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EDITORIAL

Maurie J. Cohen
Editor

Turning Japanese

Let me begin with a proviso. Since the inception of *Sustainability, Science, Practice, & Policy* a half-dozen years ago, I have believed that this modest piece of editorial real estate is best used to offer a diverse array of perspectives. Accordingly, during my editorship I have suppressed occasional impulses to appropriate the space for myself and instead have sought out a range of voices with something interesting to say. A preoccupation with Japan’s social and economic path impelled me for this issue— with all requisite apologies—to deviate from this tradition.

The urge to speak up is partly motivated by the degree to which sustainability scientists and practitioners have come over the last few years to appreciate the salient role that macroeconomic variables play in regulating the global flow of material and energy throughputs. At the same time, it has become commonplace to recognize the intimate connections between recurring financial crises and the quality of our social and ecological environments. The intractable dilemma of climate change is only the most prominent manifestation of this indivisibility.

Our inseparable macroeconomic and socioecological fates have prompted me to fixate on Japan. The storyline during the 1970s and 1980s was that Japan was a “miracle country,” home to a constellation of unassailable industrial corporations, an unwavering work ethic, and an unquenchable appetite for consumer goods. However, for the past two decades economists, media pundits, and numerous others have incessantly derided the country as the underperformer of the global economy. Zombie banks! Dysfunctional politics! Entrenched bureaucracies! Lethargic consumers! The conventional wisdom is that since the bursting of its own spectacular financial bubble during the late 1980s, Japan has been beset by sluggish economic growth and generally poor prospects. Despite ardent attempts to revivify the national economy, using both conventional and unconventional interventions, the country as a whole has remained unmoved. What if the textbook economists have it all wrong? Could it be that Japan has accidentally found itself a frontrunner of a novel and emergent mode of societal development where growth has become unnecessary? What if the economic preconditions that have facilitated consumer-driven economic growth for the past several decades are now dissipating and fading from relevance?

One has to delve into reform (or new) economics to find an interpretation that helps to navigate this situation, one suggesting that Japan may not be the beleaguered deviant it is frequently portrayed to be. The contrarian perspective further contends that the former Asian economic powerhouse may already be well along a path that other affluent countries—perhaps most markedly the United States—are poised to follow.

Nobel laureate Paul Krugman aired this outlook in late August when he wrote that “America is now very much in a Japan-type economic trap, only more acute” (Krugman, 2011). Given his prominence as a regular *New York Times* columnist, Krugman’s pronouncement signals new awareness within the economics profession, especially within its progressive wing. In other words, the heterodox perspective is now moving toward the mainstream. What might we make of this diffusing sensibility that the United States (and by extension other wealthy countries in their own time) is “turning Japanese”? The scaffold that enabled economic growth in Japan has largely fallen away. Are we about to witness a similar process elsewhere? Social scientific appraisal attests that favorable demographics, expanding middle-class opportunities, rising wages, incessant advertising, and easy credit have variously buoyed the economy for decades. How will we carry on as these once-suspicious trends move in reverse and start to interact in unfamiliar ways? What are the sustainability implications of these circumstances? Given its head start of nearly a generation, Japan likely holds some instructive lessons.

The evidence indicates that Japan is in better shape than often depicted, with some interesting developments taking hold at the cultural periphery. Japan’s relegation last year to number three in the global economic race (behind the United States and

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1 See, for example, Cohen, 2010.
China as measured in terms of gross domestic product (GDP) passed with relatively little emotional upheaval. This reaction stands in stark contrast to the peculiar combination of screaming and hand-wringing that occurs in the United States when it is reported that China will be the world’s largest economy by 2030.

Japan’s slippage in the league tables needs to be put in a wider context as news of its pending demotion was obviously anticipated for some time. Part of the reason for the country’s seemingly enervated economic performance in recent years is that its youth, members of so-called Generation Y, are less inclined than their predecessors to get on the work-and-spend treadmill. The country’s irrepressible twenty-somethings have grown up during an era of diminished expectations and have accordingly lowered their sights. With employment opportunities scarce, and little likelihood of change in the foreseeable future, these young people are contentedly opting for less consumption-laden lifestyles. Most notably (and consequentially), automobile ownership has been on a protracted downward slide for some time now, in part because Gen Y-ers display little enthusiasm for cars. A newly coined Japanese phrase kuruma banare (translated roughly into “demotorization”) captures this disinclination to take on the expense and responsibility of a personal vehicle (Kageyama. 2009). Interestingly, we are now beginning to witness the emergence of a similar trend in the United States and several other wealthy countries and indications are that it is not simply the result of recession-related austerity.²

Among this youthful cohort, parsimony has become a new social norm. Norihiro Kato, a scholar of Japanese literature, captures the essence of this realignment when he writes,

The rest of the world’s population is still exploding, and we are coming to see the limits of our resources...Japan doesn’t need to be No. 2 in the world, or No. 5 or 15. It’s time to look to more important things, to think more about the environment and about people less lucky than ourselves. To learn about organic farming. Or not. Maybe you’re busy enough just living your life (Norihiro, 2010).

It is further intriguing that across a range of Japanese products—from rice to furniture—production has evinced a notable downward drift (with no countervailing uptick in demand for imported substitutes). By all accounts, year by year Japan is gradually downsizing, with positive effects for the country’s greenhouse-gas emissions, rates of resource appropriation, and levels of energy utilization. As tragic events tend to do, the triple disaster (seismic, torrential, and radioactive) visited on Japan in March is likely to propel transitions already set in motion. The country’s decision to step down its reliance on nuclear power is only the most visible indication of what is yet to come. People familiar with the innermost workings of Japanese society recognize that the current reversion to fossil fuel-generated electricity is just a stopgap measure and the country is mustering its capacity for major changes in its energy infrastructure.

Among the group of affluent nations, Japan is arguably at the head of the pack in demonstrating that the era of consumer-led economic growth is coming to an end, and other wealthy countries will likely follow. One of the benefits of this historical progression is that demand for material and energy resources will soften and, if we are smart, we can take advantage of this contraction to reduce pressure on natural systems, enhance social stability, and augment well-being. In addition, distribution of the gains of the supernova phase of economic expansion has been massively unequal. Persisting public support for the growth regime emanates more from a perplexing combination of political inertia, wistful nostalgia, and magical thinking than it does from the lived experience of ordinary people. After all, in most rich nations, the vast majority of the population has, in recent decades, hardly gotten a whiff of the expanding economic pie and the benefits it purports to deliver.³

As we continue to witness the inescapable withering of the demographic and technological engines that propelled economic growth ever-upward during the second half of the twentieth century, the most fervent champions of growth will become increasingly out of touch. This may be the foremost lesson that we can derive from the Japanese experience. The end of growth does not necessarily precipitate cataclysm, but can bring liberation from a pervasive form of tyranny: the need to continually work more and spend more.

This does not mean it will be easy to cross the chasm to a post-growth economy. The notion of continual expansion infuses every facet of contemporary political affairs. It merits remembering that the impetus for measuring economic growth sprang from the need to manage the exigencies of wartime production and these tools then demonstrated effectiveness in dealing with a confluence of post-World War II challenges: civilian reconversion, industrial overcapacity, Cold War rivalry, and colonial devolution.

² See, for example, Puentes & Tomer, 2008; Millard-Ball & Schipper, 2011; Goodwin, 2010.

³ See, for example, Bartels, 2010.
Economic growth is not a natural law in the way that say, gravity is, but rather a political salve that has proven an expedient and reliable way to meet certain objectives. At its most prosaic level, it is an idea, and as the necessity of this idea ebbs away, so too will the imperatives and contrivances that drive it. I submit that it is incumbent upon sustainability scientists and practitioners to pay close attention to Japan and to be attentive to its position on the leading edge of these changes.

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ARTICLE

The rise and fall of sustainability in Western Australian politics: a review of sustainable development under the Western Australian Labor government between 2001 and 2008

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This article addresses problems associated with the political operationalization of the sustainability agenda and the design of new development goals based on the case of Western Australia (WA). In this state, rapid economic development, long the key objective of successive governments, has caused serious environmental problems and brought into question the sustainability of the state’s development path. In the 2001 WA state election, the Labor Party came into office in part because of its overt commitment to sustainable development, departing from past progrowth philosophies. This article analyzes the extent to which the WA Labor government was able to operationalize politically its sustainability agenda during its time in office between 2001 and 2008. It finds that despite a strong commitment to its sustainability agenda in the early years of holding office, the Labor government failed to institutionalize policy changes, which, following a 2006 leadership change, allowed for a reversal of progress. We then discuss the WA experience within the global policy context and place it within the larger debates on the operationalization of sustainability.

KEYWORDS: bureaucracy, political power, public policy, government programs, economic development, environmental protection

Introduction

The notion of sustainability entered the international political scene only relatively recently. In the early 1970s, the idea of the also increasingly visible “limits to growth” (Meadows et al. 1972; Mesarovic & Pestel, 1974) began to challenge the until-then firmly embedded dogma of unbridled economic development that had been prevalent since the end of World War II. A decade later, the Brundtland Commission (WECD, 1987) provided a new normative frame that shaped contemporary discourses of development, marking the point at which the concept of sustainable development came to be embraced globally (Sneddon et al. 2006). That this new development perspective considered economic activity and environmental protection as complementary certainly contributed to its widespread appeal (Hunter, 2002). The political interpretation of sustainable development as mapped out in the Brundtland Report constituted a crucial global agreement serving as a foundation for the 1992 United Nations Conference on Environment and Development in Rio de Janeiro. This so-called “Earth Summit” launched the “sustainability decade” of the 1990s that saw much political and academic debate about the definition, nature, and operationalization of sustainable development (Lele, 1991; Commonwealth of Australia, 1992b; Hurka, 1992; Basagio, 1995; Shrivastava, 1995; United Nations, 1997; Neumayer, 1999).

Australia illustrates in extreme form the exponentially accelerating horse race in which the world now finds itself...On the one hand, the development of environmental problems in Australia, as in the whole world, is accelerating exponentially. On the other hand, the development of public environmental concern, and of private and governmental countermeasures, is also accelerating exponentially. Which horse will win the race?

Jared Diamond, Collapse, 2005

By the turn of the millennium, sustainability discourse had become firmly embedded in policy documents around the world (Moran et al. 2008). This was coupled with the widespread adoption of sustainability principles in the commercial realm (WBCSD, 2000; 2002; Schaltegger et al. 2003; Kolk, 2004), amounting to what former British Prime Minister Tony Blair described as a “sustainability revolution” (Roosa, 2008). The burgeoning sustainability rhetoric seemed to promise a departure from the globally entrenched economic credo of growth at all cost, hailing a new era of development that balances economic, social, and environmental concerns. Recognition appeared to be growing for the need to shift, at least in the long term, patterns of production and consump-
...tion in all parts of society (Christie, 1994; Lafferty, 1996). However, the sustainability euphoria of the 1990s did not translate into the political and economic reforms pledged at the beginning of the decade as national and international politics, vested commercial interests, and political inertia stymied change (Paton, 2008; Beddoe et al. 2009). In fact, in most instances to date, efforts to implement sustainability principles at national and subnational levels continue to reflect a “business as usual” approach (Jordan, 2008) as opposed to widely called-for fundamental change (MEA, 2005; Adams, 2006; UNEP, 2007; Butler, 2008). Western Australia in this regard serves as an exemplar case to shed light on the problematic of shifting traditional development patterns onto a more sustainable trajectory. We will show that, while Australia has been an early adopter of sustainability rhetoric, policy implementation nationally and subnationally has proved slow, short-lived, and largely cosmetic.

In Australia during the 1990s, the idea of ecologically sustainable development (ESD) moved comparatively quickly onto the political center stage (Bührs & Aplin, 1999). Indeed, Australia was one of the world’s first jurisdictions to formulate a National Strategy for Ecologically Sustainable Development (NSESD) (Commonwealth of Australia, 1992b) and to reach agreement nationwide to integrate the core objectives of sustainable development into more specific policies at the subnational level. It bears noting, however, that Australia’s enthusiasm for sustainability faded at the federal level in the late 1990s, attracting much international criticism, especially in the context of climate-change negotiations (Kinrade, 1998; Mercer et al. 2007; Pearse, 2007).

In Western Australia (WA), the focal point of this article, the “sustainability revolution,” was—albeit delayed—particularly pronounced, marked by the arrival of the newly elected Labor state government in 2001 with sustainability as its purported policy platform. This outcome coincided with the state becoming an internationally recognized hotspot for sustainability and environmental technology research (Cowan, 1999). The overt sustainability orientation of the incoming government was remarkable in that economic growth and the rapid development of the state have been the prime objectives of all WA administrations since European settlement (Walker et al. 2002).

The enduring prodevelopment stance across the political spectrum prior to 2001 reflected a view of WA as still being underdeveloped in large parts, with its physical environment in combination with its isolation and remoteness believed to impede social and economic development (Moon & Sharman, 2003). Industry sectors such as mining, timber production, and agriculture have traditionally driven the exploitation of WA’s rich natural resource base with the economic policy support of successive state governments. However, the state’s natural resource dependence, which is mirrored nationally (Fenna, 2004), has also posed challenges for WA’s development (Beresford, 2001). The narrowness of the state’s economic base not only made it vulnerable to external economic shocks, as evidenced by the most recent global economic downturn, it also incurred considerable environmental costs. The large-scale exploitation of the state’s natural assets, unsustainable and often conflicting land-use practices, rapid population growth, and spiralling household consumption over time have resulted in water shortages, pollution, and the increasingly visible loss of biodiversity, as well as land degradation and dryland salinity (EPA, 2007a).

Diamond’s (2005) “horse race,” to be understood here as the intensifying contest between economic and ecological imperatives (Eckersley, 1992), has not only begun to pose real challenges to political decision making but also to threaten the ideological stronghold of developmentalism within WA state politics. The rising tensions between the economic growth agenda and the need for environmental protection, however, are believed (at least by some theorists (e.g., Barbier 1987)) to be reconcilable to the notion of sustainable development through the joint optimization of social, economic, and environmental goals. Leaving aside the hotly debated interpretative pitfalls surrounding questions of what to sustain and how (see, for example, Daly, 1996; Gütés, 1996; Holland, 1997; Neumayer, 1999; Ayres et al. 2001), in its broader sense the sustainability concept was embraced by the Australian Labor Party (ALP) in WA during its term in office between 2001 and 2008. Labor’s open commitment to sustainability seemed to promise a departure from, and alternative to, the exploitative paradigm of incessant economic development, and it is Labor’s delivery on this promise of change we take issue with here.

While recognizing the sustainability paradigm’s broader dimensions (Giddings et al. 2002), in this article we map some of the Labor government’s key environmental policy initiatives between 2001 and 2008. Specifically, we analyze the effectiveness of...
Labor policies in terms of delivering a lasting break with the customary development-policy agenda, focusing on the government’s ability to affect institutional change, provide political leadership, and achieve policy continuity. These are recognized as important ingredients for the successful integration of economic, social, and environmental considerations in policy and decision making (Ross & Dovers, 2006; 2008).

Given the breadth of the subject, the focus of this article is necessarily selective. Our analysis is based primarily on available literature and media, offering insights into key policy initiatives under Labor and advancing an argument about the Labor government’s ability to embed the principles of sustainability into the structures and processes governing environmental policy making in WA. We begin by describing the national policy context and providing a brief overview of the state of the environment in WA. This discussion provides the requisite background for the ensuing review of Labor’s efforts. We then use our findings to place the WA experience in the international policy context and help identify the obstacles to effective policy making for sustainability.

The Environmental Policy Context

Many external factors, often in complex interrelationship, significantly influence the form and dynamics of environmental policy. Features of the political system, historical developments, economic structure, demographic and sociocultural factors, as well as the geographical setting are all important determinants of any policy-making process. For WA, this means that policy making cannot be assessed in isolation but requires, for instance, reference to broader issues of environmental policy and politics at the national level. Some key developments in the national policy arena and their respective impacts on the state level are briefly addressed below.

Nationally, environmental concerns have stimulated much debate and created substantive potential for conflict over the philosophy of economic progress (Beder, 1996). The main political parties needed to respond to this growing debate, for they realized the electoral significance of environmental issues at both state and federal levels (Blackburn & Stone, 2003). The political responses, however, were frequently driven by opportunism in the lead up to elections and largely characterized by ad hocery and amnesia as opposed to integrative, active and adaptive planning (Dovers, 2000). In other words, environmental policies have come and gone, lacking alignment with other portfolios as well as inadequate continuity and consistency.

In WA, the dryland-salinity crisis in 1993 (see Beresford, 2001) and the native forest debate in the late 1990s (Barker & Bennett, 2001; Stone, 2001) are examples of environmental problems that became political battlegrounds (Black & Phillips, 2001; van Onselen, 2005). At the federal level, there is also a well-documented history of regularly arising tensions between the Commonwealth and the states and territories over environmental policy matters (Davis, 1989; Wescombe, 1990; Economou, 1992; Carron, 1993; Kellow, 1996; Dargavel, 1998; Lane, 1999; Slee, 2001). Overall, however, it is fair to suggest that many of these conflicts were not driven by assertions of political leadership or vision but by fear of potential voter backlash. While governments “greened up” to varying degrees during the 1980s and early 1990s (Dovers, 2002), their policy imperatives have remained firmly embedded in neoliberalism, economic growth, and development (Fenna, 2004; Mercer et al. 2007).

The state-federal tensions cited above, rooted in the fact that the Commonwealth holds external affairs and trade powers under the Australian Constitution, arose in response to a more prominent Commonwealth role in environmental policy matters. The High Court’s broad interpretation of these powers (Section 51, xxix), based on international treaty commitments, led to centralized authority in policy areas originally not allocated to the Commonwealth. The application of these expanded federal powers became obvious in a number of environmental disputes around the country (e.g., Fraser Island, Franklin River, Coronation Hill) (Fenna, 2004). The resistance by state and territory governments to the Commonwealth’s intervention in essentially local resource disputes was a matter of course.

The early 1990s, however, saw the beginning of a retreat by the Commonwealth, curtailing its natural resource-related responsibilities to that of a watchdog and facilitator (Lane, 1999). While some commentators criticized these self-imposed restrictions as a political cost-cutting exercise (Toyne, 1994; Sackville, 1995), the states welcomed the withdrawal of the Commonwealth and the devolution of environmental responsibilities. This devolutionary process was continued under the Howard coalition government between 1996 and 2007, albeit for different reasons (Crowley, 2002; Fenna, 2004).

It is the subject of much conjecture whether the devolution of Commonwealth powers was a sign of federal disengagement with environmental affairs or a pragmatic approach to addressing questions of environmental management and protection. Past engagements have certainly proven politically opportune but equally precarious in that previous federal elections had been lost over environmental conflicts. Also, the
handling back of environmental responsibilities to relatively poorly funded environmental state agencies may be a means of reducing the political influence of the environmental agenda. At the same time, such withdrawal could also be seen as consistent with calls for decentralized policy making under the banner of ecological modernization or Agenda 21, as well as a pragmatic step toward conflict resolution between state and Commonwealth governments (United Nations, 1993; Dovers, 1996; Dryzek, 1997; Gibbs, 2000). Irrespective, the winding back of environmental responsibilities to the subnational level not only renewed the states’ obligations to fulfill their traditional role in environmental policy but also allowed them to engage more directly with local environmental issues virtually free from Commonwealth interference.

The State of WA’s Environment

WA is recognized internationally for its richness in unique, often endemic and mega-diverse terrestrial and marine flora and fauna (Beard et al. 2000; Shepherd et al. 2002; CALM, 2004; DSEWPC, 2011). At the same time, the state’s extremely diverse ecological systems are vulnerable and highly susceptible to change, placing them at risk from anthropogenic impacts that continue to increase (GWA, 1992; DEP, 1998; EPA, 2007).

WA’s most recent State of the Environment (SoE) report (EPA, 2007b) shows a highly mixed scorecard, depicting, despite isolated improvements, a state of environmental decline. In what follows, we address a selection of priority areas (EPA, 2007b), namely climate change and greenhouse-gas emissions, population and consumption, as well as salinization of land and inland waters. These are environmental issues that, due to their extent; degree of irreversibility; rate of deterioration; or overall social, economic, or environmental impact demand policy development, management focus, and resource allocation. Previous SoE reports had already shown these priority areas to be of concern in light of worsening trends (GWA, 1992; DEP, 1998).

Climate Change and Greenhouse-Gas Emissions

Today, climate change–while still highly politicized in Australia (Hamilton, 2010)–is an internationally recognized phenomenon (CSIRO, 2007; IPCC, 2007a), and the release of greenhouse gases and their effects on climatic stability are a key concern (IPCC, 2007b). In WA, greenhouse-gas emissions increased 45% between 1990 and 2005 (land-use concessions excluded) (EPA, 2007a), amounting to the highest per capita emissions in both the country and the world and falling well outside the 8% increase allowed under the 1997 Kyoto Protocol (United Nations, 1997; Turton, 2002). The state’s overall emissions are expected to increase further in spite of a required 60% reduction by 2050 (CSIRO, 2007; IPCC, 2007a). Thus, a tremendous challenge lies ahead in light of the energy- and resource-intensive nature of the WA economy (Higham & Verstegen, 2006), the implications of which are highlighted in the on-going debate over carbon taxation and a national emissions-trading scheme (Garnaut, 2008a; 2008b; Moran, 2010).

These unprecedented emission levels are especially disconcerting given that future climate change is expected to be costly for WA in environmental, social, and economic terms. As the state is predicted to become warmer and dryer (ABS, 2003a; CSIRO, 2007), climate change has serious implications not only for biodiversity and freshwater availability but also for economic sectors such as agriculture, forestry, and tourism (EPA, 2007a).

Population and Consumption

Population growth and consumption are fundamental drivers of environmental decline in WA. The state’s population has grown steadily from around 450,000 in the 1940s to two million in 2005 (EPA, 2007a). WA’s current population growth rate of around 2.3% is higher than the national average and also higher than that of most developed and some developing nations due to natural increases as well as overseas and interstate migration (EPA, 2007a; ABS, 2008a; 2008b). This level of growth is expected to continue into the future (EPA, 2007a).

Both population growth and (over)consumption drive the demand for natural resources and lead to increases in waste generation and pollution (ABS, 2008b). Per capita consumption in WA is rated among the highest in the world, resulting from the combination of a resource-intensive state economy, high standard of living, and consumption-oriented culture (Watkins, 2005). Consequently, WA’s ecological footprint per capita of around 14.7 hectares dwarfs the national average of seven hectares and compares poorly with the sustainable per capita footprint of an estimated 1.88 hectares (Worldwatch Institute, 2004; Higham & Verstegen, 2006; EPA, 2007a). The state’s predicted future economic expansion and population growth are expected to add further consumption, creating more pressure on already stressed environmental systems.

Salinization of Land and Inland Waters

The salinization of land and water resources is a long-standing environmental problem in WA (Briggs, 1996). Inappropriate land-use and irrigation patterns have increased the scale and extent of dryland salin-
ity, adversely affecting biodiversity, agricultural productivity, and infrastructure. At present, 75% of Australia's dryland-salinization problem is in WA, affecting 51% of all farms over an area of about 1.2 million hectares (ABS, 2003b). The extent of salt-affected land continues to worsen in many areas at an estimated annual economic cost of US$664 million nationally. In WA, the salinity impacts on road and rail infrastructure are expected to double over the next 50 years (EPA, 2007a).

The above examples illustrate some of the key environmental challenges for the state and its political decision makers. WA’s environmental trends, which are mirrored both nationally and internationally, highlight the scope of, and indeed the need for, effective environmental policy making (ABS, 2006; Beeton et al. 2006; UNEP, 2007). This perceived need explains our interest in what promised to be a new approach to environmental policy making heralded by the Labor Party at the 2001 state election to which we now turn our attention.

The 2001 election in WA was decided in part by the rival parties’ stance on environmental issues. The Labor Party campaigned strongly on environmental grounds, promising, inter alia, the cessation of old-growth forest logging in the state’s southwestern region, the continuation of a ban on uranium mining, and the tackling of the state’s worsening water crisis. The Labor Party also committed itself to the development and implementation of a state sustainability strategy, meant to provide the framework for future policy making. The “greenness” of Labor’s electoral victory in 2001 is contested territory (Walsh, 2001), since its “landslide” win was primarily the result of the allocation of preferences under the alternative vote electoral system, with the Greens attracting many of the primary votes (Stone, 2001). Nonetheless, Labor arguably came into office in part because of its environmental policy platform that seemed to promise a departure from past progrowth philosophies premised on economic-ecological tradeoffs to a new era of environmental policy making.

The circumstances appeared favorable, with the right ingredients for environmental policy success. The leader of the newly elected Labor government entered office with an already articulated reform agenda (Gallop, 1998) ready for implementation at a time when environmental issues were prominent in WA and the federal government’s “hands off” approach facilitated devolution of environmental responsibilities to the state. This alignment of factors arguably bode well for the pursuit of political change and the embedding of sustainability principles across government.

Labor’s Taste for Sustainability between 2001 and 2005

Following its 2001 win, the Gallop-led Labor government moved quickly on its environmental promises, keen to promote its commitment to sustainability and political will to operationalize the concept at the government level and across the state. We address below several flagship initiatives, namely old-growth forest logging, Ningaloo Reef, and the State Sustainability Strategy, that were all government initiatives meant to mark the arrival of a new environmental politics (Carpenter, 2006).

Old-Growth Forest Logging

Since the 1960s, native forest logging has been politically contentious both nationally and in WA (Carron, 1985; Penna, 1987; Mercer, 1995). The federal government’s Regional Forest Agreement (RFA) process, which grew out of the National Forest Policy Statement in 1992, was meant to end the long-running forest dispute. The RFAs were purported to deliver forest conservation, ecologically sustainable forest management, and development of sustainable and internationally competitive native timber production (Commonwealth of Australia, 1992a).

In WA, however, the RFA process derailed in the late 1990s because of public outrage over ongoing old-growth forest logging as well as the science and the unpublic nature of the RFA proceedings (Horwitz & Calver, 1998; Westpoll, 1998; AMR: Quantum Harris, 1999; Brueckner & Horwitz, 2005; Brueckner et al. 2006). Despite “green” amendments by the Court Coalition government to the original RFA document only eight weeks after it had been signed, the public credibility of the RFA could not be rescued. The protracted RFA process left the Liberal party internally fractured (Grove, 1999; Martin, 1999), which not only led to a split of the party with the formation of the “Liberals for Forests” but also provided a considerable advantage for Labor’s forest-policy platform at the 2001 polls (Blackburn & Stone, 2003).

Following Labor’s 2001 electoral victory, old-growth-forest logging was effectively banned in 99% of remaining old-growth areas. Also, new areas of old-growth forest were identified and 30 new national parks were established for biodiversity protection. The resultant reduction in timber availability for industry and the concomitant social fallout were offset by an industry-restructuring package and worker-assistance program (Miller, 2004). Conflict over commercial timber production and forest protection is ongoing (Musselwhite & Herath, 2005; CCWA, 2006; 2008). Nonetheless, Labor’s “heroic” policy intervention helped quell public disquiet over forestry
issues, which contributed to the demise of the previous Court Coalition government (Newman, 2004).

**Saving Ningaloo Reef**

The decision to “save Ningaloo” was another key Labor initiative, which, seemingly consistent with its election promise to work toward greater reef-area protection, helped cement the party’s environmental credentials during its early years in office. Located 1,132 kilometers (km) north of WA’s capital city, Perth, the Ningaloo reef is an almost pristine 230 km long part-fringing and part-barrier reef, lying offshore on the western side of the North West Cape Peninsula. While remote and relatively uninhabited, the area has been experiencing rapid growth in visitor numbers over the last fifteen years. While the expansion of tourism has enhanced the region’s economic profile, it has also increased pressures on the fragile reef ecosystem (Wood & Hughes, 2006).

Against this background, Coral Coast Marina Development had been seeking approval for a number of years to develop a 2,500-bed resort-style marina at Maud’s Landing, which is situated three kilometers north of the existing township of Coral Bay adjacent to the Ningaloo Marine Park. Despite heated debate and public agitation over the proposed development, the project was widely believed to have the go ahead in light of two existing approvals by the state’s Environmental Protection Authority (EPA). Yet, in response to considerable national, international, and celebrity intervention (Gilles et al. 2004), as well as environmental concerns raised by the independent Appeals Committee, the WA state government rejected the proposal (Gallop, 2003b). In July 2003, the WA Premier, Geoff Gallop, announced that the development at Maud’s Landing would not proceed because the “proposed Coral Coast Resort [was deemed] environmentally unacceptable” (Gallop, 2003a). Subsequently, a regional plan was developed for Ningaloo that established legislative requirements (Statement of Planning Policy and an Interim Development Order) to protect the Ningaloo area. The government formed the Ningaloo Sustainable Development Committee charged with planning and decision-making responsibilities for the region. Also, funding for the management of the area’s marine and terrestrial environments was increased.

The government’s decision was a win for the local communities and the “mum and dad style popular

**The State Sustainability Strategy**

Arguably, Labor’s most widely applauded achievement at the time, in terms of its sustainability initiatives, was the development of Australia’s first State Sustainability Strategy that was intended to form an integral part of a larger sustainable development governance framework (GWA, 2003). The Strategy was launched in September 2003 (more than a decade after the National Strategy for Ecologically Sustainable Development (Commonwealth of Australia, 1992b) was released) and hailed as a “trailblazing blueprint” and an exemplar for other states and countries (Davidson, 2004). Developed in partnership between the state government and local universities, the Strategy provided numerous avenues for public input via a series of civic seminars and a period for citizen comment on a public consultation paper and a draft state sustainability strategy (Newman, 2005). The process was designed to be participatory and premised on newly developed guidelines for community engagement (DPC, 2002; 2003), marking a shift toward more collaborative policy making and negotiated policy outcomes (McGrath et al. 2004). The proceedings were overseen by the Sustainability Policy Unit in the Department of Premier and Cabinet, established in 2001 soon after the state election (Hartz-Karp & Newman, 2006).

The Strategy was designed to focus government thinking on sustainability issues and to provide a platform for the integration of environmental protection, social advancement, and economic prosperity. A shift in policy direction was envisioned based on a change in language, thinking, and culture with a view to making sustainability a lived reality across government and society (Newman, 2005). At its core, the Strategy described how the state and its agencies could adopt a sustainability framework and provide leadership in supporting a transition to a sustainable

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2 Fringing reefs are coral structures that are attached to the mainland, following a shore from beach to beach and thus creating a chain of reefs. In contrast, barrier reefs are reefs separated from a mainland or island shore.
future in partnerships with local government, industry, and nongovernmental organizations. Widely supported by environmentalists, politicians, and business leaders both nationally and internationally, the Strategy placed WA center stage in the global sustainability arena and marked a highpoint for sustainability initiatives within the state (Newman, 2005). Also, a range of other sustainability initiatives were sparked by, or accompanied the development of, the Strategy, such as the Dialogue with the City\(^3\) and the WA Collaboration\(^4\) that sought to mainstream the sustainability agenda and foster community engagement and cross-sectoral collaboration (Hodgson et al. 2005).

**A Change of Direction after the 2005 Elections**

Compared to 2001, far less attention was paid to environmental issues during the 2005 state election (Black & Phillips, 2005; Rootes, 2005), arguably due to the absence of iconic issues such as ending old-growth logging or protecting the Ningaloo Reef (Weber, 2005). While water security promised to be a key election issue, the water debate derailed, with the focus shifted onto a blunder by opposition leader Colin Barnett (Rootes, 2005). Overall, the broader sustainability agenda in the state had lost momentum within the context of a largely muted environmental debate nationally (Dovers, 2002), falling behind issues such as health, education, and the economy (Black & Phillips, 2005). On election day, while the Green vote collapsed, the Labor government was re-endorsed despite have being touted as the highest taxing and least popular state government in the country and trailing in the polls in the lead up to the election (Green, 2004; van Onselen, 2005).

In January, 2006, the office of WA’s Premier changed when Geoff Gallop, suffering from depression, surprisingly resigned from politics while at the zenith of his career (Steketee, 2006; Mackerras, 2007). Gallop’s office was taken over by Alan Carpenter, who had served previously as State Development Minister and whose prodevelopment stance would affect Labor’s approach to the environment. Only days later, Environment Minister Judy Edwards resigned from office, which set in train a succession of ministerial appointments to the environmental portfolio between 2006 and 2008. These two years were distinguished by growing criticism from environmental groups regarding environmental policy making in the state, the character of which had changed from visionary to reluctant and reactive. Overall, Labor’s environmental credentials—once considered trail-blazing (Davidson, 2004)—became increasingly eroded on a number of fronts, some of which we elaborate on below.

One such example was the lead-pollution incident in Esperance in early 2007 that resulted in the mass die-off of birds caused by dust escaping during loading of Magellan Metals products at the Esperance Port. Subsequent testing revealed elevated levels of lead in the blood of some Esperance community members, including children (Phillips & Kerr, 2008). An inquiry by the Legislative Assembly’s Standing Committee on Education and Health uncovered major failings and shortcomings in the industry-regulation function of the Department of Environment and Conservation and other regulatory agencies that led to the exposure of workers and the community to unacceptable and avoidable health and environmental risks (Education and Health Standing Committee, 2007; Taylor, 2007). The Esperance incident fueled perceptions of the government and its agencies’ growing inability to adequately monitor and control industrial activities, perceptions the government sought to counter by increasing the number of environmental department staff (ABC News, 2007).

Another example of environmental retreat was the ongoing debate over protection of the banded ironstone formation (BIF) ranges that are part of an isolated ancient landscape rich in minerals and thus earmarked for future mining activity (CCWA, 2008). In response to growing pressure from conservationists and its own departments, the Carpenter government commissioned a report on biodiversity-conservation requirements in the BIF ranges of the Yilgarn Craton in the state’s Midwest and Goldfields regions. The interim report by the Department of Environment and Conservation (2007) highlighted the region’s significant biodiversity values, recommending that up to 60% of the ranges be preserved and that flora and fauna be protected from development by establishing Class A reserves and national parks.\(^5\) The Department warned in its interim report that in the absence of a “strategic approach to resource utilization and biodiversity conservation” both “EPA and [the] government [would] face an increasing and dif-

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\(^3\) The Dialogue with the City was an attempt to give citizens a unique opportunity to contribute to the creation of a planning vision and strategy to guide Perth’s future growth and development over the next two decades with the objective of making Perth the world’s most liveable city by 2030.

\(^4\) The WA Collaboration sought to progress sustainability through partnership and deliberative democracy. It was founded in 2002 as a multistakeholder nongovernmental organization with the aim of fostering a grassroots dialogue about sustainability in WA.

\(^5\) Class A reserves are the most protected type of public land and marine areas in WA, as reservation status can only be lifted with the consent of both houses of parliament. Reserves are established for different purposes, such as the creation of conservation parks, national parks, or nature reserves.
difficult challenge in addressing cumulative environmental impacts” should mining activities proceed in the region (DEC, 2007). Despite these warnings, and in the context of a growing number of mining proposals, the Carpenter government did not follow through with the proposed preservation of the area. This in turn gave rise to concerns about the government’s seeming protection of short-term resource interests over internationally unique landscapes and biodiversity values.

Finally, the release of WA’s third State of the Environment (SoE) report provided a good opportunity for the Carpenter government to mark the progress made within the environmental portfolio (EPA, 2007a). The State Sustainability Strategy reinforced the importance of environmental monitoring and reporting efforts that had been underway in WA since the 1990s, stressing the need for government to “provide community access to the latest research and data…to enable improved land management” (GWA, 2003). Surprisingly, the launch of the SoE report was left to EPA, and to this date no formal response has been given by government and the EPA recommendations have not been implemented (CCWA, 2008). This turn of events raised doubts over the government’s commitment to the SoE reporting process that in earlier years was purported to be a cornerstone of Labor’s environmental policy framework and the key mechanism for reporting on the state’s environmental bottom line (Edwards, 2003).

In the lead up to the 2008 state election, Labor refocused attention onto environmental issues. The Carpenter government pledged an extra US$32 million over four years to protect what was referred to as WA’s environmental icons, earmarking funding for the Kimberley, the Great Western Woodlands, and the marine environment. Also, extra incentives were pledged for renewable power sources such as wind, solar, wave, and geothermal. At the same time, the electorate was warned of the Liberal Party’s environmental platform that included the future prospect of uranium mining and the introduction of genetically modified food crops (ABC News, 2008). In contrast, the Liberal Party focused on Labor’s alleged environmental policy failures, citing a confused and disjointed approach to water policy, dishonesty in connection with claims about the carbon neutrality of the Kwinana desalination plant, and a host of failures in energy and salinity management (The Liberal Party (WA), 2008).

In the end, however, the environment did not feature as a key issue for the two major parties during the election that saw a return of a Liberal-National Coalition government and the end of Labor’s seven years in office. It is remarkable that in the 2008 state election campaign global environmental issues such as climate change, although a key election issue during the federal election in 2007, did not feature prominently. Notably, however, the Green vote recovered from the electoral defeat of 2005, achieving the party’s best outcome to date.

Environmental Policy Under Labor: Unfinished Business or Reversal to Developmentalism?

Labor came to power in 2001 with a strong commitment to advance sustainability in WA by showing both leadership and vision. Following the launch of the State Sustainability Strategy in 2003 and the unexpected departure of Geoff Gallop two years later, however, the reform agenda lost thrust. Labor’s Sustainability Strategy proposed over 330 specific actions to be undertaken across the whole of government, illustrating how agencies were to include sustainability considerations in their planning, policies, and decision-making processes (GWA, 2003). However, the Strategy remained a statement of intent only (Mercer & Marden, 2006), described as “just words” by political opponents (Phillips & Kerr, 2005). The criticisms were directed at Labor’s failure to enact sustainability legislation. We concur with the critique that this failure left government agencies without requisite support for the operationalization of the sustainability principles espoused in the Strategy and provided insufficient stimulus for the implementation of sustainability initiatives across government, industry, and the wider community. This outcome mirrors the status of the National Strategy for Ecologically Sustainable Development that also was derided as a mere wish list in the mid-1990s (Wilkenfeld et al. 1995; ACF, 2006).

The Carpenter government disbanded the Sustainability Round Table after only a few years of existence. This forum comprised representatives from government agencies, community, and industry and was intended to offer advice to the Premier and to conduct a biennial review of the State Sustainability Strategy. Similarly, the Carpenter government demoted the Sustainability Policy Unit that was meant to ensure a whole-of-government approach. The unit was moved from the Premier’s to the Environment portfolio, rebadged as the Sustainable Programs Unit, and repackaged together with the Waste Management Branch and the Community Education Programs into the department’s Sustainability Division. As the Strategy was premised on active leadership by both premier and cabinet, it became apparent, along with the removal of other cornerstones of Labor’s sustainable development governance framework, that enthusiasm for sustainability had waned.

Despite the development of a comprehensive sustainability strategy and the establishment of a
range of coordination and implementation mechanisms to facilitate policy integration across all government agencies (e.g., Sustainability Code of Practice for Government Agencies) during Labor’s first term, these measures ultimately turned out to be temporary due to a lack of administrative stability and an absence of continuing strong political leadership (Ross & Dovers, 2008). Thus, we argue that one of the great failures of the Gallop administration’s sustainable development approach was its inability to maintain initial momentum by adjusting institutional arrangements and introducing legislative change. Such measures would have helped cement the sustainability agenda, protect the vision, and withstand less supportive policy environments that come with changes of government. A long-term commitment to such a complex and wide-ranging initiative is essential to overcome the many “sources of ‘unsustainability’ [that] are deeply embedded within not only the prevailing policy and institutional contexts but also within the structures of the society as a whole” (Pope & Grace, 2006).

Also, while important, Labor’s flagship initiatives described above strike as largely symbolic in nature and as politically opportunistic. So-called “bold” or politically courageous decisions were made in areas of little or dwindling economic importance for the state against the backdrop of significant public agitation, as was the case with the old-growth debate and the Ningaloo conflict (Newman, 2004). The forestry sector in WA has been in a state of decline for many years (ABARE, 1990; 1998; NFI, 1998). Consequently, a reduction in timber availability posed little political threat, especially in light of strong pro-forest sentiments among Perth-based voters. Similarly, the Ningaloo Reef area, while an increasingly popular tourist destination, contributed comparatively little to state revenue (Wood & Hughes, 2006). At the same time, the high public profile the area received during the Save Ningaloo campaign marred the risk of an electoral backlash should the marina development have been allowed to proceed.

Even popular, proconservation decisions such as these, however, were not without tradeoffs. On one hand, both old-growth forests and the Ningaloo Reef area were protected from uncontrolled economic exploitation, while, on the other hand, equally controversial, yet economically more attractive, projects were approved. To illustrate, shortly after old-growth logging was effectively banned in native forests, sand mining in the Ludlow Tuart Forest was allowed to proceed. Similarly, following the decision to “save” Ningaloo, the Gorgon gas project off the Pilbara coast received ministerial permission. Moreover, unpopular decisions by the Ministry for the Environment were followed by new appointments to the portfolio, blurring lines of accountability.

Decisions under the Gallop government that on their face seemed politically courageous did not receive adequate follow up. The State Sustainability Strategy, for example, was a government initiative that—implemented—would have required far-reaching policy reform and substantial legislative support. However, despite much fanfare surrounding its launch, the operationalization of the Strategy, as indicated above, was not pursued in earnest and was ultimately shelled by the Carpenter government. In this context, commenting more broadly on the Labor government’s political reforms, Hodgkinson (2006) speaks of “compromises and a degree of accommodation.” A similar argument can be advanced in connection with Labor’s policy approach to the environment, especially during its later years in government. In connection with WA’s rapidly expanding economy, Gallop’s initial reform agenda was viewed as increasingly at odds with business interests keen to reduce bureaucratic red tape and fast track development approval (Hobbs, 2008). This observation, in turn, may help explain accusations of a “soft touch” on the resource sector and a string of decisions or lack thereof, which served to advance the development agenda (Phillips & Kerr, 2005).

Speculation aside, a substantial shift occurred in both rhetoric and policy following the 2006 leadership handover. While the early years under the Gallop government seemed to signal a sincere, albeit populist, attempt at governance for sustainability, Labor’s second term saw a reversal to a policy approach more akin to the kind the party campaigned against in 2001. The Gallop government, while forced to make political compromises, was overall committed to its sustainability agenda and largely true to its postulated reform program (Gallop, 1998). With Gallop’s departure, Labor lost its sustainability champion along with stability and continuity in the cabinet ranks. Labor’s new “prodevelopment” premier not only dropped the sustainability agenda but also undid a series of policy measures implemented under Gallop such as the abandonment of the Sustainability Roundtable and the sustainability unit in

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6 Tuart trees (Eucalyptus gomphocephala) are endemic to WA and limited in their distribution along the coastal plain in the southwestern part of the state. The Ludlow Tuart Forest is the only remaining Tall Tuart Forest in the world, which is why local conservation groups widely criticized the government’s approval to grant sand mining in the area.

7 The US$43 billion Gorgon liquefied natural gas project off the north coast of Western Australia was, at the time, the country’s largest natural resources project in history. The project was controversial due to its siting on Barrow Island, a Class A nature reserve area with sensitive flora and fauna.
the Premier’s Department (Lewis & Laurie, 2006; Morgan et al. 2006) as well as failed to reduce WA’s dependence on fossil fuels, instead proposing additional coal-fired power stations in the state’s southwest. Due to the failure to institutionalize Labor’s first-term changes, much progress could be stopped, even reversed, allowing for a return to development and growth-oriented policy prescriptions.

Many of WA’s environmental conflicts in recent decades have been based on a public reaction to, and rejection of, the development agenda of successive state governments. Despite increasing environmental stakes, environmental issues have routinely been relegated to the political backburner during the state’s resource boom of the past decade (EPA, 2007a). Similarly, social problems are also on the rise in the face of mounting evidence that WA’s recent boom times failed to deliver on its promises, experienced most by the vulnerable communities in WA’s rural and remote areas (Denniss, 2007; Carney, 2008a; 2008b). In other words, the state’s triple bottom line is becoming increasingly unbalanced, raising grave concern about the long-term sustainability of WA’s development path. Also, there are no visible signs of change in direction despite EPA’s persistent warnings about the unsustainability of the state’s growing population and development-driven environmental impacts (EPA, 2007a). As recently as April 2010, on the eve of a new resource boom, calls were made by industry interests to increase the state’s population by 70,000 people per year to meet the projected labor demand of 400,000 people by 2016 (Phaceas, 2010). Returning to Diamond’s (2005) analogy, the “horse race” continues and political responses in WA, after a temporary lead, trail behind accelerating environmental changes. A new political “heroism” may be needed to overcome the economic-ecological dichotomy that undermines efforts to harmonize economic development with social and environmental health. Labor thus far had seemed to be the state’s best bet (no pun intended) to achieve this objective. Yet, the return to developmentalism in WA seems complete.

Conclusion: Western Australia’s Experience in the Global Context

The WA experience is mirrored nationally and internationally, where political enthusiasm for sustainable development has ebbed and flowed considerably over the last twenty years. At present, despite rapidly growing social and environmental stakes (MEA, 2005; Beeton et al., 2006; UNEP, 2007; Worldwatch Institute, 2009), sustainability per se seems to have been relegated again to the “political backburner,” overshadowed by economic concerns triggered by the ongoing global financial crisis. Indeed, the market meltdown seems to have intensified political resolve internationally to press ahead with conventional pro-growth policy prescriptions. The seeming intensification of neoliberal economic globalization also appears to have tightened what has been called the “ideological and epistemological straightjackets” that have militated thus far against cohesive and politically effective interpretations of sustainable development (Sneddon et al. 2006). Instead of reforming the management of globalization and mitigating its side effects, there is much renewed political determination to persist with orthodox market-based approaches to policy making (Stiglitz, 2010). In the case of WA, the answer to the economic slowdown appears to be the intensification of natural resource extraction as evidenced by record numbers of resource-development approvals (Roarty, 2010).

While political and commercial decision makers still widely employ the language of sustainability, the focus seems to have shifted, with the sustainability message translated, redefined, and simplified. To illustrate, major corporations increasingly address sustainability concerns under the banner of corporate social responsibility (CSR), using both concepts interchangeably despite stark differences in their respective roots and orientation (Rondinelli & Berry, 2000; Schmitt, 2005; Wolff & Barth, 2005; Gustavson, 2008; Málovics et al. 2008). Similarly, in the political realm, sustainability is now broadly being captured by the international climate-change debate, leaving little room for other socioecological concerns and problems (Paton, 2008). In other words, despite an ever-growing need for serious engagement with sustainable development, the sustainability agenda finds itself subsumed by other concepts and issues.

To our reading, the simplification and apparent subordination of the sustainability agenda not only bespeaks a certain imaginative poverty in policy making (Paton, 2008), but it is also broadly reflective of a lack of critical engagement with sustainable development per se. The state of play in WA is mirrored also in other state jurisdictions and countries such as the United Kingdom (HM Government, 2007).

8 Due to the resources boom, recent years saw a discernible rise in homelessness because of reduced housing affordability, a marked increase in the uptake of social services in the face of rising costs of living, as well as growing family and community impacts associated with fly-in-fly-out employment practices in the resources sector (e.g., Denniss, 2007; WACOSS, 2008).

9 Originally, sustainability was overtly ecological in nature while CSR was born out of ethical concerns about the social impacts of business conduct. Recent controversial resource-development projects in WA have been defended on the basis of proponents’ good CSR practices with effective sustainability outcomes implied (see Barnett, 2010).
2005; Mercer & Marden, 2006; Mercer et al. 2007) and indicates a political approach to sustainable development that ignores its complexities and instead presents it as an unproblematic concept aligned with orthodox growth and development (Connelly, 2007). This in turn makes sustainability prone to “hijacking” and “abuse” by political and commercial interests, a phenomenon widely lamented in the literature (Lafferty & Langhelle, 1999; Beder, 2000; Mittlin, 2001). Thus, without critical engagement with the sustainability problematic and needed reflection on the values and ideologies behind many of today’s pressing social and environmental concerns, effective sustainability policy making is likely to remain a distant reach. While charismatic leadership and personal convictions helped challenge engrained policy approaches to development and environmental protection in WA—at least temporarily—the case described here attests to the need for more far-reaching economic and political changes to make possible a lasting break with developmentalism and to enable a shift toward more sustainable trajectories.

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Using Q-methodology to identify local perspectives on wildfires in two Koyukon Athabascan communities in rural Alaska

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Sustainable resource management depends upon the participation of resource-dependent communities. Competing values between community members and government agencies and among groups within a community can make it difficult to find mutually acceptable management goals and can disadvantage certain resource users. This study uses Q-methodology to discover groups with shared perspectives on wildfire policy in the Koyukon Athabascan villages of Galena and Huslia, Alaska. Before the study, participants appeared to disagree over the amount of wildfire suppression needed, but Q-method results showed three perspectives united around deeper, less oppositional concerns: Caucasian residents and resource managers who preferred natural processes; older Koyukon residents concerned about losing local control, small animals, and cultural places; and younger Koyukon residents who felt subsistence activities were resilient to social-ecological change. Additionally, both Koyukon groups suspected it was cheaper to suppress all wildfires while small. These results imply that community frustration with wildfire management may be reduced through collaborative research with Koyukon elders on locally important issues, cultural site mapping in order to extend some level of wildfire protection, and greater agency transparency about wildfire-suppression costs. The results also indicate that age may be an understudied driver of community resource-use preferences. This study proposes that without identifying resource user-interest groups and their main concerns, it is difficult to develop equitable environmental goals. It shows how Q-methodology provides a systematic approach for identifying the stakeholders and issues needed in resource management.

KEYWORDS: natural resource management, wildfire suppression, community involvement, environmental policy, stakeholders

Introduction: Communities and Natural Resource Management

Rural residents often disregard resource-use regulations that are incompatible with traditional use patterns, especially when communities distrust the resource-management agency (Dolsak & Ostrom, 2003; Ostrom, 2005; Berkes, 2007). As policy enforcement may be impossible, sustainable resource management depends on local cooperation, which improves when agencies include communities in environmental planning. Additionally, rural residents often have local environmental knowledge, culturally appropriate resource-management institutions, and a vested interest in sustainable management (Ciracy-Wantraup & Bishop, 1975; Berkes, 1987, Acheson et al. 1998; Berkes & Folke, 1998; Ostrom, 2005; Tsing et. al 2005). Finally, democratic principles imply that communities have a right to participate in decisions affecting their well-being, as good governance includes stakeholders (Western & Wright, 1994).

Unfortunately, community environmental practices may not fulfill nonlocal conservation goals. Many community-based natural resource management (CBNRM) projects struggle with competing environmental values between communities and outside organizations and even within communities (Walters, 1997; Kruse et al. 1998; Agrawal & Gibson, 1999; Kellert et al. 2000; Robbins, 2000; Tallis et al. 2008; Clark & Slocombe, 2009). Some CBNRM projects force communities to meet government objectives and ignore community goals (Schroeder, 2005). In divided communities, CBNRM projects can further disempower women, minorities, or poorer residents (Rocheleau et al. 1996; Tsing et al. 2005). Additionally, it is often unclear which stakeholders need to be included in decision-making processes and which problems management should address (Hjortsø, 2004).

Some researchers address poor CBNRM outcomes by investigating the conditions under which community management succeeds (e.g., Ostrom, 2005; Padge et al. 2006; Kareiva et al. 2008). Other scholars search for values and scientific errors in government or conservation-organization goals that conflict with community goals (e.g., Blaikie, 1985; Berkes, 1987; Berkes & Folke, 1998; Holling et al. 1998). Although both approaches recognize value...
differences, neither offers a methodological tool to address competing interest groups. Agrawal & Gibson (2001) argue that groups sharing territory or physical characteristics may disagree about resource management and that “imagined communities,” or people with shared values, are more likely to manage resources sustainably. Blake (1999) concurs, explaining that “there are different communities that form and disperse around particular issues and concerns.” This study proposes that without identifying resource user-interest groups and their main concerns, it is difficult for CBNRM projects to develop equitable environmental goals. It demonstrates how Q-methodology provides a systematic approach for identifying the stakeholders and issues that should be included in sustainable resource-management policies.

Public Participation and Wildfire Management

National

Since the year 2000, the need for sustainable wildfire management in the United States has become clear, as catastrophic wildfires have burned millions of hectares and caused fatalities, home losses, and unaffordable suppression costs (Machlis et al. 2002; Steelman & Kunkel, 2004). Climate change, wildfire suppression-induced changes in forest structure, and wildland-urban interface expansion all exacerbate wildfire damages (Pyne, 2001; Brown et al. 2004; McKenzie et al. 2004). Social changes, such as community risk-reduction planning and lifestyle modification to accommodate natural burning, may reduce wildfire losses, indicating a need for increased public engagement (Dombeck et al. 2004; Kauffman, 2004; Steelman et al. 2004). Recent policies, such as the Healthy Forests Restoration Act of 2003, provide incentives for community-led risk reduction at the wildland-urban interface (Machlis et al. 2002; Steelman et al. 2004). Additionally, federal regulations in the United States (e.g., the National Environmental Policy Act and the Department of Interior mandate) require that wildfire managers consider public values, making community participation an essential part of any sustainable solution (Machlis et al. 2002).

Local

Many residents of Koyukon Athabascan communities in rural Alaska have advocated for wildfire management that accommodates traditional livelihoods. This study focuses on Galena (population 675) and Huslia (population 293), Alaska, two small, predominantly Koyukon Athabascan communities located, respectively, along the Yukon and Koyukuk Rivers in the Koyukon homeland (Figure 1), a remote subarctic region dominated by vast lowlands, lakes, and boreal forest (Nelson, 1983; U.S. Census Bureau, 2009). Fire management is important throughout much of the area due to highly flammable black spruce forests (Viereck, 1973) and local livelihoods dependent upon wild resources such as moose, bear, waterfowl, small game, fish, furbearers, berries, and firewood (Nelson, 1983; Marcotte, 1986; 1990; Alaska Region U.S. Fish and Wildlife Service, 2008). Wild food-use estimates conducted in the 1980s showed that Galena residents annually harvested an average of 358 kilograms (787 pounds) of wild food per person, and Huslia residents averaged 492 kilograms (1,082 pounds) per person per year (Marcotte, 1986; 1990). The communities are not connected to the road system, formal employment opportunities are limited, and nonwild food is expensive because it must arrive by plane or barge. As such, local food security depends upon wild-food harvests. Additionally, residents consider wild foods to be healthier than store foods, and harvesting activities such as hunting, fishing, and berry picking are an important part of local cultural identity.

The Alaska National Interest Lands Conservation Act (ANILCA) of 1980 created the Koyukuk and Innoko National Wildlife Refuges, bringing federal land management to Koyukon traditional use areas. The U.S. Fish and Wildlife Service’s Galena office manages the 1.8 million hectare Koyukuk National Wildlife Refuge (Koyukuk NWR) and 304,000 hectare Northern Unit Innoko National Wildlife Refuge (Alaska Region U.S. Fish and Wildlife Service, 2008). The ANILCA legislation protects subsistence, which is the customary and traditional use of wild products on federal lands, but harvesters must follow...
Many Koyukon residents feel that wildfires impede subsistence uses, as downed trees complicate access, and important species such as moose and fur-bearers rebound slowly. Hunters need to hunt every year and to teach their children, so a decade of scarce wildlife or complicated access causes major problems (Chapin et al. 2008). Additionally, wildfires can displace caribou because their main winter forage, lichen, may not recover for up to 80 years (Rupp et al. 2006). A review of the ecological literature indicates that after wildfires forage for moose, bear, and martens may improve, but that these species probably need mature, unburned forest for shelter from predators, denning, and/or hibernation (Nelson et al. 2008). Thus, a mosaic of stand ages may provide the best habitat for subsistence species. In practice, suppression near villages may cause a shortage of younger stands, whereas areas without suppression may lack older stands due to recent warming-induced increases in wildfire extent (Kasischke & Turretsky, 2006; Chapin et al. 2008). Climate, not forest age or wildfire suppression, drives this wildfire expansion (Johnson et al. 2001). Given the warming Arctic climate, the areal extent of wildfires in Interior Alaska will likely continue to increase (Chapin et al. 2008).

The Koyukuk NWR wildfire-management plan (FMP) emphasizes wildfires’ beneficial effects and encourages managers to “[m]aintain fire-related ecological processes to the maximum extent feasible” (Alaska Region U.S. Fish and Wildlife Service, 2005). The plan suggests protection of human life and property, important wildlife habitat, and cultural or historic sites, but recommends that managers use wildland and prescribed fires for resource management when possible. In contrast, many Koyukon residents favor more extensive suppression to protect subsistence uses. The FMP mentions local resistance to wildfire and describes an outreach plan, stating that “[i]t will take some time to educate the local public of the ecological benefits of wildland and prescribed fire” (Alaska Region U.S. Fish and Wildlife Service, 2005).

**Q-Methodology and Resource Conflicts**

Q-methodology, developed by psychologists to investigate people’s subjectivity, or internal frames of reference, gives researchers a detailed view of respondents’ perspectives (Brown, 1996; Robbins & Krueger, 2000). Participants complete a Q-sort on a specific topic by ranking statements drawn from the respondents or similar people (McKeown & Thomas, 1988). Researchers then use factor analysis to group participants with similarities in their statement rankings, thus discovering “imagined communities.”

Existing case studies provide ethnographic detail on resource conflicts (e.g., Agrawal & Gibson, 2001; Brosius et al. 2005), and various innovative methods describe rural resource use (Slocum et al. 1995). The Q-methodology’s mix of ethnographic detail, statement ranking, and factor analysis is different, however, because the process uncovers patterns not apparent from qualitative analysis, while allowing more respondent control than most quantitative analyses. When qualitative research discovers participant concerns, it may be difficult to determine which are representative of other community members. Q-methodology reveals broadly shared concerns, as respondents rank many local concerns, and factor analysis uncovers patterns in the responses. Respondents’ perspectives predominate because, rather than responding to researcher-designed questions, participants rank community-generated statements. Thus, community priorities drive the analysis. Additionally, participant comments and ethnographic observations give context for the factor analysis. Q-methodology has been lauded for its systematic approach to human subjectivity and its ability to discover points of consensus and conflict, to identify groups responding to specific issues, to more clearly define competing viewpoints, to discover criteria important to participants, and to guide policy creation and improvement (Peritore & Peritore, 1990; Steelman & Maguire, 1999; Nijink & Mather, 2008).

**Methods**

This study, conducted in Galena and Huslia, Alaska, between March and July, 2008, used Q-methodology to group community members and resource managers with similar perspectives on wildfires. For detailed instructions on conducting a Q-method study, see Brown (1993).2

The first step in Q-method is to develop a statement set representing perspectives on an issue (McKeown & Thomas, 1988). In this study, statements about wildfires were drawn directly from area residents. First, statements representing Koyukon reactions to wildfires were collected from one-on-one semistructured interviews conducted with a purposive sample of 41 Koyukon forest users over the age of 45 (23 from Huslia and 18 from Galena; 21 male and 20 female). Second, statements representing the perspectives of local resource-management agencies on

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2 For an earlier, online version, see http://faculty.uwm.edu/ cottlec/QArchive/Primer1.html.
wildfires were collected from policy documents, resource-manager comments, and educational brochures. From these two collections, 27 statements were chosen to represent Koyukon and resource-manager viewpoints (Table 1).

To ensure equal representation, statements were roughly balanced to provide a negative and a positive option on most topics. For example, “It just isn’t possible to fight all wildfires, especially if they are far from villages” and “It is cheaper to fight wildfires while they are small, even if they aren’t threatening villages” were considered an opposing pair. Respondent phrasing was preserved, although some resource-management language was simplified. Koyukon Q-sort participants were often surprised to see Koyukon concerns formally represented and were happy to rank locally meaningful statements.

The next step in a Q-method study is to choose respondents representing a wide variety of potential perspectives. Q-methodology discovers distinct perspectives on an issue, but does not predict their rate of occurrence in the larger population. As such, a purposive sampling scheme targeting people with different viewpoints and backgrounds ensures maximum representation of possible perspectives (McKeown & Thomas, 1988). In this study, a sample of 46 such respondents sorted the selected statements in one-on-one sessions with the author. Agencies represented included the U.S. Fish and Wildlife Service, the Alaska Department of Fish and Game, and the Alaska Fire Service (N=10). One agency employee was a Koyukon resident of Galena and another was Athabascan from another area. Caucasian residents not employed by resource-management agencies also participated (N=8). Finally, Koyukon residents of both Galena (N=14) and Huslia (N=14) not employed by resource-management agencies were part of the process. Respondents were chosen to represent diversity in age, gender, employment, town of residence, views on wildfires, and experiences using the boreal forest. It was not possible to exactly balance all demographic categories, and unequal numbers of men (N=26) and women (N=20) participated. A sufficient number of respondents from both genders were included so that any differences would be reflected in the analysis.

The next step, the Q-sort, requires respondents to rank the statements according to level of agreement. First, participants sorted cards containing the 27 locally generated statements about wildfire into three piles: “Agree,” “Disagree,” and “Not Sure.” They then further sorted cards onto a template with a fixed seminormal distribution (Figure 2). Categories ranged from “Most Disagree” to “Most Agree.” While participants sorted the statements, their comments were recorded as notes. In addition, respond-

![Figure 2 Q-Sort template.](image-url)
The interviews, recorded semistructured interviews about experiences with wildfires, and informal interviews about resource issues (Slocum et al. 1995; Bernard, 2006) were reviewed by participants.

In a Q-method, the factors explain the participants, or cases, and not the statements, or variables (McKeown & Thomas, 1988). Respondents matching to the same factor have some similarities in statement rankings and thus represent a perspective. Once respondents match to factors, PQMethod creates average statement rankings for each factor and reconverts these averages into the scale of the Q-sort (-3 to 3) to create a composite Q-sort. The composite Q-sort represents a factor group’s general outlook, but does not describe each member’s exact viewpoint.

To provide context for the Q-method, this study drew on six months of ethnographic fieldwork in Galena and several weeks in Huslia. Ethnographic information was used to further explain the factor groups in terms of participant livelihoods and history. The primary methods were participant observation, recorded semistructured interviews about experiences with wildfires, and informal interviews about resource issues (Slocum et al. 1995; Bernard, 2006). The interviews, as described in the beginning of the

Table 1 Q-sort statements and average statement rankings for each group. Opposing statements pairs are grouped together.

| Statement                                                                 | Factor 1 | Factor 2 | Factor 3 |
|---------------------------------------------------------------------------|----------|----------|----------|
| The experience of local users who have seen wildfires in this area is more important than scientific predictions and should be given more weight in decision making. | -2       | 3        | 0        |
| Decisions about wildfire policy should be made using science.             | 1        | -3       | 0        |
| Old portages, camping sites, and places where things happened in the past are an important part of the cultural history of the area. Wildfire destroys these places and cultural history is lost. | -1       | 2        | -2       |
| Most sites will survive a wildfire. Cultural sites are usually still recognizable, travel routes can be recut, forest will grow back, and animals will return. | 0        | 0        | 3        |
| It is cheaper to fight wildfires while they are small, even if they aren’t threatening villages. | 0        | 1        | 1        |
| It just isn’t possible to fight all wildfires, especially if they are far from villages. | 2        | -1       | -2       |
| Large wildfires can be harmful because they leave open areas where the permafrost will start to melt. It is bad to lose permafrost. | -1       | 1        | -1       |
| Wildfires are good because after a wildfire there is more unfrozen soil above the permafrost. This means that more things can grow. | 0        | -2       | 0        |
| After a wildfire God’s creation is gone forever the beauty is gone.        | -3       | -3       | -3       |
| It is important to have wildfires because they are a natural part of the Alaskan environment. | 3        | 2        | 3        |
| No areas are remote areas. Just because it isn’t private property doesn’t mean it’s not our land. Wildfires there still affect us. | 0        | 1        | 0        |
| If villages are made safer from wildfire, it will be easier to accept more fire away from villages. | 1        | -1       | 0        |
| Resource-management agencies should do controlled burns on public lands in order to improve habitat for moose. | 0        | -1       | -1       |
| It isn’t necessary to burn any area for any amount of food or resources.   | -3       | -2       | 0        |
| Spruce forests are very important to people in this area. After a wildfire spruce may not return within our lifetimes. Because of this it is bad to have too many large wildfires in an area. | -1       | 1        | -1       |
| Wildfires are good because they convert spruce to willow and birch. It is better to have more stands of willow and birch because they keep the landscape diverse and make it less flammable. | 1        | -1       | 2        |
| There is always new growth in this area, even without wildfires. Ice movement, flooding, and human use keep areas from becoming overgrown and provide enough food for moose. | -1       | 0        | 1        |
| We need wildfires to keep the landscape from becoming overgrown. If we don’t have wildfires, there won’t be enough new growth for moose to eat. | 2        | 0        | 0        |
| Heavy timber along drainages is important for moose because it provides shelter. If these areas burn, moose might move away or die off. | -2       | 0        | 1        |
| Wildfires are an important tool that can improve habitat for moose.        | 3        | 2        | 1        |
| Some small animals can’t escape from a wildfire. At certain times of the year, there may be nests with eggs, or baby marten in dens, and they will burn in a wildfire. | 0        | 3        | 2        |
| Wildfires are good for trapping. A few years after a wildfire there are lots of marten because there are more mice and lemmings for them to eat. | 0        | 0        | 2        |
| The resource-management agencies should teach people more about wildfires so that they can accept them. | 1        | 0        | 1        |
| Scientists cannot really predict how wildfires will affect the landscape.   | -1       | 0        | 1        |
| If someone’s camp or trapline burns, it will be harder to pass knowledge on to their grandchildren. | -2       | -2       | -3       |
| If all wildfires are suppressed, there may not be good subsistence in the future. | 2        | -1       | -2       |
| Climate change means more extreme fire weather and more intense wildfires. This could change how wildfires affect subsistence and the landscape. Wildfire management should take this into account. | 1        | 1        | 1        |
methods section, were used to produce the Q-sort statements while still in the field. These interviews were later transcribed, entered into ATLAS.ti, and coded for researcher-determined and emergent themes (Marshall & Rossman, 1995).

**Results**

Average statement scores were calculated from the respondents significantly matched to each factor (Table 1). Each factor represents a group of respondents with similar perspectives as expressed through their Q-sort.

Interestingly, factor groups separated by age, ethnicity, resource use, and employment (Tables 2 and 3).

Both resource management-agency employees and Caucasian residents not employed by agencies loaded higher on Factor 1 than Koyukon residents not employed by agencies (Figure 3). Older Koyukon residents generally loaded highest on Factor 2, and younger Koyukon residents loaded highest on Factor 3 (Figure 4).

**Factor 1: Natural and Necessary**

Factor 1 represented an abstract, ecological perspective on wildfires and its highest ranked statements came from resource managers (Table 1). This group, largely comprising Caucasian residents and resource managers, believed wildfires were important natural processes and worried that wildfire suppression would result in overgrown landscapes. For Factor 1 matches, wildfire was a tool to produce moose browse, and suppression was problematic because it limited moose browse. These respondents believed total suppression was impossible and that science should drive wildfire planning. Fifteen of the seventeen people matched to Factor 1 were resource management agency employees or Caucasian residents (Table 3). The majority was from Galena because Huslia has few Caucasian residents and no resident resource managers. Resource managers were enthusiastic about wildland fire and hoped it could increase moose populations through habitat improvement. In general, managers supported local subsistence activities and felt wildfires improved subsistence opportunities by maintaining a mosaic of successional stages on the landscape. Managers recognized local resistance to wildfire, but hoped education and in-town risk reduction would garner support for allowing wildfires to burn naturally.

**Negative Factors 1 and 3**

In Q-methodology, positive numbers represent agreement with statements and negative numbers signify disagreement. This means respondents opposed to a factor’s perspective match to the negative of that factor (McKeown & Thomas, 1988).

Four respondents scored as either negative Factor 1 (3 respondents) or negative Factor 3 (1 respondent). As Factor 1 represented the resource-manager position favoring wildfires, negative Factor 1 matches opposed most resource-manager statements, trusted local knowledge more than science, and felt wildfires damaged the landscape. As Factor 3 represented respondents less concerned about cultural places or local knowledge, the negative Factor 3 match believed wildfires threatened cultural sites, local knowledge was more important than science, and losing a trap line made teaching subsistence to grandchildren difficult.

All four negative factor matches were older Koyukon respondents, with an average age of 65 years. Semistructured interviews and participant observation with older Koyukon showed that childhood experiences shaped their perspectives. As children, they spoke Koyukon Athabascan, moved with their families between seasonal camps, and learned subsistence activities and traditional rules dictating respect for animals from their parents and grandparents.

Older respondents distrusted government agencies due to a lifetime of negative experiences, such as forced attendance at boarding schools where they were prohibited from speaking Koyukon Athabascan. Moreover, some of these elders had observed

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3 A qualitative data analysis software program.

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Table 2 Factor demographics, organized by declining resource use.

| Factor | Caucasian | Koyukon | Koyukon Avg Age | Traps | Extended Stays on Land |
|--------|-----------|---------|----------------|-------|------------------------|
| -1 and -3 | 0% | 100% | 65 | 100% | 100% |
| 2 | 10% | 90% | 60 | 50% | 70% |
| 3 | 20% | 80% | 40 | 20% | 30% |
| 1 | 82% | 18% | 49 | 12% | 24% |
relatives punished by nonlocal game wardens for traditional food harvesting and felt outsiders should not regulate Koyukon subsistence activities. Older Koyukon respondents had experienced drastic changes over their lifetimes and feared an increase in wildfires could further damage traditional livelihoods.

**Factor 2: Local Knowledge and Cultural Places**

Factor 2 matches, most of whom were older Koyukon, worried that wildfires could harm small animals, asserted that local knowledge should inform decision making, and distrusted decisions made in the name of “science.” These respondents disagreed with the statement “Wildfires are good because after a wildfire there is more unfrozen soil above the permafrost. This means that more things can grow.” As one respondent commented, “The more we lose our permafrost, the more we lose our land.” Factor 2 matches felt that the loss of old portages and camping sites to wildfires threatened cultural history. Overall, these respondents were connected to local landscapes and did not regard area forests as wilderness. This group also suspected it was less expensive to suppress wildfires while they were small. Many Factor 2 matches, although concerned about wildfire-induced subsistence hardships, agreed that wildfires were natural and could improve moose habitat. Basically, this group considered wildfires to be complex, with both positive and negative effects, and wanted more local involvement in decision making. Most supported statements from both elders and resource managers (Table 1).

Eight of the ten respondents matched to Factor 2 were Koyukon over the age of 50 (Koyukon average age 60) who used the boreal forest frequently and valued traditional knowledge. Factor 2 matches expressed that large boreal forest wildfires complicated access, as trees fell across trails, and the lack of shelter hindered winter travel. In addition, many older residents described favorite places transformed by wildfires into impenetrable areas of fallen trees and ash. These respondents feared subsistence in affected areas would not recover during their active years. Finally, older Koyukon worried about small animals burning, as, according to Koyukon culture, disrespecting animals prevents successful subsistence.

**Factor 3: Take It as It Comes**

Factor 3 matches, mostly young or middle-aged Koyukon, believed wildfires were natural and could improve trapping, landscape diversity, and moose habitat, but did not feel wildfire suppression would cause an overgrown landscape. They thought it might be cheaper to suppress wildfires while they were small. This group worried about small animals burning in wildfires but thought that losing camps, trap lines, or historic places did not threaten cultural history or subsistence. Overall, these respondents indicated that both subsistence and culture were resilient. Factor 3 matches mostly agreed with resource manager statements, but they supported some statements from Koyukon elders (Table 1).

Eight of the ten people matched to Factor 3 were young or middle-aged Koyukon (Koyukon average age 40). Participant observation showed that younger Koyukon engaged in subsistence activities. Unlike older Koyukon, most younger respondents did not live in seasonal camps or speak Koyukon Athabascan as children. Instead, this generation grew up in villages and pursued subsistence activities on day trips or during stays at family camps. Younger Koyukon prioritized subsistence, but did not express the same sense of loss or distrust of management as older Koyukon.

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*Note: Children were sent far away from their home villages and unwilling parents were threatened with imprisonment.*
Table 3 Demographics of factor matches. Rows represent study participants. Bold numbers indicate a factor match.

| Match | Gender | Ethnicity | Age | Agency | Town | Factor 1 Loading | Factor 2 Loading | Factor 3 Loading |
|-------|--------|-----------|-----|--------|------|-----------------|-----------------|-----------------|
| Factor 1 Matches | | | | | | | | |
| Female | Caucasian | 40 | No | Galena | 0.82 | 0.13 | 0.05 |
| Male | Caucasian | 62 | No | Galena | 0.82 | 0.15 | 0.02 |
| Male | Caucasian | 47 | Yes | Galena | 0.81 | -0.17 | 0.34 |
| Female | Athabascan | 29 | Yes | Temporary | 0.79 | -0.04 | 0.14 |
| Male | Caucasian | 32 | Yes | Temporary | 0.77 | 0.27 | 0.13 |
| Male | Caucasian | 58 | Yes | Galena | 0.74 | 0.12 | 0.39 |
| Female | Caucasian | 40 | Yes | Galena | 0.72 | 0.10 | 0.21 |
| Male | Caucasian | 58 | No | Huslia | 0.71 | 0.25 | 0.22 |
| Female | Caucasian | 37 | Yes | Galena | 0.70 | -0.12 | 0.25 |
| Male | Koyukon | 40 | Yes | Galena | 0.70 | 0.24 | -0.16 |
| Male | Caucasian | 41 | Yes | Galena | 0.67 | -0.04 | 0.40 |
| Female | Koyukon | 46 | No | Galena | 0.63 | 0.35 | 0.36 |
| Female | Caucasian | 50 | No | Galena | 0.62 | -0.04 | 0.36 |
| Male | Caucasian | 52 | Yes | Temporary | 0.53 | 0.24 | 0.38 |
| Female | Caucasian | 57 | No | Galena | 0.48 | 0.44 | -0.14 |
| Female | Caucasian | 52 | No | Huslia | 0.47 | -0.13 | 0.39 |
| Male | Koyukon | 62 | No | Huslia | 0.47 | -0.19 | 0.39 |
| Factor 2 Matches | | | | | | | | |
| Female | Koyukon | 67 | No | Galena | 0.03 | 0.77 | 0.06 |
| Female | Koyukon | 60 | No | Huslia | 0.16 | 0.73 | 0.47 |
| Male | Koyukon | 62 | No | Huslia | 0.36 | 0.67 | 0.13 |
| Male | Koyukon | 69 | No | Galena | -0.45 | 0.59 | -0.15 |
| Male | Koyukon | 52 | No | Galena | -0.05 | 0.58 | -0.11 |
| Male | Koyukon | 60 | No | Galena | 0.37 | 0.54 | 0.38 |
| Female | Koyukon | 38 | No | Huslia | 0.04 | 0.53 | -0.01 |
| Male | Koyukon | 63 | No | Galena | 0.24 | 0.51 | 0.43 |
| Female | Caucasian | 42 | Yes | Temporary | 0.35 | 0.47 | 0.30 |
| Female | Koyukon | 67 | No | Huslia | -0.27 | 0.38 | -0.02 |
| Factor 3 Matches | | | | | | | | |
| Male | Koyukon | 32 | No | Huslia | 0.11 | -0.01 | 0.68 |
| Female | Koyukon | 26 | No | Galena | 0.25 | 0.31 | 0.66 |
| Male | Koyukon | 52 | No | Huslia | 0.39 | 0.07 | 0.58 |
| Male | Koyukon | 48 | No | Huslia | -0.50 | 0.03 | 0.55 |
| Female | Koyukon | 31 | No | Huslia | 0.22 | -0.05 | 0.55 |
| Female | Koyukon | 22 | No | Galena | 0.15 | 0.09 | 0.55 |
| Male | Caucasian | 40 | No | Galena | 0.39 | 0.22 | 0.50 |
| Female | Caucasian | 57 | No | Galena | 0.42 | 0.17 | 0.47 |
| Male | Koyukon | 50 | No | Galena | 0.11 | 0.40 | 0.41 |
| Male | Koyukon | 58 | No | Galena | 0.06 | 0.33 | 0.40 |
| Negative Factor 1 Matches | | | | | | | | |
| Male | Koyukon | 64 | No | Galena | -0.55 | 0.28 | 0.39 |
| Male | Koyukon | 69 | No | Huslia | -0.69 | -0.07 | -0.13 |
| Female | Koyukon | 56 | No | Huslia | -0.61 | 0.15 | -0.16 |
| Negative Factor 3 Matches | | | | | | | | |
| Male | Koyukon | 71 | No | Galena | -0.25 | 0.46 | -0.59 |
| No Match | | | | | | | | |
| Male | Koyukon | 21 | No | Huslia | 0.19 | -0.29 | 0.28 |
| Female | Koyukon | 70 | No | Galena | 0.05 | 0.01 | -0.08 |
| Female | Koyukon | 21 | No | Huslia | -0.21 | -0.11 | -0.09 |
| Male | Koyukon | 50 | No | Huslia | 0.48 | 0.49 | 0.17 |
| Male | Koyukon | 46 | No | Galena | 0.12 | 0.49 | 0.50 |
Discussion

Koyukon respondents reviewing the results of this study agreed that the separation of younger and older Koyukon into distinct factor groups accurately reflected local realities. Value changes by generation have been noted locally, as well as documented around the world (Inglehart & Baker, 2000), but age-related differences in resource-management preferences have received less interest than categories such as ethnicity, class, livelihood, or gender (e.g., Rocheleau et al. 1996; Agrawal & Gibson, 2001). The lack of gender differences on this issue did not surprise respondents, who were, however, struck that no differences emerged between Koyukon residents of Galena and Huslia, as Galena is larger, 25% Caucasian, and considered less traditional.

The results indicated that older Koyukon were the group most dissatisfied with current wildfire management and most interested in participating in resource management. These elders believed local knowledge should drive management decisions and feared scientific management could not protect area livelihoods, ecosystems, and culturally significant places. Caucasian residents shared resource-manager perspectives and younger Koyukon were less frustrated with current management. This finding indicates that resource managers should target older Koyukon more than other groups for inclusion in management and supports Steelman & Maguire’s (1999) suggestion that participatory projects, rather than randomly recruiting large numbers of participants, can use Q-methodology to select participants representing important perspectives.

Some CBNRM programs have been criticized for forcing resource-dependent communities to meet government priorities (Schroeder, 2005). In a Q-method study no perspective dominates, as participants rank both community and resource manager-generated statements. The issues that arise are genuinely important to the different groups, and participatory processes addressing these issues are more democratic than programs focused only on government priorities. Additionally, democratic participation, as defined by Arnstein (1969), means stakeholders must be included in decision making, and not simply give opinions to decision makers. As such, the following policy suggestions address both the issues raised in the Q-sort and methods for giving residents some decision-making power.

Policy Suggestions

1. Conduct Collaborative Research Projects to Address Locally Important Issues

Koyukon elders strongly disagreed with the statement “Decisions about wildfire policy should be made using science” and some felt science was used to discredit traditional knowledge and local experience. One resident explained that he felt “science means not us.” As such, research projects that bring together traditional knowledge and science should be a management priority. Management decisions based upon collaborative research will be strengthened by elders’ traditional knowledge and long observation and will have more credibility with community members. Research should address topics important to Koyukon elders, such as small animals burning in wildfires or the effects of wildfires on important subsistence species or permafrost.

Older and younger Koyukon shared a concern about wildfires killing small animals such as furbears and birds. Koyukon follow an ethical code dictating respect for animals, as disrespecting animals prevents success in subsistence activities (Nelson, 1983). Elders worried about wildfires during denning and nesting times. To address this concern, managers and elders could list species of concern, map denning or nesting areas, and determine high-risk time periods. Applicable methods include that of Kangas et al. (2008), where residents map important areas, or of Hytönen et al. (2002) that combine respondents’ qualitative descriptions, such as “old growth spruce forest,” with forest-inventory data. As the Koyukuk NWR FMP already protects sensitive biological communities such as peregrine falcon habitat or critical caribou habitat (Alaska Region U.S. Fish and Wildlife Service, 2005), this approach would not conflict with current policy but rather extend it by having elders help determine sensitive habitat.

2. Work with Elders to Map Cultural Sites and Prioritize Some for Protection

Older Koyukon respondents’ attachment to cultural places separated them from other groups. The Koyukon sense of place is not an anomaly, as many traditional cultures value place, not just as a space that produces material goods, but as an important part of cultural identity (Thornton, 1995; Basso, 1996; Watson & Huntington, 2008). Roth (2004) claims that traditional and resource management-agency knowledge cannot be reconciled without considering the spatial dimensions of knowledge, use, and management practices. Additionally, Kangas et al. (2008) argue that participatory spatial planning can be more useful than value-based surveys and describe a method for mapping respondents’ place-based values. Managers could help elders prioritize important cultural places, using Kangas et al.’s (2008) method or Hytönen et al.’s (2002) technique for weighting important places. The Koyukuk NWR FMP already
allows cultural and historic site protection, but a “Regional Archeologist or Cultural Resources Specialist” must identify these sites (Alaska Region U.S. Fish and Wildlife Service, 2005). Extending this policy to allow local elders to identify cultural and historic sites needing protection could help diminish anxiety about cultural losses in wildfires.

3. **Provide More Information about Wildfire Suppression Costs**

Finally, all Koyukon groups suspected it cost less to fight wildfires while they were small. The Koyukuk NWR FMP suggests wildfire-ecology education, as recommended by the biological literature, to help the public accept wildfires (Dombeck et al. 2004; Kauffman, 2004; Alaska Region U.S. Fish and Wildlife Service, 2005). Since wildfires cause direct material losses for Koyukon residents, frustration with wildfire policies persists even after education and outreach efforts. Some residents suspect that managers have the funding to suppress wildfires but choose not to do so because of the agency position that wildfires are ecologically beneficial. If areas burn because suppression is too costly or dangerous, managers should explain this, as many residents would find that to be a more acceptable reason. Any flexibility in the allocation of suppression funds could be passed to residents through a structured value referendum, in which respondents read about the predicted costs and benefits of various options and then vote for their preferred option (McDaniels & Thomas, 1999).

**Conclusion**

Although sustainable resource management depends upon community participation, engaging communities has proven difficult, sometimes due to value differences. This study shows how identifying resource user-interest groups and their concerns can help projects develop equitable environmental goals. Q-methodology was used to identify the stakeholders and issues that should be included in equitable wildfire management on public lands traditionally used by Alaskan indigenous communities. The analysis shows that only one stakeholder group, older Koyukon, strongly desired participation, suggesting that future participatory processes should reach out to these knowledgeable elders. Additionally, the study generated policy suggestions to address Koyukon elders’ concerns about wildfires affecting cultural sites and ecologically sensitive areas. Results also indicated that among societies in transition, age may be an understudied driver of resource-use preferences. As this case study demonstrates, Q-methodology provides a practical approach to re-source-management conflicts; the act of systemically describing user groups and their concerns can generate novel solutions to policy disagreements.

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ARTICLE

Causal efficacy and the normative notion of sustainability science

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Sustainability science requires both a descriptive understanding and a normative approach. Modern science, however, began as purely descriptive knowledge, the core of which is that matter is dynamically inert and without purpose. The British philosopher David Hume concluded that the only type of causation in the material world is "efficient causation," which supported this purposeless view of a deterministic world "governed" by the causal laws of dynamics. But Hume did not argue against the existence of efficacious causation, only the error of humans projecting the mind's efficacy to objects. Though dynamically inert, a material object away from equilibrium can be thermodynamically reactive, suggesting the possibility of the object being efficaciously managed for a purpose. Furthermore, quantum physics has replaced classical physics as the fundamental theory of the material world. Its basic equation, the Schrödinger wave-equation, is deterministic but causally inert—it cannot govern, leaving the determinism door unlocked. This causal gap, according to the von Neumann-Stapp quantum measurement/activation theory, necessitates the pragmatic existence in an irreversible universe of the causal efficacy of mental effort and information management. The resulting "bigger" empirical science has room for "descriptive determinism" and "normative action," both of which are utterly essential in formulating sustainability science as an integral discipline.

KEYWORDS: theories, cause-effect relationships, interdisciplinary research

Introduction

Sustainability science requires both a descriptive knowledge and a normative approach. The knowledge of descriptive necessity presupposes the efficacious causation of an orderly nature. The course of normative actions presumes, in addition, the efficacious causal decision that is based on sound descriptive knowledge. This article considers the existence and the nature of efficacious causation by first investigating the British philosopher David Hume’s philosophical position on efficacy and then placing the concept of efficacy in today’s frameworks of irreversible thermodynamics and Copenhagen-von Neumann quantum physics. The objective is the establishment of efficacious causation as a scientific concept.

Hume’s empiricism was rediscovered when the climate of philosophy and science in the twentieth century turned toward naturalism, materialism, and reductionism. Materialist naturalism, which admitted only efficient causation, denying the ontological existence of efficacy, came to dominate and define the past century of science and technology as the guiding vision of an extraordinarily productive modern era of pragmatic quantum physics and molecular biology.

At the dawn of the twenty-first century, however, “having benefited from the great gains in fundamental science that reductionism made possible, we again turn our attention to fundamental integration [the Humboldtian unity of nature]—whether called consilience...or sustainability science. Sustainability science returns to ask the question about the unity of nature” (Kates, 2000). Sustainability is a normative concept regarding not merely what is, but also what ought to be the human use of the Earth (Kates, 2001). The purposeful and normative nature of sustainability is meaningful only if human action is efficacious (Daly, 2008), a key concept in Hume’s argument against anthropomorphism. The first part of this article provides a critical philosophical analysis of Hume’s Treatise (Hume, 1985) to argue that the twentieth-century materialist naturalism inspired by Hume turns out to be the opposite of Hume’s real conclusion. Hume’s naturalism is not materialistic: he is not a reductionist. He denies the efficacy of physical causes, not the existence of efficacious anthropogenic power.

Hume did not elucidate the nature of efficacy. Indeed no one could find efficacy within the framework of the classical physics of the pre-Carnot and
The second part of this article suggests a scientific explication of efficacy based on the second law of thermodynamics and the pivotal role of information (and information processing in the context of the quantumneurophysical model of mind-body interaction).

The Sciences of Motion and Matter and the Philosophy of Causation

“Every science begins as philosophy and ends as art,” as Durant (1926) observed astutely. It may not be that every science began as philosophy, but certainly the best sciences began as philosophical problems. When a philosophical problem was solved successfully, it disappeared as a philosophical issue and became a scientific discipline. Such transformations started first with Galileo and Newton, who took the philosophical question of who is the unmoved mover(s) and transformed it into a scientific investigation of motion. The ancient philosophical controversy, between the atomist school of Leucippus and Democritus and the school of Socrates, Plato, and Aristotle, on the nature of matter remained unresolved after the Copernican-Newtonian revolution. However, since the beginning of the twentieth century, matter has been incontrovertibly shown to be made of molecules and atoms. The science of matter that had begun as philosophical atomism ended as the pragmatic quantum theory of matter—and led to quantum electronic/nucleus gadgets such as transistors and magnetic resonance imaging (MRI) scanners.

Another crucial question in science is the nature of causation. The philosophical debate of causation’s true meaning extends over millennia. In the Western philosophical tradition, the discussion stretches back to at least Aristotle. Over the centuries, many philosophers followed Aristotle and developed the view of cause and effect as a logical connection of some sort. This view equating causality with a logically necessary connection was overthrown by Hume, whose analysis concluded that the validity of science was based on empirical grounds, not logical necessity. And he could find only efficient causation in scientific laws, not power or efficacy. That is, Hume found no efficacious connection between event A and event B as described by scientific laws to justify claiming “A causes B.” As Russell (1945) noted, The strongest argument on Hume’s side is to be derived from the character of causal laws in physics. It appears that simple rules of the form “A causes B” are never to be admitted in science, except as crude suggestions in early stages. The causal laws by which such simple rules are replaced in well-developed sciences are so complex that no one can suppose them given in perception;...So far as the physical sciences are concerned, Hume is wholly in the right: such propositions as “A causes B” are never to be accepted, and our inclination to accept them is to be explained by the laws of habit and association.

Hume’s great discovery is an example of the scientific capture of a broad philosophical concept of causation and the reduction of it into the narrower, but more precisely defined, scientific concept of efficient causation. Efficient causation may be scientifically defined as event-connection characterized by constant conjunction and invariable succession in conformity with [note: not “as governed by”] laws of nature. However, this process of capture did not transform causation into a purely scientific problem. The German philosopher Immanuel Kant’s powerful response to Hume’s skepticism was a philosophical one and the philosophical issue of causation did not disappear. The topic remains a staple in contemporary philosophy. A true transformation awaits a successful scientific response.

Causality for Sustainability Science

Sustainability is a normative concept. Clark et al. (2005) have argued that the fundamental difference between descriptive objective science since Copernicus and Galileo and the new sustainability science calls for a second Copernican Revolution. The new science emerging from this required revolution, while it is deeply rooted in the “exact and objective” tradition, must transcend it in three crucial ways:

2 The term “second Copernican Revolution” was first used by Scheltinghuber (1999).
3 The exact and objective tradition is the Galilean and Newtonian tradition of descriptive science. In the twentieth century this tradition was already critiqued by Michael Polanyi (1958) who argued that even in the exact sciences, “knowing” is an art, of which the skill of the knower is a logically necessary part (a point not unlike one made by Kant who argued that “knowing” originates from presupposition or a priori categories of the mind). The tendency to make knowledge impersonal in our culture has split fact from value, science from humanity. Polanyi made the case for substituting for the impersonal ideal of objective science an alternative ideal, the post-critical philosophical ideal.

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1 In the period of pre-Carnot physics, a material object is dynamically inert without the understanding that it can be thermodynamically reactive when it is away from equilibrium.
1. Introduces a systems approach beyond the limits of an object approach to comprehend the existence of the Earth system at “far from thermodynamic equilibrium.”

2. Addresses the complexity and contingency of such a system as a result of it being brought about by efficacious causation, instead of it being limited to “clockwork” regularity as described by laws of nature (efficient causality).

3. Accepts the epistemological insight derived from Copenhagen quantum physics that abandons the sharp “borderlines between observing subjects and scrutinized objects.”

Others have made similar points by calling for the explicit need for a new kind of “knowledge to inform policy and management decisions” (Lubchenco, 1998). In her 1997 Presidential Address to the American Association for the Advancement of Science, Jane Lubchenco (1998) stated that, in recognizing the urgent need for knowledge to understand and manage the biosphere, I propose that the scientific community formulate a new Social Contract for science… [The Contract] should express a commitment to harness the full power of the scientific enterprise in discovering new knowledge, in communicating existing and new understanding to the public and to policymakers, and in helping society move toward a more sustainable biosphere.

Gallopín et al. (2001) argued for a “science for the twenty-first century” that involves “both natural and social scientists in the investigation of the necessary steps to develop a sustainability science.” Kay et al. (1999) referred to such science as post-normal science (a concept developed by Silvio Funtowicz and Jerome Ravetz)4 and wrote that only post-normal science is able to provide “a coherent conceptual basis, in the workings of both natural systems and decision systems.” Common to all three proposals is that sustainability science requires both a descriptive understanding of the biosphere and the normative management of a human-dominated Earth system (Vitousek et al. 1997). Here, management, or efficacious causation, is a necessary concept (Vitousek et al. 1997). Yet, materialist naturalists consider efficacy and purpose to be an illusion. Acknowledging other broad issues in these proposals, this article focuses on the crucial issue of causation and argues for replacing materialist naturalism with a new “ecological naturalism” for a “bigger” empirical science.

**Causation and Hume’s Naturalism**

Because David Hume is the most influential philosopher ever to write on causation, it is necessary to begin with a critical discussion of his thought. Standardly, it is common to interpret his great discovery as advancing two views: (1) the regularist view on laws of nature that scientific propositions are mere descriptions of the uniformities or regularities in the world since induction cannot establish the necessity of propositions;5 (2) the reductionist view (see Footnote 5) that causality is exhausted by (equal to) constant conjunction and invariable succession (i.e., as Curd & Cover (1998) put it, “causal connections are a species of lawlike connections”), which do not imply causal efficacy.

It is reassuring for the author, as an engineer, to learn that “New Hume” scholarship (Wright, 1983; Kemp Smith, 2005) offers a revised interpretation of the philosopher’s position on matters relating to the first of the two views:

What, historically, until late in the Twentieth Century, was called the “Humean” account of Laws of Nature was a misnomer. Hume himself was no “Humean” as regards laws of nature. Hume, it turns out, was a Necessary—i.e., believed that laws of nature are in some sense “necessary” (although of course not logically necessary). His legendary skepticism was epistemological. He was concerned, indeed even baffled, how our knowledge of physical necessity could arise. What, in experience, accounted for the origin of the idea? What, in experience, provided evidence of the existence of the property? He could find nothing that played such a role. Yet, in spite of his epistemological skepticism, he persisted in his belief that laws of nature are (physical) necessities (Swartz, 2009).

Hume did answer his perplexity in the following way: “What principally gives authority to this system is, beside the undoubted arguments, upon which each part is founded, the agreement of these parts, and the

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4 See Funtowicz & Ravetz (1993).

5 See the glossary of Curd & Cover (1998) for the definition of “regularist.” Both “regularity theory of laws” and “reductionism” are defined there. Two additional points are that: (1) philosophical terms in the article follow usage in this glossary to the extent that is possible; (2) Curd & Cover also point out that the regularity theory of causation is a “conjunction” of both the regularist view/claim on laws and the reductionist view/claim on causation.
necessity of one to explain another‖ (Hume, 1985, 1.3.13.19). This method of achieving the physical necessity (Hume, 1985, 1.3.14.33) or “truth” of scientific propositions is expressed today as consilience, the unity of knowledge linking together propositions/laws from different branches/disciplines, especially when forming a comprehensive theory. We achieve a degree of “certainty” through “consilience-concurring” the totality of our established propositions/laws from different disciplines by canonical principles—in addition to the application of induction to each single proposition alone. The principle of energy conservation is an outstanding example of a canonical principle that applies to all scientific disciplines, linking together various other propositions in individual disciplines. As Quine (1951) puts it, “The totality of our so-called knowledge or beliefs, from the most casual matters of geography and history to the profoundest laws of atomic physics or even of pure mathematics and logic, is a man-made fabric which impinges on experience only along the edges.”

A principal source of old misunderstandings is that Hume used necessity and power interchangeably in many cases so that when he denied necessity he was actually denying power in physical causality, not physical necessity (or the doctrine of necessity).6

We now turn to our main concern with respect to Hume’s position on causality (matter relating to the second of the two views). In Treatise, he made the most sustained and systematic analysis on the nature of physical causality. A summary of the analysis is succinctly captured by Fiske (1874):

Physics knows nothing of causation except that it is the invariable and unconditional sequence of one event upon another. July does not cause August, though it invariably precedes it.

The invariable Necessitarian necessity does not come with the efficacy or power of a real causation; physical causality is only efficient causality, not efficacious causality. This subtle difference has wide-ranging implications. Hume’s position on this matter with regard to whether his naturalism was reductionistic is considered below.

First, Hume only denied the power or efficacy of physical causality, not the idea of power:

And this we may observe to be the source of all the relations of interest and duty, by which men influence each other in society, and are placed in the ties of government and subordination. A master is such-a-one as by his situation, arising either from force or agreement, has a power of directing in certain particulars the actions of another, whom we call servant. A judge is one, who in all disputed cases can fix by his opinion the possession or property of anything betwixt any members of the society. When a person is possessed of any power, there is no more required to convert it into action, but the exertion of the will (Treatise 59-60, 1.1.4.5).

It is this power or efficacy that he tried to find in the physical world of matter.

The heart of Treatise relevant to this search can be found in Book I: Part III: Section XIV: Of the Idea of Necessary Connexion. Here, Hume limits himself to considering the nature of causality in the physical world of pure matter. His conclusion is clear that there is no power or efficacy in the connection of material events: “matter is in itself entirely unactive, and deprived of any power” (Treatise 209, 1.3.14.9). A large part of the misunderstanding of Hume derived from his use of the term necessity or necessary connexion: “I begin with observing that the terms of efficacy, agency, power, force, energy, necessity, connexion, and productive quality, are all nearly synonymous” (Treatise 206, 1.3.14.4). This is unfortunate, because he did not always use them as synonymous terms. A close reading reveals that he used “necessity” as a broader term than “power,” with at least two meanings: as physical necessity in his doctrine of necessity and as power or efficacy.7 What he repudiated in this section is the power and efficacy, not the necessity, of physical causality. “Upon the

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6 See Hume (2000) Chapter 8, Of Liberty and Necessity.

7 Millican (2008) writes, “This suggestion can be backed up with an analysis of Hume’s usage of the various terms concerned, which reveals an interesting and significant pattern in both main discussions of the idea in question. In Treatise I iii 14, he refers to the idea of ‘power’ or ‘efficacy’ roughly three times more often than he does to the idea of ‘necessity’ or ‘necessary connexion’, and the only parts of that long discussion where he prefers the latter terms are in the section’s title, the very first paragraph (as quoted in §1 above), and in a short passage of less than 250 words between the end of paragraph 20 and paragraph 22 (T 166-5-6). Shortly before this passage he introduces talk of ‘power or connexion’ (T 163), without any clear implication of strict necessity. In Enquiry VII, Hume refers numerous times to the idea of ‘power or necessary connexion’, though mainly in parts of his discussion where he is introducing (E 63, E 64) or reviewing (E 73, 78) the main stages of the argument, and in the section’s original title. Within the body of the argument itself, he almost always prefers either ‘power’ alone or various combinations of ‘power’, ‘force’ and ‘energy’, never referring to the idea of necessity or necessary connexion except in one short passage, the first half of a single paragraph (E 75) in which he refers initially to ‘this idea of a necessary connexion among events’ and later to ‘the idea of power and necessary connexion’.”
whole, necessity is something, that exists in the mind, not in the objects” (Treatise 216, 1.3.14.22) should be read as “power is something, which exists in the mind, not in the objects.” He could not find in the natural occurrences of the material world the power and efficacy that he referred to in human affairs, and, as one of the greatest champions against anthropomorphism, warned against the projection of mind to objects.

In this warning, Hume denied physical objects the anthropogenic power to govern:

I am, indeed ready to allow, that there may be several qualities both in material and immaterial objects, with which we are utterly unacquainted; and if we please to call these power or efficacy, ‘twill be of little consequence to the world. But when, instead of meaning these unknown qualities, we make the terms of power and efficacy signify something, of which we have a clear idea, and which is incompatible with those objects, to which we apply it, obscurity and error begin to take place, and we are led astray by a false philosophy. This is the case, when we transfer the determination of the thought to external objects, and suppose any real intelligible connexion betwixt them; that being a quality, which can only belong to the mind that considers them (Treatise 218-219, 1.3.14.27).

The error is the false philosophy of materialistic-reductionistic naturalism of causal closure (see below). Hume’s more important conclusion is not that physical causality is exhausted by (equal to) constant conjunction and invariable succession—i.e., there is no efficacy in physical causality—but that man should not project the efficacy in conducting human affairs to the natural events of physical objects. Hume did not reject efficacy: he was not a reductionist and the twentieth-century reductionistic interpretation is the opposite of his real conclusion as the next section further examines.

Causal Closure vs. Hume’s Compatibilism

“Matter is in itself entirely unactive, and depriv’d of any power” (Treatise 209, 1.3.14.9): matter is dynamically inert; it cannot strive or act. While God is omniscient and omnipotent, matter is not supposed to have any kind of power—definitely not the power to constrain. Hume was perfectly clear on this point (see below). A strange thing, then, happened to science: in the twentieth century, scientists and philosophers—in a move that showed the vestige of God’s omnipotence—gave governing power to the laws of nature. That is, force-driven interactions inclusively produce physical effects. Nothing else can cause physical effects according to twentieth-century materialist naturalism.

There is an interesting history to science’s view about the kinds of things that can “cause” physical effects. Early Newtonian physics did not impose excluding restrictions on possible causes of physical effects; indeed, Newton himself was not a Newtonian. The philosophes of the eighteenth-century Enlightenment formulated the worldview now known as Newtonianism; a few Newtonians in the eighteenth century were converted into strict materialists.

However, for the majority of scientists and philosophers, the first step of the conversion (hardening) of Newtonianism into naturalism took place, according to Papineau (2009), only in the nineteenth century with the discovery of the conservation of energy (and of evolutionary theory). Even so:

The nineteenth-century discovery of the conservation of energy continued to allow that sui generis non-physical forces can interact with the physical world, but...any such mental forces would need to be law governed and thus amenable to scientific investigation along with more familiar physical forces...If mental or vital forces arose spontaneously, then there would be nothing to ensure that they never led to energy increases (Papineau, 2009; emphasis added).

When, during the course of the twentieth century, “detailed physiological research gave no indication of any physical effects that cannot be explained in terms of basic physical forces,” Papineau (2009) continued, “belief in sui generis mental or vital forces had become a minority view. This led to [the second step in] the widespread acceptance of the doctrine now known as the ‘causal closure’ of the physical realm” (emphasis added). This step completed the conversion to materialist naturalism. In a causally closed physical universe, a human lived in “a world that is deaf to his music, just as indifferent to his hopes as it is to his suffering or his crimes” (Monod, 1971).

The idea of a causally closed world also coincided with the transformation of the triumph of atomism into radical atomism—the philosophy according to which the absolute and timeless properties of elementary particles capture eternal reality (Smolin, 1997). The presuppositions of causal closure and radical atomism are, of course, metaphysical, not propositions based on scientific evidence. Smolin (1997) remarks, “I want to suggest that per-
haps the answer is that the belief in radical atomism in the existence of a final and absolute theory that governs the behavior of the elementary particles [thus, life and man]—is as much a religious as it is scientific aspiration.”

In a causally closed world without efficacy, matter is the sole determinate of physical effects. But, even so, “determination” is not governing, nor is “necessity” constraint. It is logically fallacious to repudiate anthropomorphism by stripping away from material objects their anthropogenic power as Hume argued, and then turning 180 degrees to impart to material objects that very anthropogenic power so that matter can govern over a causally closed world. Collingwood (1940) argued, “The so-called ‘materialism’ which was the favorite metaphysical doctrine of these anti-metaphysicians was in consequence only in name a repudiation of anthropomorphism; really it was anthropomorphic at the core.”

Hume’s doctrine of necessity is not the necessity of hard determinism, but of “soft determinism” (“descriptive determinism”) or compatibilism: “By liberty, then, we can only mean a power of acting or not acting, according to the determinations of the will... this hypothetical liberty is universally allowed to belong to everyone who is not a prisoner and in chains” (Hume, 2000) and “Liberty, when opposed to necessity, not to constraint, is the same thing with chance [see comment below with regard to the lack of understanding on chance and statistical physics in the eighteenth century]; which is universally allowed to have no existence” (Hume, 2000). Liberty is compatible with necessity, so is action; they are only opposed to constraint, not necessity. Here, Hume explicitly holds that physical necessity does not equal constraint, or restraint, or governing, contradicting squarely with hard determinism.

I thus define efficacious causation as event-connection in conformity with laws of nature resulting from action that utilizes matter’s internal thermodynamic “force.” This does not mean that matter has any kind of “free will.” However, it does mean that matter can be managed by the action of living things requiring no “heavy lifting” or mental force (as explained in the section below). What Hume’s philosophy does say is that it finds no efficacy in the material world alone; therefore, efficacy requires a nonmaterial origination. The following sections take a critical look at the two principal elements of the “man-made fabric” of causal closure: the absence of mental force in accordance with the energy-conservation law and the materialism of classical physics. The first part is an original proposal/result of my research and the second part is a proposal by Stapp (2001) based on orthodox Copenhagen-von Neumann quantum physics (see also Schwartz et al. 2005).

Comprehending Efficacious Causation in Terms of Force-Driven and Spontaneity-Driven Interactions

The first law of energy conservation is completely consistent with the dynamical laws of physical forces. Dynamical forces, however, are not the only cause for physical effects. Matter is dynamically inert. However, matter away from equilibrium can be thermodynamically reactive or subject to spontaneous changes (Prigogine & Stengers, 1984). These changes result from another kind of “forces”—entropic “forces.” The first law is also consistent with this “force” in the form of the principle of the increase of entropy, or the second law, which accounts for spontaneous natural processes (Wang, 2007; 2011). Their consistency is assured, in the first place, by the fact that the two laws were simultaneously formulated by Rudolf Clausius between the years 1850 and 1865 with the assistance of Lord Kelvin.

One aspect of the new “forces” remains completely in accord with the existing materialist naturalism: the mechanistic laws of dynamical forces, the great law of conservation of energy-mass, and the entropy principle remain a consistent set of core ideas for a worldview of a causally closed world, as seen in Figure 1. In this world, physical effects are caused by physical or efficient causality alone.

However, the full implication of the second law points to a fundamental departure from twentieth-century naturalism by creating room for managed application of the entropic “forces,” i.e., heat and spontaneity (Wang, 2011). As shown in Figure 2, once we admit the possibility of managed events taking advantage of the irreversibility of nature, the implication of the mechanistic laws of nature become much greater. As Poincaré (1946) pointed out, “In the deterministic hypothesis there is [in every event] only a single possibility [of invariable succession].” In view of the second law, however, the full implication of the mechanistic laws of nature is to provide a possibility space vastly bigger than that of the causally closed world (see Figure 2). Compton (1967) wrote, A set of known physical conditions is not adequate to specify precisely what a forthcoming event will be. These conditions, insofar as they can be known, define instead a range of possible events from among which some particular event will occur. When one exercises freedom, by his act of choice he is

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8 This is the definition of “determinism” or “hard determinism,” a term invented by William James.
himself adding a factor not supplied by the physical conditions and is thus himself determining what will occur...Thus the way is cleared for our great task. We are free to shape our destiny. Science opens vast new opportunities.

That is, hidden in the quantum mechanical laws lay unimaginably rich possible options. But those laws provide only the possibility space for what can happen, not the construction of the reality that actually does happen. Ellis (2008) has made the same argument in recent times. Likewise, the conservation law of energy-mass is merely able to provide its version of possibility space. To make possibility into actuality requires both the entropic "forces" of nature and their management through information. Only spontaneity (the entropic "force") can determine whether, in accordance with mechanistic and conservation laws, a given possibility is entropically possible in the macroscopic reality space, for example, whether a given chemical reaction or a given fission reaction is entropically possible. The physical possibilities (though not their efficacious construction) of macroscopic events are jointly "determined" by (1) the mechanistic laws, (2) the mass-energy conservation law, and (3) the entropic "forces."

Moreover, what makes a spontaneity-driven or entropic forces-driven causation efficacious is (4) the information management of the entropic "forces"—the last of the four great ideas necessary for comprehending the real world. Hume wrote that power is something which exists in the mind. Actually, power is associated with information management with or without the mind; the possibility of information management exists for any living organism, including ones without minds. The ability to manage information is one of the characteristics of life. Let us consider for now (and in the next section) the example of efficacious causation in terms of the mind. The brain, the physical "mind," cannot bend a spoon because the spoon lacks its own spontaneity engine. But, the brain can set in motion by a remote-control signal an internal combustion engine's ignition, or command a dog to run to you, because both the engine and the dog have their own "spontaneity reservoirs" or "entropic 'forces' reservoirs." 9 Entropic "forces" exist to be managed easily; this is not the case with dynamical forces. The brain generates no forces for physical effects; it is spontaneity that physically produces physical effects or physical events—the brain and information-signal merely set events in motion. This is what Hume meant, "When a person is possessed of any power, there is no more required to convert it into action, but the exertion of the will" (Treatise 1.1.4.5). Efficacious causation is the exertion of the will without having to do any physical heavy lifting.

9 An internal combustion engine is of course not alive as a dog is. What is common between the two is that both have their own spontaneity reservoirs. The agent is the only one that must be alive and thus can set both events in motion. The dog can just as well be a mechanical dog with its own battery, and it can be "commanded" by a remote control.
Scientists in the eighteenth century did not have an understanding of the second law of thermodynamics or of the nature of chance or statistical physics. It is not surprising that Hume was wrong about chance and had no conception of entropic “force.” The identification of the possibility of efficacious causation with the second law here is consistent with the view of Ladyman & Ross (2007):

Because all the special sciences take measurements at scales where real patterns conform to the Second Law of Thermodynamics, all special sciences traffic in locally dynamic real patterns. Thus it is useful for them to keep epistemic books by constructing their data into things, local forces, and cohesion relations. As we will discuss in the next chapter, causation is yet another notional-world conceptual instrument ubiquitous in special science. The great mistake of much traditional philosophy has been to try to read the metaphysical structure of the world directly from the categories of this notional-world book-keeping tool…In this context, reductionistic scientific realism has the odd consequence of denying their existence.

Taking directed, irreversible transmission of influence, plus conservation principles, for granted is rational when you know you’re taking all your measurements from regions governed by the Second Law. This practice conforms so closely to what is enjoined by a folk metaphysical endorsement of causation that no serious risk of misunderstanding arises if the scientist helps herself to the culturally inherited folk idea of causation. But she need not thereby endorse folk metaphysics.”

Efficacious causation is when life and humans make use of matter, the spontaneity of the irreversible world, and information to prescribe and construct the reality space—the creative living world—within the possibility space provided by the mechanistic science and subject to the mass-energy conservation constraints.

Figure 2 Ecological naturalism: a world of efficient and efficacious causation.
gressively more complex systems at far from thermodynamic equilibrium in the reality space.

One thermodynamic insight of efficacious causation is the concept of free heat in addition to the existing concept of waste heat (Wang, 2011). Instead of the inevitability of matter degenerating into waste heat, it is possible for life to harness free heat. Passive cooling and heating of buildings, maintained at far from equilibrium, are concrete examples of harnessing free heat (Meierhans, 1993; Wang, 2011). As I have written elsewhere, “The objective of thermodynamic management is not only the reduction/recovery of waste heat, but also the generation of free heat. Otherwise, no matter how successful man’s attempt in reducing/recovering waste heat is, it merely delays the eventual unsustainable doom” (Wang, 2011).

The Causal Gap for Information Management: The von Neumann-Stapp Quantum Theory

What makes a spontaneity-driven or entropic forces-driven causation efficacious is the information management of the entropic “forces.” But, “who” is the nonmaterial manager? The French philosopher René Descartes formulated the dualism of the mind and the body, with the mind as the manager. The important thing then was to inquire how the mind became aware (i.e., conscious and self-conscious) and how it succeeded in acting upon the body. A satisfactory answer cannot be found in classical physics, which is not surprising because classical physics is completely materialistic.

Just as the doctrine of causal closure and radical atomism reached its apogee, classical physics was shown to be empirically incorrect in the first quarter of the twentieth century and was replaced by quantum physics, a seminal discovery that turned the whole concept of what science is inside out. The core idea of classical physics was to describe the “world out there” with no reference to “our thought in here.” In quantum mechanics, “our thought in here” or “acts of knowing” become a fundamental reference point of the science:

Von Neumann capitalized upon the key Copenhagen move of bringing human choices into the theory of physical reality. But, whereas the Copenhagen approach excluded the bodies and brains of the human observers from the physical world that they sought to describe, von Neumann demanded logical cohesion and mathematical precision, and was willing to follow where this rational approach led. Being a mathematician, fortified by the rigor and precision of his thought, he seemed less intimidated than his physicist brethren by the sharp contrast between the nature of the world called for by the new mathematics and the nature of the world that the genius of Isaac Newton had concocted (Stapp, 2007).

Von Neumann carried out a detailed and mathematically rigorous analysis of the process of measurement to remove the ambiguity in the positioning of the “Heisenberg cut” by shifting parts involved in measurement into the physically described realm. Step by step, all parts of the universe that are conceived to be composed of atomic particles and the physical fields associated with them are positioned below the cut, and left above the cut is a residual experiential reality that von Neumann called the “abstract ego.” The physical processes below the cut are called “Process 2,” which evolve deterministically according to the Schrödinger equation between probing actions. The probing action by the abstract ego is called “Process 1,” which picks out from a potential continuum of overlapping possibilities of Process 2 some particular discrete possibilities. The third process, “Process 3,” is “choice on the part of nature” between “yes” and “no”—the statistically specified (based on quantum rules) outcome triggered by the probing action. Process 2 “governed” by the Schrödinger equation is deterministic, but causally inert because of Processes 1 and 3.

Stapp (2001; 2007) and his neuropsychologist collaborators (Schwartz et al. 2005) have extended von Neumann quantum mechanics into a new formalism, which contains a radical conceptual move insofar as quantum measurement is understood to involve efficacious conscious human choices. In particular, he postulates the mind’s effect on the activities of the brain as the connection between effort, attention, and so-called quantum Zeno effects. Stapp calls this “active Process 1” (Schwartz et al. 2005) or “Process zero” (Stapp, 2007).

I...will use here the more apt name “process zero,” because this process must precede von Neumann’s process 1. It is the absence from orthodox quantum theory of any description on the workings of process zero that constitutes the causal gap (emphasis added) in contemporary orthodox physical theory. It is this “latitude” offered by the quantum formalism in connection with the “freedom of experimentation” (Bohr, 1958) that blocks the causal closure of the physical, and thereby releases human actions from the immediate bondage of the
physically described aspects of reality (Stapp, 2007).

Quantum measurement problems become quantum measurement/activation problems.

It suffices to indicate the direction of this research program by reciting the abstract and the conclusion of Schwartz et al. (2005):

Contemporary physical theory brings directly and irreducibly into the overall causal structure certain psychologically described choices made by human agents about how they will act. This key development in basic physical theory is applicable to neuroscience, and it provides neuroscientists and psychologists with an alternative conceptual framework for describing neural processes … [The new framework] is able to represent more adequately than classic concepts the neuroplastic mechanisms relevant to the growing number of empirical studies of the capacity of directed attention and mental effort to systematically alter brain function.

Materialist ontology draws no support from contemporary physics and is in fact contradicted by it… These orthodox quantum equations, applied to human brains in the way suggested by John von Neumann, provide for a causal account of recent neuropsychological data. In this account brain behaviour that appears to be caused by mental effort is actually caused by mental effort: the causal efficacy of mental effort is no illusion (Schwartz et al. 2005).

The twentieth-century philosopher Anscombe (1971) made the insightful remark, “The laws’ being deterministic does not tell us whether ‘determinism’ is true.” The Schrödinger wave equation is deterministic but causally inert—it cannot strive or govern, leaving the determinism door unlocked. The von Neumann-Stapp causal gap necessitates the pragmatic existence in an irreversible universe of the causal efficacy of mental effort, which can be and will be subject to evidence-based scientific testing.

Looking Ahead and Up

The causal gap in the mathematics of quantum theory has the potential to overthrow the doctrine of causal closure of the material realm, which is fundamentally quantum mechanical. Rival proposed theories (of the von Neumann-Stapp quantum-theory) exist. One may look forward to a day when causation will disappear as a philosophical dispute and become a scientific subject. The concept of causation, which has room for “normative action” and “descriptive determinism,” and the second law will link together sustainability science and normal science (Kuhn, 1962). The resulting ecological-naturalism (Figure 2) accords equal objectivity to irreversible entropic “forces” as well as reversible dynamical forces, and to the world of information and mind as well as the world of matter and brain. “How can we know if any worldview is true? The ultimate test is the effect of the worldview in question upon the survival of its holders,” notes Robert Zubrin (2007). Ecological naturalism will help us to formulate what ought to be the human use of the Earth.

Murray (2003) commented on the materialist naturalism worldview this way,

It may well be that the period from the Enlightenment through the twentieth century will eventually be seen as a kind of adolescence of the species… In the manner of adolescents, humans reacted injudiciously, thinking that they possessed wisdom that invalidated all that had gone before.

But adolescents, eventually, will grow up and become explorers. In his sublime essay, Zubrin (2007) writes,

Humans are the descendants of explorers.

Four hundred million years ago, our distant ancestors forsook the aquatic environment in which they had evolved to explore and colonize the alien world above the shoreline. It is remarkable when you think about it—sacrificing the security of the waters for the hazards of the land… On land it is possible to build fires. On land it is possible to see the stars.

Out of the security of a causally closed cave humans can learn to see the stars and hear the music.

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INTRODUCTION

Introduction to the Forum on Transportation and Land Use in the Maryland Suburbs of Washington, DC

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Urban and suburban growth patterns have long been tied to major transit arteries. In the United States, older, inner suburbs initially followed streetcar routes and were organized around stations. As the automobile came to the fore after World War II, and the road network grew, it created extreme individual mobility, leading to the sprawling suburbs of the latter half of the twentieth century. This hypermobility brought a certain kind of freedom, but at a price, as exponentially more cars spurred congestion, leading to new roads and new developments, and yet additional traffic. Alongside the automobile and the highway came widely separated residential developments, shopping centers, and jobs (see, for instance, Duany et al. 2000). The environmental costs were high in habitat fragmentation, runoff from impervious surfaces due to roads and parking facilities, local pollution spurring health problems such as asthma, and increased carbon-dioxide emissions. Critics of sprawl also feel there has been a social cost in increasing isolation as people are cloistered in their vehicles and houses.

The Washington, DC outer suburbs developed during the 1950s and beyond, the greatest period of metropolitan dispersal in history. As such, these communities are characterized by extreme automobile dependence. The region consistently ranks as one of the most congested in the United States, and it continues to grow rapidly. Paradoxically, the state of Maryland has long been in the forefront of efforts to fight sprawl, beginning with its 1964 “wedges and corridors policy,” which called for compact urban development with access to rapid transit and shaped the basic architecture of county land use (MNCPPC, 1964). In 1980, the county government created an agricultural reserve protecting 93,000 acres, almost a third of the county, for farming and recreational uses (MontgomeryPlanning.org, 2008). Despite such progressive efforts, larger waves of sprawl and disabling congestion continue both in Montgomery County and throughout much of the state. What is needed, it seems, is better policy. Part of the answer is more sophisticated and accurate tools to measure and predict the effects of policy decisions. The two articles comprising this forum describe cutting-edge instruments to measure transit and land-use objectives.

Mishra Sabyasachee and her colleagues discuss the powerful Maryland Statewide Transportation Model (MSTM), which extends previous models by accounting for traffic from nearby states. The MSTM is being used to analyze many scenarios as part of an ongoing study. In this article, Sabyasachee and her coauthors compare a business-as-usual scenario and a high gasoline-price scenario to show that higher fuel cost does in fact lower the number and length of automobile trips. The study gives quantitative validation to environmental arguments for a higher gasoline tax. Further, it concludes that the high gasoline-prices scenario “results in clustered urban development as opposed to sprawl.” This finding suggests that policy affecting one element of the mobility problem can have long-term, synergistic effects, resulting in the establishment of virtuous cycles.

In the second forum article, Dan Hardy and his collaborators discuss how policy area mobility review (PAMR) accounts for an array of factors to quantify the effects, for instance, of new roads or transit systems on mobility. Unlike previous meth-

1The Washington, DC metropolitan area includes parts of Maryland and Virginia in both the inner and outer suburbs. Specifically, Montgomery County, Maryland is located to the north, Prince George’s County, Maryland to the east, and Fairfax County, Virginia to the south and west. The multiple jurisdictions can make regional governance difficult.
ods, PAMR accounts for the numerous interactions of car trips at various locations. This contribution shows how policy instruments develop in tandem with, and are wedded to, policy, as Montgomery County allows greater congestion in areas with better public transit, encouraging growth in those areas. Developers that upset this balance are responsible for implementing specific mitigation measures, such as providing additional transit. A precise policy instrument, such as PAMR, is thus crucial for calibrating growth.

A reading of Hardy and colleagues shows that policy is not set in a vacuum, that models, however sophisticated, are only as useful as the broader context allows. Policy is set by community norms in conjunction with a political process. The instruments described here deliver a powerful sense of precision, but in the real world are applied in conjunction with processes that account for community values. How much worth does a community give to automobility? How much does it value public transit? How important is the quality of the local environment to the community? While these values are key to defining policy objectives, the lobbying by interest groups also affects the outcome. In Montgomery County (as in many places) activist groups contend that property developers have an outsized role in determining policy, maintaining development outside core urban areas and transit hubs, and encouraging growth anti-theretical to regional balance. Still, numerous public transit projects and compact communities around transit hubs are being developed in Maryland’s suburbs adjoining Washington, DC. The town of Bethesda and downtown Silver Spring, for instance, are successful, vibrant mixed-use communities based around transit, while the proposed Purple Line light rail, which would connect Metro stops in inner suburbs throughout Montgomery and Prince George’s Counties, seems likely to be built. Planning departments predict traffic and transit trips generated with every new project, remaining a crucial part of every decision.

Sophisticated quantitative instruments, then, are a necessary, but not sufficient, part of the policy/politics equation needed for transit and growth decisions that truly encourage compact development, minimizing car use and infrastructure expansion. If transportation arteries define land use, and land use influences transportation decisions, sophisticated policy needs to account for multiple, intertwined effects. The implications of effective policy on sustainability are real and measurable. A recent study commissioned by the U.S. Environmental Protection Agency demonstrates that transit-oriented development can cut energy use significantly, in some cases nearly in half (Hernandez et al. 2011). It is becoming apparent that better transit and land use can go a long way toward the 80% reduction in greenhouse gases many sustainability proponents assert is needed for a healthy planet.

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Montgomery County, Maryland has an Adequate Public Facilities Ordinance (APFO) that requires the county’s Planning Board to determine that available or programmed transportation facilities can accommodate the peak-period trips that a proposed residential or commercial subdivision will generate before they can approve that subdivision. This requirement generates nearly continuous discussion among policy makers, residents, property developers, and other interest groups about what it means for a transportation system to be adequate. Since 2007, the county’s biennial growth policy has addressed that issue with a measure called Policy Area Mobility Review (PAMR). The review uses a regional travel-demand model to consider current and future system performance across 32 policy areas that range in size from ten to thirty square miles. The PAMR analysis integrates transit system and roadway system mobility measures, incorporating a county policy that transportation-system equity can be maintained by allowing more congestion in areas with better transit service. The regional nature of the PAMR analysis provides geographic and analytic capabilities beyond the typical traffic-impact study. The Montgomery County Planning Board (MCPB) uses PAMR for both near-term subdivision regulation for compliance with the APFO and long-term master-planning purposes. These characteristics of the PAMR application, plus context-sensitive development-mitigation approaches including peak-hour vehicle trip-reduction measures, additional public transit capacity, and nonautomobile-transportation facilities, help improve the sustainability of new development. This article describes how PAMR has worked and the issues its use has generated in integrating sustainability into the transportation-planning process.

KEYWORDS: regional planning, land use, metropolitan areas, transportation, travel, traffic management

Introduction

At what point does new development overburden a transportation system? How can new development best contribute to a sustainable network? These questions are addressed at different levels of scale and detail by planning and zoning practices around the world and require a careful synthesis of science and policy. The science aspect involves defining reliable, relevant, and consistent measures of effectiveness that can be forecasted. The policy aspect requires developing a system that is coherent and equitable, yet sensitive to judgments by elected officials.

Montgomery County is an urbanizing jurisdiction adjacent to Washington, DC with a long history of applying progressive growth-management strategies. Both the definition and achievement of transportation-system adequacy are topics of almost continuous debate among policy makers and county residents. The consideration of sustainability as part of the adequacy discussion has become increasingly important as the county matures from decades of active greenfield development to recognize that in the face of a growing population, housing stock, and economy, it retains little buildable raw land.

This article explores the state of practice in assessing the county’s transportation-system adequacy. At the heart of the matter is how travel-demand forecasting connects land-use and transportation planning in both near-term and long-term horizons, and how both measurement objectives and tools evolve under such circumstances and enhance sustainability. As an example, the Adequate Public Facilities Ordinance (APFO) provides an alternative review procedure for Policy Area Mobility Review (PAMR) within areas located in close proximity to Metro stations, based on incentives to direct growth to areas served by regular public transit that meets smart growth criteria. This procedure encourages infill development where transit service is plentiful, which reduces traffic congestion and vehicle-miles of travel. Relative to sprawled/automobile-oriented development, the resultant compact/transit-served development is much greener through less carbon emissions.
With nearly one million residents, Montgomery County is the most populous jurisdiction in the state of Maryland. It continues to experience intensive growth, having added 200,000 residents since 1990 and is planning for another 200,000 new residents by the year 2030. At the same time, the county has a strong open space-preservation program. Nearly half of its 507 square miles is protected from development by a combination of approaches including agricultural zoning, parkland, and conservation easements. Only 4% of the county’s land area remains both zoned for development and undeveloped (M-NCPCC, 2009a).

Montgomery County has had an APFO since 1973. The APFO requires the Planning Board to determine that public facilities, including transportation and school capacity, will be adequate to support and serve any new subdivision that it approves. The APFO is implemented through the county’s Growth Policy, a resolution adopted biennially by the Montgomery County Council (2009). The APFO and the Growth Policy originated during the era of suburban expansion and were designed to stage development so that there was no gap between the creation of new business and residential communities and the facilities needed to serve them. This APFO was intended to prevent leapfrogging sprawl as vacant land was converted into new communities. The development of a biennial Growth Policy recognized that implementation rules would need to evolve as the county applied its land-use and transportation plans. The biennial review also provides opportunities to coordinate with adjacent municipalities with different development procedures.

Where Is Montgomery County Today?

Montgomery County’s current Growth Policy includes two tests of transportation-system adequacy (M-NCPCC, 2008). One assesses conditions in close proximity to the development site and the other considers the effects of secondary and cumulative development over a larger geographic area. Both tests require applicants for new development to mitigate unacceptable traffic impacts generated by their proposed development projects.

- The Local Area Transportation Review (LATR) test examines transportation impacts on intersections adjacent to, and substantially affected traffic generated by, a development site. The LATR test is similar to traffic-impact studies and statements required by many jurisdictions in the United States (ITE, 2010).
- The PAMR test examines transportation conditions for the 32 policy areas into which the county is divided including all approved (but unbuilt) development in Montgomery County and a six-year forecast of development and infrastructure in the Washington, DC region.

The PAMR process addresses secondary effects of development beyond the immediate site and the cumulative effects of all previously approved development. The process is typically considered part of the nonsite traffic-forecast evaluation described in the recommended practice for conducting transportation-impact analyses for site development by the Institute of Transportation Engineers (2010).

The traffic impact from a single new development is conceptually like the ripple effect from a pebble thrown into a pond. It spreads in all directions and diminishes with distance, as the shorter trips reach their destinations. The cumulative effects of multiple developments can be thought of as the ripple effects of a hailstorm in the same pond. Some of the impacts are additive, while others are offsetting; for instance, some of the trips generated by a new townhouse complex will be intercepted by a new office building nearby. The examination of thousands of simultaneous actions across the region is beyond the scope of any individual LATR study. The PAMR process provides a measure of these secondary and cumulative effects and establishes standards for mitigating them for all developments in a given policy area. This technical analysis provides the basis for regulations requiring appropriate levels of trip mitigation that take into account the need for fiscal sustainability in implementing the master-planned transportation system of an area concurrently with its development. Mitigation actions include trip reduction, transit, nonautomobile facilities, intersection improvements, and roadway construction. Because the PAMR analysis is conducted as a component of the Growth Policy, it does not require study by individual applicants, thus improving the efficiency and reducing the cost of review.

The Planning Department uses travel-demand forecasting to examine the effects of the entire hailstorm of development. The Department’s regional travel demand-forecasting model, TRAVEL/3, is used to develop forecasted travel-demand results for weekday travel and evening-peak periods. The TRAVEL/3 results are used to assess adequacy in the PAMR process. TRAVEL/3 is a traditional four-step model consisting of:

- **Trip generation**: person-trips generated by land-use type and density with each transportation-analysis zone (TAZ).
• **Trip distribution:** person-trips generated in each TAZ that travel to each of the other TAZs within the metropolitan region.

• **Mode split:** travel mode of the person-trips, including single-occupant automobile, multiple-occupant automobile, transit, or nonmotorized mode, such as walking or bicycling.

• **Traffic assignment:** roadways used for vehicular travel between TAZs.

The TRAVEL/3 model incorporates land-use and transportation assumptions for the metropolitan Washington, DC region, using the same algorithms applied by the Metropolitan Washington Council of Governments (MWCOG) for air quality-conformity analysis. The MWCOG is a regional planning organization of Washington, DC area local governments and its transportation staff serve the Transportation Planning Board, the federally designated Metropolitan Planning Organization for the region. TRAVEL/3 provides system-level results that are used directly to obtain the metrics for the county’s PAMR process, described below.

The two-tiered system outlined above is akin to the local and regional concurrency tests proposed for Washington State (Hallenbeck et al. 2006, Samdahl & Pfundt, 2009) and the mitigation-payment system applied in King County (Washington State). Such fee-based systems apply a computer model to allocate the cost of planned or programmed transportation improvements to proposed development according to the relative forecasted traffic impacts of those developments. The PAMR process adds the incorporation of performance indicators for both transit and roadways, as described below.

The PAMR policy area-wide transportation test, introduced in 2007, evaluates two measures called relative arterial mobility (RAM) and relative transit mobility (RTM). The RAM is the speed by which automobile trips move during the evening-peak hour, relative to the free-flow speed. The RTM is the relative speed by which journey-to-work trips can be made by transit, compared to by car. For the purposes of the APFO, the RAM and RTM calculations are based on traffic generated by existing and unbuilt approved development on a transportation network anticipated to be on the ground within the timeframe of the capital program (typically four to six years in the future).

The use of PAMR represents a paradigm shift in measuring the adequacy of the local transportation network. Rather than using a congestion-based measure (i.e., volume-to-capacity ratios on a set of roadway-network links weighted by vehicle miles of travel), PAMR employs the relative travel time, mobility-based metrics of RAM and RTM. For example, RAM reflects the fact that effective roadway travel time in a typical corridor between point A and point B is a function of travel conditions along links between intersections, as well as the delay experienced at intersections. The use of this metric is in keeping with the monitoring of observed travel times reported in the county’s biennial highway-mobility report (M-NCPPC, 2009b). Relative to the previous capacity-based metric, the mobility-related PAMR metrics are more intuitively consistent with how people generally perceive travel.

The RAM is based on the urban street-delay level of service (LOS) in the 2000 Highway Capacity Manual, published by the Transportation Research Board (2000). This concept suggests that for a trip along an urban street that has a free-flow speed (generally equal to posted speed) of 40 miles per hour (mph), LOS A conditions exist when the actual travel speed is at least 34 mph, including delays experienced at traffic signals. At the other end of the spectrum, LOS F conditions exist when the actual travel speed is below ten mph. These relationships are shown in Table 1.

The RTM is based on the transit-versus-automobile travel-time LOS concept in the 2003 Transit Capacity and Quality of Service Manual published by the Transportation Research Board (2003). This concept suggests that LOS A conditions exist for transit when a trip can be made more quickly by transit (including walk-access/drive-access and wait times) than by single-occupant automobile. This LOS condition is true in the Washington, DC region for certain rail-transit trips with short walk times at both ends and some bus trips in high-occupancy vehicle (HOV) corridors. LOS F conditions exist when a trip

**Table 1** Relative arterial mobility (RAM) and arterial level of service (LOS).

| If the actual urban street travel speed is | PAMR Arterial Level of Service is |
|-------------------------------------------|----------------------------------|
| At least 85% of the free-flow speed        | A                                |
| At least 70% of the free-flow speed        | B                                |
| At least 55% of the free-flow speed        | C                                |
| At least 40% of the free-flow speed        | D                                |
| At least 25% of the free-flow speed        | E                                |
| Less than 25% of the free-flow speed       | F                                |

Note: Speed ranges based on the 2000 Highway Capacity Manual (TRB, 2000).

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1 “Planned” refers to projects recommended in master plans, but not funded in a capital improvement program (CIP). “Programmed” refers to master planned projects which are funded in a CIP or are otherwise the committed responsibility of a private sector entity.
takes more than an hour longer to make by transit than by single-occupant automobile. The RTM incorporates the shortest path between points for both car and transit modes. The shortest transit-travel time may reflect transit vehicles traveling in mixed traffic (for which transit vehicle stops will result in a slower speed than for the automobile), transit vehicles traveling on a separate guideway (for which the travel time may be faster than automobile even considering station-dwell times), or a combination of the two.

This ratio between automobile and transit-travel times can also be expressed in an inverse relationship, defined by modal speed. If a trip can be made in less time by transit than by car, the effective transit speed is greater than the effective automobile speed. Based on the typical roadway-network speed during the peak period, RTM reflects the following relationship between car and transit trips as described in Table 2.

The PAMR transit LOS and the PAMR arterial LOS standards are inversely related, reflecting Montgomery County’s long-standing policy that greater levels of roadway congestion should be tolerated in areas where high-quality transit options are available. As adopted, PAMR uses the equivalency shown in Table 3.

This equivalency reflects the county’s current policy that any new development occurring in areas exhibiting RAM conditions at or below LOS D threshold must fully mitigate the trips generated by that development. By current policy, the maximum level of trip mitigation is 50% of the trip generated by new development.

The county is divided into 32 geographic policy areas, shown in Figure 1, for the purposes of transportation-system adequacy. Each policy area has a RAM and RTM score. Adequacy standards depicted in Table 3 are based on the relationship between RAM and RTM as depicted in Figure 2. Generally, the greater the RTM, the lower the acceptable RAM score.
The comparable RTM-related metrics for the Aspen Hill area, a forecast of morning-peak period (journey-to-work) travel-time conditions by automobile and transit combined with the number of work trips by car and transit from Aspen Hill to everywhere else in the region, are estimated to be:

- 36,796 trips to work
- 16% work trips by transit
- 52.7 minutes (average journey-to-work travel time by transit)
- 34.9 minutes (average journey-to-work travel time by automobile)
- 66% RTM

Plotting the combined RAM/RTM score for Aspen Hill (i.e., 48%/66%) results in this area falling into one of the triangular areas on the year 2013 PAMR chart (Figure 2). Given the relative location of this data point to the diagonal line on the PAMR chart, the percent trip-mitigation requirement for Aspen Hill is 20%. A developer of a new project in Aspen Hill would be required to reduce or otherwise mitigate 20% of trips generated by that project using some combination of the mitigation measures depicted in Figure 3. Both the LATR and PAMR tests are applied at the time an applicant seeks subdivision approval. Qualifying projects (those of a certain size that have greater than de minimis impacts—more than 30 peak hour-vehicle trips for LATR and more than three peak hour-vehicle trips for PAMR) must:

- Conduct an LATR study of nearby intersections and
- Address PAMR impacts by mitigating vehicle trips according to the current tabulation of mitigation requirements, which range from 0% of trips in policy areas on the PAMR chart found “adequate” to 50% of trips in policy areas on the PAMR chart found “adequate with full mitigation.”

Development that creates an adverse transportation-system impact is required to mitigate those effects. Figure 3 demonstrates the type and priority of mitigating actions required. The mitigation priority is to first seek mitigating actions that reduce vehicular demand or induce a modal shift to transit or nonmotorized travel. These exactions, described in Figure 3, are supplemented by a transportation-impact tax. This tax can be thought of as a “hookup” charge for development to contribute to the planned expansion of the countywide transportation system, regardless of the conditions in the vicinity of the development site. The transportation-impact tax is established by the Montgomery County Council and based on the estimated cost of master-planned transportation-system capacity. Development exactions based on the results of the LATR and PAMR tests can be thought of as an impact-mitigation ap-
proach. Many exactions required by LATR and PAMR can be credited against the transportation-impact tax if they are used to build master-planned capacity (in other words, facilities included in the impact tax-estimation process).

The PAMR process blends scientific analyses developed by staff with policy decisions made by the County Council.

- The LOS D threshold reflects constituent concerns about vehicle delays. The Planning Board had supported the technical staff recommendation to allow LOS E in the most transit-served areas, recognizing that the maximum throughput of people and goods occurs at LOS E, even though delays to individual travelers are increased.
- The partial mitigation approach (from 5% to 45%) was a policy decision to move from a binary “pass/fail” system to a more finely graded scale. The previously proposed “pass/fail” system would have resulted in PAMR mitigation required in only two policy areas. The County Council determined that tougher standards were required to address constituent concerns about congestion.
- The cap of 50% for full mitigation was a policy decision to move from the 100% mitigation requirement initially implemented, reflecting concern from the development community that full mitigation was prohibitively costly.

**What is an APFO Intended to Do?**

A common misperception is that an APFO is primarily designed to direct growth to certain geographic areas where growth is intended, or to ensure that the development incorporates certain design standards or principles. Generally, this is not the case. In Montgomery County, as in most jurisdictions nationwide,

- **Where** growth should occur is determined by master plans that contain recommendations for the ultimate amount and type of land uses and the public facilities to accommodate those land uses at build out.
- **How** growth should occur is determined by zoning that describes in greater detail what uses are appropriate in given zones and what form the development can take.
- **When** growth should occur is governed by the APFO that ensures that public facilities will be in place concurrent with growth.

Many jurisdictions, particularly in the western part of the United States, have growth-management laws that are termed “concurrency,” rather than APFO. This term reinforces the temporal nature of an APFO law. One concern is that if APFO or concurrency laws are too strict or inflexible, a long-term moratorium may ultimately influence where (i.e.,

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| Priority | Mitigation Approach                      | PAMR Mechanism                  | LATR Mechanism                  | Single Mitigation Action Addresses                                                                 | Examples of Mitigation Actions                               |
|---------|------------------------------------------|----------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| 1       | Peak hour vehicle trip reduction         | Traffic mitigation agreement (TMAg) | Traffic mitigation agreement (TMAg) | Both PAMR and LATR impacts                                                                           | Vehicle trip caps, flex-time/telecommute programs, shuttle services |
| 2       | Public transit capacity                  | Service provision                | Not applicable                  | PAMR impacts only                                                                                   | Purchase of RideOn bus with 12 years of operation              |
| 3       | Non-auto facilities                      | Project implementation           | Project implementation           | Both PAMR and LATR impacts                                                                           | Offsite sidewalks                                             |
| 4       | Intersection improvements                | Applicable if required by LATR   | Project implementation           | Both PAMR and LATR impacts                                                                           | Turn lanes, change of lane use configurations                 |
| 5       | Roadway link improvements                | Project implementation           | Project implementation only if site-specific LATR impacts are addressed | PAMR impacts, LATR impacts if applicable                                                            | Roadway widening                                              |

Figure 3 PAMR and LATR approaches to mitigating unacceptable impacts (M-NCPPC, 2008).
“not here”) planned growth occurs. This concern is part of the reason that APFO regulations must blend science with policy to support the orderly implementation of planned development.

**How Does an APFO Relate to Sustainability?**

The term “sustainability,” like “smart growth,” is often defined by the user. The Montgomery County Planning Board (MCPB) proposed the following definition of sustainability as related to development in 2007 (M-NCPPC, 2007).

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. It recognizes the fundamental inextricable interdependence between the economy, the environment, and social equity, and works to promote each to the benefit of all.

This definition is informed by the 1987 Brundtland Commission report that promoted the intergenerational nature of sustainability, as well as by the commonly accepted three pillars of economy, environment, and equity. While the county has not adopted a formal definition of sustainability, the county code reflects these three pillars of sustainability in the purpose clause of the Growth Policy as a “process by which the County Council can give policy guidance to agencies of government and the public on matters concerning land-use development, growth management; and related environmental, economic, and social issues.”

The identification of sustainable transportation-performance indicators continues to be an ongoing challenge, one made particularly daunting by the diverging objectives to be all-encompassing, pragmatic, and authoritative, as noted in current calls for additional research (Sustainable Transportation Indicators Subcommittee, 2009). Proposed sustainable transportation performance-indicator systems typically encompass several dozen diverse measures that are difficult to apply in practice due primarily to a combination of data limitations and complex relationships among the measures ( Cormier & Gilbert, 2005). For instance, most planners agree that, all else being held constant, it is desirable to reduce vehicle miles of travel (VMT) to improve environmental sustainability. But the VMT reduction is neither sustainable nor desirable if it occurs because the economy is failing.

The three pillars of sustainability are reflected in the LATR and PAMR elements of the Growth Policy as follows:

- Economic considerations include both ensuring that mobility and accessibility support economic objectives and that mobility infrastructure is affordable. A key APFO concept is that new development pays for its fair share of planned infrastructure.
- Environmental considerations include pursuing travel-demand reduction, promoting transit-oriented and walkable solutions, and providing sufficient mobility to avoid true gridlock, all actions that support air-quality objectives and minimize other environmental impacts.
- Equity considerations include designing for all users and promoting alternative travel options for those who are unable or unwilling to drive.

An APFO can serve as a useful growth-management tool by ensuring that the public and private sectors work together to maintain a desired quality of life. Like most growth-management tools, however, a transportation APFO mechanism is the proverbial double-edged sword. Used appropriately, it ensures that growth that generates travel demand occurs concurrently with the transportation services planned to accommodate that demand. These services can be provided either by the public sector through a capital-improvements program or by the private sector. An APFO will incentivize private sector implementation of public facilities if the development community finds a fiscal rationale for providing the public facilities faster than the government can. An unintended consequence of an APFO, however, can be that growth is actually encouraged at a faster pace in areas where less growth is ultimately desired, based either on the presence of facilities with excess capacity or the lower cost of providing those facilities (TRB, 1998).

Montgomery County uses three mechanisms to match the APFO process with its goal of sustainable development:

- A context-sensitive definition of adequacy, in terms of both the conditions required to determine whether the transportation system is adequate as well as mitigating actions that the private sector can take to address determinations of inadequacy.
- A biennial review to align the definition of adequacy with the goals and objectives of the planning department’s constituency.
- An application of the APFO/PAMR approach to the development of master-plan amendments to ensure that new long-range land-use plans provide a balance between land use and transportation at their end-state.
How is the Measure of “Adequacy” Context-Sensitive?

Montgomery County’s policy areas constitute a transect ranging from urban to rural. Ten of the 32 policy areas are designated “Metro station policy areas”—communities generally within a half-mile radius of a Metro station. At the other end of the spectrum, the largest areas are “rural policy areas” in the county’s agricultural reserve where development is constrained by a wide range of planning and zoning tools.

The context-sensitive definition of adequacy recognizes that equitable transportation service includes all modes of transport, but that all modes will not be developed in equal proportion countywide. High-quality transit and pedestrian connections are not economically or environmentally sustainable in the agricultural reserve. Similarly, high automobile speeds are not feasible or safe in the Metro station policy areas where land values (economics) and a walkable environment (equity) dictate solutions that move a higher number of people (person-throughput) most efficiently, but at slower speeds. In these areas, quality transit service is more practical and effective. Therefore, PAMR defines a relationship between transit-service levels and roadway-service levels; in areas with better transit service, greater levels of roadway congestion are considered acceptable.

This concept is also recognized in application of the LATR process and is illustrated in Figure 4 in terms of the level of intersection congestion allowed in different policy areas. The LATR metric applies intersection critical lane volume (CLV), a measurement of the number of vehicles competing for space at an intersection during the busiest hour (a subset of the total number of vehicles entering the intersection). A CLV of 1600 represents the boundary between LOS E and LOS F, which is generally the point at which the intersection is processing the greatest amount of vehicular throughput. In the agricultural preserve, intersections must operate in the LOS D range (a CLV of 1350), as transit and non-motorized transport options are scarce. Conversely, in Metro station policy areas, a CLV less than 1800 (and perhaps higher if more detailed analysis confirms spillback to upstream intersections is not a problem) is considered acceptable. The CLV LOS standards are set by policy as referenced in the county’s LATR and Policy Area Transportation Review Guidelines (M-NCPPC, 2008).

Finally, the planning department seeks context-sensitivity and sustainability in applying transportation impact-mitigation approaches. From the perspective of sustainability, the priority for mitigation approaches is to:

![Figure 4 LATR intersection-congestion standards by policy area (M-NCPPC, 2009a).](image-url)
• Reduce vehicle trips with travel demand-management measures.
• Provide public transit capacity.
• Invest in nonautomobile facilities, such as offsite sidewalks.
• Construct automobile-capacity improvements.

Transit-oriented development and the presence of nonautomobile facilities are well-documented means of reducing vehicle trip-generation rates and improving the internal capture of activity centers (Kuzmyak et al. 2006; ABAG, 2008; Arrington & Cervero, 2008). More research is needed to quantify these values in the context of a subregional travel model, however, where intrazonal trips are typically not loaded onto the network and benefits may therefore not be measured.

These priorities need to be context-sensitive to both land use and the community. While reducing vehicle trips may be the most sustainable approach from a fiscal perspective (reducing the amount of infrastructure and maintenance required), it is not always feasible from the perspective of an applicant. For retail properties in particular, a reduction in vehicle trips is (not necessarily, but usually) an indication of economic failure.

Often the most time-consuming aspect of the mitigation process is developing consensus on an appropriate offsite-mitigation solution given the civic and legal environments. A new turn lane, for instance, may solve a quantitative APFO problem but draw constituent concerns about pedestrian-crosswalk length, or require right-of-way for which eminent domain powers are needed. To streamline the development-review process, smaller-scale projects can mitigate trips through a payment-in-lieu process at which trips are valued at a one-time cost of US$11,000 for each daily peak hour-vehicle trip generated. This value is based on the estimate of Montgomery County’s US$1.1 billion construction cost to accommodate the additional 101,000 peak hour-vehicle trips anticipated by 2030, using a typical impact fee-study process such as described by Wallstedt (1999).

How Do APFO Rules Evolve?

Montgomery County’s APFO policies recognize that times change, and with them public perceptions of the adequacy or acceptability of travel conditions. A biennial review was built into the growth-policylaw, requiring the county to examine the APFO rules in light of recent growth, supporting policies, and constituent and stakeholder attitudes. The County Council recently changed the review period to every four years, finding that too little change occurred in the shorter period to justify the amount of time and effort required in the review.

How PAMR Supports Master Planning

As previously described, the APFO is designed as a concurrency test—it prohibits development where master-planned infrastructure necessary to support it does not exist and is not scheduled for timely construction. The master plan itself defines the balance of land uses and transportation facilities considered adequate at the end-state of a master plan. The term of art for this condition in Montgomery County is “balance.” A plan may also contain a staging element that requires certain facilities to be in place and/or mobility-performance standards to have been achieved before a next level of development can proceed. For instance, the Great Seneca Science Corridor Master Plan requires the Planning Board to have found that implementation milestones for the Corridor Cities Transitway and measured progress toward the plan area’s end-state nonautomobile driver-mode share are met before opening any of the master plan’s four stages of development (MNCPPC, 2010).

Community-master plans typically have a useful life span of about two decades, and several throughout Montgomery County are in the process of being amended at any given time. As each plan is amended, the current APFO rules are applied over a 25-year horizon to ensure that the land-use and transportation systems are balanced. By applying a regional travel-demand model, this assessment of balance not only considers new planning and zoning proposals for the community that is the subject of the master-plan amendment, but also the current thinking on land-use and transportation planning for the rest of the county and region.

Where Have We Been?

As Montgomery County has grown over the past four decades, it has nearly completed its greenfield-development phase and is shifting into a mode of promoting more urbanized, infill development. Growing up, rather than growing out, reduces per-capita carbon footprint and provides development densities needed to support the transit components of the county’s planned transportation system. The Growth Policy has evolved as well, shifting from a focus on transportation-system capacity to an emphasis on the resulting mobility. During that time, the county has struggled with some basic questions on growth policy as it relates to transportation-system adequacy:
● How should adequacy be defined? What should be measured, and for each measurement metric, at what point is success defined? In considering these definitions, what is the appropriate balance between mechanical tools and policy judgment? Or between precision and transparency?

● What is the fair share for new development to contribute to either the construction or operation of the county’s transportation system? How should this nexus be defined?

● When conditions are found to be less than adequate, how should impacts be mitigated?

The introduction of a policy area transportation metric in 1986 included the land-use transect; six different area types were defined and LOS standards (ranging from LOS C to LOS E) were assigned to them. The county was still primarily in a greenfield-development mode and the principal objective of growth policy was to ensure that the master-planned highway system was constructed concurrently with development. Therefore, the primary measurement of automobile performance for the policy areas was the volume-to-capacity ratio (weighted by VMT). The transit component was qualitative; the Silver Spring Metro Station, located adjacent to the Washington, DC boundary and served by a multimodal connection to high-quality bus service in the US29 corridor, provided the greatest transit-system accessibility and all other locations in the county were judged relative to this location. By estimating remaining capacity in the system, staging ceilings for jobs and housing levels in each policy area were established using an interactive allocation process.

This approach had two primary limitations. First, the use of a relative transit-system metric based on a comparison to Silver Spring was counterproductive; any improvement to the Silver Spring station would have the unintended consequence of downgrading the performance of every other transit center in the county. Second, the establishment of jobs and housing ceilings reflected an unstable combination of technical analysis and policy judgment; policy makers exercised a greater level of control than ultimately could be justified by technical analysis. For instance, the two sizeable incorporated municipalities (Rockville and Gaithersburg) represent about one-fifth of the county’s development but have independent planning and zoning authority. It was undesirable for county policy makers to cede development potential (as measured by staging ceilings) in unincorporated parts of the county to the two municipalities. So by 2002, the combined remaining staging ceiling capacity of the two municipalities was assumed to be less than zero: ~8,500 households and ~32,900 jobs. An upgrade to a new regional travel demand-forecasting model in 2002 demonstrated that the policy area review process being used was, itself, unsustainable and led to its repeal in the 2003 Growth Policy.

From 2003 to 2007, the county’s APFO test consisted solely of LATR. Many constituents were dissatisfied with the removal of the policy-area test, primarily because of the recognition that even the smartest growth in transit-served Metro station policy areas creates some adverse mobility impacts beyond the boundaries of those areas. In 2007, the policy-area test was reinstated, following substantial discussion of alternative methods and metrics that are described in the following section.

Where Else Could We Have Gone?

In the context of considering alternative area-wide transportation tests to supplement LATR in 2007, planning department staff considered a variety of approaches. The PAMR methodology described above was ultimately selected. Among the approaches considered are those briefly summarized below. A more detailed discussion describing the strengths and weaknesses of each approach follows this summary.

● Proportional Staging: Allow development based on the proportion of the transportation system as a percentage of the master-planned development potential.

● Jobs/Housing Accessibility: Measure opportunities to match available employment locations with available employment locations within a given (and generally acceptable) travel-time budget.

● Travel-Time Variability/Reliability: Consider the consistency of expected travel times from one day to the next with particular concern for “travel-time reliability,” a measure of increasing importance to many transportation-service providers, particularly for transit service and goods movement, as well as for most travelers in private vehicles.

● Refined Policy Area Transportation Review (PATR): Use volume-to-capacity ratios (weighted by VMT) as the metric to assess policy area automobile performance. This congestion-based approach is similar to what was used prior to 2003 in the application of PATR with some refinements in accounting for the quality of transit service and allocations of land use.

As with PAMR, each of these potential alternative methods was rated according to how well it satisfied several characteristics that planning department staff judged relevant to decision makers, as well as to the broader stakeholder community. These characteristics included the following:

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Table 4 Characteristics of alternative area-wide transportation tests.

| Alternative Approaches                        | Importance | Relevance | Coherence | Reliability | Availability |
|-----------------------------------------------|------------|-----------|-----------|-------------|--------------|
| Policy Area Mobility Review                   | Good       | Excellent | Fair      | Excellent   | Good         |
| Proportional Staging                          | Fair       | Poor      | Excellent | Poor        | Good         |
| Jobs/Housing Accessibility                    | Fair       | Excellent | Poor      | Good        | Good         |
| Travel-Time Variability/Reliability           | Good       | Poor      | Excellent | Good        | Fair         |
| Refined Policy Area Transportation Review     | Fair       | Excellent | Poor      | Fair        | Good         |

- **Importance**: Are the factors measured of interest to constituents (e.g., residents, business interests, and decision makers)?
- **Relevance**: Are the factors measured appropriate for considering the transportation effects on growth?
- **Coherence**: Are the test results understandable to constituents and are the results of different scenarios intuitive to the decision makers and stakeholders?
- **Reliability**: Does the test measure what it says it does, and can the results be replicated?
- **Availability**: Are the data observable and available today for current conditions and can measures reasonably be forecasted to represent future conditions?

Table 4 contrasts the various alternative approaches based on these characteristics.

*Proportional Staging* was analyzed in detail twice during the past decade by planning department staff and the methodology continues to spark interest among some stakeholders. Proportional staging is attractive because its basic premise—providing planned transportation capacity at the same time as planned development—closely meets the definition of the APFO. However, the proportional staging process exhibits a fatal flaw in that there is truly no fixed “end-state” condition for either development or transportation service in the county. Adding new projects to master plans increases overall potential system capacity, but concurrently reduces the amount of the master-planned transportation system that is “complete” since the overall system becomes larger.

A compelling example of this fatal flaw is that the addition of a major new transportation project in a master plan, such as the adoption of the Purple Line transitway extension east of the Silver Spring area of Montgomery County, would have exactly the opposite effect of that desired. The Purple Line is a fourteen-mile east-west light-rail line planned to link Bethesda, in Montgomery County, with New Carrollton, in adjacent Prince George’s County. The portion between Bethesda and Silver Spring was added to the Montgomery County master plan in 1990, and the eastward extension to New Carrollton was added in 2010. Because the Purple Line extension would increase the master-planned transportation capacity in the area, the current and programmed transportation capacity would immediately be a lower proportion of master-planned capacity. Therefore, the application of the proportional staging method would result in the Purple Line actually reducing the current staging capacity of any area affected by the project. While this tool is inappropriate for regulatory work, it may be useful as an indicator of progress in capital programming.

*Jobs/Housing Accessibility* measures how many opportunities for matching housing with jobs exist within a given travel-time budget (such as a 45-minute trip from any given starting point). From a planning perspective, this may be one of the purest measures of the balance between transportation and land use. Jobs/housing accessibility is attractive because it can be improved substantially by either providing additional transportation-system capacity (i.e., achieving greater accessibility by increasing the geographic coverage area within the travel-time budget) or by reallocating land uses (i.e., achieving greater accessibility by increasing the number of destination points within a smaller geographic coverage area). This technique has frequently been used as a means to depict the relative performance of alternative land-use/transportation-system scenarios (see Figures 5 and 6).

A primary concern with the accessibility measure, however, is that it is not particularly meaningful to constituents, as not all jobs are created equal. When planners reallocate theoretical job/housing totals, the jobs that locate in traditionally residential suburban areas may not have the same value to those residents as jobs that locate in a traditional central business district area. A secondary concern is that the measure is not easily understood. For example, a typical worker may currently reach many thousands of potential jobs within a 45-minute trip. But most workers only want to reach one job, and that job is defined by the type of work it entails, as well as many other issues unrelated to transportation. There-
fore, the value of increasing the number of potential jobs within a 45-minute trip by 20,000 or 40,000 with a new transportation project appears to be of limited relevance to most people.

Travel-Time Variability/Reliability considers the consistency of expected travel times from one day to the next. The transportation-system travel-time reliability, also called the travel-time index, is a measure of increasing importance to many transportation-service providers (particularly for transit service and goods movement) and for all travelers (Schrank et al. 2010). Travel time varies based on many external factors. Nonrecurring delay is a term frequently used to describe these factors, where vehicle crashes and other incidents are perhaps the most notable, but other variables of equal importance in determining variability include weather conditions, special events, and system-maintenance activities. The transportation-service industry continues to improve data collection, analysis, and forecasting tools to assess travel-time reliability. A relevant example of a major data-collection and analysis effort that includes a focus on travel times is the Texas Transportation Institute’s annual report on traffic congestion in major metropolitan areas in the United States (see Table 5). However, the information systems needed to make decisions based on reliability are still several years away. Further, while travel-time variability is important to decision makers, its relationship to growth policy is not very strong. This measure appears to be a useful indicator of system performance without being a basis for growth-policy decisions.

Refined Policy Area Transportation Review (PATR) is a slightly modified version of a growth management transportation test used in Montgomery County from 1992 to 2003. Under the PATR test, each policy area was allocated an amount of development (expressed in jobs and housing units) that could be supported by the existing and programmed transportation network. This maximum amount of development that could be approved was called the policy area’s staging ceiling, and was adopted annually by the County Council (M-NCPPC, 2009a).

The method used to determine staging ceilings was called Total Transportation Level of Service (TTLOS), in which congestion standards varied by policy area based on the amount of transit service provided. Traffic-congestion levels were measured using a metric called an Average Congestion Index.
(ACI). The ACI reflected the average VMT-weighted volume-to-capacity ratio for the local roadways modeled in each policy area.

The TTLOS equation was defined as follows:

$$TTLOS = (\text{Auto LOS} \times \text{Auto MS}) + (\text{Transit LOS} \times \text{Transit MS})$$

Where,

Auto LOS = Average Congestion Index (ACI) Standard

Transit LOS = Regional Transit Accessibility (to jobs and households)

Auto MS = Mode Share (MS) for work trips by county residents using automobiles

Transit MS = 1 – Auto MS

This equation was solved for the ACI standard (Auto LOS) for each policy area. By policy, the TTLOS was fixed at the countywide standard of 0.585 (roughly LOS C–). Planning department staff considered the implementation of minor adjustments to PATR to better account for the quality of available transit service without reliance on a quantitative measure. Such modifications would have generally followed the Five-Group Framework identified in the Staff Draft Policy Element of the 2003–2005 Annual Growth Policy Report that identified five basic types of transit-service areas (see Table 6).
The intent was to have a policy area group system that would be more sensitive to transit availability and associate each group with a range of standards of average roadway congestion—the ACI standards. Thus, an investment in a sufficient amount of improved transit service could more likely result in an increase in the staging ceiling for an area because the policy area “moved up” within its group, rather than moving from one group to another in its entirety. A major limitation of this system, however, is that the minor changes desired to allow an area to “move up” incrementally within its group required a quantitative analysis tool to ensure that judgments are not arbitrary. As a result of this assessment, this approach was not considered further for regulatory purposes.

Conclusion: Moving Forward But Not Quite There Yet

The PAMR process is currently integral to Montgomery County’s growth policy and its master planning. These efforts were recently recognized by the Transportation Planning Council of the Institute of Transportation Engineers, which presented the Department with the 2009 Best Program Award for the “2009–2011 Growth Policy” study.
However, PAMR has limitations and detractors. Its principal shortcoming is a consequence of its relatively narrow function: to provide a reliable policy base for guiding administration of the APFO and establishing a reasonable balance between land uses and transportation in master plans. Because it averages the mobility experience of drivers and transit users in subcounty policy or planning areas, it does not specify the improvements that must be provided by public agencies or private developers to achieve an acceptable LOS for either mode. By relying on a transportation model that combines all road segments, all transit services, and all travel directions in peak periods, it is not sensitive to the experiences of individual travelers to different destinations. And, because it focuses on the overall speed or time of entire trips, it averages out trip segments in which a commuter may experience LOS F with segments where the experience is at LOS A or B. Thus, without the additional analysis provided by the LATR test and other standard traffic-measurement techniques, specific capital or operational improvements in the system cannot be identified.

While “smart growth” groups have generally supported PAMR, some civic associations have opposed its use because it allows higher levels of roadway congestion in areas with better transit service, thus permitting more dense development or redevelopment to occur. These groups also favored a return to the pre-2003 policy-area tests that established housing and jobs ceilings for each policy area. In general, the opposition to PAMR comes from residents in detached single-family homes for whom automobility is highly valued. Other interests, such as pedestrian and bicycle advocacy groups, have supported the relaxed congestion standards and flexibility of mitigation approaches, recognizing that acceptance of slower speeds in highly congested areas facilitates the safety and convenience of those on foot and bicycle.

Developers have been ambivalent toward PAMR. They have liked the certainty it provides of the level of exaction they must provide in each planning area and that they are not required to conduct an individualized study of the area-wide impact of their projects as part of subdivision review. They have been critical of the mitigation requirements and succeeded in persuading the County Council in 2009 to reduce the percentage of trips that must be mitigated to satisfy PAMR.

The Montgomery County Department of Transportation and the County Executive (who, while a member of the Council in 2003, opposed the abandonment of the old policy area review process) objected to the introduction of PAMR (Leggett, 2009) and have since proposed an alternative to it—Transportation Policy Area Review (TPAR)—for use in subsequent growth policies (MCDOT, 2010). The TPAR proposal seeks to separate the measurement of arterial and transit adequacy, thus placing greater emphasis on reducing roadway congestion as a condition for development to proceed. The TPAR process improves upon PAMR by identifying specific transportation improvements that need to be included in subsequent capital budgets. However, it remains unclear whether it provides a better or more easily determined overall assessment of the current and forecasted state of mobility for a policy area. Its details and the extent to which it modifies or replaces PAMR may not be determined before the next round of growth policy, now scheduled for 2012.

In summary, the development community is concerned about the additional costs that the mitigation requirements add to a project and the uncertainty in a system wherein conditions may change on an annual basis. Many elected officials are concerned that a “pay and go” system does not provide sufficient commitment to their constituents that improvements will actually be implemented. And most stakeholders recognize the tension inherent in developing an analytic framework that is sufficiently robust to satisfy technical and legal challenges, yet simple enough to understand and explain; nearly all travel-forecasting tools suffer from the “black box” label.

The planning department is exploring alternative concepts through which transportation adequacy might be explored in future evaluations of sustainable communities and APFO definitions. These concepts reflect current stakeholder concerns that the present system remains insensitive to variables that promote smart growth.

**Introducing Vehicle-Trip Length More Directly into the APFO Process**

While the PAMR process implicitly incorporates trip lengths within the four-step travel demand-forecasting process, both PAMR and LATR use vehicle trip-generation rates for assessing impacts of and mitigation for new development. The Planning Board Guidelines incorporate transit proximity in vehicle trip-generation establishment. However, recent household surveys have confirmed that households in activity centers (where mixed land uses are concentrated) not only generate fewer vehicle trips, but that those trips are also shorter than trips generated outside activity centers, due in part to diversity and design characteristics not reflected at the regional model scale (Nelson\Nygaard Consulting Associates, 2005).
Incorporating Carbon Footprinting as an Equivalency Measure

The carbon footprint of a development site includes both the activities occurring on site as well as the carbon required to connect the site to its constituent community. Therefore, a LEED (Leadership in Energy and Environmental Design) platinum building located in an isolated greenfield has a larger carbon footprint than the same building located in a connected activity center, due to the higher per-capita (or equivalent unit) VMT generated by the isolated location. There is general consensus among stakeholders that the VMT component should be included in the definition of development impact. Opinions differ, however, as to whether it is desirable to augment or replace an adequacy definition for mobility (or for another transportation measure such as accessibility or reliability) with an adequacy definition for sustainability. For instance, should a development in a Metro station policy area be able to mitigate its transportation impact by exactions that exchange VMT for other greenhouse-gas credits, such as installing a more effective green roof? These types of equivalencies are becoming more accepted in grading development quality through the LEED rating system, but cross-disciplinary actions are not yet generally accepted as an alternative means to define adequacy within any individual discipline.

Rethinking Local Fiscal Requirements

One of the primary concerns regarding APFO systems in general, and the PAMR process in particular, is that it only tells you what you cannot do. It does not facilitate the development of solutions. Another concern, as previously described, is that APFO tools may discourage planned growth in the most efficient, transit-served locations by making that development artificially expensive if the more efficient trip-making characteristics in those places are not adequately reflected in the APFO. Montgomery County is currently examining adjustments to the PAMR process that would replace the US$11,000 per vehicle-trip valuation with separate values specific to each policy area, reflecting the cost of infrastructure required to achieve adequacy in those areas.

Refining the Incorporation of Sustainable Performance Indicators

The state of the practice in developing sustainable transportation indicators is continually evolving. The primary purpose of an evaluation system such as PAMR is to manage the implementation of a predetermined end-state through the land-development process. However, PAMR is also a tool to re-evaluate the performance of the end-state during the master-planning process. As described in this article, the current process incorporates economic, environmental, and equity considerations. We recognize, however, that additional refinements are warranted, an interest that is shared with both the state of Maryland and the federal government in developing sustainability and livability principles and objectives.

The term “balance” is most frequently described in growth-policy discussions as a condition where the planned transportation systems are adequate to serve the planned land uses. As this article summarizes, the term is also appropriate to describe the balances that must be struck in successive APFO reviews between:

- Theoretical purity and ease of understanding
- Mathematical rigidity and judgment of policy makers
- Quantitative and qualitative values of transportation service, and
- Constituent desire to promote or dampen the rate of growth.

The policy pendulums tend to swing slightly along each of these axes from year to year. The increasing scarcity of land, budgets, and natural resources at both global and local scales has increased the need to incorporate sustainability into each successive APFO amendment. In summary, one of the most sustainable growth-policy elements may be the regular stakeholder review needed for continual course correction toward an ever-moving target.

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A functional integrated land use-transportation model for analyzing transportation impacts in the Maryland-Washington, DC Region

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The Maryland-Washington, DC region has been experiencing significant land-use changes and changes in local and regional travel patterns due to increasing growth and sprawl. The region's highway and transit networks regularly experience severe congestion levels. Before proceeding with plans to build new transportation infrastructure to address this expanding demand for travel, a critical question is how future land use will affect the regional transportation system. This article investigates how an integrated land-use and transportation model can address this question. A base year and two horizon-year land use-transport scenarios are analyzed. The horizon-year scenarios are: (1) business as usual (BAU) and (2) high gasoline prices (HGP). The scenarios developed through the land-use model are derived from a three-stage top-down approach: (a) at the state level, (b) at the county level, and (c) at the statewide modeling zone (SMZ) level that reflects economic impacts on the region. The transportation model, the Maryland Statewide Transport Model (MSTM), is an integrated land use-transportation model, capable of reflecting development and travel patterns in the region. The model includes all of Maryland, Washington, DC, and Delaware, and portions of southern Pennsylvania, northern Virginia, New Jersey, and West Virginia. The neighboring states are included to reflect the entering, exiting, and through trips in the region. The MSTM is a four-step travel-demand model with input provided by the alternative land-use scenarios, designed to produce link-level assignment results for four daily time periods, nineteen trip purposes, and eleven modes of travel. This article presents preliminary results of the land use-transportation model. The long-distance passenger and commodity-travel models are at the development stage and are not included in the results. The analyses of the land use-transport scenarios reveal insights to the region's travel patterns in terms of the congestion level and the shift of travel as per land-use changes. The model is a useful tool for analyzing future land-use and transportation impacts in the region.

KEYWORDS: land use, urban planning, models, traffic management, travel, transportation, economic conditions

Introduction

Traffic congestion in the Maryland-Washington, DC region causes an estimated loss of US$3 billion per year because of lost time and traffic delays and peak-hour traffic volume has increased more than 135% since 1985 (Schrank & Lomax, 2007). Along with more traffic, new development has spread farther from central cities, causing increased demand for transportation services in developing areas and placing strains on what once were rural road networks. Planning agencies need to understand the interactions between these changing land-use patterns and traffic and to develop strategies that will mitigate the effects of growth. The Baltimore Metropolitan Council (BMC) and the Metropolitan Washington Council of Governments (MWCOG) are the two metropolitan planning organizations (MPOs) in the region that currently have transportation models. The travel-demand models of BMC and MWCOG are well-suited for their respective jurisdictions. However, there are issues that must be addressed in the context of a multi-state region. These include: (1) the interaction of travel on the boundary between the two MPOs, (2) the modeling of transportation in regions outside the MPO boundaries such as western Maryland or the eastern shore of the Chesapeake Bay, and (3) the estimation of the impact of travel that passes through the multistate area, particularly freight travel. The MPO models can partially address these issues (or in some cases not address them at all), but to fully reconcile them requires a broader view supported by multistate analytic procedures.

The boundaries of the two MPOs are presented in Figure 1. The individual MPO regions only cover portions of Maryland and Virginia. The two major cities within the region are Baltimore and Washington, DC. The two beltways and all freeways in the region are shown in Figure 2.
The transportation impact on Baltimore is sensitive to policy/travel changes in the Washington, DC region. The effect on a regional scale, such as the sensitivity of travel between the Baltimore and Washington, DC areas, can only be explored by a regional or statewide model. In addition, such models can be used to assess impacts on sustainability by measuring sprawl, congestion, and greenhouse-gas (GHG) emissions. The remainder of the article is structured as follows. The following section presents a literature review on national statewide modeling practices, followed by the scenario-development steps and regional model-development methodology proposed for this paper. The next section describes the integrated land use-transportation model. Data requirements are then presented followed by the results. Finally, we discuss our conclusions and future scope of the work.

Literature Review

Statewide travel demand and forecasting models address significant planning needs by estimating, for a future date, the number of vehicles that use major transportation facilities in a state. Statewide models can forecast both passenger and freight flows, and include a variety of modes including highways, urban transit systems, intercity passenger services, airports, seaports, and railroads. The earliest experiments in statewide travel forecasting during the 1970s adapted methods that had been developed specifically for urban travel forecasting, but those early statewide modeling efforts were not elegantly designed to reflect realistic land-use development and travel patterns because of difficulties in adequately covering large geographic areas in sufficient detail. During the past ten years, state-transportation planners have seen dramatic improvements in socioeconomic and network databases, tools for accessing these databases, and computational power (NCHRP, 2006).

The most mature statewide passenger-travel models used in the United States are from Ohio (Parsons Brinckerhoff, 2010), Michigan (MDOT, 2006), Oregon (PBQ&D, 1995), and Indiana (BL&A, 2004). These models have undergone considerable refinement over the years and share many similarities. Michigan, in particular, has exhaustively documented each step and each assumption made, so it is possible to use this model as an indicator of the “state of the practice.” Other states with existing models include Connecticut (ConnDOT, 1997), California (Caltrans, 2010), Florida (Bejleri et al. 2008), Kentucky (Wilbur Smith Associates, 1997), and Vermont (Weeks, 2010). A number of other states have models in various stages of development (NCHRP, 2006).

While several states use transportation models, very few have implemented integrated land use-transportation models into practice. Most notably, the California Department of Transportation (Caltrans) is exploring the feasibility and benefits of the potential implementation of a statewide integrated land use/economic/transportation model. Caltrans aims to test the model to assess and depict the interregional effects of land use, economics, and transportation on energy, the economy, and the environment.

While every state uses its own methodology to reflect travel behavior, the Maryland-Washington, DC region is unique, with significant daily work trips...
from neighboring states. The MPOs have transportation models that are better suited to their individual areas. The lack of a single comprehensive statewide model provides an opportunity to develop a functional integrated land-use transportation model to reflect current and future travel behavior in the Baltimore-Washington, DC region. Collecting land-use data, transportation-network data (highway, transit (long and short distance), and feeder services), and special generators poses a challenge in developing a comprehensive travel-demand model. In addition, travel behavior in rural areas (western Maryland and the Eastern Shore) is a unique feature in this model. The objective of the research is to develop an integrated land-use-transportation model and analyze the travel impacts in the Maryland-Washington, DC region and the immediate surrounding area by constructing land-use scenarios depicting future growth.

**Scenario Development and Methodology**

A modeling process to assess the region’s future growth can be formulated in three steps: (1) construction of land-use scenarios; (2) development of a regional travel-demand model; (3) development and application of a functional regional integrated land use-transport interaction model covering the entire region.

**Land-Use Scenarios**

The National Center for Smart Growth Research and Education (NCSGRE) at the University of Maryland has been actively involved in the analysis of land-use patterns in the state for close to a decade. One of the activities of NCSGRE is to explore alternative futures for the state of Maryland and to identify what policies should be adopted today to maximize the likelihood of more desirable future outcomes. The land-use scenarios are based on a three-layer system, as presented in Figure 3. The three stages are: (a) national level, (b) regional level, and (c) local level.

- **National econometric model.** The national econometric model consists of two submodels: (1) The Long-term Interindustry Forecasting Tool (LIFT), a macroeconomic input-output model operating at the national economy level, forecasts more than 800 macroeconomic variables that are then fed into (2) the State Employment Modeling System (STEMS) to calculate employment and earnings by industry for all 50 states and the District of Columbia. Output from

**LIFT** serves as input to STEMS. Results from the STEMS model are then allocated by region (political boundaries are imprecise predictors of demarcations for labor markets and economic regions) using current proportions of state-level forecasts for each sector. A detailed description of LIFT and STEMS can be found in the literature (McCarthy, 1991; Inforum, 2010).

- **Regional Model:** The regional model depicts land-use variables at the county level. At the regional level, the forecasting approach is based on near-total reliance on empirically calibrated relationships. The calibrated model involves 40 equations using progressively more inclusive sets of predictors. The allocation model incorporates review of the benchmark forecasts (Hammer, 2007).

- **Local Model:** The local model results in land-use outputs at the statewide modeling zones (SMZ) level. The initial allocations are made based on transportation costs and the basic employment distribution. At the local level, a Lowry model-based allocation is used to assign household and employment by five income categories from the counties to the SMZs.

From the perspective of development patterns, two broad future scenarios are discussed in this article:

- **Business-As-Usual (BAU)**
- **High Gasoline Price (HGP)**

The BAU scenario is generated by introducing the path of real oil prices and the Long-Range Transportation Plan (LRTP), the proposed strategic improvement program for the transportation system. In

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1 Econometrics is a tool that can be deployed to model land-use characteristics. A set of discrete choice models is used to model national-level population, household, and employment.

2 SMZs are polygon structures used in the statewide model and can be considered similar to Traffic Analysis Zones (TAZs) in transportation planning. The SMZs in the statewide model are equivalent to TAZs in high-density development areas, or TAZs are nested under SMZs in low-density development areas.
the high gasoline-price scenario, four key parameters are considered: (1) increase in crude oil price, (2) increase in agricultural commodity prices, (3) increase in federal defense spending, and (4) increase in employment in professional service. These factors were selected by a scenario-advisory committee with the rationale of identifying exogenous trends that would provide clustered urban development, more jobs and housing close to transit stations, less development on green infrastructure, fewer new impervious surfaces, and fewer vehicle miles traveled (VMT) without any change in government policy. The path of higher oil prices is presented in Figure 4. The three trend lines represent: BAU, annual energy outlook (data from United States Energy Information Administration), and the HGP scenario (data input into LIFT). Similar graphs for other agriculture commodities, federal defense spending, and employment in professional service are considered in the HGP scenario. The changes in the key parameters (including higher gasoline price) in the land-use model result in different patterns of employment by industry sector and spatial distribution of households. The top-down land-use model is used to allocate employment and households from state to counties to SMZs. The HGP scenario results in clustered urban development as opposed to sprawl.

Development of a Regional Travel-Demand Model
The regional travel-demand model, titled the Maryland Statewide Transportation Model (MSTM), is designed as a multilayer model working at national, regional, and local levels. The study area covers all of Maryland, Delaware, and Washington, DC, along with portions of New Jersey, Pennsylvania, Virginia, and West Virginia (with 64 counties in the region).

The MSTM model consists of 1,607 SMZs and 132 regional modeling zones (RMZs). The 132 RMZs cover the complete United States, Canada, and Mexico. Maps of SMZs and RMZs are presented in Figures 5(a) and 5(b) respectively. A four-step travel-demand model is developed to forecast passenger-travel demand between origin-destination (OD) pairs by various travel modes and time-of-day periods. The next section discusses details of the transportation model.

Integrated Land Use-Transportation Model
The integrated land-use-transportation model is presented in Figure 6. As previously discussed, the land-use model consists of three stages: (a) an econometric model at the state level; (b) a regional

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3 Regional Modeling Zones (RMZs) are larger polygon structures used in the statewide model to incorporate the source of long distance, visitor, and external travel. The RMZs are much larger in size compared to SMZs, as SMZs are used to incorporate the source of intrazonal trips.
model at the county level; and (c) an econometric model at the SMZ level. The transportation model contains the following steps (NCSGRE, 2009):

- **Trip generation** is a cross-classified model for production and attraction of nineteen types of trips (home-based work, home-based shopping, and home-based other trip purposes interact with five travelers’ income levels (fifteen trip purposes); home-based school, journey to work, journey at work, and nonhome-based other).

- **Trip distribution** is a gravity model for distributing nineteen types of trips into OD trip matrices.

- **Mode choice** is a nested logit model for splitting OD trip matrices into eleven travel modes (three automobile modes and eight transit modes). The three automobile modes refer to single-occupant vehicles (SOV), high-occupant vehicles with two occupants (HOV-2), and high-occupant vehicles with three or more occupants (HOV-3+).

- **Time-of-day allocation** is a model for splitting daily travel demand into demand over four daily time periods (AM peak, midday, PM peak, and night).

- **Traffic assignment** is based on a user-equilibrium method of assigning trips to the links by minimizing travel time.

We are currently completing the development and integration of freight demand and long-distance travel components into MSTM. However, these components were not completed at the time this article was written.

**Data**

Data for MSTM are derived from a number of national, state, and local agencies. The socioeconomic data for the MPO region in Maryland and Washington, DC are collected from the cooperative-forecast data from BMC and MWCOG. The non-MPO region socioeconomic data in Maryland is derived from the Census Bureau’s Census Transportation Planning Package (CTPP) and the Quarterly

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4 The trip-generation step determines the number of trips produced and attracted to the SMZ.

5 The trip-distribution step determines the origins and destinations of trips between SMZs.

6 The mode choice computes the proportion of trips between each origin and destination that use a particular transportation mode.

7 Traffic assignment allocates trips between an origin and destination by a particular mode to a route. Further, a route consists of a set of links in the transportation network.
Census of Employment and Wages (QCEW). The land-use data for outside the Maryland-Washington, DC region are acquired from several sources including the Departments of Transportation in Virginia, Pennsylvania, and Delaware. The socioeconomic data are classified in households by number of workers, persons per household, and household by income. Five income categories are considered (less than US$20,000, US$20,000–40,000, US$40,000–60,000, US$60,000–100,000, and more than US$100,000). Four types of employment are considered: retail, office, industrial, and other. The base year (2000) socioeconomic data are collected from the aforementioned agencies. The horizon year (2030) socioeconomic data are obtained by the three-stage land use model approach. The transportation network is built on a regional scale after combining the portions of the networks received from various agencies.

The base-year network consists of more than 167,000 links, and contains sixteen functional classifications including all highway, transit, walk access, and transfer links. For external travel all the freeways are included outside the modeling region. The toll roads and HOV lanes are coded in the network with the current user charges. The network also contains all transit facilities in the region including metro rail, light rail transit (LRT), bus, and commuter rail (both regional and Amtrak). Proper connection is established between highway and transit in the form of park-and-ride, access, and transfer links.

**Results**

The results include a base case and two scenarios; a BAU scenario and a HGP scenario are presented in the following section.

Tables 1, 2, and 3 represent the trip flows among each of the states and the District of Columbia. Maryland, Delaware, and the District of Columbia are represented in their entirety while Pennsylvania, New Jersey, Virginia, and West Virginia are partially represented (see Figure 1). The trips represent home-based work, home-based shopping, home-based other, home-based school, and nonhome based (journey to work, journey at work, and other nonhome based). The freight and long-distance passenger components were not completed at the time this article was prepared and were not used in these scenario tests.

*Origin and Destination of Travel*

Table 1 presents the OD flows within and between states for the year 2000 in the number of trips per day. For this year, over 16.25 million (last column of Table 1) trip movements occurred in Maryland on an average day. Approximately 15.02 million trips originated and ended within Maryland. Similarly, for Washington, DC, over 1.80 million vehicular trips occurred on an average weekday. Of these journeys, 1.20 million trips originated and ended in Washington, DC. For Delaware, over 2.39 million trip movements occurred on an average weekday, of which 2.15 million trips originated and ended within Delaware. The “other” column represents movements from Maryland, Washington, DC, and Delaware, to and from the neighboring states. The state-level OD matrix presents a measure of trip movement within and between states. The OD matrix is critical to the ultimate choice of link or route of travel. For the year 2000, a total of 36.59 million trips per day occurred in the MSTM. Very few trips are made between Washington, DC and Delaware in Table 1. The long-distance passenger-component results of MSTM are not presented here.

The OD matrix for 2030 BAU is presented in Table 2. For Maryland, total trip movements are 20.62 million (last column, second row of Table 2), compared to 16.25 million for the year 2000 (last column, second row of Table 1). For Washington, DC, total trips are 2.65 million (last column, third row of Table 2), compared to 1.80 million for the year 2000 (last column, third row of Table 1). A similar increasing trend is observed for Delaware and the neighboring states. The total trips in the region for 2030 BAU are 45.57 million.

Table 3 presents the 2030 HGP scenario OD matrix. The HGP scenario suggests that there is less travel when compared to the 2030 BAU. It is expected that with a high gasoline price fewer trips are made, with most development near the workplaces or the central business district of the corresponding region. For example, in Maryland, 18.93 million trips are made per day (last column, second row of Table 3) compared to 20.62 million in 2030 BAU (last column, second row of Table 2), and 16.25 million (last column, second row of Table 1) in 2000. Similarly, fewer trips per day are observed in the 2030 HGP scenario when compared to the 2030 BAU scenario.

Finally, note that under the 2030 BAU scenario there are approximately 3.5 million more trips than under the 2030 HGP scenario (45,159,547 versus 41,628,927). With higher gas prices, travelers...

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8 The QCEW data are collected on a quarterly basis from the Maryland Department of Labor and Licensing Regulations (DLLR).

9 The base year for the transportation model is 2000, confirming to the last census year. For calibration and validation purposes an intermediate year, 2007, was considered; however, the result for 2007 is not presented for brevity.

10 For the BAU scenario there are 97.69% automobile and 2.31% transit trips. For the HGP scenario there are 95.79% automobile trips.
change mode to transit or walk, accounting for some of the difference. In addition, trips become shorter. Very short trips are not represented in the highway network, accounting for the remainder of the differences.

**Critical Link Analysis**

Three critical locations (corridors) are considered in the study area for demonstration of traffic volume for the base year and two horizon-year scenarios. Figure 7 presents traffic volume for the Capital Beltway, the Baltimore Beltway, and the section of Interstate 95 connecting the two beltways. For the year 2000, both the Capital Beltway and Interstate 95 carried 90,000 vehicles per day (including cars and trucks), while the Baltimore Beltway carried 68,000 vehicles per day. Traffic volume for the three critical link groups in the 2030 BAU scenario is higher than the 2030 HGP scenario. The lower traffic volume for the 2030 HGP scenario is the result of less travel under the higher gasoline-price scenario. Similar link-level traffic volume for other major and minor streets can be obtained in MSTM.

**Statewide Transportation Impacts**

The statewide transportation-impact results are presented with three measures of effectiveness (MOE): (1) vehicle hours of travel (VHT), (2) vehicle miles traveled (VMT), and (3) vehicles hours of delay (VHD).

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**Table 1** OD travel pattern between and within states—2000.

|       | MD       | DC       | DE       | Other** | Total     |
|-------|----------|----------|----------|---------|-----------|
| MD    | 15,023,803 | 671,239  | 89,377   | 472,185 | 16,256,604 |
| DC    | 377,266   | 1,200,544| *        | 224,511 | 1,802,473  |
| DE    | 127,110   | *        | 2,150,974| 120,132 | 2,398,494  |
| Other** | 847,650  | 580,215  | 312,911  | 14,401,642 | 16,142,418 |
| Total | 16,375,829| 2,452,276| 2,553,414| 15,218,470 | 36,599,989 |

**Table 2** OD travel pattern between and within states—2030 BAU.

|       | MD       | DC       | DE       | Other** | Total     |
|-------|----------|----------|----------|---------|-----------|
| MD    | 18,743,367 | 904,481  | 149,920  | 823,045 | 20,620,813 |
| DC    | 428,908   | 1,998,758| *        | 233,318 | 2,659,212  |
| DE    | 136,217   | *        | 2,812,907| 151,809 | 3,101,325  |
| Other** | 950,800  | 645,409  | 370,020  | 18,778,197 |
| Total | 20,257,292| 3,548,940| 3,333,075| 18,020,140 | 45,159,547 |

**Table 3** OD travel pattern between and within states—2030 HGP.

|       | MD       | DC       | DE       | Other** | Total     |
|-------|----------|----------|----------|---------|-----------|
| MD    | 17,216,747 | 862,821  | 130,443  | 729,355 | 18,939,366 |
| DC    | 435,166   | 1,583,163| *        | 222,863 | 2,241,382  |
| DE    | 142,885   | *        | 2,498,738| 203,458 | 2,845,375  |
| Other** | 894,510  | 629,077  | 346,996  | 17,602,805 |
| Total | 18,689,308| 3,075,855| 2,976,367| 16,887,898 | 41,628,927 |

* There were fewer than 80,000 trips between these regions. These trips are not presented.
** “Other” represents neighboring states such as portions of Virginia, West Virginia, Pennsylvania, and New Jersey as shown in Figure 1.
Vehicle Hours of Travel: VHT represents the time spent by traffic at a system level, which is obtained by aggregating VHT at the link level. The link-level VHT is determined by multiplying the traffic volume and travel time (assigned travel time as opposed to free-flow travel time). The VHT for the states is presented in Figure 8. For the base year 2000, VHT for Maryland is more than 3.5 million hours per day and for 2030 BAU VHT is over 5 million hours per day. For the 2030 HGP scenario, the VHT is less (than 5 million hours per day) compared to the 2030 BAU scenario. Lower VHT for the HGP scenario can be justified as reduced travel due to higher gasoline prices. For Washington, DC and Delaware, similar VHTs are observed in Figure 8. The other group in Figure 8 represents the portions of Virginia, West Virginia, Pennsylvania, and New Jersey. The study region consists of parts of these states; therefore, the results are not specifically mentioned as state VHTs in Figure 8, but placed in the category “other.”

Vehicle Miles Traveled: VMT represents the total number of miles traveled and is computed by multiplying the traffic volume and the corresponding distance traveled. From the traffic-assignment results the link-level VMT is computed first and then aggregated to the state level. Figure 8 presents VMT for the states in the study region. For Maryland in the year 2000, VMT is over 120 million miles per day. A Maryland Department of Transportation (MDOT) report suggests that the observed annual VMT for the year 2000 was 50.6 billion miles (MDOT, 2010). The VMT presented in Figure 9, when converted to annual VMT, is estimated to be 45 billion miles. The difference of 5 billion annual VMT for Maryland is attributable to long-distance passenger and commodity travel. For Maryland, the 2030 BAU VMT is 158 million miles per day. The 2030 HGP scenario resulted in less VMT than the 2030 BAU. The HGP scenario results in fewer and shorter trips because of higher gasoline prices, thereby reducing the VMT. Similar results are observed for Washington, DC, Delaware, and neighboring states (Figure 9).

Vehicle Hours of Delay: VHD is measured by summing the delay experienced by all the vehicles in a link. Delay can be defined as the extra time needed for the vehicle to traverse the length of a link when compared with the free-flow travel time. Figure 10 presents the VHD for the states in the study region. The VHD for Maryland in the year 2000 is 0.8 million hours per day, and increases to 1.7 million hours per day in 2030 BAU. The VHD increases at a much larger rate than VMT. This can be explained by demand increasing at a much higher rate than supply (transportation-infrastructure development), which results in more congestion, and higher delay. The 2030 HGP scenario VHD is lower than the 2030 BAU. Similar results are observed for the other states in the region (Figure 10).

Summary

The transportation impacts for the base year 2000, horizon year 2030 BAU, and horizon year 2030 HGP are presented at the link level and at the state level. At the link level, three major corridors, the Capital Beltway, the Baltimore Beltway, and Interstate 95 between the two beltways, are selected to
assess traffic-volume impacts. The Capital Beltway carried higher traffic volume than the other two facilities for all three years analyzed. Traffic volume for the three facilities in the 2030 BAU scenario is higher than the 2030 HGP scenario. Transportation impacts for the state level are presented with three measures of effectiveness: VHT, VMT, and VHD. As expected, the MOEs for the 2030 BAU are always higher than those for the 2030 HGP. The HGP scenario shifts development closer to city centers (estimated at a 17.34% increase in households). This change in development patterns combines with lower total commuting travel due to fewer and shorter trips.

Conclusion

With growing traffic congestion and continued urban development, it is critical that states have the capability to analyze the interactive effects of land use and transportation. The unique contribution of this research is twofold. First, this work develops an integrated land use-transportation model with realistic scenarios. Second, we apply the integrated model to determine consistent and defensible estimates of how different patterns of future land use will result in changes of key measures of transportation performance. The MSTM by design is a multilayer-modeling framework at national, regional, and local levels. Preliminary model results indicate that it can analyze travel patterns in the base and horizon years within the state of Maryland and the immediate surrounding area for different land-use scenarios. Two land-use scenarios, BAU and HGP, are analyzed. The BAU scenario is generated by introducing the path of real oil prices and LRTP, the proposed strategic transportation-improvement program for the transportation system. The HGP scenario is generated by introducing the path of increased oil prices and federal defense expenditures to reflect travel behavior in the region with changes in land use. The MSTM is a unique tool to analyze land-use and transportation impacts in the region.

The region-level OD matrix provided the travel pattern within and between the states. Link-level analysis demonstrated the traffic volume on selected critical corridors in the region. Sensitivity tests of the model respond well to alternative future scenarios, showing that higher energy prices result in fewer trips and decreasing VMT and VHT at the statewide level. These tests have shown that traffic volume in the Baltimore, Washington, DC, and connecting areas also declines with higher energy costs. The model is currently being improved with the addition of interregional trips and freight and long-distance passenger flow. The MSTM can be used to assess the impact of major facilities proposed or under construction, including the freeway-intercounty connector (ICC), new commuter rail lines being established by the Washington Metropolitan Area Transit Agency; major highway-rail freight flows, and electronic toll lanes on Interstate 95. This model provides a critically needed understanding and analysis of future land-use and transportation interactions and patterns in the Maryland-Washington, DC region. In the broader vision, MSTM can evaluate a number of integrated land-use and transportation scenarios including freight, improved transit, congestion pricing, and emission estimates in the region, as well as sprawl. The integrated land-use-transportation model is a useful tool to model travel behavior and to determine transportation sustainability at statewide and regional scales.

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COMMUNITY ESSAY

Seeking a dialogue: a targeted technology for sustainable agricultural systems in the American Corn Belt

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This Community Essay aims to start a dialogue on the role of targeted environmental technologies in “sustainable agriculture.” Using the new water-quality technology of denitrification bioreactors as a specific example, we focus on the question: are edge-of-field technologies such as bioreactors simply band-aid approaches to sustainable agriculture? Or can they be part of a comprehensive paradigm shift? Denitrification bioreactors are a novel approach for reducing the amount of nitrate in on-farm agricultural drainage, a pollutant that has caused water-quality concerns at both local and national scales. We first address whether or not denitrification bioreactors might qualify singularly as a “sustainable technology” within the conceptual continuum of weak to strong sustainability. Then we introduce a broader perspective on the potential role that targeted technologies might play in multifunctional agricultural landscapes. We suggest that denitrification bioreactors are one technology that can, in a small way, mediate a shift in agrarian paradigms. A transition toward sustainability is a long and gradual process requiring the incorporation of a wide range of approaches including targeted technologies and multifunctional landscapes. While the issues presented here are hardly exhaustive, it is our hope that this commentary spurs broader dialogue within the sustainable agriculture community about the role of technology in the future of agriculture. We are seeking to encourage broader philosophical reflection on work being done in the name of a sustainable agriculture.

Introduction

The current Corn Belt landscape of the United States developed over several generations due to a multitude of factors including technological advances, demographic trends, regional shifts in production goals, economic and policy stimuli, and cultural heritage (Hurt, 2002). Today’s resulting Midwestern landscape is characterized as being a highly complex, socially constructed mosaic of intensive land uses constrained by ecological, technological, and economic capacity (Nassauer et al. 2002). It is clear that the current intensive model of agriculture, while highly productive in terms of economically important crop commodities, is also known to have pervasive impacts on patterns and processes essential to ecosystem function and therefore agricultural productivity and environmental quality (Tilman et al. 2002; Robertson & Swinton, 2005; Dale & Polasky, 2007). Further, many consequences of ecosystem impairment are subsequently passed on to society as costly negative externalities that are increasingly being experienced at multiple spatial and temporal scales (Tegtmeier & Duffy, 2004).

This state of affairs will likely push twenty-first century American agricultural policy toward the promotion of multifunctional landscapes (Ruhl et al. 2007), that is, economically viable landscapes that jointly produce increased quantities of ecosystem goods (e.g., food, fiber, and fuel) and broader arrays of environmental services that control negative externalities, enhance productive capacity, and provide numerous ecosystem benefits (Boody et al. 2005; Jordan & Warner, 2010). Generating, enhancing, and/or maintaining ecosystem services across landscapes is integral to any sustainable agriculture paradigm and will increasingly be viewed as a primary component of operationalized sustainability (Selman, 2008; Taylor-Lovell & Johnston, 2009). Nevertheless, farmers are significantly challenged to find a balance that fulfills their shorter-term production goals and longer-term stewardship interests (Chouinard et al. 2008). In short, the future of agriculture is a very complex socioecological issue with much at stake for farmers, consumers, and the environment.

Arguments and concerns about a sustainable future for Corn Belt agriculture in the United States have been framed from a number of overlapping,
systemic perspectives (e.g., Bell et al. 2004; Flora & Flora, 2007; Nassauer et al. 2007). To channel the discussion and start a dialogue, this essay purposely chooses one angle on which we, as an agricultural engineer and a natural resource economist, have unique, pointed perspectives: agro-environmental quality and the role of environmental technology in a “sustainable agriculture.”

In the agricultural domain, it is easier to recognize what is clearly not a sustainable condition than to identify what is; as such, a key point in closing a sustainability gap is to eliminate or mitigate the offending state of affairs (Boron & Murray, 2004). In the American Midwest, a key environmental indicator of declining Corn Belt sustainability is the acute deterioration of water quality due to nutrient and sediment loading, which has created cascading negative effects across multiple scales (Helmers et al. 2007). Expensive local drinking-water treatment, combined with national concerns about hypoxia in the Gulf of Mexico, means that the prime source for this nutrient pollution, Corn Belt agricultural drainage, needs to be a major starting point for addressing environmental sustainability (Goosby & Battaglin, 2000; McMullen, 2001). Moreover, the timing is critical for addressing these agro-environmental issues as the 2008 Gulf Hypoxic Zone was the second largest on record and the 2009 zone was unusually severe in certain locations (USEPA, 2011). This hypoxia is one of the United States’ largest water-quality concerns; the resulting death of aquatic organisms represents a severe disruption of ecosystem function as well as lost economic opportunity for the Gulf’s associated aquatic industries.

The Role of Technology

In response, agricultural scientists have amplified their calls for the increased role of technology in sustaining agriculture and the environment (e.g., Aldy et al. 1998; Tilman et al. 2002; Secchi et al. 2008). Recent research regarding on-farm options for water-quality improvement has led to new ideas such as denitrification bioreactors for nitrate removal from agricultural drainage (Jaynes et al. 2008; Christianson et al. 2009; Woli et al. 2010).

Denitrification bioreactors are an innovative technology that maximizes the natural process of denitrification, a conversion of problematic nitrate to comparatively benign nitrogen gas by native soil bacteria. Denitrification technologies were originally used to treat nitrate pollution in groundwater in the 1990s (Schipper & Vojvodic-Vukovic, 1998), and this idea has now proven promising to treat agricultural drainage waters (van Driel et al. 2006; Schipper et al. 2010). In the case of agricultural drainage, a pipe that receives drainage water from between 8–20 hectares (ha) (20–50 acres) is intersected with a trench filled with woodchips (e.g., 3–6 meters wide and 30 meters long or approximately 10–20 feet wide x 100 feet long). Beneficial bacteria colonize the woodchips and use them as their carbon source (i.e., food) to provide energy for nitrate conversion as the nitrate-laden drainage waters flow by. This nitrate-mitigation strategy is promising for the American Corn Belt, reducing nitrate concentrations by over half and even as high as 99% depending upon a number of environmental factors such as flow rate and temperature as well as bioreactor design (Jaynes et al. 2008; Woli et al. 2010). In terms of nitrate-load reduction (i.e., considering volume of water treated in addition to nitrate-concentration changes), bioreactors may remove 33–55% of the total nitrate amount that would otherwise have gone downstream (Jaynes et al. 2008; Woli et al. 2010). After the upfront installation cost, to which governmental cost-sharing may apply, comparatively little maintenance cost or time is required over a life of at least ten years (Schipper et al. 2010).1

Though denitrification bioreactors for agricultural drainage are still a new idea, a handful are operational in Iowa, Illinois, Minnesota, and Canada (van Driel et al. 2006; Christianson et al. 2009; Willette, 2010; Woli et al. 2010). To date, most installations have been via private groups (e.g., watershed associations, commodity groups) or research organizations (e.g., universities, United States Department of Agriculture’s Agricultural Research Service), though researchers think that eventually individual landowners will instigate installations. With “field-scale” treatment areas, bioreactors do not treat wide swaths of land but are ideal for individual Midwestern drainage systems. Bioreactors can be incorporated into existing conservation practices such as grassed buffers (Christianson et al. 2009), and their “edge-of-field” treatment means that they are minimally affected by variable in-field practices (e.g., no-till, fertilizer management, increased cropping due to demand for biofuel feedstock). Additionally, once installed, this technology has very low external energy requirements; as drainage water flows through the woodchips, the bacteria do the work. However, beyond the standard applied research questions regarding pollution-removal effectiveness and cost, critics have brought up a broader, equally important question: are edge-of-field technologies such as bioreactors simply physical and metaphorical band-aid approaches

1 Though no denitrification bioreactors treating drainage waters have yet failed due to woodchip exhaustion, it is thought that utilized woodchips would be removed and the excavation refilled with new chips if treatment was to continue.
treat problematic symptoms rather than addressing the sustainability of agriculture as a whole?

This is not a new question, as Allen et al. (1991) expressed concern that many technological approaches to agricultural sustainability seem to accept the current industrial evolutionary path of crop production as given. The concern that certain technologies seek “sustainable” approaches to “conventional” production paradigms suggests that such strategies may simply delay the inevitable collapse of an inherently unsustainable model. More recently, an article in the online journal *Grist* challenged bioreactors specifically by pondering why Midwestern researchers were pursuing denitrification-bioreactor research, as the technology “fall(s) flat when you realize it’s just a technical fix for the status quo of over-fertilized conventional commodity crops” (Hoffner, 2009).

We readily acknowledge that such concern is valid. However, we advance several reasons why technologies such as bioreactors do have a place in a sustainable agriculture. Further, arguments framed by concern regarding “techno-fixes” at the scale of individual technology (e.g., bioreactors) are likely too narrow in contextual scope and should be couched more broadly to examine a specific technology’s role in a sustainable, multifunctional agriculture.

**Denitrification Bioreactors—To What Side Of Sustainability Do They Lean?**

To give our discussion credence in the sustainability realm, we first address whether or not denitrification bioreactors might qualify singularly as a “sustainable technology” within the conceptual continuum of weak to strong sustainability (Turner, 1993). We then introduce a wider perspective on the role that bioreactors might play in agricultural landscapes. While the issues presented here are hardly exhaustive, it is our hope that this commentary spurs broader dialogue within the sustainable agriculture community about technology’s role (in general, as well as specific to bioreactors) and to encourage broader philosophical reflection on various approaches to sustainable agriculture.

The notion of weak or strong sustainability seems a reasonable place to start in philosophically evaluating a particular technological approach to mitigating agricultural externalities. To a large extent, the distinction between weak and strong sustainability is the degree to which human-made capital can substitute for natural capital (in this case natural process). Table 1 articulates philosophical distinctions as described by Turner (1993) on a progressive continuum of “very weak” to “very strong” sustainability across different perspectives on resource use, substitutability, and economic growth. Agricultural land use, technology, and externalities all have significant overlapping economic qualities, suggesting that this continuum of sustainability is an appropriate exploratory framework (Stoneham et al. 2003).

Generally put, agricultural systems that lean toward the “stronger” side of sustainability exhibit an ecosystem perspective and give more weight to the interests of society than to those of the individual property owner, thereby rejecting the notion of externalities. In this context, the implementation of bioreactors distinctly shows a valuation of water quality that rejects externalities and extends interests to a collective. We can infer this because farmer adoption of practices designed to deal with environmental quality are motivationally different from innovations that lead to production efficiencies, largely because short-term economic advantages of adopting a mitigation technology are rare (Prokopy et al. 2008). Furthermore, while still arguably anthropocentric in perspective, interest in remediating water quality displays an ecosystems perspective in both application (water quality as a watershed concept) and effect (protection of aquatic ecosystems). It should also be noted, however, that the scope of an individual technology is often focused on specific indicators of environmental sustainability (i.e., nitrate and water quality). As such, any impact that this technology has on nonenvironmental realms of sustainability (e.g., social) may be highly nuanced and difficult to assess. Yet the impact of the surrounding environment on human society can never be underestimated (Moran, 2010).

Assertions that denitrification bioreactors “fall flat” (Hoffner, 2009) imply that this technology is very low on a sustainability continuum. However, based on our exploratory arguments, the use of denitrification bioreactors may well extend beyond the realm of “very weak” sustainability into “weak,” and in some cases extend into the “strong” side of sustainability. A reasonable follow-up question may be, “does the technology go far enough”? We leave this unaddressed, though note that very weak sustainability has long been rejected because its key assumptions (particularly perfect substitutability) are incompatible with ecological and agricultural systems (Ayres et al. 1989; Turner, 1993). Though the implementation of an individual technology itself may never lead to an agricultural system that is considered clearly “strong” from a sustainability perspective, the employment of bioreactors, in their own scale-specific way, may well challenge status quo agricultural paradigms (Table 1). It seems that conventional agricultural operations that are considered weakly sustainable may be shifted (in varying degrees, as exemplified in Table 1) to stronger sustainability categories simply through use of certain technologies.
Furthermore, while conventional agriculture often has path-dependent challenges (e.g., existing capital investment involving fixed costs often makes significant farm-scale change difficult), the use of the types of technologies discussed here is generally not limited by such barriers. That is, while a farmer’s use of technology such as a bioreactor may involve a new personal perspective on environmental management,

Table 1: Spectrum of Overlapping Sustainability Positions (Adapted from Turner, 1993) with rationalizations of bioreactor “weak” to “strong” sustainability.

| Row Description                                      | Very Weak                      | Weak                          | Strong                           | Very strong                      |
|-------------------------------------------------------|--------------------------------|--------------------------------|----------------------------------|----------------------------------|
| General perspective of position                        | Anthropocentric and utilitarian | Anthropocentric and utilitarian | Ecosystems perspective           | Bioethical and eco-centric       |
| The context of water-quality improvements associated with the use of bioreactors is clearly anthropocentric and its application is utilitarian in nature; nevertheless, these systems enhance naturally occurring biotic and abiotic interactive processes at localized scales. |
| Perspective on resource use                            | Resource exploitive             | Resource conservationist      | Resource preservationist         | Extreme resource preservationist  |
| Improved water quality brought about through bioreactor implementation is not exploitative of water resources. |
| Perspective on resource valuation and value timing     | Natural resources are to be used at economically optimal rates. Market-based valuation is the only appropriate economic measure. The economy functions to satisfy private property rights and consumer values. Focused on current generation. | Recognizes concern for the distribution of costs and benefits within current generations as well as intergenerationally. | Interests of the human and ecosystem collective given more weight than those of the individual property owner. | Recognizes intrinsic value in nature encompassing nonhuman living organisms and critical abiotic requirements. |
| Valuing water quality as it affects downstream conditions (e.g., fishers in the Gulf Coast) speaks of valuing the collective. The land draining into a bioreactor may or may not be used at an economically driven rate (most likely so, though bioreactors can be used for diversified systems). Intergenerational concerns cannot be addressed with a given, individual bioreactor as the technology has a life span within one generation. However, an agricultural system that actively internalizes externalities (regardless of approach) could, arguably, be on a path that spans generations. |
| Perspectives on resource fungibility                   | Infinite substitution possible between natural and human-made capital; continued well-being assured through economic growth and technological innovation | Rejection of infinite substitution between natural and human-made capital; recognition of some aspects of the natural world as critical capital with regard to maximizing human welfare (e.g., some ecological functionality cannot be adequately substituted for with technology). | Recognizes primary value of maintaining functional integrity of ecosystems over and above secondary value through human-resource utilization. | Strongly influenced by the “rights” of nature, including abiotic elements that are critical to a system. Outright rejects utilitarian perspectives on resource use. |
| Bioreactors are distinctly an engineered, technologically-based approach to mitigate nitrate by “artificially” enhancing a natural process (thus recognizing a degree of substitution between systems that enhance denitrification–e.g., wetlands); yet we argue that the process of denitrification, and thus the ecological functionality of land where denitrification is occurring, cannot adequately be substituted with tertiary systems such as nitrate drinking-water treatment that occurs in the city of Des Moines, Iowa. |
| Perspectives on economic growth                        | Explicit decoupling of negative environmental impacts from economic growth. | Recognizes negative externalities and approves of technological fixes; still prioritizes economic growth. | Explicit internalization of externalities required. Full-cost accounting needed to balance the interests of the collective. Accepts qualitative economic growth (e.g., Genuine Progress Indicator), largely rejects quantitative economic growth (e.g., GDP) | Anti economic growth |
| While economic growth is important for the sustainability of most agricultural systems, negative externalities (i.e., nitrate loadings) are recognized and addressed with bioreactors. Though cost sharing for bioreactors is available, currently the landowner must partially invest his or her own resources to internalize this water quality externality with bioreactors. |
it does not require significant modification of existing farm structure or management (Christianson et al. 2009).

A Role for Denitrification Bioreactors in a Multifunctional Landscape?

Despite our interpretation of bioreactors as being appropriate technology within a sustainable agriculture, we ultimately contend that such a perspective is far too narrow in contextual scope—that is, non-technical, philosophical critiques positioned strictly at the technology level disregard what a sustainable agriculture probably is; one that is purposefully multifunctional and highly productive with minimal (and perhaps correctable) tradeoffs (e.g., Tilman et al. 2002; Wilson, 2007). In this case, the argument may well be contextualized by assessing the role a particular technology might play in a multifunctional landscape. Multifunctional agriculture will require, in varying degrees, a targeted approach to land use. Targeted agricultural land use is founded on the premise that strategically-placed conservation practices can produce more than proportionate ecosystem benefits relative to their total spatial extent (Secchi et al. 2008; Taylor-Lovell & Johnston, 2009). The determination of targeted land uses may be thought of as a two-stage process. The first stage involves identifying key locations at a watershed-scale where land-use modification or technological remediation could have significant impact. The second stage involves targeting land-use change at the field/farm-scale by examining localized variable source areas and soils and accounting for equipment requirements and other management considerations. Ultimately, such a targeted approach can significantly improve ecosystem-service delivery, minimize land-use tradeoffs, and efficiently use monies already allocated to conservation via various government programs (Secchi et al. 2008).

If a targeted approach to agriculture is truly a legitimate path toward sustainability, where then does a technology such as a bioreactor fit within this concept of multifunctional agriculture? The notion of targeted technologies continues to beg Hoffner’s (2009) implicit question, “Are these only band-aids?” A reasonable analysis of this question may begin by examining bioreactors in the context of the “economy of pragmatism.” Realistic, multifunctional farms in the American Midwest will still require artificial drainage to maximize economic profitability (Comis, 2005). The complexities of soil-water relationships and farm-level nutrient management suggest that runoff and nutrient leachate will remain remedial issues even in multifunctional systems (Coiner et al. 2001; Randall & Goss, 2001). Denitrification bioreactors and similar water-quality technologies can reduce nitrate loads in drainage from both conventional and alternative operations. Therefore, certain technologies will have a place even as ideas and patterns shift. The transition toward sustainability is a long and gradual process involving shifting agrarian paradigms that will invariably require the incorporation of a wide range of technologies, approaches, and philosophies.

Of course, there are other technologies that incorporate or augment natural processes to effectively provide the same denitrification (nitrate removal) process as bioreactors in addition to a host of other ecological functions. Foremost are restored or constructed wetlands that additionally provide services such as biodiversity and habitat, flood protection, groundwater recharge, and carbon sequestration (O’Geen et al. 2010). However, government programs or water-quality professionals do not intend (that we are aware of) to “pit” bioreactors against wetlands or suggest 1:1 fungability with regard to direct and indirect ecological outcomes (Christianson et al. 2009). In fact, in most cases denitrifying bioreactors complement other best management practices and do not preclude a variety of mitigation strategies (Woli et al. 2010). Ultimately, bioreactors are best utilized within a “suite of solutions” for achieving water-quality goals in an agricultural watershed (ISA, 2011). Because a degree of remedial immediacy is involved with local and regional water-quality goals, various technologies and best management practices are collectively required to gain aggregative benefits on a watershed-scale.2

In the context of targeted land use at multiple scales, bioreactors have a number of key technological advantages. They can easily be targeted at the field/farm level to optimize impact while requiring a relatively small surface footprint (approximately 0.1% of the drainage area); this is an important factor when minimizing land-use costs is paramount. Further, bioreactors can be installed in locations where wetlands cannot be built (ISA, 2011) and many farmers may have access to required excavation equipment and be able to use on-farm materials (e.g., wood chips), lowering installation costs. However, as Christianson et al. (2009) note, these two technologies offer options for different scales: bioreactors are primarily intended for farm-scale with a relatively small treatment area of 8 to 20 ha (20 to 50 acres),

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2 A potential unintended consequence of the use of mitigation technology is that producers may feel somewhat insulated from potential off-farm effects and be prone to overfertilization or intensifying tillage. Nevertheless, since the usage of mitigation technology is voluntary (often motivated by an active desire to manage environmental risk) we believe that this type of moral hazard is limited.
A Word or Two Beyond the Physical

Even though bioreactors are a focused technology to improve the environmental sustainability of agriculture as narrowly indicated by nitrate loads, it is thought their use and promotion (e.g., via demonstration projects, participatory research, and cost-share programming) may provide a unique opportunity to open the door for proactive mindsets and a broader discussion about sustainability (e.g., Willette, 2010); this phenomenon of social learning and dialogue is common in the context of agricultural demonstration and on-farm research within the American Corn Belt (Lemke et al. 2010; Petrehn, 2011) as well as international agricultural contexts (e.g., Verstraeten et al. 2003). With on-farm communication about innovative technologies such as bioreactors comes something even more powerful with regard to motivating farmer-management intentions: education about the relationship among land use, environmental quality, and agricultural sustainability (Lemke et al. 2010). The idea here is that bioreactors and other applied technologies can (to some degree) be a technological segue to increased interest in environmentally sustainable agricultural. The novelty of bioreactors, as well as their scaled technological advantages and complementary nature, provides an interesting and complex backdrop for landowner education regarding innovation, environmental quality, and potential roles for farmers as land stewards. This feature could indeed contribute to positive but nuanced social outcomes that enhance and expand the role a “community of farmers” might have in defining regional identity by better protecting social and environmental amenities (Bell et al. 2004). Work is currently underway in Iowa to explore this educational dynamic and to characterize farmer opinions, concerns, and potential intentions regarding the use of bioreactors (Christianson & Helmers, 2009).

Final Thoughts

It is important that research not lose sight of the reality of conventional agriculture while trying to achieve land use that leans toward the stronger side of sustainability. In agriculture, land use (to a large degree) dictates the suite of “goods” and “bads” associated with that landscape. Water-quality dilemmas in the American Midwest are creating social pressure of remedial immediacy—to deny a well thought-out water-quality management approach seems counterproductive in this context. Technology, such as the denitrification bioreactor, that is effective for nitrate mitigation, scale appropriate, compatible with other technology/management, affordable, and broadly appealing to farmers has an enhanced probability of being embraced. As noted earlier, the adoption of bioreactors reflects a pointed private interest in stewardship with a degree of internalized responsibility (i.e., internalized cost at private expense) toward agro-environmental quality. This may reflect farmer behavior, motivation, and interest that, in the aggregate, helps “pave the pathway” toward a more sustainable agriculture. To the degree that a technology helps initiate broader understanding of the link between land stewardship and sustainability, all the better. This dynamic surrounding bioreactors strikes us as a technological approach to a pragmatically defined issue that not only treats symptoms of socially inefficient land use but also promotes a different agricultural paradigm. The American ecological designer William McDonough has articulated, “Sustainability takes forever—that’s the point.” Some critics argue that bioreactors and related technology cannot play a potential role in agriculture on the assumption that such technology belies the complexity of sustainability (e.g., Hoffner, 2009); we wonder if they are themselves failing their own assumptions by assuming a complex, systemic change will occur all at once.

Ultimately, we freely admit that we struggle philosophically with this issue and are broadly seeking insights. It is our hope that this article initiates the kind of dialogue that will encourage others to be reflective about their research and to contemplate the broader philosophical implications of technology in agriculture.

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BOOK REVIEW PERSPECTIVES

Stuart Sim, *The End of Modernity: What the Financial and Environmental Crisis is Really Telling Us*

Edinburgh University Press, 2010, 216pp, ISBN: 9780748640355

**Editor’s Introduction**

The financial collapse of 2007–08 and the subsequent Great Recession triggered latent recognition that Wall Street chicanery and climate destabilization share a number of common features. The failure to adequately regulate both financial markets and emission streams springs from a perilous combination of political malevolence, corporate greed, and public quiescence. Our dual economic and environmental problems are also emblematic of a global economy that is intent—indeed programmed—to use any and all available means to propagate an endless supply of consumer goods to maintain an illusion of “growth.”

We have also come to understand in palpable ways the tragic consequences that ensue when enthusiasm for this treadmill wanes and consumers are no longer able to keep running with sufficient vigor. We have created over the past sixty years a growth-bound economy that is dependent on three preconditions to maintain itself—proportional investment in public goods, rising wages across a broad cross section of income classes, and continual novelty.

John Kenneth Galbraith’s prescient observation in 1958 that the United States was characterized to a growing extent by “private affluence and public squalor” was an early warning of where things were heading with respect to the first precondition. With regard to the second prerequisite, several economically advanced countries—the consumptive sponges of the contemporary global economy—have seen more than three decades of stagnating average wages while the bulk of the proceeds of growth have been appropriated by the wealthiest consumers. Finally, with the exception of information technologies, most innovation has focused on relatively ephemeral design modifications, production-cost reductions, creative financial instruments, and new ways to impart premature product obsolescence.

To reinvigorate the shattered machinery of the growth economy, we are now confronted with a number of alluring concepts centered on notions of “green growth” and the “green economy.” Like a two-pack-a-day smoker captured by the promises of low-nicotine cigarettes, “safe tobacco,” and other such marketing inducements, many policy makers today are besotted by the prospect of seductive, but ultimately chimerical, solutions that avoid the challenges of confronting head-on the tangled contractions in our severely impaired growth machine.

Rumblings through have begun to emerge on the periphery of scholarship and policy practice. Numerous efforts are afoot to bring to public attention the propensity of current activities to promote “uneconomic growth,” the rebound effects that are induced by more efficient technologies, the overall weak relationship between economic growth and well-being, and the opportunities that abound to facilitate flourishing lives. We are also witnessing a renewal of interest in the field of political economy and an exciting uptake of its insights by sustainability scientists. My own bookshelf holds a number of relevant studies and it bears calling attention to them by name (in chronological sequence): James Gustave Speth’s *The Bridge at the Edge of the World* (Yale University Press, 2008), Tim Jackson’s *Prosperity Without Growth: Economics for a Finite Planet* (Earthscan, 2009), David Boyle and Andrew Sims’ *The New Economics: A Bigger Picture* (Earthscan, 2009), David Korten’s, *Agenda for a New Economy: From Phantom Wealth to Real Wealth* (Berrett-Koehler, 2010), Joseph Stiglitz’s, *Freefall: America, Free Markets, and the Sinking of the World Economy* (Noton, 2010), Juliet Schor’s *Plenitude: The New Economics of True Wealth* (Penguin Press, 2010), Diane Coyle’s, *The Economics of Enough* (Princeton University Press, 2011), Karin Ekström and Kay Glans’, *Beyond the Consumption Bubble* (Routledge 2011), and Chandran Nair’s, *Consumptionomics: Asia’s Role in Reshaping Capitalism and Saving the Planet* (Wiley, 2011). This list is by no means complete, but is indicative of a powerful wave.

It would have been wonderful to convene symposia on each of these volumes, but alas time and space have worked against this ambition. Instead, the current issue of SSPP provides a tripartite discussion of Stuart Sim’s new book, *The End of Modernity: What the Financial and Environmental Crisis is Really Telling Us* (Edinburgh University Press, 2010).
Perhaps in the future there will be opportunities to take up some of the other studies in a similar format. For now, let me thank Ian Gough, Kyla Tienhaara, and John Piene for their thorough reviews and acknowledgment as well Stuart Sim’s thoughtful response to these commentaries.

Maurie Cohen, Editor

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Stuart Sim, in The End of Modernity, contends that the twin crises in the title are propelling us beyond modernity and postmodernity. What does this mean? And does it help us understand and deal with the aftermath of the twin crises? Let me say to begin that I agree that these crises do indeed exist and pose an egregious threat to our well-being and that of the planet.

“Modernity” Sim identifies with the quest for continual progress in mastering nature and in expanding economic output without limit. This outlook is associated with a universalist history expounding progress, a worldview associated with the Enlightenment. It is thus plausible that modernity lies at the root of the threat to planetary sustainability evinced by global warming and other macro-level environmental threats, and possibly of the implosion of financial capitalism in 2008.

However, Sim also contends that modernity has involved a strong commitment to deregulated free markets and democracy. This point reminds us of the neoliberal turn around 1980 and the subsequent Washington Consensus. It drastically collapses the time span of modernity from three centuries to three decades. It is not possible to define modernity both ways. Indeed, as the author recognizes later on, even in the heyday of neoliberal capitalism other forms of capitalism thrived (e.g., Germany) and emerged (e.g., China), and the dominant issue today may well be the “contested modernity” shaped by China’s challenge to the United States.

What about postmodernity? This is characterized as an intellectual challenge to modernity with roots in architecture and aesthetics, but which began to develop as a more integrated critique during the late 1960s at the end of the long post-war boom. Postmodernism challenged Marxism and other grand narratives of progress. In its place it advocated skepticism and limits to the power of reason, antiauthoritarianism and pluralism to enable the pursuit of personal liberation, small government, and respect for the past. Sim develops the idea of the “economic sublime” to encapsulate this—a situation where we genuinely do not know what will happen next, or what the effects of our actions will be.

But he goes on to assert that postmodernism underpins “an economics of enough,” a recognition that it is not always necessary or desirable to have more of everything in material terms. Of this I am unconvinced. Does not much postmodern writing extol the virtue of the abundance and variety that modern capitalism makes available to consumers in the rich world?

In any case, Sim argues that we now need to move beyond postmodernity to what he calls real postmodernity. In part, he says, this is a move from an intellectual critique to “an actual state of affairs requiring a concerted sociopolitical response.” Now that modernity itself is collapsing under the weight of its internal contradictions, we have transcended the rhetoric of postmodernism. The challenges we face are immediate and material as well as moral. So, he claims, we need strong, interventionist states (even elements of a command economy) to deal with climate change and economic breakdown—no more small government! Conspicuous consumption must be replaced with the economics of enough, a new collectivism counterposed to the hyperindividualism of the past three decades, and a renewed belief in public service.

This new sociopolitical response is not so different from one variant of modernity—modern social democracy. But what does it have to do with postmodernism? Is it not as accurate to see postmodernism as an intellectual current feeding into the neoliberalism of the 1980s? In other words, is it not the case that postmodernism has contributed to the last phase of modernism which ended in such a spectacular crisis in 2008? Much postmodernism writing rejected interventionist states, admired the catallaxy of markets and individual initiative, and rejected big narratives that could be used to challenge producer and consumer interests. It was at least compatible with the age of me-now. Sim’s recognition of this connection does not so much rebuild the whole postmodern project as challenge it.

I would also question the displacing of “capitalism” by modernity in the book. The system which dominates the world today, one in which firms must perform pursue profit or face extinction, is still capitalist. The dull pressure of economic competition forces all managers of capital to expand its value ad infinitum, which drives economic growth and carbon emissions. True, states and public institutions can modify the operation of national capitalisms at a macro-level: forms of state intervention interact with...
other historical institutions and tend to be strongly path dependent. But financial capital still wields a structural power over states, via control over investment, ability to exit from national jurisdictions, pressure over the terms of public sector borrowing, and in other ways.

An alternative political economy explanation of the financial crisis would begin with the collapse of profits in the late 1960s and 1970s which engendered the political success of the neoconservative counter-movement around 1980. Since then the share of wages in gross domestic product (GDP) has fallen ten percentage points in the countries comprising the Organization for Economic Cooperation and Development (OECD) and inequality has mushroomed. This collapse of the wage share threatened growth in domestic consumption demand and fueled the catastrophic rise in personal debt across much of the West, which eventually precipitated the financial crisis of 2008. Political economy provides an understanding of capitalism as a system of path-dependent development interrupted by infrequent crises and switching points, which recast the role of states in managing the system.

The secular and unprecedented growth in world output is now engendering the distinct and longer-term crisis posed by climate change. Here, there is at first sight common ground with Sim’s critique of modernity as unsustainable. Yet, I would still claim that the ideology, the narrative of belief in unending growth and progress, is a reflection of the real processes rooted in the competitive pressure to enhance profits within a now-global capitalist economy. Moreover, the postmodern “solutions”—skepticism about our collective ability to understand and control these events, the pursuit of personal liberation—are woefully inadequate, as Sim demonstrates.

The “real postmodern” appears to have contradictory aims: to undermine the neoliberal version of postmodernity, while including modernist principles of governance within the term. This ambivalence suggests that the modernism-postmodernism framework is not a helpful way to understand the wrenching changes now taking place in the world economy and ecology. In my view, a political economy analysis of capitalism offers a better understanding of the twin financial and environmental crises than a resurrected postmodernism.

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Ian Gough is professorial fellow at the London School of Economics where he is researching the interface between climate change and social policy. He has previously written on the political economy of welfare states, on human needs and well-being, and on welfare regimes in developing countries.

Kyla Tienhaara

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I found Stuart Sim’s The End of Modernity to be an accessible and enjoyable read even though I have very little prior knowledge of postmodernism. I also applaud the author—a professor of critical theory and English literature—for his willingness to venture into debates about economics. He brings a fresh perspective to many of the issues that he discusses and manages to weave in interesting references to art, architecture, music, and theatre.

The basic premise of The End of Modernity is that “modernity has reached its limit as a cultural form” because it is “destructive of both the planet and...socio-economic systems.” For Sim, the evidence of modernity’s demise is found in the 2008 global financial crisis and the ongoing climate crisis. However, Sim is not arguing for an “intellectual” postmodern response to these crises. In his view, postmodernists have been successful in illuminating and critiquing the underlying power structure of modernity, but have failed to critically examine its overall objectives (e.g., economic growth). Instead, Sim believes that what we need is “real postmodernity”—a concerted sociopolitical response to the environmental and financial crises. This is what he proposes to outline in this volume.

The first part of the book examines the cultural dimensions of the end of modernity. In the introductory chapter, Sim argues “that there is currently an ideological vacuum where modernity once held sway,” which “presents an opportunity to construct a better kind of lifestyle.” He criticizes the “cult of progress” that has defined modernity and calls for the cultivation of a politics and an economics of “enough” and a return to a simpler way of life. Interestingly, Sim suggests that it is no longer “at all radical to question conspicuous consumption and its impact, not just on our individual psychology but on the environment.” I more hope, rather than believe, this to be the case. It is certainly true that, of late, critiques of society’s obsession with consumption and economic growth have become more popular within certain fields of academia. Some excellent books in this vein have been published in the last few years (e.g., Dauvergne, 2008; Victor, 2008; Jackson, 2009). However, I would argue that such thinking has not yet been welcomed in mainstream public discourse. For example, in the current debate in Australia over a
carbon tax, both sides remain firmly couched in either fear or reassurance about the impact on the continuing ability of consumers to consume and the economy to grow (Thompson, 2011). It would be political suicide for an elected official in this country to suggest that a carbon tax should curb consumption or that Australia’s gross domestic product (GDP) does not need to grow any further.

Sim’s next chapter discusses what modernity, as a cultural paradigm, promised and assesses how well it has delivered. The author acknowledges that in “material terms it would have to be agreed that modernity has largely delivered the goods,” at least in the West. He also points out that individuals in many countries are better off in political terms, with greater rights and freedoms and a greater say in how society is governed, than they were in premodern times. However, he highlights that, in practice, democracy has not always reflected the ideals that underpin it and, furthermore, that much of the world remains in the grip of authoritarianism. Additionally, he notes that many material gains in developed countries have been made possible only through continuing oppression in the developing world. Although Sim briefly turns to these elements that comprise the “dark side” of modernity in the closing pages of Chapter 2, I was surprised that he did not dwell in this section on the psychological implications of our addiction to consumption, which experts have argued has made us prone to depression and anxiety (James, 2008).

The second part of the book examines the economic dimensions of the end of modernity. The chapters in this section summarize the Marxist critique of capitalism and take particular aim at Milton Friedman and the neoliberal economic theory that he espoused. The section covering the financial crisis is largely a series of summaries/reviews of several books that have been written by economists, economic journalists, and industry insiders. Sim agrees with some of the conclusions drawn by these authors, but questions others. For example, while Sim clearly has a great deal of respect for Paul Krugman, he argues that Krugman’s assessment of the credit crisis is too optimistic and too narrow and thus “hides the bigger picture” of an ideology of constant material progress that is fundamentally unsustainable. Although very little in this part of the book is new, the summaries are well done and provide a good entry point to the literature for those who have not read widely on the topic.

The final part of the book aims to look “beyond modernity” to see what life and politics would look like in a “post-progress world.” Sim begins in Chapter 7 by assessing what we can learn from the arts. Although I found this chapter interesting, I did get a little lost, perhaps because concepts such as “double-coding” are alien to me. However, I do agree with Sim’s suggestion that “it would be socially beneficial if much of the energy being channelled into creating more economic value were instead directed into artistic activities.”

In Chapter 8, Sim turns to the question of how politics should be structured after the demise of modernity. Essentially, he appears to be arguing for “big government,” for more regulation and more intervention in the market to deal with the financial and environmental crises. However, he does recognize the pitfalls of big government and the need to guard against authoritarianism. Some of Sim’s comments in this chapter—for example those he makes about the benefits of the Euro and the need to consider China’s recommendation for a world currency—appear to be largely focused on ensuring financial stability. Others, such as his discussion of the need to replace GDP as our principle measure of national well-being, address the problem of our overriding preoccupation with economic growth.

In the concluding chapter, Sim reiterates his call for a “strong central authority” and more regulation. He also makes a plea for socialism to be reconsidered as a source of cultural ideals. In the closing paragraphs, the author notes that the post-progress world that he has outlined “will not be to everyone’s taste” and that “an economics and politics of enough will no doubt invoke some resistance, especially from the business community and the commercial world.” In my view, this is a gross understatement. One can, for example, contrast this appraisal with Tim Jackson’s (2009) assessment that reorienting the economy and shifting the social logic of consumerism “may well be the biggest challenge ever faced by human society.”

Overall, I do not believe that Sim presents, in this final part of the book, a strong and coherent vision of a post-progress world. I was left with a very clear picture of what he believes is wrong with modernity, but less appreciation of how exactly we can move beyond it. The calls for greater regulatory intervention in the market could have been much more specific. For example, advertising, especially when targeted to children, plays a critical role in promoting and sustaining conspicuous consumption. More regulation in this area could, therefore, make an important contribution to efforts to bring about a “culture of enough.” Furthermore, while Sim suggests that we need government “to protect us against an ever-inventive corporate sector eager to bring back modernity,” he does not explore how the corporate sector itself could be radically restructured to be brought into line with the ideals of a post-progress world.

My other main critique of the book is that its subtitle suggests that Sim will explore both the finan-
cial and environmental crises, but the discussion of the former far outweighs that of the latter. It feels as though Sim assumes that his readers appreciate all the connections between growth, consumption, and environmental degradation. However, most politicians and even the leaders of some environmental nongovernmental organizations (ENGOs) continue to advance the view that sustainability does not require a re-evaluation of the Western lifestyle or an abandonment of growth. Many observers who accept the world’s dire situation continue to believe that greater investment in technological solutions to environmental problems will be sufficient to avert disaster. This is why other authors have endeavored to dismantle the myth of absolute decoupling—the notion that environmental impacts and resource use can decline in overall terms despite rising GDP (see, e.g., Jackson, 2009).

Finally, I was also surprised that there was so little mention in the book of the “green” responses to the financial crisis—the calls for a “green new deal,” the “green” elements of fiscal stimulus packages and so forth (see, e.g., Green New Deal Group, 2008, Barbier, 2010). I would have been interested in Sim’s views on whether such proposals and actions—often referred to as “green Keynesianism”—represented a turn toward a “real” postmodernity or were instead an “opportunity for the rejuvenation of global capitalism” (Mueller, 2009).

Sim has been very ambitious and at the same time economical (The End of Modernity is only 216 pages). As such, I suppose it is hardly surprising that he has not touched on every issue that I regard as important, especially considering how different our disciplinary backgrounds are. On this note, I should also stress that I am not capable of evaluating the contribution that this book makes to the literature on disciplinary backgrounds are. On this note, I should also stress that I am not capable of evaluating the contribution that this book makes to the literature on postmodernism. What I can say is that while Sim certainly does not have all the answers to the monumental challenges currently facing human society, his book is a welcome addition to a growing body of literature that is exploring potential paths to a more egalitarian and environmentally sustainable future.

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John D. Peine

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The End of Modernity, Stuart Sim’s holistic perspective on the evolution of capitalism and financial investment policy and related politics, is complex and insightful, particularly in the context of our current tumultuous global economy, high unemployment, and massive loss of investment capital. The introduction highlights how the 1972 demolition of a high-rise public housing complex in St. Louis, Missouri, which had become a harbinger for drugs and crime, symbolized the end of modernity in the context of architecture. Sim proposes that modernity was closely tied to what he refers to as “the cult of progress” via the pursuit of unbridled capitalism. He describes an economic tipping point with the demise of the Wall Street investment bank Lehmann Brothers, “who had prospered on the basis of a huge credit bubble” until 2008, as a symbol of the singular focus on capitalism. Much of the book focuses on Western society’s central push for ever-expanding consumerism. His implication is that the demise of modernity has been on a long slippery slope toward disfavor. His reference to Lehman Brothers left me confused as to if and when the end of modernity has actually occurred.

Reflection on modernity’s promise and reality was the most compelling overarching message to me. For the Western lifestyle, modernity has improved health and well-being in terms of an expanding economy and jobs. Sim points out that “[t]he last few decades have been something of a golden age, where
disposable income has increased remarkably.” The book’s description of the evolution of the economic dimensions effectively illustrates the transformation of a system that distributed benefits and control from the many to the contemporary system that serves the interests of the few. The globalization of the economy via multinational corporations and the financial sector has been the stage for the concentration of wealth and political influence. The credit crisis is best reflected in Sim’s description of how hedge funds evolved to become a huge crap game of risk that benefited only a few who bet against them. Sim, though, missed an opportunity to drill down in more detail on how no one was in charge or understood the true risks as related to, say, the mortgage market. More importantly, almost no individual paid a price for their malfeasance through payment of a fine and/or jail time. A teachable moment was lost on how modernity tends to get a free pass and the challenge of defining and describing accountability and consequence is still wanting. There is no discussion of how to compensate legitimate victims who were taken for a ride.

Another tenet of the philosophy underpinning modernity is to gain greater control over the environment. The threat to our planet’s environmental sustainability from the consequences of these policies and actions is woven throughout the book, with frequent reference to the implications of global warming from ever-increasing carbon-dioxide emissions into the atmosphere. Updating their assessment of the dangers of climate change, the International Panel on Climate Change tracks their concerns, including “increases in extreme events with substantial consequences for societies and natural systems. Examples include increase in the frequency, intensity, or consequences of heat waves, floods, droughts, wildfires, or tropical cyclones” (Smith et al. 2009). The extraordinary North American extreme weather incidents experienced so far in this La Niña year of 2011 have resulted in a high cost of lives and property from extreme drought in the west, to flooding along the Mississippi River basin, and numerous tornados in the Midwest and south.

The most significant shortcoming of the book, for me, is an inadequate number of case examples reflecting Sim’s major points. For example, when it comes to the concentration of wealth currently in the United States, 1% of the population takes in nearly 25% of the income and controls over 40% of the wealth (Stiglitz, 2011). Another dramatic example of the concentration of power is that in 2010, the U. S. Supreme Court ruled that corporations can contribute unlimited funds to political campaigns. President Obama swiftly blasted the court’s decision, stating that “The Supreme Court has given a green light to a new stampede of special interest money in our politics. It is a major victory for big oil, Wall Street banks, health insurance companies and the other powerful interests that marshal their power every day in Washington to drown out the voices of everyday Americans” (Tedford, 2010).

Sim’s book largely leaves open the question of who will drive the espoused dramatic change toward a more equitable view. In the United States, prime twentieth century examples of change include the right to vote for women, emergence from the Great Depression (due largely to involvement in World War II and the subsequent legislation that provided decommissioned soldiers with free access to higher education and generous housing subsidies), and the Civil Rights and Vietnam War protests. In the emerging twenty-first century, youth have been primary global voices in calling for environmental sustainability, including reducing greenhouse-gas emissions, and in the exciting so-called Arab Spring demanding democratic governance in authoritarian countries across the Middle East and North Africa. At the center of implementing successful change is the unfettered sharing of ideas and innovation, particularly by the youth. Information technology has emerged as the connective tissue via Facebook, YouTube, Twitter, and blogs. Today’s young-uns, as we say in East Tennessee, give me hope for this fundamental shift toward social responsibility in the future that we so desperately need!

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John Peine is a social scientist retired from the United States Geological Survey at the end of 2010. He worked for the U.S. Department of the Interior for over 37 years, serving eight administrations and is currently adjunct professor at the University of Tennessee in Knoxville with the Institute for a Secure and Sustainable Environment. From 1982 to 1992, he served as Chief Scientist at Great Smoky Mountains National Park. He is the editor of and contributor to the 1999 book Ecosystem Management for
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Rejoinder from the author
Stuart Sim

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My first response to the three reviews of The End of Modernity is to thank the reviewers for their thoughtful and fair analyses of the book’s arguments. I am taken to task by all of them for not having an absolutely clear-cut answer to the problems facing us, but the book was intended above all to generate debate, so I am pleased it has done so.

That I have been very influenced by postmodern thought is critical to why I have not offered comprehensive solutions to the crisis we are mired in. It would be only too easy to come up with such solutions if I were either a Marxist or a neoliberal: recommending a command economy on the one hand, or an even more unregulated market economy on the other, which relied on the “invisible hand” to correct any of the system’s excesses and abuses. In both cases there is a clear plan of action based on a set of ideological principles that adherents totally believe in and will accept no counterargument to. Whether you agree or disagree, you know precisely what the position is: you are being offered a program claiming to have all the answers needed. I really do believe we are currently stuck in an “ideological vacuum,” however, and the book can be considered a report from there. If there is one thing that postmodernism has persuasively communicated it is that no one theory, or grand narrative, will answer all our problems. The central dilemma facing any postmodernist wishing to criticize the current political set up, therefore, is that he or she has no universal theory to fall back on. Unfortunately, most people are still looking for the elusive “grand narrative” that will offer us a route out of the current mess.

In retrospect, the book might better have been entitled The End of Modernity? because it is querying the sustainability of the growth economy we associate with modernity as a cultural system. I am aware that modernity can mean many things and not just “capitalism,” and I was certainly not arguing against the benefits brought by the social and political changes of the post-Enlightenment era. While I agree with Ian Gough that capitalism has not gone away and is still the prevailing ideology in the business world, what I was emphasizing was that it has lost its credibility. Perhaps the book might even better have been titled The End of the Credibility of Modernity? (although no doubt the publisher would have found this too unwieldy!). I would claim, as well, that it is pretty difficult to imagine modernity without capitalism, which becomes the means by which modernity can achieve its goal of endlessly improving the material quality of life. If that is not all that modernity is about, it is manifestly what has come to dominate it. Perhaps other forms are available, but capitalist modernity is the one we are stuck with at present, and all that the Washington Consensus has done is to reduce what few controls were being applied to it. At the very least, capitalism is a logical extension of modernity.

Losing credibility does not mean that capitalist modernity will wither away in the fashion that Marx had predicted; otherwise, the Great Depression would have been the end of it. Those with a stake in the system will do their utmost to keep resuscitating it, and they have found allies in the political class who have provided public money to keep the system going in the aftermath of the credit crisis. This does bring out a problem for anyone writing on current affairs. I was writing the book in 2009 when the viability of neoliberal economics was being called into question on a variety of fronts, but throughout the Western nations the population is being urged by governments to believe we can return to “business as usual” if we agree to cut down on public spending. In most cases this argument has been accepted (if often somewhat grudgingly), which suggests that collectively we are in denial over the real situation (which might also be said of global warming). I find this to be quite depressing and was hoping it would not happen. If John Peine is “confused” about when, and whether, modernity actually did end, I can only say that its loss of credibility does not seem to have deterred its true believers from carrying on with their crusade. And their efforts have proved more successful than one might have guessed back in 2009: Lehman Brothers seemed a very symbolic event at the time, but somehow we have managed to “forget” it collectively.

I am currently writing a follow-up to The End of Modernity entitled Addicted to Profit? Reclaiming Our Lives from the Free Market (due out in 2012...
from Edinburgh University Press). This book will look at the factors, psychological as well as political, that have disposed us toward forgetfulness over the traumatic events of the credit crisis, so perhaps it will answer Kyla Tienhaara’s point about my lack of detail regarding “the psychological implications of our addiction to consumption” (note that I have been careful to include a question mark in the title this time around). I might also say, in response to the point Tienhaara raises about undercoverage of the environmental crisis, that I had in fact gone into detail on just that topic in a previous book, *The Carbon Footprint Wars: What Might Happen If We Retreat from Globalization* (Edinburgh University Press, 2009). I am now thinking of *The End of Modernity, The Carbon Footprint Wars, and Addicted to Profit?* as forming a trilogy about the current socioeconomic paradigm and its underlying ideological principles; so there is a larger-scale critique taking place.

It comes across in all the reviews that modernity and postmodernity can mean a diversity of things and I concede that a form of shorthand must occur when writing a book on those topics. Yes, as Ian Gough claims, some postmodernists do support the “abundance and variety” that the free market economy brings—but not all do. One of the most striking aspects of postmodern thought is that dispensing with grand narratives can induce feelings of pessimism in some theorists, a recognition that neither the far right nor the far left have all the answers to humanity’s problems and that we are condemned instead to an endless series of negotiations about how to deal with the local problems at hand. I think that ditching grand narratives is liberating, and clearly it is for some postmodernist thinkers (Charles Jencks, for example), but there is no set position adopted by all postmodernists. Postmodernism is not an ideology, it is a critique of ideology, and a critique that is being conducted in a variety of sometimes conflicting ways. I regard postmodernism as an extreme form of skepticism, and as with skepticism in general it can be an uncomfortable position; but I also regard it as being more honest than believing that we can find yet another theory that will explain everything and tell us precisely what to do. I take real postmodernity to be that skeptical cast of mind, rather than simply jumping onto the neoliberal bandwagon because it freed us from political controls. It also freed us from responsibility toward others, and that is more problematic. I do not agree that postmodernism has to lead to such a condition (it does not in the work of Jean-François Lyotard, for example), and my intention was not so much to resurrect postmodernism as to point out that there are some aspects of its critique of modernity that we might learn from if we are going to question the ideology behind the cult of progress.

Neither is modernity a homogenous set of beliefs, and yes, it can include social democracy as well as neoliberalism. The book works on the assumption, however, that the latter has eclipsed the former in the last few decades and that it would be a positive step to reintroduce some social democratic practices into the current situation in order to protect us from the excesses of the free market. Even if all that does is to temper the impact of neoliberal economics on the current world order, that would be a move in the right direction. What I am campaigning for, ultimately, is a change in consciousness about how we view the world, and that is an ambitious project. However, I just cannot believe that the free market represents the summit of human achievement and that we cannot change our mind over that.

I recognize that there is a problem in arguing for stronger government to defend us from neoliberalism, as this is very much against the grain of the current political climate in the West, where government is all too often viewed with outright suspicion. The neoliberal have won a significant victory in this respect, and one can still find politicians arguing the case for less government intervention in the public sphere. The current government in the UK is yet again repeating the neoliberal line that there is too much regulation of business and is planning to scrap some of the existing controls. After the events of the credit crisis this beggars belief, and at such points it becomes necessary to voice objections. I am no advocate of a command economy style of government, but the effect of neoliberal deregulation is to leave us ever more exposed as individuals. We are in danger of seeing the public sector all but disappear if neoliberal thinking prevails, and that will lead to a decline in the quality of life for large sections of the population if it is carried through. The contract between government and citizens needs to be renegotiated constantly (that is what elections are for, after all), but there has to be something between us and the anarchy of the market, and governments are the only entities with the weight and authority to implement regulations protecting us. I see no evidence that the corporate sector will reform itself from within, nor accept its social responsibilities in any but the most superficial and cursory way.

I am neither an economist nor a scientist, and I realize that I have been encroaching into areas in which my knowledge and expertise is limited. My academic background is in philosophy as well as literary studies, and I tend to share an assumption common to many philosophers that it is a discipline which allows one to enter into other discourses and evaluate the arguments in play. Perhaps that is over-optimistic, but it was my primary objective in *The End of Modernity* (and the trilogy as a whole). The
more of us who are “exploring potential paths to a more egalitarian and environmentally sustainable future,” as John Peine puts it, whether specialists or generalists, the better. There is no one answer as to what we should do, much as we might wish there were. I have a feeling this is going to be a long haul and that we are probably still only at the ground-clearing stage of the exercise, but one has to start somewhere.

About the Author

Stuart Sim is retired Professor of Critical Theory in the English Department, University of Sunderland and currently Visiting Professor in Critical Theory in the English Department, Northumbria University, Newcastle upon Tyne. His main research interest is in postmodern thought, and he has specialized in recent years in the application of critical theory to public affairs.
BOOK REVIEW PERSPECTIVES

Sprawl and Politics: The Inside Story of Smart Growth in Maryland by John W. Frece

State University of New York Press, 2008, 190pp, ISBN: 9780791474129

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Maryland invented, or at least popularized, the term “smart growth” in the late 1990s under former Governor Parris Glendening. Although land-use planners in the United States had long tried a variety of strategies to contain sprawling development, notably in Portland, Oregon with its urban growth boundary and in Arlington, Virginia which concentrated development around Metro stations, it was Maryland that gave the term “smart growth” national resonance. Sprawl and Politics tells the story of the heady, improvisatory days in which Glendening and a small band of audacious urban planners developed this policy, then pushed and prodded it through the state legislature. It is also the story of how politics obstructed the policy’s long-term effectiveness. While Maryland’s key smart growth legislation was passed in 1997, a recent University of Maryland study concluded that the legislation’s key instrument, priority funding areas (PFAs), “has not produced the intended effects over the last 10 years”; that PFAs have, in fact, done almost nothing. This report reads almost like an afterword to Sprawl and Politics: both make clear that, beyond technical instruments, continued follow-up to ensure tough implementation, as well as to improve any failings in legislation, is necessary for comprehensive land-use planning to succeed.

As Communications Director for Governor Glendening, and later Special Assistant for Smart Growth, John Frece would seem the ideal author for Sprawl and Politics. He was there when the key decisions were made in the genesis of smart growth. The book relies heavily on Frece’s notes from the time, as well as on later interviews with key participants. In tone, the book is moderate and impartial, maintaining an academic distance to the point where the author refers to “John W. Frece,” giving no hint that he is speaking about himself. And a reading of the book provides no indication that Frece has a particular agenda other than general support of smart growth policies. Appearing as an objective look at the origins of smart growth, the book makes clear the policy’s idealistic promise, as well as the real-world failure to attain that promise, at least so far.

Frece shows that smart growth did not spring from nowhere, but was in many ways a crystallization of previous policies to contain sprawling land use and snarled traffic, to maintain rural areas, and to revitalize older communities. Even Glendening’s smart growth advocacy did not begin as a comprehensive vision, but was more of a reaction to events, including pressure from environmentalists not to build huge projects ever outward. Yet neither could smart growth simply hew to the environmentalist line; to succeed in the real world, it had to appeal to the business community.

The key—or at least one key—is the PFA, which designates “specific growth areas in every county that would be the only areas eligible for future state financial assistance for growth.” Unlike the heavily regulatory policies of the past, PFAs were designed to rely on incentives, making them a prototypical instrument of a time dominated by market policies. This quality also made them politically easier to pass in a state where local governments are wary of any attempt to take away too much of their power. In fact, land-use policies in Maryland have long been decided largely at the county and municipal levels, making comprehensive regional planning difficult, to say the least, as each jurisdiction strives to maximize its own position. As with all politics, smart growth policies involve compromise. Objective planners could not simply sit down and design an idealistic system; it had to be palatable and it had to be sold. Even when initially passed, PFA density was smaller than originally planned: 3.5 units per acre rather than five.

Smart growth in Maryland may have been born smaller than ideal, but what really squelched it was the election of a governor, following Glendening, unfriendly to the concept. Robert Ehrlich, who served from 2003 to 2007, largely gutted the Office of Smart Growth. In Maryland’s Washington suburbs, he opposed an east-west light rail and instead fast tracked the construction of a long-disputed highway. Even the phrase “smart growth” was retired from official
use. In Maryland where it was born, smart growth was soon moribund.

One lesson of Sprawl and Politics, then, is that long-term follow-through is necessary for smart growth policies to succeed; and yet, in a democracy with frequently changing faces in government, such commitment is problematic. To make matters worse, catchy phrases and trendy ideas will often morph to serve individual purposes. Even while Glendening remained as governor, “the label ‘Smart Growth’ was being co-opted,” explains Frece, applied to projects with only a few smart growth characteristics, or only a superficial appearance of smart growth. Within the PFAs, some projects were placed on the periphery to satisfy the requirements in only a perfunctory way. In addition, Frece argues, from the beginning the program was underfunded: “the financial incentives the state offered were never sufficient to prompt the kind of changes the administration hoped to achieve.”

True smart growth, then, requires strong policies enforced with eternal vigilance. Perhaps the most valuable part of Frece’s book is the conclusion, which provides a thorough set of suggestions for avoiding the many pitfalls. Strong leadership and knowledge of policy are crucial. Defining and measuring goals are crucial. In Maryland, explains Frece, “the state never made any attempt to set specific goals or benchmarks for what it intended to achieve through the Smart Growth initiative.” In addition to the government, the public must be engaged through publicity and education. Programs must be fully funded, with strong government authority. Although localities need to be engaged, left to themselves they will likely fall into old habits. Given the natural resistance to change, if smart growth is to succeed, Frece’s entire panoply of ideas must be followed, and then some.

Maryland’s smart growth experience holds deep lessons for environmentalists, policy experts, and sustainability advocates of every variety. Change is not easy. Our social organization and assumptions seem a deeply ingrained part of “human nature,” almost biologically immutable. To convince people to alter their lifestyles, to drive less, to waste less, to stop measuring their worth through consumption, is a task that requires perseverance, deep knowledge, and more perseverance, as Sprawl and Politics vividly illustrates.

About the Author

Ethan Goffman is Associate Editor of Sustainability: Science, Practice, & Policy and writes the SSPP Blog. His publications have appeared in E: The Environmental Magazine, Grist, and elsewhere. He is the author of Imagining Each Other: Blacks and Jews in Contemporary American Literature (State University of New York Press, 2000) and coeditor of The New York Public Intellectuals and Beyond (Purdue University Press, 2009) and Politics and the Intellectual: Conversations with Irving Howe (Purdue University Press, 2010). Ethan is a member of the Executive Committee of the Montgomery County (Maryland) Chapter of the Sierra Club.
BOOK REVIEW PERSPECTIVES

The Smart Growth Manual by Andres Duany & Jeff Speck with Mike Lydon

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The Smart Growth Manual is a handy guide to the nitty-gritty details of planning and building compact, walkable, mixed-use communities. Two of the three authors, Andres Duany and Jeff Speck (along with Elizabeth Plater-Zyberk), also wrote the now classic Suburban Nation: The Rise of Sprawl and the Decline of the American Dream. That book gave narrative voice to the angst so many of us felt, but had not collectively identified, as networks of roads infested with automobiles were flung ever outward, as stripmalls took the place of grass and trees, sidewalks disappeared, and even crossing the street could become a life-threatening adventure. The very different Smart Growth Manual is a practical guide to at least part of the solution.

The authors of The Smart Growth Manual are architects and planners who are founders of the new urbanist movement. While often associated with smart growth, new urbanism works at a more local, architectural level. Drawing upon neighborhood planning from generations past, planning that was swept aside in the latter half of the twentieth century (in the United States, at least), new urbanists design attractive, walkable communities that mix housing, shopping, and, ideally, employment. One problem is that such communities can be somewhat artificial, and may not blend in with the surrounding car-oriented sprawl. Rather than replicating traditional community life, their residents may tend to use them as “bedroom communities,” while their jobs are elsewhere. Indeed, in vibrant urban areas, shopping and entertainment may lure new urban residents to use automobiles almost as much as before. Nevertheless, the approach outlined in The Smart Growth Manual, while partial, may be the only one viable in our contemporary society, where people migrate across the country in search of jobs, where the car is the default mode of transportation, where the isolated individual is paramount and the idea of community has slipped away.

For a society that has forgotten how to design traditional communities, The Smart Growth Manual offers extensive practical advice. These recommendations include many gems that at one time must have been “common sense,” such as reclaiming and repairing old buildings and neighborhoods (which we should also do with consumer goods); creating road networks in grids rather than curvy dead-ends; designing for pedestrians and bicycles; providing wide, tree-lined sidewalks in retail districts; allowing ancillary dwellings to increase density; employing passive heating and cooling; ensuring a natural, healthy indoor environment; and using plants appropriate to an area’s features, notably water availability. Other advice is more tailored to our present circumstances, such as reducing parking where public transit is available; slowing traffic in residential neighborhoods; designing porous surfaces to reduce runoff; generating on-site energy; using high-tech conservation methods; preserving wetlands and surrounding them with parks; collecting and reusing water; and, overall—what really should be common sense but somehow is not any more—avoiding unnecessary waste.

Partly offsetting the critique that new urbanism may result in isolated islands, The Smart Growth Manual begins with a discussion of the need to “think globally, act locally, but plan regionally.” Regional planning is, indeed, the key to an organic smart growth. Yet too often, as the authors admit, “effective regional planning is rare, because few municipalities are organized to coordinate administratively at a scale encompassing the entire metropolitan area.” Unfortunately, the core of The Smart Growth Manual, with its emphasis on specific neighborhoods, is unable to follow through on the idea of the regional with any kind of comprehensive discussion. The book does end with four extremely instructive appendices, on what smart growth is, how it may be achieved, the Charter of the New Urbanism, and a companion follow-up that contextualizes the book’s core. The placement at the end of the volume is a bit strange, as without this discussion the main text amounts to “preaching to the converted,” showing planners and
architects who already agree with the premises of smart growth how they can go about changing things. Not that there is anything wrong with this approach. It is simply tailored to a particular audience, one far smaller than those attracted to Suburban Nation. The Smart Growth Manual is not a sweeping argument intended to persuade, but a guide to professionals as to how to go about changing things. In this it is a starting point, not detailed enough to be followed step-by-step, but full of excellent principles and little packets of useful advice. The book is organized as a reference for readers who want to begin to reclaim our lost communities from the concrete jungle and to help preserve our dwindling social and natural environments.

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