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# The Environmental Consequences of Stagnation in Nicaragua

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**Summary.** — A decade of war and revolution under the Sandinistas caused macroeconomic chaos but may have been indirectly beneficial to the environment. Now the country is a ward of the international financial community with foreign debt at almost six times GDP and few policy options. The Chamorro government, elected in 1990, has reduced the role of government and restored the price system as the principal means of resource allocation and income distribution. A three-gap model is used to show that environmental deterioration is likely to accelerate as a result of pursuing neoliberal policies. The analysis is based on a distinction between intensive and extensive environmental decay.

## 1. INTRODUCTION

After more than a decade of war and revolution, there has been no significant growth in Nicaragua (Gibson, 1994b). The economy contracted every year during 1984-92. Were there a direct tradeoff between growth and environmental preservation, Nicaraguans could be consoled that although the country sank to the second poorest of the Western hemisphere, they would at least enjoy the benefits of cleaner, greener environment.<sup>1</sup> But even if economic stagnation did not bring environmental preservation to Nicaragua, recovery will probably be more ecologically devastating.

What stagnation has brought is foreign debt that is six times GDP. As a severely indebted low-income country, Nicaraguan policy will largely be determined by its foreign creditors. The Medium Term Development Policy Document (GON, 1993a) argues that environmental impact must be considered as an aspect of all economic policy. The need to escape the burden of debt, however, is so overwhelming that the government must show that it is responsibly limiting money growth in order to qualify of debt relief. As a result, there will be few resources devoted to assessing the quality of the environment or likely policy-induced damage. This is not to single out the current administration; no government in the history of the country, Sandinistas included, has made the environment a priority. Other needs always seemed more pressing.

Following Taylor (1991), Bacha (1986) and Helleiner (1986), this paper employs three-gap and decomposition analysis to argue that so long as

Nicaragua remains severely indebted, the savings gap will bind and little progress on the environment will be made. Section 2 sets the stage for the discussion by providing an overview of recent economic events in Nicaragua. Section 3 identifies the main areas of environmental concern, water pollution, pesticide poisoning, deforestation and, the topic about which most is known, soil erosion. The analysis conducted in terms of a distinction between intensive environmental destruction which can be attributed to income inequality and extensive deterioration which accompanies growth. A final section draws some conclusions.

## 2. SOME RECENT ECONOMIC HISTORY

### (a) *Summary indicators of macro performance*

In 1978, Nicaragua was classified by the *World Development Report (WDR)* as a middle income country, with per capita income at US\$ 840 (World Bank, 1978). By 1993, it had become a low income country with income sinking to US\$ 340 (World Bank, *WDR*, 1994, p. 162). Table 1 confirms that macroeconomic imbalances grew dramatically during the Sandinista period (1979-89). The poor performance is variously attributed to external shocks, ranging from poor weather to the covert war with the U.S.-backed Contras, to the pursuit of nonmarket oriented policies.

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The economy was badly managed, even for a crisis period, and per capita income declined to 30% of its historical maximum, which occurred in 1977 (Gibson, 1987, p. 24). This figure may exaggerate the cost of the revolution somewhat since there were some gains in the social wage during the period. In 1992, exports fell to 62% of their 1981–85 level and by 1988, there were severe imbalances in the economy, with the exchange rate wildly overvalued. The inflation rate peaked at 33,548%, as seen in Table 1.

As of the end of 1993, foreign debt had risen to almost US\$ 11 bn. or six times GDP, with US\$ 5 bn. in arrears. On a per capita basis, Nicaragua's debt is among the highest of the severely indebted low-income countries. Interest payments are currently running at 124% of exports. Some 72% of the debt is with bilateral creditors with 16% on commercial terms. The largest share (34.1%) is held by the former socialist countries and half of what is owed to the Socialist countries is in arrears (*Envio*, August, 1994, p. 29). The widely accepted view is that the debt is unpayable; thus, Nicaraguan commercial debt is trading at 8% of face value on the secondary market (World Bank, 1994, p. 32). A chilling calculation is that to have its debt service in the manageable range of a quarter of 1993 exports, approximately 89% of the debt would have to be written off.

The Chamorro government, elected in 1990, has managed to reestablish relations with the international financial community, clearing arrears with the World Bank and the Interamerican Development Bank in September 1991. This set the stage for the signing of an 18-month standby arrangement from the International Monetary Fund (IMF), an Economic Recovery Credit from the World Bank and a Trade and Finance Loan from the Interamerican

Development Bank (GON, 1994a). Since the elections, the world community has provided approximately US\$ 3.24 bn. in assistance, of which the United States has contributed a third. Just over 50% of this amount went to finance imports while the rest was used for debt service and reprogramming (Larson, 1993). Consumer imports during the period were about US\$ 900 mn., which suggests that external cooperation since the election has helped sustain macroeconomic imbalance and postponed necessary adjustment.

Population is growing faster than the average for low-income countries, at approximately 2.7% per year in 1980–92 with the same rate of growth projected until the year 2000 (World Bank, 1994a, p. 162). During the Sandinista period, almost a million Nicaraguans migrated to the United States and now remittances is a significant source of foreign exchange, some \$100–200 mn per year (*Envio*, April, 1994, p. 29). Pressure on the land is, at the moment, not as severe as elsewhere. Nicaragua is moderately underpopulated by Latin American standards with 29.2 people per square kilometer compared to the average for low income countries of 82. Other than some subsistence crops, agricultural output in almost half the country is negligible due to very poor soil quality. According to the Human Development Index, a composite of life expectancy, education, and income that runs from zero to one, Nicaragua at 0.496, is in the low to the middle of the range for Central America. The index for Honduras, the lowest, is 0.473 and is highest for Costa Rica at 0.842 (UNDP, 1992, pp. 127–129). As in many other countries surveyed in this symposium, environmental awareness has been limited due to the low levels of human development.

Table 1. Basic macro data

	1970–77	1981–85	1986	1987	1988	1989	1990	1991	1992	1993
Real growth*	6.6	0.6	-1.0	-0.7	-12.1	-1.9	-0.7	-0.2	0.4	-0.9
Inflation*	10	60	600	900	33548	1689	13490	775	4	1
GDP†	1132.5	2263	2180	2165	1903	1867	1854	1850	1857	1841
GDP/capita‡	100.0	67.5	59.2	60.5	39.9	40.6	42.9	34.1	30.5	29.3
Investment§	22.6	22.0	16.9	15.8	25.9	26.4	20.2	20.8	17.2	17.2
Exports†	391.0	498.8	247.8	272.8	232.7	310.7	330.6	268.1	224.1	268.9
Imports†	41.59	780.0	677.4	734.4	716.6	547.3	567.4	663.4	784.2	690.1
Resource bal.§	2.2	12.4	19.7	21.3	25.4	12.7	12.8	21.4	30.2	22.9
Real exc. rate‡	100.0	53.4	20.4	10.2	18.5	35.2	28.8	25.9	23.0	25.1
Terms of trade‡	100.0	82.6	90.1	87.4	86.4	79.2	74.6	69.0	49.1	54.6
Debt†	530	4199	6847	7663	8387	9344	10522	10313	10806	10987

\*Percentage.

†Millions of US\$.

‡1970–77 = 100.

§Percentage of GDP.

Source: Central Bank of Nicaragua (1979), Corbo *et al.* (1993), Edwards (1992) ECLAC, IMF, IFS.

(b) *Growth and capacity utilization*

Following Taylor (1991) recent events in the Nicaraguan economy can be described in terms of three "gaps," in capacity utilization growth space. The savings gap relates growth to the sum of capital inflow net of debt service, private savings less capital flight and the inflation tax minus the public sector borrowing requirement (PSBR) and reserve accumulation. Savings flows come from profits and not wages in Nicaragua and are held in domestic money or as capital flight depending on political conditions (Gibson, 1994a). At its height in 1988, the black-market premium, the barometer of the rush of capital to flee, was 571 times the official rate (Lankes, 1993, p. 49). Domestic savings increases both with higher capacity utilization and forced savings due to sticky nominal wages and variable inflation (Gibson, 1991b). Capital flight may dominate both effects, however, and accelerates as capacity utilization falls. Consequently, the savings gap is not very elastic with respect to capacity utilization and subject to shifts caused by changing perceptions of domestic stability and future profitability.

The investment gap depends on the sum of public and private capital formation. Its slope is positive with respect to capacity utilization, but because the accelerator is weak, the investment gap is much flatter than the savings gap. It is difficult to say what determines investment in the Nicaraguan economy since, for the most part, it has declined more rapidly than GDP.<sup>2</sup> Clearly, there are determinants other than the real interest rate since throughout the Sandinista regime, the real interest rate was negative, falling from a maximum of -4.4% in 1981 to -72.3% in 1985 to -98% by 1988 (Lankes, 1993, p. 64). Quantity constraints on credit were evidently more important.

The foreign exchange gap balances net exports and

resource inflow net of capital flight, reserve accumulation and debt service. The slope with respect to capacity utilization is negative, given that higher levels of investment will drain away scarce foreign exchange otherwise absorbed by intermediates. The three gaps come together to form an *ex post* equilibrium. But *ex ante*, all can shift by the combination of external shocks, the growing burden of debt and policy choices.

(c) *Fiscal balance*

The Contra War created a crisis atmosphere in which the normal mechanisms of macroeconomic adjustment were all but disregarded (Ocampo, 1992). Defense expenditure increased rapidly under the Sandinistas, rising from an average of 11% of GDP in 1981-85 to 18.9% in 1990.<sup>3</sup> Meanwhile, public sector investment in infrastructure, commerce, production and transport fell as is confirmed in Table 2. An explicit decision was taken to pay for the war by reducing public sector investment in order to minimize the impact on current transfers. Table 2 shows that the dramatic change of course under the Chamorro regime with a decline in the public sector borrowing requirement (PSBR) from 30.2% of GDP in 1990 to 8.2% in 1991.

Why did growth slow when defense spending increased? The rise in the PSBR caused the savings gap to shift down. Credit was allocated to the state-owned enterprises which were using the funds to increase consumption rather than investment (Lankes, 1993, p. 66). The private sector was, thus, crowded out by the lack of available savings. In other circumstances, the private sector could have raised its savings to compensate, and certainly forced savings did help; but capital flight increased as a fraction of total

Table 2. *Consolidated operations of the nonfinancial public sector (percent of GDP)*

	1970-1977	1981-1985	1986	1987	1988	1989	1990	1991	1992	1993
Expenditure	15.7	48.9	50.4	46.9	51.4	37.4	49.0	34.5	41.1	33.9
Social spending	5.3	11.5	12.4	11.1	8.7	7.4	14.9	9.2	nd	nd
Investment	4.1	12.5	7.9	5.6	7.9	3.8	2.6	4.9	10.7	12.3
Defense	1.9	11.0	17.7	18.2	16.2	11.9	18.9	5.9	6.5	4.7
Revenue	17.6	29.7	35.3	28.9	22.8	29.1	18.8	26.3	31.6	35.8
Direct	2.2	5.9	7.1	6.3	3.7	5.5	3.6	3.6	3.7	nd
Indirect	15.3	23.8	29.0	25.2	17.3	25.5	15.2	22.6	27.9	nd
Current deficit	-6.0	6.6	7.2	12.4	20.7	4.5	27.6	3.3	-0.2	-1.9
PSBR	-1.9	19.1	15.1	18.0	28.6	8.3	30.2	8.2	10.5	10.4
Financing										
Grants	0.0	nd	1.7	0.5	0.6	3.6	15.5	12.8	6.0	nd
Foreign borrowing	4.5	nd	-0.1	0.0	2.5	4.8	20.1	0.7	13.0	nd
Domestic borrowing	0.4	nd	13.5	17.5	25.5	-0.1	-5.4	-5.3	-8.5	nd

Source: World Bank (1992); Corbo *et al.* (1993).

Table 3. *Change in PSBR (percentage of potential GDP)*

Contributing to a rise in PSBR*	1976-80	1981-85	1986-90	1990-93
1. Negative external shocks	-0.7	-4.7	-1.5	2.6
2. Burden of accumulated debt	2.5	2.8	0.3	0.1
3. Policy options	4.5	7.4	3.5	-20.9
3.1 Decline in tax revenues	-5.8	-6.4	15.0	-3.2
3.11. Cyclical tax decline due to fall in capacity for:	4.2	1.8	3.5	0.1
3.111. Direct taxes	0.9	0.4	0.8	0.0
3.112. Indirect taxes	2.1	1.1	2.3	0.1
3.113. Import duties	1.1	0.3	0.4	0.0
3.12 Structural tax decline due to fall in:	-10.0	-8.2	11.5	-3.3
3.121. Direct tax rate	-2.1	-1.8	2.0	-0.2
3.122. Indirect tax rate	-5.7	-6.8	7.5	-2.4
3.123. Import duty rate	1.3	1.2	-0.5	-0.1
3.124. Import intensity	-2.6	0.1	0.3	-0.5
3.125. Lump sum taxes	-0.9	-0.9	2.2	-0.0
3.2 Rise in expenditure	10.3	13.8	-11.5	-17.7
3.21 Current expenditure	11.7	11.2	-5.8	-18.1
3.211. Goods and services	5.2	2.5	-3.9	-3.0
3.222. Remunerations	2.9	1.1	-1.4	-3.1
3.233. Transfers	0.4	0.6	0.4	-1.9
3.234. Military and police	3.2	7.0	-0.8	-10.1
3.22. Capital expenditure	-1.4	2.6	-5.7	0.3
4. Calculated PSBR increase	6.3	5.5	2.4	-18.2
5. Observed PSBR increase	6.2	5.5	2.4	-18.2
6. Residual	0.1	+0.0	-0.0	-0.0

\*Positive numbers represent increases in the PSBR.

Source: Author's calculations.

savings, causing adjustment to take place along the relatively steep savings gap.

Table 3 provides a decomposition of the PSBR during 1976-93 with the sign convention that positive numbers indicate an increase in the PSBR. Entries are measured as percentage of capacity output rather than GDP (Bacha, 1986; Helleiner, 1986). The decomposition is broken down into external shocks, that is, changes in the interest rate that increase the fiscal deficit, and the burden of accumulated debt and policy options. Observe that external shocks were on balance favorable to the Sandinista PSBR and have hurt Chamorro. The adeptness with which the Sandinistas avoid servicing debt was remarkable and this obviously helped reduce the effective fiscal deficit. The impact of external shocks on the Chamorro PSBR has not been overwhelming. Success in renegotiating the debt burden, while raising paid interest, increased the PSBR by only 2.1% of capacity GDP.

The burden of accumulated debt is accounted for in line 2 of Table 3. This was more of a factor for the Sandinistas than Chamorro since debt in 1981-85 was 10 times that of the previous five-year period. By 1990, debt again doubled (as seen in Table 1). Thereafter, the rate of increase was less, with accumulated 1993 debt only 13% higher than in 1990. The

effect for the Chamorro period is thus 0.1% of capacity GDP.

Table 3 shows that policy options explain most of the fluctuations in the PSBR. In contrast to Sandinista policies which raised the PSBR by 4.3% and 1.4%, in the first and second half of their rule respectively, Chamorro's policies brought a decline in the PSBR of 14.6% of capacity output (line 4). For the Sandinistas, the increase in the PSBR was due primarily to a rise in expenditure in the first semester of their rule (line 3.2) and declining revenues in the second. As the hyperinflation emerged, the tax take dwindled due to the Olivera-Tanzi effect, causing the PSBR to increase<sup>4</sup> (line 3.1). The pallid recovery under Chamorro has been insufficient to reverse the sign of the cyclical component in tax revenue. It was left to a full-scale military demobilization (from 98,000 in April, 1990 to 15,000 by the end of 1992) to make an important difference in government spending and lower the PSBR (GON, 1994a, p. 2).

The rise in the PSBR explains why the steep savings gap shifted down in the first semester of Sandinista power. Total expenditure increases accounted for a 13.8% of capacity GDP increase in the PSBR in 1981-85 with a 7% increase for police and military alone. But public sector credit absorption was

offset by the inflation tax and seigniorage, primarily because capital flight had not yet devastated domestic deposits. Part of the explanation for the monetary overhang was related to information available at the time (Taylor *et al.*, 1989 and Corbo *et al.*, 1993). Reliable data on the inflation rate were difficult to obtain and the most visible indication of inflation was the exchange rate which the Sandinistas kept overvalued. The net effect of public sector credit absorption on growth was thereby reduced.

The savings gap apparently became less restrictive during 1986–90. The effect of the PSBR on the credit flows was much less pronounced in the second semester. Table 3 shows that current expenditure was cut substantially, owing to the demobilization as the Contra War wound down. Capital expenditure also continued to decline. As argued in the following section, the foreign exchange gap became increasingly binding during the second half of Sandinista rule.

Under Chamorro, there has been very little monetary expansion and the savings gap again became binding, despite the cut in the PSBR. The rate of growth of nominal aggregates slowed dramatically. Still, money and quasi-money in local currency units recovered by almost 90% in real terms from March 1991 to December 1991, touted by the government as a return of confidence due to financial liberalization (GON, 1994b, p. 4). Credit granted to the public sector declined to 2.7% of GDP in 1992 from a high of 44% of GDP in 1990. With little money growth, the contraction in credit absorbed by the public sector did not allow much expansion of credit to the private sector, especially small and medium-sized farmers.

The PSBR was reduced by expenditure cuts and tax increases. Tax revenue had fallen to an all-time low of 18.8% of GDP in 1990, but the following year, tax rates were indexed to the dollar through the new monetary unit, the *córdoba oro*. The indirect tax rate rose from 10 to 15%, but significant reductions in corporate and profits tax, as well as eliminating various consumption taxes, weakened the overall effect (Ocampo, 1992, p. 35). A tax on luxury consumption was finally introduced in January 1993, but the base is still very thin as is the base of the tax system generally. Some 30% of total taxes are still collected from only 11 enterprises.

Again growth appears to have been credit constrained and, as argued below, the environmental costs of the credit restriction began to multiply. The investment constraint was not binding in that capacity utilization was increasing. As seen in Table 3, public sector investment showed the first growth since early years of the Sandinista regime. The crunch came in policy supposedly designed to rationalize the banking system. Direct central bank participation in lending, which in the past had been an uncontrolled source of emission, was restricted. Seven private commercial banks opened to compete with the state banks (GON,

1994a, p. 3). The state banks are being recapitalized and will follow strict rules and guidelines for loan recuperation; if not, the government has threatened to downsize or sell the public banks (GON, 1993a, p. 10). These credit restrictions were imposed to reduce money growth and demand. It was an effort to restore credibility, at least in the eyes of the elite, if not poor Nicaraguans whose only access to formal sector credit had been under the Sandinistas.

#### (d) *Foreign balance*

Traditional wisdom suggests that the Nicaraguan economy is foreign exchange constrained, but detailed analysis of the gaps tells a different story. Only in the second semester of the Sandinista regime does the economy appear to be truly constrained by a lack of hard currency. As will be argued below, a binding foreign exchange gap may in fact bring some environmental benefits. The overall balance of payments, shown in Table 4 to have reached US\$ 1,289.5 mn. by 1992, was “financed” principally through arrears accumulation of US\$ 1,151 mn. This implies that Chamorro has been no more constrained by the foreign gap than were the Sandinistas when aid was flowing freely from Latin America and Western Europe. As noted above, remittances have also helped.

The *ex post* adjustment of the foreign gap came through a decline in exports which was the effect of policy choices under the Sandinistas and terms-of-trade deterioration under Chamorro.<sup>5</sup> Table 5 shows the decomposition, again with the sign convention that positive numbers represent an increase in the current account deficit and measured as a percentage of potential rather than current GDP. Policy, not external shocks or burden of debt, has been the most important factor in the run-up of debt. External shocks helped the Sandinistas' current account balance but have not been favorable to Chamorro, whose policies have exacerbated the effect of external shocks on the current account. As noted above, assistance to the Sandinistas came as interest rate relief, simply unpaid interest. This more than compensated for the precipitous decline in the terms of trade in 1981–85 and just offsets the terms-of-trade effect in 1986–90. The profit repatriation term was unimportant for the entire period. Transfers, on the other hand, were significant for the Chamorro government but not enough to offset the deterioration in the terms of trade and the interest rate effect.

Table 5 shows that in the first half of the Sandinista period, policies were more restrictive, leading to almost no change in the current account as measured here. In the second half, the deficit fell dramatically due to highly contractionary policies and changes in import widening and deepening. As noted above, this

Table 4. *Balance of payments (US\$ mn.)*

	1981-1985	1986	1987	1988	1989	1990	1991	1992
Current account	-446.0	-594.4	-668.2	-638.0	-383.4	-327.5	-426.9	-977.9
Resource balance	-361.6	-429.6	-461.6	-483.9	-236.6	-236.8	-395.3	-560.1
Factor payments								
Interest-paid	76.4	28.1	16.5	9.6	7.5	12.0	21.2	87.7
Interest-unpaid	226.2	121.3	192.7	229.0	204.1	216.8	419.0	402.1
Noninterest	9.06	0.7	1.4	2.1	6.8	11.8	9.7	7.7
Transfers	83.8	0.7	1.4	2.1	6.8	11.8	9.7	7.7
Capital account		392.1	166.3	118.3	-137.5	-170.2	-601.5	-311.5
Errors and omissions		-474.5	-294.8	63.8	-122.7	-255.3	-234.7	-0.1
Balance		-676.8	-796.7	-455.9	-643.6	-753.0	-1263.1	-1289.5
Financing								
Change in reserves		202.7	222.7	-16.0	67.6	197.8	-15.8	1.4
Rescheduling		142.3	7.0	12.5	0.0	0.0	0.0	0.0
Increase arrears		330.5	564.3	455.2	562.4	531.6	1259.5	1151.0

Source: IMF, IFS, Corbo *et al.* (1993), GON (1994a).

Table 5. *Change in current account deficit (percentage of potential GDP)*

Contributing to a rise in CA deficit*	1976-80	1981-85	1986-90	1990-93
1. Negative external shocks	-8.8	-4.0	-1.6	7.0
1.1 Foreign interest rate rise	-0.7	-4.7	-1.5	2.6
1.2 Profit outflow	-0.1	-0.8	0.5	-0.1
1.3 Decline in incoming transfers	-4.0	0.4	-2.2	1.0
1.4 Terms of trade deterioration	-4.0	1.2	1.5	3.4
2. Burden of accumulated debt	2.5	2.8	0.3	0.1
3. Policy options	14.5	2.3	-11.9	3.6
3.1 Rise in imports:	10.8	-3.4	-9.7	5.8
3.11 Import widening due to:	-7.0	-0.5	-8.1	1.4
3.111 Capacity utilization	-8.3	-2.1	-6.4	-0.3
3.112 Consumption share of GDP	1.2	-0.4	-0.3	1.4
3.113 Intermediate share in GDP	2.7	0.3	-1.0	1.5
3.114 Investment share in GDP	-2.6	1.7	-0.3	-1.2
3.12 Import deepening due to:	17.8	-2.9	-1.6	4.4
3.121 Consumption import coef.	5.6	-2.8	0.3	2.7
3.122 Intermediate import coef.	10.0	-3.0	-3.0	0.3
3.123 Investment import coef.	2.2	2.8	1.1	1.4
3.2 Decline in exports due to fall in:	3.7	5.7	-2.2	-2.2
3.21 Real exchange rate	0.5	20.6	1.0	1.6
3.22 Private sector responsiveness	3.2	-14.9	-3.3	-3.8
4. Calculated deficit increase	8.2	1.2	-13.2	10.7
1+2+3	8.2	1.2	-13.2	10.7
5. Observed deficit increase	8.2	1.1	-13.3	10.6
6. Residual	+0.0	0.1	0.1	+0.0

\*Positive numbers represent increases in the current account deficit.

Source: Author's calculations.

is the period in which the foreign exchange constraint appears to have been most tightly binding. The Chamorro regime reinstated a more typical pattern of external dependence and foreign finance was more freely forthcoming.

The degree of dependence is illustrated by the import deepening (imports per unit of output) section

of the table. During the late 1970s, there was a significant increase in the economy-wide import intensity. Under the Sandinistas, import compression caused all but the investment coefficient to fall, aiding external balance. The Chamorro regime is seen to return to business as usual: import deepening caused the current account to slip by 3.2% of capacity.

(e) *The role of relative prices: the real exchange rate and exports*

Export earnings are assumed here to depend upon the terms of trade, the nominal exchange rate and the physical volume. Physical volume, in turn, depends upon the expected real exchange rate. This latter effect is disaggregated into a real exchange rate appreciation and a fall in exports holding the real exchange rate constant (Gibson, 1994b, appendix). The softening of exports began in the late 1970s with the onset of the revolution.

Table 5 confirms that Sandinista export policy was an unqualified disaster. In the first five years, the rapid appreciation of the real exchange contributed some 17.4% of capacity GDP to the current account deficit. This was partially offset by the lack of response to the real exchange by the private sector, responsible for 12.2% of capacity improvement in the current account. Part of the explanation lies in the willingness of state-owned farms and cooperatives to export despite the acutely appreciated real exchange rate. A second part is that there was a large (but unknown) difference between the real and effective exchange rate (Medal, 1992). Chamorro has not done much better than the Sandinistas in stimulating exports, contributing only about 1.5% of capacity to lowering the current account deficit.

To summarize, Tables 4 and 5 suggest the following characterization: In the first Sandinista and Chamorro periods, the savings gap was most binding. The foreign exchange gap came into play in the second Sandinista term but in none of the periods was the investment gap terribly important. Even in the period of slowest growth, 1986–91, there appears to be an excess demand for investment funds due to the negative real interest rate and Sandinista support for small and medium-sized farmers. As in Russia and Argentina, available credit was absorbed by the public sector and capital flight in the first five years of Sandinista rule (Chisari, *et al.*, 1996; Vorobyov and Zhukov, 1996). Monetary contraction required by stabilization restricted credit growth later on under Chamorro.

As noted in the paper on Mexico in this symposium, the effort to open the Nicaraguan economy, will expose the country to increasing international pressure to adopt stricter environmental regulations (Ros *et al.*, 1996). The link between the foreign exchange gap and environmental barriers to growth will only intensify in the medium to long run.

(f) *Inflation and stabilization*

There were several episodes of incomplete stabilization under the Sandinistas (Ocampo, 1991). Here is the sequence of events: By 1985, inflation had

accelerated to more than 300% and a set of heterodox stabilization policies was adopted. The currency was devalued in February 1985 from 13 to 23 córdobas per dollar, causing only a brief upward blip in the multilateral real exchange rate index (Edwards, 1992, p. 122–123). The stabilization programs of February and June 1988 were stronger, with a nominal devaluation from 70 to 10,000 córdobas per dollar. Currency reform eliminated 20% of the money supply (in part to neutralize Contra currency holdings). In June 1988, the Sandinistas liberalized prices and wages. Expenditure and credit targets were significantly underestimated and the reduction in the rate of inflation was only temporary.

The key to showing that the savings constraint failed to bind is the effect on nonfiscal monetary expansion. Example: the domestic lending rate was kept at 45% per year and dollar denominated loans could be repaid with prereform notes. As noted by Ocampo, these decisions were equivalent to generalize debt forgiveness (Ocampo, 1992, p. 25). Banking losses were made up through monetary creation, further aggravating the situation. It seemed that to the Sandinista policy mind that nonfiscal monetary expansion did not count. Obviously it did, but the net effect was to keep the savings gap from constraining growth.

The 1989 stabilization effort was more comprehensive and thus more successful. Inflation fell precipitously, as shown in Table 1 and output continued to decline even though exports began to recover. The main effect of the 1989 program was on public sector employment; in 1989, 8,000 civilian and 13,000 military jobs were eliminated. This showed significant commitment to stabilization by the Sandinistas, since their chief political constituency was public sector employees, both civilian and military. As argued by Lankes, the reforms introduced in 1988 removed the last elements of the Sandinista conception of the mixed economy (Lankes, 1993, p. 75). The consolidated nonfinancial current deficit was reduced from 20.7 to 4.5% of GDP in 1989 (see Table 2) but the financial system still seemed to be outside the scope of reforms. Credit growth remained significant, however, as *reliquidaciones* were justified as necessary to stimulate export crops. Lending rates were fixed by policy below deposit rates, leading to further monetization of Central Bank losses. Despite the reforms net transfers through the banking system, which had reached a maximum in 1987 of 20% of GDP, were above 15% of GDP through 1989. The continued decline in the terms of trade offset whatever effect there might have been on export growth (see Table 1).

In 1990, the Chamorro government took several decisive steps to reduce nonfiscal monetary emissions. These included exchange rate unification, financial reform aimed at a positive real interest rate and control of debt write-offs and subsidies.

Administered prices were increased, especially for imported fuel, and the tax system was completely overhauled. The credit crunch was severe as the financial system was immediately indexed to the dollar and public goods prices were increased. Inflation continued.

In March 1991 a new seven-point stabilization plan was announced. It involved a 400% devaluation followed by a fixed exchange rate. Net monetary reform provided for general circulation of the córdoba oro at a five million-to-one ratio to old córdobas. The restrictions on credit was not yet sufficient to stop the inflation and a comprehensive attack on monetary growth was mounted. The goal was zero net credit from the Central Bank to the public sector and off-budget spending by public entities was proscribed. Financial reforms plugged many leaks that had been ignored in the past (see Gibson, 1994b for details). Central bank losses declined from 14% of GDP in 1989 to 1.4% of GDP by 1993 (GON, 1994a, p. 9).

These measures were in themselves insufficient to stabilize the economy. What was ultimately required was a deep recession. As it had been in Bolivia, the target was public sector employment. The restructuring took place throughout 1991, affecting more than 100,000 or 8% of the economically active population (Ocampo, 1992, p. 40). In April 1994, Chamorro signed a Letter of Intent with IMF for an Enhanced Structural Adjustment Facility that will extend to mid-1997. The conditions include further contraction of the state sector, further import liberalization and rescinding labor legislation to promote "balanced strike regulations" (GON, 1994b; *Envio*, June 1994, p. 4). These measures will insure that the savings constraint will continue to bind under Chamorro.

#### (g) *Fiscal abdication and private sector fragility*

It was small wonder the Sandinistas lost the 1990 elections. Social spending dwindled, the embargo interrupted trade with Nicaragua's most natural partner, the United States, and aid flows shifted to the Soviet Bloc. By 1988, the parking lot next to the Ministry of Trade was filled with idle Soviet-made tractors as a testament to the inefficiency of tied aid. It is easy to speculate that if Carter rather than Reagan had been in power in the United States, the outcome of the Sandinista experiment could have been quite different (Gibson, 1993).

Many would argue not, pointing out that the Sandinistas were to blame for their own undoing. The Sandinistas lacked a comprehensive macroeconomic vision and badly mistreated the private sector. While the stabilization policies were severe, even draconian, they were generally not followed up with consistent policies across the fiscal and financial systems. The "rules of the game" (a phrase beloved by well-to-do Nicaraguans) were in constant flux and there was a

hardened core of the private sector, represented by the Superior Council of Private Enterprise (COSEP), ready to oppose virtually any Sandinista initiative.

By contrast, Chamorro has sought to win over the private sector by way of rigorous application of the principles of neoliberal reform. The chief ideological objective was to undo the model of state-led accumulation. Changes have been striking, reducing public sector holdings from 30% of GDP to around 16%. In agriculture, state participation declined from 25.7% of sector GDP in 1989 to only 8% by 1990. State ownership in the environmentally sensitive areas of fishing and mining have also been reduced significantly from 100% to 24.5% and 74% (Corbo *et al.*, 1993, Table 10).

To satisfy the demands of conditionality, the state has withdrawn from active participation at every level. Citing the need to provide "a proper incentive structure," trade has been liberalized. There has been an attempt to maintain the real exchange rate despite terms-of-trade deterioration. A crawling peg was put into place in January 1993 and in November, the rate of crawl was accelerated. As a result, the real exchange rate has depreciated by some 6% since 1992 (GON, 1994a, p. 13). Import controls were lifted and the average tariff level was reduced from 47.9% to 14.7% with the standard deviation falling from 53 to 9.2% (Corbo *et al.*, 1993, p. 14). In 1992 a "nondiscriminatory" foreign investment law was enacted which allows for repatriation of profits of foreign owned companies (GON, 1994b, p. 21). Whether these measures will incite growth in the future depends on how the gaps behave. The combination of a fragile private sector and retiring state could easily lead to a binding investment constraint, especially if the debt is pardoned and capital flight ends.

#### (h) *The state and social classes*

As elsewhere, stabilization and structural adjustment have been achieved by creating a large pool of unemployed workers, mostly discharged from the public sector. The first growth in almost a decade occurred in 1992 and was driven by growth in the agricultural sector. There was an approximately equal contraction in manufacturing. The economy grew on balance because of growth in the service sector, much of which is informal. Formal sector real wages began to increase for the first time since the 1970s. An otherwise authoritative SIDA study argues that the Chamorro anti-inflationary policy probably enhanced the welfare of the poor, noting that they are less likely to be able to protect themselves from inflation through capital flight, the banking system or real investments (Corbo *et al.*, 1993). Perhaps, but it is far more likely that income has been distributed since the takeover of

UNO (Union Nacional Opositora) in a broadly regressive way. Small farmer production increased during the years of the hyperinflation. Few held money balances and grain stocks and animals provided a natural hedge against price increases. Above all, the sharp increase in the real interest rate coupled with the lack of credit has ravaged the poorest segments in the countryside. It is the relatively well-off, not the poor, which have primarily benefited from Chamorro's stabilization policies. There has been a significant drop in the inflation tax and also the return of confiscated properties. Only the real tax burden has increased, but this is regressive since taxes are primarily indirect.

### 3. THE ENVIRONMENT AND THE ECONOMY

In what follows, it will be useful to distinguish between extensive and intensive environmental deterioration. The distinction hinges on whether the environmental problem is more closely linked with growth or with distribution. Extensive degradation accompanies expansion as previously integral ecological systems are undermined, exploited or destroyed. Growth in unregulated extractive industries, forestry and fishing, and cattle are clear examples of extensive destruction. Presently, the expansion of shrimp mariculture constitutes the more immediate threat to the coastal waters (Stonich, 1993). Indeed, growth of nontraditional exports usually involves extensive decay, owing to the lags inherent in recognition of the damage, formulation of policy to regulate the activity and implementation and enforcement of the regulatory framework. Extensive environmental damage is either unforeseen or entirely external to the firm. Policy makers with high discount rates may permit or encourage extensive damage.

Intensive environmental damage is not the direct consequence of growth. Intensive decay is the product of poorly distributed income that forces individuals to mine the land, denude forests, contaminate water supplies or otherwise destroy the environment. Intensive degradation need not be an externality (although it often is); the decay may be completely internalized, yet unavoidable due to subsistence requirements. With the binding constraint, the Coase Theorem does not apply, since environmental preservation depends upon how resources are distributed (Pezzey, 1982, p. 38). Nor can a Pigouvian tax be employed to regulate intensive decay, since the poor typically cannot be forced to pay for external damage their survival strategies cause. It is clear that intensive environmental deterioration is defensive and has little to do with capital accumulation and higher capacity growth as suggested by a trajectory which runs from A to C in Taylor's Figure 2 (1996).

Extensive and intensive decay may trade off, or not, depending upon whether growth brings authentic

development. The 1992 *World Development Report* points out that traditional societies and methods must be protected as conservationist. But this is only true in a state of simple reproduction, that is, with no growth and a resource base that is sufficient to sustain traditional society (Taylor, 1992, p. 12). Clearly, the distinction between intensive and extensive deterioration is structural in that the nature of decay cannot be determined *a priori* or by agency but is, rather, path dependent.

#### (a) *Historical interactions of the market and the environment*

The *Somocismo* of 1950s and 60s involved both extensive and intensive environmental assault inasmuch as GDP and poverty were growing simultaneously. In the decade prior to the 1972 earthquake, Nicaraguan export growth was among the fastest in Latin America, yet per capita caloric intake declined (Gibson, 1987). In the interwar period, Nicaragua exported coffee and bananas, but with the cotton boom in the early 1950s, the area sown to cotton tripled and cotton surpassed coffee as the most important source of foreign exchange in 1955 (Biderman, 1982). During the decades of the 1950s and early 1960s, large-scale cotton and coffee producers displaced small corn and bean growers from the fertile volcanic soil of the Pacific plain to the thinner and leached soils of the agricultural frontier on the Atlantic Coast. Tenancy and land usufruct rights were revoked by large landowners, rents were raised and peasants were forcibly evicted to unify large tracts for agroexports.

The fertile valleys and lowlands belonged to the large growers while smallholders cultivated the steeper terrain with lowland technologies, using little or no crop rotation. Both intensive and extensive environmental deterioration accelerated. The introduction of "nontraditional exports" in the 1940s and 50s, such as commercial cotton cultivation, caused some of the worst extensive environmental damage and public health hazards in Latin America (Stonich, 1993). The postwar cattle boom contributed to deforestation as land was converted to pasture, again in an extensive way (Williams, 1986). Enclosures created a massive marginal population that overworked and parcelized critical upslope holdings. Intensive deforestation led to other forms of intensive decay, especially soil erosion.

#### (b) *The state of stress: key environmental indicators*

An environmental action plan (PAA) was published in 1993 which identified the central problems facing Nicaragua as water pollution, destruction of marine ecosystems, pesticide poisoning, deforestation and

soil erosion, especially in the North Pacific region (GON, 1993b). It is clear from the proposals for financing of clean-up and restoration programs discussed in that document that the entire project must be funded externally. Given the enormous pressure on the state budget, there will be no internal funding on anything but a token level. The total costs are significant; projected projects, as enumerated in the PAA, account for 3–5% of GDP.

Some of these problems are broadly decomposable from the macroeconomy. Deforestation, water pollution, destruction of coral and coastal wetlands and red mangroves are linked to macropolicies but have little feedback. As the policies of the current government create more unemployment, deforestation will accelerate and delicate ecosystems will yield to the demand for food and firewood. Despite the World Bank's incantation that forests have "spiritual" value, most of Nicaragua's rural poor apparently see little opportunity cost in deforestation. Finally, as in Russia, part of Nicaragua's current environmental problems are linked to past extensive decay (Vorobyov and Zhukov, 1996). Lake Managua is "dead" due in part to the estimated 40 tons of mercury which have dumped there in the last two decades (GON, 1993b).

(i) *Water pollution, fertilizer and pesticide poisoning*

Water pollution in urban and rural areas comes from the lack of treatment of municipal and industrial discharges that percolate up through the underground aquifer. Fertilizer and pesticide run-off is also a chief cause. Contaminated drinking water is unlikely to be restored because of the destruction of cloud forests that regenerate surface and ground water supplies. Water itself is scarce and could easily become a binding constraint on growth in the future.

Although they had been introduced much earlier on, the Sandinistas heavily subsidized chemical fertilizers

and pesticides to modernize Nicaraguan agriculture across the social spectrum. Now prices are more in line with international averages and the use of chemical agents is declining. The binding savings gap will unquestionably reduce the level of inorganic agents on smallholdings. Table 6 shows some sketchy data from the Banco Nacional de Desarrollo for pesticide use.

Cotton is the most environmentally damaging crop, with up to 30 applications of pesticides applied per crop cycle. It is also the most technologically advanced, with unregulated applications of DDT and other chlorinated agents sprayed by aircraft. Output is concentrated primarily on the flat plains of the Northern Pacific Coast and the land and water is seriously contaminated there, with high levels of pesticide residue in local food supplies (Leonard, 1987).

Significant soil erosion in the 1980s, along with rising costs and falling prices, has recently contributed to a deep slide in cotton area sown, roughly a fifth of the maximum that occurred in the 1970s. The forecast is for this decline to continue. Tobacco is also a big user of run-off contaminants, but the area sown is only roughly 7,000 hectares, as seen in Table 6. Observe that the other food crops are relatively less intensive in pesticides.

(ii) *Deforestation*

Forest resources have declined in the developing world by some 20% in the 20th century (World Bank, 1992, p. 58). Recent satellite imagery suggests that tropical forests in Latin America are disappearing at close to worldwide rate of almost 1% per year. Some 50% of Central American land mass was forested in 1960, but that declined to 41% by 1972 and to 30% by 1987 (Stonich, 1993, p. 69). Nicaragua has a large forested area, some four million hectares (out of 13 million total area of which 4.9 mn. is arable) of which only 20% is currently harvested.

Table 6. *Pesticides (liters per hectare)*

Crop	Insecticides	Herbicides	Fungicides	Adherents	Biological	Area*
Export						
Cotton	14.5	4.8			1.8	76–
Coffee	1.2	3.6	3.5	1		81+
Sugar	21.1	2.5				39–
Sesame	2.1	0.4				16++
Food						
Tobacco	14.9	3.7	111.1	1.8	0.8	7
Beans	7.2	1.1	1.9	4.1		78
Maize	7.3	1.6	2.8	0.9		171
Rice	4.8	2	4.4	0.4		34
Sorghum	3.9	0.9	3.8			58
Soybeans	2.3	1.8			1.1	10+

\*In thousands of hectares; sign indicates recent direction of change.

Source: Banco Nacional de Desarrollo as cited in De Franco *et al.* (1993).

During 1960–80, Nicaragua experienced the highest rate of deforestation in Central America and forest cover was reduced by two million hectares. In contrast to what occurred in the Philippines, most was intensive rather than extensive (Montes and Lim, 1996). Some estimates suggest that the country will be denuded, at current deforestation rates, within three decades. The agricultural frontier began to advance again after the Contra War ended and producers are now encroaching into the national forest reserves of Indio-Maíz in the south and Bosawás in the north. These, with the pine forests of the North Atlantic, are the forests at greatest risk. One estimate of the out-of-pocket costs of preservation subsidies, ground and satellite monitoring and support for nonlumbering use is \$US 6 mn. or about 2% of 1993 exports (Nítlápan, 1993).

Intensive deforestation due to population pressure is taking place in the tropical wetlands in the Atlantic Coast region as well as on the drier Pacific coast. USAID (1991) blames the forest loss on uncertainty over land rights, the nationalization of the forestry industry and resettlement under the Sandinistas. There is very little evidence, however, that the Sandinistas engaged in extensive destruction of forest resources. The Chamorro government claims it will attack the problem of deforestation through establishing a clearer pattern of property rights. The forestry industry will be privatized, although the government will continue to regulate the rate of harvest (GON, 1994b, p. 26).

### (iii) *Soil erosion*

The Global Assessment of Soil Degradation (GLASOD) study shows that approximately 25% of the vegetated land in Mexico and Central America is moderately to extremely degraded with 10% in the serious and extreme categories. The whole of Central America is considered in the worst category of "Area of Serious Concern" (World Resources Institute, 1992, p. 117). Much of the deterioration is due to water erosion along the mountainous Pacific Coast, but GLASOD notes "physical and chemical deterioration . . . in Nicaragua" is caused by deforestation, overgrazing and poor agricultural practices (World Resources Institute, 1992, p. 116).

Several factors intermingle to reduce agricultural productivity in soil depleted land. First, erosion is a cumulative process. As topsoil washes away, the subsoil is exposed and has less absorptive capacity. Less water and nutrients are available which reduces plant coverage. The unstable cycle quickly reduces yields, often leading to heavier use of the degraded soil. The principal technique for combating soil erosion is adequate moisture management. Mulching, manuring, low tillage, contour cultivation and agroforestry reduce run-off, sediment loss and retain nutrients. Water-carrying capacity of soil is enhanced by plants and especially trees that protect the soil from flooding,

the most damaging mechanism by which soil is eroded. Deforestation and soil degradation are therefore closely linked. Droughts reduce the moisture in soil causing erosion, but erosion increases damage caused by droughts.

Country studies extrapolating from plot samples conclude that gross soil loss can significantly affect overall GDP growth. The cost of soil loss can be (under) estimated by the costs of replacing the equivalent amount of nutrients, nitrogen, phosphorus and potassium. In Costa Rica, the replacement costs of annual soil loss were between 6 and 13% of GDP from 1970–89 (World Resources Institute, 1991). The World Bank reports estimates ranging from a loss of 0.5–1.5% of GDP annually for Costa Rica, Malawi, Mali and Mexico (World Bank, 1992, p. 56).<sup>6</sup> Despite Bank worries that the effects of soil erosion on aggregate agricultural productivity are over estimated due to an "asset redistribution" effect (soil blows or washes off the land of one farmer onto the land of another), soil erosion can be of significance for countries with complex patterns of agricultural holdings such as exposed plains bounded by water or jungle, as in Nicaragua.

Table 7 provides a crop-region breakdown of the effects of soil erosion. Losses of topsoil and consequent productivity decline are shown for the principal export and food crops for 1981–90. Nicaragua is divided into six administrative regions and three special zones. The latter comprise the agricultural frontier along the Atlantic Coast which, as noted above, is of insignificant agricultural value. Regional data are aggregated into two areas, the Central Highlands and the coastal Pacific plain. The greatest loss in productivity naturally occurs in crops with significant erosion losses. Note first that food crops are more erosive than exports, and even more so when food is grown in the highlands with rudimentary techniques. Severe degradation was suffered in beans and maize due to upslope cultivation practices and the annual nature of the crop. In general, annuals are more erosive than perennials, since the latter cover the ground continuously. Annuals grown using technically retarded methods are typically the worst; rice, for example, is produced using advanced means and erosion is moderate.

Cotton and coffee experience medium losses. For cotton, large producers have managed erosion better than small and much of the erosion had taken place previously. Cotton production is most devastating to the land when inexperienced producers cultivate small plots. They lack the resources to protect against long-term soil depletion and intensive environmental decay is the result.

As a perennial crop, coffee trees offer the best soil protection, for the reasons cited above (although coffee processing can be very damaging to water quality). Moreover, coffee is cultivated across the social spec-

Table 7. *Effects of soil erosion 1981-90*

Crop	Average annual erosion (tons per hectare)		Nicaragua	Loss in productivity (%)		
	Central Highlands*	Pacific Coast		Central Highlands*	Pacific Coast	Nicaragua
Export						
Cotton	nc†	109	109	nc	1.1	1.1
Coffee	93	88	92	1.2	1.1	1.1
Sugar	97	37	38	0.9	0.4	0.4
Sesame	nc	145	145	nc	1.5	1.5
Food						
Tobacco	63	87	71	0.7	1.1	1.1
Beans	119	101	115	2.0	1.7	1.7
Maize	132	102	125	1.8	1.2	1.2
Rice	29	40	35	0.5	1.1	1.1
Sorghum	121	95	100	1.4	1.0	1.0
Pasture	151	93	122	1.7	1.2	1.2

\*Central Highlands = regions I, V and VI; Pacific Coast = regions II, III, IV.

†nc = not cultivated.

Source: Adapted from De Franco *et al.* (1993).

trum, with the widest mix of small, medium and large producers. Consequently, it was the export crop most encouraged by Sandinista agricultural policy. Sesame is grown by small and medium producers on land inherited from cotton producers, which is already significantly eroded. Pasture erodes due to overgrazing.

Soil erosion is essentially negative technological change. It can be modeled as such, as is done for Nicaragua in the computable general equilibrium framework (CGE) presented by De Franco *et al.* (1993). They find that after 10 years, GDP is reduced by 7% compared with a baseline projection without productivity loss due to soil erosion. The closure of the CGE model is neoclassical with savings driving investment and fixed government expenditure. Hardest hit is output of those crops shown in Table 7 with the highest degree of "soil capital" depreciation. In the neoclassical framework, lower output leads to higher prices for food crops. Low demand elasticities imply that the distribution of income moves in favor of smallholders due to the effect of erosion on supply.<sup>7</sup>

### (c) *Macroeconomic feedbacks of environmental decay*

Can it be concluded that intensive and extensive depreciation are linked to the three gaps as revealed through decomposition analysis? Roughly speaking, it may be said that extensive decay is more closely associated with the investment and foreign exchange gaps, while intensive decline is linked to the savings gap. While any binding constraint will ultimately reduce growth and thus extensive damage, processes operated by the poor are less intensive in foreign

exchange and more dependent on credit. Moreover, the constraint on small and medium agricultural producers is rarely the inducement to invest; their financial surpluses are typically negative. This suggests that when the savings constraint binds at the macroeconomic level, the associated environmental costs are likely to be intensive rather than extensive.

With this distinction in mind we return to the periodization of the decomposition exercise to examine the environmental consequences of external shocks, burden of debt and macroeconomic policies. In the first five years of Sandinista rule, the principal causes of environmental damage were more extensive than intensive. There was growth with some redistribution through the social wage, an agrarian reform and the formation of state agricultural farms along with service and production cooperatives. The pressure on delicate ecosystems was lessened by the Sandinistas' effort to bring small and medium-sized farmers up to minimum technological levels. The mechanisms were credit and foreign exchange allocation. For a time, yields increased and the pressure on the forests and the agricultural frontier abated. Conversely, large farmers were threatened with expropriation and foreign exchange was withheld. Policies of the first Sandinista period were disastrous for exports and debt accumulation, but probably reduced the rate of environmental destruction, both intensively and extensively.

Economy-wide collapse and hyperinflation in the second semester of Sandinista rule reduced extensive damage to the economy. The effect could not have been large, however, since the growth in the first five years after the revolution was already stunted. Intensive decay, on the other hand, began to accelerate as the foreign exchange constraint tightened and the

Sandinistas dismantled the parastatals. Still, credit continued to flow into the countryside and the public sector was a repository of vast amounts of labor, soon to be unemployed due to stabilization and structural adjustment policies. These two factors helped stem the intensive destruction. On the other hand, the decline in public sector investment most certainly increased ground and surface water contamination through lack of maintenance, coverage and control of sources of emission.

By stressing the modernization of the subsistence sector, the Sandinistas inadvertently supported a greener strategy than had been known previously in Nicaragua. Large export producers, the most environmentally damaging, were encouraged to produce food for the local market by an extreme anti-export bias. On the other hand, small and medium-sized producers were encouraged to produce export crops, principally coffee, and basic grain technologies used by the smallest farmers were improved. This combination of policies minimized both extensive and intensive decay under the Sandinistas.

Under the Sandinistas, the traditional centers of political power and prestige, the old agricultural elite temporarily lost their influence but have now returned with the ascendancy of UNO. The critical debt problem insures that the government will encourage large producers, by any means possible, to produce for the export market. For the moment, cotton appears to be less important but overuse of fertilizers and pesticides with harmful consequences for run-off and ground water have also been associated with technically sophisticated coffee production. The same applies to sesame cultivation and it is likely that the next wave of "nontraditional exports"; shrimp mariculture and melons, will experience similar difficulties. Moreover, there will be little room in the public sector budget for policy that helps small and medium-sized producers to move up to more sophisticated, conservation oriented, techniques. As has been seen above, the savings gap binds most tightly these individuals.

#### 4. CONCLUSIONS

Nicaragua's environmental problems are directly linked to macroeconomic policy, now more than ever.

The problem of foreign debt overshadows any other and the principle conclusion of this paper is that unless a substantial fraction debt is pardoned, there will be serious environmental deterioration, both intensive and extensive. Whether debt relief will be forthcoming hinges on continued progress toward "sound and responsible" fiscal management on the part of the Nicaraguan authorities. Unfortunately, responsible fiscal management in Nicaragua most probably means accelerated environmental deterioration since currency policy makers equate resource management with privatization. Moreover, as the experience of China suggests, even rapid growth and comprehensive policy do not guarantee compliance (Amsden *et al.*, 1996).

Stabilization policy has required that the savings gap, as defined by Taylor (1991), become more binding. The principal mechanism is credit allocation. The Sandinistas reallocated credit from large to small and medium producers, but when the economy had to be stabilized, credit flows were cut, despite their relatively better recovery rates. Now many smallholders affected by the agrarian reform have not yet been fully titled and without clear titles cannot even apply for loans, effectively red-lined. Large, established producers, on the other hand, always depended upon imported intermediaries and trusted supply and marketing channels and these have not been easily restarted under Chamorro.

A second link to debt is through the degree of activism of the state. Compliant to every demand of conditionality, Chamorro has dramatically reduced public sector participation in the Nicaraguan economy. As in Turkey, market-based environmental policy, consistent with neoliberal reforms of the late 1980s and 90s, will be favored (Boratav *et al.*, 1996). But reversing soil erosion, for example, requires watershed management at the regional, or for Nicaragua, national level. Land husbandry by individual farmers cannot entirely solve the problem and must be assisted by programs which will ultimately be attacked as contributing to higher fiscal deficits. As long as the ratio of the fiscal deficit to GDP is seen as the principal indicator of adherence to the principals of neoliberalism imposed on Nicaragua by its international creditors, the environment will remain at risk.

#### NOTES

1. No assessment has been made here on the effects of Nicaraguan growth on macroecological variables; suffice it to say that a country with five elevators is no more likely to be a threat to global warming than it was to US national security in the days of the Contras.

2. See Table 1. Note that in 1988, investment as a share of GDP rose above 25% due to the fall in the GDP by more than

12%. A second factor is the tied aid from the former socialist countries.

3. Ocampo (1991) makes the point that much of defense expenditure before 1990 was off budget.

4. Ocampo calculates that given a month's lag in collections, the 1984 share of government revenue in GDP,

35.2%, would have fallen to 29.1% in 1987 and 22.4% in 1988, due to the effect of inflation alone (Ocampo, 1992, p. 13).

5. Reserve accumulation has never been an issue.

6. These are onsite losses only; no attempt is made to estimate the negative externalities associated with offsite damage to irrigation systems, silting of waterways or damage to fish populations.

7. *Campesinos* benefit from the rising prices due to higher land rents, but among them are individuals who lose since total labor demand in agricultural sectors is reduced due to falling output levels. The total effect for the rural population is a resultant of these two forces (from private communication of the authors of De Franco *et al.*, 1993).

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