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AGRICULTURAL SECTOR ASSESSMENT

FOR

ST. KITTS/NEVIS

By

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I. EXECUTIVE SUMMARY

St. Kitts/Nevis (SKN) has undergone important changes during the past couple of decades similar to those experienced in other nearby islands. The most important adjustment has been the decline of the sugar industry caused by changes in international markets. The drop in profitability of sugar has driven out private capital and has forced the government into an active land ownership and management role. Associated with the change in the sugar industry has been a significant reallocation of labor out of sugar into construction, manufacturing, tourism and services on and off the islands. Increases in labor demand in these activities have drawn labor out of sugar and encouraged a shift in work preferences away from the sugar estates.

SKN has several current distinctive economic features. These include its very small size, government control of most of the best agricultural land, its continued primary reliance on the sugar industry, relatively large amounts of remittances and foreign aid, slow growth in tourism and manufacturing, and continued heavy dependence on agriculture for foreign exchange and employment. Also, despite large amounts of experimentation and investment in agricultural diversification, SKN has made little headway the past 20 years in lessening its sugar dependency. Food imports are mounting, outmigration continues to bleed the country of human capital, and the sugar industry is encountering crises

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with increasing frequency. Not only is SKN losing the ability to feed itself, but it is also stalled in efforts to use its ample land and labor resources as a major contributor to economic development. Clearly, significant changes are needed in SKN's agricultural development policy. Doing more of the same things that have been tried the past 20 years will not be sufficient to resolve SKN's agricultural woes. Other ways must be found to more productively combine SKN's underutilized land and labor resources.

What should SKN's agricultural sector look like in 20 years? Without some unforseen change, the sugar industry in SKN will likely continue to shrink. Developing more flexibility in agricultural production, replacing a significant part of the current food imports, and substantially expanding a variety of agricultural exports ought to be major objectives that guide agricultural development policy over the next few years. This will require reducing the amount of land, labor, and public subsidies that currently go into sugar production. Developing land and labor management arrangements that are more responsive to changes in prices and investment opportunities will play a key role in creating a more supple system.

The range of alternatives that USAID might consider to help the SKN government stimulate agricultural development are limited by the small size of the SKN economy and the relatively large number of donor assisted projects in the

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country. Water management is a constraint, but the Canadians are well along in efforts to help SKN on these problems. There are problems in agricultural planning and policy, but UNDP has a three member team in the country working on these topics. The sugar industry is again facing major problems, but the British have been heavily involved in this in the past and are planning another major evaluation of the sugar industry in the near future. The British, along with the Taiwanese, continue to give the government major assistance in irrigation, intensive crop production, and farmer training. The British have also bee intensively involved in helping SKN upgrade the quality of their livestock and dairy herds. Several outside agencies have provided assistance to the fishing industry. In addition, prior AID regional efforts in research, extension, and farming systems have attempted to extend these services to farmers. The SKN Department of Agriculture, along with technicians in the National Agricultural Corporation (NACO), have been experimenting with most of the major enterprises that might be involved in substantial diversification of agricultural production on the two islands.

In spite of these efforts to promote agricultural development there has been very little supply response, and very little progress is being made in growing products that will substitute for food imports and expand agricultural exports. We conclude that a major reason for this lack of

vitality in SKN's agricultural sector is a faulty land tenure system. Land and labor are poorly utilized. Much more intensive use of labor and land would occur if individuals or groups of individuals have more widespread and secure access to government controlled land. Tenure is the key constraint to restructuring of the islands' agriculture and facilitating the transfer of some labor out of agriculture, while encouraging the modernization and diversification of farming for those that stay behind. We therefore recommend that AID develop a project that assists several hundred people over the next 5 years to become farm operators, through land purchase arrangements or long term land leases, on land that is currently government controlled.

II. AGRICULTURAL SECTOR PERFORMANCE, CONSTRAINTS AND PROSPECTS

A. Overview of the Economy and Agriculture

There have been only modest changes in the SKN economy since the comprehensive 1979 World Bank report. (Those interested in the performance of the economy during the 1970s may refer to that document.) Recent fragmentary information suggests that the SKN economy has grown little the past 4 years and probably suffered a decline with the sag in the sugar industry in 1983. The Caribbean Development Bank reports an annual growth rate of Gross Domestic Product (GDP) in SKN for 1979-81 of only .4 percent (p.25). It is unlikely that the GDP per capita has changed much from the $1,062 U.S. reported in 1981. External loans and grants, government deficits, and substantial amounts of remittances may have propped up these incomes in spite of a decline in the overall economy the past two years.

While agriculture only contributes about one-quarter of the GDP, it continues to be the predominant economic sector. Manufacturing contributes 7 percent to GDP, and construction a bit over 8 percent. A large percentage of the 45 thousand plus people who live on SKN depend directly or indirectly on agricultural activities for their livelihood. Of the 17 thousand people in the workforce, more than one-quarter of them are full or part-time employees of the state owned sugar industry. Even with a recent temporary spurt in

construct employment, the slow growth in both the manufacturing sector and in the tourist industry mean that young people must either leave the islands, or find employment in agriculture.

Because the Eastern Caribbean Currency is tied to the dollar, rates of inflation in SKN are essentially an echo of price changes in the U.S. Through 1981, inflation was double digit, but the past two years inflation probably declined to the 5-6 percent range.

We were unable to obtain current figures on imports, exports, and balance of payments. It is likely, however, that the value of imports continues to substantially exceed the value of exports and that the country is experiencing large balance of payments deficits. SKN runs a relatively open economy with mild restrictions on imports. The large number of new cars on the streets of SKN indicate that the approximately 50 percent duty applied to imports of new cars in only a modest discouragement to their purchase.

A feature of the SKN economy that has changed since the World Bank report is internal taxes. Outside agencies had argued that the sharply progressive income tax in force in the late 1970s was a major disincentive for enterprise on the islands. When the current government came to power in 1980, it abolished the personal income tax and also granted very substantial pay raises to most government employees, including those in the sugar industry. Again, we could not

obtain up to date figures on government deficits, but is is likely that these have increased substantially over the past several years as a result of these changes in fiscal policy.

SKN's agriculture is only a few years removed from being a plantation. While the plantation owners have left, the legacy of sugarcane monoculture continues to stalk the slopes of these two picturesque islands. "Plantationism" permeates the economy. It is manifest in the land use -- heavily concentrated in state control; in the places people live -- around the fringes of the large estates; in the transportation system -- largely set up to service the sugar industry; and in the lack of social sanctions against helping oneself to estate products -- widespread praedial larceny. Heavy reliance on foreign aid to fund development activities is an additional sign of the dependency ingrained in plantationism. Since government controls three-quarters or more of the best land, SKN provides few opportunities for individual agricultural enterprise. The disappointing results from crop diversification efforts on government controlled estates in the past strongly suggest that a large measure of self-sufficiency in food and more dynamic food exports will be virtually impossible until more latitude is allowed for other ways of managing land and labor. Government industries have been too inflexible to provide the agility needed to develop a diverse and dynamic agricultural sector in SKN.

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While it is easy to be pessimistic about SKN's past economic development, there are some encouraging signs. The numerous ruins of sugar mills around the two islands are vivid reminders that the economy has and is changing, though often slowly and painfully for some. Improved breeds of cattle now graze on some land diverted from sugarcane the past thirty years. Some fruit trees, coffee, and other miscellaneous crops have edged onto land around cane fields. A surprisingly large number of new crops and livestock breeds have been introduced to the islands during the past several years. (One has to be disappointed, however, that more of these "pilot projects" have not taken off into large-scale production). Other encouraging signs are that local people now make economic decisions previously made by expatriates, economic activities on Nevis are substantially different now than 20 years ago, and SKN has a significant number of reasonably well-trained agricultural technicians. Unlike many other less developed countries, SKN also has some excellent agricultural land.

People are adequately dressed and have acceptable housing in most rural areas, and there is an absence of the grinding poverty that is common in other low income countries. Substantial income transfers to workers via large deficits in the government owned sugar industry, relatively large amounts of foreign aid, and large amounts of

remittances allow people to live better, at least for a time, than current local production can support.

In spite of special quotas that allow SKN to export 30 thousand tons of sugar at preferential prices, the sugar industry is facing another major crisis in 1983. Rapidly mounting debt, a large underutilized labor force in the sugar industry, sharp declines in the production of sugar, and the inability to harvest all of the cane each year are signs of a troubled industry. The sugar industry utilizes virtually all of the highest quality land on St. Kitts. It supports a large part of the country's labor force, in part by borrowing from the national bank. Its activities tie up a large part of the best trained agricultural technicians on the islands, and its downturn is a major drag on the economy.

B. Subsector Reviews

1. The Sugar Industry

The sugar industry in SKN has been on an irregular path of decline since the Second World War. In the 1950s, about 50,000 tons of sugar were produced on 15,400 acres in St. Kitts and 1,200 acres in Nevis. The acreage harvested slipped to about 13,000 over most of the 1960s, while tonnage per acre steadily fell, resulting in only 35,000 tons being produced in 1968. The cane/sugar conversion ratio remained stable at around 8.6 over this period. Troubled by the decline, the government, starting in 1965, commissioned

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a series of studies of the industry. Each study recommended centralized organization of the forty odd estates, but the estate owners were unable to make arrangements for such control. The acreage harvested continued to fall, reaching a low of 8,500 in 1975, producing only 25,000 tons of sugar.

In 1972 the growers were heavily in debt and their main creditors refused to extend further credit, offering instead to lend the government EC$3.6 million to reorganize and rehabilitate the industry over a three year period under the Sugar Industry Rescue Operation (SIRO). The sugar lands were substantially rehabilitated with more than 9,000 acres being replanted in 1972-75. As can be noted in Table 1, the amount of sugar produced during that period was low at about 25 thousand tons because SIRO exercised no control over workers (estate owners retained control), and there were four years of drought. The estate owners, meanwhile, offered to sell their land but at prices unacceptable to the government. The government then asked an independent tribunal to establish a fair price and proceeded in early 1975 to acquire the estate land, buildings and equipment by decree. A compensation of EC$10 million was to be paid through a sugar tax (set at EC$1.20/ton in 1975) on exports, with part of the payment to be made to the owners in cash and part in bonds. Of the 22,000 acres acquired, 11,000 were in sugar. A government corporation, the National Agricultural

TABLE 1: SUGAR AND MOLASSES PRODUCTION AND EXPORT, ST. KITTS/NEVIS, 1970-1983

Year	Cane Ground 000 Tons	Sugar Made 000 Tons	Yield (Cane/ Sugar)	Acreage		Mean Rainfall Inches	Tons Per Acre		Avg Sugar Price Per Ton Exported US$	Sugar		Molasses	
				Cultivated	Harvested		Cane	Sugar		000 Tons	000$US*	000 Gals	000$US*
1970	326	27	12.0	12,487	9,704	81	34	2.8	130	22	2,836	1,992	231
1971	272	25	10.7	11,818	9,763	47	28	2.6	138	18	2,480	1,594	181
1972	243	27	9.2	10,809	10,539	54	23	2.5	155	24	3,720	990	124
1973	211	24	8.8	9,693	8,606	41	24	2.8	150	20	2.996	1,291	362
1974	217	26	8.3	8,914	8,974	61	24	2.9	265	23	6.)	238	132
1975	216	25	8.6	9,237	8,525	49	24	2.9	574	22	12,62 '	1,644	526
1976	321	36	9.0	10,755	9,800	54	33	3.7	329	31	10,205	998	256
1977	352	41	8.6	12,000	11,140	45	31	3.7	247	38	9,367	1,480	356
1978	362	39	9.2	12,000	10,933	57	33	3.6	318	37	11,762	1,653	161
1979	384	40	9.7	11,269	9.453	80	41	4.2	305	37	11,304	1,412	324
1980	352	35	10.1	11,790	10,445	44	34	3.3	450	32	14,398	1,821	470
1981	338	32	10.6	10,187	10,027	69	34	3.2	475	30	14,399	NA	499
1982	350	36	9.7	10,317	9,948	NA	35	3.6	364	34	12,364	NA	328
1983	276	28	9.8	10,680	10,159	NA	28	2.8	NA	NA	NA	NA	NA

Source: Statistical Office, Planning Unit, Premier's Ministry, Annual Digest of Statistics for 1980, Basseterre: Government of St. Christopher/Nevis, July 1982; and other unpublished information on file in the Planning Unit and in the National Agricultural Corporation (NACO).

* From 1965 to July 1976 the East Caribbean dollar was tied to the Sterling Pound at the rate of L1.00 = EC$4.8. In July 1976 the link with Sterling was broken and the East Caribbean dollar was aligned with the U.S. dollar at US1.00 = EC$2.70. In 1970 1L = US$2.40, In 1971 1L = US$2.44, In 1972 1L = US$2.50; In 1973 1L = US$2.45, In 1974 1L = US$2.34, In 1975 1L = US$2.02, and In 1976 1L = US$1.70.

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Corporation (NACO) was set up to manage the estates and to sell the cane to a government owned sugar processing plant.

The economic situation for sugar in 1975 was favorable. The price received in SKN per ton of sugar nearly quadrupled in two years (Table 1). Yields also increased because of cane replanting. Cultivation was mechanized, with fertilization and some weeding done by hand. Harvesting was by hand but there were good prospects for development of a mechanical harvester suitable for the light soils of St. Kitts. Loading was mechanical with push-pile type tractors. Wage rates were substantially lower in SKN than in Barbados, although total costs of production per acre were about the same.

The SKN sugar acreage increased to 12,000 acres in 1977 and sugar production rose to 41,000 tons. The price received per ton, however, fell back substantially from $574 U.S. in 1975 to $247 U.S. in 1977. Nevertheless, sugar production was maintained at around 40,000 tons until 1979, in spite of some decrease in harvested acreage. Smut struck the island's most promising commercial variety of cane (HJ 57/41) in 1979. In response, about a third of the cane area was replanted in 1980 to resistant varieties and again in 1981. The successor varieties are lower yielding in both cane tonnage per acre and sugar production per ton of cane. The best current variety is B49-136. A persistent problem

is that not all cane has been harvested because of management and labor problems. In 1983 about 300 acres of cane were not harvested.

A brief financial analysis shows the serious situation currently faced by the sugar industry. The proceeds of sugar and molasses sales are directed to three institutions: the government, NACO, and the St. Kitts Sugar Manufacturing Company (SSMC, another state corporation). As NACO and SSMC costs have increased, especially labor costs, their share of the proceeds have not covered costs. Meanwhile, the government has attempted to retain its claim on the proceeds through export taxes, sugar levies, sugar taxes, and income taxes. Table 2 shows how the three claimants have fared during 1978-82. Since NACO and SSMC are government owned, their profits and losses are, in fact, government profits or losses and can be added to government proceeds from levies and taxes to calculate the total gross proceeds or losses to the government attributable to the sugar industry. Government costs of servicing and managing the industry, outside of those incurred by NACO and SSMC, are not included in the calculation. The gross proceeds from 1978 to 1981 were positive but decreasing, falling from $4 million U.S. to $18 thousand U.S. over that period. In 1982, however, a real loss of more than $3 million U.S. was incurred by the industry. In spite of stagnant revenues, costs have not been contained. Comparing 1982 with 1978, revenues were 4%

TABLE 2: GROSS GOVERNMENT GAIN OR LOSS FROM THE SUGAR INDUSTRY, 1978-1982

	ITEM	YEAR 1978	1979	1980	1981	1982
				- (000 US$) -		
1.	Gross Receipts, Sugar and Molasses	12,196	11,804	14,388	15,121	12,719
2.	Direct Proceeds to Government: Levies and Taxes	3,333	2,931	4,725	5,864	745
3.	Proceeds to NACO	4,658	4,661	5.033	4,783	6,323
4.	Less NACO costs	5,034	6,519	6,766	8,840	9,941
5.	SUBTOTAL-Net Profit/(Loss)	(376)	(1,858)	(1,733)	(4,057)	(3,168)
6.	Proceeds to SSMC	4,205	4,213	4,630	4,471	5,651
7.	Less costs	3,154	3,343	4,409	6,262	6,414
8.	Less Government Taxes	618	436	-	-	-
9.	SUBTOTAL-Net Profit/(Loss)	433	433	221	(1,791)	(763)
	Total Gross (Loss)/Proceeds to Government: Direct Proceeds Plus (Minus) NACO and SSMC Profit (Loss)	4,008	1,942	3,213	18	(3,186)

Sources: St. Kitts Manufacturing Co. (SSMC), "Annual Accounts," 1978-1982, Basseterre, various years. Peat, Marwick & Mitchell (PMM), Annual Auditors Reports, 1977-1982, Basseterre, various years.

Notes: Lines 1,2,3,9 were taken from Schedules 30, 17, 9 and 2, respectively, of the SSMC accounts. Lines 4 and 5 came from PMM accounts. Food crop sales, net of direct costs, are excluded from NACO totals. NACO and SSMC costs are calculated residuals. SSMC figures are for a Sept. 1 - Aug. 31 year, while NACO figures are for the calendar year. Tax deductions were reserved in the accounts, but may or may not have been paid. See Table 1 for exchange rates used to convert local currency to U.S. dollar values.

higher, but NACO costs were 89% higher and SSMC costs were 103% higher. This is mainly the result of very large wage increases.

The current problems of the sugar industry are particularly disturbing since they are very similar to the difficulties faced about 10 years ago when sugar production was consolidated, the industry recapitalized, and government began to operate the entire industry. Sugar has become a brake rather than an accelerator for the economy. Not only has the government an outstanding debt to the land-owners that is something between six and eight million U.S., but NACO has an even much larger outstanding balance in loan from the National Bank used to cover losses. The latest published figure listed these loans at about $12 million U.S., but these outstanding amounts may have climbed to closer $15 to $18 million U.S. during this past year.

The government of SKN has requested the assistance of the British Government to again do an evaluation of the sugar industry similar to the rescue effort mounted in the early 1970s. This assessment is scheduled to start soon, but it is hard to see how its results could recommend anything other than additional contraction of the sugar industry. Unless something unforeseen happens, changes in consumer tastes, rapid increases in the use of corn non-sugar sweeteners, and increasing labor costs on SKN will

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make it very difficult for the sugar industry to sustain itself, let alone grow.

2. Crops

Numerous crops, including fruits and vegetables, are grown on SKN. There has been a surprisingly large amount of experimentation with various crops over the past several decades. Comprehensive data on trends in crop production and yields are not available, but there is no clear cut evidence of any sustained significant growth in any crop output in SKN. Production of several crops has been erratic. In the case of sea island cotton, for example, production fell from a high of 156,000 pounds in 1976 to 8,000 pounds in 1980, then rebounded to 80,000 pounds in 1981. Production of peanuts, tomatoes, cabbage, and copra have gone through similar swings.

Some of the more important non-sugar crops are starches. Table 3 provides data on area and production of these crops in 1981. Cereal and starchy crops are grown fo local consumption and sale in the local market. The two most important oil seed crops are peanuts and coconuts. Most of the peanuts are consumed locally, while coconuts are largely exported due to the lack of commercial copra processing equipment on the islands. There has been some expansion in production of peanuts since 1975 due to the promotional efforts of the government, but production levels

TABLE 3: CROP AREA, PRODUCTION AND YIELD PER ACRE, 1981

CROPS	AREA IN ACRES	PRODUCTION IN 000 POUNDS	POUNDS PER ACRE
Cereals			
Maize (corn)	35	20	571
Starchy Crops			
Sweet Potatoes	376	1,129	3,003
Yams	84	200	2,381
Tannia, Dasheen, Eddoes	90	270	3,000
Cassava	90	200	2,222
Breadfruit	NA	98	NA
White Potatoes	1	2	2,000
TOTAL	641	1,899	
Oil Seed Crops			
Peanuts	556	568	1,022
Coconuts	800	1,920	2,400
TOTAL	1,356	2,488	

Source: Planning Office, Ministry of Finance St. Kitts/Nevis, "Agriculture (Ex-Sugar)," Unpublished paper prepared by the Planning Office, Basseterre, 1983.

are still likely less than realized in the late 1960s and early 1970s.

Tomatoes, pumpkins, cowpeas, pigeon peas, and cabbage are the most important vegetables in terms of crop area (Table 4). NACO produces vegetables on its land, and farmers, particularly in Nevis, rent some government land for home and commercial vegetable production. Small British and Taiwanese projects are underway to promote vegetable production. The Planning Office argues that production of vegetables should be expanded to about 500 acres to meet the needs of the country. Large amounts of onions, cabbages, tomatoes and carrots are imported. There has been a decline in local production of these goods recently. Limited local cold storage is claimed as a factor in explaining this decline.

Table 5 provides a comparison between yields in the U.S. and SKN for selected vegetables. Generally, SKN yields are low and a wide margin exists for improvement. Vegetables must be sprayed with moneb or dithane to control fungus diseases. Drip irrigation has been tried with cucumbers and tomatoes with excellent success but costs are high.

Mangoes and bananas are the two most important fruit crops, followed by pineapples and oranges (Table 6). The Planning Office reports a substantial expansion in all four of these crops since 1975, but there was a decline in production of grapefruits, avocados, and limes. Oranges,

TABLE 4: AREA AND PRODUCTION IN VEGETABLE CROPS, 1981

CROP	AREA IN ACRES	PRODUCTION IN 000 LBS.
Tomato	35	140
Onions	1	4
Carrots	15	20
Cabbage	20	57
Cauliflower	12	21
Eggplant	19	60
Sweet Pepper	14	14
Watermelon	3	12
Pumpkins	28	104
Cucumbers	13	56
String Beans	8	8
Lima Beans	4	4
Cowpeas	32	32
Pigeon Beans	20	20
TOTAL	224	552

Source: Planning Office, Ministry of Finance, "Agriculture (Ex-Sugar)," Unpublished paper prepared by the Planning Office, Basseterre, 1983.

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TABLE 5: VEGETABLE YIELDS IN ST. KITTS AND THE UNITED STATES

VEGETABLE	AVERAGE YIELDS IN LBS/ACRE	
	ST. KITTS[1]/ 1981	U.S.[2]/
Tomatoes	4,000	20,000
Onion	4,000	18,000
Carrots	1,333	27,000
Cauliflower	1,750	15,540
Eggplant	3,158	9,900
Pepper - Sweet	4,000	6,125
Watermelon	4,000	7,000
Cucumber	4,308	7,440
Snap Beans	1,000	3,300

1/ Planning Office, Ministry of Finance, "Agriculture (Ex-Sugar)," Unpublished paper by the Planning Office, Basseterre, 1983.

2/ James E. Knott, "Handbook for Vegetable Growers," 1962.

TABLE 6: AREA, PRODUCTION AND YIELD IN FRUIT CROPS, 1981

CROPS	AREA (ACRES)	PRODUCTION 000 LBS.	YIELD IN LBS. PER ACRE
Papaya	5	20	4,000
Banana	89	405	4,551
Pineapples	25	56	2,240
Oranges	32	56	1,750
Avocado	12	20	1,667
Mangoes	309	1,077	3,485
Lime	10	9	900
TOTAL	482	1,643	

Source: Planning Office, Ministry of Finance, "Agriculture (Ex-Sugar)," Unpublished paper by the Planning Office, Basseterre, 1983.

grapefruits, and limes represent important imported fruits. Some bananas are also exported.

Sea island cotton production is concentrated on Nevis. Table 7 shows cotton production from 1972-73 to 1982-83. As with several other SKN crops, area and yields have experienced wide year-to-year variations. The 1975-76 crop was largest in both area and production with over 500 acres and 150 thousand pounds produced. In the past few years, about 200 acres have been planted to cotton each year yielding 50-75 thousand pounds. Lowery notes that infestations of pink ballworm were high in 1981-82 resulting in low yields; however, only a small percentage of producers used government spraying services even though spraying appears to be highly cost effective. Fertilizer use is also limited but may be much less valuable as a practice until farmers make more effective use of spraying. The government has produced 25 to 60 hectares of cotton per year and, although average yield differences are noted between farmers and the government, there appear to be no systematic differences. Most farmers grow half an acre or less. The cotton is shipped to Barbados for processing and exported to the Japanese who have agreed to buy all the cotton produced at very favorable prices.

Mr. John Spence, a retired cotton agronomist, did a study in 1983 of cotton produced on Nevis (CARDI). He reported the following constraints to cotton production:

TABLE 7: COTTON PRODUCTION: AREA AND YIELD IN NEVIS, 1972-83

YEAR	AREA (ACRES)	SEED COTTON 000 LBS.	YIELD IN LBS. PER ACRE
72-73	172	49	283
73-74	197	72	363
74-75	248	95	384
75-76	523	157	300
76-77	315	71	224
77-78	205	45	218
78-79	72	13	183
79-80	38	8	212
80-81	183	75	411
81-82	235	52	224
82-83	188	55	294

Source: J.E. Lowery, "Cotton Production - Nevis," Unpublished report prepared by the Caribbean Agricultural Research and Development Institute, Charlestown, Nevis, December 1982.

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(1) The cotton crop suffers severely from stray livestock.

(2) The seed material supplied to farmers had poor germination and there seemed to be varietal contamination.

(3) Pest damage.

(4) There is only one buying point.

(5) Timely land preparation

(6) Weed control.

(7) Insufficient extension service and,

(8) Lack of land for rent in some areas.

The Government proposed the following actions to encourage increased production: the Government will pay at least EC $2.00 per pound for seed cotton, cotton land will be plowed and ridged for EC $45.00 per acre, ammonia sulphate fertilizer will be supplied at EC $20.00 per acre, the Government will supply an insect control service to those farmers requesting it at half its cost, and the Government will make credit available for weed control.

Mr. Spence made the following recommendation to improve cotton production:

(1) Seed issued for planting should be pure with a germination capacity of over 80%.

(2) The ginnery should be improved.

(3) A full-time cotton office is needed with permanent employees.

(4) Safe pesticides and fertilizers are needed at all times.

(5) Accurate rainfall records are essential.

(6) Research is needed on weed control such as mulching, intercropping with legumes, use of herbicide and inter-row cultivation.

(7) Research on pest control, and

(8) Research on fertilizer trials are required.

Peanuts could be a more important crop on SKN. The most popular variety of peanuts is Tennessee Red which matures in three months, yields of which have attained up to 2,400 pounds per acreage but 1,100 pounds is more common. The price of peanuts is EC $1.80 to EC $3.00 per pound but the farmers usually receive EC $1.20 per pound. Most of the peanuts are exported to Barbados.

Typically, NACO workers prepare the land and plant the peanuts. They also apply a pre-emergence herbicide and spray to control the insects. The farmers dig the peanuts and remove the pods from the vines before they dry them. The peanuts are sold to the Government and the cost of land preparation and spraying is deducted from the price farmers receive for their peanuts.

The Department of Agriculture has a 32 acre Extension Project on peanuts with 25 farmers.

The yield of peanuts for the last few years are as follows:

Crop Year	Yield Pounds Per Acre
1975-'76	300
1976-'77	140
1977-'78	136
1978-'79	292
1979-'80	420
1980-'81	345

On the island of Nevis, CARDI research scientists had intercropping trials with cotton, single and double row peanuts, corn and cowpeas. It was possible to increase the base income of EC $1,998 (pure cotton) by 55%, 41%, 25% and 15% respectively. The income from the intercrops improved the farm cash flow as this was available after 3 or 4 months of planting. It also reduced the demand on labor for weeding the cotton.

3. Livestock

The livestock industry has declined in recent years. Several decades ago, before mechanization, sugarcane plantations maintained a large number of work animals that also supplied SKN with meat. The most recent data on livestock population are reported in Table 8. Small ruminants are the most numerous followed by cattle and pigs. In spite of Nevis's small size, livestock are important there due to the elimination of sugarcane on the island several decades ago, outcropping of rocks in some areas, less rainfall than on St. Kitts, and the predominance of small-farm holdings on Nevis.

TABLE 8: LIVESTOCK POPULATION ON ST. KITTS/NEVIS, 1975

TYPE	NUMBER		
	ST. KITTS	NEVIS	TOTAL
Cattle	2,078	2,418	4,496
Sheep	3,606	7,687	11,293
Goats	1,705	5,869	7,574
Pigs	1,666	1,903	3,569
Farms with Poultry	290	295	585

Source: Government of St. Kitts/Nevis, 1975 Census of Agriculture, Basseterre, 1975.

Over the past 20 years there has been substantial emphasis on improving livestock production. The British and others helped develop one quality dairy herd on St. Kitts, and two livestock breeding ranches on Nevis. These herds were to supply improved stock for local producers and high grade bred heifers for other countries in the Caribbean. Artificial insemination is available but is not extensively used.

In addition to government herds, many farmers raise a few head of livestock. Animals frequently graze on communal pastures on government estates, along roadways, and along the edge of cane fields. Several private estates on St. Kitts and a number of small and medium sized farms run cattle on their own land.

Currently, diseases represent a major management problem. A recent outbreak of dermatophosis, a bacterial skin disease transmitted by ticks, forced the liquidation of almost one-third of the cattle on Nevis, including a number of breeding animals. Spraying is said to be controlling this outbreak. It is difficult to eradicate dermatophosis because it is involved with at least four hosts: cattle, mongooses, ticks and egrets. It was discouraging to see that several dip tank facilities installed earlier with foreign aid were not in use. Because of disease problems, cattle numbers may have now declined below 4,000 head. On

the other hand, sheep, goats, and swine numbers are reported to have held more or less constant over the past 10 years.

Various kinds of livestock are kept for home use and for sale. Sales are made to butchers in the local market, and a number of animals in Nevis are sold to foreign traders who ship them live to nearby islands. Compared with other countries having traditional agriculture, poultry play a minor role in SKN. Both the Census and the CARDI Farming Systems Research in Nevis confirm this observation (Lowery). The CARDI Survey found that only 27 percent of the surveyed farmers reported having poultry, these being used largely for egg production. There are 3 or 4 commercial egg producers on the islands, but overall egg production has not changed much in recent years. The private sector has experimented with broilers but has found it impossible to compete with imports from the U.S.

The cost of feed is a major constraint for both livestock and poultry. Imported mixed feeds, mainly from the Dominican Republic, are required in the absence of commercial corn and sorghum production and feed mills. Cattle in Nevis suffer from a lack of forage during the dry season and farmers must spend considerable time cutting and carrying forage (Lowery). CARDI found little response, however, to developing protein-energy feedbanks consisting of ~~legumes~~ LUCERNE interplanted with guinea grass and legumes. Some pastures have been improved but the quality of most grazing

land leave much to be desired. In many areas of Nevis scrub brush is encroaching on government owned lands that were previously in crops or pasture.

SKN has the land, market, technicians and breeding stock to develop a much larger livestock herd than it presently maintains. Imports of meat and meat products amounted to over $2 million U.S. in 1981 (Table 9). The forage can be sharply improved by better management of existing pasture, more acreage in improved pasture, and starting a fattening operation based on cane tops, molasses and protein cake from oil crops, a technology well developed in other sugar producing countries. Two government employed veterinarians and five technicians currently are working on livestock problems. The nearly completed Ross Veterinary School on St. Kitts will provide additional talent and laboratory facilities to work on livestock problems.

4. Fishing

Two major characteristics emerge from existing data and studies of the SKN fishing industry. First, the industry, consisting largely of individuals using small craft and uncomplicated methods, is depleting stocks of several commercially important species within territorial waters (3 miles from shore). Second, adoption of more advanced fishing techniques would allow exploitation of large fish stocks located farther off-shore.

TABLE 9: FOOD AND AGRICULTURAL IMPORTS IN 1973 and 1981

COMMODITY GROUP	1973 Quantity (000 LBS)	1973 Value (000US$[a])	1981 Quantity (000 LBS)	1981 Value (000US$[a])
Meat Products	2,186	987	3,915	2,224
Fish Products	647	277	534	475
Dairy (Fresh milk equivalents)	2,819	554	2,534	1,508
Cereals (raw cereal equivalents)	8,274	1,041	8,181	2,219
Fruit Products	-	128	-	362
Vegetables	1,533	254	2,028	662
Edible Oils	645	205	505	343
Food Preparations	-	252	-	626
Coffee, Chocolate, Tea, etc.	-	139	-	205
Beverages	112	368	-	969
Miscellaneous		468		919
SUBTOTAL		4,673		10,512
Animal Feeds		126		266
TOTAL		4,799		10,778

Source: Unpublished data, Planning Office, Ministry of Finance, St. Kitts.

a/ Exchange rate used: 1973 EC$1.92 = US$1.00, 1981 EC$2.70 = US$1.00.

Very few data are available on the fishing industry. In 1970, Vidaeus estimated there were 180 fishing boats operating from St. Kitts and 90 from Nevis. A study done in 1981 estimated 350 boats on St. Kitts, 300 on Nevis, and 900 full and part-time fishermen on the two islands. Government officials, however, believe these estimates are exaggerated.

Most boats have gas powered outboard engines and no navigational equipment. Since the typical boat is 15 feet long, only near-shore fishing is possible. Fishermen use pots, handlines, small seines, and other similarly uncomplicated gear. Catches are sold fresh at landing sites. There is cold storage capacity only for lobster and conch.

No reliable data exist on catch, but the Fisheries Division of the Ministry of Agriculture estimated total annual landings at roughly 1,850 metric tons. Stock depletion is indicated by the decreasing average size of some species, notably lobster, by the need to fish farther from shore in recent years, and by the fact there no longer are excess supplies of bonita available during May and June, as was formerly the case.

A 1962 statute prohibits capturing undersized or moulting lobsters, and egg-bearing females. There also has been a closed season on turtles since 1948. Enforcement of these regulations, especially for lobsters, however, is practically non-existent. The police force has only three boats and is not capable of effectively monitoring fisherman

compliance. Environmental Resource Projects, a firm from Rhode Island, is conducting studies to determine if and wher a closed season on lobster is needed.

The potential to expand fishing exists and some new initiatives are underway. The Leeward Islands Shrimp Company is constructing ponds for shrimp raising, and IDRC is supporting research on mussel production. Some of the SKN fishing fleet could be equipped to join fishing fleets currently harvesting tuna, flying fish and other species from the Saba Banks and other locations within 60 miles of the country. Private firms have expressed some interest in initiating joint fishing ventures with the government. Such ventures might train SKN fishermen in techniques needed to operate further off-shore.

5. Forestry

No forest inventory has been done since 1944. Skerritt and Evelyn reported on the wide variety of tree life on SKN at the Caribbean Conservation Association's 1982 meetings. Two small areas of untouched rainforest remain on SKN. Elfin woodland predominates at elevations above 2,500 feet. Between 1,200 and 1.800 feet, palm brakes are found, with mountain cabbage (Futeupe globosa) being predominant. In areas with less precipitation, dry evergreen forests occur between 800 and 1,500 feet, while dry scrub woodland is located at lower altitudes.

Tree covered land above 1,500 feet has been designated as forest reserve since 1903, and an ordinance passed in 1959 created a separate Forestry Board for each island. These boards are responsible for hiring officers to carry out forestry policies. Management of forests, however, has been lax in recent years. As of 1982, St. Kitts' Board employed three rangers, and one forest guard who issue charcoal production licenses.

Weak control over private access to forests has led to declines in both area and quality of woodlands. Most trees that once covered St. Kitts' south-eastern peninsula have been cut for fuelwood. Trees in the dry evergreen forests are small, the maximum height and girth being 60 and 3 feet, respectively. The viability of any forestry-based development will be threatened unless access is controlled.

Currently, there is some public and private sector interest in more effective utilization of forest resources, but no reforestation is underway. Commercial operations of bamboo, rattan and screwpine for use by furniture makers and craftsmen are being investigated. A more promising approach appears to be increased protection of forests in the vicinity of water catchments to maintain the quality of drinking water, and vegetation in marshes threatened by garbage dumping and other human activities.

6. Trade

SKN largely exports primary goods, and the agricultural

sector has been responsible for exports of approximately US$10-15 million per year. These agricultural exports represented two-thirds to three-quarters of total exports in 1975-80 (Table 10). Sugar and molasses make up most of the value of agricultural exports followed by small amounts of cotton, copra, fruit, vegetables, livestock and fish products. The problem for the SKN economy is that it has been difficult to diversify exports, year-to-year variations have been large, and the growth in exports in nominal value has barely kept pace with inflation.

Another disturbing trade problem is the emergence of food imports as an important drain on foreign exchange during the past 10 years. Part of this is explained by the fact that some products such as wheat cannot be easily grown in the tropics. A more important concern, however, is the rapid expansion in value of imports of some products, such as meat and beverages, that are locally produced. Table 9, presented earlier, shows the major categories of food and agricultural imports in 1973 and 1981. The total value of imports more than doubled in this interval from less than US$5 million to almost US$11 million. While part of this increase is explained by inflation, there were real value increases as well, such as almost doubling the quantity of meat imported and a one-third increase in quantity of vegetable imports. The country now imports 75 to 100 percent of its consumption of some major food categories, and half to

TABLE 10: AGRICULTURAL AND TOTAL EXPORTS, 1975-80

YEAR	TOTAL EXPORTS	AGRICULTURAL EXPORTS[a/] VALUE* 000 US	AGRICULTURAL EXPORTS[a/] PERCENT OF TOTAL EXPORTS
1975	16,699	10,750	64
1976	16,552	10,526	64
1977	14,180	10,162	72
1978	15,791	12,367	79
1979	16,274	12,214	75
1980	23,548	15,471	66

* See Table 1 for exchange rates used to convert local currency to U.S. dollar values.

Source: Planning Office, Ministry of Finance, Annual Digest of Statistics for 1980, Basseterre, 1981, p. 36.

a/ Food, beverages and tobacco

two-thirds of all of its food. Prime cuts of beef and white potatoes consumed by tourists are difficult items to produce in adequate quantity and quality at this stage of the island's development. The importation of many other commodities, however, reflects a failure of agriculture to adequately adjust when resources, especially labor, were reallocated to other sectors and tastes switched to more expensive products. The shelves of the local stores are devoid of goods produced on the two islands. Any major expansion in the tourist industry will exacerbate this problem. Aside from seafood and a few vegetables, relatively little of the tourists' food is locally produced.

As can be noted in Table 9, meat (including poultry) and dairy products made up over one-third of the total value of agricultural imports in 1981. Nearly a half million dollars in fish products were also imported that year. Fruits, fruit preserves, and vegetable imports used another million dollars of scarce foreign exchange. SKN also imported a hundred thousand dollars worth of tropical fruit juices! Worse yet, SKN imports a half million dollars each year of alcoholic beverages, about two-thirds of which is rum! In spite of hundreds of years of experience in producing illegal rum in the hills, colorfully called "Hammonds report," SKN is just now starting to produce its own legal rum.

The production conditions on the islands allow oranges, grapefruits, limes, white potatoes, tomatoes, onions, carrots, cabbages, sweet peppers, peppers, and eggs to be produced economically as import substitutes. The amount of importation is large enough to allow considerable expansion in production without having to worry about flooding the local market. The major concern is not with quantity of production, but whether or not the quality is high enough to compete with imports, and whether or not commodities are available when needed. It appears that imports decline during periods when buyers have access to local production and rise during the dry season when local supplies are scarce.

C. Resource Endowment

1. Soils

The soils on SKN are volcanic and susceptible to erosion. The major soil types are protosols and lactosolics (Lang and Carroll). The former, composed of beach sand and volcanic ash, have rapid drainage, are moderately fertile and predominant on the sugar estates. The lactosolics are mature soils of clay formation over fragmented volcanic materials and are used primarily for food crops, pasture, and fruit. Frequent rock outcroppings on Nevis limit the development and expansion of mechanized crop production to sites on the north end of the island. The sugar estates on St. Kitts, however, are reasonably rock free and

the topography permits field size conducive to mechanization.

Although the soils are well drained and fairly fertile, fertilizers are required in areas that have been in production for many years. NACO currently uses a fertilizer mixture of 18-4-18 on sugarcane land, but this formula may be changed to 15-0-16. Lowery found some response to 15-15-15 on Nevis in the yields of cotton and peanuts, but the results were mixed due to diseases and other problems encountered in the research.

Based on a land use survey conducted in 1966, Lang and Carroll classified land according to suitability for agriculture (Table 11). They concluded that about 26 percent was high quality agricultural land, while 45 percent was fair. A relatively small proportion of good land was found on Nevis due to rocky conditions and undulating topography. A current reclassification probably would reveal less good land available for agricultural use because of the constraints imposed by mechanization, as well as land lost to roads and settlements. Most of the best land on both St. Kitts and Nevis is in government controlled estates.

Most of the land is subject to soil loss. Many fields have moderate to steep slopes and are exposed to heavy rains that deliver the 40 to 65 inches of annual precipitation received in the major crop growing areas. Erosion is fairly well contained on sugarcane land because cane is planted on

TABLE 11: LAND USE CLASSIFICATION FOR ST. KITTS/NEVIS, 1966

CLASSIFICATION	ST. KITTS ACRES	%	NEVIS ACRES	%	TOTAL ACRES	%
Good Agricultural Land	14,610	35	2,146	9	16,756	26
Fair Agricultural Land	14,250	34	15,000	66	29,250	45
Land Suitable Only for Forest	7,000	17	2,800	12	9.800	15
Settlements and Sub-Divisions	2,600	6	1,000	4	3,600	6
Poor Land	3,140	8	2,094	9	5,234	8
TOTAL	41,600	100	23,040	100	64,640	100

Source: D.M. Lang and D.M. Carroll, Soil and Land Use Survey No. 16, The Regional Research Center, University of The West Indies, Trinidad, 1966.

contours and the crop provides good soil cover. Unfortunately, many of the old terraces have been abandoned. Gullying is causing some damage on both islands. On St. Kitts, farmers frequently plant small vegetable plots on gullied land that NACO has withdrawn from sugarcane.

Future crop diversification must be accompanied by land tenure arrangements that strengthen incentives for farmers to manage land in ways that maintain long-term productivity. Soil conservation programs will be required on public and private land, appropriate farming systems and practices must be employed, and educational programs implemented that stress the causes and consequences of erosion.

2. Land Tenure and Distribution

The most recent comprehensive data on land distribution drawn from the 1975 Census of Agriculture are found in Table 12. The differences in types of agriculture found on the two islands are clearly evident. The island of St. Kitts has highly skewed land ownership with 24 properties over 500 acres, now mostly under government control, taking up about three-fourths of the total land. Small farms with less than 5 acres total about 1,600 holdings but control only 6 percent of the land. There were also about 50 holdings with 5 to 500 acres that controlled 18 percent of the land. Land ownership is less concentrated on Nevis. Both islands report about 45 percent of the holdings with 1 acre or less which essentially represents a house site and small home

TABLE 12: NUMBER AND AREA IN RURAL LAND HOLDINGS IN ST. KITTS/NEVIS, 1975

Size	Holdings Number	Percent	Acres	Percent
St. Kitts:				
Households without land	786	31.8	-	0
0 to 0.9 acres	1,083	43.8	310	1.3
1 to 4.9 acres	524	21.2	1,224	5.1
5 to 99.9 acres	39	1.6	304	1.3
100 to 499.9 acres	14	0.6	4,089	17.1
500 acres and over	24	1.0	18,055	75.2
TOTAL	2,470	100.0	23,982	100.0
Nevis:				
Households without land	213	10.4	-	0
0 to 0.9 acres	953	46.3	393	2.2
1 to 4.9 acres	698	34.0	1,618	9.0
5 to 99.9 acres	147	7.2	2,891	16.1
100 to 499.9 acres	39	1.9	7,917	44.2
500 acres and over	4	0.2	5,108	28.5
TOTAL	2,054	100.0	17,927	100.0

Source: Summary Report on the Census of Agriculture, 1975.

garden. Almost a third of the holdings on St. Kitts reported no land compared to only 10 percent in Nevis.

Most of the large estates are government owned or controlled. The government began acquiring estates on Nevis as early as 1933 and the last estate was acquired in 1968 (Table 13). Now the government owns over 5,000 acres on Nevis. Many of the estate acquisitions on St. Kitts occurred in 1972-75. A major problem in St. Kitts is that since land payment has not been negotiated with the owners, the government does not have land title. It is reported that the current price asked by the land owners is $6-8 million U.S.

It is common for small farmers, particularly on Nevis, to possess a freehold on their home plot of an acre or so, lease a few additional acres from government estates for production, and/or graze cattle on communal pasture or on government estates.

Farmers request leases of government land through the Department of Agriculture. The estate managers determine the land that can be rented and who gets which plot. The farmers must pay the annual rental in advance, the amount varying from $4-11 U.S. per acre. A receipt is given that identifies the estate and amount of land rented, but the exact plot location is known only to the estate manager and renter. Central registration of leases appears to have been abandoned several years ago. Although the leases are

TABLE 13: GOVERNMENT OWNED ESTATES ON NEVIS

NAME	YEAR ACQUIRED	TOTAL ACRES	LAND USE: LEASE PURCHASE	LAND USE: ANNUAL RENTAL	LAND USE: AGRIC. DEPT. USE	LAND USE: IMPROVED PASTURE	LAND USE: SCRUB AND UNIMPROVED PASTURE	LAND USE: FOREST
Low ground	1951	493	248				245	
Hamilton	1933	580	433[a]	[a]			147	
Prospect	1940	236		135	16[b]		85	
Hardtimes	1939	192		135				57
Fothergills	1955	228		17	15		196	
New River and	1938	790		200		100[c]		490
The Valley	1944	---						
Indian Castle	1959	470				320[d]	150	
Eden Brown	1956	303		50			253	
Dos D'an	1939	193						193
Maddens	1945	1,024		112		400[e]	512	
Potwork	1955	179			76[b]	103[f]		
Nisbett	1942	259		90			169	
Cades Bay	1939	184		112[g]			72	
Spring Hill	1939	97			45[h]		52	
Stock Pen	1968	247		(No information provided)				
TOTAL		5,475	681	851	152	923	1,881	740

a/ Area in lease purchase and annual rental combined.
b/ Nursery.
c/ Pasture used for communal grazing.
d/ Pasture used for 184 head of government cattle.
e/ Pasture used for government cattle.
f/ Improved pasture and scrub combined.
g/ Rental to the Nevis Farmers Cooperative Society for crops and livestock.
h/ Pasture used for government cattle.

Source: Unpublished information on file, Department of Agriculture, Nevis.

usually annual, farmers may lease the same plot for several years. Tenure security is uncertain because termination of leases occurs occasionally. A major inadequacy of the current system is that farmers do not have formal land rights which can be used as collateral for loans, and land users have no incentive to maintain, or to make improvements in land quality.

Although annual leasing is fairly well established, the government appears to have done little to provide long-term leasing or ownership by private individuals. On Nevis, some small plots of 2 acres or less have been sold for housing sites and adjoining garden plots, but no large plots have been sold. The land title problem on most of the St. Kitts land managed by NACO complicates such changes in tenure.

The land holding and tenure system is one of the major impediments to modernizing and vitalizing agriculture. The government has acquired essentially all the good farming land. Releasing some land for house plots and annual leases relaxes social pressures but does little to stimulate agriculture or encourage investment. Estate managers have few of the incentives that private operators have to experiment with new crops and farming systems, intensify farming, practice good conservation, and control praedial larceny.

The number one priority on the islands is to accelerate secure access to land by private individuals, and stimulate intensive and efficient land use. The rural households that

reported no land or less than one acre represent a large population of potential beneficiaries to expand their house gardens, move into commercial vegetable production, and increase their livestock herds. In St. Kitts in 1975, these landless or small land holdings represented almost 75 percent of the total rural households. In Nevis, this group made up over 50 percent of rural households. There appear to be a large group of farm households, therefore, that have little access to land, or have insecure tenure on small amounts of land they rent from the government. Even if only, say, 10 percent of this group chose to lease or buy more land, the number would exceed 170 on St. Kitts and 110 on Nevis.

3. Water and Irrigation

Water supplies, use, and pricing will be important issues for agriculture, especially if substantial irrigation is to occur. Historically, agriculture, like the rest of the economy, obtained water from surface sources. Stable year-round supplies were ensured early in the colonial period by constructing catchments high in heavy rainfall forests and channelling (later piping) water to settlements and sugar mills. In the Basseterre valley, these supplies were augmented by shallow wells, and by the 1960s nearly 900 acres of mostly sugar land were irrigated by this latter source.

The Water Authority, a Branch of the Public Works Department, operates the St. Kitts water system. Water quality is maintained through the efforts of two workers at each intake and an inspector who controls land use in the vicinity of all catchments.

Water supplies represent a constraint because all of the best catchment sites are being exploited and precipitation seems to be at the trough of a 60 year cycle. The government, therefore, is seeking to augment supplies by drawing on subterranean sources. The Canadian International Development Agency (CIDA) initiated a study of St. Kitts' groundwater resources in 1981. The study will take longer than the originally planned 30 months because of drilling problems. CIDA is planning to finance and import another drilling rig. Preliminary data suggest a safe yield of underground water in the Basseterre valley of about 2.5 million gallons a day, which is 150 percent higher than current demand.

Underground pumping, of course, is more expensive than catchments. The Water Authority reports the cost of delivering 1,000 gallons of water now averages U.S. $0.52. This does not include the cost of many services (e.g. labor and electricity) provided by other agencies. The cost of 1,000 gallons of well water could exceed U.S. $1.11.

Agriculture uses a fairly small proportion of the total water supply, even though the current rates are subsidized.

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Domestic users pay between U.S. $0.33 and U.S. $0.67 for 1,000 gallons depending on volume consumed. Non-domestic users are charged U.S. $0.56 per 1,000 gallons. Water must generate a higher return than currently occurs on typical agricultural operations before farmers would be willing to purchase water at non-subsidized rates from a central system, especially from underground sources.

New water sources also must be exploited in Nevis if irrigated agriculture is to expand. Exploiting untapped surface water seems prohibitively expensive. Halcrow's 1983 update of the 1966 assessment of Nevis water resources suggests a capital cost of U.S. $1.9 million to impound water for 15 to 20 hectares of cropland. Annual operating costs would be U.S. $93 thousand. A less expensive option would be pumping water from a single borehole. Drilling and equipment for 10 hectares would be U.S. $93 thousand with operating costs of U.S. $9 thousand plus annually. Halcrow estimates a safe yield of 3.7 million cubic meters per year of water on Nevis. Saline intrusion could occur, however, if pumping were done in some areas.

4. Human Resources

Estimates about the islands' population range widely. The World Bank refers to a population of 49,800 in 1977, and a 0.8% annual growth rate in the 1970's This information is not consistent with government population estimates for

1971-80 (Table 14) which show a slightly declining population from 44,850 to 44,400. It is clear that large amounts of outmigration have taken place. The Annual Digest of Statistics (p.7) reports a natural increase of 7,502 persons from 1970 to 1980. Considering the net population decline of 450 persons mentioned above, these data imply a net emigration of almost 8 thousand persons. The net effect of these population changes is that Nevis seems to have lost about 1,600 in total population, while St. Kitts has gained 1,200 over the 1970s.

Emigration does not have a neutral impact on population. The persons most likely to emigrate are the young, healthy, and best educated, those who have a comparative advantage in finding work away from home. As a result of outmigration, the economically active population on SKN is becoming older. The areas that attract the most migrants from SKN are the U.S., the U.S. Virgin Islands, and Trinidad.

A direct benefit of emigration is the large amount of remittances that flow back to SKN. These payments help finance a level of consumption not supported by the islands current production. If emigration were curtailed it would cause hardship both for the migrants as well as for those left behind who receive remittances.

Some of the effects of emigration can be noted in the statistics on student population in the schools. In

TABLE 14: ESTIMATED MID-YEAR POPULATION FOR ST. KITTS/NEVIS, 1971-80[a/]

YEAR	ST. KITTS	NEVIS	TOTAL
1971	33,900	10,950	44,850
1972	34,050	10,750	44,800
1973	34,200	10,550	44,750
1974	34,300	10,400	44,700
1975	34,450	10,200	44,650
1976	34,600	10,000	44,600
1977	34,700	9,850	44,550
1978	34,850	9,650	44,500
1979	35,000	9,450	44,450
1980	35,100	9,300	44,400

a/ Revised estimates based on 1970 and 1980 Population Census.

Source: Annual Digest of Statistics for 1980, Statistical Office, Planning Unit, St. Kitts/Nevis, July 1982.

1973-74, the Annual Digest of Statistics reported almost 15,000 students, but in following years the number has tended to range between 12,500 and 13,500.

D. Markets and Institutions

1. Fertilizer, Varieties, and Technology

Most of the soils on SKN are sandy or clay loam with a pH of 6 to 7. Ammonia sulphate is the chief source of nitrogen, but single and triple superphosphate, as well as muriate of potash, are also used extensively. High analysis fertilizers should be used whenever possible to reduce the transportation cost. At the present time the main source of nitrogen on SKN is ammonia sulphate containing 21 percent nitrogen. If a policy change could be made to import urea, which contains 46 percent nitrogen, more than one-half of the freight cost would be saved as well as extra handling charges and transportation within the island.

No facilities are available on SKN for conducting soil and tissue analyses needed to determine the optimum nutrient requirements for crops. Soil samples are sent to Trinidad or Jamaica for analysis, requiring a long time to obtain the results and at times the results are not forthcoming. When coffee leaves have been sent to Trinidad they are burned and not analyzed, probably due to the fear of introducing Oriental leaf rust there.

The highest yielding varieties of cucumbers are Ashley and Poinsette 76. Tomato varieties yielding the most are

Tropic, Calypso, TAES No. 6 and No. 9. The TAES No. 6 and 9 were developed at a Texas Experiment Station and are tolerant to high night temperatures. The best varieties of sweet peppers are California Wonder and Keystone Resistant Giant which are resistant to fusarium wilt.

The best hot pepper variety currently being produced is Long Cayenne. The highest yielding variety of okra is the Clemson Spineless. High yielding varieties of onions are Texas Grano, Texas Yellow Grano 502 and Yellow Burmuda. The best beet variety is Detroit Dark Red and the highest yielding variety of cowpeas is California No. 5. The best variety of mung beans is CES 55 which was developed in India. The highest yielding cabbage is the KK Cross which is a hybrid resistant to hot weather. The best cauliflower variety is Snowqueen.

Several varieties of pulse crops have been imported from the International Tropical Institute in Nigeria for testing in variety trials and CIMMYT in Mexico has supplied various synthetic lines of corn.

The highest yielding variety of peanuts is Tennessee Red. It yields more than NC-2. Gypsum is used on some of the areas where peanuts are grown to lower the pH of the soil and provide a source of sulphate. Peanut driers in some areas would be very beneficial since part of the crop is lost when rain occurs during the drying period.

There is a shortage of agricultural equipment and facilities for maintaining and repairing vehicles and equipment. An insufficient supply of spare parts also makes it difficult to keep the vehicles and equipment in operation.

No facilities are available for storage of seed. In order to maintain the viability of many seeds they need to be stored at low temperatures (35°-40°) and a low humidity (20-30%). The Department of Agriculture has a nursery and raises small plants for sale to the farmers such as onions, eggplant and cabbage. They also bud Valencia oranges or rough lemon rootstock which is sold to the farmers. They have also budded Julie mango trees for sale at subsidized prices.

There is no coordinated system for ordering seed and plant material from foreign countries. A seed law is needed that will protect the farmers from purchasing seeds, foreign or local, with low germination. This also would tend to encourage proper storage to maintain high germination percentage. Plant quarantine control would be desirable to prevent the importation of plant material infested with desease such as lethal yellows on coconut or the Oriental leaf rust on coffee.

The Department of Agriculture provides small loans to farmers to purchase agricultural equipment such as rotatillers and spray equipment. The Taiwanese purchased agricultural inputs the first year for the vegetable project and

the Department of Agriculture has agreed to finance them in the future. A few Chinese rotatillers also have been sold to small farmers.

Several pests are prevalent that tend to discourage production of many crops. A large population of monkeys causes damage to fruit crops grown at higher elevations. Rats constitute a serious menace in the production of coconuts and melons, and birds consume a lot of food grains produced. At the present time traps are being used to collect monkeys which damage fruit. There is a gun law at the present time so the farmers cannot have guns to reduce the population of monkeys. About 500 monkeys are exported to the United States each year for medical research. Studies will be needed in the future to reduce the number of rats, birds, bats, mongoose and ticks that lower the production of food commodities.

When rats become a serious pest in coconut plantations, it is necessary to ring the trees with pieces of metal about one foot in width so that the rats cannot climb the trees. Rats also eat melons and make many melons unmarketable.

2. Product Markets, Processing and Storage

There are many constraints to the economic production, marketing and storage of food and textile commodities. For example, no standard formal grading system exists for fruits and vegetables. There are radical price fluctuations in the

vegetable market, a result of limited cold storage facilities. The price of tomatoes fluctuates from EC$0.30 a pound when they are in heavy production, to EC$3.00 in July when they are scarce. It is difficult to grow some vegetables during the months of heavy rains due to disease and insects.

Further, all of the cuts of meat are price-controlled and this is a disincentive to producing meat for the local market. Sanitary slaughter house for graded and selected cuts of meat are not available.

As mentioned earlier, a large part of the food commodities are imported. Hotel management has indicated that local sources are not dependable for food supplies since they are in short supply during long periods of the year and the quality varies substantially.

Expensive imports of agricultural chemicals, seeds, and equipment increase the cost of producing food. Another severe constraint is a shortage of cold storage facilities. Most of the vegetables grown locally could be stored up to three months to provide a greater supply of food commodities between harvests. This would increase the local farmers income and tend to reduce the wide spread in price fluctuations for the consumer. It might be possible for the Government to build cold storage facilities and rent them to entrepreneurs so that they can take the risk required in handling fresh produce. These also could be used for storing imported and locally produced seed. Some cold

storage facilities should be located near a slaughter house to reduce transportation costs, as cold storage and freezing units are not sufficient for holding large quantities of meat over a long period of time.

There is currently a shortage of food processing facilities. Mangoes, for instance, are in abundance over a period of three months and the price is relatively low. If processing facilities were available, fruit slices, puree and juice could be canned, dried and frozen for local use and as export products. This could be true of many of the other fruits and vegetables produced that can be grown on the island. Table 15 shows estimates of the amount of fruit produced in SKN in 1981. It would be desirable to include a feasibility study for processing of fruits, vegetables and meat. This might include canning as well as freezing in order to determine the value of each type of processing.

There are also no commercial oil extraction plants for coconuts, cotton seed and peanuts. This results in a considerable amount of the copra and cotton seed being exported for oil extraction. Most of the cooking oil presently used on SKN is imported.

The Central Marketing Corporation under the Ministry of Finance has the responsibility of marketing and processing food crops produced in the country. It also has responsibility to reduce imports that compete with local production. It operates a cold storage facility that has barely

TABLE 15: AREA, PRODUCTION AND YIELD IN FRUIT CROPS, 1981

CROPS	AREA IN ACRES	PRODUCTION IN (000 lbs.)	YIELD (POUNDS PER ACRE)
Papaw	5	20	4,000
Banana	89	405	4,551
Pineapples	25	56	2,240
Oranges	32	56	1,750
Avocado	12	20	1,667
Mangoes	309	1,077	3,485
Limes	10	9	900
TOTAL	482	1,643	

Source: "Agriculture (Ex-Sugar)", Unpublished Paper, Planning Office, St. Kitts, 1983

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enough space to handle perishable produce for the retail outlet. Two other cold storage and freezing units are operated by Ram and Ocean Cold Storage. Expansion of cold storage facilities would likely reduce the amounts of vegetables and meat that are imported each year.

Funds would be needed to expand the storage facilities under the Central Marketing Corporation so that the farmers could rent the cold storage rooms in order to hold their food commodities when there is an excess on the market at any given time, thus preventing waste. A feasibility study would be needed first to determine the capacity of the cold storage rooms as well as the size of the rooms and types of compressors required to operate the system. Mr. Ram indicated that construction cost currently is about $50.00 per cubic foot.

3. Labor Market, Mechanization and Technical Skills

Labor markets have been active in shaping agriculture in SKN. During the past several decades the labor market has moved people out of agriculture into employment on SKN in industry, services, and tourism. They have also channelled people into emigration. These markets also reallocate labor among sectors during the year. In 1979, for example, the monthly peak level of employment in the sugar factories and estates was 4,700 in August, and the lowest level was 3,400 in December (Table 16). Conversely, the hotel industry employed a low of 350 persons in August and a

TABLE 16: NUMBER OF PERSONS EMPLOYED IN PRINCIPAL INDUSTRIES AND SERVICES, 1979

MONTHS	INDUSTRY					
	SUGAR	CONSTRUCTION	ELECTRONIC	HOTEL	GARMENT AND SHOE	BEVERAGE
January	3,830	235	207	499	720	121
February	4,185	247	204	500	810	122
March	4,320	240	204	491	824	123
April	4,302	238	224	475	825	109
May	4,249	243	230	386	828	110
June	4,186	263	215	360	883	114
July	4,577	257	241	388	919	115
August	4,723	257	249	350	739	116
September	4,109	257	227	364	735	121
October	4,078	265	240	378	779	115
November	4,090	237	242	486	861	116
December	3,446	234	252	490	817	111
ANNUAL AVERAGE	4,125	247	228	431	812	116

Source: Planning Office, Ministry of Finance, Annual Digest of Statistics for 1980, p. 9.

high of 500 in February, while the garment and shoe industry employed a low of 720 people in January and a high of 920 ir July. The evidence suggests a fairly dynamic labor supply in which households allocate labor within and outside the country as conditions change.

One of the effects of intersectoral labor shifts that concern policy makers is the abandonment of the countryside by young people, especially males, and the resulting aging labor force that remains behind to farm. Lowery reported that the farming systems research survey in Nevis found only 13 percent of the farmers were under 40 years of age, 45 percent were in the age group 56-70, and 19 percent were over 70 years. Furthermore, a third of the farmers had employment outside of the farm, with fishing and trades the most common nonfarm occupations.

This ongoing shift of labor out of agriculture has and will force adjustments in crops, cropping patterns and production technology. Already the sugar industry has mechanized most tasks except cane cutting. Plowing is mechanized on cane land, and much of the plowing on small farmer plots is also mechanized through government tractor pools. The widespread expansion of labor intensive crops will face constraints unless means are found to hold or attract into farming younger members of the labor force.

While the educational system provides a good basic education for school age children, insufficient opportunities

exist for higher education in technical and professional fields (World Bank). This has ramifications for the agricultural sector, both for entrepreneurs as well as technicians who service the sector. The technicians who currently service agriculture are impressive in their understanding of agriculture and dedication to their work. The livestock industry generally is well supported by veterinary staff and the new Ross Veterinary School should improve the situation. There are some shortages, however, in number of extension personnel, in persons to develop farm plans, in land surveyors, and in other specialized areas.

4. Financial Markets

SKN has reasonably adequate financial services on both islands. The Central Bank for the Eastern Caribbean is located in Basseterre along with the National Bank, Barclays, the Royal Bank of Canada, a Cooperative Bank, and the new Development Bank (formerly the Development Finance Corporation [DFC]). Aside from the substantial amounts of loans provided to NACO by the National Bank (said to amount to more than US$ 16 million in late 1983), only a handful of loans are made to farmers by the Barclays Bank Branch in Nevis and the Development Bank in St. Kitts. In late 1983, the Development Bank had less than a dozen outstanding small loans for agricultural purposes, representing something near 5 percent of the total value of its loans. Most of its loans were going into housing. The Manager of the

Development Bank reported that he expected to recover less than half the value of loans made for agricultural purposes that were inherited from the DFC. The Barclays Branch in Nevis has less than 20 agricultural loans outstanding out of a total loan portfolio of more than 200 loans. Other banks seldom make loans for agricultural purposes. Aside from the large increase in the amount of money borrowed by NACO over the past few years, it appears there has been little change in the access of SKN farmers to loans over the past 15 years (Hunting Technical Services).

Loan officers in both Barclays and the Development Bank reported there was little additional demand for agricultural loans even at the low nominal interest rates of 10-12 percent charged on commercial loans. They stated that most rural people did not qualify for formal loans because they lacked acceptable collateral. While few rural people qualify for loans, a large number use deposit services provided by the banks and credit unions. The Manager of the Barclays Branch in Nevis reported nearly 3,000 savings accounts in his Branch, more than 10 times the number of loans outstanding. He estimated that 80 percent of the deposits came from remittances sent by friends or relatives working elsewhere. The credit union in Charlestown also reported rapid growth in the number of people with savings accounts.

These relatively large amounts of money were being mobilized despite the low rates of interest paid on savings -- generally less than 5 percent per year. Since inflation has been double digit until recently, over the past 10 years, these deposit rates have been negative in real terms. The surfeit of savings allows banks to enjoy a very substantial spread on their loans, even though interest rates are regulated. While we did not attempt to carefully document net flows of funds into or out of the formal financial system in SKN, it is likely that relatively large amounts of funds are flowing out of SKN through the financial system. In March 1983, the total amount of deposits in commercial banks in SKN was about US$ 62 million. (This did not include the Development Bank, which does not accept deposits, credit unions, or the Cooperative Bank.) These commercial banks had made about $50 million in loans and advances; had $10 million in foreign assets, treasury bills and securities; and had another $10 million in other bank owned assets. Because the financial system was mobilizing about $12 million more than it lent in SKN, one might conclude that roughly that amount of liquidity was moved to other geographic areas. It would be useful to carefully document this outflow and compare it to the total amount of foreign assistance provided to SKN. Clarifying why local money managers do not finance more local investments through

loans would provide powerful insights into restraints on development.

We did not explore informal forms of rural finance in SKN. We did hear numerous mention of the local variants of the savings/credit associations (ROSCAS) that are common in the Caribbean and other parts of the world. Their local name is "partner hands." They typically involve 5-20 people who make periodic contributions to a fund that is distributed in rotation to participants. The rotation may be decided on the basis of alphabetical name order, by ad hoc choice, or by lot. Analysis of these partner hands, plus other forms of informal finance, could provide useful insights into financial needs in rural areas.

5. Research Activities and Information Dissemination

Very little original research is done on SKN. The USAID has a contract with CARDI to conduct some applied research on vegetables and pulse crops as well as intermediate technology and farming systems. CARDI has a six acre research station near the airport on St. Kitts. Variety trials have been conducted on peanuts, dwarf pigeon peas that are not daylight sensitive, cowpeas, tomatoes, eggplants, corn peppers, cucumbers and sorrell.

Jeff Million, a graduate student in the Department of Horticulture at the University of Florida, is working on a vegetable research project on the CARDI experiment station

in St. Kitts for his Ph.D. thesis. Mr. David Hubbel is a Soil Scientist working at the same experiment station.

CARDI has been doing research on annual crops and has made information available on high yielding varieties and pest control. There is a shortage of research information on optimum fertilizer rates for most of the annual food crops. A lack of reliable research information has made diversification difficult since very little work has been done on perennial crops. More work needs to be done on annual crops to determine the optimum rates of fertilizer and best time of application.

Experiments have been tried with interplanting of peanuts and cotton with good results. The Government has ten acres of cotton. The cotton usually is planted in September and harvested in February. When peanuts are planted with cotton the peanuts usually are planted in August and harvested in December. The cotton then is harvested in February. The pink bollworm is the most serious cotton pest and earwigs and weevils cause damage to peanuts from time-to-time. The Agriculture Land Development Authority has hired a cotton specialist and an entomologist to assist the farmers in production techniques and pest control.

Two Taiwanese farmers are cultivating two and a half acres of vegetables on St. Kitts. The Taiwanese are growing onions, tomatoes, pumpkins, cucumbers, muskmelons, cabbage,

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broccoli and carrots. Work done by CARDI and the Taiwanese specialists indicates that high yields can be obtained in St. Kitts with proper cultivation, irrigation, optimum fertilizer levels and pest control. AID could provide specialists to work with the Department of Agriculture to train farmers in modern cultivation techniques, efficient irrigation methods, the application of optimum fertilization for each crop and the correct use of herbicides and pesticides for high crop production.

The specialist also could assist in training Department of Agriculture personnel in the production of certified seed and plant material that are recommended, based on the CARDI research information and the results from the Taiwanese production plots. The farmers need a local source of improved seeds and plant material.

A retired dentist, Dr. Skow, who lives on Nevis, has imported several high yielding cultivars of citrus. These plantings could provide an excellent source of budwood for the nursery at the training center.

There is a shortage of extension personnel which has resulted in few training and radio programs. Too few entomologists are available to assist the farmers in controlling pests on livestock and plants.

It will be useful to establish training centers to train extension personnel, farmers, 4H Club members and students in the secondary schools on proper techniques of

producing, storing and marketing food crops. Assistance may be needed in developing radio programs and video tape programs for television and training sessions.

Foreign scientists will be needed to conduct research on the most promising perennial crops in the future, possibly including coffee, pineapples, tree fruits, nuts and spice crops.

Arrangements should be made with reliable soil and tissue testing laboratories so that results along with interpretations can be obtained in a timely fashion.

E. Government Agricultural Policy

Sugar has dominated government concerns over the past decade. This has been induced by the need to provide employment for the large number of people who have been employed by the industry. In large part, the increasing deficits suffered by NACO result from the government policy of sustaining sugar workers' incomes via loans to NACO from the National Bank, and paying wages not justified by production. This is a type of unemployment insurance that shows up as NACO deficits. On the books NACO is administering a major income transfer program to sugar workers, and helping to sustain labor allocation that is clearly in need of additional major adjustments.

While the government, NACO, and the Department of Agriculture have placed some emphasis on diversification away from sugar production, investments in these efforts

have been largely left to foreign donors. One sees modest government commitment to diversifying agriculture outside the holding action carried out by NACO and the Department of Agriculture. While the government currently has a great deal of interest in the Taiwanese intensive vegetable production project, it is not clear if this project can move beyond the pilot phase without major changes in the way land and labor are used. It is also not clear if the country has gained extensively from the sizable number of pilot agricultural projects that dot the two islands.

The government imposes a mild form of price control on most major commodities. Periodically, a list of approved wholesale and retail ceiling prices are published, the latest being in June 1983. Slightly higher retail prices are allowed on goods sold outside Basseterre. In a few cases, importers are able to use these price ceilings as a lever to negotiate lower prices on goods imported. If a good cannot be imported at or below the wholesale price, the government is pragmatic in granting licensing exceptions. Aside from the lobster industry where fishermen are pressured to keep the internal prices of lobster low to help the tourist industry, and the meat industry where the prices of meat cuts are controlled, product price controls have not introduced serious distortions in internal incentives. If inflation pressures increase in the future, and/or the government decides to make these price ceilings more

binding, these controlled prices may become a more serious incentive problem.

The government provides a variety of input subsidies to farmers but the magnitude of such subsidies and their impact on production is difficult to document. A tractor pool is available, for example, where farmers can obtain machinery services for plowing and transporting produce. The tractors on Nevis appear to be quite large for the small rocky fields that are plowed. Considerable time is lost in driving from the pool to the farmer's field. Aside from a brief period when many farmers want to plow their land for cotton at the same time, the service appears adequate. The fees charged farmers do not cover costs: the fee is U.S. $22 to plow an acre, while the cost probably exceeds U.S. $37. It also appears that spraying services for cotton are subsidized on Nevis. As noted above, water prices also are subsidized.

III. AGRICULTURAL GOALS AND DEVELOPMENT STRATEGY

The agricultural sector on SKN and its performance represent a paradox. The preceeding section showed these islands are blessed with fertile soil, reasonable water supplies, an active labor force, and a variety of governmental agencies with knowledgeable and energetic staff, yet the performance has been poor with total production barely holding even or declining. Labor and capital are fleeing the sector. What explains this paradox?

Some of the explanations are beyond the control of small island economies. The decline in sugar due to changes in the international market is one. A second is the emergence of sugarcane smut and the need to make replantings of resistant, but lower yielding varieties. Changes in labor demand represent the success of local development efforts in industry and tourism, but also changes in international employment opportunities.

Important as these explanations are, they do not totally explain the periodic crises in the sugar industry, the management problems that occur in cane left unharvested in the field even though export quotas are unmet, and the limited supply response of private farmers to crop and livestock markets. Other explanations such as periodic interruptions in input supplies, disease outbreaks, and lack of market information do not seem to be sufficient either.

In our opinion the key agricultural problem currently is access to and management of agricultural resources. The government has assumed a large burden in recent years: attempting to buy out and manage both the sugar estates and sugar processing facilities; grow fruits and vegetables and operating livestock farms; conducting agricultural experiments and extend information to farmers; supply production inputs, control water allocations, regulate prices, and manage a large labor force in the sugar industry. Taking over the sugar industry was an enormous task alone without

these other activities. Even with dedicated and well-trained employees, the public sector cannot efficiently accomplish all these tasks, in addition to developing industry and tourism.

To correct these problems, a two-part long-term agricultural strategy should be developed. First, government should concentrate its efforts on those activities that only government can do or where it has advantages over the private sector. Two groups of efforts meet these criteria: efficient management of the sugar industry and the provision of timely research and market information to the private sector. Secondly, the government should implement a strategy to gradually restructure agriculture by transferring some government estates to the private sector through sales or long-term lease. Only the private sector can provide the labor, management and entrepreneurship required for the production and marketing of crops and livestock on small holdings. Private entrepreneurs can provide the innovativeness and flexibility needed to respond to changes in crops, technology and markets that the islands will face in the future.

This strategy of mixed public and private sector farming will contribute to achieving 4 goals in agriculture:

(1) Improve the short-term profitability and efficiency of the sugar sector, while simultaneouslv

planning for its decline at a rate consistent with trends in international markets.

(2) Accelerate the orderly transfer of land into private hands, and ease the transfer of labor out of agriculture as higher paying non-agricultural jobs develop.

(3) Increase the islands' self-sufficiency in most crops and livestock, and expand selected agricultural exports.

(4) Improve public sector support services, especially in training, research and extension, which cannot be easily provided by the private sector.

The economic trends that make these high priority goals are fairly clear. Unless something unforeseen happens, SKN must expect its sugar sector to continue to erode over the next several decades. The increasing use of corn and artificial sweeteners, changes in consumer tastes away from products with large amounts of sugar, and increasing labor costs will force SKN to live with a smaller output of sugar. Even though 30,000 tons of sugar can be currently exported to the U.S. and the European Common Market at preferential prices, these export quotas are not etched in stone. They are much more likely to be reduced than they are to be increased in the next several decades. While some diversion of sugar and molasses into ethanol for energy uses may boost sugar demand in the international market, that will only

happen with a significant increase in relative petroleum prices. If this does not occur, it is unlikely that international sugar prices will increase dramatically from current depressed levels.

Since the sugar price outlook is not bright, SKN might plan to reduce targeted sugar production to 30-35,000 tons from the current targets of 40-50,000 tons. SKN will also be forced to further mechanize sugar production to sustain an industry that does not require heavy subsidies. This will force more land and labor out of sugar production, create more opportunity for stressing food import substitutes, and allow more latitude for developing non-sugar, agricultural exports.

In the short-run, SKN ought to allocate resources released by the sugar industry into food import substitution activities. Experience over the past 10 years has shown that use of these "excess" resources on state farms in non-sugar activities yields poor results. It is unrealistic to expect that technicians, who are well versed in sugarcane, will ever become very interested or knowledgeable in the production on small plots of diverse enterprises such as pineapples, cotton, peanuts, feeder cattle, coffee, vegetable and fruit production. Management of these diverse products is likely to be of high quality only if carried out by people who have incentives to carefully manage them. In the longer-run, emphasis might be switched to developing

more diversified agricultural exports. Initially, export promotion might focus on other markets in the Caribbean area. Later a few speciality crops might be stimulated for shipment to North America, Europe, and Japan.

The changes described above will require the formation of more small- to medium-sized farms. Because of the nature of the SKN economy, one should not expect that many of the new farm operators will be full-time farmers. Many will continue to work in the sugar industry, spend time fishing, and earn income from working on other farms. Some of these new farm operators will be young people who may currently have non-farm jobs, while other new operators will be older men and women who are temporary tenants on state owned lands. It is also likely that many of these new units will require at least some tractor power to work their land. This might be provided by private tractor owners who do custom work for neighbors. Adjustments must be made so lenders are willing to extend loans to these new units to finance the purchase of machinery, cattle, irrigation facilities, and housing in rural areas. Movement of many more farm families into houses on farm lots would improve farm management and also help to reduce theft of agricultural commodities.

Some differential specialization ought to occur on the two islands. Nevis, with its drier climate and rockier soil, should continue to stress livestock, oil crops and

cotton, and expand production of coarse grains such as sorghum, millet, and corn. St. Kitts should continue with a smaller sugar industry, but also stress irrigated fruits, vegetables, and other speciality crops. A cattle feeding operation also might be developed on St. Kitts using cane tops, molasses, locally produced oil cake, and some sorghum to fatten feeder cattle raised on Nevis. St. Kitts also might develop some food processing facilities as the scale of production increases. These processed foods, plus the beef produced by the feed lot, ought to provide a good deal of the commodities necessary to feed tourists and substitute for most expensive food imports.

There is a good deal of agricultural entrepreneurial energy bottled up on, or leaving, the two islands. While some of this is vented through short-term formal and informal land rental arrangements on state owned lands, dozens of other people on the islands would respond to having access to good agricultural land. Hundreds of sugarcane workers have had some experience with growing various crops and livestock on small plots, individually or in groups. Many others, especially women, have experience in growing fruits and vegetables on their own small plots. Many of these individuals would increase production if they had access to more land and to more secure forms of tenure. Many individuals are already participating in intensively supervised crop growing programs sponsored by the British, the

Taiwanese, or in programs sponsored jointly by the National Agricultural Corporation (NACO) and the Department of Agriculture. Many more would likely participate in these training efforts if improved and expanded access to land were possible.

Overall, SKN ought to aim at creating a diverse and flexible agricultural sector that does not have all its eggs in only a couple of baskets. This will allow the sector to shift resources to products with the most attractive prices. Land tenure changes and allowing the private sector to play a much larger role in production should be key changes in introducing this flexibility.

The willingness of donors to assist with this agricultural development may be a mixed blessing for SKN. While foreign aid makes foreign exchange and technical assistance more readily available, large amounts of aid reinforce dependency. This allows government to avoid or postpone making difficult policy decisions involving increased self-help, to place more stress on mobilizing internal savings to finance capital formation, to cut down on state subsidies, and to plan for major restructuring of the agricultural sector. Politically, it is easy to eliminate income taxes, tolerate deficit spending, expand perquisites for government officials and employees, grant cheap credit, hire more government employees, shorten working hours, ignore the theft of public goods, or to spend a good deal of time and

effort pursuing additional foreign assistance. It is much more painful to raise taxes, balance the budget, restrain wage increases to productivity gains, be stingy in handing out jobs and perquisites, charge and pay interest rates that allocate financial claims efficiently and equitably, encourage people to work more, guard government property as carefully as one's own, and seek modest amounts of external aid only when internal savings, incentives and expertise are not sufficient. Care must be exercised by both donors and government that large amounts of aid do not inhibit needed policy changes.

IV. DONOR ACTIVITIES

Several donor countries and agencies provide technical and financial assistance to SKN. The report on 1978 development assistance to St. Kitts/Nevis/Anguilla listed a total of US$1,768,000 in projects (UNDP). Agriculture, forestry and fisheries represented about 5 percent of the projects, while another 4 percent were in natural resources. Most of the agricultural projects were British bilateral efforts to support sugarcane and livestock. ECLA had three projects to support agricultural marketing and development planning, and CFTC had one project in fisheries development. All of these projects were completed by 1983.

Current donor assistance represents an expansion in number of donors, a diversification of activities, and a sharp increase in assistance to agriculture. The total

value of agricultural projects planned or underway exceeds U.S. $4 million (Table 17). The British are continuing to support their traditional interests: sugar, livestock, and crop diversification. The Canadians have partially completed an assessment of St. Kitts' subterranean water resources and have funded research on coconut oil processing on Nevis. The Taiwanese are providing financial and technical assistance on commercial vegetable production. An announcement was recently made that the Taiwanese had agreed to provide U.S. $1 million for partial payment to the estate owners on St. Kitts for the sugar estates taken over by the government. Another US$650,000 was committed to technical assistance, and agricultural equipment and supplies. A US $1.5 million line of credit for purchase of Taiwanese imports also was announced. Currently, USAID's activities are limited to a regional agricultural extension project and a planned regional farming systems research project. The future role of the Inter-American Development Bank (IDB) is unclear. A team is expected to arrive soon in SKN from IDB to conduct a sector review.

The government maintains a list of projects for which they seek foreign assistance. Table 18 presents this list for agriculture as prepared by the Planning Office in August, 1983. As noted, a few projects already have donors identified. The projects focus on the production,

TABLE 17: ONGOING DONOR ASSISTANCE TO ST. KITTS/NEVIS, 1983

Project	Donor	Amount	Objective
Bayfords Stock Farm Rehabilitation	BDD	(Series of grants)	Upgrade milking facilities, equipment for milking parlor, pasture development
Pilot Citrus Expansion	BDD	(Series of grants)	Planting citrus trees on approximately 10 acres, supply local market with fresh fruit (oranges, grapefruit, limes)
Irrigation Development-Nevis	BDD	U.S.$83,000	Irrigation and settlement on 10 acres of land
Water Development	CIDA	U.S.$2.8 million	Test drill for wells, commercial water development for residential and agricultural use
Training Scholarships	CIDA	Unknown	Academic training at UWI, Guyana School of Agriculture and ECIAF (East Caribbean Institute of Agriculture and Forestry)
Mussel and Edible Seaweed Culture	IDRC	U.S.$70,000	Propagate a special species to be used for mussel production
Agricultural Feeder Roads	CDB	U.S.$1.4 million	Hire local contractors to build feeder roads
Agricultural Policy and Planning	UNDP/FAO	Unknown	Provide three long-term technicians, short-term consultants and training
Vegetable Production	Taiwan	±U.S.$185,000	Commercial vegetable production on 3.2 acres; provide 2 Taiwanese workers, equipment and other inputs
Caribbean Ag. Extension	USAID	U.S.$79,000	Country component of the regional USAID Project
Slaughter Houses	CIDA/BDD	Unknown	Construct 2 slaughter houses, 1 in St. Kitts and 1 in Nevis for semi-processed meat
Farming Systems Research	USAID	Unknown	Regional Research Project

Project	Donor	Amount	Objective
Livestock Tick Control	BDD	Unknown	Operating costs and facilities for a tick control program
Sugar Industry	BDD	Unknown	Consultants to assess the sugar industry
Rose Farming	Private Enterprise	Unknown	Produce roses for export

Source: Interviews with government officials on St. Kitts/Nevis.

TABLE 18: ST. KITTS/NEVIS AGRICULTURAL PROJECT LIST, AUGUST 1983

Project	Estimated Cost in U.S.$	
1. Fisheries		
a) Artisanal fisheries development	1,481,181	
b) Deep sea (shark) fishing	592,593	
SUBTOTAL		2,074,074
2. Agricultural land improvement and soil conservation		243,681
3. Pork production		740,741
4. Agricultural and agro-industry equipment		
a) Oil extracting plant	92,593	
b) Equipment for roasting peanuts	18,519	
c) Shaft cutter equipment	22,222	
d) Machinery and cultivation equipment	185,185	
e) Marketing development	9,815	
SUBTOTAL		328,333
5. Ginnery improvement		31,685
6. Abattoir (possible CIDA/BDD funding)		174,074
7. Livestock development (possible EDF funding)		444,444
8. Tick control (possible BDD funding)		370,370
9. 65 acre vegetable crop		370,370
10. New central workshop and store - NACO		536,544
11. Renovation of Ag. Dept. building and establishment of an agri-laboratory		55,556
12. Renovation of Basseterre Public Markets and installation of cold storage facilities		111,111
13. Turbo-Automator (generator-15KVA)		92,593
14. Establishment of watering facilities for livestock		37,037
15. Irrigation water storage assessment and development (possible UNDP funding)		92,593
16. Input/output scheme - Nevis (possible CDB funding)		360,000
TOTAL		6,063,207

Source: Planning Office, St. Kitts.

processing, and marketing of crops (sugarcane, peanuts, cotton, vegetables) and livestock (cattle, pork).

Time did not permit a comprehensive analysis of donor activities, but a few impressions emerged from the data and interviews:

1. The government has replaced farmers as the primary source of innovation and experimentation in producing new products, and employing new cropping, processing and marketing systems.
2. The periodic upgrading and remodeling of equipment and facilities, such as in the sugar sector, normally financed out of operating earnings is identified for donor assistance.
3. Foreign assistance is becoming sizable and represents an increasingly large share of gross investment. The U.S.$6 million in the current project list for agriculture represents about US$135 per capita. That amount also exceeds total gross domestic investment in 1977 (World Bank, 1979), and represents 25 to 35 percent of total exports in recent years.
4. Most of the funds continue to prop up and support the sugar sector: sugar production, livestock and other crops grown on the government controlled estates.

The support of other donors for key agricultural activities limits the opportunities for USAID, but one key possibility exists which can make a crucial difference and exercise the innovativeness that USAID has as a donor. Several projects are production oriented, but none make any contribution toward a shift of land from public ownership back to private use or ownership. Thus the relationship between land and labor - the basic factors of production - is unaffected by existing projects. If government land ownership and management continues largely as it is today, opportunities for young people to farm will continue to be virtually nil. USAID has an opportunity to contribute to resolving this major problem.

V. PROJECT RECOMMENDATION

USAID could follow the example of other donors and fund one or more small projects designed to relax some technical, production, marketing or administrative constraint on SKN. Such an approach could be useful in attacking some short-term problem. The current problems of SKN are much more fundamental, however, and no real progress will be made in promoting agricultural development until the land tenure bottleneck is broken. This provides USAID an opportunity to help initiate a process of tenure reform which will strengthen the on-going process of structural transformation, and help integrate and increase the productivity of assistance provided in regional agricultural projects and by

other donors. Improved secure access to land is the primary constraint at the moment, and the team recommends the following land settlement project as the first priority for USAID to pursue.

A. Major Project Elements

The principal objectives of this project will be to help SKN: (1) accelerate adjustments in its land tenure and agricultural labor employment, (2) develop a more flexible agricultural sector that is less dependent on sugar, (3) promote food import substitution along with selected agricultural exports, and (4) provide more opportunities for private sector participation in agricultural production and marketing.

While a number of factors are slowing agricultural development in SKN, the land tenure system is clearly the largest impediment. Most of the best land, especially on St. Kitts, is in government controlled estates. Sugar workers continue to have very limited access to land on the estates for subsistence crops, limited commercial production of crops on short-term land leases, and the use of small areas of land for grazing a few animals. Many individuals on Nevis use some of the state-owned lands as common pasture. These short-term insecure arrangements provide few inducements for farmers to make investments in land or to maintain its productivity. The fences that are falling down, the terraces that are eroding away, and the widespread

stealing of agricultural goods are all indications of a tenure system that does not encourage a dynamic agriculture.

Nevis is further along in the plantation-decaying process than is St. Kitts. Hastening the transfer of significant amounts of state-owned lands via long-term leases or land sales to private individuals would ease labor utilization problems that plague the islands. Opportunities to gain access to land would attract more young people into agriculture who have been leaving the islands, provide more opportunities for the hundreds of women who are heads of rural households, and allow people who are currently mainly sugar workers to make more productive use of their time. With a modest amount of additional training, extension and research support, these new land operators would make much more efficient use of land and their labor than is currently the case.

Initially, the tenure reform effort might focus on Nevis. There are several reasons for this: Government has clear title to the land in state farms on Nevis; the tenure system is more diversified; there are more small- and medium-sized farms than on St. Kitts, and therefore more latent farm entrepreneurial skills; operators of new farm units should be able to expand production of well understood enterprises such as cattle, goats and sheep, along with peanuts and cotton.

New farm operators on St. Kitts will start enterprises in which they have relatively little experience; therefore, the training requirement on Nevis will likely be less than on St. Kitts. Land settlement on Nevis probably would result initially in increased production of animals for which there are well established markets. Relatively little market development would be required in the initial stages of a land settlement scheme on Nevis. The crop irrigated project run by the British Development Department on Nevis could be used as a training center for some of the new farm operators who need to upgrade their cropping skills. Department of Agriculture programs in peanuts and cotton on Nevis also could be adjusted to help new farm operators improve crop production. With very little expense, part of the two government ranches on Nevis could be used as training centers for helping new farm operators improve their livestock operations. The Mininstry of Agriculture and the Department of Agriculture on Nevis could be the implementing agencies for this land settlement program.

For political reasons, it would also be important to initiate some settlement efforts in St. Kitts in the early stages of the project. The unresolved payment problem for most of the government operated land blocks major efforts to redistribute land on St. Kitts. The government hopes to resolve this problem in 1984. Recent financial commitments from the Taiwanese to help pay for the land may be a step

forward in this regard. If the government cannot clear title to the land they operate on St. Kitts in the near future, representatives of the landowners must be brought into a discussion of any land settlement scheme. If this happens, the government might explore several options. The first would be to allow the government to issue long-term leases to land settlers with all of the tenants' lease payments going to the landowners. These leases might be designed as options to buy the parcel operated by the tenant. Another option would be to offer landowners partial payment to clear the title to several estates. The payments made by the settlers on these estates would go into a rotating fund to help acquire additional estates in the future.

Most of the participants in the settlement scheme in St. Kitts should be drawn from workers on the sugar estates who have participated in commercial crop production activities with NACO and the Department of Agriculture. The labor unions should be drawn into the selection process. Some of the participants in the settlements might be required to receive formal training in cultivation of specific crops either through the Taiwanese program, NACO's crop production efforts, or activities carried out by the Department of Agriculture.

The Department of Agriculture would be the most likely candidate for administering the land settlement program in

St. Kitts. To do this, however, its staff must be expanded. Some of the technicians who currently work for NACO in its crop diversification efforts might be shifted to the Department to help with a settlement program.

Some of the Caribbean regional agricultural projects supported by AID could be drawn on to support these settlement efforts. Regional research, regional extension, and farming systems research could all add to this bilateral program. Tying some of these regional efforts to this bilateral program may be a fruitful way to integrate them. As the project evolves, AID may also want to explore providing further assistance to the Development Bank so that financial services might be provided to settlement participants. This could include long-term loans to build homes on the new farm units, a few loans to purchase additional cattle, and a small number of loans for participants to buy machinery that might also be used for custom plowing.

It is unlikely that an AID sponsored land settlement program in SKN would require much infusion of loanable funds. Some work with both lenders and borrowers may be necessary to increase the credit worthiness of the participants in the project. Some special funding arrangements also may be necessary to facilitate loans for purchase of machinery, irrigation equipment, on-farm housing, and land. In the initial phases of the project, finance looks to be a relatively minor constraint. Some easing of interest rate

controls and getting land titles or long-term land leases into the hands of potential borrowers will go a long way in getting lenders more interested in lending to small- and medium-sized farmers.

B. USAID Inputs

A modest tenure reform project will require some additional administrative and technical inputs. Suitable land must be identified, plots surveyed, farming systems designed, farmers selected, roads and fences built, water systems installed, inputs acquired and distributed, training courses conducted, and research undertaken. The type and amount of foreign assistance required will depend on the magnitude of the project. Five years is probably a minimum period of time over which to implement this type of project. USAID inputs might involve short- and long-term technical assistance, academic and short-term training, imported equipment and supplies, credit for on-lending to farmers and, potentially most important, budget support to the government to help build and sustain the capacity to implement the project.

C. Issues to be Resolved

There are a number of issues that need to be addressed by USAID and SKN officials as the scope and nature of this project are discussed. These topics are presented in approximate order of priority.

1. SKN Office to plan and implement the project.

Much of the land on St. Kitts is controlled by NACO and the estate managers are probably most knowledgeable about the current land rights, soil quality, and possible settlement participants. The Department of Agriculture, however, has some unique information and talent that must be systematically accessed. The Ministry of Agriculture is the most likely candidate to be the major coordinating unit, especially to tie together the work on the two islands. The decision on which office(s) to provide project leadership and management will be influenced in large part by who becomes the major local advocate for this project.

2. Involvement with local groups

Consideration must be given to involving local groups, such as unions and political representatives, in various aspects of the project design and implementation.

3. Relative participation of the two islands

The two islands may want to participate on an equal basis, or the project may be phased with most activities initiated first on one island followed later by the other.

4. Land potentially available for distribution

A land inventory will be needed to determine the

amount of land on government estates that might be available for distribution considering: current use rights, reserves for communal grazing, susceptibility to erosion, forest and water resources reserves, and areas for Department of Agriculture use.

5. Method to obtain title to St. Kitts land

Since the government does not yet have clear title to many St. Kitts estates, it will be necessary to explore alternative ways of getting title to part of the land so that the project can proceed on St. Kitts.

6. Number of potential beneficiaries

This item involves making a preliminary estimate of the number of potential persons/families that might become beneficiaries considering management and administrative capacity of the project and demand by local entrepreneurs. Information on their skills and interest in participating are also needed.

7. Type of access to land to be provided

The project can provide leasehold, freehold or both to beneficiaries. A decision will be needed about the appropriate or preferred method(s).

8. Type and size of farm

A decision will be needed on the types of farming

systems expected to be employed by the beneficiaries: fruit, vegetables, field crops, livestock, improved pasture, and use of machinery. Land availability and its physical attributes will influence the size of unit distributed.

9. Inputs and services to be provided to beneficiaries

Settlement schemes vary from simply providing land to a full range of complementary inputs and services. This decision depends on the availability of private sources, expected needs of beneficiaries, and farming system employed.

10. Nature and level of AID inputs desired

Some suggestions about possible type and level of assistance are provided in an earlier section of this report.

11. Integration and coordination with regional and other bilateral projects

This point involves both political, diplomatic, and technical issues. The survey of donor assistance provided above is evidence that this project would fit in well with other bilateral projects, but this point needs to be further explored. Secondly, this project can build upon the experience and information gained from other projects providing that a means to effect integration and coordination are found through consultation.

VI. LIST OF PEOPLE INTERVIEWED

Mr. Hector, Director of the Development Bank in Basseterre
Mrs. Powell, Loan Officer, Barcleys Bank in Basseterre
Mr. Allen, Economist with the Eastern Caribbean Central Bank
Mr. Bass, employee of NACO
Mr. Marsden, USAID, Private Sector
Mr. Dore, former head of NACO
Mrs. Williams, Economist, Planning Office
Mr. Olf, UNDP, Planning Office
Mr. Kudeabo, UNDP, Planning Office
Mr. Bradley, Planning Office
Mr. Hidegar, Fisheries, Ministry of Agriculture
Mr. Williams, Planning Office
Mr. Martin, Department of Agriculture
Mr. Powell, Ministry of Agriculture
Mr. Titley, Loan Officer, Barcleys Bank, Nevis
Mr. de Silva, farmer
Mr. Saunders, farmer and estate manager
Mr. Gordon, British Technical Assistance
Mr. Heyleger, Dept.. Office of Planning
Mr. Versailles, Price Control and Imports
Mr. Morris, Department of Agriculture
Mr. Maynard, Ministry of Agriculture
Mr. Nesbit, Veterinarian
Mr. Pilgrim, Caribbean Development Bank
Mrs. Verity, Caribbean Development Bank
Ms. Lowery, CARDI, Nevis
Mr. Nisbett, Department of Agriculture, Nevis
Mr. Cruickshank, Caribbean Development Bank, Barbados
Mr. Leeown, Caribbean Development Bank, Barbados
Mr. Elwen, Caribbean Development Bank, Barbados

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AN IMPORT SUBSTITUTION PROJECT FOR ST. KITTS/NEVIS

by

by E. T. Bullard, USAID Consultant
15 November 1983

Our Scope of Work requests goals and objectives for the agricultural sector, consistent with Government of St. Kitts/Nevis (SKN) and AID policies.[1] It was not possible for the team to determine with certainty whether or not a land settlement project was consistent with the Government of St. Kitts/Nevis policy during our stay in SKN. None of the government personnel we contacted indicated any objection to the possibility of a land tenure project, however.

The following project is consistent with the Governmen of SKN policy and is presented as a second alternative in case the Government does not feel that the land settlement project is consistent with their present policy. The team believes that a land settlement project should receive top priority if long-term economic development is a goal and that the alternate project might be considered as an interim step to the land tenure approach if it is not possible to currently move forward with land settlement.

Goal and Objectives

A general goal of the current SKN Government is economic diversification resulting in import substitution.

1/ This proposal is closely related to a larger study done by Dale W Adams and others, "Agricultural Sector Assessment For St. Kitts/Nevis," unpublished report prepared for USAID/Barbados, 30 November 1983.

Consistent with this goal, the objectives of this project are as follows

1. Strive for a large degree of self-sufficiency in food production in SKN.
2. Obtain a more favorable balance of payments.
3. Provide more employment opportunities.
4. Provide abundant local food supplies throughout the year.
5. Attain more efficient use of available land.
6. Improve the standard of living of persons engaged in agriculture and related activities.
7. Develop a viable self-perpetuating non-sugar agricultural industry. And,
8. train personnel to implement the project.

Implementing Agency

The Ministry of Agriculture should be the coordinating agency for this project and the implementing agency should be the Department of Agriculture. It will be necessary for the Department of Agriculture to hire additional staff, and foreign technicians will be required to assist in implementing the project.

Project Design

To develop an import substitution project, it will be necessary to work on several different components at the same time. This will include training, plant introduction,

cultural practices for crops and livestock, seed multiplication, marketing, transportation, storage and processing.

Nevis

A training and seed center is needed to multiply seeds and train personnel in crop and livestock production in Nevis. The training center for crops could be correlated with a small irrigation scheme. The training center should be for extension personnel, farmers, 4H Club members and secondary school students. To train personnel, it will be necessary for students to be involved with crops. CARDI has been doing research on annual crops for several years and has identified varieties that perform satisfactorily under the environmental conditions in Nevis. Seed from these outstanding varieties should be increased at the training center so that they can be sold to farmers. The training will then fulfill two objectives: to train personnel and to provide certified seed of high yielding annual crops and plant material required by farmers.

The training center also should include a nursery to provide students with plant material and techniques on how to raise and bud perennial plants. This would include oranges, grapefruit, tangerines, limes and lemons as well as passion fruit, coconuts, mangoes, custard apple, soursop, papaya (paw-paws), pineapples, and avocados.

Technical assistance would be required at the training center for at least four years. It would be desirable to

have one horticulturist and an agronomist who have had a great deal of experience with pulse crops in the tropics. The foreign technicians should be extension specialists with experience in training under tropical conditions.

A crops training center will provide the farmers and extension personnel with the latest techniques in producing vegetables, fruits, root and pulse crops. A total of more than $440 thousand U.S. was spent in 1980 to import these crops; it should be possible to reduce these imports considerably if people have adequate sources of seed and use the correct management procedures to obtain high yields.

One other area that needs attention is the efficient production of livestock. In 1980 imports of meat, poultry and eggs amounted to almost $1.2 million U.S. due primarily to a lack of feed for these animals, as well as poor management procedures and a lack of good disease prevention techniques and control.

In order to reduce the imports of meat and eggs, it would be desirable to establish a training center for livestock and forage production similar to the one for crops. A good location for this training center might be at the government owned ranch at Maddens with a limited amount of training to be conducted at the government owned estate at Indian Castle.

The project would consist of two objectives as in the training center for crops; namely, training farmers,

extension personnel, veterinarians, 4H Club members and students in efficient livestock production, as well as producing certified seed and plant materials for animal feed.

The training program at Maddens should include rotational grazing, proper fencing, artificial insemination, breeding techniques and feeding trials. Grasses and legumes should be tested under different fertility levels to determine which forages are the most palatable and providing the greatest gains for the animals. Seed and plant material of the best forages would need to be increased and sold to the farmers. Corn, sorghum and millet should be tried in the low rainfall areas.

The cattle dips should be put back into use on Nevis to reduce the time required to eliminate ticks on the animals.

Funds will be needed for purchase of vehicles and farm machinery, as well as for spare parts to fix the equipment presently available and for the new equipment as needed.

A pilot feed mixing plant should be constructed so that different blends of feeds can be tried using local feeds such as cassava, breadfruit, pulse, grain, and oil crops. Economic studies should be conducted to determine if it is cheaper to import meat and eggs or to grow the feed locally in order to produce poultry and livestock. A pilot slaughter house might be built that can be used at the training center as well as for others who are willing to pay for the service. Limited cold storage facilities, as well

as a small freezing unit, might be constructed for holding meat and freezing small quantities for experimental purposes.

It will be necessary to have an animal husbandry specialist, and a forage specialist for a period of four years to supervise the training programs. All of the foreign specialists should have a good background in extension and training methods in the area of animal husbandry. They should have previous experience working with cattle, sheep, goats, pigs and chickens under tropical conditions. Candidates should be selected and sent abroad to obtain advanced degrees in livestock production, veterinary science and forage research so that when they return they can assume the duties of the foreign technician.

Training also will be needed in credit, marketing, storage, management, processing, extension work, pest control and agricultural engineering. All of the training agreements should have a clause that states that the candidates must return and work for the Government for two years for each year they receive in training or else repay back the cost of the training program.

St. Kitts

CARDI has some vegetable plots to determine marketable yield and earnings per acre, using the highest yielding varieties which were based on earlier trials. Table 1 indicates the results of the trials which were on 0.05 to 0.07

acre plots. The results of these trials indicate that vegetable production can be economical and can be expanded if the farmers have viable marketing, operating, and storage facilities available throughout the year.

A project entitled "65 Acre Vegetable Crop Project for St. Kitts" was prepared by Miss Sheila Bass in June, 1978, but to date it has not been funded. The proposed project was to be located at Pond's Estate, Basseterre East Region. Water for irrigation is available from existing pipelines and wells were already dug in the project area.

TABLE 1

MARKETABLE YIELD AND EARNINGS PER ACRE FROM SELECTED VEGETABLES[1/]

VEGETABLE	MARKETABLE YIELD LBS./ACRE	EARNINGS PER ACRE $EC*
Cabbage (1)	5,300	$2,988
Cabbage (2)	5,220	6,600
Cucumber (1)	6,529	4,204
Cucumber (2)	14,084	9,202
Okra	4,938	3,463
Sweet Pepper	1,267	1,017

1/ "Small Farm Systems Research Project No. 538-0015. Final Report," 1978-'82, Vol. IV, pp. 7-15 to 7-19.

* In 1982 one U.S. dollar equaled $2.70 E.C.

This project would contribute to import substitution. The original project was established as a vegetable production project operated by the National Agricultural Corporation (NACO) to produce vetetable crops and provide

work during the period when labor is not involved in cutting sugarcane.

It is suggested that the project be composed of the following components:

1. Training in vegetable production.
2. Vegetable production.
3. Vegetable seed multiplication.
4. Vegetable storage and processing. And,
5. Plant introduction.

The Department of Agriculture would be responsible for preparing the land for planting, establishing and maintaining the irrigation system and purchasing agricultural equipment and supplies for the training operations. The farmers would have the option of renting small areas of land under the Project for producing vegetables, peanuts, root and pulse crops.

Three acres of the 65 acres should be set aside for office space and pilot cold storage and processing plants, agricultural output storage sheds for the training and seed multiplication operation. The farmers who have not produced vegetables before should have an opportunity to participate in a training program for several weeks. The program would include selecting the highest yielding varieties, planting seeds and transplant methods for the vegetables that are customarily transplanted, such as onions, cabbage and

tomatoes. The program also would include pest control techniques and methods of harvesting, drying and storage.

It probably would be necessary to have a horticulturist and irrigation engineer for at least two years to assist in training the local staff in management, cultural practices, irrigation techniques and for implementing the training program as well as the seed multiplication activity. Funds will be needed for agricultural inputs and storage facilities.

The horticulturist should have the responsibility for importing high yielding improved clones of macadamia nuts, coffee, and spice crops such as allspice and nutmeg than can be tested by the Department of Agriculture for projects in the future. High yielding plant material of passion fruit should be imported and tried since there is rapidly expanding market in the United States for the fruit and juice.

The Department of Agriculture should maintain a source of high yielding plant material for entrepreneurs interested in trying new crops on the island.

Funds should be provided to the Central Marketing Corporation to build pilot cold storage facilities so that farmers or speculators can rent space for storage of vegetables when prices are low, then sell in off-season.

A pilot processing plant also should be built so that the vegetables could be canned and frozen for both local

consumption and for export. A food technologist would be needed to assist in this project in order to determine if it is economically sound to produce vegetables and process them under the local environmental conditions. Studies also should be conducted on processing fruits, juices, jams and jellies, as these products are needed locally and could be exported as well.

Project Duration

The project will require a period of at least five years since the efficient production of livestock is one of the components of the project. It probably will take about one year to locate a Land Grant University or private contractor to assist in implementing the project. Funding may be necessary after the project has terminated if graduate students are still in the United States.

Technical Assistance

It will be necessary to provide technical assistance in several areas to train personnel in the Department of Agriculture. The following Table indicates the number and time period for some of the project specialists:

No.	Specialist	Person Months
2	Horticulturist	72
1	Agronomist (Peace Corps)	48
1	Forage Specialist	48
1	Animal Husbandry Specialist	48
1	Irrigation Specialist	24
1	Food Technologist	24
1	Agriculture Engineer	12

At the present time USAID is funding regional projects in extension, research and livestock production. It may be possible to reduce the list of specialists indicated if sufficient personnel can be made available from the other regional projects.