International Journal of Political Economy, vol. 34, no. 1, Spring 2004, pp. 75–93.

ISSN 0891–1916/2005 $9.50 + 0.00.

MARIANO TORRAS

The Impact of Ecological Inequality on National Well-Being

The Case of Brazil, 1965–1998

Opposition to growth in gross domestic product (GDP) as an indicator of economic development or social well-being improvement has been widespread since the advent of national income accounting. Some of the recent literature, motivated by growing interest in environmental issues, and sustainable development in particular, criticizes GDP from the perspective that it confuses true income and wealth consumption (Daly 1995; Repetto et al. 1989). Other critiques focus on a variety of social variables (e.g., life expectancy, literacy), designing alternative indicators that go beyond income-based definitions of social welfare (Morris 1980; UNDP 2001). Related to such efforts, Ahluwalia and Chenery (1974) take into account income inequality and disaggregate GDP to calculate well-being growth rates that, according to the authors, are more relevant than GDP growth.

The index of sustainable economic welfare (ISEW) (Daly and Cobb

---

 "El Impacto Ecológica y el Bienestar Nacional: El Caso de Brasil, 1965–1998," *Problemas del Desarrollo* 134 (July–September): 109–25. The author thanks James Boyce, Mohan Rao, and Tom Stevens for their comments and suggestions on an earlier work on which the present article is based; to the colleagues who participated in the research forum at Adelphi University; and to the participants in the Tenth World Congress on Social Economics, UK, August, where another version of this article was presented.

Translated by Stephen Naron.

1989) is among the few alternative indicators that accounts for both the natural environment and inequality.[1] Yet even the ISEW falls short in that it does not account for the potentially unequal distribution *of the environmental impacts* resulting from economic activity, that is, the "ecological distribution." Indeed, the great majority of economic studies on the environment disregard such matters of political ecology. The principal argument of the present article, in contrast, is precisely that proper measurement of progress or well-being improvement depends critically on the ecological distribution, particularly in regions or countries where environmental degradation has been substantial.

Brazil, without a doubt, exemplifies a country that has degraded its natural environment over the past forty years. Its "economic miracle" (1965–73) marked the beginning of an intensified use of the environment—especially in the Amazon region—that has since then continued more or less unabated. This is, by itself, not necessarily a problem. If the benefits resulting from the environmentally degrading economic activity are sufficient to compensate those who suffer most of the consequences, we may conclude that the country is better off than in previous years. But in the case of Brazil, the problem was that in many instances the poorest and least powerful suffered most of the consequences, while the political system failed to extract any meaningful compensation from those who gained. On the contrary, the military governments that ruled Brazil over the years were especially generous to the oligarchy.

In this article, I develop a methodology that accounts for both inequality and environmental degradation, and is based on earlier studies by World Resources Institute (WRI) researchers and by Ahluwalia and Chenery (1974). Moreover, contrary to the ISEW, I account for the specific impact of the ecological distribution on the critical result—that is, the degree of progress or national well-being improvement over time. I apply the methodology to data from Brazil, demonstrating that the country's well-being declined from 1965 to 1998 assuming a regressive ecological distribution—this despite fairly rapid per capita GDP growth over the same period. Although the absence of reliable data on ecological distribution detracts somewhat from the results, the main conclusion—namely, that ecological distribution is a critical component of any national well-being assessment—remains robust.

Political Ecology and Ecological Distribution: Methodological Problems

Some of the recent research in environmental economics is directed toward developing new methods for estimating natural resource values, and sometimes even ecosystem values. In most cases the techniques developed are an extension of neoclassical theory, with hypothetical markets constructed to account for values that are not manifested in our behavior as consumers of goods and services.[2] The fact that such methods are increasingly visible in the mainstream of the profession (see, for example, El Serafy 1989; Hoehn and Randall 1989; Krutilla 1991; Shyamsundar and Kramer 1996) is evidence that they are regarded as objective or as scientific.

In contrast, precious little research has been conducted on the question of how to measure the *distribution* of environmental impacts—in other words, what Martinez-Alier (1995, 1997) has referred to as the ecological distribution.[3] Like almost anyone else, the majority of neoclassical economists are doubtless aware that the distribution of social costs associated with natural resource depletion (economists call them "externalities")[4] is, in many cases, quite unequal. Yet neoclassical theory has in no manner contributed to the measurement of ecological distribution, because it considers such problems to be unavoidably subjective. The reasoning is that even where the ecological distribution is severely unequal, it is not a problem as long as it is associated with economic growth (or some other economic activity that produces a "Pareto improvement"), because in theory the beneficiaries would be able to compensate the losers.

Nevertheless, there are many others who argue that subjectivity is inevitably present not only in evaluations of ecological distribution, but in the ecological impact evaluations themselves. Leipert (1987) and Norgaard (1990, 1995), for example, claim that monetary evaluations of natural resources diminish their importance relative to goods and services exchanged on the market. Moreover, and this notwithstanding, given that individuals not yet born are incapable of participating in such "environmental markets" even if the latter existed, many believe that the values attributed to particular kinds of natural resources or ecological services are inevitably arbitrary (e.g., Christensen 1989; Martinez-Alier 1987; Oberhofer 1989; Solow 1974). A discount rate lower than the prevailing interest rate might compensate for posterity, but it is obviously impossible to objectively determine the "correct" rate.

Finally, researchers such as Hornborg (1998), Luks and Stewen (1999), and M'Gonigle (1999) believe that natural resource valuations are inseparable from problems of inequality and politics in general. Hornborg, in particular, argues that economic evaluation is a culturally relativist phenomenon that is *necessarily* subjective. Martinez-Alier (1995) illustrates this by referring to the infamous memo written by Larry Summers to his colleagues at the World Bank. Martinez-Alier infers from it that Summers justifies the increase in pollution levels in poor regions because "the poor sell cheap"—that is, the natural environment is worth less if we ask a poor person to value it (because his willingness to pay to preserve it is very low) than if we ask a rich person.

We must therefore conclude that if monetary assessments of natural resource values are arbitrary, ecological distribution estimates must be so a fortiori. What does this imply? Should we reject all monetary evaluations of the natural environment? Doing so would resolve nothing for, aside from misrepresenting what has occurred, such a response *would also be subjective* because it would only intensify the rate of depletion of natural resources. As noted by Pearce:

> Typically, development benefits can be fairly readily calculated because there are attendant cash flows. . . . Conservation benefits, on the other hand, are a mix of associated cash flows and "non-market" benefits. Components with associated cash flows are made to appear more "real" than those without such cash flows. . . . [D]ecisions are likely to be biased in favor of the development option because conservation benefits are not readily calculable. . . . Unless incentives are devised whereby the non-market benefits are "internalized" . . . conservation benefits will automatically be downgraded. . . . This "asymmetry of values" imparts a considerable bias in favor of the development option. (1991: 242–43)

It should therefore be clear that some way of evaluating in monetary terms is justified.

As for ecological distribution, it is far more complicated to quantify. The historical example of Brazil, discussed in what follows, illustrates that its assessment is as much a qualitative problem as a quantitative one. Nevertheless, the Brazilian case adequately informs us regarding the gainers and losers from ecological distribution, and, as we shall see, supports certain assumptions to be used in the analytical section of the article.

The Political Ecology of Economic Growth in Brazil

Many researchers in the area of political ecology (e.g., Millikan 1992; Schmink and Wood 1987) view their area of study as a synthesis of political economy and human ecology. In the most general terms, political ecology is a body of scholarship that focuses on how existing social, political, and ideological institutions govern property rights, and how these in turn determine land-use patterns. Also of fundamental importance is how different types of land use generate different environmental outcomes, as well as "winners" and "losers" (Bryant 1992). In other words, although seldom, if ever, stated in these terms, much of the study of political ecology is an attempt to explain ecological distribution.

Unfortunately, despite the fact that research on political ecology consistently touches on the areas of inquiry described above, it has thus far failed to produce a unique, coherent theory (Moore 1993; Peet and Watts 1993; Peluso 1992). Absent some form of theory, we are severely limited in our ability to assess ecological distribution. Insightful observations abound in the literature, however, and some are especially useful for our present purposes.

For example, the presence of severe inequality is generally not conducive to the emergence of a system of democratic government because one would assume that those who benefit will do everything possible to preserve the existing distribution (Schmink and Wood 1987). And, because an authoritarian government is less responsive to the people than are the leaders in a democracy, it is more likely that the former will pursue a policy favoring the social group that is indispensable for maintaining power (Bunker 1995). The consequence would be even greater inequality.

Brazil's experience from 1960 until approximately 1972 illustrates the point. Populist President João Goulart's policies— for example, limiting foreign profit remittances, nationalizing the oil refineries, threatening to institute land reform—were opposed by the more powerful segments of an already polarized Brazilian society and ultimately led to his overthrow by the military in 1964. For the next twenty years a succession of military regimes introduced policies that involved generous tax breaks and subsidies to investors for "developing" regions in the Brazilian interior (Browder 1988; Keck 1991). Such policies enabled the already wealthy investors to concentrate their wealth, making Brazilian inequality even more severe (Deininger and Squire 1996).

Some contributors to the literature on political ecology also suggest that democratic or egalitarian governments are far more likely than dictatorships to pursue greater equity in land distribution (i.e., land reform), which requires an active role in establishing and enforcing property rights. In contrast, nondemocratic governments have historically opposed such changes.[5] Since de jure preservation—or even intensification—of already-unequal land distributions may sometimes be politically imprudent, property rights legislation is often written more ambiguously and is less well enforced so that land ownership may be further concentrated de facto (Katzman 1987). Less-well-defined property rights (i.e., "open access" as opposed to common property), in turn, tend to lead to less ecologically sustainable land uses because of the so-called tragedy of the commons (Bromley and Cernea 1989; Hardin 1968; Hecht 1985; Nygren 2000).[6]

Again the Brazilian experience is illustrative. The National Integration Program (PIN) of 1970, which involved resettling many poor families from the impoverished northeast to the interior provinces, was a means of addressing the widespread clamor for more land for the poor while avoiding the political strife associated with land redistribution (Butts 1989; Hecht 1985; Katzman 1987). Although, in principle, PIN ensured that many of the poor obtained rights to a plot of land at least sufficient for subsistence, in practice, obtaining titles to these plots was a formidable task. In many cases, several people held title to the same area. Although poor enforcement was sometimes the cause—police officers were poorly paid, hence easily bribed—the main reason for this was that the institutions for titling land, allocating capital, and resolving disputes, themselves discriminated against small farmers. This led to an intensification of inequality, and, as noted by Smith and colleagues (1996), was compounded by the fact that without title to land, banks would not supply credit.

Even where poor families did secure land titles, they found that most of the land in the Amazonian region was inadequate for agriculture. As a result, they often utilized what little land they did possess to *plant grass* in order to entice large investors, particularly cattle ranchers, to purchase their land (Bunker 1981). The gradual conversion of the Brazilian interior to large cattle ranches—and often large export-crop farms as well—made unsustainable use of the tropical forest, leading to a diminution in its area that continues to this day (Browder 1988; Fearnside 1993; Goodland 1980; INPE 1997).

Large investors exploiting ill-defined property rights are likely to have

far greater mobility than the poorer groups, and hence be less likely to practice sustainable behavior than the year-long residents of the forest (Broad 1994).[7] They suffer limited losses from their behavior since they reside far from the environmental damage, or they are not harmed at all because, quite on the contrary, the forest is an obstacle to their pursuits (e.g., ranching, mining, monocrop agriculture).

The fact that the forest residents often constitute activist forces in hopes of protecting their local environments is a clear sign that they are disproportionately hurt by the environmental changes caused by deforestation (Bandyopadhyay and Shiva 1988). The most well-known environmental campaign in Brazil (spearheaded by the late Chico Mendes during the 1980s) was over provision of "extractive reserves"—that is, protecting areas of forest in the state of Acre from cattle ranchers so that the locals could continue harvesting its products (e.g., resins, latex, fruits, nuts). The Kayopó and Yanomami, indigenous peoples living in harmony with the Amazon forest for centuries or longer, are also being adversely affected by the encroachment of developers (see, e.g., Possey 1985). Finally, regressive ecological distribution has given rise to the activist landless people's movement (known in Brazil as *movimento sem terra,* or MST), a campaign that continues to expand to this day.

Although the political ecology circumstances described here do not contribute to expressing Brazil's ecological distribution quantitatively, the qualitative story told strongly supports the thesis that the poorer groups bore the preponderance of the resource depletion burden. As we shall see, the observation bears directly on the following analysis, and casts doubt on the proposition that Brazil experienced an improvement in national well-being in the period from 1965 to 1998.

Accounting for Ecological Distribution in Assessing Well-Being

World Resources Institute and Ahulwalia and Chenery Methodologies

WRI studies on Indonesia (Repetto et al. 1989), Costa Rica (Solórzano et al. 1991), and the Philippines (Cruz and Repetto 1992) argue that GDP accounting is misleading because it implicitly regards "natural assets" (i.e., natural resources) as valueless. Each study adjusts the respective country's GDP for estimated natural resource depletion values

and calculates growth in the revised national income measure (hereafter green GDP) as well as "green net investment," to illustrate that the development paths followed by these countries were more costly than suggested by per capita GDP growth.[8] Yet, the authors of the WRI studies do not go far enough, in that their accounting approach disregards the distributional impact of economic growth.

In contrast, Ahluwalia and Chenery (1974, hereafter A&C) were among the first to consider the impact of inequality. They noted that when taken as a measure of welfare change, GDP growth, in effect, weights each individual by his or her income. That is, the income growth of the wealthiest members of society carries greater weight than that of society's poorest in determination of GDP growth. Consider, for example, a case in which the wealthiest 20 percent of the population garners two-thirds of all national income, while the poorest 20 percent receives just 2 percent. In this situation the income growth rate of the richest quintile takes on about *thirty-three times* more weight, in the determination of GDP growth, than does the income growth rate of the poorest quintile.

In place of conventional accounting, A&C recommend one of two alternative weighting schemes: "equal" or "poverty" weights. Suppose that we rank order all the individual members of a population according to income and then divide the population into five equal parts. First we calculate the income growth rate for each income quintile, and then apply A&C's alternative weights. The equal weights criterion would require multiplying each growth rate by 20 percent and taking the sum, resulting in one alternative manner of measuring the "rate" of well-being improvement.

In contrast, the poverty weights scheme ascribes greater importance to income increases accruing to the poorest groups, and less to increases for the richest. Here, the rationale is that the ability to satisfy basic needs is more important (hence has greater "social value") than the ability to satisfy secondary needs or superfluous desires (e.g., Barrera 1997).[9] In their original study, A&C assigned a factor of 60 percent to the group of the 40 percent poorest, and only 10 percent to the group of the 20 percent richest. Conversely, one could use the inverse of the suggested figures for income distribution, as I do in the following analysis.[10]

If the main weakness of the WRI approach is its silence on the question of inequality, the problem with the A&C method is its disregard for environmental problems.[11] We should therefore expect that applying

A&C's alternative weights scheme to the WRI's green GDP instead of to conventional GDP would yield a more exhaustive indicator of social progress—one that accounts for both natural resource depletion and distributional equity. While undoubtedly a step in the right direction, such a hybrid indicator fails to address the separate question of how the depletion-related externalities or costs are distributed across the population. In other words, it ignores ecological distribution, and the bearing that it may have on national welfare assessment. As is demonstrated later, it is impossible to ignore ecological distribution when the A&C weights are applied to green GDP.

An Empirical Illustration of the WRI–A&C Synthesis

My approach is analogous to that of the WRI in that I also adjust GDP for estimated values of losses in the mineral, timber, and soil sectors. Absent of course from the latter, but present here, is an accounting for inequality along the lines followed by A&C. Moreover, I address the problem of unequal ecological distribution and how it bears on well-being improvement. All data sources are found at the end of the article.

The problem with combining the WRI and A&C approaches is that disaggregating green GDP by population quintile implies that the total externality as well as total GDP accrues disproportionately to the wealthy, since conventional GDP and overall natural capital depletion are lumped together (to form green GDP) prior to the disaggregation. In other words, ecological distribution is assumed to immensely favor the poor—an outcome that, while possible, is in most cases unrealistic (see, e.g., Boyce 1994; Dasgupta 1995; Khan 1997; Martinez-Alier 1993). We should therefore compare among alternative ecological distribution assumptions in assessing national welfare. Since data are, unfortunately, not available, we are left to consider competing hypothetical scenarios, as has been done in earlier work (Khan 1997; Torras 1999). In the analysis that follows, I consider three alternative schemes for apportioning depletion losses across income quintiles, which are symmetrical to the aforementioned A&C weights.

The "proportionate" distribution assumption reflects the above example—that is, the possibility that everyone suffers externalities proportionate to their income share. The "equal" distribution assumption divides the total value of natural resource depletion into five equal parts, which are then subtracted from the aggregate income of each quintile.

Finally, assuming a "regressive" distribution implies allocating a greater share of total natural resource depletion costs to the poor, according to the inverse of the income shares.

The next step is to calculate average annual growth rates for each group as well as for each of the three hypothetical equations using the following formula:

$$g = [(y_i^{t_i} - d_i^{t_1})/(y_i^{t_0} - d_i^{t_0})]^{[1/33]} - 1 \quad (1)$$

where g is the growth rate (or, more accurately, the "welfare improvement rate") from 1965 to 1998, y_i^t is the per capita income of quintile i ($i = 1, 2, \ldots 5$) in year t, d_i^t is the portion of the total externality affecting said quintile in year t, and t_0 is 1965 while t_1 is 1998. The number 33 represents the number of years between 1965 and 1998.

For example, the rate of improvement in well-being for the richest fifth, assuming a regressive ecological distribution, would be as follows (see Table 1).

$$g = [(17{,}998 - 185.62) \ / \ (7{,}305.2 - 138.39]^{[1/33]} - 1 = 2.8\% \quad (2)$$

The other quintile growth rates found in the final three columns of Table 1 are calculated in the same manner.

The next step involves taking a weighted sum of the quintile growth rates according to the three weighting schemes (GDP, equal, and poverty) in order to produce alternative measures of well-being improvement that can be compared among themselves as well as with conventional GDP. The analysis yields a three-by-three matrix of nine possible results (Table 2).

Applying the A&C method to the green GDP, we see that the rate of well-being improvement is reduced dramatically if we assume either an equal or a regressive ecological distribution.[12] Taking a weighted average of the quintile growth rates according to the "equal weights" assumption yields annual growth rates less than half what they would be not accounting for the ecological distribution (1.3 percent in the case of equal and 1.2 percent in the case of regressive distribution). Assuming a "poverty weights" scheme, we see that well-being actually *declines* for the period studied.

Two factors contribute to the result. First, the "green income" of the poorest two quintiles decreased from 1965 to 1998. The decrease was as much due to the decline—or at least stagnation—in per capita income

Table 1
Individual Quintile Growth Rates Per Capita Resource Depletion Adjustments

	Per capita GDP (Reais, 1998 prices)		Proportionate equal distrib.		Equal ecol. distrib.		Regressive ecol. distrib.		Individual quintile growth rates, 1965–1998		GDP ecol. distrib.	Equal ecol. distrib.	Regressive ecol. distrib.
	1965	1998	1965	1998	1965	1998	1965	1998	1965	1998			
Poorest quintile	395.67	705.25	138.39	185.62	826.19	1,486.40	2,555.0	4,737.0	2,555.00	4,737.00	2.2%	–1.8%	–1.9%
Second quintile	938.98	1,551.50	328.41	408.36	826.19	1,486.40	675.41	1,358.70	675.41	1,358.70	1.9%	–1.7%	–0.9%
Third quintile	1,240.20	2,821.00	433.75	742.48	826.19	1,486.40	433.75	742.48	433.75	742.48	2.9%	3.6%	2.9%
Fourth quintile	1,931.10	5,162.40	675.41	1,358.70	826.19	1,486.40	328.41	408.36	328.41	408.36	3.4%	3.7%	3.4%
Richest quintile	7,305.20	17,998.00	2,555.00	4,737.00	826.19	1,486.40	138.39	185.62	138.39	185.62	3.2%	2.9%	2.8%

Table 2
Brazilian Well-Being Improvement from 1965–1998, Adjusted for Ecological Distribution

Presumed ecological distribution	A&C weighting scheme		
	GDP (%)	Equal (%)	Poverty (%)
Proportionate	3.1	2.7	2.3
Equal	2.7	1.3	–0.7
Regressive	2.5	1.2	–0.8

Note: Assuming a discount rate of 5.0 percent.

after the "economic miracle" as to the increase in the monetary value of the total resource depletion relative to GDP over the period studied. Second, the equal and poverty weighting schemes allow the negative growth rates of the two poorest quintiles greater influence (compared to GDP weights) in determining overall well-being improvement.

Although the ecological distribution scenarios used in the analysis are hypothetical, the results demonstrate how a regressive ecological distribution may bear significantly on the measurement of well-being improvements. Of course actual data—or at least reliable estimates—would only make our conclusions more robust.[13] As I have noted, reasonably accurate quantitative estimates will probably remain elusive. Yet alone it is insufficient justification for abandoning continued attempts at developing measures or quantitative indices for assessing regional or national well-being improvements.

Conclusion

Studies conducted by the World Resources Institute (cf. Repetto et al. 1989; Solórzano et al. 1991; Cruz and Repetto 1992) and Ahluwalia and Chenery (1974) call into question the political importance ascribed to GDP growth rate. Combining the WRI and A&C methods yields a methodology that takes into account the depletion of natural resources as well as income inequality. It essentially sidesteps the question of ecological distribution, however, a question that is critical in measuring improvements in national well-being.

I conclude, first, that ecological distribution in Brazil was generally

regressive in the period from 1965 to 1998. For reasons already discussed, the *degree* to which it was regressive cannot be known, much less estimated, in any reasonable manner. The fact, however, that *as a bare minimum* the poor as a whole suffer more than the rich, implies that at the very least we should assume an equal ecological distribution. Our main conclusion then depends on which of the two A&C alternative weighting schemes—equal or poverty weights—is more appropriate. The question cannot be answered definitively since it is inescapably subjective. Nevertheless, even in the best of cases (that is, employing equal weights), we can conclude that Brazilian well-being from 1965 to 1998 improved at an annual rate of less than half the growth rate of GDP. Moreover, we have seen that if instead we choose poverty weights, well-being diminishes by an average of not much less than 1 percent per year.

To sum up, given that Brazilian per capita GDP increased by more than 3 percent annually from 1965 to 1998, it seems clear that GDP is misleading as an indicator of progress or well-being improvement. Still, there are at least two questions that have not yet been addressed. First, is there necessarily a causal link between GDP growth and failure to develop? Although the results presented here are suggestive, they in no way imply causation. We could easily imagine cases in which both GDP and national well-being increase over time, provided that GDP growth is rapid enough to compensate for the negative consequences of both natural resource depletion and worsening income inequality. At the root of the matter is what type of relationship exists between economic growth, on the one hand, and the natural environment and society, on the other. It is a question that has attracted, much well-merited attention, and without a doubt will continue to do so.

Second, although the question regarding the appropriate choice among the A&C weighting schemes will always be subjective, political ecology research can inform us about the other key dimension of the analysis, namely, the precise ecological distribution. The foregoing analysis was based exclusively on Brazil. Although we might suspect that the main conclusions here apply in the general case of any developing country, it cannot be known for certain without further investigation. Such research would be sure to produce new and insightful observations not only on political ecology and ecological distribution but also on the relevance of GDP to the broader question of social well-being improvement.

Notes

1. See also, inter alia, Castañeda (1997) and Stockhammer et al. (1997) for ISEW studies on a variety of countries.

2. The contingent valuation survey approach is probably the most well known and widely utilized, if also the most controversial. Other more indirect methods include hedonic pricing, travel cost, or damage avoidance estimates. For an overview of the subject, see Groombridge (1992).

3. Martinez-Alier (1995: 520) distinguishes among three types of ecological distribution—social, spatial, and temporal—the first of which is the predominant focus of this study. Social ecological distribution refers to within-country inequality in resource depletion or pollution burden. Examples include mercury poisoning in rivers caused by gold prospectors but suffered by local residents, or severe soil erosion endured by groups other than the parties to the deforestation that caused it (see, e.g., Millikan 1992). Spatial ecological distribution implies cross-country inequality in exposure to natural resource depletion or environmental degradation. Acid rain is a salient example, with "downwind" sulfur dioxide emissions that cause it originating in different countries than those suffering its consequences. Finally, temporal ecological distribution refers to cross-generational inequality in the distribution of external costs pertaining to the environment. Perhaps the most conspicuous example is the use of nuclear energy today and the untold damages to be faced by future generations from problems associated with waste storage or accidents.

4. *Externalities* refer to the indirect and unintended consequences resulting from any economic activity or transaction. Although most examples from the literature are negative externalities, one can easily imagine positive externalities as well.

5. There are, of course, important exceptions. General Alvarado's military junta that ruled Peru from 1969 to 1974, for instance, enacted progressive land reform policies.

6. The famous "tragedy of the commons" described by Hardin (1968) in fact describes what occurs when land is open use or open access. Since common property implies possession (albeit social instead of individual), there are incentives to utilize the land in a sustainable manner, at least more so than in situations described by the author.

7. They are what Broad (1994) refers to as "itinerants" as opposed to residents who are more invested in the long-run viability of the land.

8. For simplicity, "GDP growth" hereafter signifies per capita GDP growth.

9. The objection might be raised that doing so requires interpersonal utility comparisons, a practice considered unacceptable in neoclassical welfare economics (see, e.g., Harberger 1984). Yet the same objection applies to the GDP weights method, or indeed to any quantitative indicator of social welfare that aggregates individual characteristics. What is indeed lost on many economists is that developing national-level welfare indicators is inescapably a normative exercise because some value judgment regarding the relative importance of each social group cannot be avoided.

10. Inverse income weights would imply, in our earlier example, that the income growth of the poorest 20 percent receives two-thirds weight while that of the wealthiest 20 percent receives a mere 2 percent weight.

11. Although, to be fair, sustainable development was not nearly as visible an issue at the time of their writing as at present.

12. If the figures assume a 5 percent discount rate in the monetary valuation of the total externality. There obviously exists no consensus over which discount rate is most appropriate. Some argue for the use of discount rates in the 10–12 percent range while others believe that very low discount rates—around 1 percent—are warranted. A 5 percent discount rate therefore represents a "moderate" option between the extremes.

13. I am of course referring to data on the ecological distribution basis. Ecological distribution is a "positive" issue, and I present the three alternative scenarios due to absence of adequate evidence to resolve it. The A&C weights, in contrast, imply a "normative" question that involves a value judgment rather than empirical observation.

References

Ahluwalia, M., and H. Chenery. 1974. "The Economic Framework." In *Redistribution with Growth,* ed. H. Chenery, M. Ahluwalia, C.L.G. Bell, J.H. Dully, and R. Jolly, 38–51. London: Oxford University Press.

Bandyopadhyay, J., and V. Shiva. 1988. "Political Economy of Ecology Movements." *Economic and Political Weekly,* June 11: 1223–32.

Barrera, A. 1997. "Degrees of Unmet Needs in the *Superfluous Income* Criterion." *Review of Social Economy* 45, no. 4: 460–86.

Boyce, J.K. 1994. "Inequality as a Cause of Environmental Degradation." *Ecological Economics* 11: 169–78.

Broad, R. 1994. "The Poor and the Environment: Friends or Foes?" *World Development* 22, no. 6: 811–22.

Bromley, D.W., and M.M. Cernea. 1989. "The Management of Common Property Resources." World Bank Discussion Paper no. 57, Washington, DC.

Browder, J.O. 1988. "Public Policy and Deforestation in the Brazilian Amazon." In *Public Policy and the Misuse of Forest Resources,* ed. Robert Repetto and Malcolm Gillis, 247–97. Cambridge: Cambridge University Press.

Bryant, R.L. 1992. "Political Ecology: An Emerging Research Agenda in Third-World Studies." *Political Geography* 11, no. 1: 12–36.

Bunker, S. 1981. "The Impact of Deforestation on Peasant Communities in the Medio Amazonas of Brazil." In *Where Have All the Flowers Gone? Deforestation in the Third World,* 88–113. Williamsburg: College of William and Mary, Department of Anthropology.

———. "The Eternal Conquest." In *Fighting for the Soul of Brazil,* ed. K. Danaher and M. Shellenberger, 130–53. New York: Monthly Review Press.

Butts, Y. 1989. "Economic Development: Brazil." In *International Amazonia: Its Human Side,* ed. Y. Butts and D.J. Bogue. Chicago: Social Development Center.

Castañeda, B. 1997. "An Index of Sustainable Economic Welfare (ISEW) for Chile." Institute of Ecological Economy, Solomons, MD.

Christensen, P. 1989. "Historical Roots for Ecological Economics—Biophysical Versus Allocative Approaches." *Ecological Economics* 1, no. 1: 17–36.

Cruz, W., and R. Repetto. 1992. "The Environmental Effects of Stabilization and Structural Adjustment Programs: The Philippines Case." World Resources Institute, Washington, DC.

Daly, H. 1995. "Consumption and Welfare: Two Views of Value Added." *Review of Social Economy* 53, no. 4: 451–73.

Daly, H., and J. Cobb. 1989. *For the Common Good: Redirecting the Economy Towards Community, the Environment, and a Sustainable Future.* Boston: Beacon Press.

Dasgupta, P. 1995. "Economic Development and the Environment: Issues, Policies, and the Political Economy." In *Critical Issues in Asian Development,* ed. M.G. Quibria, 93–124. Oxford: Oxford University Press.

Deininger, K., and L. Squire. 1996. "A New Data Set Measuring Income Inequality." *World Bank Economic Review* 10 (September): 565–91.

El Serafy, S. 1989. "The Proper Calculation of Income from Depletable Resources." In *Environmental Accounting for Sustainable Development,* ed. Y. Ahmad, S. El Serafy, and E. Lutz, 10–18. Washington: World Bank.

Fearnside, P. 1993. "Deforestation in Brazilian Amazonia: The Effect of Population and Land Tenure." *Ambio* 22, no. 8: 537–45.

Goodland, R. 1980. "Environmental Ranking of Amazonian Development Projects in Brazil." *Environmental Conservation* 7, no. 1: 9–26.

Groombridge, B. 1992. *Global Diversity: Status of the Earth's Living Resources.* London: Chapman and Hall.

Harberger, A.C. 1984. "Basic Needs versus Distribution Weights in Social Cost-Benefit Analysis." *Economic Development and Cultural Change* 32: 455–74.

Hardin, G. 1968. "The Tragedy of the Commons." *Science* 162: 1243–48.

Hecht, S. 1985. "Environment, Development, and Politics: Capital Accumulation and the Livestock Sector in Eastern Amazonia." *World Development* 13, no. 6: 663–84.

Hoehn, J.P., and A. Randall. 1989. "Too Many Proposals Pass the Benefit Cost Test." *American Economic Review* 79, no. 3: 544–51.

Hornborg, A. 1998. "Towards an Ecological Theory of Unequal Exchange: Articulating World System Theory and Ecological Economics." *Ecological Economics* 25, no. 1: 127–36.

INPE (Instituto Nacional de Pesquisas Espaciais). 1997. "Extensão do Desflorestamento na Amazônia Legal." Available at www.dpi.inpe. br/amazonia/desflora.html (accessed March 14, 1999).

Katzman, M.T. 1987. "Ecology, Natural Resources, and Economic Growth: Underdeveloping the Amazon." *Economic Development and Cultural Change* 35, no. 1 (January): 425–36.

Keck, M. 1991. "The International Politics of the Brazilian Amazon." Conference Paper no. 63, Columbia University, New York.

Khan, H.A. 1997. "Ecology, Inequality, and Poverty: The Case of Bangladesh." *Asian Development Review* 15, no. 2: 164–79.

Krutilla, J.V. 1991. *Environmental Resource Services of Malaysian Moist Tropical Forest.* Baltimore: Johns Hopkins University Press.

Leipert, C. 1987. "A Critical Appraisal of Gross National Product: The Measurement of Net National Welfare and Environmental Accounting." *Journal of Economic Issues* 21, no. 1: 357–73.

Luks, F., and M. Stewen. 1999. "Why Biophysical and Economic Assessments Will Bring Distribution Issues to the Top of the Agenda." *Ecological Economics* 29, no. 1: 33–35.

Martinez-Alier, J. 1987. *Ecological Economics: Energy, Environment, and Society.* Oxford and New York: Blackwell.
———. 1993. "Distributional Obstacles to International Environmental Policy: The Failures at Rio and Prospects after Rio." *Environmental Values* 2: 97–124.
———. 1995. "Distributional Issues in Ecological Economics." *Review of Social Economy* 53, no. 4: 511–28.
———. 1997. "Some Issues in Agrarian and Ecological Economics, in Memory of Georgescu-Roegen." *Ecological Economics* 22, no. 3: 225–38.
M'Gonigle, R.M. 1999. "Ecological Economics and Political Ecology: Towards a Necessary Synthesis." *Ecological Economics* 28, no. 1: 11–26.
Millikan, B.H. 1992. "Tropical Deforestation, Land Degradation, and Society: Lessons from Rondônia, Brazil." *Latin American Perspectives* 19, no. 1: 45–72.
Moore, D.S. 1993. "Contesting Terrain in Zimbabwe's Eastern Highlands: Political Ecology, Ethnography, and Peasant Resource Struggles." *Economic Geography* 69, no. 4: 380–401.
Morris, D. 1980. *Measuring the Condition of the World's Poor: The Physical Quality of Life Index.* New York: Pergamon, for the Overseas Development Council.
Norgaard, R.B. 1990. "Three Dilemmas of Environmental Accounting." *Ecological Economics* 1, no. 3: 303–14.
———. 1995. "Beyond Materialism: A Coevolutionary Reinterpretation of the Environmental Crisis." *Review of Social Economy* 53, no. 4: 475–92.
Nygren, A. 2000. "Development Discourses and Peasant-Forest Relations: Natural Resource Utilization as Social Process." *Development and Change* 31, no. 1: 11–34.
Oberhofer, T. 1989. "The Changing Cultural Discount Rate." *Review of Social Economy* 47, no. 1: 43–54
Pearce, D. 1991. "An Economic Approach to Saving the Tropical Forests." In *Economic Policy Towards the Environment,* ed. D. Helm, 121–49. Oxford: Blackwell.
Peet, R., and M. Watts. 1993. "Introduction: Development Theory and Environment in an Age of Market Triumphalism." *Economic Geography* 69, no. 3: 227–53.
Peluso, N.L. 1992. "The Political Ecology of Extraction and Extractive Reserves in East Kalimantan, Indonesia." *Development and Change* 23, no. 4: 49–74.
Possey, D. 1985. "Indigenous Management of Tropical Forest Ecosystems: The Case of the Kayopó Indians of the Brazilian Amazon." *Agroforestry Systems* 3: 139–58.
Repetto, R.; W. Magrath; M. Wells; C. Beer; and F. Rossini. 1989. *Wasting Assets: Natural Resources in the National Income Accounts.* Washington: World Resources Institute.
Schmink, M., and C.H. Wood. 1987. "The 'Political Ecology' of Amazonia." In *Lands at Risk in the Third World: Local-Level Perspectives,* ed. P.D. Little, M.M. Horowitz, and A.E. Nyerges, 38–57. Boulder: Westview Press.
Shyamsundar, P., and R. Kramer. 1996. "Tropical Forest Protection: An Empirical Analysis of the Costs Borne by Local People." *Journal of Environmental Economics and Management* 31, no. 2: 129–44.

Smith, N.; I.C. Falesi; P.T. Alvim; and E.A.S. Serrão. 1996. "Agroforestry Trajectories among Smallholders in the Brazilian Amazon: Innovation and Resiliency in Pioneer and Older Settled Areas." *Ecological Economics* 18: 15–27.

Solórzano, R.; R. de Camino; R. Woodward; J. Tosi; V. Watson; A. Vásquez; C. Villalobos; and J. Jiménez. 1991. *Accounts Overdue: Natural Resource Depreciation in Costa Rica.* Washington: World Resources Institute.

Solow, R. 1974. "The Economics of Resources or the Resources of Economics." *American Economic Review* 64, no. 2: 1–14.

Torras, M. 1999. "Inequality, Resource Depletion, and Welfare Accounting: Applications to Indonesia and Costa Rica." *World Development* 27, no. 7: 1191–202.

Data Sources

Commodity Trade and Price Trends, 1989–1991. Baltimore, MD: Johns Hopkins University Press. For the World Bank.

Commodity Research Bureau, Inc. *Commodity Yearbook.* 1975, 1984.

Deininger, K., and L. Squire. 1996. "A New Data Set Measuring Income Inequality." *World Bank Economic Review* 10 (September): 565–91.

IBGE (Instituto Brasileiro de Geografia e Estadística). *Censo Agropecuário.* Rio de Janeiro: Secretaria de Planejamento da Presidência da República, 1970.

———. *Anuário Estatístico do Brasil.* Rio de Janeiro: Ministério de Planejamento e Orçamento, 1973.

———. *Censo Agropecuário.* Rio de Janeiro: Secretaria de Planejamento da Presidência da República, 1975.

———. *Anuário Estatístico do Brasil.* Rio de Janeiro: Ministério de Planejamento e Orçamento, 1978.

———. *Censo Agropecuário.* Rio de Janeiro: Secretaria de Planejamento da Presidência da República, 1980.

———. *Censo Agropecuário.* Rio de Janeiro: Secretaria de Planejamento da Presidência da República, 1985.

———. *Anuário Estatístico do Brasil.* Rio de Janeiro: Ministério de Planejamento e Orçamento, 1986.

———. *Anuário Estatístico do Brasil.* Rio de Janeiro: Ministério de Planejamento e Orçamento, 1994.

IMF (International Monetary Fund). *International Financial Statistics Yearbook.* Washington, DC, 1990.

———. *International Financial Statistics Yearbook.* Washington, DC, 1996.

———. *International Financial Statistics Yearbook.* Washington, DC, 1997.

INPE (Instituto Nacional de Pesquisas Espaciais). Extensão do Desflorestamento na Amazônia Legal, 1997. Available at www.dpi.inpe.br/amazonia/desflora.html.

Torras, M. *Welfare, Inequality, and Resource Depletion: A Reassessment of Brazilian Economic Growth, 1965–1998.* Aldershot: Ashgate Press, 2003.

UNDP (United Nations Development Programme). 1999. *Human Development Report.* New York and Oxford: Oxford University Press.

———. 2001. *Human Development Report.* New York and Oxford: Oxford University Press.

Villela, A. 1992. "Brazilian Outcomes in Terms of Equity and Alleviation of Poverty." In *The Political Economy of Poverty, Equity, and Growth: Brazil and Mexico,* ed. A. Maddison et al. pp. 79–110. New York: Oxford University Press, for the World Bank.

World Silver Survey, 1950–1990. The Silver Institute.