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NATURAL CAPITAL, TOTAL WEALTH AND SUSTAINABLE DEVELOPMENT IN NAMIBIA

Glenn-Marie Lange

The Earth Institute of Columbia University, New York

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Department of Agricultural Economics, Faculty of Natural and Agricultural Sciences
University of Pretoria; PRETORIA 0002, Republic of South Africa

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ABSTRACT

A country's income and economic well-being depend on its wealth, where wealth is defined in the broadest sense to include produced, natural, human and social capital. Recognising this, international agencies have begun to shift their emphasis from economic development as GNP growth to economic development as a process of 'portfolio management' that seeks to optimize the management of each asset and the distribution of wealth among different kinds of assets. In resource-rich economies such as Namibia, building national wealth requires that natural capital be transformed into other forms of capital. However, there has been growing concern that economic growth, especially in resource-rich developing countries, has been achieved by liquidation of natural capital without adequate provision for replacement of these assets for future generations.

Several studies have attempted to measure total national wealth or changes in wealth, but have been seriously hampered by a lack of data, especially for natural and human capital. Using newly available accounts for natural capital in Namibia, total national wealth accounts are constructed and used to assess its development paths, comparing it to its neighbor, Botswana, for which total wealth are also available, albeit not for as long a time series. In Namibia's pre-independence period (before 1990), there was significant liquidation of capital, natural and produced. With new policies and a new investment environment since independence, Namibia has slowly started to rebuild its national wealth although per capita wealth has not recovered to the level of 1980.

1. Introduction

Theoretical work has demonstrated that sustainable development requires non-declining per capita wealth, where wealth is defined in the broadest sense to include produced, natural, and human (including social) capital (e.g., Arrow et al. 2003; Dasgupta and Mäler, 2000, 2001; Heal and Kristrom 2005; Kunte et al. 1998). This implies a shift in focus from economic development as GNP growth to economic development as a process of 'portfolio management' that seeks to optimize the management of each asset and the distribution of wealth among different kinds of assets (Alfsen and Graeker, 2006; Hamilton 2002; Dasgupta 2002; Maler, Aniyar and Jansson, 2007; Norwegian Ministry of Finance 2005; World Bank 2002, 2005). The particular challenge for resource-rich economies is to transform natural capital into other forms of productive wealth, a process that requires policies to promote efficient resource extraction that maximizes resource rent, and reinvestment of that rent.

Many resource-rich developing countries have not been successful in this transformation of natural capital. Indeed, as a group, their economic performance has lagged behind that of other developing countries, a phenomenon known as the 'resource curse' (Auty 1993; Brunnschweiler and Bulte, 2008; Gylfason 1999; Sachs and Warner 2001; Sala-I-Martin and Subramaniam 2003). Clearly, the ability to monitor total per capita wealth and analyze changes in this indicator is central to economic development. The challenge of this wealth-based approach to sustainable development is the lack of data, particularly for natural and human capital. There have been several attempts to measure total national wealth or changes in national wealth for a large number of countries, notably, Dasgupta (2001, 2002), Hamilton and Clemmens (1999) and the World Bank (2005). However, these estimations are applied over a large number of countries with often crude data and assumptions that may not accurately reflect economic values for natural capital in a given country. Most provide estimates only for a single year, giving no indication of the trend over time.

A few resource-rich developed countries have begun to implement natural capital accounts as part of their official statistics, mainly in their Balance Sheets[1], following the System of Environmental and Economic Accounting (SEEA) developed by the UN and other international agencies (United Nations et al., 2003). These include Australia, Canada, and Norway; several other countries have implemented natural capital accounts for selected

natural capital, mainly oil and natural gas, such as UK and the Netherlands. In the developing countries, total wealth accounts were constructed for Botswana and Namibia (Lange, 2004; Lange and Wright 2004; Lange et al. 2003) for the years 1980 to 2000 based on their most important, commercial natural resources: minerals and (in Namibia only) commercial fisheries.

This paper presents the updated and expanded accounts for Namibia, with an emphasis on performance since independence in 1990. Namibia's economy is highly dependent on its natural resources: minerals, fisheries, and agricultural land, which together account for roughly 30% of GDP, 85% of exports, and about 10% of government revenues (Central Bureau of Statistics, 2008). Prior to independence, Namibia's economy was based largely on rapid depletion of its natural capital, and this can be seen in the decline of all forms of capital and per capita GDP from 1980 to 1990 (Lange, 2004). Natural resources were exploited without any regard for building the national economy; fishing was carried out in an open-access environment, and minerals were exploited with little reinvestment of rents in the domestic economy. But since independence, natural resource management has changed and there have been signs of turning around. In recent years, Namibia has benefited from the global commodities boom, especially the growth of nuclear power; Namibia is a major source of the world's supply of uranium. This paper now looks at a longer time series to assess the post-independence trend toward sustainability of economic growth in Namibia.[2]

The organization of the paper is as follows. The next section discusses the general methodology and data used for the estimation of total wealth. Appendices provide more detailed information for minerals and fisheries. Section 3 presents the accounts for natural capital. Section 4 presents the wealth accounts and analyses Namibia's economic sustainability over the post-independence period and the success of the government in turning around the previous trend of unsustainable development based on depletion of natural capital. These are compared to the performance of the Botswana economy over the same time period. Concluding remarks are provided in the final section.

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[1] Norway also includes related indicators for 1)GDP by income including resource rent from a) renewable and b)non-renewable resources and 2) depletion adjusted NDP and in the national income accounts

[2] However, the value of human capital is still not included because there is no agreement about how to measure it. The potential bias in the measure of national wealth that results from the omission of human capital and the impact of HIV/AIDS, which is an especially important factor in development in many Southern African countries, is discussed in the concluding section.

2. Methodology and data sources

2.1 Wealth and sustainability

A commonly accepted definition of sustainable economic development is a time path where per capita well-being does not decline at any point (Pezzey 1992). Solow (1974, 1986) and Hartwick (1977) derived the conditions necessary for economic sustainability in an economy dependent on a non-renewable resource, which came to be known as the Solow-Hartwick rule. The rule requires non-declining total wealth, which is achieved by reinvesting some portion of the rents from the non-renewable resource in other forms of capital (assuming, among other things, that resources are priced efficiently). The relationship between sustainable well-being and non-declining wealth was further developed by, among others Mäler (1991), Pearce and Atkinson (1993), Dasgupta (2001), Dasgupta and Mäler (2000, 2001) and Hamilton and Clemmens (1999).

The theoretical literature has defined wealth as consisting of produced capital, natural capital and human (including social) capital. Drawing on Hamilton and Clemmens, a highly simplified version of this formalization defines a closed economy producing a composite good that can be consumed or invested in either produced capital or human capital, $F(S_P, Q, S_H) = C + \Delta S_P + m$, where S_i are stocks of produced (S_P), natural (S_N) and human capital (S_H); Q is use of a non-renewable resource; C is consumption; ΔS_P is investment in produced capital; and m is investment in human capital. The change in the stock of human capital is a function of investment, $\Delta S_H = q(m)$, and the depletion of natural capital is equal to extraction, $\Delta S_N = -Q$. Well-being, V, at time t is then defined as the discounted sum of all future utility, $V_t = \sum_{\tau=t}^{\infty} \frac{U(C_t)}{(1+r)^{\tau-t}}$. For this economy, a change in well-being is proportional to the change in the value of assets:

$$\Delta V_t = U_{t,c} \cdot \sum p_{t,i} \Delta S_{t,i} \qquad (1)$$

where U_c is the marginal utility of consumption, p_i are the shadow or accounting prices of produced (p_P), natural (p_N) and human capital (p_H).[3] It is relatively straightforward to

[3] The accounting price is the social worth of a good, which is not always reflected by its market price; indeed, some goods, notably environmental goods, do not have market prices at all. Thus, implementation of this index of sustainability requires estimation of accounting prices for at least some forms of capital, a subject taken up in the next section.

expand this model for renewable resources, pollution and environmental degradation, as well as for other specifications of the utility functions, including for example utility derived from environmental quality (Dasgupta 2001; Dasgupta and Mäler 2000). Dasgupta (2001) also considered various ways in which demographic change could be incorporated into the index of sustainable development; much depends on the extent to which well-being, *V*, is a function of population size, *P*. The simplest rule derived by Dasgupta is that "*…social well-being increases if and only if wealth per head accumulates*" (Dasgupta 2001, p. 258)[4]. In the format of equation 1, this rule for sustainability can be expressed as:

$$(2) \qquad k_{t+1} \geq k_t$$

where *k* is the value of per capita (*K/P*) total wealth, the sum of the products of the per capita stocks of assets (*S/P*) and their shadow prices $k_t = \sum k_{t,i} = \sum p_{t,i} s_{t,i}$. To implement this indicator of sustainability for open economies, such as Botswana and Namibia, the concept of wealth must take into account claims on foreign stocks of capital, which are represented by net holdings of foreign financial assets.[5] Total per capita wealth, *k*, is thus defined to include $k_{t,f}$, net foreign financial assets as well as produced, natural, and human capital,

$$(3) \qquad k_t = \sum (k_{t,P} + k_{t,N} + k_{t,H} + k_{t,F})$$

In using equations 2 and 3 to monitor sustainability over time, it is essential that all assets be included. Human capital is not readily measurable at this time; however, measures for the other three components of wealth can be estimated. The following modification of equation 3 is implemented for Botswana and Namibia:

[4] The most simple form is used because there is insufficient information at this time to estimate how well-being changes with population size. Population growth can, for example, have negative impacts due to increased congestion. Of greater concern in Southern Africa is the potential impact of population decline or the skewed age distribution due to HIV/AIDS. The impact of HIV/AIDS on human capital and productivity is directly accounted for by the stocks of human capital; the additional impact on well-being is not known at this time.

[5] Claims on domestic and foreign assets are not explicitly differentiated in theoretical models, but empirical work on wealth has recognized that net foreign financial assets are an important component of wealth for open economies. Further theoretical work might make this distinction explicit in order to examine the impact of international trade and finance on the wealth and sustainability of open economies.

(4) $$k_t = \sum (k_{t,P} + k_{t,N} + k_{t,F})$$

Methods and data sources for each component of national wealth are described in the next two sections.

2.2 Measuring national wealth

Implementation of equation 4 requires information about produced capital, natural capital, net foreign financial assets and population. For produced capital and net foreign financial assets, data are readily available and observed market prices can be taken as reasonable approximations of their accounting prices. For natural capital, market prices of the assets *in situ* are usually not available. Accounting prices can be reasonably derived for the major natural resources using methods developed for the SEEA, which are described in this section. Prices cannot be estimated for all natural capital at this time, an issue taken up in section 2.3; the report addresses the most economically important forms of natural capital: minerals and fisheries.

Produced capital

The stock of produced capital includes all manufactured structures and equipment. The standard method for measuring produced capital, which has been recommended by the System of National Accounts 1993 (UN et al., 1993) and implemented by most statistical offices around the world, is the perpetual inventory method (PIM). PIM at any given time is simply cumulative gross investment in fixed capital minus depreciation of existing stock. Depreciation is based on an assessment of the lifetime of fixed capital in each industry and capital stock is revalued each year so that it represents replacement value rather than historical value. Namibia's Central Bureau of Statistics provides estimates of manufactured capital stock based on the PIM in its annual national accounts.

Foreign financial capital

Foreign financial assets represent claims by domestic agents—government agencies, enterprises and private individuals—on assets held in foreign countries. For small countries with relatively limited opportunities for profitable domestic investment, these assets can represent an important alternative investment of resource rents. In most countries, the foreign assets of government agencies and enterprises are reported regularly to the central bank.

Information about these assets was obtained for Namibia from (Bank of Namibia 1995, 2007; IMF 2007). For Namibia, it was only possible to construct accounts from 1989 onward; no information was available for the period before independence. Until 1990, Namibia was administered by South Africa and its finances were largely intertwined with those of South Africa. For several years after independence there were disputes with South Africa about Namibia's financial obligations, which were eventually settled by negotiation (World Bank 1995). The lack of data prior to 1989 is not a serious omission because, as we will see, the volume of Namibia's net foreign financial assets is quite small relative to other forms of wealth.

Information about holdings of foreign assets by individuals is not regularly reported in most countries and is often obtained only through special surveys. There is no published information for Namibia. Because of its colonial past and a relatively well-off minority population with ties to other countries, it is not unlikely that some of Namibia's private citizens have substantial holdings of foreign assets but there is no way to estimate these holdings.

Natural capital—physical accounts

The major natural resources for Namibia include minerals, marine fisheries, water, and land that provides ecosystem services supporting both a strong agricultural sector as well as an important nature-based tourism industry. Annual accounts are only available for minerals and fisheries at this time. Experimental, one-time accounts were constructed for wildlife and forests, but no further information is available at this time. This section describes the approach for mineral and fisheries accounts. More detailed information can be found in (Lange et al. 2003; Lange 2003a; 2003b, 2003c; 2004).

Namibia mines a wide range of minerals, but a few minerals account for virtually all of the economic value: diamonds, gold and uranium. The increase in global commodity prices in the last few years resulted in reopening of some old mines and establishment of some new mines, particularly for copper and zinc. But with deteriorating economic conditions at the end of 2008, many of these mines are struggling and some have already closed.

The mineral accounts include the most important minerals: diamonds, uranium and gold, which provide more than 95% of mining GDP. There is not sufficient information about

other minerals at this time to include them in the accounts. Diamonds are by far the most important mineral, accounting for roughly 85% of mining GDP. Information about extraction of minerals is published in the annual reports of the Ministry of Mines and Energy and the Namibian Chamber of Mines. Information about reserves is more difficult to obtain because many companies treat this as confidential information. Information about reserves was obtained from a combination of public and private sources. The main source was a survey of the companies that mine Namibia's three major minerals. This was supplemented by information from annual reports published by the mining companies and, in the case of uranium, from an international trade organization, the World Nuclear Association.

For diamond reserves, the information obtained from companies remains confidential and cannot be reported here, except for a couple of years, 1999-2000, in which DeBeers reported reserves in its Annual Reports. De Beers has since stopped publication of reserves. Data about uranium reserves were obtained for 2005 from the World Nuclear Association website (www.world-nuclear.com); stocks for earlier years were estimated by adding back annual extraction. This method assumes no new discoveries or redefinition of assets over the previous 25 years. This does not give a realistic picture of the severe economic fluctuations faced by uranium mining companies because companies have revised estimates of proven and probable reserves in response to changes in market prospects over time. However, it does give a reasonable time trend for the asset. Data for gold mining was obtained from the mining company, Navachab. Information is also publicly available from the annual report of its parent company, AngloGold. Where the estimated reserves differed, we use the publicly reported data.

Namibia's fisheries accounts include the three commercially most important fisheries: hake (*Merluccius capensis* and *Merluccius paradoxus)*, horse mackerel (*Trachurus capensis*) and pilchard (*Sardinops ocellatus*), which account for more than 80% of the value of fish production. There are several other smaller but important fisheries, which in recent years have come under similar controls (TAC established for the fishery and quota fees levied to recover resource rent): crab, lobster, orange roughy and monk fish. Fisheries only became part of Namibia's national wealth at independence from South Africa in 1990. Prior to that time, Namibia was unable to exert control over its 200-mile Exclusive Economic Zone, which contained the most lucrative fisheries, because no country would recognize South Africa's jurisdiction over the area. Namibia's fisheries were exploited, largely by foreign

operators, under virtually an open-access regime, a practice that severely depleted the fish stocks and was halted after 1990. There is little reliable information about fisheries stocks prior to 1990 but since 1990 Namibia's Ministry of Fisheries and Marine Resources has provided information about fish stocks and annual catch.

Natural capital-- monetary accounts

Asset valuation is ideally based on market prices, but there are no markets for minerals and fisheries resources in Namibia. In an optimizing economy, the price of an asset would be equal to the present value of the stream of net income an asset is expected to earn over its lifetime. Where market prices for assets are missing, the SEEA recommends estimating the present value of the future stream of income (resource rent) directly, a method that involves two steps: (i) calculating resource rent in a given year and (ii) calculating the likely future stream of rent over the lifetime of the resource.

The resource rent, p_j, represents the accounting price of natural resource j and is calculated as the residual between product price (unit revenue), v_j, and the unit marginal production costs, mc_j:

$$p_{t,j} = v_{t,j} - mc_{t,j} \tag{5}$$

where production costs include intermediate consumption, labor costs, and the costs of fixed capital (depreciation and the opportunity cost of capital). Having calculated the value of rent in a given year, the asset value is the sum of rent generated each year over the remaining lifespan of the resource, T :

$$K_{t,j} = \sum_{\tau=t}^{T} \frac{p_{t,j} Q_{t,j}}{(1+r)^t} \tag{6}$$

$$T = \frac{S_{t,j}}{Q_{t,j}} \tag{7}$$

where variables are defined as above and in section 2.1.

For renewable biological resources like fisheries or forests, the net present value approach to asset valuation may take a slightly different form. If the resource is being 'mined,' that is, harvested at an unsustainable rate, then the lifespan of the resource is finite and the asset value is determined using equations 6 and 7. However, resources managed sustainably have

an infinite lifespan and, assuming constant unit rent, equation 6 collapses into the following form, where the asset value of resource *j* is simply the total resource rent, *pQ*, divided by the discount rate:

$$(8) \qquad K_{t,j} = \frac{p_{t,j} Q_{t,j}}{r}$$

Implementation of these relatively simple models of asset valuation poses a number of challenges. Regarding the calculation of resource rent, data about marginal costs are not generally available so average cost is commonly used, which may introduce an upward bias into the measure of rent and asset value. In Namibia, national statistical offices provided unpublished economic data from the annual mining company surveys that are used to compile the national accounts. These surveys provide reasonably accurate information for the calculation of accounting prices for minerals. For fisheries, the statistical office provides data about each of the major fisheries based in part on observed data (for fish catch, fish prices, fuel costs) and partly on a model of fishing costs for each fishery. This model is being revised on the basis of a recently introduced annual survey of fishing companies, which should improve estimates in future. Approximately, 50 companies exploit the three major fisheries. The data are less accurate for fisheries than for minerals, but probably provide a reasonable picture of fisheries value over the long term.

From these data, a modified version of equation 5 was used, based on total rather than unit revenue and costs: total rent, *R*, was calculated for each resource, *j*, as gross revenue, *GR*, minus total production costs: intermediate consumption, *IC*, compensation of employees. *CE*, consumption of fixed capital, *CFC*, and 'normal profit,' *NP*, the opportunity cost of produced capital invested in resource exploitation:

$$(8) \qquad R_{t,j} = GR_{t,j} - IC_{t,j} - CE_{t,j} - CFC_{t,j} - NP_{t,j}$$

Normal profit is the rate of return (*i*) to produced capital used for production of resource *j*:

$$(9) \qquad NP_{t,j} = iK^{j}_{t,P}$$

From equation 8, the unit rent is calculated as total rent divided by the quantity of resource extracted or harvested $p_{t,j} = \frac{R_{t,j}}{Q_{t,j}}$

All figures except normal profit are obtained from observed data. For minerals, normal profit for mining was calculated with a 10% rate of return on fixed capital in line with guidelines of government planning agencies. For fisheries, a 20% return was recommended by the Ministry of Fisheries and Marine Resources to reflect the higher degree of risk in that industry.[6]

These prices can then be implemented in equation 6 to obtain asset value. Asset valuation should be based on expected future extraction paths, production costs, and market prices. However, in many instances this information is lacking so the SEEA recommends an assumption that both the future volume of extraction and the per unit rent remain constant over time. This assumption is not unreasonable for fully established mines that expect to operate for the estimated lifespan; under these circumstances, mining companies themselves often assume a constant level of extraction for long-term planning. However, in the current climate of high global demand for commodities and rising prices, it is likely that companies are changing their extraction paths. In some instances, annual reports of mining companies or from the Ministry of Mines and Energy provide information abut a company's plans in a given year, and, where available, these are incorporated in asset valuation.

Compilation of fisheries asset accounts presents greater challenges than other resources because of a combination of characteristics unique to fisheries: fish stocks cannot be directly observed, some fish species are highly mobile and may migrate out of territorial waters, fisheries are affected by complex predator-prey interactions, and stocks are often subject to large, unpredictable, inter-annual variations. The present value of each fish stock depends on future fish prices, fishing technology and costs of production, and fish stock levels and exploitation.

[6] In more detailed reports (Lange et al. 2003), a sensitivity analysis for the return to capital was performed.

As with minerals, in the absence of alternative information, common practice has been to assume that the current year's prices, technology, and production costs remain constant in the future. There is a high degree of uncertainty about future stock levels because the dynamics of many fish populations and of large marine ecosystems like Namibia's Benguela Ecosystem are poorly understood. While Namibia's Ministry of Fisheries has set a goal of restoring fish stock to the high levels seen decades again, only hake has seen some improvement over the past decade; other fisheries have remained more or less the same, subject to considerable inter-annual fluctuations.[7] For the purpose of asset valuation, a conservative approach was taken that assumes fish stocks have stabilized at current levels and will generate the same rent in the future. This is not an entirely satisfactory assumption, but it is used for lack of any other information at this time.

2.3 Missing assets: ecosystem accounts

Non-urban land provides a wide range of ecosystem services as described in the Millennium Ecosystem Assessment. The major use values from Namibia's terrestrial ecosystems which can be readily measured include agriculture, tourism and biodiversity conservation. In developed countries, where most land is privately owned, land value is measured based on market transactions. However, in Namibia no market prices exist for the very large portions of the land where sales or long term leasing is not allowed: 41% held under traditional tenure and 15% state-owned land, mostly for national parks and protected areas. Only 44% of land, is privately held and it is not taxed so there is no assessed value that can be used for constructing monetary land asset accounts.[8] There is an active market in private farmland, but prices in recent years have been driven in part by speculation and uncertainty regarding future land reform policy, making them less useful for assessing the social value of land. Purely agricultural use has been replaced in many areas by mixed agro-tourism operations, but there is no national estimate of the value of land under this new use at this time.

Namibia has large areas of non-agricultural land set aside for biodiversity conservation that provide subsistence benefits to local communities, international tourism, and provide significant global non-use values. Studies in many countries indicate that tourism generates the largest single value from these ecosystems. In 2004, Barnes et al. (2004) estimated asset

[7] See Lange 2003b for more detailed discussion of how fish stocks are estimated, confidence intervals for stock estimates and sensitivity analysis of assumptions used in calculating asset value.
[8] A commercial land tax has been introduced and may provide information for land valuation in future accounts.

value of wildlife for tourism and subsistence uses in all regions and all systems of land tenure (private, government, traditional), which provides a rough proxy for the tourism and subsistence value of terrestrial ecosystems.[9] A later report on the value of Namibia's protected areas provided similar values, supporting these estimates (Turpie et al. 2004). Although there are no comprehensive figures on tourism values in Namibia over time, the number of tourists has risen substantially since independence in 1990, growing at 10% or more annually. It is likely that the value of these natural areas has grown a great deal, at least keeping pace with population growth. The impact of missing natural capital on the measure of wealth and sustainability will be discussed further in the conclusions.

3. Natural capital in Namibia

This section reviews the level and composition of wealth in Namibia over the past 20 years to determine whether the economy, largely dependent on natural capital, has been managed in a manner that promotes sustainability, i.e., whether per capita wealth is non-decreasing, and whether depletion of natural capital is compensated for by an increase in other forms of wealth. Discussion begins with a review of the physical and monetary accounts for natural capital.

3.1 Physical accounts for natural capital, 1980 to 2005

The volume of annual extraction and reserves of minerals is shown in Table 1 for the three major minerals. Gold mining began only in 1993. Reserves of minerals can be shown only for two years due to confidentiality issues mentioned earlier. The table shows considerable fluctuation of annual extraction.

[9] The wildlife accounts are being updated but were not available at the time this report was written.

Table 1. Reserves and extraction of major minerals in Namibia, 1980 to 2005

	Extraction			Reserves		
	Diamonds	Uranium	Gold	Diamonds	Uranium	Gold
	million carats	thousand tons of U308 metal	Tons	million carats	thousand tons of U308 metal	tons
1980	1.3	5.5		Confidential Data	131	na
1981	1.0	5.3			126	na
1982	0.8	5.1			121	na
1983	0.8	5.2			116	na
1984	0.7	4.9			111	na
1985	0.6	4.4			106	na
1986	1.0	4.6			102	na
1987	0.8	4.8			97	na
1988	0.9	4.9			92	na
1989	0.8	4.2			88	na
1990	0.6	4.3			84	na
1991	0.8	3.3			80	na
1992	0.9	2.3			78	na
1993	0.6	2.3	2.0		76	17
1994	0.7	2.6	2.3		73	16
1995	0.6	2.9	2.0		70	16
1996	0.7	3.5	2.1		67	15
1997	0.8	4.1	2.5		63	12
1998	1.5	3.3	1.9		59	10
1999	1.6	3.2	2.0	7.0	56	11
2000	1.5	3.2	2.4	16.2	53	10
2001	1.4	2.6	2.9	Confidential Data	50	8
2002	2.6	2.8	2.7		48	20
2003	2.9	2.4	2.3		45	17
2004	3.7	3.6	2.1		42	15
2005	3.6	3.7	2.5		38	17

'-' indicates mineral was not mined in that year.
Source: Extraction: Lange (2003a), Ministry of Mines and Energy (annual); Namibia Chamber of Mines (annual), USGS (annual),
Reserves: Various sources and methods described in the text and for diamonds: DeBeers (1999,2000); for uranium: World Nuclear Association (2005); for gold: AngloGold (2006, 2005, 2004)

There are no confidentiality constraints on information about fisheries so the entire account can be shown for each of the three major fisheries, including opening and closing stocks, annual catch and other volume changes. As mentioned earlier, reliable information about catch and stocks have only been available since Namibian independence in 1990.

Table 2. Fisheries accounts: Stock and catch for hake, horse mackerel and pilchards, 1990-2005 (Fishable biomass in thousands of tons)

A. Hake

	Opening stock	Catch	Other volume changes	Closing stock
1990	136	55	199	281
1991	281	56	249	474
1992	474	87	135	522
1993	522	108	-39	375
1994	375	112	73	335
1995	335	130	161	366
1996	366	129	75	312
1997	312	110	461	663
1998	663	141	-100	422
1999	422	161	51	312
2000	312	160	86	238
2001	238	173	54	119
2002	119	155	219	184
2003	184	189	243	237
2004	237	174	217	280
2005	280	158	60	182

B. Horse mackerel

	Opening stock	Catch	Other volume changes	Closing stock
1990	1450	409	309	1350
1991	1350	434	1184	2100
1992	2100	426	126	1800
1993	1800	479	179	1500
1994	1500	360	260	1400
1995	1400	314	114	1200
1996	1200	319	119	1000
1997	1000	306	1106	1800
1998	1800	258	266	1808
1999	1808	288	-46	1474
2000	1474	320	96	1250
2001	861	315	257	803
2002	803	359	615	1059
2003	1059	367	683	1375
2004	1375	315	579	1639
2005	1639	325	Na	Na

C. Pilchard (sardines)

	Opening stock	Catch	Other volume changes	Closing stock
1990	500	89	249	660
1991	660	68	49	641
1992	641	82	-128	431
1993	431	116	-100	215
1994	215	115	25	125
1995	125	95	-25	5

1996	5	2	147	150
1997	150	32	182	300
1998	300	65	40	275
1999	275	42	-8	225
2000	225	27	-107	92
2001	92	11	-81	0
2002	0	4	558	554
2003	554	22	-137	395
2004	395	29	-318	49
2005	49	27	na	Na

Source: Lange (2003b) and unpublished data from the Ministry of Fisheries and Marine Resources

3.2 Resource rent and taxes

The amount of resource rent generated and the amount recovered through taxes is shown in table 3. The mining sector has generated substantial amounts of resource rent, mostly from diamonds. In all years, diamond rent is positive and a large component of total mining rent. In some years diamond rent even surpasses total rent. This occurs in years when rents for other minerals (not reported here) are negative, i.e., mining companies do not earn enough to cover their full capital costs including a normal profit.

Pilchard generated the most rent at the beginning of Namibian independence, but was eventually surpassed by hake. This is not surprising since Namibia already had an established pilchard fishery prior to independence and only achieved control over the other fisheries over the past decade. Pilchard has shown the greatest volatility of rent over the decade. Rent became nearly zero in 1996 when virtually no pilchard was caught that year. It has not recovered well since that time.

The rent per ton for hake has been steadily rising, reflecting both improvements in the industry and also the devaluation of the Namibian dollar over time, which has a major impact on earnings because most Namibian hake is sold to the lucrative European market. Horse mackerel, though harvested in higher volumes than either of the others, generates the least rent.

Like many countries, Namibia levies a number taxes and fees on its mineral and fisheries industries. Some of these are ordinary corporate profit taxes, but others are designed specifically to capture the resource rents. Table 3 includes only those taxes that target resource rent.

Table 3. Resource rent and taxes on rent from minerals and fisheries in Namibia, 1980 to 2005(millions of Namibia $)

	Minerals		Taxes on mineral rent	Fisheries					Taxes on fisheries rent
	All mining	Diamonds		Pilchard	Hake	Horse Mackerel	Other	Total	
1980	355	281	66						
1981	179	93	30						
1982	189	57	30						
1983	157	86	33						
1984	190	66	38						
1985	482	159	57						
1986	538	199	94						
1987	395	201	83						
1988	579	414	92						
1989	769	466	121						
1990	380	241	83	117	27	9	na	153	-
1991	364	370	99	65	30	30	na	125	-
1992	355	343	135	135	36	20	na	192	-
1993	151	150	180	112	106	40	12	270	98
1994	462	400	174	115	162	46	21	345	118
1995	279	237	144	76	163	41	38	318	100
1996	759	595	178	0	96	51	20	167	57
1997	761	590	371	14	146	45	34	241	89
1998	801	655	265	67	299	71	62	499	91
1999	889	935	305	32	294	75	43	444	91
2000	1,343	1,093	379	29	390	84	40	542	91
2001	2,284	1,941	521	19	406	161	66	652	109
2002	3,073	2,460	812	58	564	183	94	898	129
2003	1,326	1,428	498	71	656	130	71	927	147
2004	1,642	1,693	462	56	473	73	53	654	119
2005	1,441	1,305	481	13	320	106	42	482	70

Notes: Rent is calculated for minerals assuming a 10% rate of return on fixed capital and for fisheries a 20% rate of return.
Taxes on fisheries reported here include quota levies that are designed to recover resource rent, but not other forms of taxes. It is not possible to determine the amount of taxes collected from each fishery.
Source: Author's calculation of rent; quota levies obtained from CBS (2007)

Rent recovery in the mining sector

In the mining sector, government has recovered an average of 30% of the rent generated by all mining activities, but rent recovery has varied enormously from year to year (Figure 1). Rent recovery improved significantly after independence, from an average of 17% before 1990 to 39% after 1990. In the past, taxes designed to recover rent were only levied on diamond mining; taxes paid by other mining operations fall within the range of normal corporate taxes on income. However, in the past few years, the government has introduced a tax on other minerals, 2-3% depending on the type of mineral.

Whether this degree of rent recovery is sufficient is difficult to determine. When rent is so volatile, it is not feasible to attempt full rent recovery, and government must be careful not to set taxes so high as to discourage investment. By comparison, the government of Botswana has recovered a greater share of resource rent, averaging 76% over the period 1980 to 1997 (Lange, 2004; Lange and Wright, 2004). However, diamond rent has been much more stable in Botswana over the past two decades, which makes it much easier to establish appropriate tax regimes.

Rent recovery in the fishing sector

Substantial amounts of resource rent are generated by the Namibian fishing industry. The government established a system of quota levies in order to help achieve its objectives of sustainable and equitable management of the industry. While full recovery of rent is not practicable because the significant year-to-year fluctuations in rent, recovery of a significant portion of the expected long-term rent is important for several reasons:

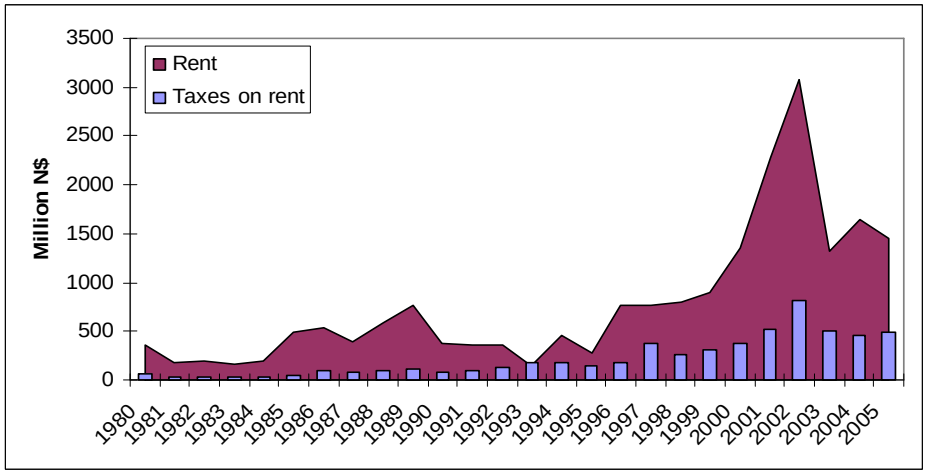
1. recovery of rent contributes to the *sustainable management* of fisheries by removing the economic incentives for overfishing and depletion of the resource.
2. set at the appropriate level, levies create incentives for the most *economically efficient* (most profitable) level of fishing, based on both biological and economic criteria
3. recovery of rent promotes *equity* by recovering excess profits obtained from a national asset which can be used for development that benefits all Namibians, not just the few involved in the fishing industry (see (Lange, 2003) for further discussion of these issues).

In the first few years after independence, no quota fees were levied as the Ministry established the new policy regime for fisheries management. Quota levies, recovered a

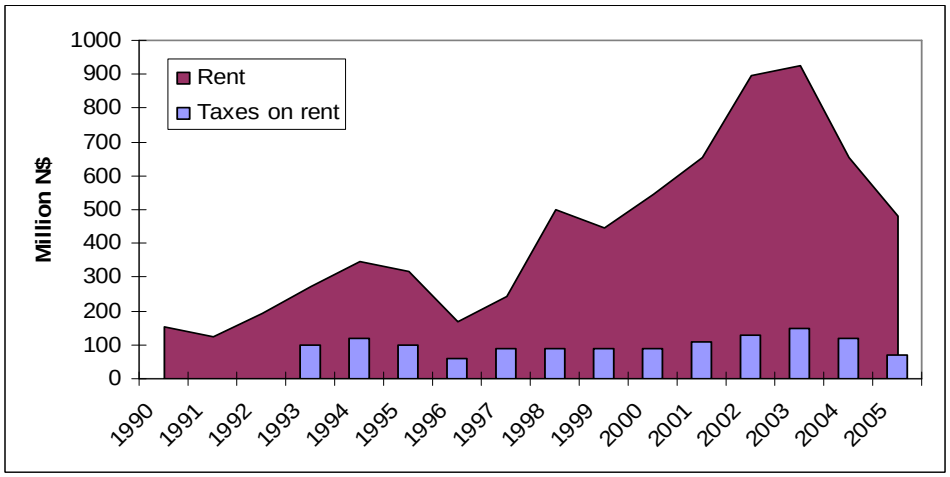
significant amount of rent when first introduced, but the share of rent recovered has since fallen to less than 20%. The, probably unintended, declining recovery of rent has two sources: first, an increasing share of Namibian-owned companies, which are eligible for up to 50% subsidies on their quota levies; secondly, the failure to index quota levies to inflation, a common problem faced by governments who find it politically difficult to adjust taxes for inflation. While quota levies have been increased in recent years, the increase has not kept up with inflation.

Figure 1. Rent recovery from mining and fisheries in Namibia, 1980 to 2005

A. Mining



B. Fisheries



Source: Table 3.

3.3 Monetary accounts for natural capital

In current prices, natural capital increased between 1980 and 2005 (from N$2,352 million to N$14,946 million) but when the asset values are adjusted for inflation, the depletion of

natural capital becomes clear (Table 4). In constant 1995 prices, the value of Namibia's natural capital fell by 36% from N$11,330 million in 1980 to N$7,179 million in 2005. The loss of asset value is almost entirely due to depletion of minerals. The value of fisheries, which only became part of Namibia's national wealth in 1990, has remained roughly constant, albeit fluctuating considerably over the 15 year period.

By dividing the time series into two parts, pre- and post-independence, a better assessment can be made of the performance of the economy under new, Namibian management. In constant prices, Namibia's natural capital increased at independence (from N$6,188 million in 1989 to N$7,612 million in 1990), as fisheries became part of the national wealth. But the decline in total natural capital soon continued due to the continued decline in mineral assets and volatility of fish asset value.

Physical depletion of all minerals compounded by declining real rents for diamonds and uranium caused mineral assets to lose more than half their value in the first 5 years after independence. The decline in real rent is not surprising. The global market for uranium was not good at that time. Diamonds, the most valuable mineral, have been mined since the beginning of the 20th century. Initially, the reserves consisted of relatively high quality gem and near-gem stones, which could be mined relatively cheaply. But by independence at the end of the 1980's Namibia had largely exhausted its most profitable diamond reserves and moved to more costly offshore diamond mining. It took some years before the new investments in offshore mining began to pay off; diamond assets only started to increase in value from 1998.

Table 4. Value of natural capital in Namibia, 1980 to 2005
(million N$ in current and constant 1995 prices)

	Current Prices			Constant 1995 Prices		
	Minerals	Fish	Total natural capital	Minerals	Fish	Total natural capital
Pre-Independence						
1980	2,352	-	2,352	11,330	-	11,330
1981	1,778	-	1,778	8,481	-	8,481
1982	1,624	-	1,624	6,737	-	6,737
1983	1,534	-	1,534	5,793	-	5,793
1984	1,451	-	1,451	4,908	-	4,908
1985	1,923	-	1,923	5,181	-	5,181
1986	2,695	-	2,695	6,583	-	6,583
1987	3,036	-	3,036	6,806	-	6,806
1988	3,567	-	3,567	6,565	-	6,565
1989	3,883	-	3,883	6,188	-	6,188
Post-Independence						
1990	3,475	1,526	5,001	5,289	2,323	7,612
1991	3,212	1,250	4,463	4,670	1,818	6,487
1992	2,878	1,916	4,795	3,820	2,543	6,362
1993	2,136	2,699	4,835	2,611	3,300	5,911
1994	1,888	3,449	5,337	1,996	3,645	5,641
1995	1,709	3,181	4,889	1,709	3,181	4,889
1996	2,397	1,672	4,069	2,094	1,460	3,554
1997	3,060	2,407	5,467	2,496	1,963	4,459
1998	4,034	4,995	9,029	3,031	3,753	6,784
1999	4,575	4,440	9,015	3,226	3,131	6,357
2000	7,952	5,423	13,375	5,039	3,437	8,476
2001	9,113	6,516	15,629	5,088	3,638	8,726
2002	13,249	8,982	22,231	6,641	4,502	11,143
2003	13,298	9,269	22,567	6,706	4,674	11,380
2004	13,515	6,544	20,058	6,740	3,264	10,004
2005	10,131	4,816	14,946	4,866	2,313	7,179

'-' indicates a zero value
Source: Based on (Lange, 2003a; 2003b) and recent updates by the author using data and methods described in the text.

Although fish provide a bright spot in the Namibian economy, the asset value has fluctuated rather wildly over the past decade due to unpredictable environmental events that affect fish stocks. Despite government's goal to restore fisheries to high levels of stocks last seen in the 1960's, there has been little or no stock growth in the years since independence. At such a depleted level, Namibia's fisheries are less easy to manage and even more vulnerable to shocks and overexploitation. Although data are not available for the last few years yet, it is

likely that asset values, particularly for minerals, have increased in response to the global commodity boom.

4. Total national wealth in Namibia

The previous section has shown that the value of Namibia's natural capital has decreased over the past two decades, largely the result of the depletion of mineral assets and failure to restore fisheries to levels seen several decades ago. But depletion of natural capital is not necessarily bad for the economy, if the rents from natural capital are used to build wealth in the form of other assets. An assessment of total wealth—produced capital, natural capital, and foreign financial assets—will show whether depletion of natural capital has contributed to building national wealth (Table 5).

During the pre-independence period, Namibia's total, real wealth declined by more than 10%, and per capita wealth fell by one-third. Total natural capital (minerals) fell by 45%, but the depletion of minerals was not offset by investment in produced capital: private capital actually fell slightly over the decade while public infrastructure increased, but only slightly and net foreign financial assets were negative at the end of the decade. This is not surprising since the decade prior to independence was marked by civil conflict and extreme political uncertainty, factors that encourage rapid extraction of resources, discourage investment and drain resources from productive activities. There was no policy of reinvestment of rents from non-renewable resources and economic incentives favoured very rapid extraction that were being depleted.

Trends in the years after 1990 are particularly important because independence provided an opportunity for new resource management and development policies. Real wealth in 1990 was N$31,578 per person and wealth continued to decline until 1996, when it reached N$27,244 per person, its lowest point in 20 years. This situation is probably not surprising, as there were many uncertainties at the time of independence that would discourage private investment. Around 1997, this picture began to improve, and by 2001 total per capita wealth had recovered to the level achieved at independence. Since them wealth has fluctuated, largely due to fluctuations in natural capital. Although the amount of capital available for each Namibian to work with is still less in 2005 than it was in 1980, it is particularly encouraging to note that private sector capital is the fastest growing component in the post-independence period, growing an average rate of 6% per year.

5. National wealth and well being in Namibia and Botswana

Economic well-being depends on wealth. Therefore, one would expect trends in indicators of well-being to reflect trends in per capita wealth. National income, despite its widely acknowledged weaknesses, is the most commonly used indicator of well-being. Figure 3 compares Namibia with Botswana, a neighboring country with many similarities in terms of size, population and role of natural capital in the economy. Botswana is often cited as a model for other countries for its good management of its natural capital and macroeconomy. Figure 2 provides an index of growth of real per capita wealth and real per capita GDP for Namibia and Botswana from 1980 to 2000. See Lange and Wright, (2004), Lange et al., (2003), and Lange (2004) for a detailed discussion of Botswana's national wealth.

Table 5. National wealth of Namibia, 1980 to 2005

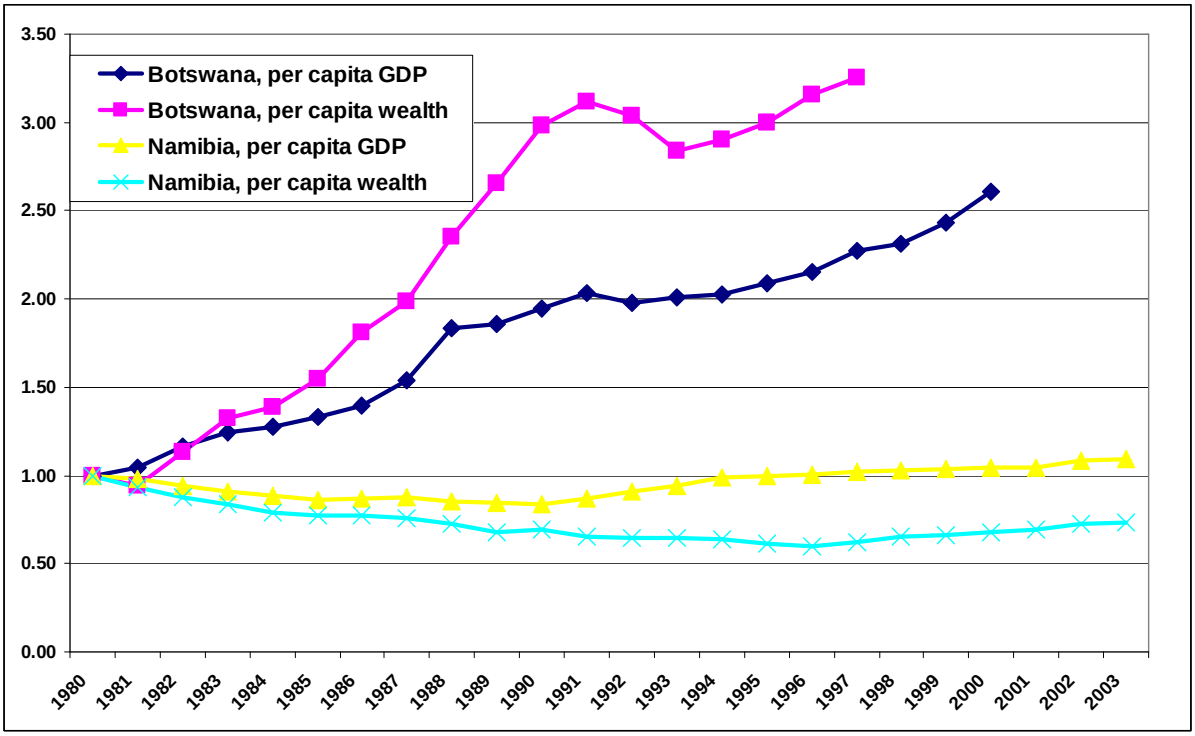
(Millions of N$ in constant 1995 prices; percapita figures in N$)

	Produced Capital					
	Private	Public	Natural Capital	Net Foreign Financial Assets	Total	Per capita wealth
Pre-Independence						
1980	19,132	15,305	11,330	NA	45,766	45,616
1981	19,285	16,039	8,481	NA	43,805	42,398
1982	19,391	16,651	6,737	NA	42,778	40,159
1983	19,061	17,009	5,793	NA	41,863	38,118
1984	18,749	17,257	4,908	NA	40,914	36,134
1985	18,403	17,563	5,181	NA	41,146	35,246
1986	18,308	17,753	6,583	NA	42,643	35,430
1987	17,974	17,929	6,806	NA	42,709	34,418
1988	17,807	18,074	6,565	NA	42,446	33,177
1989	17,955	18,128	6,188	-1,426	40,845	30,966
Post-Independence						
1990	18,176	18,282	7,612	-1,124	42,946	31,578
1991	18,101	18,353	6,487	-692	42,249	29,966
1992	18,457	18,557	6,362	-725	42,652	29,478
1993	18,842	18,447	5,911	463	43,663	29,405
1994	19,508	18,538	5,641	389	44,076	28,924
1995	20,344	18,691	4,889	8	43,932	28,092
1996	21,604	18,793	3,554	-226	43,725	27,244
1997	22,389	18,941	4,459	715	46,504	28,235
1998	23,815	19,020	6,784	709	50,328	29,775
1999	25,161	19,149	6,357	1,595	52,263	30,129
2000	25,864	19,350	8,476	1,653	55,343	31,089
2001	27,747	19,346	8,726	1,457	57,276	31,352
2002	29,723	19,349	11,143	1,308	61,523	32,816
2003	32,615	19,258	11,380	1,316	64,569	33,560
2004	34,596	19,157	10,004	1,350	65,107	32,957
2005	36,233	19,141	7,179	1,377	63,930	31,519

Source: Produced capital: CBS (2001; 2008). Natural capital: Table 4; Foreign financial assets: IMF (2007) and Bank of Namibia (2001, 2007).

In 1980, Namibia's national wealth was 75% greater than Botswana's (Lange, 2004a), but much of it was used purely for consumption during the pre-independence period. By contrast, over the last two decades Botswana used its natural capital to build national wealth, which brought about growth in income. Real, per capita wealth more than doubled by 1997, while income increased 160% by 2000. The growth of national wealth is consistent with Botswana's development policy, which explicitly aimed to reinvest all mineral revenues for national development, investments that included public infrastructure, human capital, and foreign financial assets. After a few years into the post-independence period Namibia has begun to see its wealth grow and percapita income surpass 1980 levels again.

Figure 3. Index of real per capita wealth and per capita GDP in Namibia and Botswana, 1980 to 2003 (1980 = 1.00)



Source: Namibia: index of wealth calculated from Table 3; GDP from CBS (2007). Botswana: based on (Lange 2004).

6. Concluding Remarks

Sustainable development requires non-declining levels of per capita wealth. In resource-rich economies, this requires that natural capital be transformed into other forms of capital to build wealth. However, there has been growing concern that economic growth, especially in resource-rich developing countries, has been achieved by liquidation of natural capital

without adequate provision for replacement of these assets for future generations. Although natural capital may be a large component of wealth, it has not yet been systematically included in the national economic accounts of most countries. Consequently, conventional measures of well being, such as GDP or NDP, are misleading indicators of sustainability—they indicate economic growth, but whether that growth is sustainable.

Wealth as an indicator of sustainable development requires that all forms of capital are included and that they are properly measured. The implications of some of these omissions were discussed in section 2. The preliminary asset value for ecosystems—based solely on wildlife values for tourism and subsistence use—was estimated for 2003 at N$1,267 million in current prices; in 1995 constant prices N$639 million, or N$332 per capita, about 1% of total wealth. Preliminary work based on the asset value of the Okavango Delta in Botswana indicates that ecosystem assets contribute significantly to Botswana's total wealth (Turpie et al. 2006).

While the measure of total wealth presented here is an important step toward a comprehensive measure of wealth, human capital continues to present a major challenge, especially in countries like Namibia, which are struggling with the HIV/AIDS pandemic. Recent work by Mäler et al. (2007) indicate a method to include all forms of capital.

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