

Food-consumption patterns in Central West Africa, 1961 to 2000, and challenges to combating malnutrition

B. G. Honfoga and G. J. M. van den Boom

Abstract

We discuss food-consumption patterns in Central West Africa from 1961 to 2000 and some implications for combating malnutrition. The availability of food in the region improved in the 1960s, declined sharply in the 1970s and the early 1980s, and has shown a modest positive trend since the mid-1980s. Notwithstanding obvious progress over the past decades and in the region as a whole, food availability today remains below the required levels for large parts of the population and appears unstable over time, particularly in the Sahelian zone. On average, diets in this zone contain fewer than 2,200 kcal, compared with almost 2,500 kcal in the coastal zone. Conversely, protein deficiency is more common in the coastal zone, where a typical diet contains only 45 g of protein, compared with 60 g in the Sahelian zone. Furthermore, consumption is showing a dietary shift toward cereals, while yield growth lags far behind population growth. The associated import dependency and pressure on land seem to gain significance regardless of the region's agro-ecological capacity to increase and to substitute cereal imports for locally produced food. Moreover, food consumption appears responsive to income changes (calorie-income elasticity ranges from 0.25 to 0.62), while, in turn, it has a significant impact on nutritional outcomes (stunting-calorie elasticity of -1.42). We conclude that combating malnutrition requires first broad-spectrum income growth, and next specific policies that promote the yield and the contribution to diets of nutritious food produced within the region.

Key words: Central West Africa, food consumption, malnutrition

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Introduction

Food security is a fundamental concept for elaborating development strategies, particularly in West Africa. It has been defined as access for all individuals at any time to sufficient nourishing food for a healthy and active life [1, 2]. Accordingly, it has several aspects, including the availability of foodstuffs, the quality of the diet, the stability of supplies over time and space, and the access to food produced at home or purchased [3]. Accessibility further includes access to price and other relevant information, such as nutritional education and culinary knowledge.

In this paper we consider various aspects of food security in five Central West African countries—Burkina Faso, Côte d'Ivoire, Ghana, Mali, and Togo—henceforth referred to as the SADAOC region. In 1992, the Fondation Sécurité Alimentaire Durable en Afrique de l'Ouest Centrale (SADAOC) implemented a research and policy dialogue program in this region aimed at improving the formulation of food-security policies by the concerned governments. The region is currently inhabited by about 60 million people, and the landscape ranges from the dry Sahelian zones beneath the Sahara desert to the coastal zones with humid rain forests, with Sudanian or Sudano-Sahelian climates in between. Food insecurity has been manifest in all its aspects and remains a large concern of the regional governments. Local food production is insufficient to cover the needs of the population, especially in the Sahelian zone. Production systems are still extensive, with output well below potential. Despite apparent progress achieved in cereal production, food availability remains dependent on a favorable climate and considerable imports of rice and wheat. The adoption of high-yielding varieties and improved technologies has been very limited, while a continual expansion of cultivated areas is risky because of infertile soils. The resulting insufficiency of domestic supplies and the problems of satisfying the demands of a growing population in a sustainable manner create the need for importation of large quantities of food, among which cereals are predominant.

In the effort to satisfy food needs, policies have focused on the availability of cereals, because cereals dominate the diet of a majority of people in the region. However, because of erratic rainfall patterns and very low use of improved technologies, production remains unstable and inadequate, which constitutes a subtle but serious threat to food security. Especially in the Sahelian zone, each year a large part of the population suffers from poverty and malnutrition.

Traditionally, two broad diets can be distinguished: cereal-based diets in the Sahelian countries of Burkina Faso and Mali, and roots-and-tuber-based diets in the coastal countries of Côte d'Ivoire, Ghana, and Togo [4]. High levels of malnutrition persist in the region, and the countries of West Africa have shown very little progress in reducing child malnutrition, as determined by stunting since 1980 [5]. Indeed, deficiencies in nutrient intake are widespread in the Sahelian countries as well as in the coastal countries. In Burkina Faso in 1990, for example, one-third of the households consumed less than 80% of the calories required for a healthy and active life. [6]

Policy makers have been concerned about the discrepancies between food availability and diets of the people in the Sahelian and coastal subzones on the one hand, and nonutilization of the agro-ecological complementary potentials of the two subregions on the other hand. Likewise, they are concerned with the possible incongruity between income growth and improvements in food consumption and nutritional status. Considering the concerns of development specialists, policy makers, and the civil society about the food situation in the SADAOC region, a systematic analysis of the various discrepancies could contribute to more focused actions to reduce food insecurity and malnutrition.

This paper addresses some of these issues, primarily by exploiting data on food-consumption patterns in the SADAOC region during the period 1961 to 2000, and by linking them to income and malnutrition data.

Methods

The analysis is made both from the quantitative viewpoint of nutrient needs and from the qualitative perspective of the most suitable diet in relation to the agro-ecological potentials in the SADAOC region. The study relies on cross-country time-series data compiled for the SADAOC food exchange information database "matrice" [7]. The matrice is based on various data sources, including the Supply Utilization Accounts for agricultural products [8], the World Development Indicators [9], the Global Database on Child Growth and Malnutrition [10], and national data sources. Analytical tools include consistent data aggregation, tabulation, trend analysis, polynomial curve fitting, and regression techniques.

The Food and Agriculture Organization (FAO) database on the Supply-Utilization Accounts of agricultural products is a major data source. It has four dimensions—regions, products, variables, and years—and covers almost every country of the world and almost every food product for which production, consumption, and trade figures are recorded for the period 1961 to 2000. Further variables include the cultivated area, the size of livestock herds, the values of imports and exports, and, finally, the equivalents in the consumption of calories, proteins, and fats. Employing the FAO database and dedicated aggregation software [11, 12], we extracted time series for 1961 to 2000 for the five countries of the SADAOC region. Additional time series for income are drawn from the World Development Indicators in order to analyze the response of food consumption to income. Finally, we employ nutritional status data from the Global Database on Child Growth and Malnutrition and mortality data to explore the impact of food consumption on malnutrition.

This study uses the data to examine food-consumption patterns in the region and relate these to income and malnutrition. In the next section, we display the time-series data from 1961 to 2000 and fit the data to regression curves that indicate dietary trends with respect to both the calorie and protein content of consumption and the contribution of cereals, roots and tubers, and other products to the diet. Particular attention is devoted to the changing role of imported cereals in the consumption pattern.

Next, we briefly explore the relation between food consumption, population, and poverty. In particular, we try to estimate income elasticities of calorie and protein consumption. We recognize the limitations of the methodologies and inaccuracies of the data, especially in the light of conceptual and data-collection issues associated with the construction of variables that reflect true food consumption and true income [13–15]. Unlike Diakosavvas [16], who considered a range of economic factors influencing cereal consumption, we concentrate on aggregate food Engel curves,* considering the entire range of foodstuffs. Because of data limitations, we do not consider specific factors, such as seasonality and consumption smoothing opportunities. Evidence suggests that survey-based poverty estimates can have a seasonality bias [17], whereas idiosyncratic income fluctuations tend to be smoothed [18, 19]. Yet, the Supply Utilization Accounts provide a rough approximation of food-consumption patterns in the SADAOC region, since they give cross-country time-series information for all food products. Such comprehensive information is difficult to gather

* An Engel curve is a graphic representation of the demand for a particular good as a function of income when all prices are held fixed. In this paper, Engel curves for energy, proteins, and food are defined in equation 2, with corresponding estimates and plots in table 4 and figure 4, respectively.

from sources such as food-expenditure and food-recall surveys. Likewise, the income variables from the World Development Indicators are the only comprehensive source of cross-country time series for per capita income.

Finally, though it is well established that the causes of malnutrition are complex, we consider the impact of food consumption on the reduction of malnutrition. Since full analysis requires more data than are available for this paper, a comprehensive analysis is not possible here. Nonetheless, we look for evidence that lack of food availability is the most important single cause of malnutrition [20]. We conclude with a discussion of the findings, suggesting the formulation of strategies and policies that would be effective for combating food insecurity and malnutrition in the population of the SADAOC region.

The figures for nutrient availability, diets, production, acreage, yields, and imports were calculated by the authors from the Supply Utilization Accounts 1961 to 2000 [8], employing dedicated software to aggregate food products [11, 12]. Income figures (expressed in dollars) and population figures are taken from the World Development Indicators on CD-ROM [9]. Time series for gross domestic product (GDP) in the Sahelian zone and for the region as a whole start in 1967 because of missing GDP data for Mali from 1961 to 1966. Time series for purchasing power parity (PPP)-adjusted (or "international dollar") income start in 1975 and derive from GDP figures after the application of purchasing power parity-adjusted exchange rates. Child malnutrition and mortality figures are from the Global Database on Child Growth and Malnutrition [10]. The malnutrition indicator, height-for-age Z score (HAZ), denotes the percentage of children younger than five years whose height is more than 2 standard deviations below the median of a reference distribution (i.e., the distribution of nutritional status among healthy North American children). Child mortality is expressed as the number of children dying before reaching the age of five (per 1,000 live births). The time series in figures 1, 2, and 3 are fitted on a fourth-order polynomial regression curve.

Food-consumption patterns from 1961 to 2000

Nutrient availability

Figure 1 shows the trends in overall food availability in the SADAOC region during the period from 1961 to 2000. The estimates of the corresponding long-term growth rate are listed in table 1. The growth rate of a variable y is estimated by the equation

$$\log(yt) = \log(y_0) + rt \quad (1)$$

TABLE 1. Growth rate of population and food availability in the SADAOC region, 1961 to 2000

Variable	Growth rate
Population (millions)	2.84
Calories (per capita per day)	0.41
Proteins (g per capita per day)	0.35
Calories (per kilogram of food consumed)	0.28

with estimated initial value y_0 at $t = 0$ (i.e., the year 1961) and estimated growth rate r .

At rates of 0.41% and 0.35% per annum for calories and protein, respectively, the long-term average growth of food availability per capita during the period has been positive, though small. Nonetheless, this trend has led to an increased availability of calories by almost 20%, from about 1,900 kcal per capita per day in the 1960s to about 2,300 in recent years. Likewise, the availability of proteins rose by about 15%, from around 45 g per capita per day to around 50 g. This protein availability is still far below the recommended intake of 1 g per kilogram of body weight [21]. The recent figure for the average availability of calories is, however, comparable to the benchmark recommended average intake of calories under normal activity levels.* Still, large parts of the population will have actual calorie intakes below the recommended levels, since availability figures tend to overestimate intakes, whereas both the availability and the intake of calories tend to be unevenly spread.

The uneven spread is evident in fig. 1 when one considers the disparities of food availability between the coastal and Sahelian countries of the region. Whereas calorie availability is around 2,500 kcal per capita per day in the coastal zone, it is less than 2,200 in the Sahelian zone.

Similarly, at around 60 g per capita per day, proteins are more available in the Sahelian zone and reach only 45 g in the coastal zone. Changes over time are significant, reflecting the various phases of the development path of the countries in the region as well as variability of production, especially in the Sahelian zone. Table 2 gives estimates of the absolute deviations over time and space of the growth rate in food availability.**

* Recommended intake (RI) is calculated from a person's body weight (WT) and activity level (A) using the formula $RI = (a + b*WT) * A$, with age and sex specific constants a and b (see FAO/WHO/UNU [21]). For example, the equation reads $RI = (679 + 15.3*WT) * A$ for males aged 18 to 30. With a body weight of 60 kg and involvement in light activities, $A = 1.5$ times the person's basic metabolic rate implies requirements of about 2,400 kcal. Likewise, $A = 2$ for more demanding work, and the person's caloric needs rise to about 3,200 kcal.

**The figures in table 2 are deviations from the respective averages in table 1. The deviations are obtained from separate estimation of the growth rate for the coastal and Sahelian countries and for the four subsequent decades.

It appears that the improvement in the availability of calories has been slower in the coastal countries, which had faster population growth. Furthermore, most of the improvement in the coastal zone was due to a shift

toward food with much higher calorie content, probably because of the increased importance of imported cereal products over root crop products. Such a dietary shift is much less pronounced in the Sahelian zone,

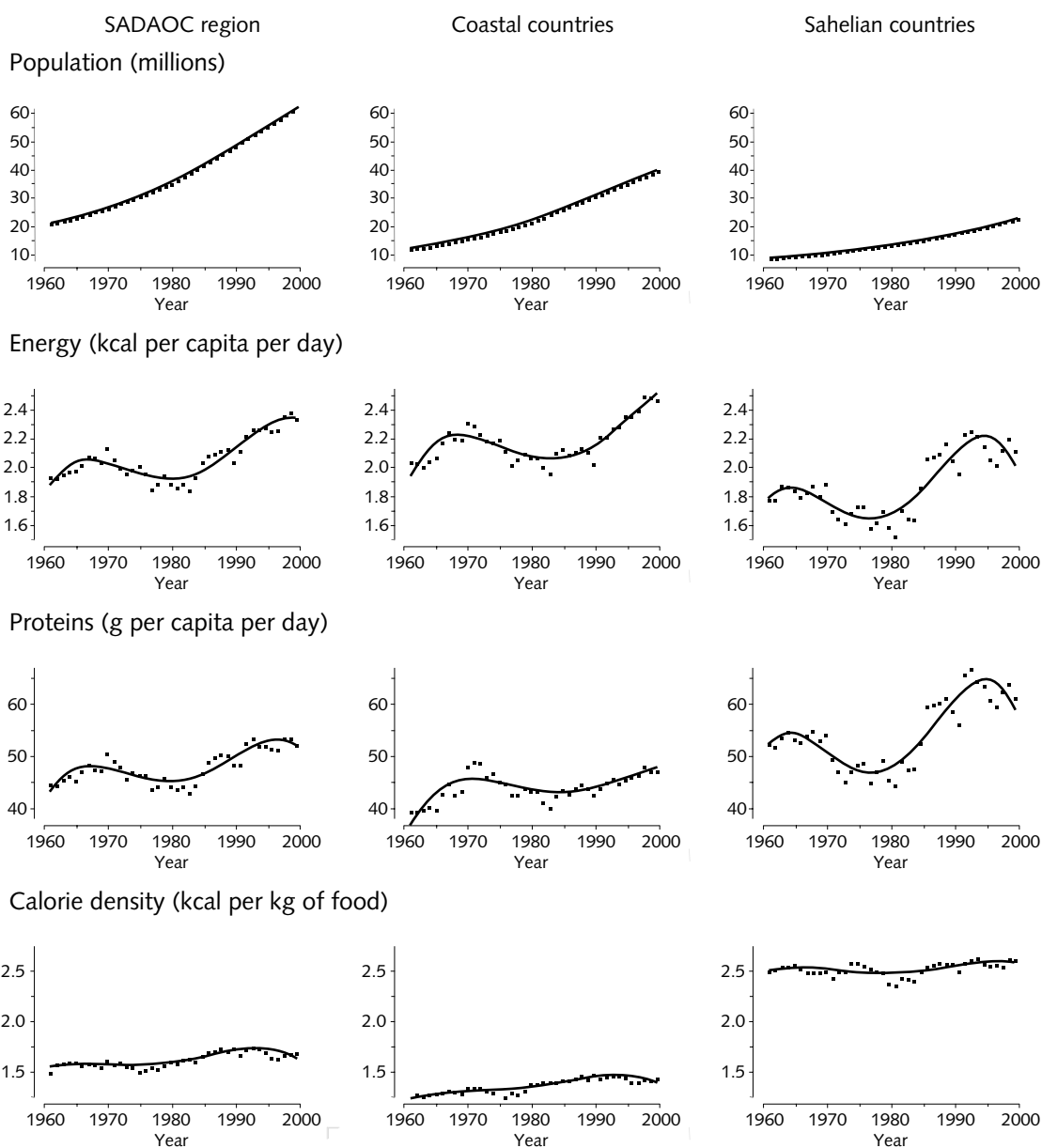


FIG. 1. Population and nutrient availability in the SADAOC Region, 1961 to 2000

TABLE 2. Variation over space and over time of growth rates^a of population and food availability in the SADAOC region, 1961 to 2000

Variable	Coast	Sahel	1960s	1970s	1980s	1990s
Population	+0.28	-0.43	-0.22	+0.07	+0.14	-0.02
Calories per capita per day	-0.14	+0.18	+0.67	-0.98	+0.10	+0.30

a. Growth rates are expressed as deviations from the respective averages in table 1.

where locally produced cereals are already the predominant source of calories. The developments over time reflect the pattern of favorable developments in the 1960s, crises and collapses during the 1970s, and recovery since the 1980s, whereas recent figures seem to indicate slower population growth and trends in higher levels of food availability.

The first decade (the 1960s) marks the commitment, after independence, to food self-sufficiency with government support for locally grown food crops. In spite of rapid population increases, food availability improved, although it remained insufficient during the 1960s. During the second decade (the 1970s), population growth accelerated, and a general decline in the support of agriculture began to affect production and consumption capacities negatively. Droughts in the years 1975, 1977, and 1982, and an upsurge of economic mismanagement practices also played a major role in this. The per capita availability of calories fell sharply at an average rate of 0.5%. Structural adjust-

ment policies began to take shape in the mid-1980s, when the economic recession reached its lowest ebb. Access to relatively expensive products of high nutritional value, such as animal products, dwindled during the 1980s and 1990s. Although per capita income has gradually recovered since the mid-1980s, the role of relatively nutritious products in total consumption has remained small or even diminished. For example, real prices of beef increased considerably during the years following the devaluation of the CFA (the local currency for SADAOC countries except Ghana) in 1994 [22].

Composition of the diet

Figure 2 illustrates the composition of the regional diet and its trends since the 1960s. In the SADAOC region as a whole, the broad structure of food consumption has remained fairly stable throughout the period. Staple foods contribute around 80% of dietary energy calo-

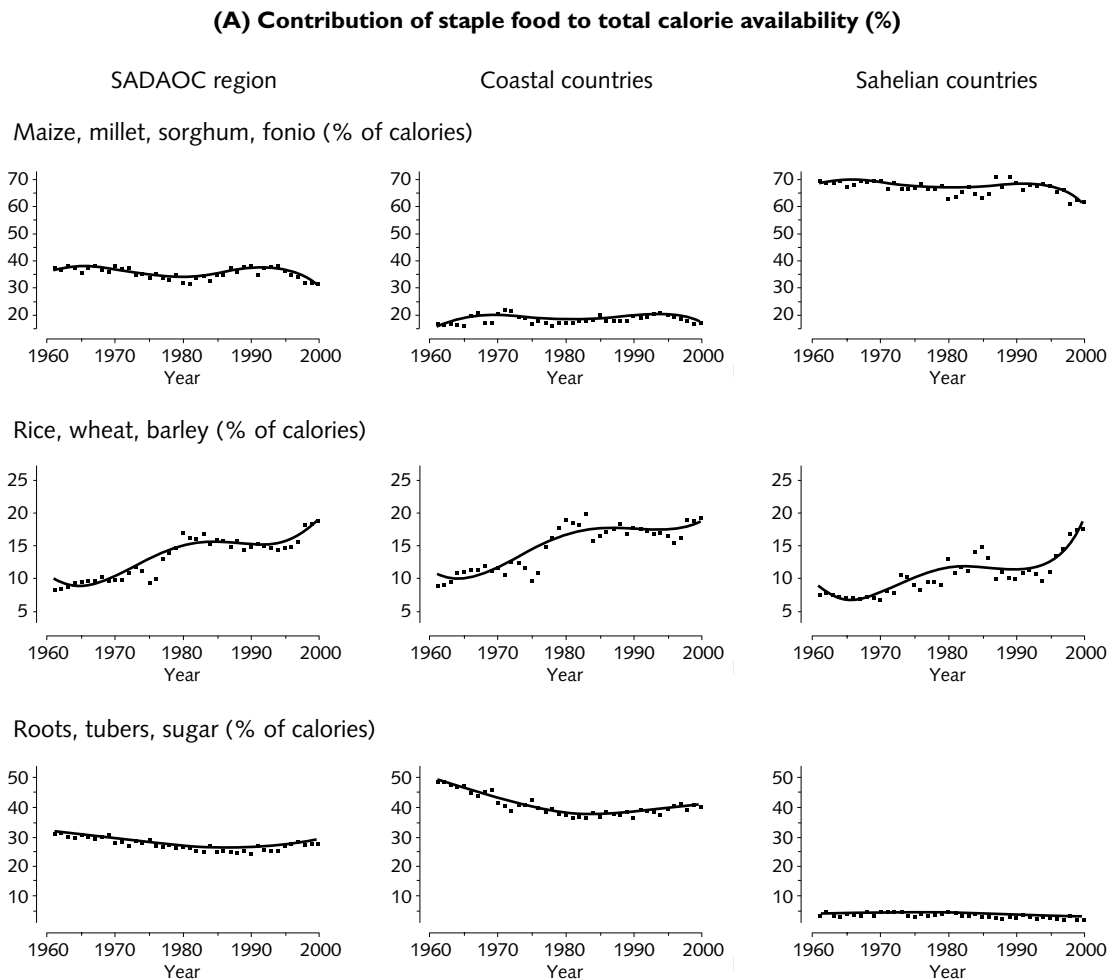


FIG. 2. Diets in the SADAOC Region, 1961 to 2000

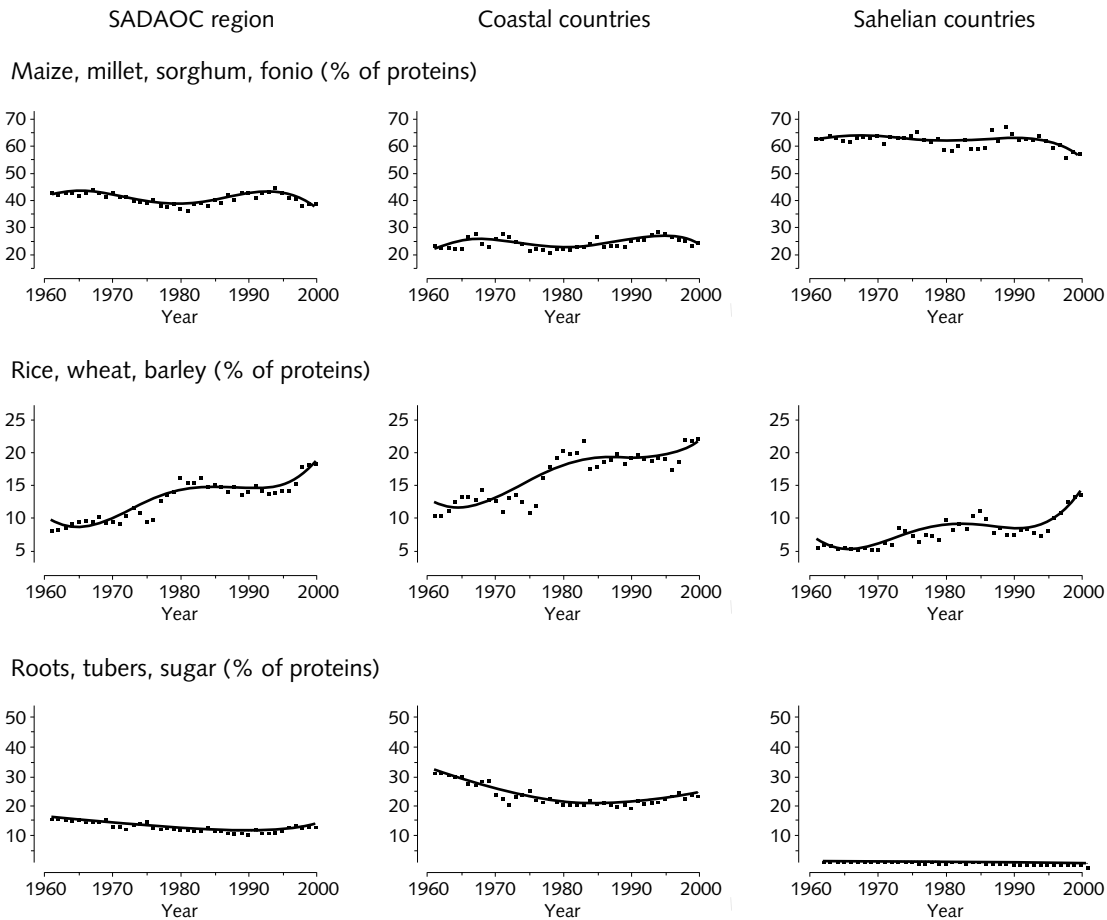
(B) Contribution of staple food to total protein availability (%)

FIG. 2. Diets in the SADAOC Region, 1961 to 2000 (continued)

ries, with cereals accounting for 50% and tubers and roots for some 30% (fig. 2A). Staple foods are also the predominant providers of proteins, contributing close to 70% of total availability (fig. 2B). The position of oil crop products (10% and 6% of calories and proteins, respectively), fruits and vegetables (6% and 4%), pulses (2% and 4%), and animal products (4% and 15%) has remained relatively stable (fig. 2C and D).

Huge differences appear when the diets in the coastal countries are compared with those in the Sahelian countries. Diets in the Sahelian zone remained very much cereal-based during the period, with cereals providing about 80% of total calories and 70% of total proteins. Millet and sorghum are the predominant cereals, and the production of these two crops is close to 10 times the production of maize. Conversely, diets in the coastal zone have a mixed base of cereals and roots/tubers, each providing close to 40% of total calories, with an additional 10% and 8% deriving from oil crops and fruits, respectively. This result refutes the popular idea that diets in the coastal zone are mainly

based on tubers and fruits, as would be expected considering the agro-ecological potentials. An increased and accelerated production and trade of tubers and plantains produced in forest zones and consumed in the capitals and other growing cities probably lacks adequate processing and transportation capacities in terms of both equipment and knowledge. Fruit consumption is negligible in the Sahelian zone.

A further notable feature is the diminishing role of pulses and animal products, particularly in the coastal countries, where their contribution to protein availability has declined from around 25% and more in the 1960s and 1970s to less than 20% in recent years. Since these two groups of foods are the best sources of quality protein, this dietary shift suggests that the quality of the diet has decreased somewhat.

The quality of the diet is a matter of both insufficient supplies and an uneven distribution of the different groups of food. The comparative analysis of protein consumption in the SADAOC region shows that in the coastal countries animal proteins contributed

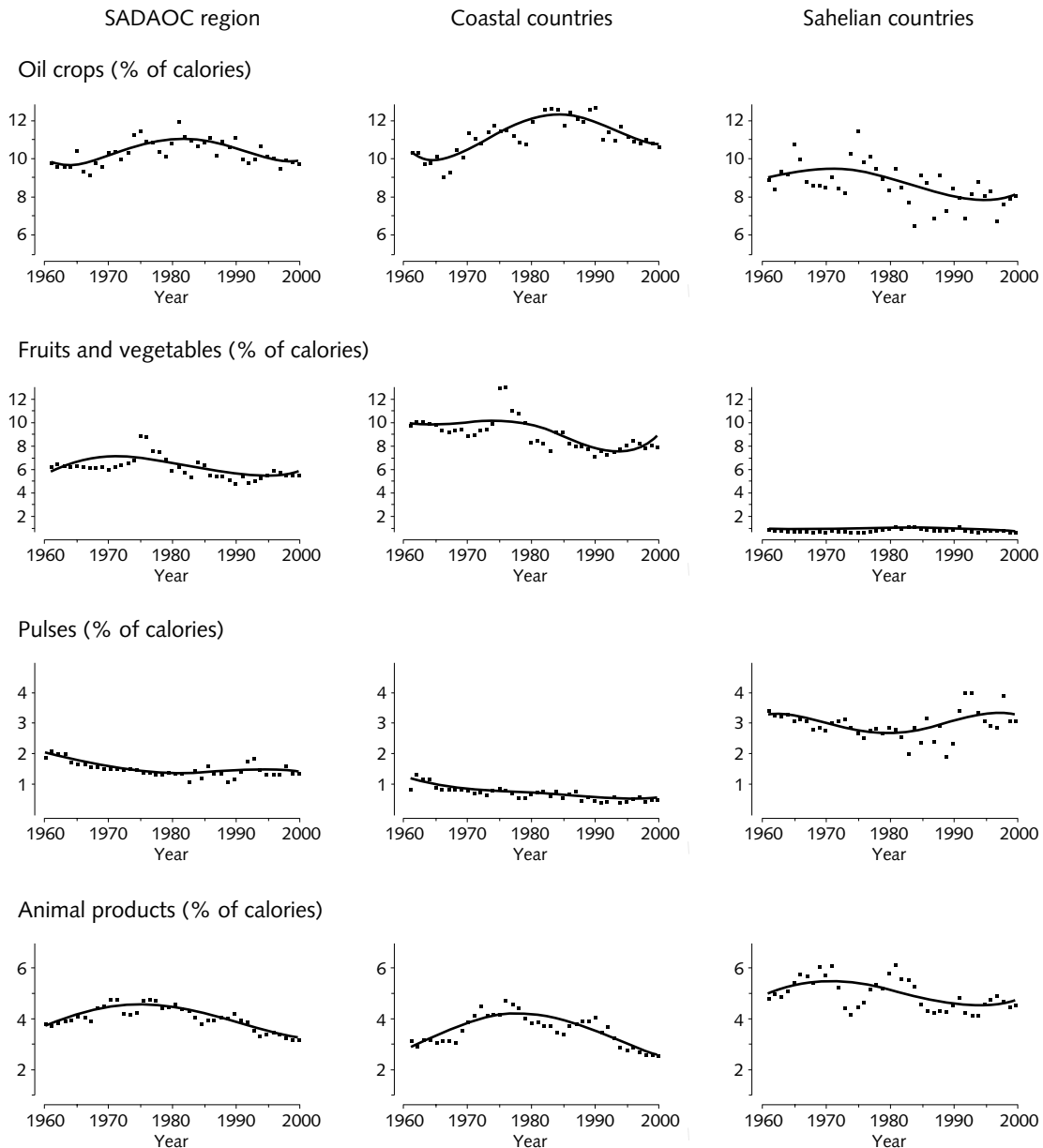
(C) Contribution of other food products to total calorie availability (%)

FIG. 2. Diets in the SADAOC Region, 1961 to 2000 (continued)

only some 16%, while cereals and tubers provided 45% and 25%, respectively. In the Sahelian countries, animal proteins provide about 15% of the total protein supply, whereas cereals account for some 75%. The large proportion of the protein in the diets of Sahelian people derived from cereals is striking. Indeed, despite the potential animal resources of this subregion, the low share of animal protein consumption is not greatly different from that of coastal countries. It would thus seem that the high prevalence of protein deficiency in

the coastal countries must be attributed to the role of root crops in the southern diets and their relative absence in those of the north.

The most notable diet change in all of the countries of the region is the shift in recent years toward rice, wheat, and barley products. This probably reflects the taste for such cereals associated with urbanization and income growth, and we pay special attention to the consequences of this dietary shift in both the Sahelian and the coastal countries.

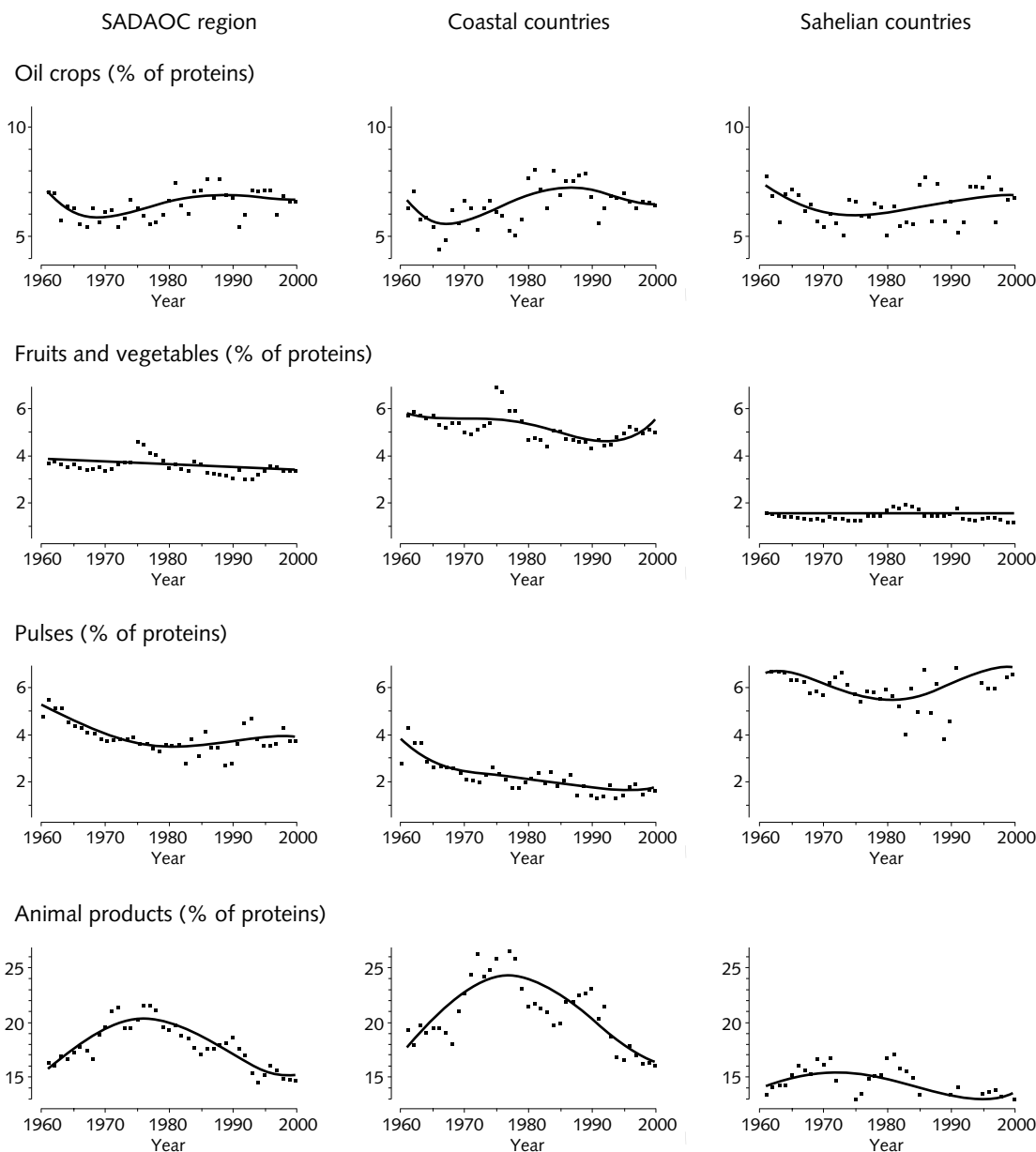
(D) Contribution of other food products to total protein availability (%)

FIG. 2. Diets in the SADAOC Region, 1961 to 2000 (continued)

The role of cereals

The preceding discussion on the availability of food and the composition of the diet has revealed that the role of cereals is gaining significance for food security in the SADAOC region. The observed improvement in the quality of diets over the past decade has largely been due to greater cereal consumption. As figure 2 shows, the increase in the per capita availability of calories in the coastal zone is due to an increased consumption of rice, wheat, and barley products. In the

Sahelian zone, millet and sorghum continue to be the predominant providers of both calories and proteins, but rice, wheat, and barley products are beginning to play a larger role.

Part of this increased consumption has led to increased imports of rice and wheat flour that are further encouraged by the unstable per capita levels of locally produced cereals. This pattern is shown in figure 3, and a further analysis of the figures reveals several other interesting characteristics of cereal production and import patterns during the period 1961

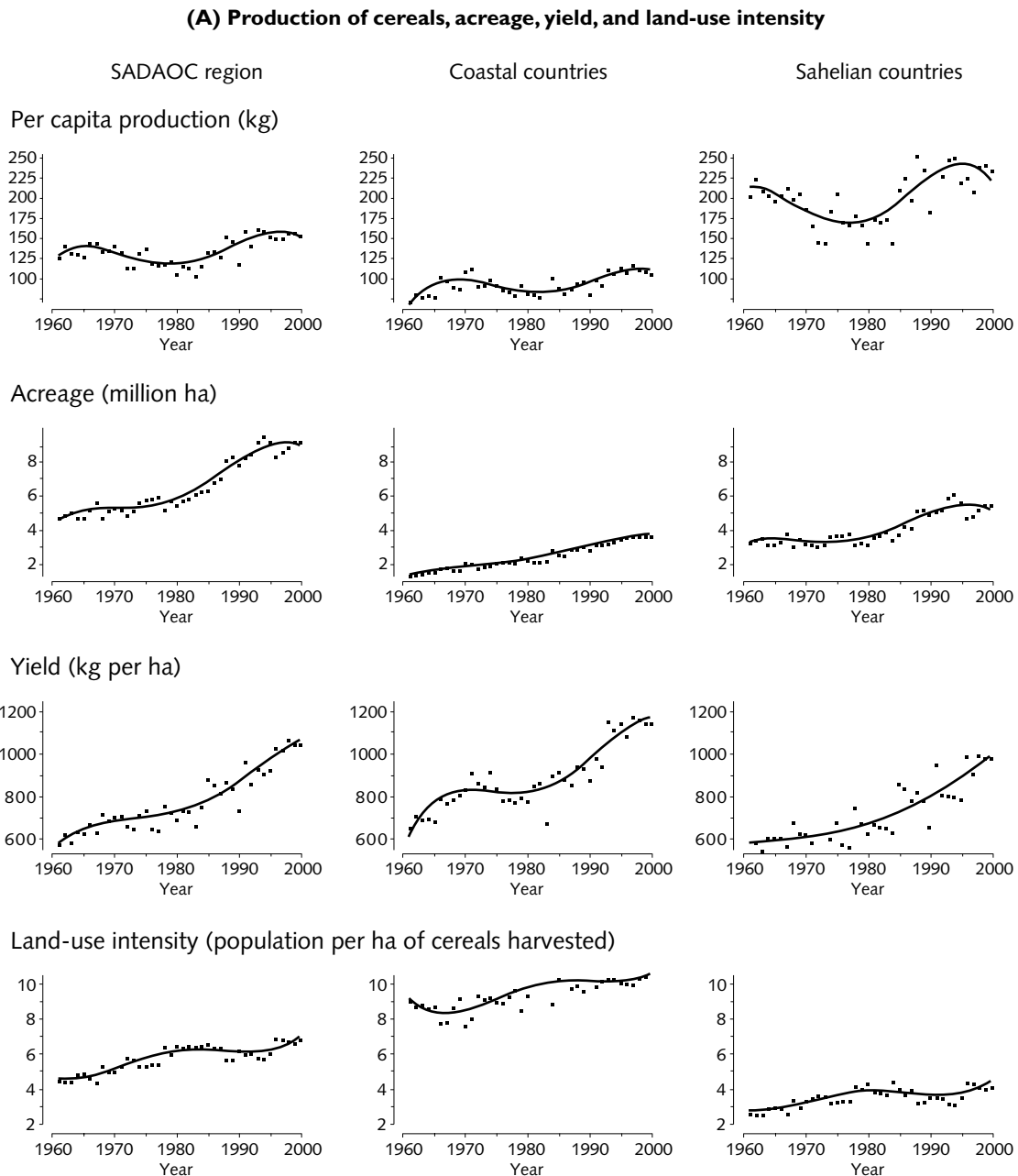


FIG. 3. Production, yields, and imports of cereals in the SADAOC Region, 1961 to 2000

to 2000. For example, equation 1 describes and table 3 illustrates the long-term growth rates of production and imports as well as those of acreage, yields, and land-use intensity.

Apparently, food-consumption patterns have been putting pressure on cereal production. The long-term production trend has exceeded population growth and led to improvements in per capita cereal production by 0.5% per annum, in both the coastal and the Sahelian zones of the region. At the same time, the growth of cereal imports has exceeded population growth by

far, suggesting that food-consumption patterns led to substantial and increasing cereal imports. Moreover, the largest part of the pressure exerted on dry cereals (millet, sorghum, maize, and upland rice) is borne by the increase in cultivated areas under a relentless, extractive, low-input agriculture that remains unstable because of undependable rainfalls and a failure to improve yields. At current average yields of around 1,000 kg per hectare, long-term annual growth in production is estimated at 1.2% to 1.4%, well below that of population growth, necessitating a continual expansion

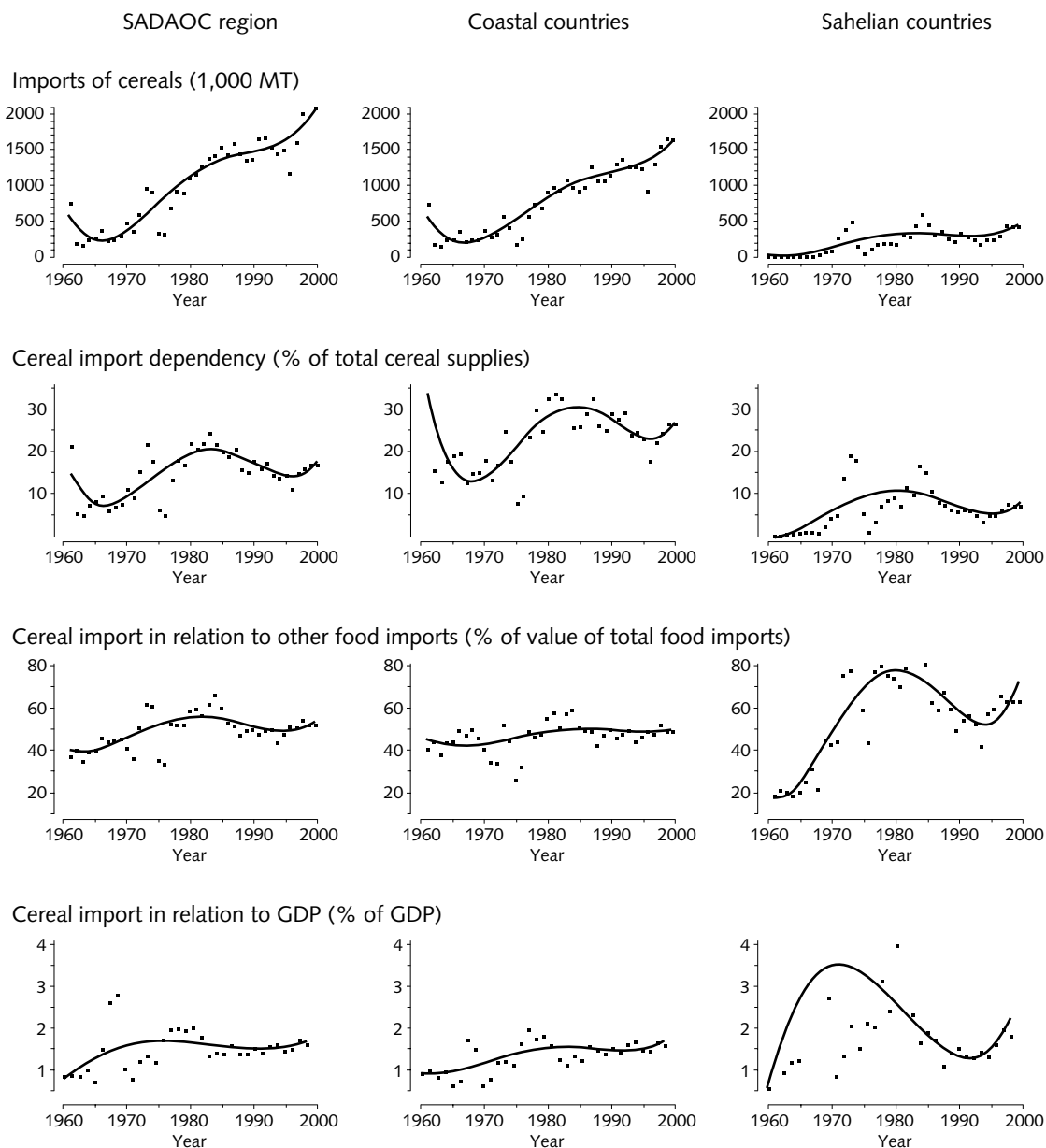
(B) Imports of cereals and import dependency

FIG. 3. Production, yields, and imports of cereals in the SADAOC Region, 1961 to 2000 (continued)

of cultivated areas.

Land is under pressure, particularly in the Sahelian zone, where already cleared lands that used to be under shifting cultivation are now undergoing constant tillage with associated soil depletion and restraints on future growth in productivity. With the use of traditional cropping techniques which, in general, do not care much about the protection of natural resources (mainly soils and vegetation), the risk of environmental degradation and productivity decrease becomes higher than ever. During the 2000–2001 crop season in Burkina Faso, for

example, a low rainfall was recorded, and cereal deficits were estimated at about 440,000 metric tons, exposing more than 1 million people to hunger.*

It is noteworthy that in the coastal countries, cereal imports constitute some 25% of total cereal supplies, whereas this import dependency is only around 5%

* Kaboré I. Opening speech of the CEDA seminar on "Challenges in land tenure, food security and biological diversity," Ouagadougou, Burkina Faso, 2001.

TABLE 3. Growth rates (%) of cereal import and production in the SADAOC region, 1961 to 2000

Variable ^a	SADAOC	Coast	Sahel
Imports	5.55	5.35	8.12
Production	3.26	3.70	2.98
Yield	1.36	1.20	1.41
Acreage	1.90	2.49	1.57
Land-use intensity	0.94	0.62	0.85

a. Import and production figures are given in metric tons (MT); yield in kg/ha; acreage in hectares (ha); and land-use intensity as the ratio of cultivated land to total agricultural land available.

in the Sahelian zone (fig. 3B). Food imports consist mainly of cereals (about 50% of the total value of food imports) and include substantial amounts of food aid, especially in years with erratic rainfalls. Finally, in terms of income, cereal imports on average cost about 1.5% of gross domestic product in SADAOC countries in aggregate, a cost that is fairly stable in the coastal countries but very volatile in the Sahelian zone.

Food consumption: responsiveness to income

In the previous section we discussed food-consumption patterns in the SADAOC region through time-series curve-fitting and trend regressions and decomposition of the diet. We continue the discussion by considering the responsiveness of total food availability to income. Indeed, the insufficiency of income in poor population groups is generally seen as the single most important cause of inadequate food availability. In particular, the responsiveness of food demand to income in developing countries is generally expressed through an estimate of calorie-income elasticity, which is considered an important parameter both in the literature and in the policy arena.

Many studies have addressed the issue and estimated the effect of increases in income on the consumption of

calories by the poor; see, for example, tables 5 and 8.4 in the surveys by Bouis [13] and Ray [23], respectively. The studies mostly employ data from countries in Asia or Latin America. Two exceptions are studies in Kenya [24] and Ghana [25] that reported average elasticities of 0.15 and 0.57, using, respectively, per capita income and per capita expenditure of the household as the explanatory variables.

We will now try to estimate the calorie-income relation in the SADAOC region and also consider the responsiveness of protein availability to income, although the results must be interpreted cautiously, given the inaccuracies of the data employed.*

The cross-country time-series data are displayed in figure 4, where a per capita food-consumption variable is on the y axis and the logarithm of per capita income is on the x axis. This is the common form for estimating food Engel curves, and it also shows that the corresponding food-income elasticities decrease with income.**

The following equation specifies food Engel curves, i.e., the demand for food F as a function of income Y :

$$F = a + b \log(Y) \quad (2)$$

with per capita income Y taken from the World Development Indicators database and expressed in international dollars (time series available for 1975 to 1999) and per capita availability of calories or proteins F .

* Though the food consumption data may not be accurate, they are comprehensive. Such comprehensive information is difficult to gather from sources such as food expenditure and food recall surveys. Likewise, the World Development Indicators are the only comprehensive source of cross-country time series for per capita income in the region.

** We also included the average price of imported calories (proteins) as an additional explanatory variable. The price variable had a negative but insignificant effect on the availability of calories (proteins) and did not affect the respective income elasticity. This corroborates the finding by Skoufias [15], who concludes that the calorie-income elasticity is remarkably insensitive to price changes.

TABLE 4. Calorie-income and protein-income elasticities in the SADAOC region, 1975 to 1999^a

Equation 2	a	b	b/F
$F = 1000$ kcal/capita			Calorie-income elasticity (at $F = 3.0$ to 1.5)
SADAOC region	1.196 (16.6)	0.851 (12.8)	0.28–0.57
Coast	1.221 (9.5)	0.750 (7.6)	0.25–0.50
Sahel	1.493 (22.5)	0.935 (7.7)	0.31–0.62
$F = g$ protein/capita			Protein-income elasticity (at $F = 70$ to 35)
SADAOC region	30.5 (17.3)	17.2 (10.5)	0.25–0.49
Coast	32.3 (20.5)	9.3 (7.7)	0.13–0.27
Sahel	42.7 (22.8)	28.3 (8.2)	0.40–0.81

a. The t -scores of the parameter estimates a and b are given in parentheses.

Table 4 contains the estimates, their significance,* and the corresponding estimates of the income elasticities.

The estimates show that in the SADAOC region, both calorie and protein availability are highly responsive to income. The estimated calorie-income elasticities range from 0.25 for relatively high incomes in the coastal zone to 0.65 for low incomes in the Sahelian zone. Likewise, protein-income elasticities are estimated to range from 0.13 for relatively high incomes in the coastal zone to 0.81 for low incomes in the Sahelian zone. These estimates support the idea that food availability in the region is highly responsive to income, whereas protein is more responsive to income than to caloric intake.

Food consumption: impact on child malnutrition and mortality

It is commonly believed that the availability of nutritious food translates into favorable nutritional status, which in turn is an immediate indicator of food security. Indeed, studies of malnutrition seem to indicate that lack of food availability is the most important single cause of malnutrition, particularly for the case of child malnutrition in Africa [16]. Therefore, we attempt to relate food-consumption patterns to child nutritional status, although we recognize that an elaborate treatment is beyond the scope of this paper and would require a more sophisticated treatment of both data and methodological considerations.

We obtained child malnutrition and mortality figures for the period from 1970 to 1999 from the Global Database on Child Growth and Malnutrition (table 5) [10]. These figures are based on representative samples of the populations of the SADAOC region at large. The malnutrition indicator denotes the percentage of children under five years of age whose height-for-age is more than 2 standard deviations below the median of a reference distribution (i.e., the distribution of nutritional status among healthy North American children). Infant mortality is expressed as the number of children dying before reaching the age of five per 1,000 live births.

According to these figures, the prevalence of child malnutrition in the region currently ranges from 20% to 25% in the coastal countries and from 30% to 50% in the Sahelian countries. Over time, the figures indicate a significant relapse in Côte d'Ivoire and Mali, and alternating periods with gradual improvements and stagnation in Ghana and Togo, whereas there is only a single observation for Burkina Faso.

The patterns of child mortality reflect a similar

geographic picture, with much higher mortality rates of more than 200 per 1,000 live births in the Sahelian zone and rates between 110 and 180 in the coastal

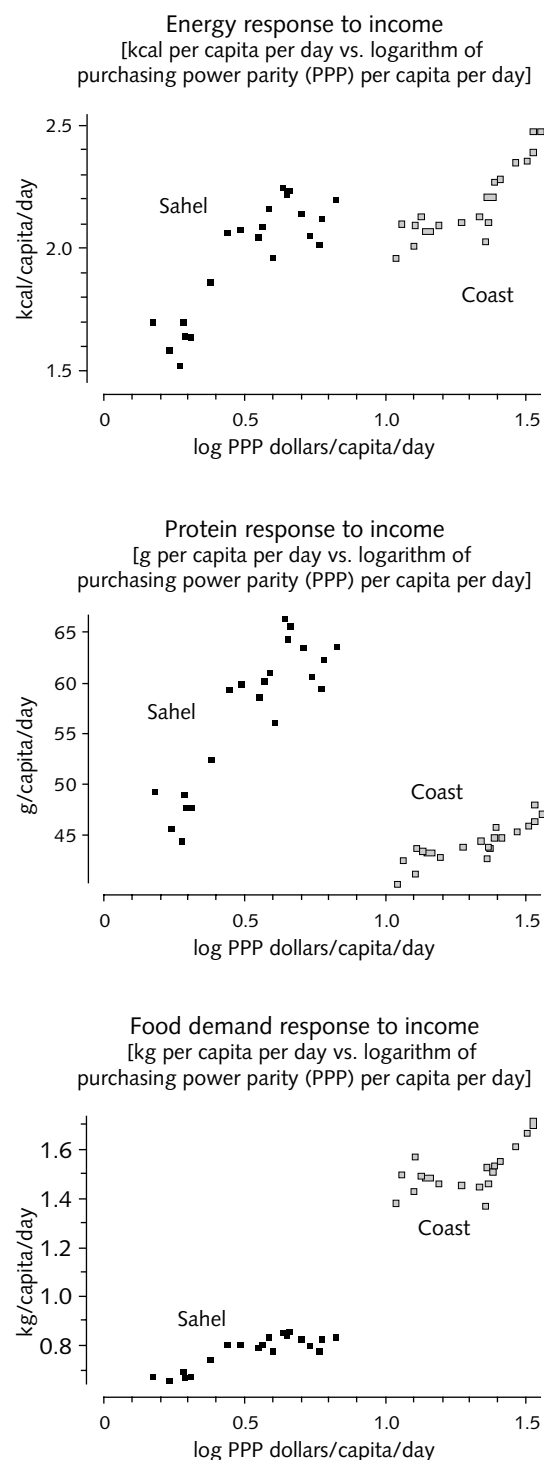


FIG. 4. Food availability in the SADAOC Region: responsive to income

* With 25 observations, *t*-scores of 2.0 and higher indicate that parameters are significantly positive at the 1% confidence level. Also, the fit is fairly high, with income explaining about 75% of the variation in both calorie and protein availability.

TABLE 5. Child malnutrition and mortality in the SADAOC region, 1970 to 1999

Year	% of children under 5 with stunted growth					No. of children per 1,000 live births not reaching age 5				
	Burkina Faso	Côte d'Ivoire	Ghana	Mali	Togo	Burkina Faso	Côte d'Ivoire	Ghana	Mali	Togo
1970	—	—	—	—	—	278	240	186	391	216
1977	—	—	—	—	33.7	—	—	—	—	—
1979	—	—	—	—	—	—	—	—	315	—
1980	—	—	—	—	—	—	170	157	—	—
1982	—	—	—	—	—	245	—	—	—	188
1984	—	—	—	—	—	—	—	—	292	—
1986	—	17.2	—	—	—	—	—	—	—	—
1987	—	—	30.5	23.8	—	217	—	—	—	158
1988	—	—	29.4	—	33.6	—	—	—	—	—
1989	—	—	—	—	—	—	—	—	268	—
1990	—	—	—	—	—	—	150	119	—	—
1992	—	—	—	—	—	229	—	—	—	142
1993	33.3	—	—	—	—	—	—	—	—	—
1994	—	24.4	25.9	—	—	—	—	—	238	—
1995	—	—	—	—	—	—	—	108	—	—
1996	—	—	—	48.6	34.0	—	—	—	—	—
1997	—	—	—	—	—	219	180	104	235	146
1998	—	—	—	—	21.7	—	—	—	—	—
1999	—	—	25.9	—	—	210	180	109	223	143

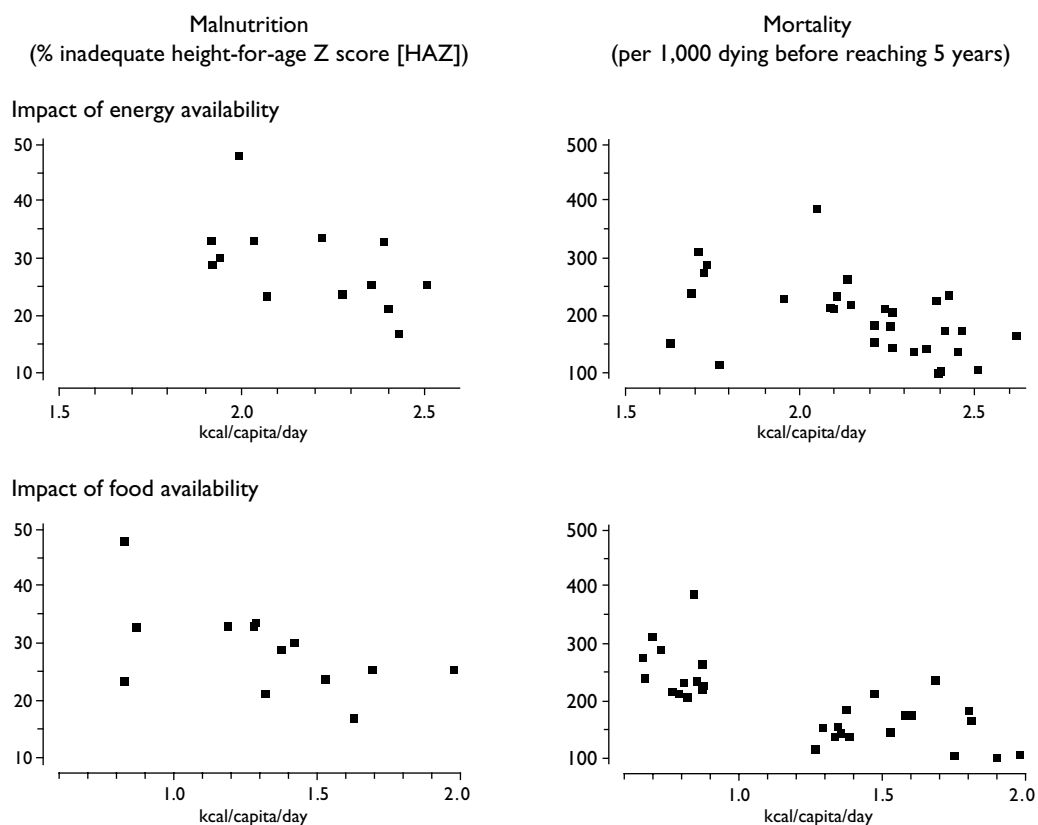


FIG. 5. Food availability in the SADAOC Region: impact on child malnutrition and mortality

TABLE 6. Stunting-calorie and mortality-calorie elasticities in the SADAOC region, 1970 to 1999^a

Equation 3	<i>c</i>	<i>d</i>	<i>d</i> * <i>F</i> / <i>M</i>
<i>M</i> = percent stunted			Stunting-calorie elasticity (at the mean of <i>F</i> and <i>M</i>)
	71.5 (9.46)	19.2 (-2.13)	-1.42
<i>M</i> = per 1,000 dying before age 5			Mortality-calorie elasticity (at the mean of <i>F</i> and <i>M</i>)
	451 (5.21)	115 (-2.90)	-1.24

a. The *t*-scores of the parameter estimates *c* and *d* are given in parentheses.

zone. Developments since 1970 indicate significant improvements in all countries until 1990. During the 1990s, more gradual improvements were reported in the Sahelian zone, while child mortality seems to have leveled off in the coastal zone.

In figure 5, these figures are displayed as a function of the availability of food in the respective countries and during the respective years. Finally, we consider the relationship between food *F* and malnutrition *M* and estimate

$$M = c - dF \quad (3)$$

with the per capita availability of calories *F* and the malnutrition or mortality rate *M*. The significance of food availability for reducing malnutrition and mortality rates is shown in table 6, which contains estimates of the parameters of equation 3 and the corresponding calorie elasticities. These elasticities equal *d* * *F*/*M* and are evaluated at the mean per capita calorie availability *F* = 2.180 and at the mean prevalence of stunting *M* = 29.4 and the mean mortality rate *M* = 202, respectively.

Food availability appears to have a negative and statistically significant impact on both stunting and mortality. However, given the complexity of the causes of malnutrition and the limitations of the data, it is not surprising that the regression of the stunting and mortality variables on the food-availability variable shows a low fit.* Other underlying causes of malnutrition and death, such as vitamin and micronutrient deficiency, lack of hygienic food-processing, and recurrence of infectious diseases, are equally important and frequently counteract the positive effect of improved availability of foodstuffs. This situation may be furthered by an inadequate distribution of nutritious food at the household level, to the detriment of children. These additional factors help to explain the poor nutritional status in the southern and middle belt districts of Ghana, in spite of the relative abundance of food in these areas [26].

* The *t*-scores in table 6 are lower than -2, indicating that the effect of food availability on stunting and mortality is significantly negative at the 1% confidence level. However, the fit is rather poor, with calorie availability explaining only 29% and 23% of the variation of the stunting and mortality rates, respectively.

Conclusions and policy implications

This study has described food-consumption patterns in Central West Africa during the period 1961 to 2000 and draws attention to the following:

- » The positive trends in calorie and protein availability, which, however, are still below requirements and unstable;
- » The extent to which cereals are in high demand because of their increasing contribution to total calorie and protein consumption, and the resulting risk of import dependency and scope for increased regional trade between the Sahelian and coastal zones;
- » The responsiveness of food consumption to income;
- » The positive impact of food availability on nutritional status and mortality rates in children.

These findings indicate that food insecurity and malnutrition are still persistent in the region, despite the progress made over the past two decades. They reveal that in general, food-consumption patterns have not changed much in Central West Africa since the 1960s. Calories and proteins are still mainly provided by cereals, which increasingly dominate the diet over leguminous and animal products. There has been a slow increase in per capita food availability, but protein needs remain uncovered. This situation shows regressive food-consumption patterns that are ineffective in using existing food-production potential and contribute to the current degree of malnutrition. Furthermore, the situation reflects a structural defect in food production in addition to its vulnerability to natural calamities, such as droughts or flooding. The structural limitations are also reflected in the ineffectiveness of supply systems and the inadequacy of food-consumption patterns relative to nutritional needs.

Two major factors are of particular interest.

The first is poverty, which limits the land available to families for producing sufficient quantities of food crops and restricts their ability to buy additional food, whether locally produced or imported. Indeed, the long-term economic growth in the SADAOC region is now low after relatively high growth in the 1960s, recessions in the 1970s and early 1980s, recovery from the mid-1980s to the mid-1990s, and stagnation in recent years.

The second structural factor affecting the persist-

ence of food insecurity and malnutrition in the region is insufficient improvement in food-consumption patterns that bear the burden of low and vulnerable yields and of consumption habits dominated by cereals. The quality of the diet is deficient. For example, cereals, roots, and tubers currently provide some 80% of the calories, fruits some 5%, and oil crops some 10%, while animal products and pulses together provide 5% of the calories. This compares unfavorably to the recommended distribution of calorie sources, which is about 55% to 60% of carbohydrates from cereals, roots and tubers, and fruits; 25% of lipids from oil crops and animal products; and 15% of proteins from animal products and pulses. Over time the dietary pattern has shown a tendency to shift to imported cereals, further increasing the share of carbohydrates, while the contribution of oil crops and leguminous and animal products to the total energy input has gradually decreased.

The harsh climate in the north is certainly not favorable to the development of the drought-sensitive leguminous crops of humid zones. The latter therefore cannot provide the main sources of proteins in the Sahelian zones. But it is remarkable that despite their huge potential and high capacities in meat and dairy production, Sahelian countries still obtain most of their proteins from cereals. Cattle are a capital good, and the supply depends on herd size and price and on health risks [27]. It is popularly assumed that animal breeding belongs to wealth-keeping and risk-avoidance strategies in the Sahelian zone, limiting meat consumption to a critically low level. Pilot studies have shown that poultry farming can be intensified and is well adapted to the socioeconomic conditions of rural communities in Sahelian countries [28].

It is also noteworthy that in coastal countries, animal products (mainly fish) make only a small contribution to the protein supply, although these areas have access to the sea and a huge potential in the availability of fresh water (rivers and lagoons) and a favorable climate for fish breeding. The potential of fish production has not been exploited because of the constraints to invest-

ment in equipment and training.

The reduction of malnutrition is restricted by national policies that simply accommodate cereal-based consumption behaviors without focusing on exploiting the region's comparative advantages to provide for a more balanced diet with less dependence on cereals. Indeed, although political support is usually strong for emergency food imports during periods of drought, a lot remains to be done to improve the production of roots and tubers in coastal countries and traditional cereals in Sahelian countries. In the face of rapid population growth, and especially the increase in urban food demand, the diversification of food production in general and the intensification of cereal cultivation in particular must be undertaken. Food policy in all of these countries should seek to rationalize a transformation of the production and supply systems and, most importantly, of consumption patterns, which are major determinants of the latter.

The results of the present study indicate that per capita income is a key determinant of per capita food consumption, while, in turn, improvements in per capita food consumption are significant for combating malnutrition. Policies and strategies to combat malnutrition thus involve broad-spectrum income growth and specific actions that promote the yield and the contribution to diets of nutritious food produced within the region.

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