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Nature's Resources as Productive Assets

A growing number of governments have recognized the need to bring depreciation of forests, minerals, and other resources into national accounting frameworks. The United States, alas, lags far behind.

Many countries are guided by the system of national income accounts in evaluating economic policies. But that system, despite its importance, fails to measure a nation's income correctly. While national income accounts treat buildings and equipment as productive capital whose value depreciates over time as they perform valuable work, natural resource assets are not so valued. Instead, they are treated as gifts of nature rather than as productive assets.

A country could exhaust its mineral resources, cut down its forests, erode its soils, pollute its aquifers, and hunt its wildlife and fisheries to extinction, but measured income would not be affected as these assets disappeared. Such balance sheet asymmetries are particularly dangerous for developing countries, which usually depend on their natural resource base for employment and exports.

Natural resources make important contributions to long-term economic productivity and should be considered as economic assets whose value lies not in their investment cost but in the potential income they can generate. Indeed, just as a machine depreciates as it wears out or becomes obsolete, soils can become less valuable as they erode and lose fertility.

If natural resources are not treated as productive assets, economic planners receive false signals that reinforce the unsound dichotomy between the economy and the environment. Confusing the depletion of valuable assets with the generation of income promotes the idea that rapid economic growth can be generated by exploiting the resource base, resulting in illusory gains in income and permanent losses in wealth.

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A more accurate accounting would recognize that one asset has been exchanged for another of higher value. Should a farmer cut and sell the timber in his woods to raise money for a new barn, his private accounts would reflect the acquisition of a new asset, the barn, and the loss of the old one, the timber. He thinks that he is better off because the barn is worth more to him than the timber.

In a typical national accounting scheme, both income and investment would rise as the barn is built, but income would also rise as the wood is cut. The value of the timber, less any intermediate costs, would be credited to value added in the logging industry. Nowhere is the loss of a valuable asset reflected, which can lead to a serious miscalculation of the development potential of resource-dependent economies by confusing gross and net capital formation.

Even worse, should the proceeds of resource depletion be used to finance current consumption, then the economic path is ultimately unsustainable, whatever the national accounts say. If the same farmer used the proceeds from his timber sale to finance a winter vacation, he would be poorer on his return and could no longer afford the barn, but national income would only register a gain, not a loss in wealth.

The fundamental definition of income encompasses the notion of sustainability. In accounting and economics textbooks, income is defined as the maximum amount that the recipient could consume in a given period without reducing possible consumption in the future. Business income is defined as the maximum amount the firm could pay out in current dividends without reducing net worth.

This income concept encompasses not only current earnings but also changes in asset positions: capital gains are a source of income, and capital losses are a reduction in income. Depreciation accounts reflect the fact that unless the capital stock is maintained and replaced, future consumption possibilities will inevitably decline.

In resource-dependent countries, the failure to extend this depreciation concept to the capital stock embodied in natural resources, which are such a significant source of income and consumption, seriously distorts economic evaluations.

Indonesia: A case study

Over the past 20 years, Indonesia has drawn heavily on its considerable natural wealth—oil, gas, minerals, timber, and forest products—to finance development and pay for routine expenditures. Indonesia's economic performance over this period has been successful by traditional measures: per capita domestic gross domestic product (GDP) growth averaged 4.6 percent per year from 1965 to 1986, and gross domestic investment (GDI) rose from 8 percent of GDP in 1965 to 26 percent in 1986 despite low oil prices and high debts. These figures are well above average for low- and middle-income countries.

But such standard measures of economic performance do not tell the whole story. They fail to account for changes in important natural resource stocks. Three resources—forests, petroleum, and soil—were examined in this case study to test whether integrating natural resources into national accounts was feasible. Physical accounts were constructed for each resource from 1970 through 1984.

The specific methodology varied, depending on the resource being measured. Timber stocks for a benchmark year could be determined from annual forest surveys. Petroleum reserves relied on geological data, and the soil accounts were set up from various land-use maps. Annual accounts for other years could then be determined by adding any new growth or newly discovered reserves to the baseline data of the preceding year and subtracting extractions and other diminutions of the resource. Reserves were defined in the economic sense as resources that could be profitably used given current technologies and market conditions.

A second step required valuing the physical inventories. Basically, the net price per resource unit was multiplied by the total number of units in the resource stock. (Net price is the international market price less all costs incurred during harvesting or extraction and is approximately equivalent to the resource's economic rent.) Once a monetary value was determined for each resource, these assets could be integrated into the national macroeconomic evaluations.

A comparison of gross domestic product (GDP) with "net" domestic product revised to include changes in the natural resource base shows that the current accounts tend to overstate real economic growth (see Figures 1 and 2). For example, the government's statistics on GDP showed an annual rise of 7.1 percent from 1971 to 1984. Yet, when allowances were made for resource depletion, the "net" domestic product was considerably smaller and rose by 4

percent per year. The overstatement of income and economic growth could actually be more than these estimates indicate since other important exhaustible and renewable resources have not yet been included in the accounts.

Measures of domestic investment, which are central to economic planning in resource-based economies, show an even greater disparity between the gross and "net" figures. When resource depletion exceeds investment, the country is drawing down, rather than building up, its asset base. Should net investment be insufficient to prepare new workers to enter the labor force, then increases in output per worker and income per capita are unlikely.

The results from the Indonesian case study show that the natural resource adjustment is large in many years relative to gross domestic investment. In 1971 and 1973, the adjustment is positive, due to additions to petroleum reserves. In most years during the period, however, the depletion adjustment offsets a good part of gross capital formation. In some years, net investment was actually negative.

Figure 1   **GDP AND "NDP"**
(in Constant 1973 Rupiah)
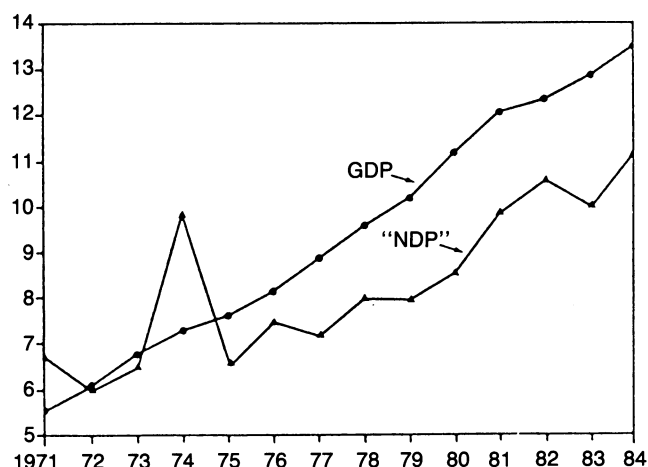
Source: "Wasting Assets: Natural Resources in National Income Accounts," a World Resources Institute research report, June 1988.

Similar adjustments can be made when evaluating the performance of specific economic sectors, such as agriculture. Almost three-quarters of the Indonesian population live on the fertile but overcrowded "inner" islands of Java, Bali, and Madura, where lowland irrigated rice paddies are intensively farmed. In the highlands, population pressures have brought steep

hillsides into use for cultivation of maize, cassava, and other annual crops. As hillsides have been cleared of trees, erosion has increased, now averaging perhaps over 60 tons per hectare every year.

Erosion's economic consequences include nutrient loss and reduced soil fertility from thin soils, and increased downstream sedimentation in reservoirs, harbors, and irrigation systems. Increased silt concentrations affect fisheries and downstream water users. Improved seed varieties and fertilizers have boosted crop yields in hilly areas, but the annual depreciation of soil fertility, measured as the value of lost farm income, is as large as the annual production increase.

Figure 2   **GDI AND "NDI"**
(in Constant 1973 Rupiah)
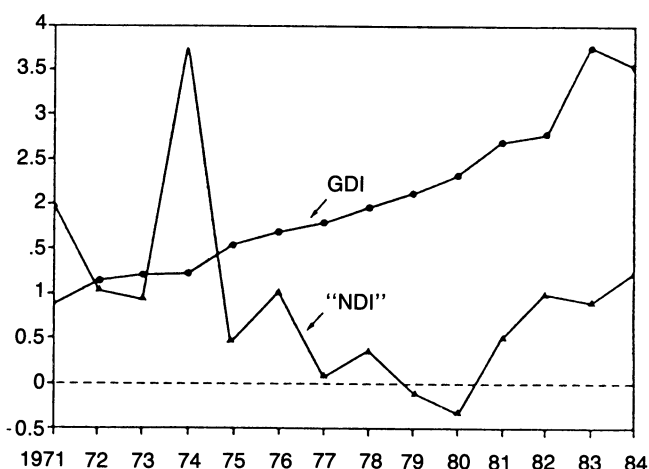
Source: Same as Figure 1.

In other words, these estimates suggest that *current* increases in farm output in Indonesia's uplands are being achieved partly at the expense of potential *future* output. Since the demand for land is unlikely to diminish in the future, soil erosion represents a transfer of wealth from the future to the present. By ignoring the future costs of soil erosion, Indonesia's agriculture accounts significantly overstate the growth of agricultural income in the highlands.

Accounting for natural resources

A considerable and growing body of expert opinion has recognized the need to bring natural resources squarely into national accounting frameworks and to treat forest, mineral, and other resources on a par

with other physical capital. In June 1985, the member governments of the OECD declared that they would "ensure that environmental considerations are taken fully into account at an early stage in the development and implementation of economic and other policies by . . . improving the management of natural resources, using an integrated approach, with a view to ensuring long-term environmental and economic sustainability."

A number of OECD-member governments, including Canada, France, Netherlands, Australia, and Norway, have started the process by compiling accounts on natural resource stocks. France and Norway have made perhaps the most extensive official estimates. France emphasizes the development of physical accounts, while Norway stresses the integration of resource accounts for energy and other significant economic resources into macroeconomic models and budgets.

The U.S. government, however, discontinued research on natural resource accounting almost a decade ago. But the underlying data for calculating accounts for fossil fuels, hard minerals, timber, and subsoil water resources are readily available.

Estimates for depletion of soil resources, fisheries, and other natural assets could be constructed without much difficulty from currently available research findings and resource information. Were such estimates of the economic depreciation of natural assets combined with more careful estimates of depreciation of publicly and privately owned physical capital, then the much-discussed deficiency in net capital formation in the United States (relative to more rapidly growing industrialized countries) would be more pronounced.

Within the last few years, governments in developing countries, recognizing their natural resource dependence, have become interested in a more adequate accounting framework. The World Resources Institute is collaborating with government research institutes and statistical agencies in Indonesia, Costa Rica, and the People's Republic of China. Thailand, the Ivory Coast, and Argentina are also considering new programs in natural resource accounting.

Currently, most countries follow the system of national accounts (SNA) established by the United Nations Statistical Office, at least in regard to core accounts. The SNA actually includes national balance sheets that record natural resource stocks and their changes if these resources are privately owned and

used in the commercial production of goods and services so that economic values can be established. But these balance sheet changes are included in the SNA only in separate "reconciliation accounts" and are not directly used to compute national income or other economic statistics.

Besides according natural resources only peripheral treatment, the current system is plagued by many inconsistencies and omissions. For example, goods and services produced outside the enterprise sector—notably by households—are omitted, as is the value of the labor force's skills and expertise.

Revising the system

The U.N. Statistical Commission is considering revisions to the SNA. Final recommendations are not due until 1991, but a preliminary decision has been made to forgo fundamental changes in the existing system.

With respect to depreciation accounts for natural resources, the necessary revisions need not include fundamental changes. The United Nation's expert statistical committees are already encouraging countries to implement balance sheet accounts for reproducible and nonreproducible tangible assets and to link those to conventional national income measures through "satellite accounts," as indicated in the present system. Their position is that depletion accounts for natural resources should be calculated, but kept apart from the main tables.

In other words, the measure of depreciation in the national income accounts should not be extended to include natural resources, and the present misleading indicators of economic performance should be maintained. The pragmatic reason for this acquiescence is that until more national statistical offices have the time and resources to tabulate natural resource depreciation accounts, the core national income accounts should not be modified.

Nearly all countries calculate national income accounts, yet few have implemented the United Nation's recommendations with respect to ancillary tables in the SNA because with limited resources they have had to "stick to the basics." Similarly, despite their recognized deficiencies, politicians, journalists, and even sophisticated economists in official agencies continue to use GDP growth as the prime measure of economic performance.

The Indonesian country case study was implement-

ed partly to obtain firsthand information about the level of effort needed. The accounts presented in this respect were prepared almost entirely by predoctoral and master's level graduate students. Enough information to make reasonable estimates was found to be already available, so that compilation and reorganization of data were the main tasks.

In this pilot study, the researchers, working from the United States without the same experience and access to data that national statistical officers would have, required approximately 12 person-months to complete the job. This modest input generated estimates that shed substantial new light on Indonesia's growth performance over more than a decade.

There is ample time before the revisions to the SNA are announced for the U.N. Statistical Office to explore fully the implications of extending the concept of depreciation to natural resource assets. It should use this time to prepare for that change.

At the same time, key international economic institutions, such as the World Bank, other multilateral development banks, the IMF, and the OECD, should begin to compile, use, and publish revised estimates of net national product and national income to reflect the depreciation of natural assets. All of these institutions should ready themselves to provide technical assistance to the growing number of national statistical offices that wish to adopt these changes and make such estimates for themselves.

The importance of bringing estimates of natural resource depletion into the main national income accounts is further demonstrated by the severe economic crises faced by many developing countries over the past decade. Only when basic economic measures reflect a valid definition of income will economic policies be influenced toward sustainability.