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## Evaluating poverty–environment dynamics

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Developing indicators to more effectively evaluate poverty–environment dynamics and inform policy is an urgent research priority. It is critical that these indicators are used in ways that accurately represent the relationship they are meant to inform. This article evaluates the theory and use of poverty–environment indicators, a relatively new tool developed to aid in the design and evaluation of poverty reduction strategies in the context of environmental change. We argue that while they have great potential, in their current form and use, poverty–environment indicators may contribute to critical misunderstandings of processes on the ground. These issues stem from a problematic and largely unacknowledged process of simplifying particular poverty–environment relationships. This article lays out the problematic character of this simplification process, and suggests how we might address these problems to create more useful understandings of poverty–environment dynamics to inform policy.

**Keywords:** development policy; poverty–environment assessment; poverty–environment indicators; sustainable development; poverty reduction strategies

### Introduction

Poverty reduction, in the context of environmental sustainability, is one of the most important global humanitarian challenges of the twenty-first century (World Bank 2005). While development efforts over the past several decades have produced gains in many measures of human well-being, these gains have come at the cost of significant and often accelerated changes in ecosystem services (Millennium Ecosystem Assessment 2005; United Nations Environment Programme (UNEP) 2008). As more development projects to alleviate poverty are initiated, and as consumption rises with affluence in many parts of the world, this trend toward ecosystem change will continue. It is therefore critical that we understand and monitor the connection between poverty reduction and environmental change to ensure a sustainable future.

Indicators are frequently used in resource assessments to highlight priority issues and guide policy formation because they provide a cost effective means of rapidly assessing various human and environmental conditions, and they can assist in analyzing progress towards or away from possible future outcomes (Segnestam 2002). Numerous studies have developed indicators to evaluate trends in the state of the environment (Grossman and Krueger 1995; Smeets and Weterings 1999; Segnestam 2002) and conditions of poverty (Hagenaars and de Vos 1988; Chen et al. 2006; Martins 2007)<sup>1</sup>; however, these studies tend to evaluate poverty and environmental issues independently of each other, and therefore face difficulties in addressing the links *between* poverty and the environment (Nunan et al. 2002). Poverty–environment indicators (PEIndicators) were developed as tools to aid

in the design and evaluation of poverty reduction strategies in the context of environmental change (Prennush et al. 2001; Shyamsundar 2002; DFID 2003). For example, ‘distance walked by household members to collect water and fuelwood’ is commonly used as a PEIndicator to describe the relationship between poverty and natural resources (Shyamsundar 2002, p. 26). This indicator is tied to the poverty–environment relationship by the assumption that a person will walk farther to collect firewood if they are experiencing degraded environmental conditions, lack the means to obtain alternative fuels, or both.

Because PEIndicators are proxies for complex poverty–environment relationships, their use and interpretation rests upon significant simplifications (Nunan et al. 2002). First, current PEIndicator practice simplifies poverty–environment relationships to a unilinear process where environmental conditions shape poverty outcomes, but give little, if any, consideration to the impact of poverty on the environment. Second, PEIndicators focus on three key areas: human health, livelihoods, and environmental risk (Reed and Tharakan 2004), ignoring how other important factors, such as national and global political economies, shape health, livelihoods, and risk outcomes in particular places. Though Nunan and her co-authors (2002), Shyamsundar (2002), and Reed and Tharakan (2004) all acknowledge that the relationship between poverty and the environment is mediated by macro- and micro-level policies and institutional change, none of these studies discuss how we might incorporate these factors into indicators, or discuss how these factors may (mis)inform poverty–environment dynamics. Both simplifications narrow the interpretive scope for particular indicators, leading

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practitioners to make problematic assumptions about the meaning of changes in those indicators. In short, the current use of PEIndicators carries a significant risk of misinterpreted correlations between poverty outcomes and environmental outcomes, with important ramifications for our ability to understand and mitigate linked poverty–environment challenges.

There is no easy fix for the problems we describe. The political–economic data required to better design, select and interpret PEIndicators are rarely available at a scale appropriate for rigorous analysis. Significant time, effort, and costs are required to obtain new data or to rework existing data. Thus, the use of indicators as cost-effective tools for the rapid assessment of the poverty–environment relationship in particular places does not appear to be possible at this time, as the accurate selection and interpretation of indicators for this relationship requires time-consuming, expensive data collection.

We begin our discussion of PEIndicators by briefly describing the historical and contemporary interpretations of the relationship between poverty and the environment. We then present the simplifications of the poverty–environment relationship common in PEIndicator practice, and illustrate through specific examples in the PEIndicator literature how these simplifications can result in inaccurate interpretations of poverty–environment dynamics. Finally, we explore the investments required to recover PEIndicators as useful tools in contemporary sustainable development.

### Poverty and the environment

Interest in the relationship between poverty and the environment extends back to at least the seventeenth century, when the economist Thomas Malthus suggested that the short-term focus of the poor led to resource degradation (Gray and Moseley 2005). A similar understanding of this relationship persisted through the middle of the twentieth century, when the colonized were accused of poor agricultural and land management practices (see, MacKenzie 1991, 1999; Leach and Mearns 1996; Leach and Fairhead 2000a, 2000b; Neumann 2003). Gray and Moseley (2005) argue that the rise of the sustainable development paradigm in the 1980s brought a ‘renewed vigor’ to the poverty–environmental degradation idea in a post-colonial era. This more recent representation of the relationship between poverty and the environment, commonly referred to as a ‘downward spiral’ in the Brundtland Report and subsequent literature, suggests a cyclical relationship between overuse of the environmental resources by the poor leading to environmental degradation, and environmental degradation contributing towards conditions of poverty. While the downward spiral idea still carries weight in the mainstream literature on sustainable development and poverty–environment dynamics, perhaps reaching its apotheosis in the environmental Kuznets curve (Bryant 1997), alternative literatures have arisen to nuance, and sometimes challenge, the assumptions underlying this characterization.

### Capitals, entitlements and poverty

An extensive literature on poverty (e.g., Reardon and Vosti 1995) and livelihoods (e.g., Chambers and Conway 1992; Carney 1998; Scoones 1998; Ellis 2000) generally treats human well-being as comprised of five different types of assets, or ‘capitals’: human, social, natural, physical, and financial. The absence of any of these capitals can compromise personal livelihoods and can result in different forms of poverty, depending on which capital is lacking. An entitlements approach to livelihoods (Sen 1981; Leach et al. 1999) further helps to explain poverty outcomes in particular places by examining how access to, or control over, these capitals during times of need directly influences the ability of people to meet their basic needs (Sen 1981).

The following generic example illustrates the connection between the livelihoods and entitlements literatures. If Farmer A has secure access to agricultural land (high social capital), but the land is characterized by poor soils (low natural capital), that farmer’s food security and resilience to economic and environmental shocks will be greatly reduced. Thus, Farmer A may have to over-farm this poor soil in an effort to overcome these problems, triggering the much-discussed downward spiral. In contrast, Farmer B might live in an area with excellent soil (high natural capital), but possesses limited social networks needed to gain access to secure land (low social capital). As a result, Farmer B may be forced to rent land from individuals who guard against overuse and other degrading practices on the part of their tenants. While there is no downward spiral in this case, the farmer’s poverty is likely to persist for lack of social capital required to secure access to agricultural land. Thus, as this example illustrates, an outcome we recognize as poverty – the lack of access to adequate arable land – may be caused by issues related to two different forms of livelihoods capital, and have two different environmental outcomes.

### Political ecology and causality in linked social–environmental systems

A more direct challenge to the neo-Malthusian ideas undergirding the downward spiral comes from political ecology, which links ecological issues to political economic processes operating at multiple scales (e.g., Zimmerer and Bassett 2003; Forsyth 2004; Peet and Watts 2004). This challenge is best articulated by Peet and Watts (2004), who argue that poverty is merely a proximate cause of environmental degradation. To understand the true causes of degradation, they argue, we must look to large-scale political economic processes, such as structural inequality at local and trans-local scales. Thus, we cannot understand the loss of mangrove swamps merely by examining the behaviors of the shrimp farmers who set up new fisheries, as the decisions of these fishermen are shaped and constrained by larger political–economic processes.

Instead, to understand mangrove conversion to shrimping, we must explore the global market for shrimp, government pressures/incentives for shrimp production, and the availability of alternative livelihoods for these fishermen, as these and other processes and actors shape the individual and local decisions that lead to the conversion of mangrove to shrimp fishery.

Political ecology therefore relocates causality in poverty–environment interactions from local degradation by smallholders to large-scale processes driven by wealthy individuals and institutions. In short, political ecology calls into question who is responsible for a particular case of degradation. Such questioning destabilizes the idea of the downward spiral by shifting causality from the local focus, as implied by Brundtland Report, toward a diffuse set of processes and actors with the capacity to influence local decision-making. From a political ecological standpoint, the poverty–environment interaction is rarely a simple relationship between the poor and a degrading environment.

### **Poverty–environment dynamics: A contemporary synthesis**

From the perspective of the contemporary poverty, livelihoods, and political ecological literatures, poverty–environment dynamics are complex, multiscalar and highly differential. Carr (2008) argues that future development efforts might be best served by abandoning the term poverty, and the associated search for a general ‘cure’ and instead focusing on the challenges facing individuals in particular places. This argument can be extended to poverty–environment relationships, where the diversity of experiences labeled ‘poverty’ suggests that there is no singular poverty–environment dynamic to be measured or understood, but instead a multitude of experiences of the environment that are conditioned by local livelihoods, entitlements and the state of various livelihood capitals in particular places (e.g., Sachs 2005).

### **Poverty environment indicators**

Work on PEIndicators is heavily concentrated in the ‘gray literature’ of large development institutions like the World Bank (e.g., Shyamsundar 2002), Department for International Development (DFID) (e.g., Nunan et al. 2002) and World Wildlife Fund (e.g., Reed and Tharakan 2004). Nunan and her colleagues (2002) trace the development of PEIndicators to the Poverty Reduction Strategy (PRS) Program, a jointly sponsored initiative by the World Bank and the International Monetary Fund. The PRS Program, which commissions the development of country-specific Poverty Reduction Strategy Papers (PRSPs), seeks to increase country responsibility for identifying both barriers to poverty reduction and economic growth and the means of addressing those barriers. Though this program acknowledges the importance of considering poverty and environment linkages, it offers little guidance for conceptualizing or measuring that linkage. As a result, few broad conceptual

writings exist on PEIndicators, and existing indicator studies tend to be focused on specific places or issues.

### **Simplifications**

The current use of PEIndicators involves two major simplifications. First, PEIndicators focus only on how environmental conditions influence (or are linked to) poverty (Nunan et al. 2002; Osuntogun 2002; Reed and Tharakan 2004)<sup>2</sup>. Such an approach, while providing the opportunity to rapidly evaluate how environmental conditions affect poverty, does not address how poverty (or humans in general) may affect the environment. Consequently, it is difficult (if not impossible) to use PEIndicators to gauge the role of the poor in environmental change. While such a simplification serves to focus development efforts on such issues as improving access to and control over resources as a mechanism for reducing poverty, it leaves open the potential to create projects without regard for the environmental impacts of poverty alleviation efforts.

The second major simplification constrains PEIndicators to variables that reflect the impacts of environmental change on human health, the environment’s impact on the quality of livelihoods for the poor who depend on natural resources, and the vulnerability of poor people to environmental risks such as natural disasters (DFID 2000). The selection of these three issues can be traced back to the 2000 Development Assistance Committee (DAC) Forum on Indicators, which sought to measure progress toward sustainable development through a very narrow set of core indicators (Table 1). DFID (2000) soon expanded these global and national indicators to the tripartite classification of sustainable development indicators that are now commonly used to guide PEIndicators. Restricting complex understandings of the poverty–environment relationship to these three variables fails to address access and control as they emerge in a larger political economy, which includes key drivers such as the role of institutions, macroeconomic policies, regulatory regimes, and power and privilege (Reed and Tharakan 2004).

Table 1. DAC forum core indicators for measuring progress toward the international development target.

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#### **National Indicators**

- existence of effective processes for sustainable development
- percentage of population with sustainable access to safe water
- forest area as a percentage of national surface area
- percentage of land area protected
- GDP per unit of energy use
- industrial CO<sub>2</sub> emissions

#### **Global Indicators**

- size of the hole in the ozone layer
  - concentration of greenhouse gases in the atmosphere and the heating effect of those gases
- 

Source: DFID 2000, p. 44.

The simplification of poverty–environment dynamics to the impact of environmental change on the health, livelihoods, and environmental vulnerability of the poor bears little resemblance to the understandings of this relationship put forth in contemporary livelihoods and political ecological literatures. Further, it risks promoting analyses that place the blame for environmental degradation and/or poverty on to local populations, regardless of the macro- (political) economic forces that might be shaping resource use or environmental change. The exclusion of political economic variables, such as structural inequality at the local and global level that often affect particular poverty–environment interactions, risks assessing the symptoms of a problem while ignoring the root causes (Wisner et al. 2004).

Few studies have expanded the focus of PEIndicators beyond the measurable effects of environmental change on health, livelihoods, and environmental vulnerability. Though some recognize the need to address key aspects of vulnerability, such as voicelessness and powerlessness, the treatment of such less-tangible issues is very uneven. For example, Nunan and her colleagues (2002) attempt to measure ‘Power and Voice’ as information important to understanding poverty and environment outcomes in Nepal, Nicaragua, and Uganda. While one of the proposed PEIndicators for this information, ‘Area of forests co-managed by user groups with representatives of the poor’, appears to reflect a concern for access and entitlements seen in the larger poverty–environment literature, the other, ‘Access to sanitation facilities by women’, measures a health impact that has little, if any, relationship to environmental quality.

Many working with PEIndicators recognize the complexity of poverty–environment dynamics (Nunan et al. 2002; Shyamsundar 2002; Reed and Tharakan 2004); however, in practice, authors do not address how to capture such complexity, or discuss what analytic or interpretive problems might arise through the above-described simplifications. For example, although Shyamsundar (2002) argues that reducing the relationship between poverty and environment to a downward spiral is an oversimplification of complex human–environmental dynamics, her practical focus reduces poverty–environment dynamics to the impact of environmental factors on poverty. She does not justify this simplification or discuss how it might limit her understanding of the relationship between conditions of poverty and environmental change. Therefore, while she is aware that PEIndicators oversimplify a complex relationship, her application of the indicator framework carries out this simplification without reflection (see also DFID 2000; Nunan et al. 2002).

### *Assumptions and interpretation*

The simplifications of poverty–environment relationships that undergird contemporary PEIndicator practice do not reflect our current understanding of the relationship between poverty and the environment. This simplification process may also lead to inaccurate interpretations of a

change in a PEIndicator; effectively closing off plausible interpretations that do not fit into this simplified relationship. Therefore, this narrowing of interpretation gives the appearance of rigorous interpretation to practices that inherently misrepresent the complexity of poverty–environment dynamics.

For example, a study of poverty–environment dynamics in Nigeria employed ‘rural per capita cereal production’ as a PEIndicator (Osuntogun 2002). Though it is never discussed overtly, it appears that the study assumes that higher per capita yields are the product of positive environmental conditions that result in increased human well-being. While at first glance this indicator may seem to be a reasonable measure of the income, security, and vulnerability of a given individual or household, its use reflects the simple relationship between poverty and the environment assumed in the PEIndicator literature, where changes in the environment drive changes in human well-being and environmental quality. However, changes in rural per capita cereal production may have more to do with national or global markets than local environmental conditions. High per capita cereal production may not correlate to local food security if locally grown cereal is exported. In addition, a high per capita production number does not capture the likely uneven character of grain production. It is possible for a few farmers to produce enough grain to give an entire region an impressive per capita measure, which masks the lower production of the majority of those living in that region. Because broader political economic literatures are excluded by the simplifications described above, it is not possible to consider these alternative interpretations from within contemporary PEIndicator practice.

The interpretation of another PEIndicator employed in this study, ‘percentage of irrigated area in the total agricultural area’, appears to reflect an assumption that a greater percentage of irrigated area will maximize the environment’s agricultural potential and lead to greater income and opportunity for those living in the area. This assumption is enabled by the same simplification of the poverty–environment relationship discussed above. While this may be a relatively safe assumption in places where the irrigated area is a very large percentage of total agricultural area, it may not be as applicable in places where the irrigated area is relatively small and where the benefits of irrigation are not likely to reach the entire population. Indeed, in such settings those with access to irrigation might not only experience greater opportunities in an average year, but also have incomes that are much more resistant to environmental shocks that might drive other farmers to adopt severe measures to preserve their livelihoods, such as selling off household stocks or land to those whose incomes are secured by irrigation. In such situations, a small but rising percentage of area under irrigation is as likely to reflect a consolidation of wealth (and therefore declining incomes and opportunities for many) in a particular area as it does greater income and opportunity for the whole population. As with the previous indicator, the exclusion of a larger political economic perspective from the interpretation of

changes in this indicator makes it impossible to treat the published interpretation as rigorous.

From the perspective of contemporary understandings of the poverty–environment relationship, PEIndicators cannot reliably illuminate causality in particular poverty–environment dynamics because they exclude issues of access, power, and political economy. Ironically, then, current PEIndicator practice likely obscures meaningful trends in these poverty–environment relationships.

### **Recovering PEIndicators?**

Our findings suggest that the current development and application of PEIndicators does not reliably identify causal links among the very different health, livelihoods, and vulnerability outcomes that emerge from different forms of poverty, differential access to resources (Reardon and Vosti 1995), differential power within households (Sen 1981), and environmental outcomes. This section describes how we may begin to recover PEIndicators by identifying appropriate scales for analysis and by incorporating key macro-political economic variables into PEIndicators, and discusses the challenges that remain in order for PEIndicators to become valuable tools for development efforts. We illustrate this recovery in respect to the two indicators (rural per capita cereal production and the percentage of irrigated area in the total agricultural area) discussed in Osuntogun (2002).

The PRS Program, from which PEIndicators emerged, is focused at the national scale. However, this does not mean that PEIndicators, or any assessment of a poverty–environment dynamic, must (or should) operate only at the national scale. There is a danger in conducting a national or global scale analysis of poverty–environment dynamics because such an approach risks aggregating diverse livelihood strategies and agroecologies into an undifferentiated mass. This aggregated analysis is likely to generate false correlations between changes in an indicator and changes in poverty outcomes and/or environmental outcomes while obscuring interesting correlations. Instead, we must begin poverty–environment investigations from the broadest scale at which any meaningful generalization about a poverty–environment dynamic might take place.

Returning to the Nigerian PEIndicators discussed above, we argue that the largest meaningful scale at which these agricultural variables might capture a meaningful relationship between poverty and the environment in Nigeria is at the level of the seven broad agroecological zones that characterize this country and land tenure practices (which will largely map to ethnic groups, with broad similarities between various groups across the country). These two variables are critical factors governing the types of crops grown in particular places and the amount of land available to individual farmers, issues critical to poverty–environment dynamics as they relate to grain cultivation and irrigation. Using these two variables, we can subdivide Nigeria into ‘regions’ of broadly shared environmental and land tenure characteristics (Figure 1a)

that, when analyzed on their own, might produce meaningful and interesting correlations between rural per capita cereal production/the percentage of irrigated area in the total agricultural area and poverty outcomes and environmental outcomes<sup>3</sup>.

Even if we are able to identify the appropriate scale of analysis for a particular indicator, we will still require political economic data to interpret that indicator. Analysis of the GINI coefficient is one method that may be used to understand the political economy of ecosystem services or livelihood activities and enable the productive interpretation of these two indicator variables. For example, we can rapidly address the interpretive confusion surrounding the ‘rural per capita cereal production’ indicator described above with information about the GINI coefficient of the area being indicated. A falling GINI coefficient suggests that an increase in per capita production represents a situation with linked positive environmental conditions and rising human well-being. On the other hand, a rising GINI coefficient suggests that increasing production is likely a product of rising inequality, which is likely contributing to a decline in well-being for many people in the area being indicated.

Although GINI coefficient data exist at the national and even sub-national level for many countries, finding GINI coefficient data that map to the agroecological/land tenure regions described above is very difficult. At best, the data required to generate a GINI coefficient exist at the level of the state or district in Nigeria. However, the agroecological/land tenure regions (Figure 1a) do not map to these political boundaries (Figure 1b). This requires, at the very least, a reorganization and recalculation of relevant data, assuming the raw data are available. In the worst case, the need for a GINI coefficient that maps to these regions might require primary data collection. In both cases, the effort to obtain this key information will be time consuming and expensive, running contrary to the understood purpose of indicators (rapid, cost-effective assessment). This is not a problem unique to Nigeria, but common to every country on Earth.

Thus, it is currently impossible to rapidly, cost-effectively integrate *existing* political–economic data into the selection and interpretation of PEIndicators. As a result, PEIndicators are, at this point in time, an oxymoron. Either we can meaningfully evaluate poverty–environment dynamics in particular places through the significant expenditure of time and money, or we can rapidly, cost-effectively mismeasure this relationship, as under current practice.

If PEIndicators are to become useful tools in the pursuit of sustainable development, we must make a substantial investment in our global data infrastructure to enable a variety of spatially flexible analyses. Where it is possible, census data will have to be broken down or collected and made available at the smallest spatial unit possible, to enable this flexible analysis. These investments will initially be very time consuming and expensive; however, we see little choice but to make such an investment. Reworking our datasets in this manner has the potential to pay tremendous dividends, allowing for the creation and application of

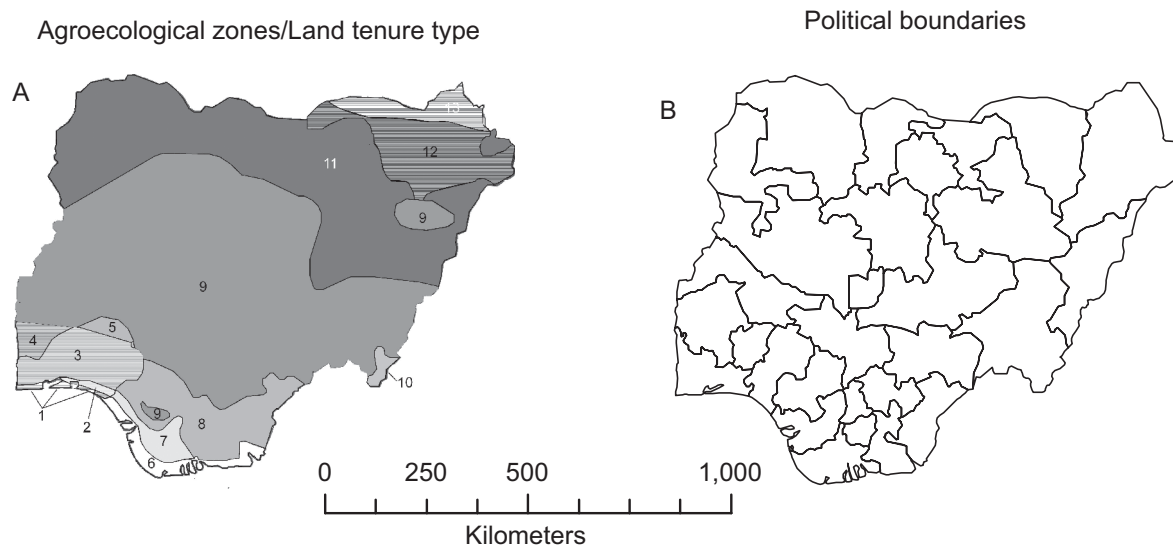


Figure 1. (a) A map of the agroecological/land tenure regions of Nigeria with distinctions great enough to warrant different interpretations of similar agricultural indicators. The regions, described as [dominant land tenure arrangement], [agroecological zone]: 1) Communal/Cognatic, Mangrove, 2) Communal/Cognatic, Freshwater Swamp, 3) Communal/Cognatic, Rainforest, 4) Communal/Cognatic, Woodland and Tall Grass savanna, 5) Communal/Patrilineal, Rainforest, 6) Communal/Patrilineal, Mangrove, 7) Communal/Patrilineal, Freshwater Swamp, 8) Communal/Patrilineal, Rainforest, 9) Communal/Patrilineal, Woodland and Tall Grass savanna, 10) Communal/Patrilineal, Short grass savanna, 11) Neo-feudal, Short grass savanna, 12) Neo-feudal, Marginal savanna. (b) A map of the state boundaries of Nigeria.

Note the lack of correspondence between the boundaries of the two maps, illustrating the problems of data collection with regard to political economic data relevant to the interpretation of agricultural PEIndicators.

Sources: Human Relations Area Files, Gordon (2005), Central Intelligence Agency, USA.

truly rigorous, meaningful indicators of change in the poverty–environment relationship. Neglecting to rework the development and application of PEIndicators will perpetuate the inaccurate interpretations that plague projects to alleviate poverty and sustain the environment.

## Conclusion

Contemporary development practice links the goals of poverty alleviation and environmental sustainability into a single project (UNEP 2007). However, how we understand, assess, and address changes in this linkage in particular places remains a point of contention. Although we have been critical of the understandings of poverty–environment dynamics that emerge from the contemporary PEIndicator literature, we are not arguing for the abandonment of either indicator frameworks or the goal of rapidly and reliably assessing the linkage between poverty and the environment in particular places. If we are to avoid studies and projects that focus on the symptoms of poverty and environmental degradation at the expense of the interactions that lie at the heart of these outcomes, we must, to paraphrase Niemeijer (2002), resist the temptation to reduce complex causality to a simple, understandable, but indeterminate, correlation between a particular indicator, poverty outcomes, and environmental outcomes. We feel that the limitations of PEIndicators require a broader approach to poverty–environment dynamics that employs indicator-specific scales of analysis and incorporates political economic variables into the selection and interpretation of indicators.

This, in turn, calls for the creation of new political–economic datasets that will allow for the meaningful incorporation of political economic issues, such as access, entitlement and power, into the practice of poverty–environment indication. Only through such efforts might PEIndicators contribute towards a more rapid and comprehensive understanding of poverty–environment dynamics.

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## Notes

1. While we are aware of the vast literature on indicators, including sustainable development indicators (Moldan et al. 1997; UN 2001; Henninger and Hammond 2002; Segnestam 2002; Parris and Kates 2003) this paper focus on PEIndicators. We therefore leave the discussion of these literatures aside.
2. Niemeijer and de Groot (2008) argue that this unilinear simplification is part of a larger trend in indicators that stems from their connection to ‘causal chain frameworks’, such as the Driver–Pressure–State–Impact–Response (DPSIR) framework.
3. Significant recent work on poverty mapping (e.g., Davis and Siano 2001; Henninger and Hammond 2002; Chen and Sydor 2006) has already addressed many of the issues that we raise here with regard to the analytic subdivision of countries, and could be easily applied to the development of a national poverty–environment assessment.

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