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GEOGRAPHICAL ASPECTS OF THE AGRICULTURE OF SANTA CATARINA STATE, BRAZIL¹

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ABSTRACT

Agriculture is the most important economic activity in Santa Catarina, in spite of rapidly developing timber and light manufacturing industries. The agricultural industry of Santa Catarina differs from that of the rest of Brazil in being small scale and almost entirely owner-operated. In general, field crops are far more important than livestock, with corn as the dominant crop of the state. Wheat, manioc, black beans, and rice are other staples. Brazilian agricultural statistics are presented on the basis of "physiographic zones," on which basis all government statistics are collected, even though this may result in quite erroneous impressions.

INTRODUCTION

The Brazilian state of Santa Catarina has been divided by the *Instituto Brasileiro Geografia e Estatística* into nine "physiographic zones" which are utilized as the basis for the gathering of all government statistics. Such a convenient arrangement of data enables the student of Brazilian geography to identify regional variations in environmental relationships by simply using these physiographic zones (hereafter referred to simply as zones). It should be borne in mind, however, that the official zones are not coincident with natural physiographic areas, because the boundaries of these official zones are modified to follow the boundary of that *município* (i.e. county) which most closely approximates it. At times this discrepancy is important, although in general the demarcation of the zones is well founded, at least in Santa Catarina.

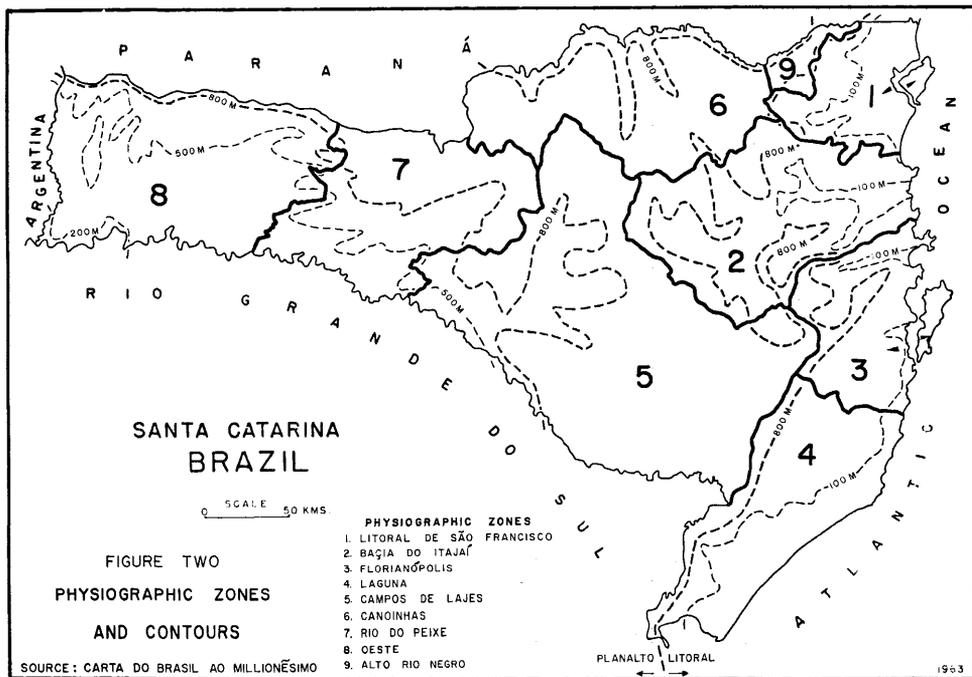
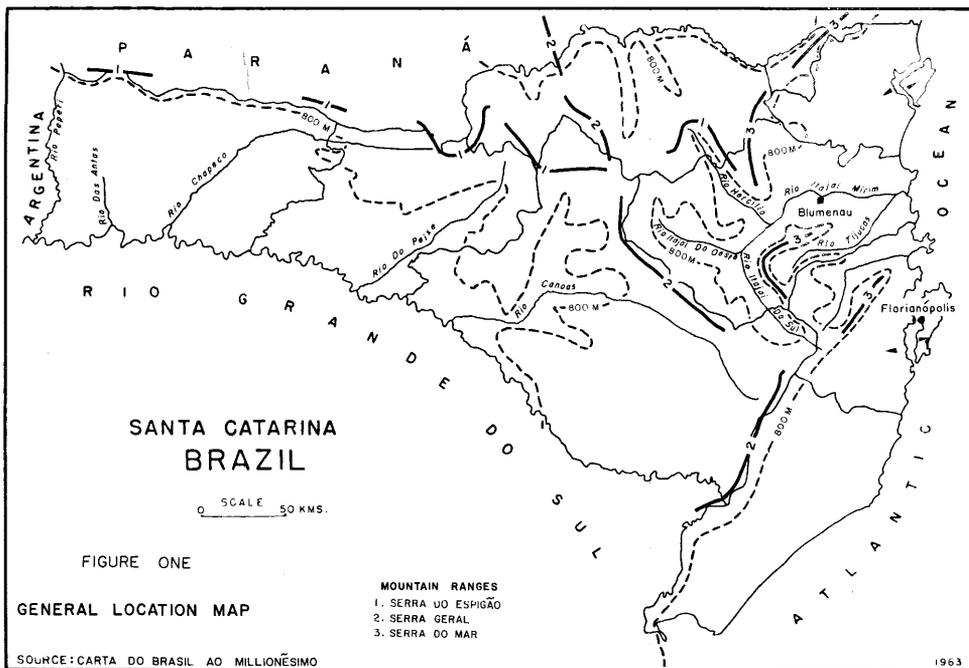
CHARACTERISTICS OF THE PHYSIOGRAPHIC ZONES

The widely divergent characteristics of the physiographic zones, which are shown in figure 2, offer various possibilities for agricultural development, and thus represent the physical frame within which the agriculture of Santa Catarina has developed. Each zone has physical and economic conditions which are relatively distinct.

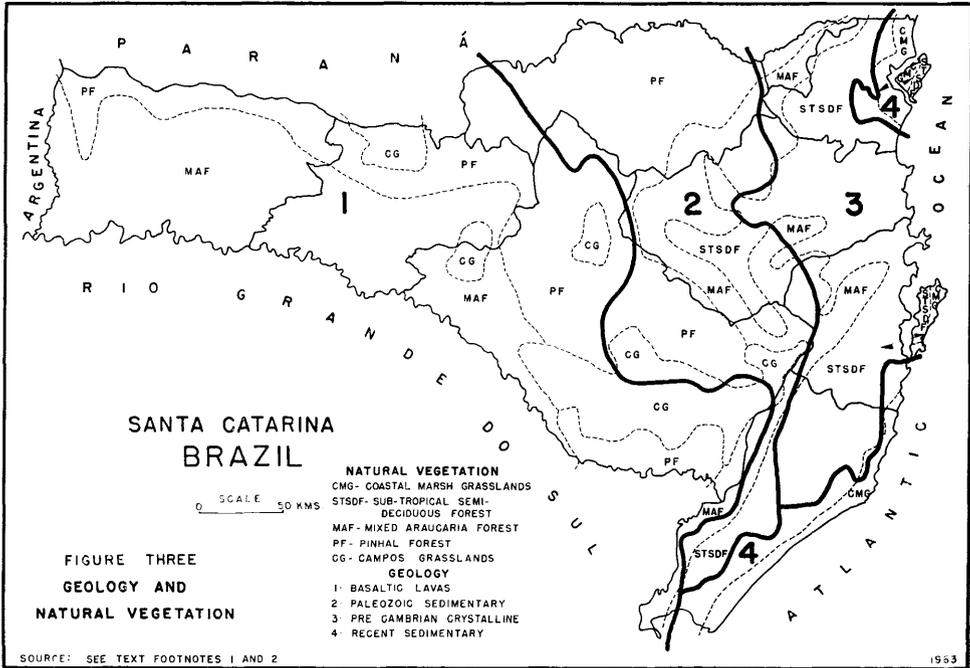
Unfortunately, many of the basic factors which should be used to designate physiographic divisions are not known in detail. Weather and climate, vegetation, hydrology, soils, and other factors have been only imperfectly studied, although activities of Petrobras, the Brazilian federal agency for the development of petroleum resources, have contributed a considerable knowledge of geological conditions in Santa Catarina.

Geologically, Santa Catarina can be divided (Confederaçã Nacional da Indústria, 1960) into four areas: (1) the recent sedimentaries, covering about 7 per cent of the state, which are situated for the most part along the coast and in

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the major river valleys; (2) the crystalline basement rock, lying west of the coastal sediments, which is mostly Pre-Cambrian and covers about 18 per cent of the state; (3) the Paleozoic sedimentary rocks, accounting for about 24 per cent of the area of the state, which lie west of the crystalline rocks, are mostly Permian and Carboniferous, and are the location of Brazil's principal coal fields; and (4) the basaltic lavas of the western plateaus, which occupy roughly 52 per cent of the total state area (fig. 3).



The boundaries of the geological areas do not coincide with those of the zones, but have a general correlation with the latter, as follows:

Physiographic Zones *Geological Areas* (from above list)
 (See fig. 3)

Litoral de São Francisco	half 3, half 4
Bacia do Itajaí	half 2, half 3
Florianópolis	mostly 3, some 2, some 4
Laguna	some 1, some 2, some 3, some 4
Canoinhas	mostly 2, some 1
Alto Rio Negro	3
Rio do Peixe	1
Oeste	1
Campos de Lajes	mostly 1, some 2

TOPOGRAPHY

Topography, which is known in some detail, is the factor which has been most important in the derivation of the zones by the *Instituto Brasileiro Geografica e Estatística*. Four lie along the shore at low elevation; the other five are located high on the plateau farther to the west. The four zones which lie along the shore-

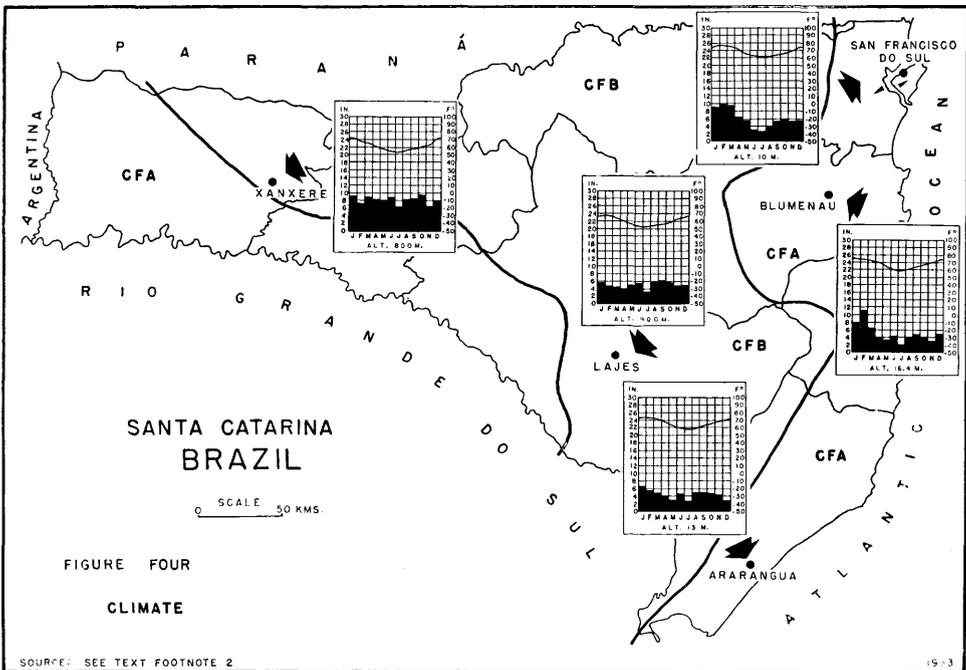
line are Litoral de São Francisco, Bacia do Itajaí, Florianópolis, and Laguna. Litoral de São Francisco is characterized by large areas of alluvial flats at about sea level and undulating plains of crystalline rock not a great deal higher. Bacia do Itajaí consists of a series of well defined stream valleys, which have been cut back through the crystalline escarpment and into the area of sedimentary rocks. While most of the area in this zone lies at low altitude, several of the divides properly belong to the plateau. The valleys are narrow, with rough to rolling floors; the slopes are steep but not angular; the summit areas are usually limited in extent and uneven in surface. Florianópolis is composed of rough to rolling plains at altitudes which vary from sea level up to about 500 meters elevation (1 meter = 3.3 feet approx.). The topography here is characterized by low rounded hills of crystalline rock, with some intervening alluvial-filled depressions. The escarpment belt of Brazil, or steep slope separating the low coastal plains from the higher land, reaches the coast in the Florianópolis zone. Laguna represents a completely different type of topography, with linear divisions paralleling the coast and the crest of the escarpment. The shore section of Laguna is composed of sandy plains, with dunes. The middle section consists of undulating rolling plains. The escarpment slopes are steep and rugged and rise to an altitude of 1000 meters in most parts.

The remaining five zones are largely located on the plateau, or planalto, which is at a higher elevation and has a decided overall slope toward the west. The Serra Geral and the Serra do Mar, which mark, respectively, the southern and northern sections of the Atlantic escarpment of the planalto, represent the highest elevations of the state. Oeste zone consists of a series of wide and gently sloping river valleys separated by low interfluves. The aspect of the countryside is decidedly open. Only along the northern side of the zone in the Serra do Espigão are moderately steep slopes encountered. Generally similar topographic conditions continue into Rio do Peixe, although landforms tend to become sharper in form and smaller in scale. Local relief is considerably higher in Rio do Peixe than in Oeste. Almost all of Alto Rio Negro lies above 800 meters and is sloping land. Although erosion by moderately heavy precipitation has tended to produce rounded hills and has in general smoothed local irregularities, this zone contains the highest local relief of any part of the state, with steep slopes predominating over valley bottoms and summit areas. Canoinhas landforms have been developed on sedimentary rocks which are essentially horizontal. The zone is beginning to be dissected by stream action, but most of the surface is still a relatively unaltered interfluvial plateau of rolling to rough character. The topographic characteristics of Campos de Lajes are markedly different from those of the other zones, because the basaltic lava flows and the more or less horizontal sedimentary strata give to this area the character of an elevated tableland. Streams on this tableland have eroded open, wide valleys, whose sides normally are a series of sharp and steep slopes interspersed with a few gentle slopes of narrow width. Other streams have cut deep, straight-sided canyons.

CLIMATE

All of Santa Catarina lies within the Cf area of climate (humid mesothermal), as classified by Koeppen-Geiger. The approximate boundary of Cfa and Cfb climates is shown on figure 4, together with a diagrammatic presentation of climatic information for certain stations in the state. The differences in climatic conditions from place to place within the state are of small magnitude. The coastal lowlands are classified Cfa (mean temperature of warmest month over 71.6°F), while most of the planalto is classified Cfb (mean temperature of warmest month under 71.6°F, but at least four months with means over 50°F). The valleys of the Rio Peperiguaçu and Rio Uruguai in the western planalto are classified Cfa because of their lower altitudes.

Along the littoral coast, rainfall is concentrated in the late summer, with more precipitation occurring in the northern portion of the coast due to the closeness of the higher elevations there. The entire area marks the place where polar and tropical air meet for much of the year. Especially in summer, tropical Atlantic (Ta) air masses produce orographic rain by impinging on the Serra do Mar as far south as the island of Florianópolis (Valverde, 1957). On the other hand, during the winter season it is quite common for large masses of polar Atlantic (Pa) air to penetrate into Santa Catarina, especially along the littoral shore. Strong southerly winds at this season often cause polar animals to be carried far into the mid-latitudes. For example, Valverde (1957) reported that in July 1955 the beaches up to Florianópolis were littered with thousands of bodies of penguins and rare species of sea lions.



On the planalto, rainfall is more evenly distributed than on the shore, but there is a very slight concentration in spring. Immediately west of the crest of the escarpment, there is somewhat of a rain shadow, although the western portions of the plateau are subject to high precipitation, resulting partially from convective sources and partially from frontal disturbances.

Temperature characteristics also tend to separate into two types—littoral and planalto. Mean maximum temperatures are roughly five degrees higher in the littoral area, while mean minimum temperatures are about eight degrees higher. Thus, the range of temperature on the planalto is greater than that on the littoral coast, although those littoral areas more removed from the coast are subject to considerable fluctuation due to the relative absence of marine influences (fig. 4, Blumenau, for example). On the planalto, at least four months of the year have mean temperatures above 64.4°F, while along the littoral shore the figure is eight or nine months. Laguna is the only portion of the littoral area subject to a yearly frost, while the Uruguai valley in the southwest of Santa Catarina typically has ten days per year of frost. The highest portions of the planalto, including most of

Canoinhas and Alto Rio Negro zones, and the higher eastern portions of Campos de Lajes, are subject to 25 days per year of frost. These frost variations are significant when agricultural activities are considered (Valverde, 1957).

NATURAL VEGETATION AND SOILS

The natural vegetation of Santa Catarina can be divided into five types: (1) coastal marsh grassland, (2) sub-tropical, semi-deciduous forest, (3) mixed Araucárian forest of the Serra do Mar and the western planalto, (4) pinhal forest, and (5) campos grasslands (fig. 3).

Coastal marsh grassland is found principally in the alluvial lowlands of Litoral de São Francisco and along the lagoon coast of Laguna. Soils are often immature and typically are poorly drained.

Over most of the littoral area, the climax vegetation is an extension of the subtropical semi-deciduous forest which occupies the coastal portions of Brazil all the way north to and beyond Recife. The common species of this forest include cedro (cedar), ipes (bow wood), imbuia (Brazilian walnut), embaúba (snake-wood), urtiga (a local name, not a generic term) (stinging nettles); mamona (castor beans), and various species of palms (Valverde, 1957). Also prominent in this humid forest are mosses, lichens, and epiphytes. The coast of Bacia do Itajaí and Florianópolis is often marked by a very narrow fringe of mangroves.

The eastern slopes of the Atlantic escarpment of the planalto and most of the western portion of the planalto itself are covered by a mixed forest which includes many of the species of the sub-tropical, semi-deciduous forest of the littoral belt, plus the Araucária or Parana pine, marfim (ivory palm), erva mate, and other trees which tolerate colder temperatures. The lower limit of this forest is about 400 meters on the seaward slopes of the escarpment and about 500 meters in the valleys of the Uruguai and other rivers of the west. Palms, with the exception of the ivory and coconut, are generally absent in this forest type, partially due to the excessively well-drained nature of the soils.

The pinhal forest consists of pure stands of Araucária pines or Araucárias mixed with erva mate and imbuia. The latter variation is typically composed of Araucária pines, which, when mature, tower 20 to 30 meters over the lower story of 12 to 15-meter-tall erva mate and imbuias (Valverde, 1957). The soil of the pine forests is generally of only average fertility and, although the pine zone has better climate and topography than the *serras*, or mountains, settlement up to now has been concentrated in the *serras*.

The final vegetation type in Santa Catarina is the campos grasslands, found mainly in the Campos de Lajes zone. The occurrence of these grasses, which resemble steppe or short prairie grasses, is not the result of lower rainfall, but on the contrary, is a reflection of certain soil processes that go on in the regions of high rainfall. The Dutch pedologist, W. F. J. van Beers (quoted by Valverde, 1957, p. 45), has hypothesized that the grass vegetation, which is not a climax vegetation, has developed because of an accumulation of carbonic acid collected in lenses in horizontal strata. Leaching is high; erosion is low. Acidic reaction of the soil is high; content of organic material and nutritive elements is low; drainage is excessive. These soils are not considered very suitable for agriculture.

CHARACTERISTICS OF SANTA CATARINA AGRICULTURE

Agriculture is the most important economic activity in Santa Catarina, in spite of rapidly developing timber and light manufacturing industries. It has been estimated by the Santa Catarina government (Estado, 1957) that 56 per cent of the state's income in 1952 was derived from agriculture. A later study (Heare, 1961) estimated the figure in 1958 to be approximately 52 per cent. At the same time, another measure of importance of agricultural activities provided by the 1960 agricultural census (Instituto, 1962) revealed that only 28.9 per cent of the Santa Catarinense population was engaged directly in agricultural activities.

Perhaps the most outstanding characteristic of Santa Catarina agriculture, as compared with that of the rest of Brazil, is the importance of owner-operated farms. In Brazil in 1950, 75 per cent of all agricultural properties were worked directly by their owners; in Santa Catarina, the figure was 90 per cent, the highest for the entire country (the state with the lowest proportion of agricultural properties directly worked by owners was Maranhão with only 26 per cent. Instituto, 1956). The strong attachment between farmers and the land they own and work has been one of the great strengths of Santa Catarina's agriculture. The clear trends toward diversification in the farm economy of this state are in great part the result of this phenomenon.

Compared with agriculture in the rest of Brazil, that of Santa Catarina is small scale, although at least one agricultural property reaches 47,000 hectares (1 hectare = 2.471 acres). According to the 1950 census, the average size of agricultural properties in Brazil was 112 hectares, whereas in Santa Catarina it was only 51 hectares. The average size of crop farms in Brazil was 36 hectares; in Santa Catarina, 27. The average size of livestock ranches in Brazil was 613 hectares; in Santa Catarina, 376 (Instituto, 1956).

TABLE 1
*Santa Catarina: Average size of agricultural properties by
"physiographic zones", 1960*

Zone	Average size (in hectares)	Per cent in crops
Litoral de São Francisco	17	22
Bacia do Itajaí	22	20
Florianópolis	26	17
Laguna	25	23
Canoinhas	56	15
Rio do Peixe	38	24
Oeste	30	24
Campos de Lajes	118	7
Alto Rio Negro	38	19
State as a whole	38	17

Source: I.B.G.E., Serviço Nacional de Recenseamento, *Estado de Santa Catarina, Símpse Preliminar do Censo Agrícola*, Rio de Janeiro, July 1962, p. 3-9.

The preliminary results of the agricultural census of 1960, while still largely incomplete, give 38 hectares as the average size of agricultural properties in Santa Catarina (Instituto, 1962). No comparative figure is yet available for all Brazil. The 1960 figure represents a decrease of 25.5 per cent from the 1950 level. The explanation for this decrease may be (1) a more intensive and efficient use of existing cultivated land; (2) more effective occupation of the land by extending cultivation at the expense of grazing, forestry, and other similar uses; (3) a relative increase in the value of agricultural land compared to other economic factors; or (4) subdivision through inheritance. Each of these situations would contribute toward subdivision of land, and there are undoubtedly many others.

A wide variation can be seen in the size of agricultural properties within the state (table 1). The largest agricultural properties are not found in the quasi-pioneering areas of the extreme west, but rather in Campos de Lajes. Here, bleak, windswept, excessively well-drained grasslands, with their thin soils, are better suited to extensive livestock raising than to intensive crop production. Almost 30 per cent of all the cattle of the state were in Campos de Lajes in 1960,

but it contained only 5 per cent of the plows and 11 per cent of the tractors (Instituto, 1962). In Canoinhas, which also has above-average-size properties, much land is still under forest cover, and large portions of individual agricultural properties are given over to woodland. The smallest agricultural properties are found in the well-watered, densely populated coastal zones. Fragmentation due to the rugged topography of the crystalline escarpment also may be a factor favoring small-sized agricultural properties, especially in Florianópolis and Bacia do Itajaí.

Agricultural techniques are most advanced in the coastal lowlands of Litoral de São Francisco, Bacia do Itajaí, and Laguna. Although these three zones account for only 31 per cent of the crop land of the state and 40 per cent of the state total of persons employed in agriculture (table 2), fully 59 per cent of the tractors in Santa Catarina are found there. Proximity to markets and well-developed transportation routes have greatly assisted the development of these zones. Further, raising of dairy cattle, an advanced type of agricultural activity, is concentrated in Bacia do Itajaí. A fuller discussion of this activity follows in the next section. The relatively lower level of mechanization in the Florianópolis zone is partially due to the prevalence of horticulture and some dairying, dependent upon their close proximity to the urban market of Florianópolis, and partially to the rough nature of the topography.

TABLE 2
Santa Catarina: Agricultural factors, by "physiographic zones", 1960

Zone	Per cent of total state							
	Total area	Agricultural land	Crop land	Persons employed in agriculture	Number of agricultural properties	Cattle	Tractors	Plows
Litoral de São Francisco	5	3	4	7	8	4	16	5
Bacia do Itajaí	13	12	15	20	21	16	19	13
Florianópolis	7	6	6	7	8	5	4	2
Laguna	10	9	12	13	14	14	24	13
Canoinhas	12	11	10	8	7	6	14	10
Rio do Peixe	12	14	19	15	14	14	8	26
Oeste	15	14	20	20	18	12	4	24
Campos de Lajes	26	30	13	9	9	29	11	5
Alto Rio Negro	1	1	1	1	1	1	1	1

Source: I.B.G.E., Serviço Nacional de Recenseamento, *Estado de Santa Catarina, Sinopse Preliminar do Censo Agrícola*, Rio de Janeiro, July 1962.

In the west (Oeste and Rio do Peixe), mechanization has proceeded only up to a point. Farming is more extensive (table 1) in these zones, which together account for 39 per cent of the crop land of the state, but only 32 per cent of the farm properties and 35 per cent of Santa Catarina agriculturalists (table 2). Against these figures, the number of tractors found in these two zones, 12 per cent of the total in the state, is surprisingly low. The explanation is found in the stage of development. In addition to a more extensive type of farming, much of the land is still virtually a pioneering-frontier area with a strong element of isolation.

Some idea of how recently these zones have been settled and just how transitional the development has been up to the present can be gleaned by noting the

frequency of recent *município* boundary and administrative changes (Instituto, 1959). Of the 14 *municípios* which lie west of 52° longitude, eight were demarcated in 1953, two in 1956, and three as recently as 1958. Further subdivision and the creation of new *municípios* is likely as settlement proceeds.

Yet the march of settlement faces many obstacles. Land titles are frequently clouded, with many settlers exercising only squatters' rights to disputed land, another factor tending to hold back mechanization in the west. Furthermore, potential markets for any surplus agricultural production lie far to the east along the coast. In addition, no railroads penetrate the region; even main roads are non-metalled. Navigable rivers flow in a direction opposite for facilitating the marketing of agricultural products in Brazilian markets and, furthermore, are interrupted by falls and rapids. Only as transportation systems are perfected and settlement advances toward the west, will agricultural technology make great strides in this area.

LIVESTOCK AND DAIRYING

The livestock industry of Santa Catarina may be divided into two sections: dairying and the raising of meat animals. Of the two, dairying is the more important. The Agricultural Census of 1950 reveals that the dairy industry of Santa Catarina, measured in terms of milk produced, ranked fourth in the country; measured by volume of milk processed for manufacture or consumption, the Santa Catarina industry stood third. With the exception of the very small and highly capitalized dairy industry of the Federal District (now Guanabara state), Santa Catarina had the highest milk production per cow of any area in Brazil. The cheese, and especially the butter, manufacturing industries are large and important in Santa Catarina. In 1950, the state produced almost one-quarter of all the butter of Brazil.

Dairying is heavily concentrated in Bacia do Itajaí where, in 1957, 61,363 milking cows (Estado, 1962) made up almost one-quarter of the state total. Production per cow here is the highest in the state, although yields are far below those of major dairying countries. In general, milk production per cow is highest along the littoral belt and lowest along the crest of the planalto. The far western, lower-lying portions of the plateau are areas of moderate production. Campos de Lajes might be cited as an area of secondary importance for dairying, because 32 per cent of the milking cows of the state are found in this zone. Output is very low, however, less than 35 per cent that of Bacia do Itajaí. Only about 19 per cent of Santa Catarina milk production comes from Campos de Lajes.

The livestock industry of Santa Catarina is restricted primarily to the raising of beef cattle. But although beef-cattle rearing is a moderately important segment of the Santa Catarina agricultural economy, it represents only about 2 per cent of the total Brazilian industry (Instituto, 1956). Beef raising in Santa Catarina is concentrated in Campos de Lajes, which has almost a third of the beef cattle of the state. Agricultural properties in Campos de Lajes are really ranches or farm-ranches. The zone accounts for 30 per cent of the agricultural land of the state, but only 7 per cent of the land in that zone is devoted to crop production. As noted above, the average size of agricultural properties in Campos de Lajes is 118 hectares, far higher than that of other zones. In 1960, there were 98 establishments in Santa Catarina which had over 500 head of cattle; 72 were located in Campos de Lajes (Instituto, 1962).

A secondary concentration of beef cattle is found in Laguna, where beef animals are raised on small farm properties as part of general farming operations, rather than on large livestock ranches. Laguna, which has less than one third as much agricultural land as Campos de Lajes, has almost half as many beef cattle. At the same time, Laguna has more land devoted to crops than does Campos de Lajes, both relatively and absolutely. The livestock industry in Laguna was

established before 1700 (Valverde, 1957). The fact of early establishment helps to explain the current importance of this area.

Although there are large numbers of pigs scattered in all sections of the state, the swine industry is not generally organized on a commercial scale. Only in Rio do Peixe has development reached a high level. Very few sheep and goats are raised in the state.

MAJOR CROPS OF SANTA CATARINA

The agricultural economy of Santa Catarina is largely a crop economy. Approximately 10 per cent of the total area of the state is devoted to crop production. Cropland, both field and tree, represents about 19 per cent of all agricultural land.

In the extreme west (Oeste and Rio de Peixe), where many farms are given over to the extensive production of grains like corn and wheat, crops occupy a relatively high proportion of agricultural land (table 2). Along the littoral area an emphasis on intensive cultivation also produces a concentration of cropland, especially on the level lands of Laguna and Litoral de São Francisco.

There are twelve crops, each of which covers at least 1 per cent of the cropland of the state (table 3). These twelve crops together occupy 94 per cent of the

TABLE 3
Santa Catarina: Cultivated land, by major crops, 1962

Rank	Crop	Total area (in hectares)	Per cent of state crop land	Per cent of crop grown in littoral belt
1	corn	342,397	37.4	16
2	wheat	100,440	11.0	1
3	manioc	95,211	10.4	92
4	black beans	86,567	9.5	21
5	cassava	54,473	6.0	65
6	rice	54,403	5.9	88
7	sugar cane	39,265	4.3	87
8	sweet potatoes	23,517	2.6	61
9	tobacco	22,225	2.4	74
10	squash	20,460	2.2	20
11	white potatoes	13,061	1.4	38
12	bananas	9,492	1.0	100
Total	twelve crops	807,038	94.1	—
Total	state crop land	915,113	—	—

Source: I.B.G.E., Departamento Estadual Estatística, Estado de Santa Catarina, *Safras Agrícolas de Santa Catarina em 1962*, Florianópolis, Brazil, September 1962.

cultivated land of Santa Catarina. Corn is by all odds the dominant crop of the state, occupying over 37 per cent of the total cropland. Three other staple food crops—wheat, manioc, and black beans—each occupy about 10 per cent of the total cropland. The remaining third of the cultivated area is devoted to the production of a wide variety of other products: cassava, rice, sugar cane, sweet potatoes, tobacco, squash, white potatoes, and bananas, many of which evidence strong locational concentrations. Minor crops include fruits, nuts, alfalfa, garlic, arrowroot, coffee, onions, rye, oats, barley, broad beans, flax, and tomatoes.

Corn is grown all over the state (table 4). It is the leading crop in Bacia do Itajaí and in every one of the zones of the planalto, where corn is very often interplanted with black beans. Although corn still remains one of the most important crops in terms of acreage along the littoral belt, it relinquishes its position to manioc in Florianópolis and Laguna, and to rice in Litoral de São Francisco.

About 16 per cent of the state's corn production in 1962 was from the littoral area (table 3).

The value of corn production for the state in 1961, on the basis of production in each of 104 *municípios*, is shown in figure 5. The total value of the corn crop in 1961 (Estado, Aug. 1962) was 4,367,738,600 cruzeiros (in 1961 a cruzeiro equaled about \$0.003). While corn always occupies first rank in each zone on the planalto, yields vary widely, with the highest production occurring on the alluvial soils of the Uruguai and other major river valleys. Conditions on the plateau are excellent for corn production—fertile soils, rainfall varying from 50 to 90 inches per year,

TABLE 4
Santa Catarina: Importance of major crops, by "physiographic zones," 1962

Crop	Rank								
	São Francisco	Itajaí	F'polis	Laguna	Canoinhas	Rio do Peixe	Oeste	Lajes	Alto Rio Negro
Corn	2	1	3	2	1	1	1	1	1
Wheat	—	—	—	—	4	2	2	2	2
Manioc	—	2	1	1	5	5	—	—	—
Black beans	—	8	7	4	2	3	3	3	—
Sweet cassava	3	3	5	7	3	9	4	—	—
Rice	1	4	8	3	7	11	8	6	—
Sugar cane	4	6	2	5	—	8	—	—	—
Sweet potatoes	—	7	—	6	8	7	9	—	—
Tobacco	—	5	11	9	—	13	6	—	—
Squash	—	9	—	—	—	4	5	7	4
White potatoes	—	10	9	—	9	—	7	4	3
Bananas	5	11	4	10	—	—	—	—	—

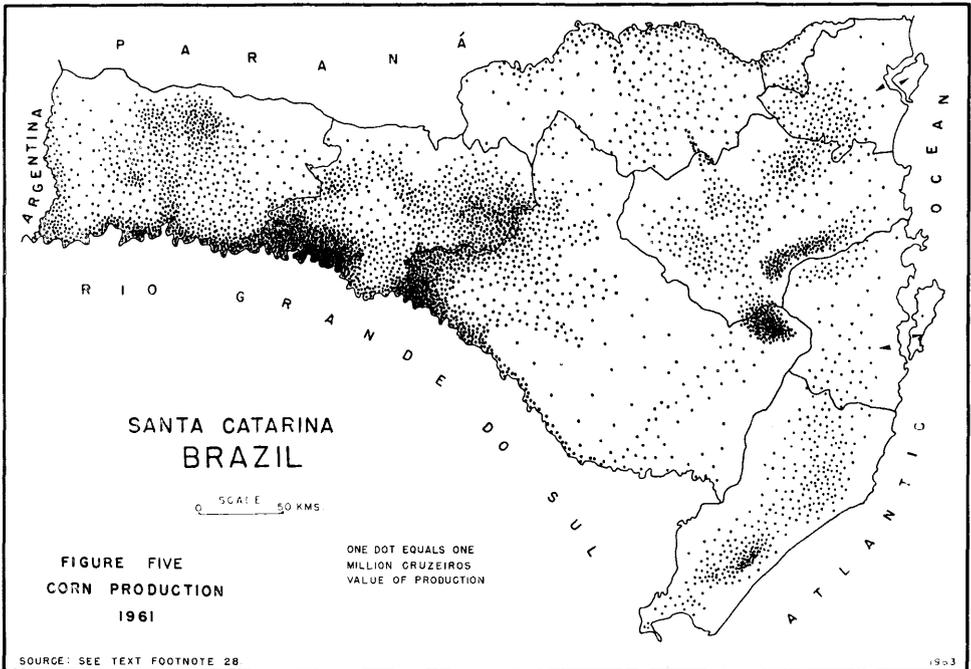
Source: I.B.G.E., Departamento Estadual de Estatística, Estado de Santa Catarina, *Safras Agrícolas de Santa Catarina em 1962*, Florianópolis, Brazil, Sept. 1962.

mean yearly temperatures of between 50° and 70°F, long growing season, and a short maturing period late in the growing season with intensely hot temperatures broken only by very brief thundershowers. Corn yields thus reach 2760 kilos per hectare in Rio do Peixe, while the less favorable conditions of the littoral belt give yields as low as 960 kilos per hectare in Florianópolis (Estado, Sept. 1962).

When the pattern of corn production (fig. 5) is compared with that of elevation (fig. 1), some significant conclusions can be formulated. First, statistics based on physiographic zones can be very misleading. For example, Campos de Lajes is classified as a plateau zone, but its corn production occurs largely in the Itajaí do Sul valley, which is more correctly grouped with the littoral area rather than the planalto. The same situation is true in Alto Rio Negro, where much of the production comes from the seaward slopes of the escarpment rather than from the inward-facing slopes of the planalto. Second, corn production is concentrated at medium altitudes. Areas over 800 meters high and under 100 meters do not support much corn production. Third, the alluvial soils of river valleys are the major areas of concentration for corn. The great centers of corn production on the planalto are (1) the Uruguai river valley in western Rio do Peixe, (2) the Uruguai river valley in western Campos de Lajes, (3) the middle Rio do Peixe valley, and (4) the Rio das Antas valley. Campos de Lajes (with the exception of the Itajaí do Sul valley) and Canoinhas stand out as areas of low production.

Although corn production throughout the coastal zones is low in comparison with the planalto, four nuclei of production can be recognized in the littoral belt. These centers are (1) the strip along the lower heights of the escarpment, extending from the western part of Litoral de São Francisco to the Itajaí do Oeste valley (in Bacia do Itajaí), (2) the Itajaí Mirim valley, (3) the relatively flat plains of middle Laguna, and (4) the very flat plains of southern Laguna, and (5) the Itajaí do Sul valley.

The second most important crop of Santa Catarina is wheat, which, in 1962, occupied 11 per cent of the total cropland of the state and over one-quarter of the cropland of Rio do Peixe zone. It is grown almost exclusively on the planalto (table 3), where climatic conditions are most favorable. In 1962, 99 per cent of the wheat production of Santa Catarina came from the planalto. Unlike corn, wheat production is centered on the basaltic soils away from the river valleys. Everywhere on the planalto (except in Canoinhas), wheat is the second crop in terms of acreage, occupying between 13 and 26 per cent of the crop land.

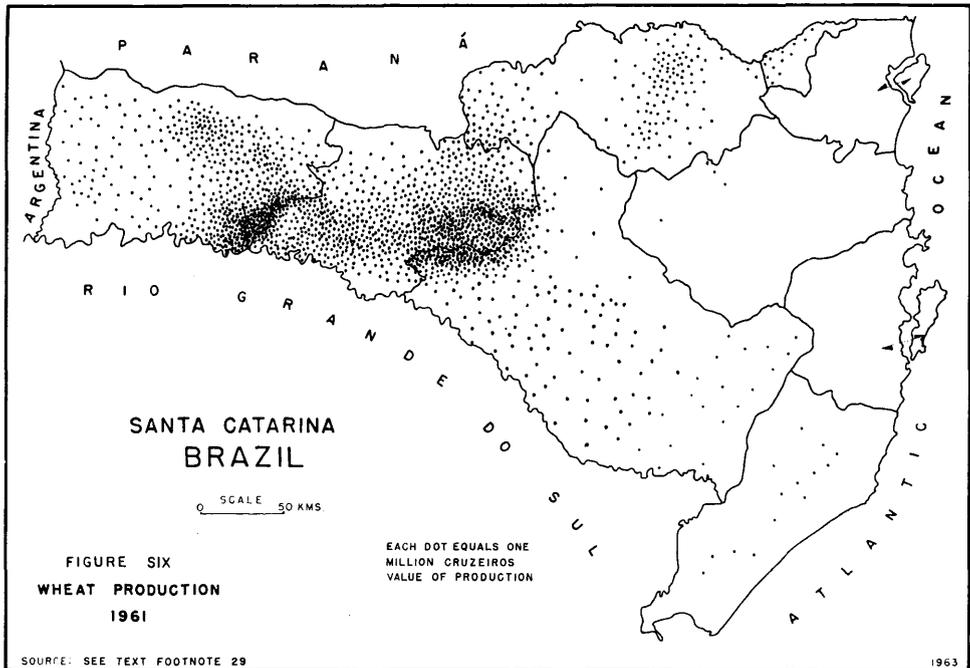


In view of the Brazilian government's current campaign to sharply increase domestic production of wheat in order to reduce the country's annual balance of payments deficit, it seems quite likely that even greater emphasis will be placed on the development of commercial wheat production. In the past, Brazilian production has been inhibited to some degree by the proximity of low-cost Uruguayan and Argentinian supplies of wheat.

The value of wheat production in 1961, based on statistics for 104 *municípios*, is shown in figure 6. Two nuclei stand out: (1) the rolling plains bordering the Rio Chapéco, and (2) the region centered on the middle Rio do Peixe. The very small production from the littoral area comes mostly from Laguna.

The third most important crop of Santa Catarina is manioc, which grows best on sandy soils, and where temperatures and rainfall are both continually high.

The term manioc, as used in this paper, refers to the Portuguese word *mandioca* and denotes the better and more common form of the tuber which contains the toxic hydrocyanic acid removed by cooking. No less than 17 separate varieties are grown in Santa Catarina state (Amaral, 1940). Cultivation is quite often accomplished without the aid of any machinery, often in small garden patches. In contrast to wheat, which is primarily consumed by urban dwellers, manioc, a major dietary source of carbohydrates, is a basic food in rural areas. Much of the crop is grown for home consumption and the balance is usually disposed of locally. This situation is in direct contrast to the experience of a century and a half earlier. In 1820, the great French naturalist, Auguste Saint-Hilaire, noted that manioc, together with rice, constituted the only important food export from the state (Amaral, 1940).

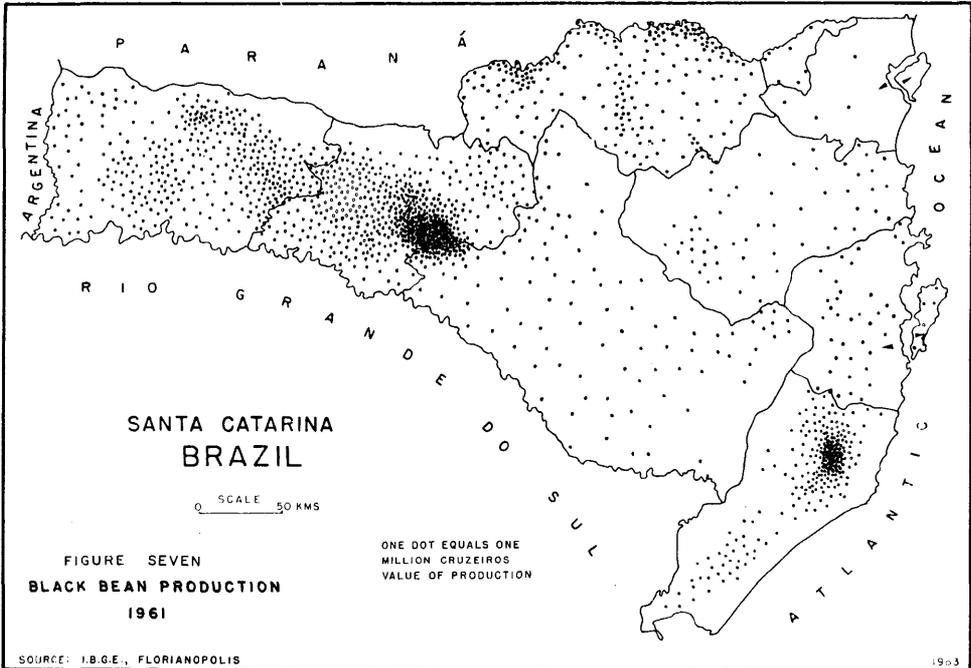


Although manioc is grown in all parts of Santa Catarina, it is overwhelmingly a crop of the littoral area (table 3), which in 1962, produced 92 per cent all manioc grown in the state. But even within the littoral belt, distribution is localized. In Laguna and Florianópolis, manioc is the leading crop; in Bacia do Itajaí, it is a poor second to corn; in Litoral de São Francisco, it hardly appears at all. In Saint-Hilaire's day, Litoral de São Francisco was the major producing area. By World War II, production was concentrated in Bacia do Itajaí (Amaral, 1940). The southward shift appears to be the result of competition from more economically important crops such as rice, corn, etc.

The cultivation of black beans is important throughout Santa Catarina except in the northeast corner of the state. In 1962, about four-fifths of the crop was produced on the planalto. Statistics for production or acreage by zone are deceptive, however. Figure 7 shows the distribution of the 1961 production for 104 *municípios*. Two sharply defined major centers of production stand out. On the planalto, the middle Rio do Peixe valley has much heavier production than surrounding areas; in the littoral area, northern Laguna marks another but less

important nucleus. Campos de Lajes and Litoral de São Francisco are notable as areas of low production. Traditionally, Santa Catarina produces a surplus of black beans, which is sometimes marketed as far away as Recife or Belem, although most goes to São Paulo and Rio de Janeiro. All over Brazil, black beans are served and eaten, together with rice and beef, in the national dish "feijoada."

Of the remaining eight major crops of the state, only two—squash and white potatoes—are grown primarily on the planalto. Both in Alto Rio Negro and Rio do Peixe, squash ranks as the fourth crop in terms of acreage. But in Rio do Peixe, only 5 per cent of the cropland is devoted to squash, against 12 per cent in Alto Rio Negro. However, yields in Rio do Peixe are over 17 times greater. White potatoes occupy a greater proportion (12 per cent) of cropland in Alto Rio



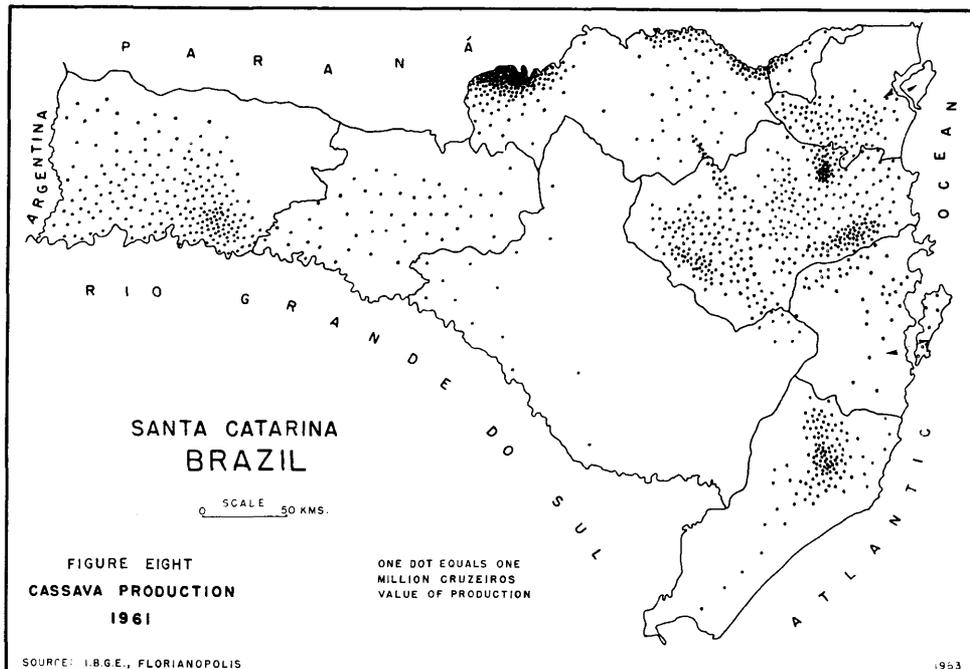
Negro than in any other zone, but the figures are misleading because of the small size of the zone. The potato production of the state is by no means concentrated here. In fact, potato acreage is higher in Campos de Lajes, Oeste, Canoinhas, Florianópolis, and Bacia do Itajaí, and potato production is higher in Campos de Lajes, Oeste, Rio do Peixe, Canoinhas, and Bacia do Itajaí (Estado, Sept. 1962).

Two crops, sweet potatoes and cassava, are grown both on the planalto and along the littoral area. The term cassava, as used in this paper, refers to the Portuguese word *aipim* and denotes that variety of manioc which is sweet in taste, and is used as a table vegetable and as a fodder crop. Figure 8 shows the 1961 cassava crop based on value of production statistics for 104 *municípios*. The principal center of cultivation is in the western part of Canoinhas, although there are secondary centers in the Chapéco Valley, in northern Laguna, and in several areas in Bacia do Itajaí.

The yields of cassava reveal a phenomenon found rather often for crops in Santa Catarina—high yield and restricted production. The Campos de Lajes zone has the highest average yield of cassava of any zone in the state. However, yields are directly related to restricted production, because only small amounts of

cassava are grown in very favorable locations, thus producing the high yields. The same relationship—high yield per hectare and low total production—is also true for bananas (in Alto Rio Negro), white potatoes (Rio do Peixe), squash (Florianópolis), sweet potatoes (Oeste), and sugar cane (Alto Rio Negro). Like cassava, sweet potatoes are a crop of secondary importance, occupying only about 2.5 per cent of the total cropland of the state in 1962. Production tends to be oriented toward home consumption or rather restricted local market. In these respects sweet potatoes are similar to manioc and cassava.

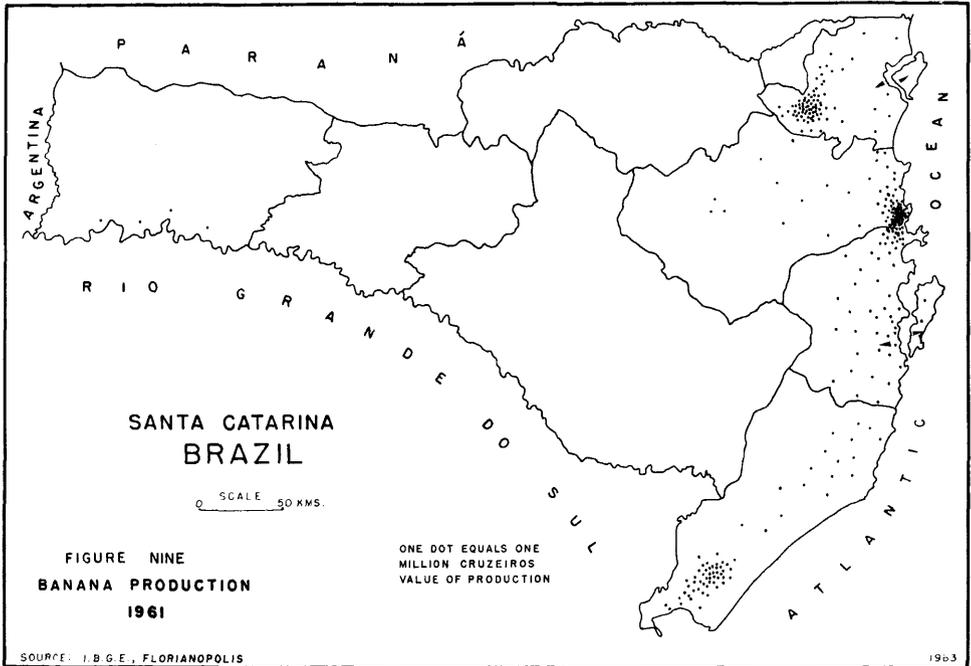
There are four major crops which are found primarily on the littoral coast—rice, sugar cane, tobacco, and bananas. Of these, rice is the most important,



with a strong concentration in Litoral de São Francisco and adjacent portions of Bacia do Itajaí. In 1962, about 6 per cent of all cropland of the state, and about 31 per cent of the cropland of Litoral de São Francisco, was in rice. Rice is a major crop (that is, grown on at least 1000 hectares) in every zone of the state except Alto Rio Negro, and in this latter zone, rice is prevented from being a major crop partially because of the limited size of the zone itself. Only corn has such a wide and significant distribution throughout the state. Rice develops most favorably on heavy alluvial clay soils where temperatures and rainfall are high. Thus, the flats of the São Francisco bay and the Itajaí river mouth are areas of concentrated rice production, while the sandy coastal areas of the Florianópolis zone, derived from the decomposition of granitic rock, are areas in which rice is markedly absent.

Like rice, other crops—sugar cane, tobacco and bananas—are heavily oriented to the littoral zones, where local concentrations often are characteristic. To a certain extent, tobacco is centered in Laguna, while sugar cane is strong in Florianópolis. Although census statistics (Estado, Sept. 1962) point toward a concentration of banana production in Litoral de São Francisco and Florianópolis zones, a study of figure 9, which gives banana production in 1961 for 104 *municípios*,

reveals a more exact and somewhat different picture. The major nucleus of banana production is the coastal area lying partially in Bacia do Itajaí and partially in Florianópolis. A larger but more scattered nucleus is centered in south-western Litoral de São Francisco. Another important area of production lies in the extreme southern part of Laguna. The banana production of Canoinhas comes from the Hercílio valley, a part of the littoral area, and not from the planalto (fig. 1). A very limited production of bananas is also found along the lower course of the Uruguai river in Oeste zone.



A LESSON FROM RYE

Before concluding this discussion of the agricultural geography of Santa Catarina state, it would be wise to look briefly at the peculiarities of the distribution of rye, and to note well the lesson which that distribution teaches. According to the 1961 statistics (Estado, Aug. 1962), rye production amounted to 3,855,820 kilos, of which 3,673,500 were produced on the planalto and only 182,320 on the littoral coast. Of the littoral production, 78 per cent or 142,800 kilos, came from the single municipality of Ibirama, in Bacia do Itajaí. On the planalto, 35 per cent, or 1,267,500 kilos, came from the single municipality of Itaiópolis, in Canoinhas. The Hercílio valley, shown on figure 1, occupies a large portion of both the municipalities of Ibirama and Itaiópolis. This valley is by nature a part of the littoral area. All of the rye production of Ibirama comes from the Hercílio valley and represents perhaps as much as half of the Itaiópolis production of rye (this latter estimate based on reconnaissance by the author). However, since that portion of the Hercílio valley which lies in Itaiópolis is classified with the planalto, the actual production of rye in the littoral area is understated in the statistics based on the physiographic zones by more than three-quarters. Such a situation should serve as a warning to the student who deals with Brazilian statistics. Future statistics will undoubtedly continue to be presented within the

framework of the various physiographic zones into which each state is divided by government statisticians. The researcher must continually have in mind the fact that the official zones do not coincide exactly with the natural physiographic areas.

RETROSPECT AND PROSPECT

The agricultural economy of the state of Santa Catarina is varied in structure and level of development. This variation is partly a function of geographical location with respect to the rest of the country and partly a function of the different physical environments of the state. The Atlantic littoral coast of the state and restricted portions of the Rio do Peixe valley are located in close proximity to long-established and easily utilized transportation routes. These areas tend to have a higher agricultural level than the other sections.

The state is divided by statistics-collecting government agencies into nine physiographic zones, each of which presents a unique physical setting in which agriculture is pursued. Although it may prove useful and convenient to a general discussion of agricultural regionalization, the use of official divisions tends to mask the individual centers of agricultural production, which often are grouped together without identification into a single unit, and which, in other cases, are combined with large areas of non-agricultural land or land of low productivity and utilization. The latter situation produces a "dilution" of statistics, by spreading the results obtained in a restricted area over a much larger total area. Because of (1) inertia, (2) the increased financial burden generated by any refinement of present statistical techniques, and (3) the general suitability for government purposes of present methods of collection, there is little likelihood that great refinements will be made in the collection of Brazilian federal statistics. It is unfortunate that the geographer will be limited in his analysis of Brazilian geography in the future, as in the past, by the lack of sufficiently detailed official statistics. The situation will be particularly regrettable with reference to Santa Catarina, which will continue to increase in its relative importance as a surplus-food-producing region of vital importance to the Brazilian nation.

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