

Applying DPSIR to sustainable development

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SUMMARY

The DPSIR framework was devised in the late 1990s as a tool for the reporting and analysis of environmental problems, ranging in scale from global systems to localized watersheds. Since then, international organizations have begun to apply this framework to the evaluation of sustainable development initiatives, to better understand and overcome barriers to sustainability. While this may seem a logical application for an integrated environmental assessment tool, the use of DPSIR in sustainable development will likely perpetuate the least satisfactory outcomes of development. DPSIR cannot address the impact of aggregated, informal responses on the drivers and pressures related to environmental problems and sustainability challenges. This problem is not merely an oversight of the framework, but an issue that emerges within the structure of DPSIR itself through the unexamined, unacknowledged hierarchy of actors that this framework implicitly creates with its typology. Therefore, a DPSIR-centered approach is not a new direction for development within international organizations, but instead, a reproduction of existing inequalities between actors and stakeholders within current approaches.

INTRODUCTION

The Driver–Pressure–State–Impact Response (DPSIR) framework for integrated environmental reporting and assessment, developed by the European Environmental Agency (EEA) in 1999, has since been widely adopted in the study of environmental problems. This approach has proven to have utility in understanding the genesis and persistence of environmental problems at scales ranging from the global (United Nations Environment Programme 2002) to the sub-catchment (Bidone and Lacerda 2004; Karageorgis *et al.* 2006; Scheren *et al.* 2004). Recently, this framework has been used to assess the interaction of environment and development (for example, Millennium Ecosystem

Assessment Conceptual Framework Working Group 2003; Walmsley 2002). On the surface, this new focus may seem to be a logical extension of the integrated environmental assessment. However, the use of the DPSIR framework (henceforth referred to as DPSIR) to evaluate the sustainability of development initiatives reproduces problematic hierarchies and power relations at least partially responsible for project failures and other troubling outcomes of development efforts. We are concerned that the unreflexive application of DPSIR to the evaluation of sustainable development will therefore inadvertently perpetuate the least satisfactory outcomes of development, while doing little

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to move development thought forward to better address the challenges facing human well-being around the world.

We begin with an overview of DPSIR, including (often-misplaced) criticisms associated with this approach to environmental reporting. We then present our critique of DPSIR, which focuses on its difficulties incorporating or otherwise addressing the impact of aggregated, informal responses on drivers and pressures. We argue that this problem is not merely an oversight of the framework, but an issue that emerges within the structure of DPSIR itself through the unexamined, unacknowledged hierarchy of actors that this framework implicitly creates through its typology. Focusing on two specific areas of concern, local knowledge and gender, we illustrate how this hierarchy downplays the importance of social diversity and local responses in a manner that makes the examination of their aggregated impacts on drivers and pressures difficult, if not impossible. Finally, with reference to other sustainable development efforts taking place in global institutions like the United Nations, we explore how a DPSIR-centered approach is not a new direction for development within international organizations, but instead a reproduction of existing inequalities between actors and stakeholders within current approaches.

THE ORIGINS OF DPSIR

The DPSIR framework that emerged in the late 1990s was built upon several previous frameworks for environmental reporting¹. The earliest antecedent for DPSIR was the Pressure–State–Response (PSR) framework developed by the Organization for Economic Co-operation and Development (OECD 1994), itself an extension of Rapport and Friend's (1979) stress–response model. The PSR framework provided a means of organizing and assessing the interactions among environmental pressures (P), the state of the environment (S), and environmental responses (R) as cause and effect relationships that can be represented through indicators (Bowen and Riley 2003; Giupponi 2002). Under this framework, the impacts of human

activities are measured as pressures on the state of the environment, and indicated through such variables as the amount of fertilizer used, fossil fuels burned, and trees logged. The state of the environment is then measured through indicators that measure environmental conditions. Response indicators measure the actions taken to address changes in state, either by reducing pressures or improving the state in some other manner.

The PSR focus on anthropocentric pressures and responses in its evaluation of environmental problems proved problematic, in that it tended to push aside natural variability, as there was no place for it in the PSR classification scheme (Bowen and Riley 2003). The UN Commission on Sustainable Development (1997) attempted to address this problem by expanding upon PSR with a Driving Force–State–Response (DSR) framework. In this model, a driving force is a pressure expanded to include not only the social, political, economic and demographic pressures in the PSR model, but also pressures that resulted from the natural system.

While addressing the limitations presented by the anthropocentric focus of PSR, DSR left two other critical issues unaddressed. First, neither PSR nor DSR contains a category focused on the underlying reasons for the pressures. As Bowen and Riley (2003: 305) point out, whether using the term pressure or driver, neither framework lays out 'a category to account for the underlying reasons for the pressures . . . A model that measures pollutants but gives no information about the social conditions surrounding driving pollutant introduction . . . is not providing the data needed to inspire meaningful change.'

Second, neither PSR nor DSR can address the motivations behind responses to changes in the state of the environment. In some ways, both of these frameworks represented all changes in state, and therefore all pressures that lead to changes in state, as being of equal concern to human beings. As Bowen and Riley (2003) observe, social resources for addressing changes in environmental state are limited, and therefore responses are prioritized through a range of factors. The social impact of such change, perhaps measured in terms of social costs imposed against social benefits gained,

¹For an excellent overview of the development of integrated assessment frameworks, see Bowen and Riley 2003. Work by Rekolainen et al (2003) and the International Council for Science (2002) also contain useful reviews.

is a critical variable that helps to prioritize responses.

These issues spawned a new framework for integrated assessment, Driving Force – Pressure–State–Impact–Response (DPSIR) (European Environment Agency 1999). Under this framework:

- **Driving forces (or Drivers)** refer to fundamental social processes, such as the distribution of wealth, which shape the human activities that have a direct impact on the environment.
- **Pressures** are both the specific human activities that result from driving forces which impact the environment, such as the resource extraction necessary to fuel the automobile fleet of the United States, and the natural processes that have a similar impact on the environment, such as volcanoes and solar radiation.
- **State** is the condition of the environment. This condition, under current conceptualizations, is not static, but is meant to reflect current environmental trends as well.
- **Impacts** are the ways in which changes in state influence human well-being.
- **Responses** generally refer to institutional efforts to address changes in state, as prioritized by impacts.

Thus, the DPSIR framework addresses the issues that plagued the PSR and DSR frameworks by creating a category (drivers) that addresses root causes of the human activities that impact the environment, incorporates natural variability as a pressure on the current state, and addresses responses as motivated by the impact of changes in state on human well-being.

DPSIR is currently used as a means of framing particular environmental problems to identify appropriate responses. For example, Scheren *et al.* (2004) used DPSIR to conduct an environmental pollution assessment for the Ebrié Lagoon in Cote d'Ivoire. This lagoon is a large coastal ecosystem dealing with several **impacts** (I) tied to human activities in the catchment, such as large fishkills and increasing rates of waterborne disease in parts of the lagoon. The authors sought to identify appropriate responses to address these impacts. Examining nutrient levels in the lagoon over time, the authors identified eutrophication as the principal change in the **state** (S) of the lagoon associated with the impacts described above. This change in state was linked to the **pressure** (P) of excessive nutrient

loading resulting from human waste washed into tributaries from the nearby city of Abidjan and the use of fertilizer on farms in the catchment. Thus, the authors concluded that the **drivers** (D) of the pollution in the Ebrié Lagoon were principally agricultural activities and human waste, and not (as many would expect) industrial development in Abidjan. The authors argued that their findings suggest **responses** (R) targeted at managing non-point sources of pollution, as the industrial producers in the area were making a negligible contribution to the changes in the Lagoon when compared to the dumping of sewage into tributaries and the washing of fertilizers from farms into tributaries.

CRITIQUES OF DPSIR

While addressing many of the problems associated with earlier frameworks, DPSIR has been criticized for several shortcomings (Rekolainen *et al.* 2003). One criticism is that this framework creates a set of stable indicators that serve as a basis for analysis that may not take into account the changing dynamics of the system(s) in question. Another criticism, related to the first, is that the framework cannot capture trends except by repeating the study of the same indicators at regular intervals. In a third

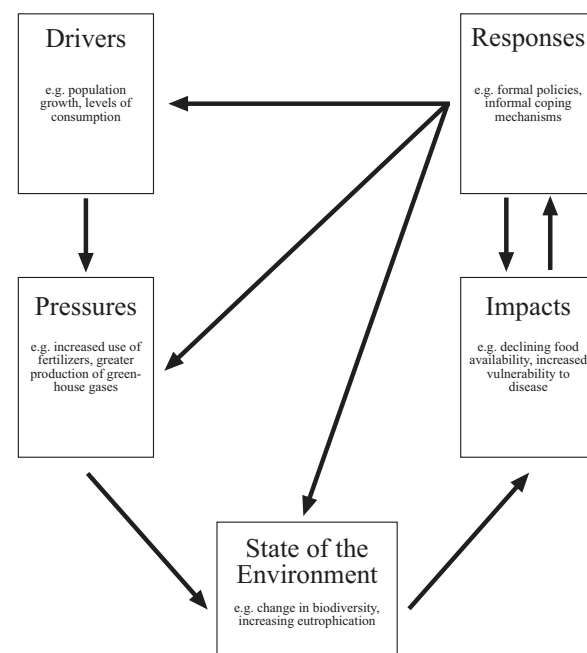


Figure 1 A visual representation of the DPSIR framework, representing the flow of causes and effects for a given environmental problem

criticism, some argue that the framework is flawed because it does not specifically illustrate clear cause–effect relationships for environmental problems. Finally, critics have argued that DPSIR suggests linear, unidirectional causal chains in the context of complex environmental problems that defy such description or analysis.

These four criticisms rest on a misunderstanding of DPSIR, both by critics of the framework and by those trying to apply it to their own research. Like its predecessors, DPSIR is not a model, but a means of categorizing and disseminating information related to particular environmental challenges. All of these frameworks were laid out with the original goal of identifying appropriate indicators for the measurement and evaluation of environmental problems, not the elaboration of cause–effect relationships that lead to these problems. As Karageorgis and his co-authors (2006) point out, to understand the cause–effect relationships related to a particular environmental issue, one must focus on the links between the different categories (Driver, Pressure, State, Impact, Response), and it is in this focus that the application of specific social science or physical science models becomes appropriate.

While these four common criticisms of the DPSIR and other related frameworks may stem from a general misunderstanding of their purpose, this is not to suggest that DPSIR is without its problems. In this paper, we focus on the issue of privilege and power implicit in this framework, and the challenges these present to the creation of new thinking about development. We argue that neither the core documents laying out the DPSIR approach, nor the many studies employing this approach (e.g., Bidone and Lacerda 2004; Holman *et al.* 2005; Karageorgis *et al.* 2006; Nikolaou *et al.* 2004; Odermatt 2004; Scheren *et al.* 2004; Smaling and Dixon 2006), appear to question who might be privileged by the categorizations created by this framework. While there is no explicit hierarchy of authority in the DPSIR framework, even a cursory examination of the responses aspect of this framework makes this implicit hierarchy clear. Those who can affect driving forces (a relatively small number of national governments, supranational organizations, and international organizations) stand at the top of this hierarchy, as they are the actors capable of addressing the ‘root causes’ of the environmental problem at hand. Following these elite actors are

those able, through their responses, to address pressures and trends in state. These actors include the first group, as well as environmental ministries of most countries and large non-governmental organizations (NGOs). Finally, there are those who can address the impacts of a given environmental issue. It is only here that the actions of the individual, the poor, and the marginal, as they address these impacts in their daily lives, become objects of investigation. Such a privileging seems to run against the systems approach promoted by this framework, especially in the way that it relegates the influence of local responses to addressing impacts. Perhaps more importantly, this privileging results in a lack of focus or concern for local, informal responses at the scale of drivers and pressures, a situation that compromises the validity of any analysis of sustainable development conducted via DPSIR. While individual responses may indeed be limited in their temporal, spatial, economic and socio-political scope, an aggregation of many responses may indeed come to affect pressures or even drivers, albeit in an informal manner. DPSIR has no means of addressing such changes, much as the PSR framework could not address natural variability.

When working in sustainable development, the privileging of elite actors able to influence drivers over the micro-knowledges of many ‘common folk’ who address impacts in their day-to-day lives recreates long-critiqued relationships between developed and developing that have resulted in the highly uneven, and often problematic, results of development in the post-World War II era. A sustainable development initiative based upon DPSIR risks becoming the latest version of this problem, unless those using the framework can come to terms with these issues. Repairing the ‘local, informal responses’ gap in DPSIR requires more than an ‘add and stir’ solution, where aggregated, informal local responses become another letter in the framework. This gap is not a product of shortsightedness, but instead results from long-standing relations between ‘developed’ and ‘developing’.

DEVELOPMENT AND POWER

Within development studies, a point of central contention is the relationship between ‘the developing’ and ‘the developed’. Long conceived as one

where the developing learned from the developed, and even followed in the footsteps of industrialized countries to development (e.g., Rostow 1959), a more recent critical literature (e.g., Escobar 1995, 1997, 2000; Esteva 1992; Esteva and Prakash 1992, 1998; J. Ferguson 1994; Simon 1998) has focused on the way this assumed relationship creates relations of power between developing and developed that shapes societal understanding of particular projects and places, with tangible impacts on the outcomes of development projects.

To summarize this broad critical literature in a general manner, the relationship between a development practitioner (i.e. a state or NGO official) and a person living in a context labeled as 'underdeveloped' often rests upon that same label, which presumes/produces a social relation between these two individuals, where 'developed' is superior to 'underdeveloped'. This labeling is a site at which power relations crystallize in that the practitioner uses this differentiation to access resources and use knowledge to alter the world in a manner the 'underdeveloped' subject cannot. For example, in the context of a development project, indigenous knowledge, so popular today in the development literature as a vehicle by which to overcome the knowledge gap between practitioner and 'underdeveloped', becomes valuable only when the development practitioner deems it so. Further, it is the development practitioner that defines the uses of, and therefore the value of, this knowledge. Under such circumstances, indigenous knowledge cannot challenge or reshape development thought or practice. Instead, this knowledge becomes a means of legitimizing existing thought and practices, with 'inconvenient' facts or opinions potentially ignored in favor of those deemed valuable by the development practitioner. It therefore becomes possible to talk about particular places and projects with reference to local voices and knowledge, without ever engaging the actual processes that shape development outcomes on the ground.

This disengagement can have disastrous consequences. Mitchell (1995) and Ferguson (1994) provide illustrations of how the constructions of Egypt and Lesotho, respectively, as 'less developed countries' by various international organizations served to establish the superiority of the knowledge of the developed over indigenous constructions of development and its problems. In the case of Egypt, Mitchell illustrates how USAID's fundamental

misunderstanding of local political economy resulted in a misinterpretation of a growing focus on beef consumption by the rich as a grain shortage anchored in inefficient agricultural practices that affected the entire population. This misunderstanding led to a series of inappropriate recommendations and actions for addressing the apparent shortage that ironically served to lower the price of beef for the rich. In the case of Lesotho, Ferguson demonstrates that the understanding of the country as underdeveloped was not only an effort to create these places as a 'suitable theoretical object of analysis' but also an effort to create 'a suitable target for intervention' (J. Ferguson 1994: 73). For example, in his close reading of the World Bank Country Report for Lesotho from 1975, Ferguson (1994: 58) illustrates that the premise for all development in the country was 'a stagnated peasant economy which requires only the correct inputs to become "developed"'. Yet the people on the ground were not all farmers; many were wage laborers contributing to the economy in other ways that eluded the World Bank's understanding because it challenged their view of what development should be in Lesotho. The failure to apprehend the diversity of the population (in terms of employment, income, etc.) led to the creation of a development project inappropriate for the context.

Most disturbing about this practice of knowledge construction is how it enables the persistence of problematic perspectives and practices in the face of evidence to the contrary. Current efforts to create generalized, quantifiable indicators of food security (such as caloric intake and stunting) are an excellent example of this problem (e.g., Christiaensen *et al.* 2001). These studies continue to nuance similar previous efforts (see Christiaensen and Boisvert 2000; Christiaensen *et al.* 2001; Just and Pope 1979) despite wide acceptance of the argument 'that concepts of food security are so highly contextual as to make the imposition of outside objectives as a means of evaluating [local strategies for negotiating insecurity] problematic at best, and counterproductive at worst' (Maxwell and Smith 1992). Studies of the quantifiable indicators of food security (such as caloric intake) have become self-referential, *constructing* insecurity, and therefore the means of measuring and addressing that insecurity, through knowledge that is structured via the relationship of these scholars to the objects of their research, the underdeveloped. This

construction of knowledge is problematic because these scholars and practitioners have access to networks of founding and policymaking, absent in the context of the underdeveloped, through which they can shape both the world and further knowledge. Thus, the developed–developing relationship, insofar as it shapes our understanding of particular challenges and solutions to be addressed by development, can result in the production of knowledge and action that can further differentiation and inequity.

Thus, we might locate the cause of the many failures of particular development efforts not in contextual anomalies, but in a systematic problem inherent to the practice of development itself. In this light, the creation of what has been critiqued as ‘the development industry,’ a combination of national, transnational, and NGOs that appear to exist primarily to enrich themselves and the developed world they represent (Peet 2003), is not the intentional outcome of development. The development industry is, instead, the outcome of the relationship between developing and developed in the context of a set of practices and discourses we call development. The power manifest in this relationship produces particular knowledges about the developing world. These knowledges suggest the definition of problems and the solutions to these problems in a manner that risks becoming self-referential and self-reproducing, and therefore perpetuating the very problems that development ostensibly exists to address. This understanding of the developed–developing relationship as a site at which power and knowledge are linked has become an important means by which we understand development’s failure to alleviate hardship and create opportunity for many of the world’s poor, even as many of those working for various institutions within the ‘development industry’ seek to address these issues with the best of intentions.

DEVELOPMENT, POWER, AND CONTEMPORARY INTERNATIONAL APPROACHES TO SUSTAINABLE DEVELOPMENT

The United Nations Environment Programme, which is the principal organization using DPSIR to evaluate sustainable development initiatives, is not exempt from the issues of hierarchy and power

discussed above. For example, the UN’s Environment for Development Initiative, which draws legitimacy from the linking of its poverty reduction strategies and sustainable development efforts to the Millennium Development Goals (MDGs), risks discounting alternative methods and perspectives for sustainable development, favoring international and national development agendas and marginalizing local actors in development projects.

Over the past 35 years, the United Nations and many of its sub-organizations such as the United Nations Development Programme (UNDP) and the United Nations Environment Programme (see United Nations Environment Programme 2006) have invested in numerous initiatives focused on developing the environment in ways that will produce a better quality of life for humans, most clearly embodied in the 1972 United Nations Conference on the Human Environment in Stockholm, the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, the 2002 World Summit on Sustainable Development and the ongoing focus on the MDGs. These UN initiatives largely approach environment and development from an international and national scale. This focus privileges national governments and international organizations like the UN at the expense of local actors when addressing linked environment and development issues. This is an outcome quite similar to that of the DPSIR framework outlined above.

For example, the report *Environment for the MDGs* stresses (and even implicitly mandates) that poverty reduction strategies and environmental sustainability initiatives should be aligned with the MDGs. This serves to legitimize the MDGs while downplaying alternative development practices that do not directly address the MDGs. The identification of drivers and pressures deemed problematic for sustainable development emerges from the concerns of an elite few. If drivers and pressures are identified only through a framing via the MDGs, such identification is likely to exclude input from other stakeholders who frame their issues in their own terms. Thus, just as in DPSIR-led development evaluations, MDG-led development efforts risk overlooking the local identification of problems and responses.

The cases of local knowledge and gender we discuss below are therefore not conclusive statements about how DPSIR will be used, but concerns about

how it is likely to be put into practice, given the issues of hierarchy and power already in place in other UNEP environment and development efforts. These cases suggest that, without serious rethinking of development assumptions at the level of the relationship between 'developing' and 'developed', using the DPSIR framework to evaluate sustainable development initiatives is likely to perpetuate previous flaws in development strategies centered on often-uninterrogated power relations. We find this to be the case because the DPSIR focus on a preconceived typology for addressing linked environment and development issues, and the resulting implicit hierarchy of actors, are already parts of the UN's Environment for Development Initiative.

DPSIR AND THE FRAMING OF SUSTAINABLE DEVELOPMENT

We argue that the application of the DPSIR framework to sustainable development within the context of UNEP and other international sustainable development initiatives is likely to reproduce the power relations within development critiqued above. This reproduction is not a conscious effort, but instead the unintended consequence of either a 'scalar trap' in the DPSIR framework or the inadvertent tendency of this framework to put local knowledge 'in its place' and deny it access to 'important' drivers of change. The scalar trap in the DPSIR framework assumes that the processes the framework is meant to organize operate in the same way from the global scale (Millennium Ecosystem Assessment Conceptual Framework Working Group 2003; United Nations Environment Programme 2002) to catchment and sub-catchment scales (e.g., Bidone and Lacerda 2003; Karageorgis *et al.* 2004). Local knowledge is put in its place by this framework insofar as it is considered only in the context of responses to particular impacts, and not in terms of the ways in which this knowledge constructs and addresses drivers and pressures – leaving the latter to governments and experts already in charge of the development process. In what follows, we offer two conceptual discussions, one on local knowledge and the other on gender, as illustrations of the scalar trap and the 'placing' of local knowledge, as well as the hierarchy they (re)create in sustainable development. It is this hierarchy of actors

in sustainable development that both reinforces many of the problems that plague 'traditional' development and enables the gap in DPSIR where the influence of aggregated, informal responses on drivers and pressures should be.

Framing sustainable development: DPSIR and the place of local knowledge

The earliest development theories of the 1950s and 60s were aimed at the implementation of large-scale industrialization policies at the level of the state (for discussion, see Dos Santos 1970; Lewis 1954; Rostow 1959). Generally speaking, these approaches assumed that 'development,' regardless of local conditions, could be achieved by any state that followed the specific roadmap set forth by economists in the 'Global North.' As the assumptions of this macro-scale approach were challenged by the experiences of many developing countries who sought to follow their prescribed path(s), some development thinkers turned away from a focus on the state to emphasize particular places, and the local knowledge contained in these places, as a tool for development (see Chambers 1995). While the use of 'local' knowledge is also problematic (see the brief example above), the idea that development should be built upon the ideas and desires of the developing has great resonance among development practitioners today (e.g., Sachs 2005) in that such an approach may provide important alternative understandings of development that can promote sustainability.

Though important within the development literature, local knowledge is not granted a prominent place in DPSIR framework-oriented sustainable development. First, in its very function as a framework, DPSIR emphasizes scientific understandings of environment and economy from the perspective of thinkers in the Global North. Such emphasis can come at the expense of alternative understandings that emerge in particular places in response to local experiences of development. For example, scholars have written at length about how perceptions of nature often vary by place or setting such that persons in the 'Global South' often use and understand their environment in a manner far different than that of their counterparts in the 'north' (Escobar 1995; Jarosz 1996; Leach and Fairhead 2000; Leach and Mearns 1996). Further, the

framework is most often employed in the evaluations of ecosystems in what might be considered a scientific or objective manner at a very large (state or regional) scale. DPSIR functions by categorizing ecological, social and economic conditions and forces as drivers, pressures and impacts, thus facilitating understanding by academics and development professionals operating within this epistemology. Because of the scalar trap inherent in DPSIR, it is assumed that this particular epistemology is appropriate for the study of local experiences as well as global biophysical processes. However, this is a scale of experience quite different from those of persons living with issues being evaluated by DPSIR. There is no clear site in this framework where translation between various forms of local knowledge and this dominant epistemology might occur, and therefore DPSIR is poorly equipped to capture alternative understandings of the environment or society. Indeed, the use of predetermined categories to describe a particular sustainable development process can unintentionally subvert conceptualizations that differ or compete with either this categorization, or the abstract scientific paradigms of the Global North more generally.

Second, DPSIR 'places' local knowledge at a particular scale of impact and response, thus reinforcing its subordinate position to the scientific epistemology of the Global North. Within this framework, local knowledge is most visible at the level of impacts and responses. These local impacts and responses, however, are not treated as central causes of challenges to sustainable development within DPSIR. In this framework, drivers and pressures are central causes of sustainable development outcomes. Local knowledge, in the form of responses, does not engage these large-scale processes directly. Thus, local knowledge, while perhaps accounted for in this framework, is incorporated in a manner that ranks it well below those forms of knowledge that are presented as capable of understanding and altering drivers and pressures. Such incorporation produces an understanding of the world in which particular places in the Global South become sites where people cope with the outcomes of larger, more important processes over which they have little control or understanding. This understanding, in turn, reproduces existing relations of power in the development process, from the local as lacking the capacity to effect

needed changes to the local as a victim of (mal-)development (Esteva 1992; Esteva and Prakash 1992). Just as it becomes possible in development to talk about a place without reference to the everyday realities of life in that place, so too it is possible to talk about the causes and management of environmental problems without serious reference to the tremendous number of local responses that, in aggregate, might influence drivers and pressures as much as the policies of any government.

Robbins (2000) illustrates this issue through a case of conflicts between local villagers and park officials in India over the management of protected areas that are preserved for reasons of aesthetics and biological diversity. While there are many different conflicts at the local scale, two serve the purpose of illustrating the outcomes that result from a disjoint between local knowledge and knowledge produced by actors in large states or international organizations. First, there is a conflict that plays out between villagers and park officials over lumber harvesting in protected areas. The local demand for access to these trees to produce lumber for sale directly conflicts with a state directive to maintain a protected area. Here, there is a clear disjoint between a state knowledge and priorities that do not take into account nor address the needs of local people. Those unable to bribe an official find themselves without access to a resource important to their livelihoods, which can then deepen conditions of poverty even as environmental outcomes improve. In such a scenario, sustainability comes at the cost of development and poverty alleviation.

In a second example, forest managers at this park who are pressured into increasing the amount of tree canopy cover to meet the state's desired goal to 'look good' on an international stage tend to introduce non-native and quick-growing species that can choke out and take over areas that were previously inhabited by local species (Robbins 2001). The state demand for more canopy cover comes from an international focus on logging and loss of forests. The state is doing what the Global North would like to see, even if it is having a negative impact on biodiversity at the local scale. This example illustrates the potential disjoint between the state's knowledge and pressures on the administration of the area and the demands of a local political economy.

Disappearing social diversity: Gender² and DPSIR

If the application of DPSIR to the assessment of sustainable development initiatives risks constructing understandings of sustainable development outcomes without reference to local responses, so too it risks constructing understandings of these same outcomes without reference to the often highly variable experiences of any impact within a given society. At first glance, evaluating sustainable development initiatives via DPSIR appears to promote the importance of gender issues to the outcomes of these initiatives. For example, within DPSIR a key driving force affecting sustainable development outcomes is population growth. Population growth is closely tied to such issues as social and cultural expectations for both men and women, access to and levels of education for women, and reproductive health. However, a closer examination of DPSIR suggests that gender, and indeed social diversity more generally, is not seen as a central factor influencing sustainable development outcomes because such diversity is 'put in its place' and unable to influence drivers of change directly.

The impact of this 'placing' of diversity on how we perceive the importance and role of social variability in sustainable development outcomes becomes apparent in the different ways in which gender responses play out under DPSIR. Much research has been done that illustrates how certain changes in the state of the natural environment impact various individuals and groups of people (including men and women) very differently (e.g., Barrientos *et al.* 2005; Barry and Yoder 2002; Bassett 2002; Bhuyan and Tripathy 1988; Boserup 1970; Bryceson 1995; Carney 1996; Carr 2005; Chikwendu and Arokoyo 1997; Creevey 1986; Dixon 1982; Egharevba and Iweze 2004; Feldman and Welsh 1995; A. E. Ferguson 1994; Gairola and Todaria 1997; Goebel 2002; Goheen 1988; Grier 1992; Harrison 2001; Harriss-White 1998; Jackson 1993, 1998; Jha 2004; Leach and Fairhead 1995; Mama 2005; Mbata and Amadi 1993; Moser 1993; Peters 1995; Riley and Krogman 1993; Rocheleau *et al.* 1996). Such disparities, commonly identified

through the observation of inequalities in variables such as the level of education, land tenure rights, resource allocation, and reproductive rights, may result in gendered responses. However, within DPSIR, gendered responses are generally identifiable only when addressing issues of impact (and perhaps state). Where women's concerns and actions might influence a driver or pressure, these concerns are framed in terms of generally-held societal needs and understandings. For example, reproductive health issues impact women quite differently than men at the local scale, and at that scale we can track gendered responses to these issues. At the scale of drivers, though, gendered concerns for reproductive health are subsumed under general headings like population growth. Further, this framework offers no way to address the heterogeneity found within the groups 'men' and 'women', detailed (yet realistic) distinctions whose exploration would prove problematic at large scales. Thus, a DPSIR-centered approach to sustainable development may be putting gender (and diversity more broadly) quite literally 'in its place', in that such diversity only rises to the surface in place-specific responses to place-specific impacts.

DISCUSSION

The limited importance of local responses under DPSIR creates two significant problems for analyses based on this framework. First, DPSIR does not encourage the examination of locally-specific reasons for individual decisions (such as what crops to plant, or whether or not to migrate) that, when aggregated, have potentially large impacts on sustainability. While a single Sahelian farmer's livelihoods choices cannot alter such fundamental drivers as consumption patterns, the aggregation of similar choices made by many actors facing similar circumstances may indeed have a measurable, tangible effect on this driver. There is an extensive literature that argues for an understanding of nature-society interactions (of which sustainable development is a part) as anchored in local knowledge, whether that knowledge incorporates

²Here we focus on the issue of gender in relation to the DPSIR framework and sustainable development as but one vehicle through which matters of diversity and inequality may be addressed in such contexts. The issues raised here in the context of gender could as easily be illustrated for class and ethnicity, among other social cleavages.

understandings of local carrying capacity (e.g. Conklin 1969; Rappaport 1967; Vayda 1969) or understandings of forces that transcend the local and their role in local development outcomes (e.g. Carney 2004; Davis 2004; Watts 1983). This literature makes it clear that efforts to evaluate sustainable development without serious consideration of local knowledge are doomed to misrepresentations of local situations, misunderstandings of what works in particular places, and even project failure (Bebbington and Bebbington 2001).

Second, the barriers to the consideration of local issues presented by DPSIR create a situation where organizations like the United Nations inadvertently take stances that are internally contradictory. For example, the UN literature recognizes that local-scale initiatives and attention to gender equality are necessary in order to achieve development goals. In the *Environment for the MDGs* report and UNDP's annual 2002 report, local-level institutions (particularly local governance) are advocated as essential to improving the management of natural resources and providing for basic infrastructure, such as health, education and water systems. The UN Development Fund for Women (UNIFEM) aims to promote women's empowerment by improving their economic security. As we have illustrated above, however, concerns for issues of social diversity and local knowledge tend to be lost in DPSIR-based analysis. Thus, entire initiatives within organizations like the UN might be marginalized if DPSIR is used as an overarching framework for the analysis of sustainable development initiatives.

It is our contention that any application of DPSIR to the evaluation of sustainable development initiatives must account for the drivers and pressures that are the result of informal local responses. However, this is more than a call for a 'technical fix' for DPSIR that would somehow bring these informal responses to the fore. The loss of informal responses is a product of the implicit hierarchy of responses in DPSIR, itself a product of existing power relations in development. Therefore, an 'add informal responses and stir' approach to addressing the shortcomings of this approach illustrated above is unlikely to impact the utility of the framework; as such a category would not address the issue of power relations at the core of these problems. Until we develop a means of addressing these issues of power, this framework is unlikely to result in measurably different

development outcomes than contemporary frameworks and approaches operating under the same power relations.

Until such time as we develop a framework for evaluating the sustainability of development that can address these issues of power, one might employ DPSIR, in a very limited manner, in a way that sidesteps some of the issues of power, informal responses, and local knowledge and diversity raised above. Specifically, practitioners could limit the application of DPSIR to local-scale studies. By treating the DPSIR framework as place-specific the nuanced understandings, inputs, opinions, and goals of multiple concerned stakeholders (including a variety of local groups and individuals, those providing financial support, and others) could be more realistically assessed. Such a place-specific application would also allow for more productive assessments of the state of the environment within a given location, as well as any changes in that state. In the context of such local application, the 'technical fixes' approach to addressing how to obtain greater and more representative community participation in a DPSIR-based assessment becomes appropriate.

CONCLUSION

While there is no question that development thought must incorporate environmental concerns if it is to achieve long-term success in improving human well-being, the unproblematic application of an environmental reporting framework such as DPSIR to the assessment of large-scale sustainable development initiatives is unlikely to transform development practice and improve human well-being outcomes. However, many of the issues raised above might be addressed by applying the framework to local-scale initiatives, though such application will require careful consideration of how the framework organizes understandings of development goals and environmental problems, even at the local level.

If DPSIR is to be useful for the assessment of sustainable development at the national, regional and global scales, those using it will have to find a way to incorporate the aggregated impacts of local, informal responses on drivers, pressures and states. One might think of this as a tremendous challenge that involves linking qualitative and quantitative data, rethinking the hierarchies within

development and challenging those hierarchies in practices ranging from the collection of interview data to the development of frameworks for organizing such data, and embracing the complexity and 'messiness' of the connection between human well-being and the environment. Perhaps, then, it is better that we look at these challenges, technical and social, as an opportunity to rethink how we 'do development' in a manner that might bring about truly new directions in development thought, and

better outcomes for those development is meant to benefit.

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REFERENCES

- Barrientos S, Kritzinger A, Opondo M and Smith S. Gender, work and vulnerability in African horticulture. *Ids Bulletin*, Institute of Development Studies 2005;36(2):74–
- Barry H and Yoder BL. Multiple predictors of contribution by women to agriculture. *Cross-Cultural Research* 2002;36(3):286–97
- Bassett T. Women's Cotton and the Spaces of Gender Politics in Northern Cote d'Ivoire. *Gender, Place and Culture* 2002;9(4):351–70
- Bebbington A and Bebbington D. Development alternatives: practices, dilemmas and theory. *Area* 2001;33(1):7–17
- Bhuyan B and Tripathy SK. Role of Women in Agriculture – a Study in Ganjam District of Orissa. *Journal of Rural Development* 1988;7(4):445–52
- Bidone E and Lacerda L. The use of DPSIR framework to evaluate sustainability in coastal areas. Case study: Guanabara Bay basin, Rio de Janeiro, Brazil. *Regional Environmental Change* 2004;4(1):5–16
- Boserup E. *Women's Role in Economic Development*. London: George Allen and Unwin; 1970
- Bowen RE and Riley C. Socio-economic indicators and integrated coastal management. *Ocean & Coastal Management* 2003;46(3–4):299–312
- Bryceson DF (ed.). *Women Wielding the Hoe*. Oxford: Berg Publishers; 1995
- Carney JA. Converting the Wetlands, Engendering the Environment: the Intersection of Gender with Agrarian Change in The Gambia. In Peet R and Watts M (eds), *Liberation Ecologies: Environment, Development, Social Movements*. London: Routledge; 1996
- Carney JA. Gender Conflict in Gambian Wetlands. In Peet R and Watts M (eds), *Liberation Ecologies: Environment, Development, Social Movements*, Second Edition. London: Routledge; 2004:316–35
- Carr ER. Development and the Household: Missing the Point? *Geojournal* 2005;62(1):71–83
- Chambers R. *Rural Development: Putting the Last First*. Harlow, UK: Addison-Wesley Publishing Co.; 1995
- Chikwendu DO and Arokoyo JO. Women and sustainable agricultural development in Nigeria. *Journal of Sustainable Agriculture* 1997;11(1):53–69
- Christiaensen LJ and Boisvert RN. *On Measuring Household Food Vulnerability: Case Evidence from Northern Mali*. Ithaca, New York: Department of Agricultural, Resource and Managerial Economics, Cornell University; 2000
- Christiaensen LJ, Boisvert RN and Hoddinott J. *Validating Operational Food Insecurity Indicators against a Dynamic Benchmark*. Washington, DC: World Bank; 2001. Report No.: 2471
- Conklin HC. An Ethnoecological Approach to Shifting Agriculture. In Vayda AP (ed.), *Environment and Cultural Behavior: Ecological Studies in Cultural Anthropology*. Garden City, NY: The Natural History Press; 1969:221–33
- Creevey LE. The Role of Women in Malian Agriculture. In Creevey LE (ed.), *Women Farmers in Africa: Rural Development in Mali and the Sahel*. Syracuse, NY: Syracuse University Press; 1986:51–66
- Davis M. The political ecology of famine: the origins of the Third World. In Peet R and Watts M (eds), *Liberation Ecologies: Environment, Development, Social Movements*. Second Edition. London: Routledge; 2004:48–63
- Dixon RB. Women in Agriculture – Counting the Labor-Force in Developing Countries. *Population and Development Review* 1982;8(3):539–66
- Dos Santos T. The Structure of Dependence. *American Economic Review* 1970;60:231–36
- Egharevba RK and Iweze FA. Sustainable agriculture and rural women: Crop production and accompanied health hazards on women farmers in six rural communities in Edo State Nigeria. *Journal of Sustainable Agriculture* 2004;24(1):39–51
- Escobar A. *Encountering Development*. Princeton: Princeton University Press; 1995

- Escobar A. The Making and Unmaking of the Third World through Development. In Rahnema M and Bawtree V (eds), *The Post-Development Reader*. London: Zed Books; 1997:85–93
- Escobar A. Beyond the Search for a Paradigm? Post-development and beyond. *Development* 2000; 43(4):11–14
- Esteva G. Development. In Sachs W (ed.), *The Development Dictionary: A Guide to Knowledge and Power*. London: Zed Books; 1992:6–25
- Esteva G and Prakash MS. Grassroots Resistance to Sustainable Development. *The Ecologist* 1992; 22(2):45–51
- Esteva G and Prakash MS. Beyond Development, What? *Development in Practice* 1998;8(3):280–96
- European Environment Agency. *Environmental Indicators: Typology and Overview*. Copenhagen; 1999
- Feldman S and Welsh R. Feminist Knowledge Claims, Local Knowledge, and Gender Divisions of Agricultural Labor – Constructing a Successor Science. *Rural Sociology* 1995;60(1):23–43
- Ferguson AE. Gendered Science – a Critique of Agricultural-Development. *American Anthropologist* 1994;96(3):540–52
- Ferguson J. *The Anti-Politics Machine: Development, Depoliticization, and Bureaucratic Power in Lesotho*. Minneapolis: University of Minnesota Press; 1994
- Gairola J and Todaria NP. The status of women in subsistence agriculture in the Garhwal Himalaya, India. *Mountain Research and Development* 1997; 17(2):169–70
- Giupponi C. *From the DPSIR reporting framework to a system for a dynamic and integrated decision making process*. Venice; 2002
- Goebel A. Gender, environment and development in Southern Africa. *Canadian Journal of Development Studies-Revue Canadienne D Etudes Du Developpement* 2002;23(2):293–316
- Goheen M. Land and the Household Economy: Woman Farmers of the Grassfields Today. In Davison J (ed.) *Agriculture, Women and Land: The African Experience*. Boulder, CO: Westview Press; 1988
- Grier B. Pawns, Porters, and Petty Traders – Women in the Transition to Cash Crop Agriculture in Colonial Ghana. *Signs* 1992;17(2):304–28
- Harrison M. Women, land and agriculture. *Geography* 2001;86:267–8
- Harriss-White B. Female and male grain marketing systems: Analytical and policy issues for West Africa and India. In: Jackson C and Pearson R (eds), *Feminist Visions of Development: Gender analysis and policy*. London: Routledge; 1998:189–213
- Holman IP, Rounsevell MDA, Shackley S, Harrison PA, Nicholls RJ, Berry PM, et al. A regional, multi-sectoral and integrated assessment of the impacts of climate and socio-economic change in the UK. *Climatic Change* 2005;71(1–2):9–41
- Jackson C. Doing what comes naturally? Women and environment in development. *World Development* 1993;21(12):1947–63
- Jackson C. Rescuing Gender from the Poverty Trap. In Jackson C and Pearson R (eds), *Feminist Visions of Development: Gender analysis and policy*. London: Routledge; 1998:39–64
- Jarosz L. Defining Deforestation in Madagascar. In Peet R and Watts M (eds), *Liberation Ecologies: Environment, Development, Social Movements*. London: Routledge; 1996:148–64
- Jha N. Gender and decision making in Balinese agriculture. *American Ethnologist* 2004;31(4):552–72
- Just RE and Pope RD. Production Function Estimation and Related Risk Considerations. *American Journal of Agricultural Economics* 1979;61:276–84
- Karageorgis AP, Kapsimalis V, Kontogianni A, Skourtos M, Turner RK and Salomons W. Impact of 100-year human interventions on the deltaic coastal zone of the Inner Thermaikos Gulf (Greece): A DPSIR framework analysis. *Environmental Management* 2006;38(2):304–15
- Leach M and Fairhead J. Ruined Settlements and New Gardens – Gender and Soil-Ripening among Kuranko Farmers in the Forest Savanna Transition Zone. *IDS Bulletin – Institute of Development Studies* 1995;26(1):24–33
- Leach M and Fairhead J. Challenging Neo-Malthusian Deforestation Analyses in West Africa’s Dynamic Forest Landscapes. *Population and Development Review* 2000;26(1):17–43
- Leach M and Mearns R (eds). *The Lie of the Land: Challenging Received Wisdom on the African Environment*. Oxford: Oxford University Press; 1996
- Lewis A. Economic Development with Unlimited Supplies of Labor. *The Manchester School of Economics and Social Studies* 1954;22:139–91
- Mama A. Demythologising Gender in Development: Feminist Studies in African Contexts. *IDS Bulletin* 2005;35(4):121–4
- Maxwell S and Smith M. Household Food Security: A Conceptual Review. In Maxwell S and Frankenberger T (eds), *Household Food Security: Concepts, Indicators, Measurements*. New York: United Nations Children’s Fund – International Fund for Agricultural Development; 1992:1–72
- Mbata JN and Amadi CJ. The Role of Women in Traditional Agriculture – a Case-Study of Women in Food Crops Production in Rivers State, Nigeria. *Discovery and Innovation* 1993;5(1):81–7
- Millennium Ecosystem Assessment Conceptual Framework Working Group. *Ecosystems and Human*

- Well-Being: A Framework for Assessment*. Washington DC: Island Press; 2003
- Mitchell T. The Object of Development: America's Egypt. In Crush J (ed.), *Power of Development*. London: Routledge; 1995:129–57
- Moser CON. *Gender Planning and Development: Theory, Practice and Training*. London: Routledge; 1993
- Nikolaou K, Basbas S and Taxiltaris C. Assessment of air pollution indicators in an urban area using the DPSIR model. *Fresenius Environmental Bulletin* 2004;13(9):820–30
- Odermatt S. Evaluation of mountain case studies by means of sustainability variables – A DPSIR model as an evaluation tool in the context of the North-South discussion. *Mountain Research and Development* 2004;24(4):336–41
- OECD. *Environmental Indicators: OECD Core Set*. Paris: Organization for Economic Co-operation and Development; 1994
- Peet R. *Unholy Trinity: The IMF, World Bank and WTO*. London: Zed Books; 2003
- Peters PE. Uses and Abuses of the Concept of 'Female-headed Households' in Research on Agrarian Transformation and Policy. In Bryceson DF (ed.), *Women Wielding the Hoe: Lessons from Rural Africa for Feminist Theory and Development Practice*. Oxford: Berg Publishers; 1995:93–108
- Rappaport R. *Pigs for the Ancestors*. New Haven: Yale University Press; 1967
- Rappaport DJ and Friend AM. *Towards a Comprehensive Framework for Environmental Statistics: A Stress-Response Approach*. Ottawa: Statistics Canada Catalogue 11–510;1979
- Rekolainen S, Kämäri J, Hiltunen M and Saloranta TM. A conceptual framework for identifying the need and role of models in the implementation of the Water Framework Directive. *International Journal of River Basin Management* 2003;1(4):347–52
- Riley PJ and Krogman NT. Gender-Related Factors Influencing the Viability of Irrigation Projects in Lesotho. *Journal of Asian and African Studies* 1993;28(3–4):162–79
- Robbins P. The Practical Politics of Knowing: State Environmental Knowledge and Local Political Economy. *Economic Geography* 2000;76(2):126–44
- Robbins P. Tracking Invasive Land Covers in India, or Why Our Landscapes have Never been Modern. *Annals of the Association of American Geographers* 2001;91(4):637–59
- Rocheleau D, Thomas-Slayter B and Wangari E (eds). *Feminist Political Ecology: Global Issues and Local Experiences*. London: Routledge; 1996
- Rostow WW. The Stages of Economic Growth. *Economic History Review* 1959;12(1):1–16
- Sachs JD. *The End of Poverty: Economic Possibilities for Our Time*. London: Penguin Press; 2005
- Scheren P, Kroeze C, Janssen F, Hordijk L and Ptasinski KJ. Integrated water pollution assessment of the Ebrie Lagoon, Ivory Coast, West Africa. *Journal of Marine Systems* 2004;44(1–2):1–17
- Simon D. Rethinking (post)modernism, postcolonialism, and posttraditionalism: South–North perspectives. *Environment and Planning D: Society and Space* 1998;16:219–45
- Smaling EMA and Dixon J. Adding a soil fertility dimension to the global farming systems approach, with cases from Africa. *Agriculture Ecosystems & Environment* 2006;116(1–2):15–26
- United Nations Division for Sustainable Development. *From theory to practice: Indicators for sustainable development*. New York: United Nations; 1997
- United Nations Environment Programme. *Global Environment Outlook 3: Past, present and future perspectives*. London: Earthscan; 2002
- United Nations Environment Programme. *Environment for Development: Value of the Environment for Human Well-Being*. Nairobi: UNEP; 2006
- Vayda AP. Expansion and Warfare among Swidden Agriculturalists. In Vayda AP (ed.), *Environment and Cultural Behavior: Ecological Studies in Cultural Anthropology*. Garden City, NY: The Natural History Press; 1969:202–20
- Walmsley JJ. Framework for measuring sustainable development in catchment systems. *Environmental Management* 2002;29(2):195–206
- Watts M. *Silent Violence: Food, Famine and Peasantry in Northern Nigeria*. Berkeley CA: University of California Press; 1983