments can also vary along with, for instance, the phases of the life course. Tyrväinen et al. (2007b) assert that residents often cannot satisfy their preferences with respect to nature in their own residential areas, and most people have



**Figure 3** Types of urban resident relationships with nature according to Tyrväinen et al. (2007b). The percentages show the distribution of residents in the cities of Helsinki and Tampere into these types based on a survey.

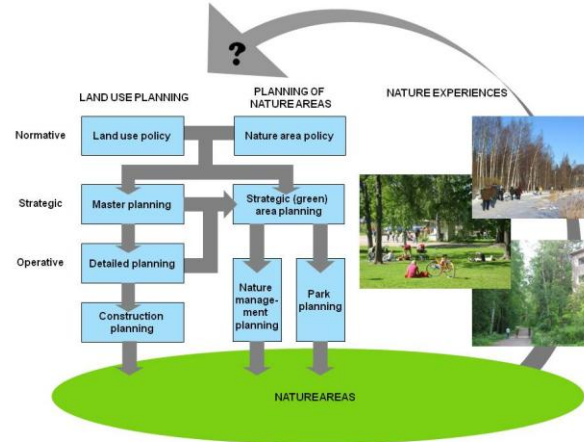
increased their use of more distant nature. Many Finns seek to balance their relationship with nature in their annual rhythm by spending some time at a summer cottage away from the city.

### Shaping Experienced Nature by Planning

As people value nature in various ways, there is no environment that would likely be equally enjoyable for everyone. This is a challenge if planners are seen as capable of defining what is good for citizens, which is the case with a functional conception of the planning profession (Schön, 1991; Evans, 1995). Another view is that such a representation of the public good is not possible and such a conception can only be built along with consideration of diverse perspectives, not by serving the interest of all, but by serving no single individual's personal interest (Bäcklund, 2007). Serving the public good, then, means that the variety of ways to experience urban nature is integrated in policies and planning processes shaping it.

In normative planning guiding urban development on the general policy level, value-based goals are defined as guidelines for land policy and land use (Schulman, 1990) (Figure 4). In Finland, an example of normative planning for urban nature is city-level green area programs in Helsinki, Vantaa, and Tampere (Rantala & Koto, 1999; Leino et al. 2001; Huttunen, 2005). Green area programs are, at the same time, an example of nature-area policy that manages common issues as a part of urban policy (see Jauhiainen, 1995; Ottisch & Krott, 2005). In Helsinki, a nature-management strategy (Saukkonen, 2007) has recently replaced the green area program, with the aim of emphasizing the role of forests and other areas termed as natural over constructed parks. Helsinki's management policy previously ignored forests even though they constitute the largest proportion of the city's green areas (Saukkonen, 2007). A proper nature-area policy, one that coordinates plans in the long run, is, however, still rare in Finnish cities (see also Mikkola et al. 2008).

Existing urban nature is also a continuum of views of an appropriate interplay between nature and the built environment that prevailed in planning in different periods. Hirvensalo (2006), in her study on the planning of housing areas in Finland, has identified three main periods of planning: the period of unity (1920–1963), the periods of alienation (1964–1979), and the period of reconnecting (1980–2000). During the period of unity, planning aimed to connect nature and the urban in a harmonious unity, using nature as a socially equalizing element of planning, providing recreation areas for all citizens near their homes. During the period of alienation, housing areas



**Figure 4** Levels of planning for urban nature areas.

were planned with trimmed lawns in the spirit of structuralism. “Real nature” was seen to belong outside of cities. During the period of reconnecting, nature was used in planning in multiple ways, with room for an idea of spontaneously growing “wild nature.”

The period of reconnecting probably still continues. In recent years, urban nature has increasingly been regarded as an (aesthetized) commodity. At the same time, ecological aspects and the experienced quality of nature have gained more attention (Hirvensalo, 2006; James et al. 2009). During the 1990s, debates on the ecological city elevated environmental problems as a key starting point for planning (e.g., Beatley, 1999). In the current decade, planning for urban nature is constrained, especially by the global need to address climate change and to mitigate its effects in urban areas.

In strategic land-use planning, concretizing the normative goals, including the amount, size, and location of nature areas, is addressed in particular by a local master plan. Nature management and other development of nature areas, such as park construction, are implemented within the framework of land-use plans. This environmental planning can also include strategic and operative phases, for instance strategic planning for a ten-year period and more detailed annual operational planning. Strategic nature-management plans can be prepared for a certain nature area or by city districts. The planning of nature areas can also be connected with street planning. In Helsinki, for instance, strategic area plans have encompassed both nature areas and streets in one or several districts for the past decade (Saukkonen, 2007).

The kind of information appropriate for planning for nature areas is determined by a particular project's scale and objectives. Normative goals for

urban development are value choices concerning all the city's residents. From the perspective of municipal self-government, such choices need to be based on residents' views of what makes good quality urban nature and how the quality should be pursued: here it is essential to make different nature experiences visible. This is supported by information-acquisition processes that allow residents to freely express their concerns. Under such circumstances, residents can identify issues they see as important in planning for nature areas. Shared understanding about the meanings attached to nature can be sought in face-to-face discussions, and, to a certain extent, also in web-based exchanges (Leino & Bamberg, 2007).

As operative planning relies on predefined values, the assembly of information is focused on finding solutions for implementing the goals that follow from these values. In this phase, it is useful to link experiences related to nature with physical places, making it possible to assess the relational importance of different nature areas for residents, qualities they appreciate in different places, and opportunities for developing these capabilities. In planning a certain nature area, information will likely be needed, for instance, on users' experiences with the functionality of trail networks, on feelings attached to certain sites within the area, as well as on observations by local ecologists about, for example, the occurrence of butterfly and other species in the area's meadows.

A practical example of obtaining information on residents' experiences for normative land-use planning is the web-based discussion organized in connection with formulation of the strategies of the Helsinki City Council for its term of office 2005–2008 (Table 1). A discussion forum was opened on the municipal website to encourage residents to candidly express their views on future challenges for the city. This process, at least in principle, gave the residents an opportunity to take part in defining the present state of the urban environment and anticipated problems. In the normative planning of nature areas, in turn, experiences of Helsinki residents have been studied, among other approaches, with group discussions. In deciding Helsinki's nature-management strategy, local neighborhood associations belonging

to the Helsinki Neighborhood Association (HELKA) were sent a draft of the strategy and invited to a discussion with planners (Saukkonen, 2007). The participants brought out, among other things, that forest management should take into account that the feeling of forest is lost if trees are cut making visible what is behind the forest. After the meeting, one of the organizers summarized that the discussion brought understanding especially of the experiential aspect of nature management.

In Helsinki, strategic land-use planning has also used residents' experiences, even their imagined stories about the future! In the planning of a new housing and business district, "Kuninkaantammi," a resident group was established, the members of which imagined themselves as future residents of the district and produced stories about an ideal life there. The stories included ideas of winter gardens flourishing with the help of warm air circulating from the refrigeration system, local allotment gardens where residents could keep foster sheep, maintain sport- and nature-oriented schools, and share responsibilities for decorating the neighborhood for feast days (Mattiila, 2008). Another example for generating such insights derives from the preparation of the Helsinki Master Plan 2002, in which local neighborhood associations were asked to make a SWOT (strengths, opportunities, weakness, and threats) analysis of their district. The associations were asked to sum up their views on the present state of, and future opportunities and threats for, the district.

In the strategic planning of nature areas, residents' experiences have been mapped with postal questionnaires and other techniques. In the making of the green area plan for Kontula, Mellunmäki, and Vartioharju, 2005–2014, researchers mapped positive and negative values of nature areas—such as peace and quiet, scariness, and opportunities for activities—with a postal questionnaire and summarized the results on thematic maps (Tyrväinen et al. 2007a). Social values for youth were also mapped based on results from questionnaires researchers delivered at schools (Mäkinen & Tyrväinen, 2008). Also, for the area plan for the district of Lauttasaari, values, uses, and developing needs for nature areas and streets were mapped with a questionnaire that the local pub-

**Table 1** Examples of normative and strategic planning in Helsinki.

	Land-use Planning	Planning of Nature Areas
<b>Normative</b>	Strategies of the Helsinki City Council for the its term of office 2005–2008	Helsinki nature-management strategy
<b>Strategic</b>	Partial master plan for Kuninkaantammi Master plan for Helsinki 2002	Green area plan for Kontula, Mellunmäki, and Vartioharju 2005–2014 Area plan for Lauttasaari 2009–2018



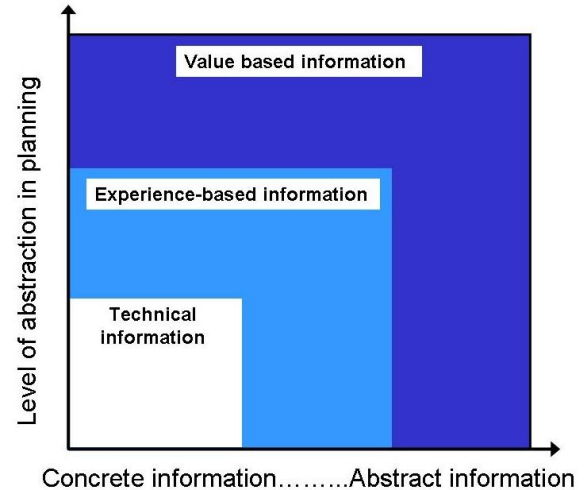
lic works department both posted to a sample of 1,000 households and made available on its website.

Glicken (1999) has usefully classified the information needed in planning and decision making with the help of three perspectives: cognitive that relies on technical expertise, personal experience-based, and value-based that concerns the community. Figure 5 illustrates how these dimensions of information are emphasized at the different planning levels. In making normative and strategic choices, there are no guaranteed technical solutions to help define the direction, only justified views and feelings (see, e.g., Sotarauta, 1996). Decision making, then, is essentially determined by the value- and experience-based dimensions of information (see Glicken, 1999). The technical dimension, in turn, is emphasized in more operative planning, as information is needed on issues such as the location of residents' favorite places or the proportion of residents of a certain district satisfied with the accessibility of nature areas there.

### Does Information Acquisition Fulfill Its Purpose?

If planners and decision makers want urban nature to contribute to social sustainability through residents' well-being and quality of life, they need to consider the experienced dimension of nature (Chiesura, 2004). Knowledge of how to give residents opportunities for the nature experiences they appreciate makes it possible, at the same time, to preserve conditions for a good life for future generations. Recent studies in Finland have found that urban children regard shopping malls as more pleasant than nature (Kanervo, 2007; Stenvall, 2009) and their most popular way to spend free time is to play on a computer (Kytä et al. 2009). Whether this is due to a wider cultural change or to ignoring children's needs in planning nature areas is important for the future of urban nature areas. What kinds of environments will the current generation, one that has largely grown up in shopping malls, plan in the future?

Positive nature experiences should be studied over the long term. Follow-up information on possible changes in residents' relationships with nature is necessary, especially in normative and strategic planning for the far future. The need to recognize residents' values related to urban nature is highlighted along with change and diversification of the urban population. In the Helsinki Metropolitan Area, as in many other metropolitan regions, the need to understand how people with different cultural backgrounds interpret the meanings of nature areas will become even more important in the future. Sociocultural changes interweaving with changes in the physical environment, and nature in particular, can modify



**Figure 5** A model of the relations between the information needed at different levels of planning for urban nature areas (adapted from Glicken, 1999).

values by reflecting the state of the ecological basis for nature experiences and human well-being. The complexity of sociocultural and ecological processes makes it challenging to forecast future generations' environmental preferences, but recognizing processes that sustain the valued experiences today provides grounding for understanding possible ways to an ecologically sustainable and socially flexible future.

In normative planning for nature areas—in defining the will—nature experiences do not necessarily need to be attached to exact places identifiable on maps. Studying residents' general values related to nature, as in Figure 3, helps planning by giving form to ways to promote opportunities for nature experiences. Where should the aim be on natural settings and where should it be on park-like environments? How should routes and opportunities for activities be improved in general, and what factors influence residents' feeling of safety? Maps, graphs, and images can be useful material for discussion and as supporting tools for planning. In strategic and operative planning, locating information is necessary. Today, more and more methods and technical tools are available to illustrate experiences of the everyday environment, for instance, on maps (e.g., Kytä & Kahila, 2006; Tyräinen et al. 2007a). Information attached to exact places is necessary in prioritizing nature areas, for instance, *where* cutting an urban forest and replacing it with a housing area would cause potential conflicts and *what areas* provide multiple positive nature experiences for different population groups and thus serve the community efficiently.

There have been attempts to come to grips with experienced nature using exact, quantitative methods (e.g. Tyräinen, 2007a; 2007b). Such approaches are justified from the perspective of the intersubjectivity

of personal experiences; quantitative methods can reveal the culture they embed. Sociocultural—intersubjective—values linked with subjective experiences related to urban nature become visible in large surveys. In Finland, for example, surveys have often shown that proximity to nature is appreciated in housing and residents usually favor natural environments (Kyttä & Kahila, 2006; Korpela & Ylen, 2007; Tyrväinen et al. 2007b). This kind of information helps in outlining general urban planning guidelines and the cultural perspectives framing subjective experiences. The usability of data from questionnaires can be hindered by the fact that the terms used—such as “green area,” “wasteland,” or “proximity to nature”—can mean very different things as everyday experiences for respondents. For one, the proximity to nature is the seaview from a balcony, for another a rural landscape at the urban fringe. The terms cannot be returned to any abstract and commensurable urban experience as residents define them with their own interpretive frames (Goffman, 1959), although planners have to use such general expressions in attempting to deal with the diverse framings. Intersubjectivity always includes a subjective, unique dimension that can also change as a person moves through the phases of life.

From the perspective of residents’ well-being and quality of life, planners of nature areas need understanding both of socioculturally shared meanings and subjective experiences bound with exact places. Understanding both of these “levels” and making them visible are key roles for planning to support the well-being and quality of life of different population groups.

In addition to the insights generated through quantitative methods, it is necessary to employ a research approach that delves deeply into individual perspectives to be able to increase understanding of the grounds and restrictions of quantitative generalizations: without understanding what is being measured, the measuring is pointless. The experience of nature cannot be translated into exact numbers without losing something essential in the uniqueness of the experiences. Focusing on individual experiences is not sufficient either. Without measuring, it is impossible to understand the size of the population being affected by the decisions. Forester’s (1993) division of two dimensions of planning—uncertainty and ambiguity—reminds us that in different levels and phases of planning, different questions are being responded to: in addition to *what* and *where* it is necessary to ask also *what kind of* and *how*. Certainty can be sought with increased technical knowledge, while ambiguity calls for understanding, making experience-based and value-based knowledge indispensable.

## **Conclusion: Taking Promotion of Residents’ Well-Being and Quality Of Life as a Goal of Urban Nature**

Even though residents’ world of experiences is, as such, recognized as an important perspective in planning in Finland (e.g., Bäcklund, 2007), using their experiences remains problematic. Staffans (2004) and Niemenmaa (2005), among others, have stated that the insights produced through public participation are easily discredited as “non-information,” as it is regarded as only representing the subjective views of a small part of the population. The intersubjectivity of nature experiences, however, means that views of even a small group of active residents on preserving a local park, for example, reveal something about the valued qualities attached to a good urban environment (see Ernstson et al. 2008). Perceiving an individual experience attached to an exact place also as translocal—revealing cultural aspects that play a role for other places as well—would make it possible for these individual perspectives to play an important role in reflecting the normative goals of planning (see Bäcklund, 2007). Although the views of the minority of “park defenders” cannot and should not be generalized, individual comments can have an essential role to play in formation of self-understanding of planning for nature areas.

The participation of urban residents in planning nature areas has not been adequately considered from the viewpoint of how information produced through such approaches could, in addition to ecological, technical, and economic data, best serve the cultivation of public preferences and the goals of planning (e.g., Janse & Konijnendijk, 2007). Current participation practices do not necessarily efficiently support knowledge construction on the different levels of planning; different types of questions require different ways to obtain data. This may explain, for instance, the result of a survey on strategic nature-area planning in Helsinki in which, although the participatory processes generally satisfied residents and authorities, both groups thought that the participants had been given the idea that they would be able to influence planning more than they actually could (Sipilä & Tyrväinen, 2005). If the information produced through participatory processes is regarded only as an assemblage of personal opinions and not equivalent to, say, urban ecological data, planning and decision making are missing an essential element regarding residents’ understandings of their own well-being and quality of life.

Many scholars have regarded integrating ecological and sociocultural values as one of the key problems in planning and decision making about nature (e.g., Yli-Pelkonen & Niemelä, 2005; see also

Koontz, 2006). Effective planning should be able to accept the incommensurability of various logics of knowing and still be capable of recognizing the role of the obtained data, which is the complementarity of knowing (Bäcklund, 2007; see also Andersson, 2006).

Lee & Roth (2006), in their study on a waterway conflict in Canada, discuss that in a democratic society, no single form of knowledge can be privileged at the expense of other forms. This can also be seen as an interpretation of equity as a sustainability principle (Kemp & Martens, 2007). In addition, Amin (2006) has emphasized that such commensurable criteria with which a good city could be built do not exist and it is exactly this point of recognition that could open the doors for equitable planning. A criterion for good planning for nature areas could thus be awareness of the different people and groups whose nature experiences are affected and with what consequences.

Recognizing the meanings of nature areas for residents is the first prerequisite for nature experiences, alongside ecology and other more established viewpoints, to contribute to the normative goals and concrete actions that guide planning. The greatest challenge in accounting for the experiential dimensions of nature is related to the interpretations of criteria for usable information for planning and to the ability of the planning process to manage various forms of information at the same time. Ecological criteria cannot be used to determine what kind of opportunities for experiences a nature area provides for residents, nor can the suitability of an area for recreation determine its value from an ecological point of view.

Residents have experience-based knowledge that planners lack, but the need to involve residents in planning is not only based on this expertise. As the accessibility and quality of nature areas affects residents' mental and physical well-being, they should have an authority role in planning their own living environments. With the concept of authority we emphasize, consistent with Burman & Säätelä (1991), *the right of residents to be involved* in defining the criteria for a good living environment and the goals of planning. This role also includes responsibilities for the common environment and for forthcoming generations. Taking residents seriously, as co-producers of essential knowledge in planning and decision making, addresses a way for futures where urban environments are shaped and used in a sustainable way via both joint decisions and individual everyday activities.

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## ARTICLE

# Anatomy of a failed sustainability initiative: government and community resistance to sustainable landscaping in a Canadian city

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This article presents a case study of a “failed” sustainability initiative to establish sustainable landscaping demonstration sites in a northern, resource-dependent Canadian community. This failure is attributable to fears by municipal staff regarding public acceptance of landscaping alternatives and, in consequence, partial and ever-changing levels of support for the project. The outcomes suggest several lessons for achieving success in sustainability initiatives, including ensuring education for all parties, establishing and maintaining mutual commitments, and overt planning for potential negative public response.

KEYWORDS: landscape planning, public lands, public opinion, attitudes, case studies, cooperation

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## Introduction

In 2004, researchers from the University of Northern British Columbia (UNBC) developed a collaborative research project in cooperation with the municipal government of Prince George, British Columbia, to explore more sustainable options for landscaping public lands that would reflect the demands of a northern climate. This project became the Prince George Northern Sustainable Landscape Initiative (SLI).

At the beginning of this project, Prince George’s municipal government had some pre-existing interest in moving toward sustainable practices in its operations, including landscaping in public areas, but had made only preliminary starts. One of the key research questions we investigated was the potential attitudes of Prince George community members toward the introduction of sustainable landscaping initiatives. Two considerations triggered this question. The first is that a significant percentage of landscaping resources (e.g., water, mowing, pesticide, and fertilizer) are used on private property. To change community practices, one would need to ensure community acceptance in private spaces. Public landscaping that demonstrated sustainable practices could provide an impetus to private citizens to change their own landscaping choices and to build public tolerance for new designs. The second consideration is that for a municipal government to adopt sustainable landscaping practices on its lands, it would need some assurances that the voting public would accept such

changes. While some municipal governments are willing to take on a leadership role in changing to sustainable practices, others avoid citizen disapprobation.

As it turned out, this last issue became the project’s crucial challenge. While some municipal personnel were supportive, and remained so, over the project’s life we faced significant resistance from other staff, who were highly apprehensive about public acceptance of a different type of landscaping. As we heard anecdotal stories about verbal abuse to staff when the color of tulips in parks was changed, for example, we realized that these were valid apprehensions. Over the project’s four years, the municipal government became increasingly uncomfortable with the idea of changing landscape options, in part due to their personal preferences and in part due to their concerns over public acceptance. In the end, only one site on city property was permanently converted to sustainable landscaping, despite an original commitment of 30 acres (other sites exist on property belonging to other partners).

In addition, we committed some crucial errors that also contributed to difficulties achieving this project’s objectives. These mistakes included a certain amount of over-ambition on our part, but also in assuming that our municipal partner was fully committed at all levels to such a project. This article presents a case study of the nature of the potential difficulties of establishing alternative sustainable landscaping schemes. It further draws some lessons learned about engaging a municipality and its tax-

payers in a highly visible sustainability initiative. Although not the original intent of the project, in the end, some of the most interesting research questions became what actions (or lack of actions) limited municipal acceptance of sustainable alternatives, questions that offered some of the most profound, if painful, lessons.

## Literature Review

Innovation failure (more commonly called the failure of new ideas) is found in all aspects of research and design. From landscaping (reflected in our own experience) to the design of city ports and the provision of foodstuffs, the literature notes a number of causes and examples of failure in encouraging individuals to adopt new ideas. A few of these conditions considered most relevant to our project are offered here.

Paluszkievicz & Mak (2009) cite the general success-gauging criteria offered by Wiegman (2005): how well a new idea fits an existing infrastructure (see also Smith, 2003), as well as the difficulty caused by people not understanding a new idea (see also Stahl, 1999). Wiegman (2005) suggests that success lies in social compatibility, simple technology, and social acceptability. He claims that failure is strongly related to insufficient funding for implementation, lack of skills, and perceptions of risk. This is particularly true when the benefits are not seen to be adequate to offset the risk. Wiegman (2005) concludes that the most common factors affecting the success or failure of new ideas include technological issues, government policy and regulatory frameworks, opposition from vested interests, and psychological dimensions (e.g., perceived risks, an unfavorable image or unfamiliarity, or future expectations). He also notes that development of a new idea often occurs through “learning by doing.”

Foxon et al. (2004) note that failures in innovation are a result of the innovation not being a subject of “deliberate policy delivery,” as well as processes that work against integration if long-term challenges receive low priority. Smith (2003) observes that vested practices limit a new idea’s ability to enter into everyday practice. Further, and following the theme of vested interests, Könnölä et al. (2005) suggest that difficulties lie in organizational, social, and instructional changes that affect the diffusion of solutions.

Although aimed at improving distance education, Stahl (1999) draws on lessons from social psychologist Kurt Lewin’s 1930s work that illuminated challenges in fostering innovation. Lewin saw three important aspects in a successful change: participants must be active in accumulating knowledge for them-

selves; knowledge dissemination must be cohesive to permanently change attitudes, ideas, and behaviors; and the social environment needs to support any change. Moreover, the participants must be able to adjust their self-perceptions, as it is easier to change a social context than an individual one. Thus the introduction of new and innovative ideas, such as sustainable landscaping, often face considerable challenges in gaining acceptance.

Human interactions with natural or naturalized settings in urban areas are reasonably well studied, particularly in Europe. For instance, Matsuoka & Kaplan (2008) examined 90 articles from one publication focused upon landscape studies. This work confirms that the availability of natural settings is important for human well-being within urban settings, and that this need is consistent across a variety of cultures. However, how that need is perceived or articulated varies widely depending upon gender, age, and socioeconomic status. Psychologists and other researchers have, for some time, examined this human attachment to nature; the classic work is E.O. Wilson’s *Biophilia* (1984; see also Kellert, 1993). Thus, the human need for nature is increasingly accepted; however, as Matsuoka & Kaplan (2008) and others note, what that need looks like can vary quite dramatically.

Meeting this need in urban settings can take the form of conventional landscapes (mowed parks and carefully controlled plantings), but cities are increasingly exploring options for such areas to add value by contributing to the new drive for “sustainability,” or fewer ecological costs. Landscaping initiatives meant to meet sustainability criteria are increasingly common in Europe (Ruff, 2002). Again, studies in Europe have noted that the public, while attracted to “nature,” may have very different perceptions of that nature. Some people, for example, are scared or disgusted by places that are too wild or find such places frightening to visit and thus might prefer more controlled outdoor designs (Ozguner & Kendle, 2006). More naturalized settings often fail to meet aesthetic preferences for tidiness or are simply not part of the landscape patterns that people are used to experiencing. Thus, public preference for landscaping is quite mixed, and sustainable landscaping choices, depending on their appearance, need to reflect that diversity of opinion. Indeed, Ozguner & Kendle (2006) demonstrate that the public (in the United Kingdom) wants “naturalized” landscapes, but also wants them to appear to be maintained. Similarly, Jorgensen & Tylecote’s (2007) examination of interstitial wilderness areas noted that such naturally landscaped areas were often viewed as not cared for and therefore undesirable. Jorgensen et al. (2007) examined the proximity of dense woodlands to residential sites in

the United Kingdom and came to similar conclusions: the public appreciated aspects such as privacy and a feeling of closeness to nature, but any sense that the area was not managed caused community concern and limited a sense of social engagement. Despite mixed public reactions, agencies exist that successfully promote naturalizing unused landscapes for ecological values (Taylor, 2008). However, North Americans are perceived as possessing different sensibilities from Europeans and certainly are engaged with a very different set of landscapes and sense of history about those landscapes. Given the setting of this research project, the remainder of this literature review focuses upon the North American context.

In North America, controlled plantings in public and private spaces, largely using lawn grass, are a recognized obsession (although some areas, such as California, have begun to encourage alternatives). Researchers have noted a rise, beginning in the 1920s, in the popularity of expanses of lawns with a scattering of trees and perennials and characterized this preference as “remarkably persistent and stable” over time (Henderson et al. 1998). Speculation on the reasons for the enduring popularity of lawns range from a perception that their presence contributes to feelings of good citizenship and neighborliness on the part of homeowners and the maintenance of property values to a sense of “controlling” nature and a mark of status dating back to European aristocracy maintaining a pristine sward of green (Jenkins, 1994; Shern, 1995; Henderson et al. 1998; Steinberg, 2006; Dorsey, 2010; Mustafa et al. 2010). Such social determinants are bolstered by civil reinforcement through municipal ordinances regarding lawn length, landscape composition, and “weed control,” as well as significant investment by lawn-care companies, garden centers and other businesses in promoting lawns as a social good (Jenkins, 1994; Lynch & Hofmann, 2007; Dorsey, 2010).

This preoccupation comes with extensive social and environmental costs. The social costs include the time spent maintaining a lawn (e.g., mowing, watering, weeding). Statistics Canada (2009), for example, reported on any average day 11% of Canadians over 30 years of age were working on their lawns or gardens and the average participant spent two hours daily on yard work (Lynch & Hofmann, 2007).

More problematic are the environmental costs of lawns and conventional landscaping. Lawns, in particular, require extensive resources to maintain, with water being a significant input. However, most jurisdictions in North America are presently experiencing lower levels of precipitation or overt drought conditions (see Mustafa et al. 2010 for a Florida case study on lawn and water regimes). In Canada, domestic water consumption can increase by 50% during the

summer months when lawns are watered and 54% of Canadian households routinely water their lawns (Lynch & Hofmann, 2007). Pesticide and herbicide applications are also key environmental costs, resulting in acute and long-term health concerns. Studies suggest that pesticides/herbicides are a leading cause of acute poisonings in Canada and can also cause chronic health effects, both as outcomes of acute poisonings and from chronic exposure (Canadian Association of Physicians for the Environment, 2000; Union of Concerned Scientists, 2008; see also Daniels et al. 1997; Infante-Rivard & Weichenthal, 2007; Rudant et al. 2007; Ecojustice Canada, 2008). Furthermore, fertilizer runoff contributes to algae blooms in water bodies and can reduce soil health (Mustafa et al. 2010). While poorly studied outside of the nursery industry, the costs of growing conventional ornamentals and bulbs for the garden trade, particularly annuals, in terms of fertilizer, pesticide use, and loss of land for food production, are likely considerable. Finally, there is the environmental cost of all the mowing resulting from water and fertilizer application. As of 2005, two-thirds of Canadian households with lawns and gardens owned a gas-powered mower, despite research demonstrating that gas mowers contribute disproportionately to poor air quality (Lynch & Hofmann, 2007). Few studies document the costs in time or resources for municipalities engaged in similar activities for the purposes of maintaining their manicured public spaces.

Awareness of the costs of maintaining lawns and conventional landscaping have grown since the 1980s as local organizations and interested homeowners have pressured municipalities to accept sustainable landscaping alternatives (Dorsey, 2010; Mustafa et al. 2010). Today, many popular magazines and journals promote alternatives to conventional lawns (see Best, 2002 and Correa, 2010, for examples); however, the majority of the North American public seems surprisingly resistant to these options (Dorsey, 2010; Mustafa et al. 2010). The key roadblock, according to Nohl (2001), is the question of aesthetics. As Dorsey (2010) notes, individuals might be well motivated toward better environmental management in theory, but in practice, their self conception and interest in maintaining good relations with neighbors (linked to the values attached to lawns cited earlier) limit the adoption of alternative landscapes on private property (or its acceptance in municipal spaces, as our experience demonstrates).

Congruent with the rise in public interest in lawn alternatives has been growth of interest in “sustainable” landscapes among professionals such as landscape architects, horticulturalists, and planners, among others. Sustainable landscapes were promoted

as early as the late 1960s (see McHarg, 1969), but much of the critical literature began appearing during the 1980s (Lyle, 1985; Van der Ryn & Cowan, 1996; Franklin, 1997; Mendler & Odell, 2000; Thompson & Sorvig, 2000; Melby & Cathcart, 2002; France, 2003; Antrop, 2006; Potschin & Haines-Young, 2006; Selman, 2008). Nevertheless, as Calkins (2005) notes, this upsurge of activity has not been mirrored in application. Of the “green building” practitioners responding to her survey, only a third characterized their projects as “very green.”

Further complicating the discussion is the diversity of opinion about what the term “sustainable landscaping” might mean. For example, Antrop (2006) notes that since landscapes constantly evolve due to natural disturbance and human actions, the definition of sustainability is dependent upon time and place. He identifies two key definitions: the first is not linked to a particular landscape, but is identified through elements of natural or human history or persistent practices to maintain traditional values. His second definition focuses on the potential of a landscaping choice to contribute toward enhancing the continuing well-being of natural and human communities. However, Selman (2008) notes that sustainability remains undefined by many of the very practitioners citing the concept. Further, the concept might be dependent upon differences between “old world” and “new world” perceptions of landscape, time, and the background of the individual applying it. None of this debate leaves either individual homeowners or municipal governments much the wiser on either the desirability or acceptance of alternative, “sustainable” landscaping.

### The Study Community

Prince George is situated in northcentral British Columbia, Canada. It is largely a primary resource extraction and primary processing economy, reliant upon timber production and saw and pulp mills. Much of the timber has been adversely affected by insect attack in recent years, leading to a significant reduction in fiber availability. Sawmills have seen closures due to the drop in housing construction in the United States, while pulp production has also declined. Other primary resource sectors, such as mining and oil pipelines, are anticipated to drive future economic growth. In addition, the city is a government-services center for federal and provincial agencies, that are assisting it explore new economic opportunities as an industrial transportation hub. The government services-center status provides other economic options, including a university, a community college, and other small industries. The city's population has fluctuated somewhat, but as of 2010

was approximately 80,000 people.

The municipal population is politically conservative in its values. Further, anecdotal evidence suggests that older residents have reacted negatively to change, particularly that brought about by the advent of the university in 1993, and have not responded positively to a concomitant rise in the diversity of social values. The community is proud of its logging town reputation, and the environmental and sustainability movements are viewed with both suspicion and some hostility, often as values coming from the large urban centers of Vancouver and Victoria far to the south. Municipal recycling initiatives and water-conservation strategies, to take the least controversial in other provincial districts, are routinely resisted by taxpayers as not necessary. As a consequence, the municipal government has moved very slowly on introducing any initiative that might be viewed as “green.”

However, as with all cities in British Columbia, the municipal government is under pressure from the federal and provincial levels to institute sustainability initiatives, including moving toward carbon neutrality, reducing waste generation, and developing and implementing a municipal sustainability plan (City of Prince George, 2010). As such, the municipality is caught between a conservative population (often seen as characteristic of northern Canada) and government initiatives that must be implemented under threat of lost tax revenues and other punitive measures.

### Study Methodology

This project began when two UNBC professors were asked to give a presentation on Prince George's sustainability initiatives to a panel of judges from an international program, “Communities in Bloom,” that was judging the city's landscaping for a provincial level award. The professors had difficulty identifying any landscape-based sustainability initiatives, which made for some awkward conversation with the judges. Having identified a potential research question—why there are sustainable landscape initiatives in the urban centers of Canada, but none in northern resource-dependent communities—we approached the city's environmental manager regarding what sustainable landscaping could mean in Prince George. He was highly supportive and almost immediately committed funding to undertake plant trials on city properties and to engage in public outreach. Upon receipt of additional funding, a commitment was made to undertake plant trials on three public sites. This limited proposal was presented to the city council for approval, which was granted.

During the first two years, the principal researchers—a hired horticulturalist/project manager

and the core municipal staff group (comprising horticulturalists, the parks manager, and the environment manager)—served as the project's steering committee with day-to-day decision-making authority. Extensive, often weekly, meetings occurred to identify and agree upon the questions, potential sites, landscaping design, plant choices, and work schedule. In addition, throughout the project all new major initiatives were presented to, and cleared by, the city council and affected departments. The steering committee provided regular written reports to the council and department heads. In addition to meetings between steering committee members, the researchers engaged in weekly, often daily, interactions and consultations with other key staff, managers, and department heads, as well as with our partners. Many meetings actually occurred on sites, as municipal staff came frequently to observe activities and progress (and often ended up helping to get plants into the ground). Much project communication was informal, but we also had regular meetings with staff and biannual review sessions to ensure that the city and all our partners were aware of and involved in the project and to address concerns as they arose. The researchers always made themselves available for meetings when questions came to the surface.

After the project's first year, we began to lose some of the early municipal members of the steering committee due to reassignments or employment changes. As it turned out, these initial collaborators were the crucial, enthusiastic partners and their departure began a gradual disintegration of that committee, despite the engagement of replacements over several subsequent months. By the project's third year, the steering committee was reduced to the researchers, who could no longer rely on day-to-day contact, but continued with an increased schedule of individual meetings and communications. At the time, the municipality indicated that it accepted this arrangement.

The original steering committee considered it crucial to engage other municipal staff, particularly those in closely affected departments. City representatives on the steering committee agreed to the need for professional development on sustainable landscaping; however this aspect of the project was to be handled internally by municipal staff, given concerns over potential union issues.

One group we did not actively engage in the project was the general public. We made this choice for three reasons. The first was an urgency expressed by the city and other funding agencies to actually get the project into the ground, literally, as soon as possible. Extensive public consultation prior to the project was not seen as a productive use of available resources. We did, however, undertake a great deal of

passive public engagement through signs at the sites, media coverage (including provincial and national radio coverage), and presentations to local groups such as the Rotary Clubs and schools. The second reason for not engaging the public was that we saw the project as "research" rather than as a municipal infrastructure project, which would have required a public consultation. While we expected successful trial sites to remain, these were identified to our partners and in our outreach as trial sites. Third, we wanted to measure public responses to new types of landscaping choices. Rather than attempt to obtain their support prior to the start of the project (with the problematic question of what to do if the public refused to allow the research to go forward), we decided to install the sites and *then* measure reaction.

Our preliminary investigations into other sustainable landscaping projects in North American jurisdictions revealed rather vague, and individualistic, definitions of sustainable landscaping, generally involving lower environmental impacts as an outcome. We held several discussions over the project's first two months with key municipal staff to develop a definition of sustainable landscaping that was reflective of other areas but that addressed Prince George's particular, northern concerns, including issues of climate particulars. As a result, we reached a jointly negotiated consensus. Sustainable landscaping design is multifaceted. It must permanently reduce the size and number of high maintenance, purely aesthetic turf areas and eliminate the need for mowing, the application of supplemental water, and all other forms of maintenance. Sustainability, in this context, also requires an end to nonorganic fertilizers, pesticides, and herbicides in favor of natural means and a reduction even in these applications. We considered this to be achievable by selecting plants that would successfully survive under Prince George's climate conditions. We were therefore willing to trial non-native (but noninvasive) species.

At its best, sustainable landscaping would protect the environment, including the general health of human, animal, and plant life, and provide economic benefits by saving maintenance costs and creating opportunities for entrepreneurs, including sustainable gardening specialists and educators. It would incorporate the improvement of environmental understanding, economic security, and social harmony. Finally, we posited that a truly sustainable landscape must meet not only the above criteria, but must also be fully acceptable to the public at large. Therefore, the project explicitly operationalized the definition of "sustainable landscaping" as landscaping meeting the following criteria:

- Is acceptable to the community;

- Is appropriate for the community and region. In Prince George, this means tolerant of snow accumulation of up to ten feet annually (a range of temperatures from  $-37^{\circ}\text{C}$  to  $+35^{\circ}\text{C}$ ), decreasing precipitation levels (summers are increasingly dry, particularly in the spring and high summer), salt and sand accumulation from ice-control operations, and vandalism;
- Takes into account changing conditions such as climate change;
- Is relatively cost effective;
- Requires minimal or no artificial watering;
- Requires no herbicides or pesticides;
- Requires minimal fertilization;
- Needs limited or, ideally, no mowing or trimming;
- Is aesthetically pleasing;
- Provides other ecological benefits such as slope stabilization or weed control.

The municipal government made an original commitment to provide the assistance and some time of its staff horticulturalists. While supportive, and essential to the project, the engagement of the horticulturalists came at a cost: they had a huge backlog of research questions that they wanted included in the proposed project, a desire supported by their supervisors. Suddenly, we were being asked to find mechanisms to undertake a much larger research project than originally planned. Further, city staff spread word of the research to other agencies, and suddenly additional questions, and funds, were being proposed. City officials began to refer colleagues from other government agencies who also had landscaping questions (as well as funding to provide). These new questions and funds were incorporated where they met the following criteria: the new proposal appeared congruent with the general direction of the overall project objectives; the proponent stated that they understood that the project's primary goal was research, rather than a cheap landscaping option; and we *thought* we could reasonably undertake the project proposed (as will be seen, we were sometimes mistaken in that last assumption). As the additional projects and funding allowed an opportunity to pursue a large funding grant, which was received based upon certain commitments, we found ourselves, unexpectedly but not unwillingly, committed to a four-year, multifaceted, and multipartner undertaking.

Our "successes" were largely dependent upon which partner and land base we were working with. Key partners included the City of Prince George, the University of Northern British Columbia, the Prince George Regional Corrections Centre, and the Prince George Airport Authority. These institutions pro-

vided the major land base for the research. In addition, we received funding from twelve agencies for different projects and had obligations to several other community partners. The different collaborating organizations were involved in very different ways, both in terms of the types of research conducted and in how they were engaged. Some of these differences had implications for whether their involvement was "successful" or not in terms of project acceptance and outcomes.

Our early discussions led to the development of the original project objectives, which were based upon goals and questions articulated by the core group of municipal staff and our project horticulturalist. Those objectives were to, over four years,

- Demonstrate that ecologically sound landscaping could be undertaken in a northern ecosystem and a resource-dependant community.
- Determine which planting combinations and maintenance regimes are most appropriate for different site requirements.
- Determine which planting combinations provide the most net ecological benefits.
- Increase public awareness of, interest in, and knowledge of ecologically sound landscaping.

Our objectives were to be developed through the following strategies: over the first three years of the project, approximately 30 acres of highly visible city property and key community partners' property were to be identified and relandscaped. These areas were to be revegetated with a mix of native plants and northern adapted plants in a planting regime that would allow us to measure the impacts of the plantings on several environmental variables. We would measure public perceptions and interest and initiate community education. Measurements were to be undertaken over the course of the project, but after at least two growing seasons.

As the project progressed, additional experiments were added to the list. These included:

- Investigate alternative (nonherbicide) weed-control initiatives. Final choices were mechanical mowing, applications of vinegar (acetic acid), livestock grazing (donkeys and then goats), and weed-suppressing perennials.
- Assist the Prince George Airport Authority to investigate both more sustainable landscaping on the facility's grounds and landscaping choices that would limit wildlife incursions onto runway areas. This included a bird and wildlife study to determine what species occur in what areas around runways, plant attractiveness to different wildlife

species, and test plots planted with two plant mixes which a literature review suggested would be least attractive to wildlife of concern, i.e., non-edible.

As noted earlier, these multiple objectives were frequently driven by funding opportunities. So, too, were some of the commitments. For example, a commitment of relandscaping 30 acres was highly ambitious (although that number did include a weed-control project at a 20-acre park). However, our biggest funding agency, which wanted a large project, mandated this size.

Specific methodologies were dependent upon the type of projects that we pursued. For our plant trials, we established test plots in a variety of locations and environmental conditions and spent several years visually monitoring the success of different plants in various locations and conditions and taking physical growth measurements. The work with various weed controls, including vinegar and domestic grazers, included establishing trial plots in test areas, undertaking weed counts, and monitoring, through these counts, the impacts of the controls on weed numbers and health (Booth & Skelton, 2009). Our work on bird and mammal deterrents at the airport included identifying and monitoring visually and by radar species, numbers, and habitats on airport grounds. Literature research was conducted to identify plants thought to be both mammal and bird resistant that would do well in the Prince George ecosystem. Trial plots of these plants were established on airport grounds and their use by birds and mammals has been monitored (this work has continued to receive funding; see Hesse et al. 2010). To measure public attitudes, we mailed to 1,300 residents a survey on perceptions of sustainable landscaping in 2007, after several of our sites were installed. The returned surveys were statistically analyzed to determine community views toward different types of landscaping choices on both private and public lands. However, different sites/projects had specific undertakings, as we will now summarize.

### ***University of Northern British Columbia (UNBC)***

A number of different projects were conducted at UNBC. While some were experimental in nature, seed and plant trials largely, the focus at this location was on installing demonstration sites. We installed four demonstration sites (three other sites failed, for a variety of reasons).

#### ***Wabooz Garden***

This garden was installed in 2005 as our first demonstration site, and officially named the Wabooz Garden (rabbit in the Anishanabe language) in 2007.

This site attracted initial resistance from senior university administrators, given fears of public disapprobation, but a year after its installation was receiving positive community reaction, including its use for weddings, graduation photos, and university social events. Casual and outdoor class use is extensive.

#### ***UNBC Sign***

A substantial garden site, including conifers, perennials, and bulbs, was installed at the university entrance sign in 2005.

#### ***Teaching and Learning Building***

The UNBC administration was interested in using the space surrounding this newly constructed building to demonstrate a new commitment to sustainable landscaping on campus grounds. Perennials and bulbs were installed adjacent to the two entry ways in 2007 and a rock garden was installed in 2008.

#### ***The Charles Jago Northern Sports Centre***

After extensive discussion with the City of Prince George regarding a municipal location for a sustainable landscaping demonstration site failed, the campus-sports facility was used as a public demonstration site. It was planted in 2008.

#### ***City Sites***

Over the project's four years, several city sites were added to the project for different experiments. At the end of the project, only two sites remained.

#### ***Studio 2880 Grounds***

A trellis and bed were installed in 2005, and a set of drought-resistant plants was established in 2006. We had reached agreement to establish our city-demonstration garden at this site, had plans commissioned, and were preparing to install the site when the city sold the land in 2007. This site was decommissioned and the plants relocated.

#### ***Carrie Jane Grey/Massey Drive***

In the fall of 2006 and the spring of 2007, perennials with weed-suppressing properties (based upon research by Weston et al. 2006 and Eshenaur et al. 2009) were planted to determine survival and attributes under local conditions. Their growth was monitored throughout 2008, and we obtained significant data on weed suppression and plant growth. In the fall of 2008, at the request of the municipal government, all trial plots were removed and the site was returned to its original lawn-grass condition, as city staff were concerned about negative public response.



### *Green Street Project*

In 2006, eight species of trees not normally grown in Prince George were planted in various neighborhoods to determine their adaptability to local conditions. A few died for undetermined reasons; the survivors remain.

### *Connaught Park*

In 2007, we were asked to develop a plan for a site along a road where several bare patches existed from the original road construction and subsequent slope slumpage. Early in the spring of 2008, the area scheduled to be planted experienced another significant earth slide, and as the site was now unstable the decision was made to find another trial site. However, locating a replacement site proved challenging. For every site proposed by one official, other officials raised objections based upon fears of public backlash. In the end, a site was chosen by two officials who failed to advise their colleagues until after it was planted. This “sneak” planting has proven publicly acceptable, but was achieved through a problematic strategy.

### *Livestock Grazing Trials*

In 2006, we utilized donkeys for weed control at three city sites, a field, and two sewage ponds. This proved unsuccessful, as the donkeys did poorly in the available grazing. In 2007, we introduced goats into two city sewage-lagoon sites. The results were successful, both in terms of weed control (Booth & Skelton, 2009) and of acceptance by municipal officials and by a curious, largely supportive public. The difference in public and municipal acceptance is discussed below.

### *Other Partners*

A number of other partners contributed sites for specific research questions. These sites also provided significant lessons in garnering acceptance.

### *Highway 97—John Hart Bridge*

Planted in 2005, this test site was very challenging, with very poor recruitment observed in 2006. While reassessment in 2007 and 2008 demonstrated better survival than originally thought, the initial perceived failure was not well received by the partnering organization. This experience demonstrated the folly of tackling a too-difficult site too early without adequate data, an important lesson in sustainability initiatives, as the failure cost the project in terms of trust.

### *Highway 97 Bypass*

A demonstration site was to be installed in cooperation with a local nonprofit on a median in this area. Plans were commissioned but had to be aban-

doned when a change in personnel within the partner organization resulted in their inability to fulfill the original agreement. In this case, the loss of a key, enthusiastic supporter proved a critical blow.

### *Prince George Regional Correctional Centre*

The corrections center was a key partner in its provision of labor (inmate crews) and they also wished to partner as a site. A trial site was installed on the grounds in 2006. In 2007, these perennials were relocated due to access (security) issues and a second experimental garden was established in an unused field. This was to serve as a staff garden, but the location proved problematic (too far from the main building) and the key staff members (including the warden) who had originally championed the project left or moved to other positions. The site was decommissioned in 2008.

### *Ministry of Forestry Building*

Perennial trials were originally established adjacent to a parking lot in 2006 in the face of resistance by occupants who liked the existing lawn. Additional plants were added in 2007, but in 2008, at the request of building occupants who had never accepted the alternative landscaping, the plants were removed and the site was seeded with lawn grass.

### *Prince George Regional Airport*

The airport became a partner in 2007 with two interests: experimenting with sustainable landscaping on a few publicly visible sites and determining alternative landscaping, which would deter wildlife from runway areas.

To address the public areas, two plantings were undertaken. In 2007, grass trials were initiated on a site around the main parking lot to determine if the species were appropriate low-maintenance choices for the region. Poor planting and maintenance (which had been handed to an airport contractor) resulted in poor establishment. Several evergreens were also planted in 2007 adjacent to the domestic arrivals entrance. Survival has been partial due to the area's extensive use as a snow dump, a fact not known by airport administrators when offering it as a research site.

At the request of the airport, work was begun to examine landscaping and other options for limiting wildlife incursions, including deer, moose, bears, large birds, and coyotes, onto runway areas. Research examined site use by wildlife and plant attractiveness to different species. The Prince George Airport Authority embraced this research and has continued to provide funding (Hesse et al. 2010). The acceptance of this work is likely due to its perceived utility by key staff.

## Discussion

While we anticipated resistance from community members (we were, after all, residents of the community and well aware of its values), we were both surprised by and unprepared for resistance on the part of municipal staff and, in a few cases, by personnel from our partner organizations. It was this last issue that proved the most fundamental to the initiative's final "success," or lack thereof. By the project's end, only one sustainable landscaping site existed on municipal land and that was, as previously noted, a "stealth" installation. Similar results occurred on several partner organization sites; only UNBC and the Prince George Airport have retained research sites. While the data collected as a result of our efforts have been of value, if success is measured in terms of public and government acceptance of sustainable landscaping, then our various interventions must be classed as a failed sustainability initiative.

The ultimate level of resistance from within the municipal government was surprising given the initial enthusiasm from some staff and the willingness to both partner on key grants and to provide actual dollars. However, while some officials within the city had agreed to collaborate and were aware of the objectives, other staff varied widely in their support and knowledge. While some were very enthusiastic and provided invaluable assistance, others were highly resistant and constructed continuous roadblocks (one even made a point of driving over labeled research sites). As staff responsible for liaison on various parts of the project rotated frequently, no continuous support could be achieved. In some cases, the resistance was subtle (no appropriate replacement sites could be found, for example, after one became unsuitable) while in other instances it was more overt. In one incident, a new manager spent 30 minutes in agitated and hostile communication with the lead researcher denying that commitments had ever been agreed to (this was two years into the project, but fortunately the commitments had been made in writing).

Although three demonstration sites were allocated over the course of the project and plans (and sometimes plants) commissioned and paid for, only one site was ever planted. One site was sold and the second, while agreed to on one hand, was on the other hand encircled by so many restrictions and demands that it became impossible to proceed. For example, one demand was that all residents within a six-block radius of the site would need to be notified and all input accommodated. We had neither financial resources nor time to meet this requirement.

In another case, a construction contractor working on city lands was referred to the project by one municipal staff member as there was interest in re-

seeding the construction site with drought-resistant, low-mow seed mixes. Another staff member stopped the initiative by demanding, again, that all residents within a three-block radius of the site be notified. All of these incidents are indicative of just how deeply uncertain some staff members were over the nature of the project. In part, this was a failure of the partner to ensure a consistent approach by its own personnel. Other contributing factors included our failure for not recognizing the need early on to conduct staff education and awareness ourselves and for not developing in advance a plan to deal with potential public disapproval.

In the face of municipal officials' concern about public disapprobation (we unfortunately only had anecdotal evidence of a rise in public complaints around our experimental and demonstration sites), we were surprised when our research into public attitudes toward sustainable landscaping in the city of Prince George found general support. The 2007 mail survey demonstrated greater civic enthusiasm for implementing sustainable landscaping on both private and public lands than municipal officials had postulated. Analysis also demonstrated that the greatest limitation on the implementation of sustainable landscaping on private lands was a lack of knowledge of such landscaping, suggesting that municipalities seeking to implement their own sustainability initiatives, or to encourage them on the part of residents, should invest in appropriate educational strategies. Municipal staff and officials were, perhaps, too driven by a vocal minority of detractors.

Lest the city of Prince George be seen as unique, we note similar issues among other partners. The UNBC administration, which provided the project with its first demonstration site, also proved uncertain about that commitment. The site was approved and then cancelled three times. Possibly one circumstance that kept the project moving was the fact that, at the point of each cancellation, substantial funds had already been invested. Further, one key individual was consistent in his support. Again, the ostensible rationale for cancelling was fear of public disapproval. In this case, the project went ahead and such fears proved unfounded. Similar concerns arose at the Regional Correctional Centre (although in part this was due to a poor choice of sites). An important aspect of this latter failure was the loss of key supportive personnel; when they left or relocated, the project simply stopped.

It is a useful learning opportunity, however, to reflect upon the shared fear of public response on the part of officials, which caused challenges for this project. Considerable investment in education, not just of its community members but of its own staff and officials, is likely required on the part of any in-

stitution or government contemplating sustainability initiatives. Further, such education should occur well before the first plant is put into the ground. Upon reflection, it appears that our crucial mistake was in accepting municipal staff assurances that there was considerable governmental support for the project, with some noted exceptions (such as the worker who kept driving over our research sites: he was a year from retirement, was the explanation). We moreover accepted the argument that the municipal staff engaged in the project would undertake the necessary education and communication requirements internally. There were two reasons we agreed to this arrangement. The first was that we chose to trust our partner. The literature is certainly clear on the problem of resistance to new ideas and this issue was discussed with the municipal collaborator thoroughly during the first year. In addition, every time a specific incident occurred, municipal staff kept assuring us that the issues were being handled. Perhaps our municipal contacts were as surprised as we were at the amount of resistance, or more likely different levels of power within the municipality were unaware of each other. We continued to try to work with the municipality. The other reason we left this crucial issue to internal solutions was concerns over the use of nonunion labor on the project (the inmates). Given the perceived sensitivity to union sensibilities, for better or for worse, education and communication over concerns with municipal staff had to be left to the municipality itself.

Conversely, some aspects of the project received considerable support. The goat weed-control experiment received strong backing from city staff and from a fascinated public (many of whom visited the sewage ponds specifically to meet the goats). Press coverage of this aspect of the project was considerable and the goats were pretty charismatic—we finally had to install “Please don’t feed the experiment!” signs. The difference in levels of acceptance might be instructive. The sites being utilized were not “public” and were generally out of sight of the larger community. Further, a sewage pond is not intended to be attractive, so the presence of a goat herd would not limit aesthetics. Finally, this project met a significant and highly specific need, nonherbicide weed control, on the part of a small city department that was able to reach internal consensus on providing support. In contrast, while some municipal officials might have seen changing to more sustainable planting schemes as useful, by no means all did so and indeed many saw no issue with conventional landscaping.

For a variety of reasons, our greatest success was at UNBC, where an acre or so of sustainable landscaping remains. An additional three acres have been set aside as a botanical reserve as part of the

initiative. In part, our success at this site was due to early support from influential staff members who remained involved throughout the project’s entire life. These personnel were vocal supporters and, in one case, accepted personal responsibility for the installation’s anticipated failure. Because this installation, the Wabooz Garden, actually succeeded, the case for subsequent installations was strengthened (see Figures 1 and 2).

In addition, as a university the community proved more accepting of the concept of research, with the attached concept of learning on occasion by failure. It also merits noting that the university had a pre-existing and identified need to improve its landscaping and the project met that requirement. A similar circumstance prevailed at the Prince George Airport. Here, the research met a vital and immediate need, namely limiting wildlife from accessing runways, a serious safety hazard (Hesse et al. 2010).

Finally, we shoulder some part of the blame for failures in this initiative. We made several crucial mistakes. Lured by additional funding and potential research questions, we overcommitted, taking on



**Figure 1** Wabooz Garden (then called the Bentley Centre) prior to sustainable landscaping.



**Figure 2** Wabooz Garden, two years after planting.

challenges that we were not ready to meet. We accepted assurances that staff education would be handled internally by our key research partners. We were naïve about internal politics, staff stresses and constraints, tensions between senior administrators and other staff, and concerns over union responses. All of these matters complicated our work and we were unable to effectively head off the subsequent problems. In retrospect, we should have followed up on the anecdotal statements that the public was not accepting the installations. As we never sought proof of the claims of public concern, this issue became a vulnerability when making the case for leaving existing installations or adding additional sites.

## Conclusion

As a result of the Prince George Northern Sustainable Landscape Initiative, we learned a number of lessons that might be helpful for others planning similar interventions in North American communities. The differences in how partners perceived and worked with the Sustainable Landscaping Initiative is particularly noteworthy. We divide our concluding observations into four categories of lessons: personal, institutional, partnership, and working with the public.

### *Personal Lessons*

- Be realistic about what can be accomplished with the available time, resources, and personnel. Stay focused.
- Be clear about what you know (what is likely to work) and what you do not (what is experimental).

Our initiative pursued a few projects early on that were beyond our knowledge and/or capacity. Several were meant to be experimental and we were aware that failure was a possibility. However, those apparent “failures” cost the project support and trust as we were not sufficiently clear with our partners on the nature of “research,” with the attendant possibility of learning by failure. Sustainability initiatives need to be clear about what is experimental and subject to failure and what is reasonably established practice.

### *Institutional Lessons*

- Target initiatives directly to the needs of the recipients (the broader the goals the less likely they are to find clear supporters).

We tried to meet some very broad objectives which, as key supporters left their positions, became difficult to sustain. Targeted goals (such as weed control or limiting wildlife incursions) that met specific needs of key supporters or partners retained their commit-

ment over the long term, even when individuals departed.

- Identify the key supporters required in advance.

We often were given contradictory information about whose support was required for a particular project. Sometimes we had to achieve support from individuals not previously identified and usually at the last minute, disallowing fair circumstances for their decisions. Decision hierarchies need to be established in advance and adhered to by all partners.

- Be clear on the tangibles committed. Sites must be stable (not subject to future sale) and all possible sites must be fully agreed to in advance.

Our project relied upon many sites that ended up being sold or otherwise became unavailable. This not only caused delays and lost dollars (plans paid for but never used), but also allowed partners to renege on commitments after the loss of supportive personnel. Further, staff time promised in the early part of the project became more difficult to maintain as the original supporters moved away.

- Ensure both short- and long-term commitments are in place and are honored.

Several of our sites suffered, or even failed, when the partners or contractors who were to undertake tasks such as establishing watering regimes or installing seeds and plants did not honor the commitments. If obligations are contracted out, someone has to ensure that they are conducted correctly or indeed conducted at all. Clear lines of responsibility and communication are also required and must be adhered to.

- Provide education in advance of the initiative for all potentially affected parties.

While we undertook substantive public outreach through various media outlets and public events, that education happened at the same time that the earliest demonstration sites were installed. In retrospect, we should have spent a year providing education before the installations began. This might not have eliminated public concern, but it would have limited the surprise. We did not, unfortunately, have this option at our disposal. Further, we overlooked a key group: municipal and partner-organization staff. We assumed that if our staff liaisons were on board, then all staff were on board. This was in no way a correct assumption and most of our challenges arose from concerned, unsupportive staff who had not been briefed.

### Partnership Lessons

- Encourage partners to provide a single authority for decisions and to be clear that that person has the necessary authorization. High staff turnover is a serious problem and must be planned for in advance.

Changes in key staff were a serious challenge as new staff did not always support the project. Some were overtly hostile and this led to delays as reapprovals by superiors had to be sought.

- Make sure that long-term support for activities is built into the project; have a plan for the possible departure of the current champion(s).

### Lessons on Working with the Public

- Develop a strategy for adverse public reaction and be clear that staff accept this possibility.

We did not anticipate negative responses and it was a crucial failure. On occasion, we received complaints from members of the public who confided that the staff to whom they had spoken echoed their concerns. Such split messaging is a public-relations problem. We also failed in actually measuring the reported public disapprobation. Engagement with such negative responses is mandatory to truly judge levels of acceptance.

- If a partner is concerned about public disapprobation, scale down the proposed changes.

Gaining acceptance with smaller projects is crucial to building toward more ambitious ones, particularly if the partner, or any members of its staff, is likely to react poorly to public concerns.

- Be realistic about the rates of acceptance and tolerance, but recognize pushing boundaries is necessary. Be persistent: acceptance is built upon experience.

This lesson derived from our experience at the university. While our initial proposal was resisted strongly by certain key administrators (and was cancelled three times), we persevered, admittedly because we were in a position to so do. The installations that caused so much initial alarm, however, became sources of great pride by the very administrators who had opposed them in the first place, due to their overwhelming public acceptance and use.

\* \* \*

Sustainability initiatives, such as changing to sustainable landscaping, depend upon many factors for short- and long-term success. Particularly where an initiative might face uncertain public acceptance, careful planning is required to assure municipal officials, as well as other partners, that the advantages of participating will outweigh any potential public outcry. While this initiative failed to meet many of its early objectives to establish sustainable landscaping sites, it was successful in identifying key lessons for future efforts.

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## COMMUNITY ESSAY

# Ecosystem services between sustainability and efficiency

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### Authors' Personal Statement:

During the last couple of years we (an economist and an ecologist) have been doing joint research on multiple ecosystem services across countries and continents. Realizing that environmental scientists of different disciplines sometimes use the same words—such as sustainability or efficiency—with distinct meanings, a crucial basis for our successful teamwork has been to define clear terminology and a mutual understanding of what we are talking about. Our impression was that many scientists, practitioners, and politicians feel the same, and would appreciate greater clarity concerning technical terms sometimes used in a colloquial way. This situation motivated us to write this essay. The Millennium Ecosystem Assessment has shown that it is an ambitious task to combine fragmented and disciplinary knowledge in a common inter- and transdisciplinary language. Our essay is meant to take up part of this challenge.

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### Introduction

The notion of ecosystem services cuts across ecology and economy and calls for overcoming science's fragmented and disciplinary nature (Norgaard, 2008). At the same time, clear and comprehensive definitions are required to avoid misunderstandings of the approach as a whole (Ghazoul, 2007a; 2007b; 2008a; 2008b; Allsopp et al. 2008; Klein et al. 2008; Kremen et al. 2008). The Millennium Ecosystem Assessment (MA) defines different kinds of ecosystem services and distinguishes among providing, regulating, supporting, and cultural servicing (MA, 2005). Although a valuable concept, it has been criticized for mixing processes ("means") for achieving services with services themselves ("ends") (Wallace, 2007; compare also Fisher & Turner, 2008).

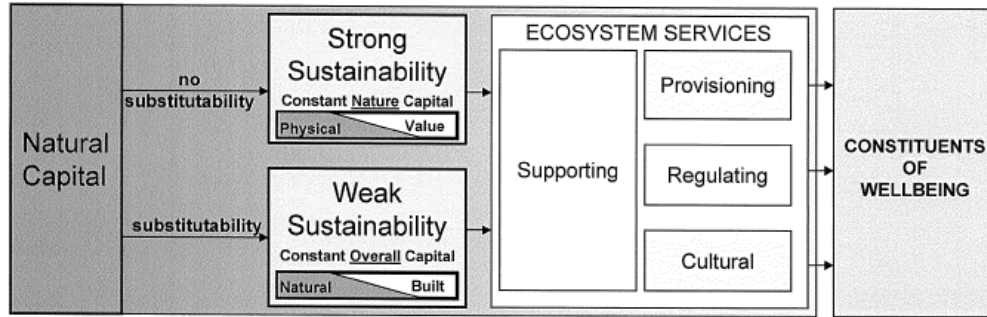
In this essay we focus on another drawback, namely the challenge of adequately taking "sustainability" into account. As Norgaard (2008) remarks, neither the MA's conceptual framework nor the empirical literature reviewed distinguishes ecological services provided by sustainable ecosystem flows from those generated through ecosystems slowly degrading over time, such as overused forests. We discuss here the ecosystem-service approach using pollination services as an example. We first distinguish between weak and strong sustainability, then consider efficiency requirements and their relationship to sustainability, and finally show the implications for pol-

icy recommendations as well as for the overall concept of ecosystem services.

### Sustainability

Sustainability refers to a concept of equity across generations and has been generally defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED, 1987). In the following, we discuss two more specific definitions of sustainability: equity-based and utility-based.

The equity-based definition of sustainability requires preserving the rights of future generations as an act of bequeathing based on distributional fairness (Norton & Toman, 1997). In contrast, utility-based sustainability strives to maintain the capacity to provide nondeclining per capita welfare in the future (Neumayer, 2003). Concerning the latter, it is crucial to distinguish between weak and strong sustainability. In the case of weak sustainability, it is assumed that natural resources and the services they provide can be replaced by other forms of capital, such as human-made (built) capital, as long as the same welfare level can be assured (Hartwick, 2000). In contrast, strong sustainability requires a constant level of natural capital without the opportunity of being substituted by built capital (see Figure 1). The physical maintenance of natural capital implies that renewable resources (e.g., habitats or resources of organisms providing ecosystem services) should be used in such



**Figure 1** Substitutability of natural capital and its impact on the provision of ecosystem services (based on MA, 2005).

a way that the extraction is compensated by regeneration, while nonrenewable resources should not be extracted at all.

### Efficiency

Efficiency in the broad sense is realized if a determined goal is achieved with minimum input or, alternatively, a certain fixed input is used in such a way that it leads to a maximum output. Both cases imply the “absence of waste” as a condition for efficiency (Samuelson & Nordhaus, 2001; Baumgärtner & Quaas, 2010). Efficiency can be claimed at various economic levels: for the household or firm, as well as for a society as a whole. Given that sustainability refers to developments in the future, a corresponding definition of efficiency should also comprise temporal aspects, resulting in the maximization of utility over time, i.e., intertemporal efficiency. This is usually achieved by discounting, which means giving less weight or importance to events that occur in the future. Discounting is often justified (i) by considering a positive time preference of the present generation (regarding future utility, e.g., from consumption, as worth less than today’s) or (ii) by expecting future generations to be wealthier than the present one (Neumayer, 2007). However, these assumptions and resulting policy recommendations are controversial. A prominent recent example is the Stern Review, which—based on efficiency calculations—recommends immediate and comprehensive action against climate change (Stern, 2007). The review has been criticized for its economic assumptions and in particular for the low discount rates applied, which substantially increase the weight assigned to costs of climate change occurring in the future (e.g., Tol & Yohe, 2006; Nordhaus, 2007). However, Neumayer (2007) argues that the discounting debate actually misses the point: instead of dealing with efficiency questions, the major question is how to adequately

tackle the issue of sustainability, and especially the nonsubstitutable loss of natural capital.

### Goals or Constraints

The concepts of both intertemporal efficiency and intergenerational equity have been widely discussed over the last decade, comprising questions such as (i) how to achieve an efficient resource allocation by choosing appropriate discount rates or (ii) how to guarantee a certain level of per capita well-being depending on sustainability in terms of the strong or the weak senses. Additionally, several approaches have been developed to deal with uncertainty (Baumgärtner & Quaas, 2009). First is a utility-based interpretation of nature conservation that emphasizes the benefits of delaying irreversible decisions. These benefits can be defined as an “option value”: the value of preserving, for example, a habitat to maintain the option to use it for other purposes in the future (Wesseler et al. 2003). Second are ethics-based principles that highlight precautionary aspects such as safe minimum standards for protected areas. Finally, rights-based principles advocate a “fair sharing” of opportunities across generations (Horwarth, 2007).

Evidence points to persisting basic discrepancies among different disciplines due to the way they understand sustainability and efficiency. For instance, while economists might regard efficiency as a goal to avoid wastefulness, and sustainability as a restriction to be considered when striving for this goal, ecologists tend to see sustainability as a goal in itself, reflecting the fundamental “inalienable” rights of future generations or nature itself (Pezzey, 1997; Howarth, 2007). Consequently, policy recommendations might differ substantially.



## Pollination as an Ecosystem Service

In the following discussion, we present the implications of applying the ecosystem-service approach, illustrated by the example of pollination services for crop production. Here, capital in the form of natural and semi-natural habitats provides forage and nesting resources for bees, which in turn pollinate crop flowers. Several authors have shown that this service can result in increased fruit production (reviewed in Klein et al. 2007), and, in turn, even increased crop revenues (Ricketts et al. 2004; Olschewski et al. 2006; Veddeler et al. 2008). In its strictest sense, strong sustainability would mean that particular natural habitats (e.g., rainforest or heath land) should be physically preserved. In a wider application, strong sustainability would allow for a *limited* substitution between different forms of *natural* capital, as in the case of conserving bee habitat in agricultural landscapes to promote wild bee populations. In contrast, weak sustainability goes beyond and allows for a *complete substitution*, i.e., the destruction of habitats if their services as a provider of bee resources can be replaced with built capital without negative impacts on human welfare. Such an alternative is, for example, available for some crop species by renting privately owned bee colonies and introducing them into the crop fields, thereby assuring appropriate pollination.

It is important to note that the outcome of a *sustainability* analysis depends crucially on the particular way *substitutability* is applied. In addition, we show that both are interlinked with the question of short- and long-term land-use efficiency. As mentioned above, efficiency requires avoiding wastefulness: the benefits of a land-use decision should be higher than the costs. Therefore, the (opportunity) costs of nature conservation are to be determined and compared with the resulting benefits. Opportunity costs are defined as the benefits forgone by realizing a particular land use A instead of the best alternative B. In our case, these costs are incurred by conserving the pollinator habitats instead of using the land, say, for alternative crop production. Strong sustainability does not allow for substitution, thereby implicitly disregarding opportunity costs (Howarth, 2007). However, local smallholders are unlikely to take this perspective. They are well aware of production alternatives when making short-term land-use and management decisions (Benítez et al. 2006). For them and their livelihoods, weak sustainability can be seen as an appropriate approach concerning local pollination services: if private bee colonies are suitable as a substitute for natural capital, why bear the opportunity costs (forgone revenues) of conserving land as bee habitat?

## Conflicts Between Efficiency and Sustainability?

Interestingly, sustainability in the weak sense is unlikely to be a binding constraint, because it allows for substitution within a wide range of different forms of capital. Under such circumstances, efficiency does not need to conflict with sustainability: efficiency would entail using the land for the most profitable alternative. If land use A (crop production) generates higher benefits than land use B (non-managed habitats), then efficiency would suggest replacing these habitats to avoid wastefulness. Moreover (and leaving ethical aspects aside), weak sustainability would allow such destruction of natural habitats as long as a replacement by private bee colonies is possible.

Despite this result, Ghazoul (2007a) points out that a trade-off between ecological and economic sustainability still arises through “the decline in ecological sustainability of the pollination services seemingly at odds with...economic productivity.” He argues that renting private honey-bee colonies is economically more efficient for California almond farmers than maintaining bee habitats on their land. However, according to our definition, this situation can only be characterized as a “conflict” when applying sustainability in the strong sense, which is often claimed for so-called life-supporting functions of ecosystems, say, when calling for safe minimum standards of conservation (Neumayer, 2003).

The decisive question is whether it is appropriate to claim strong sustainability for pollination services as a life-supporting function of the natural ecosystem? Recently, Klein et al. (2007) found that up to 35% of global crop production benefits from biotic pollination, mainly from bees. Further, agriculture has become increasingly pollinator dependent over the last five decades and this trend is expected to grow in the future (Aizen et al. 2008).<sup>1</sup> Gallai et al. (2009) calculate that pollinators are responsible for 9.5% of the worldwide crop-production value of human food. Thus, natural and semi-natural habitats as

<sup>1</sup> Agriculture has become increasingly pollinator dependent because of increasing land devoted to pollinator-dependent crop production while land devoted to crop production without pollinators decreased in the developed world and slightly increased in the developing world (Aizen et al. 2008). The observed trend may have been caused by the increasing production of pollinator-dependent bioenergy crops (e.g., canola, rape, jatropha). For soya production, evidence was found that insect pollination can increase production of at least one important cultivar (Klein et al. 2007). A further example is increasing nut production, such as almonds in California. Furthermore, a general trend toward a balanced-diversified-human diet leads to increased production of fruits and vegetables, the majority of which are pollinator dependent (see also Aizen et al. 2008).

providers of diverse bee species substantially contribute to current crop production, thereby supporting the strong sustainability approach.

However, specific flowering conditions for, say, California almonds, lead to seasonal increases in pollinator demand which cannot be satisfied by bees from natural habitats only. Here, almond farmers have to rent privately owned bee hives, including imported ones (Klein et al. 2008). In the extreme case of intensive almond-plantation landscapes, a complete replacement of natural pollination has occurred, whereas in landscapes with remaining natural habitats the rented services can be characterized as a complement rather than a substitute for native bees.

### Policy Recommendations Under Economic and Ecological Uncertainty

Public interest and awareness of the economic impact of pollination services is strong. Even the popular publication *The Economist* (2009) has taken up this issue, explaining why the rental of bee hives is currently an efficient solution for California farmers, while also discussing how the short-term volatility of pollination supply and demand is related to factors such as economic development.

In addition to economic uncertainty caused by, for example, price volatility, there is considerable ecological uncertainty due to the temporal variability of the provisioning of ecosystem services. In 2007, the National Academy of Sciences in the United States released a report on the status of pollinators in North America concluding that for most pollinator species long-term population data are lacking and knowledge of basic ecology is incomplete (CSPNA & NRC, 2007). Additionally, several authors have highlighted that, even with currently sufficient pollination services, preserving pollinator diversity provides biological insurance for future services (Winfree et al. 2007; Hoehn et al. 2008; Winfree & Kremen, 2009). Neglecting this aspect by following the weak sustainability approach and failing to consider future conditions for substitutability might lead (i) to inefficiency by making irreversible decisions, and thus losing benefits by destroying option values, and (ii) to unsustainability by causing declining per capita welfare in the long run. We therefore advocate a precautionary approach. Note that this does not necessarily mean abandoning the utilitarian interpretation of sustainability. Both the equity-based approach (claiming inalienable rights of future generations) and the utility-based approach (requiring non-declining *per capita* welfare) come to the same conclusion if welfare growth is not expected to compensate for the nonsubstitutable loss of natural capital. Under these circumstances, similar policy recom-

mendations result regardless of which concept we use.

However, scientists are skeptical regarding how far such recommendations translate into political decision making. On one hand, Pezzey (1997) remarks that people do not place “overriding importance” on sustainability as an ethical concept for intergenerational equity. On the other hand, intertemporal efficiency calculations based on discounting face limited acceptance through the argument that they are (i) myopically biased toward the present generation, placing an overly low weight on the preferences of future generations, and (ii) overoptimistically assess the welfare of future generations. Neumayer (2007) argues that irreversibility and nonsubstitutability are much closer to real public concerns and these notions provide much stronger justification for present action than the intertemporal efficiency arguments. Here, safe minimum standards, although sometimes characterized as “rules of thumb,” might serve as rational criteria for decision making under pronounced uncertainty (Woodward & Bishop, 1997).

Defining such standards on a comprehensive scientific basis requires a broad inter- and transdisciplinary effort, one that takes into account different scales and timeframes as well as approaches to uncertainty. In our example, a partial widening of the narrow interpretation of strong sustainability—one that allows for substitution between different forms of natural capital—would open possibilities to maintain pollination as an ecological process while mitigating the negative effects of habitat loss. However, to do so a better understanding of the complex processes and systems is required. The Millennium Ecosystem Assessment (MA, 2005) has shown that it is not a simple task to combine fragmented and disciplinary knowledge to reach this aim. This essay is meant to take up part of this challenge.

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## COMMUNITY ESSAY

### Tools for enhancing interdisciplinary communication

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#### Authors' Personal Statement:

This is a collaborative community essay, written by ten postdoctoral research fellows who had the opportunity to come together at Columbia University's interdisciplinary Earth Institute. In many ways, we were different: our disciplinary backgrounds run the gamut in physical and social sciences; we study in different parts of the world, from sub-Saharan Africa to Latin America; we approach our work differently—some of us spend our days in the field collecting and analyzing soil samples, others conduct in-depth interviews in rural communities, while still others spend time in the lab elaborating formulas and crunching numbers. Yet, we found common ground: all of us are committed to addressing issues of sustainability in complex environments. As such, we wanted to harness our diversity and various strengths to bring together scientific, political, economic, demographic, geographic, ecological, and ethical perspectives on the challenges and opportunities of sustainable development. We remain ambitious in our aims. Nonetheless, we realized that our first task was figuring out how to communicate effectively across often disparate disciplines. This community essay chronicles that part of our journey. We hope it will be of use to others who endeavor to work across and beyond traditional academic disciplines.

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#### Introduction

What do an ecologist, political scientist, and theologian have in common? In traditional universities, dominated by departmental silos, the answer may be, “not much.” Yet, as the magnitude and complexity of problems such as climate change, globalization, and population growth increase, scholars and practitioners are developing creative ways to approach solutions. Enter interdisciplinary research.

Interdisciplinary research draws upon and combines knowledge, worldviews, and methods from several disciplines (Collins, 2002; Morse et al. 2007). Universities, granting agencies, and researchers are more and more recognizing the importance of interdisciplinary work, and a growing body of literature is discussing its necessity, as well as bridges and barriers for its implementation (Kinzig, 2001; Benda et al. 2002; Heemskerk et al. 2003; Eigenbrode et al. 2007; Morse et al. 2007; Longstaff, 2009; McArthur & Sachs, 2009). If, at one point, emerging techniques and standards were not yet widely known or implemented (Robertson et al. 2003), interdisciplinary practices have become much more accepted over the past few years (Buller, 2008; Bracken & Oughton, 2009). As disputes about the value of interdiscipli-

nary research diminish (Redman et al. 2004), the debate is now framed around how interdisciplinary research is defined and practiced and how its outcomes differ from disciplinary projects (Heemskerk et al. 2003; Harris et al. 2008; White et al. 2008).

We broadly define interdisciplinary research as an integration of different discipline-based ontologies, epistemologies, and methodologies in order to develop emergent ideas (for other classifications, see Sillitoe, 2004; Morse et al. 2007; Harris et al. 2008). These integrated research ideas, we contend, are arguments for interdisciplinary research as they often acknowledge the research questions' true complexity. Eigenbrode et al. (2007) further suggest that understanding philosophical differences about the nature of knowledge deeply rooted in one's worldview, epistemology, and methodology can promote effective collaboration and communication among researchers with diverse disciplinary backgrounds. Others debate whether interdisciplinary research is most effectively carried out within the context of new fields of study defined by “problems”—say, a university Department of Water—or by specialists working together seeking common ground (Taylor, 2009). We recognize the current reality that most researchers attempting interdisciplinary work are firmly rooted in

their traditional academic disciplines.

Given disciplinary specialization, we argue that interdisciplinary projects can harness this specialized knowledge, using the rigorous depth and skills of core disciplines as an essential foundation for bridging them. As a diverse group of postdoctoral research fellows based at the Earth Institute at Columbia University, we had an opportunity to collaborate across an unusual range of disciplines. Although involved in our independent research projects within our various departments, we organized an informal seminar, meeting for 2-3 hours every Friday to discuss sustainability issues in complex environments. During these conversations, we quickly discovered communication barriers across disciplines that inhibited constructive discussion. We presumed these barriers would most certainly be common to any group of diverse researchers attempting to solve pressing issues facing society and naturally became interested in the process and concepts of interdisciplinary communication and research. To further structure the dialogue, we decided to focus on an urgent and relevant problem that best illustrated how different disciplines are entangled and embedded in these complex problems: *How can the world's population feed itself justly and sustainably by the year 2050?*

Upon initial discussions, we realized that before any substantive collaboration could occur, we needed to better understand our own ontologies, epistemologies, and methodologies and the way that they serve as the “building blocks” of research. In brief, ontology relates to our worldviews and assumptions about the nature of things; epistemology deals with our beliefs about knowledge: what we can know, how we can know it, as well as our values and aims; and methodology refers to the tools and techniques of research (Grix, 2002). While each of these three elements is highly personal, they also tend to be bound by disciplinary norms. We aimed for pluralism (Miller et. al. 2008) and had to acknowledge that some ontologies and/or epistemologies do not readily combine and that one frequently dominates (Hollis & Smith, 1990). Most of us had little, if any, prior formal training in communicating effectively with those outside of our respective fields, yet we felt leaving these issues unexamined was likely to stymie any attempt at interdisciplinary research.

In this essay we share highlights of our experiences using emerging communication tools, including a “philosophical toolbox” and scenario-building exercises, to enhance our collaborations as an interdisciplinary group of researchers. The activities we describe below may be useful for enhancing dialogue, defining research questions, and building collaboration within interdisciplinary research groups and institutes, both in undergraduate and graduate

classrooms, and even, as we learned, among researchers in the same discipline.

## Methods

### Overview

At the time, we were a ten-person group of early career researchers trained in ecology, public health, geography, soil science, theology, agronomy, statistics, and political science. We were postdoctoral researchers within the Earth Institute at Columbia University, all enrolled in a unique Fellows Program that is “dedicated to a better understanding of critical scientific and social issues related to meeting global sustainable development goals.”

Given the program’s freedom and flexibility (and interdisciplinary nature), we self-organized a semester-long exercise to explore how a group of diverse researchers could begin to tackle a current environmental and social issue, focusing especially on interdisciplinary communication. We met as a group once a week to explore the processes of conducting interdisciplinary research. Because we are all firmly rooted in our respective disciplines, we decided to first spend time having each member expose and communicate her/his discipline to the rest of the group. This was done by circulating a key journal article within each discipline to discuss during a one-hour session. We next examined existing definitions of interdisciplinary research and invited guest speakers to further elaborate on the topic. After a seminar with guest speakers who specialized in developing scenarios surrounding the food crisis in East Africa, the group quickly became interested in scenario building. To follow up, we invited two facilitators to demonstrate specific scenario-building exercises (e.g., creating a timeline, mind mapping). Our efforts culminated in a weekend-long retreat employing exercises aimed to bolster interdisciplinary communication and research (Box 1).

### Toolbox

Communicating and framing problems jointly is a defining mark of interdisciplinary research. However, our attempts to develop a common research question, let alone communicate our disciplines to one other, encountered unexpected barriers. We needed a tool that would expose these differences, locate at which level the barriers existed (e.g., epistemological, ontological, or methodological), and provide a platform for an open discussion. We decided to utilize a set of tools developed by Eigenbrode et al. (2007) and researchers at the University of Idaho to explore our philosophical differences.<sup>1</sup> The toolbox is essentially

<sup>1</sup> See <http://www.cals.uidaho.edu/toolbox/index.asp>.

**Box 1** Communication tools employed.

- **Interdisciplinary Toolbox** – undertake structured dialogue about research assumptions.
- **Integrated Timeline** – brainstorm with all participants and disciplines about historic events that led to the current food-insecurity situation.
- **Mind Mapping & Mini-Mind Mapping** – brainstorm factors and drivers that influence food security.
- **Cross-Impact Analysis** – explore the relationships between each major theme identified in the mind-mapping exercises.
- **Imagining the Ideal** – create and share visions about the ideal outcome or solution to the research problem.
- **Backcasting** – undertake scenario-building exercise that works backward from imagining the problem is solved (the world is food secure) and explores the paths to get there.

a set of questions that ask the researcher to think about her/his scientific values, assumptions, and language. Questions ranged from how we viewed applied versus basic science to whether we thought the scientific process could be unbiased.

Exploring our views on these subjects revealed substantial differences, including epistemological disparities regarding whether there is a place for advocacy and if it is truly possible to conduct research without an inherent bias. While some colleagues felt complete lack of bias is impossible, others countered that, “an essential component of research is objectivity and advocacy would destroy that.” Methodological differences were highlighted, especially in regard to prioritizing quantitative or qualitative methods. Some of these dissimilarities were rooted in our respective disciplinary training (e.g., social vs. natural science), but many were based on personal views and experiences, illustrating the value of this exercise even when collaborating with those in the same field. While we did not reach consensus on all issues, identifying and sharing our differences was insightful for individual researchers and was an essential first step for overcoming potential communication barriers or even future conflicts. For example, disciplines have different accepted validation methods: an ecologist may validate data using rigorous quantitative statistics while a theologian may do so using descriptive qualitative statistics. It is important for researchers from different disciplines to acknowledge and respect the different methodologies.

### ***Scenario Building***

Scenario building has been used in large scientific ventures to address problems such as climate change or global ecosystem health (MEA, 2005; IPCC, 2007; Hulme & Dessai, 2008; McLean & Egan, 2008;

O’Neil et al. 2008; Parson, 2008; Wilkinson & Eidinow, 2008). We selected scenario building as a technique because it illustrates the interconnectedness among drivers, identifies a variety of perspectives surrounding a theme, and exposes challenges and consequences to a solution (or scenario). O’Neill & Nakicenovic (2008) highlight that scenario exercises can be either process- or product-oriented, and that the process-oriented perspective may have goals such as exposing challenges and perspectives of a given situation, finding consensus, or developing strategies. Our objective was to use scenario building as a tool to bridge disciplines, to explore interdisciplinary communication, and to develop joint research agendas. We were interested more in the process of communicating as an interdisciplinary team and used scenario building to explore complexity rather than as a quantitative predictive tool. While food security serves here as an illustration of how the activities played out, we clearly did not expect to answer the question itself through these preliminary exercises.

There are a variety of scenario-building techniques (see, e.g., Bishop et al. 2007). Collectively, we identified six techniques that we thought would be helpful in systematically collecting integrated information from all participants on the issue of food security. A professional facilitator generally leads scenario-building workshops, but we chose to rotate the role of facilitator among ourselves throughout the exercises.

### ***Technique One—Integrated Timeline***

In this exercise, we drew a timeline, pieced together from various disciplinary insights, of the major events that led up to the problem of global hunger. In preparation, each participant conducted a brief literature review of food security from the perspective of her/his specific discipline and then shared it with the group in an open forum. The timeline provided an opportunity for the group to collect complementary information about key historical events from our various disciplines. The exercise of highlighting issues and important events (from a disciplinary perspective) demonstrated important differences among disciplines, as well as the need for collaboration to fully address the issue’s complexity. For example, the soil scientist discussed the use of synthetic fertilizers, the demographer emphasized population growth, and the political scientist reminded everyone of the role of political will. While it is common practice in any scientific project to review thoroughly the existing literature, the exercise of simultaneously examining literature from different disciplines and bringing together discipline-specific knowledge into a common format of discrete historical events allowed us to identify key linkages and gaps and to ask questions such as, “What has challenged us to work

to feed the world justly and sustainably in the past?” In terms of communication, the exercise also pushed us toward reorganizing and pooling our knowledge, identifying differences in our disciplinary language, and encouraging us to explicitly define key terms and concepts. Our choice of the term “researchers” to describe our group is one example. Including disciplines from the humanities means that not all of us, strictly speaking, identified ourselves as scientists!

### ***Techniques Two and Three—Mind Mapping & Mini-Mind Mapping***

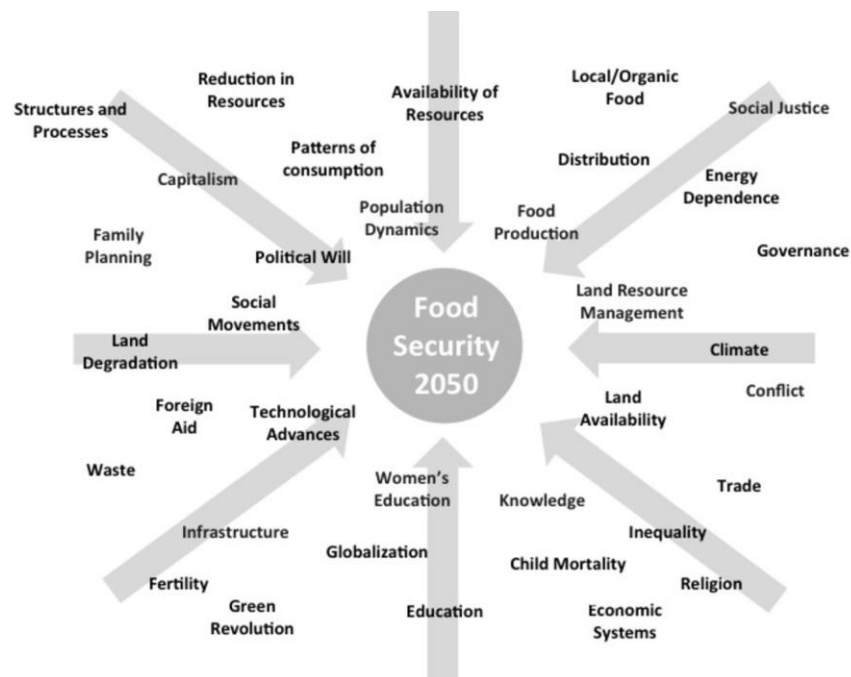
Mind mapping is a brainstorming exercise about factors that influence a given subject. This includes identifying key historical events highlighted in the previously developed integrated timeline. In our case, the drivers spanned from the influence of the green revolution and political institutions to family planning and infrastructure (Figure 1). This exercise illustrated the issue’s complexity and interdisciplinarity.

We identified three major themes that encompassed a majority of these factors: institutions, population dynamics, and land and water management. A subsequent mini-mind mapping exercise was performed under each theme (identifying and discussing specific factors influencing food security). These activities broadened our collective picture of the diverse issues that are generally targeted by different disciplines and often unseen by others. For example, social scientists might not think about the nitrogen cycle and ecologists might neglect democratic par-

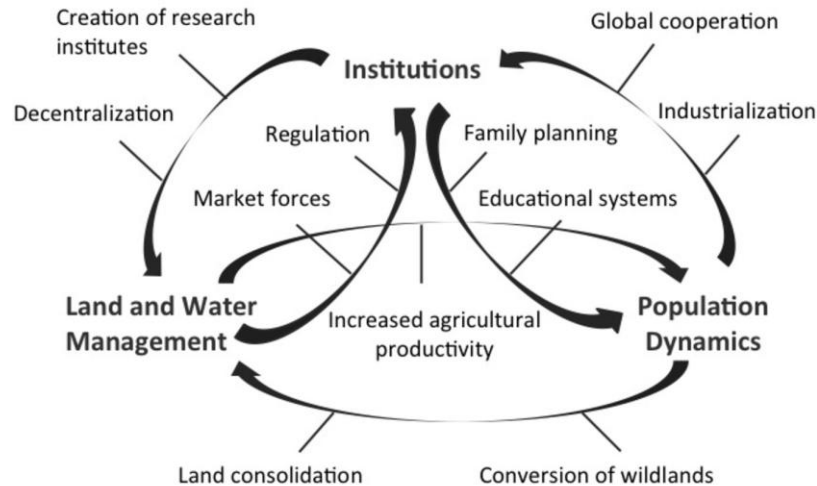
ticipation. Mind mapping also brought our respective priorities to the forefront and illustrated the different ways in which we each organize our thoughts (i.e., epistemological differences). Specific distinctions arose regarding prioritization of the three principal themes, including how abstract the themes should be. In addition, when we agreed on the major themes influencing food security, challenges arose in communicating ideas and providing a rationale to others outside of one’s discipline. This activity also emphasized that tackling food security from one disciplinary perspective is not adequate, and that acknowledging and identifying the interactions among drivers are critical to addressing the problem from an interdisciplinary perspective. For a disciplinary scientist, this can be difficult to handle, as we generally like to believe that our discipline and specialty is the most important.

### ***Technique Four—Cross-Impact Analysis***

As its name implies, cross-impact analysis involves identifying and evaluating the impacts of factors, trends, or events upon one other. The cross-impact analysis we selected to employ was a brainstorm on how trends in each of the major themes identified in the mind-mapping exercise (i.e., institutions, population dynamics, and land and water management) influence the other themes in the framework of global food security (Figure 2). During this exercise, we explored the relationships, drivers, and interactions that link these different themes to better



**Figure 1** Example of mind-mapping brainstorm: drivers influencing food security.



**Figure 2** Example of a cross-impact analysis. Three principal themes from the mind-mapping exercise were selected. The relationship between these themes was explored as well as drivers, interactions, and cross-impacts influencing food security.

understand their interdependencies regarding food security. This activity illustrated the need to consider the complex interactions between and among drivers to develop a systems analysis of the problem.

#### ***Technique Five—Imagining the Ideal***

Probably the most creative exercise we tested—and a group favorite—involved sharing our vision of the ideal outcome or solution to our research problem. Each participant developed her/his utopian vision of how the world might look in 2050 if food security were achieved. The guidelines for the exercise were deliberately loose to enable the greatest flexibility and creativity for sharing ideas.

Scenarios ranged from humans getting all of their required nutrients in a daily pill, to everyone living in cities with hydroponic roof gardens, to increased small-scale local organic farming. Even though many of us work on addressing sustainability issues, this was the first time we had envisioned what success might look like. It was in this exercise, rather than the philosophical survey described above, that ontological differences were most noticeably articulated. In fact, many of us initially thought that we all understood success in the same way, for example by promoting small-scale community development as a substitute for large-scale agriculture. Yet, other members of the group regarded the creation of bigger vertical cities surrounded by large-scale commercial farms as a viable way to increase food security and to promote economic prosperity. These diverse visions illustrated how our disciplinary and personal viewpoints influence how we see the world and define and approach problems. Once communicated, these differences explained some of the difficulties we were having as a group to come up with drivers affecting

food security. Only when we were asked to stretch our imaginations to the extreme did many of these divergences surface. Without such an exercise, collaborations could be hung up by a number of seemingly subtle differences that are in fact related to much larger worldviews.

#### ***Technique Six—Backcasting***

The final technique we deployed was “backcasting,” a method for tracing a backwards pathway from a future state or goal to the present in order to identify key steps along the route (Carlsson-Kanyama et al. 2008). We imagined the central problem was already solved—there was sustainable food security for all—and then asked, “How did we get here?” Starting from the knowledge and thinking gained through the earlier exercises, the backcasting technique motivated the search for creative, holistic, and out-of-the-box solutions and, in our case, particularly led to defining interdisciplinary research questions. For example, “backcasting” requires that a previously identified outcome already exists (i.e., holistic research institutes whose agendas are implemented globally). The exercise required identifying all of the steps that made these institutes a reality. In the case of functioning institutes, the path included: government buy-in and support was achieved, creative and realistic research ideas were implemented, ongoing funding realized, and so forth. We also discussed backcasting scenarios for the establishment of strict family-planning protocols and the development of mechanisms for the distribution of nutritious food to ensure equal access (Box 2).

Since the backcasting exercise came sequentially last and built upon previous modes of engagement, it was the easiest activity in terms of communication.



**Box 2** Examples of interdisciplinary research questions defined during the backcasting exercise.

- How do we measure resilience? What are the metrics needed? How do we measure if a system is prepared for change?
- Under what conditions are technological advances and inequality linked?
- Is it possible to have increased food production and equal access to food?
- How do we design agricultural systems with efficient nutrient cycles?
- How do we define and implement appropriate family planning?
- What is the role of education in food security?
- What is the role of the generation of knowledge in creating a food-secure world?

Backcasting combined the creativity of imagining the ideal with the logic of the timeline and mind mapping, showing how past exercises became a shared toolbox to move research forward. With this exercise, we began to develop creative ideas on how to improve food security from an interdisciplinary perspective—such as having agronomists, family planners, and engineers work together to develop practical strategies—suggesting the importance of long-term interdisciplinary collaboration. Participants also emerged with numerous ideas for future research projects and questions.

### *Writing of this Essay*

In addition to the exercises described above, the process of writing this essay provided another opportunity to explore interdisciplinary interaction. Participating in interdisciplinary research requires patience, time, willingness to compromise, and preparedness to set aside commitments that one's discipline, ideas, or writing style is best. The writing process for us took the following form: 1) During a joint meeting, a rough outline was created and authors volunteered to write particular sections; 2) The outline was circulated again for further input from the team; 3) One person was identified to combine the sections and the integrated version was sent around to coauthors in a sequential order to edit. While exceptionally time consuming, we felt that this process most accurately captured our experiences and allowed for maximum collaboration. Beyond the already significant difficulties of discipline-oriented scientific articles, interdisciplinary papers often expose dramatically different writing styles, language, and formats, with much commitment to explain ideas and rationale. Even addressing the editors' comments was done by a group of the coauthors literally sitting together and jointly going through the paper with final edits circulated among the team.

## **Conclusion**

Of course, we did not solve world hunger with these exercises, although we made steps in the right direction by improving our interdisciplinary communication and acknowledging that, to address complex problems, successful interdisciplinary collaboration is needed. For example, it may not be very often that a theologian and statistician sit together in the same room to discuss food security, nor are they commonly on the same research team to develop real-world solutions to such issues. Yet, despite our seemingly disparate disciplines, these exercises emphasized the necessity for the theologian to understand population-growth statistics and the statistician to understand the values and principles of the theologian to develop practical solutions to food security, including addressing population dynamics. Without an objective and open communication strategy, these interactions would certainly not occur. In addition, structuring these discussions on a focused topic/research question highlighted the functionality of the scenario-building techniques.

Our group concluded that these communication-enhancing techniques exposed critical differences in our epistemologies, ontologies, and methodologies, providing an important foundation for developing and conducting interdisciplinary work. We realized that much of our previous training had pushed us to focus on research products and outcomes, while paying inadequate attention to the process and potential barriers to successful interdisciplinary and collaborative research. These exercises, geared toward communication and group interaction, were new and quite often uncomfortable, forcing us to examine our disciplinary approaches and biases and to move forward despite them. In addition, while scenario-building exercises are commonly used in business situations, they can also bolster interdisciplinary communication and research.

As documented in the literature (Bracken & Oughton, 2006; Morse et al. 2007), we too acknowledge that differences in disciplinary language can be a significant barrier to conducting interdisciplinary research. We do not pretend that these exercises culminated in the development of a common language for our team. In fact, we suggest that formulating a "common" language may be too lofty a goal. We suggest aiming for open communication—the confidence to ask colleagues for clarification and to expose, to understand, and to accept differences among us. Quite often the vernacular of a disciplinary guild can limit full comprehension of those outside one's discipline, even when trying to address and frame the same questions. We expect that the effort invested in these exercises will have multifold payoffs in time

saved and problems avoided at later stages of interdisciplinary research.

While the tools that we explored here represent only a subset of the possible means of enhancing interdisciplinary learning and research collaborations, they clearly provided us with a solid foundation to embark on such work. Participation in these exercises was useful not only in our capacity as interdisciplinary researchers, experts in our respective disciplinary fields, and participants in a variety of social networks, but also in our role as educators who seek to encourage our students to think, to speak, to read, and to write analytically and critically about important global issues. In this essay, we have purposefully avoided the provision of a specific action agenda or rigid outline for successful interdisciplinary research. To do so would be to contradict one of our central points—that a reorganization of multiple, potentially equally valid ways of knowing requires a negotiation governed by the specifics of the question and the composition of the research team.

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