

# SOIL CONSERVATION, POLITICAL ECOLOGY, AND TECHNOLOGICAL CHANGE ON SAINT VINCENT\*

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**ABSTRACT.** A political-ecological perspective is used to analyze soil erosion, conservation, and the peasantry on Saint Vincent in the Eastern Caribbean. Peasants farm areas most susceptible to erosion because of the historical development of property relationships. A soil-conservation effort begun in the late 1930s was part of a broader, British Empire-wide program. Local political-economic conditions and the environmental and technical characteristics of the cropping systems influenced the nature of soil conservation on Saint Vincent. Official colonial discourse about erosion reflected a complex mixture of blaming peasants and recognizing their political-economic constraints. *Keywords:* Caribbean, peasants, political ecology, Saint Vincent, soil conservation.

Most government-inspired soil-conservation programs of developing countries have met with limited success (Blaikie 1985; Edwards 1995). Indeed, in sub-Saharan Africa, programs catalyzed resistance and armed struggle against colonial regimes (Anderson 1984; Beinart 1984; Anderson and Grove 1987; J. McGregor 1995). The case of Saint Vincent and the Grenadines in the Eastern Caribbean (Figure 1) stands in marked contrast to the experiences of most developing countries. Many researchers have commented on the impressive achievements in controlling soil loss in this small, island nation (Fentem 1961; UNESCO 1982; Ahmad 1984, 1987). A recent assessment reflected on the heyday of the Vincentian conservation effort:

In the later 1930s and earlier 40s St. Vincent's agriculture was the pride of tropical agriculturists. St. Vincent was the show-piece of the most prestigious institute for the teaching of tropical agriculture—the Imperial College of Tropical Agriculture based in St. Augustine, Trinidad. The College authority brought students from South America, Africa, Asia and other parts of the Caribbean to see the sort of cultivation that made deference to contour planting an integral part of the cultivation technique. Pilots diverted their flights to show their passengers the beautiful effect of planting on the contour. (Vincentian 1989)

The relationship of soil erosion, conservation, and the peasantry on Saint Vincent is particularly interesting. First, the environmental context is highly conducive to erosion, and peasants cultivate in the areas that are most susceptible to soil loss. Second, the development literature has ignored conservation activities on the island. Indeed, soil conservation in the Caribbean region generally has received little attention, except for a few technical (Hardy 1939; Carson and Tam 1977; Gumbs 1987,

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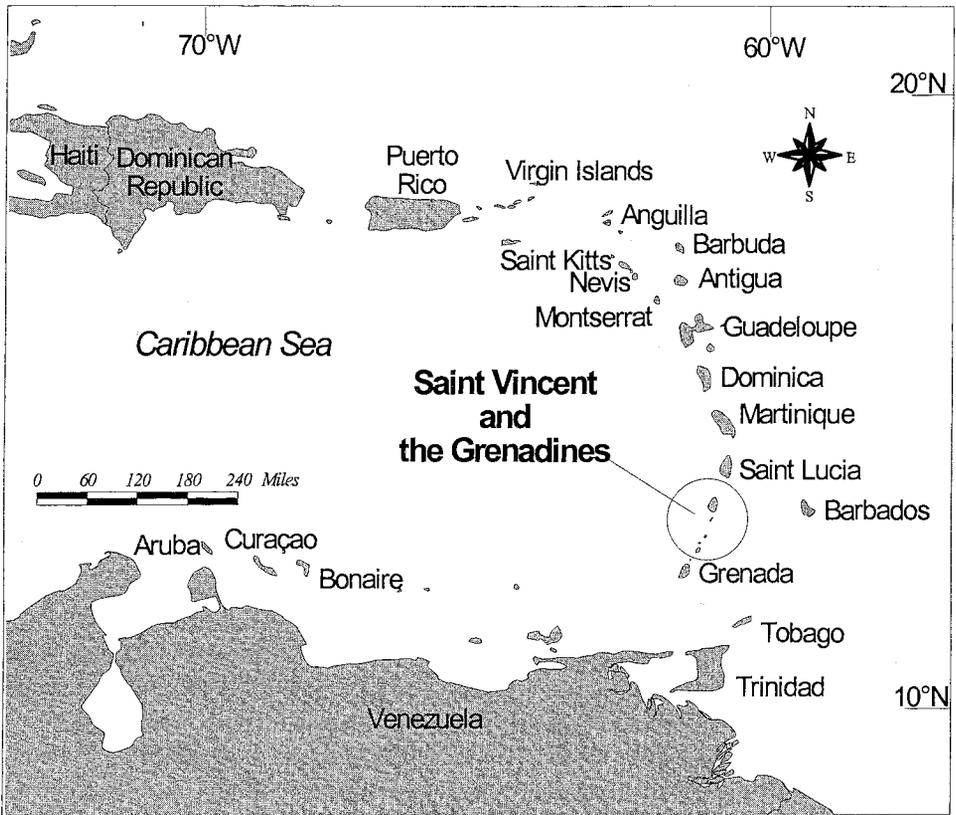


FIG. 1—Location of Saint Vincent and the Grenadines in the Caribbean. (Cartography by John Boyer, Department of Geography, Virginia Polytechnic Institute and State University)

1993; D. McGregor 1995) and socioeconomic (Blaut and others 1959; Blustain 1985; Barker and McGregor 1988; Horner 1994; Edwards 1995) studies. Certainly, the Caribbean region is underrepresented in the conservation literature, compared with sub-Saharan Africa (Anderson and Grove 1987; Leach and Mearns 1996). Even Piers Blaikie (1985), in his well-known discussion of the political economy of soil erosion, ignored the Caribbean area. Third, Caribbean researchers have failed to realize that the conservation efforts on Saint Vincent and elsewhere in the region that began there in the late 1930s were far from isolated occurrences; they were part of a British Empire-wide program (Stockdale 1937; Masefield 1978; Clarke 1987).

Political ecology focuses on the relationships among the environment, patterns of resource use, and political-economic forces (Grossman 1998). Relevant to this study is the concern of political ecology with how political-economic conditions influence susceptibility to soil erosion and the viability of soil-conservation programs (Blaikie 1985; Blaikie and Brookfield 1987; Hershkovitz 1993; Zimmerer 1993). Researchers have identified several forces that affect efforts to control soil loss: inequality in control of land, labor shortages in agriculture, and insecurity of tenure

(Eckholm 1976; Blaikie 1985; Blustain 1985; Collins 1987; Zimmerer 1993; Edwards 1995). These conditions are evident in Vincentian agriculture as well as in the wider English-speaking Caribbean (Mintz 1989), so their significance for erosion and conservation on the island will be examined.

A recent concern in political ecology is the nature and significance of environmental discourses, which represent the ideologies held by groups of individuals and institutions (Rocheleau, Steinberg, and Benjamin 1995; Jarosz 1996; Leach and Mearns 1996; Peet and Watts 1996; Zimmerer 1996). These studies tend to present official colonial discourses on peasant-related soil erosion in homogeneous terms. The literature portrays colonial officials as uniformly blaming peasants for erosion because of their inappropriate technology, mismanagement of the environment, and overpopulation; the political-economic forces that contributed to erosion were not considered. Consequently, officials offered solutions that were purely technological (Anderson 1984; Blaikie 1985; Anderson and Grove 1987; Horner 1994; Rocheleau, Steinberg, and Benjamin 1995; Jarosz 1996).

TABLE I—DISTRIBUTION OF AREA BY SLOPE, SAINT VINCENT

SLOPE CLASS (IN DEGREES)	PERCENTAGE OF TOTAL AREA
0–5	6.02
5–10	6.40
10–20	6.96
20–30	27.43
>30	53.19

Source: Ahmad 1987, 126.

#### THE ENVIRONMENTAL CONTEXT OF SOIL EROSION

The volcanic island of Saint Vincent, the largest in Saint Vincent and the Grenadines, is small—only 18 miles long and 11 miles wide—and exceedingly rugged. A thickly wooded, mountainous spine runs from north to south down the center of the island, with lateral spurs branching off toward the eastern (windward) and western (leeward) halves. The tallest of the island's several peaks is La Soufrière (4,048 feet), in the north. The leeward side, with deep, narrow valleys, is more rugged than the windward portion, though the availability of flat or moderately sloping land anywhere on the island is very limited (Table I). Indeed, only 20 percent of the land has slopes of less than 20°, a setting that is highly conducive to erosion. Most of the island's population, which numbered 99,200 in 1991, live along the coastal areas or in the inland valleys, for the interior, roughly 40 percent of the landmass, is too precipitous for settlement or extensive cultivation.

Certain characteristics of Vincentian soils mitigate the problem of erosion. The parent material weathers rapidly and deeply, partially offsetting losses due to erosion. Also, most soils are light and free draining, which reduces runoff, and they have stable soil aggregates (a function of the dominance of the mineral allophane in the clay fraction) (Ahmad 1987). However, some soils, known locally as "shoaly," have a firmly cemented, impervious layer near the surface that limits infiltration and facilitates runoff and erosion.

Rainfall reflects elevation. Average annual precipitation varies from roughly 60 inches in coastal areas to more than 150 inches in the elevated, rugged interior. Most

of the rainfall, some 70 percent of the average annual total, falls between June and November; February, March, and April are the driest months. Intense downpours are not uncommon during the rainy season, though such heavy precipitation tends to be more intermittent than sustained.

The environmental significance of soil erosion is open to multiple interpretations that reflect different cultural and political biases (Blaikie and Brookfield 1987; Leach and Mearns 1996). Nonetheless, potential for soil loss on Saint Vincent is considerable, and peasants are susceptible to erosion because they farm the steepest slopes. Why they cultivate such marginal, steeply sloping lands reflects the history of inequalities in control of land.

#### EVOLVING INEQUALITIES IN LAND CONTROL

Small-scale cultivation has historically been associated with the utilization of marginal lands with steep slopes on Saint Vincent, as in many other parts of the British Caribbean. The pattern originated in the estate or plantation system, established on Saint Vincent in the late 1700s, when large-scale sugarcane production for export to Great Britain utilized the labor of thousands of African slaves. Sugarcane on such large properties—the mean holding in the late 1820s on Saint Vincent and the Grenadines was 369 acres (Shephard 1971, vi–xxvi)—occupied the flatter lands along the coasts and inland valleys. Estate owners allowed their slaves to grow most of their own food in small plots known as provision grounds, located at higher elevations in the interior, where steep slopes and high rainfall made the areas unsuitable for sugarcane cultivation.<sup>1</sup>

Slavery was abolished in 1834, but in postemancipation years these spatial patterns persisted. Most estate owners refused to sell land to the former slaves, preferring them to remain dependent on their wages as estate laborers (Momsen 1987; Rubenstein 1987). In the late 1880s the Vincentian administration, which became increasingly sympathetic to the pleas of former slaves and their descendants for land, began to sell them small plots of Crown lands (Fraser 1980, 104). These Crown lands were mainly in the interior of the island, in terrain that was rugged and highly susceptible to erosion.

In response to recommendations made by the West India Royal Commission of 1897, the Vincentian administration initiated a land-settlement program in 1899. The administration began to purchase, mostly through compulsory acquisition, estate properties that were essentially nonfunctioning; by 1915, 7,527 acres were in the program (John 1974, 118), and additional purchases in the 1930s increased the total to 8,249 acres (Walker 1937, 223). Most of the blocks that were sold were 5 acres, and the program greatly expanded the area under peasant control (Fraser 1986). By 1937, peasant-held properties of less than 10 acres totaled 11,382 acres, though estates of more than 50 acres still held the most (37,556 acres) and best-quality land (Brown 1939, 134).

The quantity of land controlled by the Vincentian peasantry may have increased, but its quality improved only marginally. Much of the land acquired for peasant land

settlements, coming from unprofitable estates, had both exhausted soils and steep slopes, especially on the leeward side of the island (Momsen 1987). For example, C. Y. Shephard, in referring to Belmont, one of the Vincentian land settlements, reported that most (63 percent) of the lots had slopes of at least 30° and that few (6 percent) had slopes of less than 20° (Shephard 1945, 46).

By the time a major push to introduce soil-conservation techniques arrived in the late 1930s, the facts of land distribution meant that peasants, in particular, were likely to farm in areas that were prone to soil erosion. The extent of erosion was influenced by more than the characteristics of land distribution and topography, however: The specific technologies employed and the different crops grown also played a role.

#### PEASANT CROPPING SYSTEMS AND SOIL EROSION

From emancipation to the beginning of the conservation effort in the 1930s, Vincentian peasants produced food crops—especially roots and tubers—for home consumption and sale in local markets. Their two export crops were arrowroot (*Maranta arundinaceae*) and Sea Island cotton (superfine V. 135). Food crops were always the province of peasants, but both peasants and estates were involved in the cultivation of arrowroot and Sea Island cotton.

When cultivating most food crops, peasants hoed fields to construct a system of ridges and furrows, and they further loosened the soil with the aid of forks.<sup>2</sup> That agronomic method had several major drawbacks, in the opinion of agricultural officials. First, the ridges and furrows only roughly followed the slope contours; during periods of intense rainfall, precipitation could accumulate in the low points of the furrows, eventually breach the ridges, and cascade downhill, contributing to both gully and sheet erosion. Second, agricultural officials also complained about what they called “hoerosion”: In the annual process of constructing their system of ridges and furrows, villagers pulled the soil downslope, with the result that, over time, soil accumulated at the bottoms of hillsides. Third, villagers planted in the rainy season, creating an exposed and disturbed soil surface just when the danger of erosion was greatest. Lastly, peasants subsequently clean-weeded their food gardens, leaving bare spaces among the plants exposed to the erosive power of rainfall until a sufficient canopy developed. Although the potential for erosion in peasant food cultivation was significant, it varied according to the items grown. Some crops, such as yams and cassava, afforded little soil cover. In contrast, sweet potato, which dominated Vincentian food gardens because of demand for the crop in nearby Trinidad, produced an extensive and protective cover.

The crop most closely associated with erosion was Sea Island cotton (Hardy 1939). Saint Vincent, where cultivation of the crop began in 1903, became the world’s major exporter of this strain, renowned for its fineness and strength. Sea Island cotton was a particularly popular cash crop among peasants in the land-settlement schemes: Authorities encouraged its cultivation as a source of income to enable the allottees to make their installment payments (Fraser 1986, 33).

Cotton cultivation had many of the same problems as food crop production. The time of planting, regulated by government decree as a means of controlling pest outbreaks, varied but always took place over several months during the rainy season (Wright 1929, 251; Anderson 1938, 330). The plant took three months to establish a protective cover, so it provided even less cover for the soil than did most Vincentian food crops. To make matters worse, villagers planted the crop in improperly aligned ridges. As H. S. McConnie observed, in a government booklet describing appropriate cultivation techniques, "During this period a considerable amount of top soil will be washed away if banks [ridges] are not properly made to follow the contour" (McConnie n.d., 2). Because cotton plants are especially sensitive to weed competition, villagers frequently clean-weeded the crop during the rainy season (Wright 1929, 251).

The other major peasant export crop was arrowroot, the cylindrical root stocks of which are high in starch (Handler 1971). Saint Vincent dominated the world market for this crop, with its varied dietary, medicinal, and industrial uses. Peasants did not construct a system of ridges and furrows for arrowroot, as they did for food crops and cotton. Rather, they used a fork or a hoe to till an entire field, buried remaining weeds, and then used a hoe to chip shallow holes in which they planted small pieces of arrowroot rhizomes. Because the plant quickly provided a dense, extensive leaf cover, its cultivation led to less erosion than did food crops or cotton (Hardy 1939). Harvesting, which took place ten to twelve months after planting, was particularly backbreaking work, for farmers had to dig out the large rhizomes with a hoe, in the process loosening the entire soil surface. Replanting took place at the same time as harvesting.

The normal arrowroot harvesting period ran from January to May, the drier months, which helped limit exposure of fully tilled fields to the erosive power of rainfall. Nonetheless, problems could occur under certain conditions, especially given the tendency to plant the crop on sloping land. Even during the dry season, intense rainfall occurred on occasion and eroded the newly planted fields, whose surface was fully disturbed and loosened but lacked the protection of ridges and furrows. If the dry season was particularly intense, it was difficult to harvest the arrowroot, forcing growers to delay the activity until the arrival of the rainy season, when the soil became more friable (St. Vincent Agricultural Department 1937, 2). Another problem was the tendency to gradually move the date of harvesting in older, less fertile fields earlier, into the rainy months of October or November (Anderson 1938, 324–325).<sup>3</sup>

These different peasant cropping systems of the late 1930s, combined with the particular environmental context of Vincentian agriculture, suggest ample potential for significant soil erosion. But official concerns about conservation and soil loss, which would become prominent in the late 1930s, were hardly exclusive to Saint Vincent or the Caribbean region.

#### THE GROWTH OF CONSERVATION ON SAINT VINCENT AND IN THE BRITISH EMPIRE

Concern with conservation in general and with soil loss in particular was certainly not new on Saint Vincent or elsewhere in the British Empire. In 1790, for example, the

Saint Vincent Assembly discussed problems of soil erosion and gullyng on estates. And in 1791 the assembly passed the Kings Hill Forest Act to preserve a forested area in the southern part of the island, in the belief that it was needed to attract clouds and rain. At the time, there was much discussion among British and other scientists concerning the impact of deforestation on climate (Grove 1995, 294–295). Similar forest reserves were established on the nearby island of Tobago. Subsequently, the British in India began much more extensive forest-conservation programs in the mid-1800s, influenced in part by these earlier efforts; and these programs, in turn, inspired later attempts to control deforestation in British-controlled Africa (Grove 1997).

During the first two decades of the twentieth century, conservation initiatives became more widespread in the British Empire. Although much attention was still directed at limiting forest loss, interest in controlling soil erosion specifically also grew. On Saint Vincent, peasants in the land-settlement schemes who were still paying installments on their plots were supposed to follow the directives of agricultural officials, such as adopting mixed cropping, engaging in crop rotation, maintaining windbreaks, and refraining from burning bush, grass, and weeds (Wright 1929, 242). In India, Ceylon, and Malaya, colonial governments embraced such measures as constructing contour drains, terraces, and contour ridges to control erosion (Stockdale 1937; Grove 1997). In eastern and southern Africa, officials and scientists expressed concern about the extent of land degradation, in some cases blaming European settlers for the problem (Beinart 1984). Colonies there also began to make occasional efforts at conservation (Beinart 1984; Anderson and Millington 1987; Otieno and Rowntree 1987; J. McGregor 1995). All of these initiatives, however, were the result of actions by individual colonies in response to perceived local problems.

In the 1930s, scientists and officials in the British Empire began to view soil erosion not as a localized problem but as an empire-wide issue with empire-wide significance. Such an emphasis was reflected in the titles of various publications on the subject, including “Erosion in the Empire” (Watson 1936) and “Soil Erosion in the Colonial Empire” (Stockdale 1937). For example, G. C. Watson warned: “Today millions of acres of the Imperial domain all over the world are in danger of destruction by the uncontrolled forces of erosion. . . . If such basic sources of the Empire’s wealth are to be maintained it is evident that more effective anti-erosion schemes must be instituted” (Watson 1936, 305).

Although a variety of influences contributed to the growth of empire-wide interest in erosion, two were particularly prominent. First, the image of the devastating impacts of the 1930s Dust Bowl in the southern Great Plains of the United States intensified worldwide concern about soil erosion (Stockdale 1937; Anderson 1984; Beinart 1984). Agricultural officers in the British colonies visited the United States to view conservation methods developed there by the Department of Agriculture Soil Conservation Service in the 1930s, and colonial agricultural departments received the Soil Conservation Service’s publications (Anderson 1984, 326). Indeed, Saint Vincent copied conservation techniques developed in field trials conducted in

the United States and Puerto Rico (Hardy 1939, 62; Robinson 1947, 353). Second, there was growing concern about the increasing population pressure in both sub-Saharan Africa (Anderson 1984; Beinart 1984) and the Caribbean (Robinson 1947), which lent urgency to the conservation of soil resources. By the 1930s officials tended to focus blame on peasants and herders, not European settlers, for land degradation.

In contrast to the situation in previous decades, when soil-conservation efforts were mainly fragmented attempts by individual colonies to cope with their own local circumstances, the British Colonial Office in London in the late 1930s became the central force encouraging the empire's conservation efforts. Within the Colonial Office, the influence of technical advisers and their reports became increasingly important, helping to mold the direction of policy on erosion (McCracken 1982). Such an outcome was part of a broader pattern of the growing significance of technical experts in a wide range of issues of importance to the colonies, "from education to pest-control" (p. 102). Erosion was perceived as one of the most important technical problems. John McCracken notes that "the whole band of British metropolitan advisers [were] falling over each other in their eagerness to emphasize the imminent perils [of erosion] facing the dependant empire" (p. 112). During the late 1930s the Colonial Office "moved erosion up in its list of policy priorities" (Beinart 1984, 68), and in January 1938 it sent a circular to all colonies instructing them to submit an annual report of their soil-conservation accomplishments (Anderson 1984, 340–341). Moreover, the British government provided the essential financing for much of the soil-conservation work undertaken throughout the empire, including that on Saint Vincent, through grants made under the Colonial Development and Welfare Acts (Tempany, Roddan, and Lord 1944, 121).

The conservation effort in the empire at that time must also be understood in the context of institutional changes in agriculture within the British colonies. During the first three decades of the twentieth century, agricultural departments were created in the various colonies, and they became increasingly active over time (Masefield 1978). Many British colonial agricultural officers were trained at the Imperial College of Tropical Agriculture in Trinidad, which opened in 1922 and received its royal charter in 1926 (Anderson 1984, 337). At the college, the "problems of land management in the tropical environment, including the evils of soil erosion—which were well known in the West Indies—were the bread and butter of the Trinidad syllabus" (p. 337). By the time graduates of the Imperial College began to infiltrate departments of agriculture throughout the colonies, including those in the Caribbean, their training emphasized the importance of intervening in and improving peasant agriculture (Masefield 1978, 70–71).

Although limiting soil loss became a pan-empire effort, the contexts and nature of conservation efforts varied regionally. For example, in eastern and southern Africa, where African farmers and herders had lost much of their land to European settlement, colonial administrations made a variety of soil-conservation practices—such as ridging, bunds, and terracing—compulsory and vigorously pursued destock-

ing policies that helped foment resistance to colonial administrations (Anderson and Grove 1987).<sup>4</sup> In contrast, efforts on Saint Vincent relied on voluntary compliance.

#### OFFICIAL DISCOURSE AND CONCERN ABOUT EROSION ON SAINT VINCENT

Agricultural Department annual reports in the 1940s and 1950s repeatedly proclaimed soil erosion the most serious threat to Saint Vincent. The superintendent of agriculture in the 1930s and 1940s, C. K. Robinson, who was well known locally for his energetic efforts to introduce conservation techniques, asserted that soil erosion was “undoubtedly the most urgent agricultural problem in St. Vincent and, as the economy of the Colony is very largely based on agriculture, it may be said to be the most important problem confronting the Colony” (1947, 350). As in other British colonies, concerns were couched in reference to growing population pressures, which were viewed as particularly urgent on Saint Vincent because of its limited amount of arable land. Robinson noted that the average family of five on Saint Vincent had only slightly more than 4 acres to cultivate, so soil conservation was imperative.

Analyses of soil erosion also tended to stress the inappropriate technology of peasant agriculture as a contributor to erosion, a pattern characteristic in the British Empire at the time (Beinart 1984). For example, in his classic study of land-settlement schemes in the British Caribbean, Shephard argued, “It is important that the peasant should be denied the opportunity to abuse the land” (1947, 70). Furthermore, in relation to one Vincentian land settlement, he complained: “Belmont settlement provides a striking demonstration of the squandering of soil capital which occurs on steep land when the prevention of erosion is left to the uncoordinated and unsupervised efforts of peasants” (1945, 46). The consensus of officials and agricultural consultants in the 1940s was to no longer offer freehold tenure to settlers, because their “uncontrolled” production patterns contributed to soil loss (Shephard 1945, 1947; Gibbs 1947, 22; Land Settlement and Development Board 1947, 257).

Agricultural Department annual reports and other official documents often blamed erosion on peasants’ production practices or lax conservation efforts, but some also indicated a clear awareness of the political-economic constraints faced by the peasantry that contributed to soil loss (St. Vincent Agricultural Department 1940a; Shephard 1945, 1947; Gibbs 1947). One recognized problem was insecure land tenure. Frank Engledow, examining agriculture in the British Caribbean for the Moyne Commission, which the British dispatched in 1938 to investigate social unrest and economic problems in the region, observed that insecure tenure and sharecropping made farmers unwilling to undertake soil-conservation efforts (1945, 104). In situations where estate owners allowed their workers to cultivate marginal hillside plots as partial compensation for their labor, little interest in soil conservation was evident because the employees were never sure how long they would be cultivating their plots and the employers were not concerned with preserving land from

which they derived no direct income (Shephard 1947, 64). Officials could hardly have been blind to the conditions of the land most peasants cultivated: Shephard recognized that “[i]t is the misfortune of the peasants that they have often been relegated to steep land especially liable to erosion” and that “[s]ome of the land included in the settlement holdings was never fit for agriculture” (1945, 84, 109–110).

Some officials realized that the financial difficulties of peasants were directly related to erosion. The Agricultural Department annual report for 1938 noted that peasants were forced to maintain almost their entire smallholdings in arrowroot or cotton in order to earn enough cash to meet their financial obligations (1940a, 28). This pattern limited fallow periods, which, in turn, contributed to soil loss. The 1938 report argued that a better system of financing peasant agriculture was the necessary prelude to any combating of erosion.

#### SOIL CONSERVATION ON SAINT VINCENT SINCE THE 1930S

The year 1938 marked the initiation of concerted efforts to control soil loss on Saint Vincent. The Agricultural Department established an extension service in 1938, initially staffed by four officers who focused specifically on educating the Vincentian peasantry about good farming practices, especially soil conservation. That year was also the first in which a separate section on “Soil Erosion” appeared in the department’s annual report. The initial strategy of the Extension Service, the staff of which grew slowly during ensuing years, was to concentrate its limited resources in areas with large peasant populations—specifically, the land settlements. Although the major concern of the Extension Service was the peasantry, it also carried out much conservation work on estates, especially in the 1940s. The department’s plan was to implement simple measures that would not interfere with farming. Numerous techniques were tried, with varying degrees of success (St. Vincent Agricultural Department 1940b, 11; Robinson 1947, 354–355):

- Contour cultivation. Extension officers planted grass strips along contours to serve as guides for farmers to follow when they constructed ridges and furrows for cotton and food crops. In some cases, particularly in later years, extension officers simply demarcated these contour guide lines instead of planting grass on them.
- Grass contour lines as soil barriers. Where ridging was not utilized, as in arrowroot production and in the cultivation of some food crops, grass barriers planted along the contours were used to trap the sediment that was being washed downslope (Figure 2). These grass barriers were planted at varying vertical intervals, usually every 15 or 20 feet, depending on the steepness of the slope.
- Strip cropping. On long slopes, farmers were encouraged to plant alternating horizontal strips of clean-weeded crops and soil-protecting crops, such as fodder grasses or sugarcane.
- Bench terracing. More complex and demanding of labor was the creation of bench or level terraces, formed by digging soil out of the hillsides and creating



FIG. 2—Remnants of grass barriers planted on an estate on the leeward side of Saint Vincent, 1989. (Photograph by the author)

a series of level benches down the slope. Breaking the continuous slope into a series of bench terraces impeded the downhill flow of water.

- **Drains.** Varying forms of drains were utilized to control and trap water as it flowed downhill. Particularly important were the silt-trap drains dug along the contour. They were 2–3 feet wide and 2–3 feet deep, with checks or culverts placed in them at intervals, usually 10–15 feet, to prevent the trapped water from accumulating at any one point.

The laying down of contour lines to serve as guides in the construction of ridges and furrows was not particularly intrusive for peasants: They had traditionally constructed such ridges, and now they simply had to align them with the contours more carefully. But because peasants fully tilled and replanted their food crop and cotton gardens annually, extension officers sometimes had to reestablish lines on the same property the following year. Nonetheless, planting along contours remained the most widely adopted conservation technique, and it can still be found throughout Saint Vincent in food gardens (Figure 3).

That grass barriers proved particularly effective in trapping sediment reflected the considerable amounts of soil moving downslope. Over time, some hillsides took on the appearance of carefully constructed bench terraces, because the soil level gradually rose as sediment accumulated behind grass barriers. In some arrowroot fields, for example, terraces 5–7 feet high had built up behind the grass barriers by the



FIG. 3—Contour planting on a peasant plot containing cabbages and tomatoes, 1989. (Photograph by the author)



FIG. 4—In the traditional pattern of cattle raising, farmers would cut grass to feed their cattle, and manure collected at the site would be used to fertilize fields. (Photograph by the author)



FIG. 5—A traditional grass strip planted around a yam garden to serve as feed for cattle, 1989. In the background is a banana garden. (Photograph by the author)

late 1940s (St. Vincent Agricultural Department 1949, 16). But peasants preferred continuous or uninterrupted slopes because they were easier to travel on, especially for the donkeys that were used to transport harvested root crops. Sometimes villagers cut small openings in the barriers to facilitate travel. Such passages eventually grew in size and compromised the effectiveness of the barriers.

Another issue for peasants was the type of grass that was planted. The Agricultural Department initially used both khus khus or vetiver grass (*Vetiveria zizanioides*) and fodder grasses, especially elephant grass (*Pennisetum purpureum*) for the barriers. The advantage of the former, the department believed, was its hardness and durability; also, khus khus produces infertile seeds, so it does not spread beyond the line in which it is planted. The department also initially viewed fodder grasses as beneficial because it wanted to encourage more raising of cattle, the manure of which could be used to fertilize fields (Figure 4) (St. Vincent Agricultural Department 1940b, 11).

Planting fodder grass for conservation purposes fit well with preexisting agricultural patterns. Villagers without sufficient fallow land on which to graze their livestock planted fodder grass around the boundaries of their gardens, to serve as a feed source, so they were already used to managing strips of grass (Figure 5). For those with cattle and donkeys, therefore, barriers planted with fodder grass were useful. But the St. Vincent Agricultural Department expressed increasing concern about the durability of barriers made from elephant grass: Not only did farmers cut them

regularly to feed their animals, but other villagers sometimes stole the grass for their own livestock. The department placed increasing emphasis on the planting of khus khus barriers, without any immediate economic benefits for peasants, which limited the farmers' interest in barriers as a form of soil conservation.

Utilized more on estates than on peasant holdings, strip cropping never reached the desired level of adoption (St. Vincent Agricultural Department 1955b, 56). In particular, given the small size of their holdings, peasants did not want to allocate significant portions of their land to crops that could be neither consumed nor sold. Many of those who did adopt the practice were influenced by cash subsidies, but such incentives rarely encouraged long-term use once the subsidy disappeared, as Harvey Blustain found in his study of soil conservation in Jamaica (1985).

Bench terraces proved to be expensive and unpopular. Yields on the exposed subsoil were poor for the first few years, though soil loss was reduced (Robinson 1947, 355). Bench terraces remained largely restricted to demonstration plots.

Voluntary compliance was the rule, but the Extension Service provided various incentives to encourage participation. For some activities, such as strip cropping, peasants received cash payments. Furthermore, the department did not charge farmers for the costs of the grass plants, which it grew in its own nurseries. Peasants were compensated for half of the expense of planting grass lines and barriers, whereas estates had to pay the full cost (St. Vincent Agricultural Department 1948, 18). Later, when the Agricultural Department began to focus on digging silt-trap drains, it was supposed to collect one-third of the cost of construction from the peasants, but it often ended up digging them for free.

The program was most successful in the 1940s and 1950s. Robinson proudly observed that, as a result of extension work, "a high degree of erosion-consciousness has been aroused in the agricultural community. . . . Progress in the adoption of these measures by both small-holders and estate-owners has been greater than anticipated and more requests for instruction, supervision and assistance are being received than can be dealt with by the existing staff and the rather limited financial resources of the Department" (1947, 356). For example, in the Leeward District, the department reported that 90 percent of estate land and 60 percent of peasant land under cotton were planted on the contour in 1945 (St. Vincent Agricultural Department 1947a, 6).

Beginning in the 1940s, the annual reports of the Agricultural Department included statistics on the extent of the conservation efforts. Particular accomplishments varied from year to year, as the department's efforts were hampered by shortages of funding for conservation work and of grass from its nurseries for planting barriers. The extent of conservation was greatest between the mid-1940s and the mid-1950s, when the total length of all contour lines and barriers demarcated and planted in grass annually ranged from more than 500,000 feet to approximately 1,000,000 feet, and areas covered by such efforts ranged from 700 acres to 1,400 acres. The areas planted in a given year were significant, but the effort was not cumulative. Guidelines for ridging sometimes had to be relaid after the fields were fully

tilled for replanting. And the maintenance of grass barriers was, in the department's view, "most disappointing": For example, only two-thirds of the work done on peasant holdings in 1945 in the Leeward area was still effective the following year because of inadequate follow-up care (St. Vincent Agricultural Department 1947b, 17).

Despite the spread of conservation practices on Saint Vincent, the same political-economic pressures that had earlier contributed to erosion limited soil-conservation efforts. For one thing, land tenure for many remained insecure. The department complained of "[v]ague and otherwise unsatisfactory tenures" as major impediments to the adoption of soil-conservation practices (St. Vincent Agricultural Department 1945, 15) and lamented that "renters of lands with an uncertain system of land tenure, not only make no attempt at soil conservation but resist to the utmost any attempt at demonstration and persuasion by the Extension Staff" (St. Vincent Agricultural Department 1955a, 40).

Conservation efforts began to slow and change in the late 1950s. From 1958 until 1961, the length demarcated and planted in grass strips and barriers ranged annually from 260,000 feet to less than 100,000 feet, a considerable drop from the peak of approximately 1,000,000. Moreover, the nature of conservation work shifted, as increasing emphasis was placed on silt-trap drains dug along the contours. The change reflected the explosive growth of banana cultivation: Major commercial shipments to the United Kingdom began in 1953, and by 1956 bananas were the island's major export, with peasants producing the majority of the crop (Grossman 1994). An emphasis on silt-trap drains reflected the need to control surplus runoff in banana fields. In banana cultivation farmers planted only in widely spaced holes, so runoff moved downhill unimpeded. Banana farmers used large amounts of synthetic fertilizers in their fields, and silt-trap drains limited the loss of expensive fertilizers due to runoff (St. Vincent Department of Agriculture 1961, 24). Although grass barriers could impede runoff in arrowroot fields, they were less effective in banana cultivation because banana plants grow tall, develop an extensive leaf canopy, and shade out the grass strips. Furthermore, silt-trap drains fill up with rainwater, thus providing valuable means of storing water for the banana fields during the dry season.

Other changes associated with banana production were linked to a decline in the use of grass barriers. Peasants devoted land to grass barriers in order to have a source of feed for their cattle and donkeys. But cattle raising declined as banana cultivation expanded. No longer was manure needed for fertilizing fields, for banana growers relied on synthetic fertilizers. The custom of drinking fresh cow's milk gave way to reliance on imported powdered milk, which was less expensive and had a much longer shelf life. In order to reduce the potential for erosion, extension agents encouraged the use of herbicides instead of clean-weeding in banana fields, but the herbicides damaged any grass barrier that was accidentally sprayed. The demand for donkeys, which villagers also fed with grass, declined, in part because bananas bruised too easily to be transported on donkeys' backs.

Synthetic fertilizers, the use of which had grown in association with banana cultivation, also led to reduced demand for conservation practices in general. Although

farmers recognized that loss of soil reduced the productivity of the land, the application of fertilizers improved yields and masked the short-term impacts of erosion. Intercropping bananas and food crops became popular on peasant holdings, and the



FIG. 6—Exposed soil in a steep field recently planted with bananas and food crops, 1989. (Photograph by the author)

ridges and furrows constructed for food crops helped to preserve the fertilizers that were applied to the bananas by limiting runoff (Grossman 1993). Peasant interest even in silt-trap drains began to decline.

By the late 1950s, Vincentian conservation efforts slowed. The Agricultural Department reported a “noticeable degree of laxity [that] has prevailed since the advent of the bananas” (St. Vincent and the Grenadines 1966, 18). It also observed a decline in cooperation with Extension Service efforts (St. Vincent and the Grena-

dines 1967, 22), expressing disappointment over the degree to which peasants kept their drains clean. Also significant was a decline in the administration's funding for conservation work, which further slowed efforts to limit erosion.

Erosion was less a problem in banana production than under other cropping systems. Although the soil was exposed when bananas were first planted, the crop eventually provided a dense, protective canopy that lasted for several years, for farmers usually produced several ratoon crops (Figure 6). The land was also protected from erosion by the large amounts of trash—banana leaves and skin that were routinely cut off and discarded in the fields—covering the ground (Ahmad 1987, 79).

But banana cultivation also had deleterious effects, particularly during the marked expansion of production that occurred in the 1980s in association with higher banana prices (Grossman 1994). Peasants cleared steep land that had long been fallow or in pasture in order to plant bananas. Slope was less a consideration when planting bananas than was proximity to roads, given the need to carry large amounts of the fruit from farm to road after harvesting (Grossman 1993).

#### CONSERVATION ACHIEVEMENTS ON SAINT VINCENT

In a recent review of conservation practices in the Commonwealth Caribbean, Frank Gumbs lamented, "Although some farmers in the Caribbean practice soil conservation, a high level of consciousness, concern and knowledge of soil conservation is not evident. Consequently, conservation methods are not widely adopted nor always the most appropriate methods" (1993, 344). The "some farmers" Gumbs refers to are likely Vincentian peasants. Within the Caribbean, Saint Vincent took the lead in the soil-conservation effort, an achievement noted by other writers (Fentem 1961; UNESCO 1982; Ahmad 1984, 1987). Although the conservation effort on Saint Vincent had slowed in comparison with the achievements of the 1940s and 1950s, the use of conservation techniques is still more widespread on the island than in other Caribbean countries.

Why did Saint Vincent lead the Caribbean in the conservation effort? It was not the only island with steep slopes, and authorities had recognized other colonies as having serious soil-erosion problems—as in the Blue Mountains in Jamaica (Engledow 1945). Three explanations apply. One is based on personality: Robinson, the superintendent of agriculture in the 1930s and 1940s, when the conservation effort began, was particularly enthusiastic about the need to limit soil loss. A second consideration was Saint Vincent's official involvement in land settlement: Not only was it the first British Caribbean colony to establish land settlements, but the percentage of arable land devoted to peasant settlement schemes outstripped that of neighboring colonies; and it was in these settlement areas, with their steep slopes, that agricultural officers had previously intervened in peasant agriculture while installment payments were being made. Subsequently, the first efforts in peasant soil conservation were concentrated in these areas. Finally, proximity to Trinidad's Imperial College of Tropical Agriculture, which stressed so intensively the need to control soil loss, influenced conservation. Indeed, on Saint Vincent, Camden Park was established as a field experiment station for the college.

## UNDERSTANDING SOIL CONSERVATION

Richard H. Grove, in a recent review of the history of conservation efforts in the British Empire, asserted, "The way ahead, therefore, will be to construct much more detailed local environmental histories, both at government and village level, taking care to discard most preconceptions about colonial environmental policy along the way" (1997, 177). This study supports such a viewpoint; it analyzes the relations among the environment, patterns of resource use, and political-economic forces. The markedly rugged Saint Vincent landscape, coupled with an intense rainy season, creates the potential for substantial erosion. The environmental and technical characteristics of the different cropping systems practiced on the island have also been important in affecting efforts to control soil loss. In particular, the rise of banana production led to a series of complex, interrelated changes that spurred alterations in the nature of and interest in conservation. Inequalities in land control help explain why the peasants farm in highly marginal areas that are prone to erosion, and various forms of insecure tenure, such as rental and sharecropping, limit the peasants' involvement in soil conservation (Eckholm 1976; Blaikie 1985; Blustain 1985; Collins 1987). But another political-economic feature that has contributed to the lack of success in soil-conservation programs elsewhere—labor shortages in agriculture (Collins 1987; Zimmerer 1993)—has been a less significant influence on erosion-control efforts on Saint Vincent. Planting on contours and using grass barriers were not radical modifications of existing practices, and the Vincentian Agricultural Department supplied much of the labor for planting grass barriers and digging silt-trap drains.

Although these local-level influences have certainly been crucial in the Vincentian conservation effort, our understanding of changes requires a broader perspective. Specifically, soil-conservation programs were part of a pan-empire effort. Saint Vincent, like colonies elsewhere in the British Empire, was influenced by the policies of the Colonial Office in London, by images of the U.S. Dust Bowl, by concerns about population pressure on resources, and by the antierosion ideology that was an integral aspect of training for all British colonial agricultural officers at the time.

Even with these homogenizing factors, however, the conservation effort was not uniform throughout the empire. The most marked contrast with Saint Vincent can be found in the British colonies in eastern and southern Africa. The Vincentian administration, like those elsewhere in the British Caribbean, relied on the voluntary cooperation of farmers for controlling soil loss, whereas their colonial counterparts in eastern and southern Africa utilized authoritarian, compulsory methods to obtain compliance. As a result, soil conservation on Saint Vincent never achieved the notoriety or experienced the degree of resistance that it did in Africa.

The more authoritarian nature of conservation in Africa can be related to struggles for control of land. In eastern and southern Africa, use of force to expropriate land from African farmers and herders for European settlement beginning in the late 1800s established a tradition of authoritarian control. European settlers, who had considerable political influence in their colonies, viewed demands by Africans

in the so-called native reserves for more land as a direct threat to their survival. Settlers pushed mandatory conservation as an alternative to allocating more land to Africans. They argued that expansion of the area utilized by irresponsible African farmers and herders would increase the area of degradation and create an African dust bowl (Anderson and Millington 1987, 52). In addition, conservation would obviate the need to allocate more land to Africans because it would reverse degradation and improve agricultural productivity (J. McGregor 1995, 259). Furthermore, if land degradation in the reserves continued, settlers feared that it would stimulate uncontrollable rural-to-urban migration by Africans (Beinart and Coates 1995, 65–66).

The trajectory of history was markedly different in the British Caribbean. Former slaves and their descendants were gradually gaining control of more land at the expense of estates, a process sometimes encouraged by colonial administrations through settlement schemes. Also, the Vincentian conservation effort began in 1938, just three years after the start of Caribbean-wide unrest, which included arson, strikes, and rioting; in fact, such protests were continuing in some places in the region as late as 1938. British authorities certainly did not want to contribute to additional unrest. The possibility that authoritarian conservation methods would facilitate a resurgence of unrest was considerable, given the attitudes of Caribbean peasants toward land control. Control and ownership of land have much more than economic significance for Caribbean peasantries. Such a relationship to land is the source of great pride and joy, representing success in the long struggle against estate domination and oppression (Lowenthal 1961). Forcefully implementing conservation measures would have challenged hard-earned independence, surely provoking a bitter response.

The Vincentian case says much about environmental discourses. One generally held view is that colonial discourses on soil erosion failed to recognize political-economic constraints that encouraged erosion on peasant farms (Anderson 1984; Blaikie 1985; Rocheleau, Steinberg, and Benjamin 1995); because political-economic influences were ignored, solutions were framed in purely technical terms. On Saint Vincent, the colonial administration pursued technical solutions, but the environmental discourse was nonetheless more complicated than what was often portrayed: Discourse reflected a mixture of recognition of political-economic constraints and blame on the peasantry's faulty technology. Just as Grove argues that "we need to seriously question the notion of a homogeneous kind of 'colonial state' as far as the history of environmental policy was concerned" (1997, 177), so too must we question assumptions concerning homogeneous colonial discourses about soil conservation.

## NOTES

1. See Grossman 1998 for a more thorough discussion of the different types of gardens cultivated by slaves.
2. A major exception was in the cultivation of yams, which villagers planted in individual mounds.
3. Many peasants kept their fields continuously in arrowroot for five years or longer; some, for more than twenty years (Shephard 1945, 47).

4. In contrast, British conservation efforts in West Africa, where no European settlers existed to push the agenda of controlling soil loss, were much more limited in scope and much less determined (Grove 1997).

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