Economic Development and the Food System in the U.S. Caribbean

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# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Darshan S. Padda</td>
<td></td>
</tr>
<tr>
<td>Welcome</td>
<td>3</td>
</tr>
<tr>
<td>Orville E. Kean</td>
<td></td>
</tr>
<tr>
<td>Conference Overview</td>
<td>5</td>
</tr>
<tr>
<td>Darshan S. Padda</td>
<td></td>
</tr>
<tr>
<td>Holistic Approach to Economic Development and the Food System</td>
<td>7</td>
</tr>
<tr>
<td>Richard W. Moore</td>
<td></td>
</tr>
<tr>
<td>The St. Lucia Model Farms Project</td>
<td>17</td>
</tr>
<tr>
<td>Leonard M. Leonce</td>
<td></td>
</tr>
<tr>
<td>Preparing Youth for the World of Work: A Call for Family and Community</td>
<td></td>
</tr>
<tr>
<td>Social Capital</td>
<td>41</td>
</tr>
<tr>
<td>Lionel J. Beaulieu</td>
<td></td>
</tr>
<tr>
<td>Low-Input/Sustainable Agriculture Research in the U.S. Caribbean</td>
<td>57</td>
</tr>
<tr>
<td>James E. Rakocy</td>
<td></td>
</tr>
<tr>
<td>Alternative Enterprises for Microstate Agriculture</td>
<td>65</td>
</tr>
<tr>
<td>Dewayne Ingram</td>
<td></td>
</tr>
<tr>
<td>Dinner Remarks</td>
<td>73</td>
</tr>
<tr>
<td>Honorable Alexander A. Farrelly</td>
<td></td>
</tr>
<tr>
<td>Natural Resources and Development: Overview and Perspective on the U.S.</td>
<td>75</td>
</tr>
<tr>
<td>Caribbean</td>
<td></td>
</tr>
<tr>
<td>Lawrence W. Libby</td>
<td></td>
</tr>
<tr>
<td>The Natural Resource Base for Food Systems and Economic Development in</td>
<td>85</td>
</tr>
<tr>
<td>the U.S. Caribbean</td>
<td></td>
</tr>
<tr>
<td>LaVerne E. Ragster</td>
<td></td>
</tr>
<tr>
<td>Strategic Planning for Agriculture and Food Needs of the Eastern Caribbean</td>
<td>99</td>
</tr>
<tr>
<td>John J. Ambrose</td>
<td></td>
</tr>
<tr>
<td>Strategic Planning for U.S. Caribbean Development</td>
<td>107</td>
</tr>
<tr>
<td>Glen C. Pulver</td>
<td></td>
</tr>
<tr>
<td>Wrap-Up Comments</td>
<td>113</td>
</tr>
<tr>
<td>R. J. Hildreth</td>
<td></td>
</tr>
<tr>
<td>Recommendations</td>
<td>115</td>
</tr>
</tbody>
</table>
Introduction

Darshan S. Padda

Good morning! First of all, I would like to extend a warm welcome to all who are in this room today. Our first speaker today is Dr. Orville E. Kean, our third president of the University of the Virgin Islands (he will give welcome remarks). Let me give you a brief background on Dr. Kean.

Dr. Orville Edward Kean was born on October 13, 1938 in St. Thomas, U.S. Virgin Islands. His early education, both primary and secondary, was obtained in the Virgin Islands public school system. As a high school student, at the Charlotte Amalie High School in St. Thomas, Dr. Kean distinguished himself and was graduated as valedictorian of the class of 1955.

He left St. Thomas in 1955 to pursue undergraduate studies at Lincoln University, where he was graduated magna cum laude with a Bachelor of Arts degree in Mathematics. After his graduation he returned to St. Thomas to work at the Department of Social Welfare as a social worker.

A year later he returned to the mainland to further his education at the University of Michigan, where he received his Masters of Science degree in Mathematics in 1961.

Dr. Kean earned his doctoral degree in mathematics from the University of Pennsylvania in 1971.

Since 1971 Dr. Kean has moved up through the ranks at the College of the Virgin Islands - as an assistant professor of mathematics, an associate professor of mathematics, an American Council on Education fellow in Administration, acting director of the Caribbean Research institute, Acting Dean of Instruction, dean of Instruction, professor of Mathematics, executive vice president and director of the Eastern Caribbean Center.

In 1976 he took a two year leave of absence from the then CVI to organize and direct the Office of Policy Planning and Research in the V.I. Department of Commerce.

On July 1, 1990, Dr. Kean was unanimously elected president of our University.

Dr. Kean has served on numerous boards, commissions and councils.

Ladies and gentlemen, I am privileged to present to you the president of the University of the Virgin Islands - Dr. Orville E. Kean.

*Vice president, University of the Virgin Islands.
Welcome

Orville E. Kean*

Welcome to the Caribbean and to St. Croix—a nice place to visit, either on vacation or business. I extend an especially warm welcome to Farm Foundation, Southern Rural Development Center, and Caribbean Food Crops Society. Also welcome to CARDI, the Caribbean Agricultural Research and Development Institute and to Ministries of Agriculture from St. Lucia.

The University of the Virgin Islands has developed over a number of years into an institution I am very proud of as a Virgin Islander. We, from the islands and from the mainland, need to share with each other this week on a number of development ideas, concepts and accomplishments. It’s a pleasure to have you here to do just that.

Since assuming the presidency of the university, I have attempted to decentralize the campus and internationalize it so to speak. We want to focus on contributing to the development of the Caribbean in a number of areas and the land-grant program is an important part of it. Internationalization is important because we are all in global competition. We don’t want to be so much in competition with each other; we want to mobilize the region to compete more effectively with other regions.

The other day, I was speaking to a gentleman in the export business. I told him we needed to export education. He said, "You mean you want to import education." I said, "No, export because we want to sell services to nonresidents." That’s what exporting means. When a person buys a service that doesn’t live where that service is produced—that’s an exported service. We want to export education.

You all know higher education in the United States is strong. It’s probably the strongest export product that the U.S. now produces. People from all over the world want to go to colleges and universities in the United States. It’s the greatest service in terms of higher education. Everybody wants to go there—to MIT, Harvard and other schools. Well, I want the University of the Virgin Islands to also export education.

From the very beginning, the University has had regional results. We’ve always had good students from the Eastern Caribbean, with many of them going on to professional schools, medical schools, getting doctorates and so forth. We’ve produced two Rhodes scholars and are very proud of it. I don’t know of another institution with a full time enrollment of about one thousand that has produced two Rhodes scholars. If you find one, let me know.

You see, I am very proud of the University and could go on about that for a long while for there are many things to be proud of. Let me close by saying: We are small and do a good job, but we plan to get bigger and do a better job.

Thank you very much for being here.

*President, University of the Virgin Islands.
Conference Overview

Darshan S. Padda*

The first item on the agenda will be to give you an overview of the conference. The sponsors of this conference are the University of the Virgin Islands, the Southern Rural Development Center, Farm Foundation and the Caribbean Food Crops Society. Allow me to share with you information on the sponsors.

The University of the Virgin Islands was established on March 16, 1962. The institution's name was changed to the University of the Virgin Islands in 1986 to better reflect the growth and diversification of its academic programs, community and regional service, and research. The University is the publicly supported university system of the Virgin Islands, serving the U.S. Virgin Islands and the Caribbean. Its role is the same as state colleges and universities on the mainland. As a land-grant university, it offers programs of instruction, research and public service that address the individual and societal needs of the region.

The Southern Rural Development Center, one of four regional rural development centers, was created in 1974 under the authority of the Rural Development Act of 1972. The Center operates on the philosophy that the limited resources available in rural development research in the South can be used more effectively when coordination, sharing and cooperation among Southern states are maximized. A specific purpose of the Center is to provide support to extension and research staff throughout the region as they respond to rural development needs in local communities. The Center serves the 13 Southern States, Puerto Rico and the Virgin Islands. The Center's basic funding is through the U.S. Department of Agriculture Extension Service and Cooperative State Research Service.

The Farm Foundation was privately endowed as a non-profit corporation in 1933. Initial funding was provided by Alexander Legge, the president of International Harvester, the former governor of Illinois, Frank O. Lowden, and other Midwest agricultural leaders.

Farm Foundation strives to improve both the level of knowledge about agricultural and rural problems and the application of that knowledge to problems and opportunities faced by agricultural and rural people.

Farm Foundation does not deal directly with target clientele, but with such intermediaries as land grant university and federal agency researchers, state and federal extension workers, university teaching faculty, institution administrators, agribusiness leaders, congressional and administrative policy staff.

The Foundation is an operation foundation and does not provide grants. Through interaction with participants in conferences and regional meetings it sponsors, the Foundation catalyzes new research and education programs, forms coalitions to focus on selected projects or work areas, stimulates exploration of alternative approaches to agricultural and rural issues, facilitates exploration of high-risk ideas offering possibilities of long-range payoff, and communicates with agricultural, agribusiness, academic and related groups on public and private policy issues.

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technology and production of food crops in the countries of the Caribbean Basin.

There are no limitations on the number of memberships in this society. Persons, entities (national, regional, and international), corporations, societies or non-corporate associations, agreeing with the objectives of the Society, are eligible for membership. The classes of membership are active, life, honorary, emeritus, and sustaining. Members are required to pay annual dues, which are determined by the Board of Directors. For those who wish to become members in this Society, please call Mr. Kofi Boateng, who is in the group today. The next annual meeting of the Caribbean Food Crops Society is scheduled for July 28 to August 2 this year in Dominica.

Let me give you some background information on how this conference developed. Two years ago, Dr. Jim Hildreth attended the Caribbean Food Crops Society annual meeting in Jamaica. He indicated Farm Foundation's interest in sponsoring a conference on social issues facing the Caribbean. Frequent dialogues and meetings were held - i.e., a meeting in Washington, D.C. at the Cosmos Club with Dr. Jim Halpin, Dr. Hildreth and myself, followed by a planning session with the co-sponsors of this proposed conference in St. Thomas in March of last year during the spring meeting of the Caribbean Basin Advisory Group. This two-day event is the end product of those meetings, which started in 1988.

The conference has a very appropriate theme - Economic Development and the Food System in the U. S. Caribbean. I feel, however, that this conference is not limited to the U. S. Caribbean. We have some participants here from the other Caribbean islands and organizations, namely, Ministry of Agriculture/British Virgin Islands, University of Puerto Rico Agricultural Experiment Station, IICA/St. Lucia, Dominica, and CARDI/Trinidad.

The purpose of this regional effort is to offer an opportunity to assist participants in planning interdisciplinary research and Extension programs which offer realistic alternatives for addressing microstate development issues and needs. This conference will provide an understanding of current trends and implications. Participants will be able to assess opportunities for regional programs and they will be able to develop materials, methods, resources and contracts.

The program that has been finalized is very stimulating. Dr. Richard Moore, the director of the Bureau of Economic Research at the Department of Agriculture and Economic Development, will speak on the holistic approach to economic development and the food systems. A case study of the St. Lucia banana project will be presented by Mr. Leonard Leonce, who is the project manager of St. Lucia Model Farms, Ltd. Leadership and human capital will be undertaken by Dr. Lionel Beaulieu, professor at the University of Florida and Mr. Philip Gerard, who is a former commissioner of education. Dr. James Rakocy, our associate director at the University of the Virgin Islands Agricultural Experiment Station and Dr. Dwayne Ingram, of the University of Kentucky, will speak on alternative enterprises and low input sustainable agriculture for microstate agriculture.

The agenda for tomorrow is very enlightening as well. Dr. Lawrence Libby, head of the Food and Resource Economics department of the University of Florida, and Dr. LaVerne Ragster, acting vice president of our University, will lead the panel on natural resources and infrastructure. Dr. Glen Pulver, professor of Agricultural Economics at the University of Wisconsin, and Dr. John Ambrose, director of the Institutional Research and Planning, will be the panelists on strategic planning for U. S. Caribbean development.

I wish to encourage everyone to participate in the roundtable discussions following the panelists’ remarks.

I wish to remind you of the banquet scheduled for tonight at the same place at 6:30 p.m.

I hope that you will find it very rewarding to participate in this regional workshop.

Let me give you our first panelist - Dr. Moore.
Holistic Approach to Economic Development and the Food System

Richard W. Moore

INTRODUCTION

Barriers to Economic Development

Dramatic events have occurred in recent months that are of such magnitude we are required to revisit the base from which economic development strategy is derived. Four generally accepted orthodox approaches conceptualize the barriers to economic development. They originate from Neo-classical, structuralist and Marxist paradigms and are the source of competing ideas on the most appropriate strategies to pursue.

National Life-Cycles - poverty, inequality and unemployment are associated with a particular stage of the life-cycle in which a country may be found. Fundamentalist optimism results from the assertion that these conditions are found at the early part of the life-cycle curve. This is also known as the Stages of Growth approach, in which an increase in GNP is to stimulate development and resolve income distribution problems through a trickle-down effect. Early emphasis on import substitution has fallen from favor, with current emphasis on more outward-looking export promotion oriented industrialization.

Inefficiency - the stylized facts of under-development obtained from gross inefficiency. Most often the central government or the lack of one is blamed for a variety of ills, ranging from naively choosing economic development goals denied by initial endowments to deliberate factor and output market distortions knowingly applied to misdirect the economy. The prescription here is to imply "set prices right."

Population Explosion - the recent growth in Third World population is so unusual and devastating as to be responsible for a country’s economy becoming "undevelopable." Population growth is now more than twice the rate universally found for 300 years up to the mid-20th century.

Marxist Dialectical Development - the process of advancement followed by the now developed economies was gained only at the expense of those economies, now considered less developed. Joseph Schumpeter’s muse on capitalism being an activity of creative destruction supports such a vehicle of analysis. Effectively, capitalist development simultaneously produces wealth and poverty. Recent theories on dependency and the logical conclusion of sustainable economic development fall into this category.

Development Strategies: 1950-1990

Economic development programs during the 1980s were not necessarily focused on any particular strategy. They grew as a compilation of critical analysis layers with points of emphasis to meet the unusual circumstance or the perceived problem of the day. Each following period was influenced by that which preceded. Over the rapid industrialization strategy of the 1950s, lay the green revolution, radical political economy and dependency theory of the 1960s. In the 1970s employment and income distribution received greater attention and resulted in

*Director, Bureau of Economic Research, Virgin Islands Department of Economic Development and Agriculture.
development programs emphasizing rural development and basic needs. In response to slower economic growth and unrealized expectations from massive infusion of petrodollars in the late 1970s, the 1980s brought renewed interest in economic growth, with new study of policy reform, sustainable development and market liberalization.¹

Recent Events: Free Market Revolution and the Environment

Two recent events, one political, the other technical, together may force a complete reorientation of development. The first of these derives from the demise of economic systems competition, brought on by the effective surrender of the Eastern European and Soviet totalitarian regimes to the free market system. This event is more likely to cloud the economic development methodology debate than clear it. One aspect is aid. According to P.T. Bauer, Western guilt resulted in foreign aid to all those low and moderate income countries, now called the Third World, that were either aligned with the West or unaligned and appearing interested to align. By this reasoning with no systems competition, there is no Western guilt, therefore, no rationale for aid.

It is now presumed in popular literature that the Marxist paradigm has simply lost its use value. On the other hand, it appears more likely that a series of circumstances may be created to dramatically redefine the issues of the current debates and rekindle them. First, the total shutdown of these totalitarian regimes, happening over the course of a few months, is likely to be considered more important than all history that has occurred since the industrial revolution. Second, when free market states become organized in Europe and totalitarian China finally, inevitably falls; the world dominance of the transnational corporation is likely to reduce the significance of the nation-state as an entity of influence in world affairs generally and in local economic conditions, more particularly. Over the last 200 years, individual states in the U.S. have had just such an experience, as the federal system and a national corporate economy developed. It does not matter, under this scenario, that half a dozen individual countries may come into or back into existence as events unfold. More important is that resource endowments will come to dominate economic development decisions, thereby reducing community motivated choice as a variable affecting the style and standard of living.

In the midst of all this, and unrelated is the growing consensus that environmental constraints may determine that international economic development is a negative sum game. That is, an obvious, irreversible global disaster may be set to occur if the current Western standard of living is exported to poorer nations. Technological change a'la Buckminster Fuller is the only means by which to resolve this otherwise complete paradox. Until recently, such a perspective was considered at least somewhat radical. However, sustainable development, using ecology to internalize environmental damage into economic development, programming takes an inter-generational perspective and has established ever-growing acceptance in recent years. Sustainable development is defined by a Pareto principle in which the path of human progress that meets the needs of the present generation will not compromise the ability of future generations to meet their needs.² With the recent publication of The True and Only Heaven by Christopher Lasch, this point of departure for critical analysis has clearly arrived.³

The Contribution of Basic Needs

Although this assessment of economic development theorizing may be dissatisfying because the outlook appears so uncertain, from any of the foundations listed above, it cannot justify diverting attention from the absolute physical needs of many hundreds of millions of people in developing countries. It is here that the elegant simplicity of the basic needs approach to economic development becomes a useful touchstone for guiding the process.

Beginning with the goals of economic development, given in human terms, this
A final stylized fact important to recognize when applying development strategy is that the so-called Third World is not a homogenous group of countries with congruent interests and needs. The more than 150 countries considered to be part of the Third World are actually categorized into five separate groups: LLDC - least-developed, LIC - low-income, MIC - middle-income, NIC - newly industrialized, and OPEC, oil producing and exporting. Haiti, St. Vincent and the Grenadines and the Turks and Caicos Islands fall into the LLDC/LIC category and the remainder of our Caribbean neighbors fall into the MIC category. The relatively high growth rates of income per capita during the 1950-1975 period was not evenly distributed and resulted in these groupings. Further evidence of heterogeneity is found in a study by Morris and Adelman covering 23 countries over various periods from 1850 to 1914 in which they concluded that no single theory of causation can explain the different directions followed by these economies.  

In the next section, we examine aspects of agriculture’s role in the economic development strategies that are likely to come to prominence in the 1990s.

AGRICULTURAL TRANSFORMATION AND ECONOMIC DEVELOPMENT IN THE CARIBBEAN

We will use the fall of communism, sustainable development and the basic needs approach as a backdrop to consider the optimum contribution of the agriculture sector, with a focus on the Caribbean. Agriculture’s role was introduced in Arthur Lewis’s dual model through the rural labor force. Because of its zero marginal productivity, combining it with capital obtained through high income saving and aid in the industrial sector would yield growing income through the production of manufactured exports or import substitution. Progress was to be measured by the growth in per capita income which tended to neglect the household and public goods.
In the 1980s agriculture provided a mixed contribution to the macro economy, depending on the stage of development. LLDCs were victims of low demand, Engel's law and constraints on the supply curve for primary, unprocessed industrial agriculture commodities. The agriculture sector in MICs, especially those Latin American countries experiencing massive currency devaluations, provided a much greater contribution to economic growth. Most Caribbean countries, though mainly MICs, have currencies tied to the U.S. dollar but were influenced by additional factors: the Caribbean Basin Economic Recovery Act (CBERA), the Lome Agreement and the scheduled European economic integration, at the macro level. Later in the decade, two technical programs, a rejuvenation of the Caribbean Agricultural Research and Development Institute (CARDI) and the Caribbean Agriculture Extension Project, began to have great influence at the micro level.

Universal Stages of Agricultural Transformation

The transformation of the agriculture sector through apparent natural stages of its contribution to the overall economy has been defined by C. Peter Timmer. He has reviewed numerous studies that have shown the transformation of the agriculture sector, as development occurs, is nearly uniform across countries. This transformation has two elements: the declining importance of agriculture and the requirement that rapid agricultural productivity growth accompany or precede general economic growth. Timmer finds the process of transformation occurs in four phases.

Basic Institutional Organization - the institutional organization of the agriculture sector..."gets agriculture moving." Agricultural productivity per worker rises. Because the rest of the economy is so small, getting agriculture moving stimulates the rest of the economy.

Surplus Growth - agriculture contributes to economic growth through a growing surplus brought on by greater capacity utilization and productivity.

Integration - agriculture becomes integrated into the macro-economy. During this phase, integration occurs through improved infrastructure and the development of efficient factor and output markets.

Agro-Industrialization - agriculture takes its place in the industrial economy. Fallout from this phase is the growing protection of domestic agriculture incomes.

The Caribbean Case

Caribbean economies have generally survived stages 1 & 2 and, depending on initial endowments, have reacted in a variety of ways in phase 3. According to Timmer, in the latter part of phase 2, the gap in labor productivity and measured income narrows between the agricultural and industrial sectors. Because of industrial manufacturing growth, mainly due to the CBERA and the rapid growth in the tourism industry in the 1980s, this narrowing has occurred in an uneven fashion. In many monocrop economies labor must now be imported for the harvest and mechanical harvesters, although not yet dominant, are likely to be utilized to a greater extent. Agriculture production science and technology are well established throughout the region, and technology transfer now follows through a stable set of institutions.

What has not occurred is the integration of the agriculture sector into the general economy. In effect for most of these countries, there exists no incentive to diversify production or markets. As it now stands, sugar dominates the agriculture sector in Guyana, Jamaica, Belize, Trinidad, Barbados, St. Kitts/Nevis and the Dominican Republic. Banana production dominates St. Lucia, St. Vincent, Dominica and Grenada. Preferential export markets for these
commodities have created little pressure for productive efficiency.

SUBSIDIZED AND PREFERENTIAL MARKETS: A COMFORTABLE CURSE

At least two prices are to be paid for the appearance of such comfortable dependence. First, dominant foreign exchange earnings come from the export of unprocessed primary products with low income elasticities of demand and are spent on highly processed, low price and high income elastic imported food products. This is a clear reflection of certain aspects of the traditional plantation economy. The twist here is that this dependence appears to be made with free choice. Secondly, there exists a tendency for lower nutritional levels to exist among children than appropriate standards would otherwise recommend. This basic needs distortion occurs through inter- and intra-household distribution of income.

To the extent that the Caribbean region's agriculture sectors are dependent on preferential markets for the bulk of foreign exchange earnings, they become stuck in an attempt to complete stage 3, following Timmer's approach. To break such a vicious cycle, we must pass through those hurdles preventing integration. Under these conditions it appears the major hurdle is the existence of such preferential markets.

The Uruguay round of the General Agreement on Tariffs and Trade (GATT), is now stalled, but with four strong years of progress may be the most important hurdle to pass before allowing completion of Timmer's Stage 3 integration process for the Caribbean agriculture sectors. These negotiations are targeted to set liberal new rules in 15 sectors with trade totaling $1.5 trillion. Most tentative intermediate agreements have been with regard to advancing sectors becoming more important in today's economic environment: investment, intellectual property, services (including banking) telecommunications and aviation. The big stumbling block threatening collapse of these talks is subsidies given to domestic farmers in developed countries; the European Community, U.S. and Australia. The big question is whether or not these talks will be allowed to resume.

Although there may be a great deal of sword rattling, if history is any guide, the talks will eventually succeed and agriculture subsidies will be reduced. The development of free market economies in Eastern Europe and the Soviet Union is likely to create additional incentive to succeed. This is the eighth round of such talks since 1947 and dramatic declines in tariffs and increases in world trade have occurred through the last round; Tokyo, 1973-1979.

Caribbean backers of preferential markets for bananas and sugar have cause to be concerned with the Uruguay round, European economic integration and entry of the Dominican Republic into Lome. Although they may have a short term negative impact on the benefits of preferential markets for bananas and sugar, it is more likely that a successful Uruguay round together with European integration and elimination of the U.S. sugar program, will have more important long term impacts. This derives from a probable outcome resulting in massive reductions in agricultural subsidies far exceeding the most recent European Community offer to reduce such subsidies by 30 percent over 10 years. An imperative will be created to encourage further rationalization of trade in all subsidized markets. By reducing preferential treatment of sugar and banana exports to the U.S. and Europe, Caribbean economies will quickly discover profitable opportunities to integrate agriculture production with freer markets. Public policy will not drive this motivation, it will come from a fight to survive.

In the final section special reference is made to factors considered important to smooth the process of integrating the Caribbean agriculture sector into the general economy. These are agriculture market diversification, marketing domestic production to the local community and increasing locally derived applied agriculture research.
MARKETING AND APPLIED RESEARCH: KEYS TO INTEGRATION

Diversification

Markets - Sucrose to Fuel Ethanol

The world sugar market is one of the most dynamic and highly cyclical of commodity markets. Average raw sugar prices reached US $0.40/pd. in 1980, but have been depressed since then and are now fluctuating around US$0.08/pd. However, the world price of sugar does not reflect free market prices. On the contrary, it reflects only the value of the minority of supply that does not have a protected market outlet.

The market is affected by traditional climatic factors in addition to a number of market specific technology and public policy variables; every sugar producing country in the world provides subsidies or has established market distortions through some form of fiscal/financial intervention.

The structural deterioration in the market for raw sugar may be attributed to the following:

- Growth in sugar consumption has not kept pace with population growth.
- High fructose corn syrup (HFCS) sweeteners are taking a growing market share away from sucrose, especially in the U.S.
- Sugar beet productivity has increased significantly.
- The European Economic Community (EEC) is now a major exporter of refined sugar.
- Refined sugar imports have grown from 23% of total trade in 1972 to nearly 50% in recent years.

Add to this list the Uruguay round’s long term impact and the pressure mounts on these traditional producers to adjust. Given this context, no reasonable forecast could predict a return to the traditional high price cycle. The structural deterioration in the demand for cane sugar cannot be overcome by one year short term industrial welfare programs to artificially bolster sugar exports from most favored nations. The supply response to these market conditions must look forward, first by diversifying the market for sucrose. Second, a deliberate and rigorous program to diversify crop production for export and domestic consumption is best engaged with a simultaneous effort to build appropriate markets.

Even though significant attention and effort have been applied, diversification from sugar production to alternative crops has achieved only modest success. The reasons range from the condition of the soil in a particular country, to the opportunity for sufficient scale marketing. For example, Annual Sugar Reports, from the US Foreign Agricultural Service, for a number of Caribbean countries indicate the dilemma, constraints and costs of failure in redirecting the structure of agricultural production in the region. Examples of these problems may be found in Barbados and Jamaica.

The case of the Dominican Republic provides a pointed example to illustrate the difficulties of product diversification in the agriculture sector. One of the dominant factors of the sugar industry in the 1986 and 1987 crop seasons, low price years, was the decline in sugarcane yields: from 51.4 metric tons/ha. in 1986 to 50.5 metric tons/ha. In those years the Government spent US $35 million to subsidize 60,000 laborers or 40% of the labor force.

Although it was described as a good year for agriculture, the most serious and worrisome indicator of failure to adjust to market conditions was evidenced by the declining use of fertilizers and other agro-chemicals that resulted in the yield reductions. This occurred because of the desire to reduce variable cost in production, where possible, to maintain profitability. In the case of the Dominican Republic, it would appear that without a quick and profitable product market diversification, soil fertility, the most important capital good in the agricultural production function, is certain to decline, leading eventually to even more dire circumstances.
Attempts at product diversification ordinarily will be executed along the following lines. First, an evaluation of opportunities for tourism will be made, given the recent strong growth in the industry and the obvious environmental attributes of the region. Second, alternative crops will be considered. Very often this step requires both investment and management from expatriate sources, thereby reducing domestic participation in management, in particular, determining factor proportions in production, that is, labor intensity. Also, leakages from the domestic economy will be exaggerated, under both outcomes. A government’s effort to diversify crop production may be met with stiff resistance from the farmers themselves, that is, those who stand to lose the most.

One opportunity to apply least painful adjustment away from the traditional market for sugar is to develop a domestic transportation fuel ethanol market from fermented sucrose. The market diversification of sugarcane from preferential export and world market sugar to ethanol is viable for the following reasons:

• These countries generally rely heavily on oil imports to meet energy demand.

• Much foreign exchange is earned through sugar trade and depressed commodity prices make it much more difficult to pay for imported oil.

• Retail gasoline prices are at least 50% above the average U.S. price. In the case of the Dominican Republic, the retail price of gasoline is subsidized by government to keep it below US $1.00 retail.

The process of diversification away from sugar to alternate crops is difficult but the payoffs are as follows:

• Increase employment in agriculture, construction, operations and maintenance.

• Establish a program to increase energy self-sufficiency.

• Lower transportation fuel costs, under most scenarios.

• Introduce new science and technology to the agricultural sector.

• Secure participation in preserving environmental integrity.

• Combine CO2 obtained from the fermentation process with ammonia to produce a lower cost source of nitrogen fertilizer.

• Finally, product diversification may proceed at a pace determined by the domestic community.

Products - Local Food for Local Marketing - Product diversification may be tracked to proceed for some smaller economies on a commodity basis. Intimate detail on imports and domestic consumption is necessary and may be obtained through applied research, as discussed below. The necessary and sufficient condition to increase a country’s nutritional standard is through the distribution of such food products among households. In the U.S. Virgin Islands, production technology is well advanced through transfer from the U.S. Department of Agriculture’s Extension Service and Experiment Station programs. However, the agriculture sector remains very small, well below capacity, even given the high opportunity cost of land for use in the tourism industry.

For these reasons, a program of addressing local marketing has begun. It has four stages. First, a detailed, technical analysis will record just what systems of marketing are now in place. Second, an evaluation will be made of regional success stories in local marketing. Several regional projects have been completed in recent years. Third, application of more advanced marketing practices will be applied to a select number of model farms. These successful model farm programs will create a
demonstration effect to induce additional farms to adopt such practices and traditional extension service tools will be used to disseminate the appropriated practices and techniques.

Applied Research: Local Talent for Local Research

There can be no doubt that basic and applied research has a critical role to enhance a more productive and rational environment for agriculture production and marketing. Traditionally, research projects in this area were offered as a part of bi- and multi-lateral aid relationships. Project needs and concepts were developed through donor and recipient country discussions and execution occurred through contracting for services with, most often, donor country consultants.

For the last 30 years, developed country colleges and universities hosted ever-growing numbers and proportions of international students in all areas of technical study. Among those returning home, not victims of the brain drain, a cadre of local talent developed with the capability of substituting for expatriate consultants. However, virtually all such former students became fully employed with line responsibilities in domestic government or in private sector commodity or services occupations. However, from observation in the region, it appears that either developing country management/agriculture consulting firms staffed by domestic talent are small in number or there are simply a large number of projects. At issue here is the learning curve of outside consultants to local conditions, the compounding of experience benefits to the local community by using local talent and the formation of a more logical research agenda.

In recent years, there has been an appearance of change, although more appearance than change. A notable success has been the rebirth of CARDI. Since 1987, financing has become more stable from regional and multilateral donors and the organization has been of great help in providing "fire-fighting" service on projects too small to receive institutional funding. One of their special programs, Caribbean Agricultural and Rural Development, Advisory and Training Service (CARDATS) provides micro research and extension services to small producers, likely to be overlooked under the traditional regime of large scale macro projects. The highly useful and productive programs resulting from their efforts are clear testimony to the need for additional program expansion funding.

CONCLUSION

A holistic approach to economic development and the food system requires a periodic clearing of the decks with regard to economic development strategy in light of changes in the world order. The strategies for promoting economic development have derived from one or another of the perceived fundamental barriers to development. Emphasis on a particular strategy is based upon the cumulative impact of that which preceded and changing political/technical circumstances. The demise of totalitarian regimes in Eastern Europe and the Soviet Union causing an end to economic systems competition coupled with the growing technical and popular strength of environmental concerns for unbridled economic development will have a profound impact on current and future strategies to direct the modernization of developing countries. The basic needs approach to goal-setting and progress measurement provides a useful benchmark on which the transformation of traditional agriculture may be focused. Among mono-crop dominant economies in the Caribbean, a process of integrating the agriculture sector into the general economy has begun. Current negotiations to reduce agriculture commodity subsidies in developed countries and European economic integration are the major factors for this transformation. Fruitful goals to ease this adjustment process include: market diversification for traditional crops to allow smoother product diversification; growing domestic consumption of local food, through strengthening domestic marketing and competitive import substitution; and making a
greater investment in developing institutional depth in domestic applied agricultural research capacity.

ENDNOTES


6Eicher, C., and Staatz, J., ibid. Part V.


10USDA, FAS, Year Report, Various Issues.

11CARDI, Annual Report 1988, Trinidad, W.I.
The St. Lucia Model Farms Project

Leonard M. Leonce*

INTRODUCTION

The production of local food crops in St. Lucia comes primarily from small holdings, less than five acres scattered throughout the island. Approximately 80% of the Islands' banana production for export also comes from several thousands of "Small Growers" and "Medium Growers" scattered throughout the island.

Over the years there has been some group activity in agricultural production and marketing, but generally the farmers are farmers in their own rights and conduct their farming business quite independently. Their individual overhead costs are usually quite low since, in general, they own their parcel of land, undertake very little development work, use their own family labor and provide their own management.

The St. Lucia Model Farms Project is the first and only situation at present on the island, where land is made available in small farm sizes (approximately 5 acres) in one location and leased to farmers, who are to operate these farms under a system of Central Management. A sister project is the Mabouya Development Project in the Mabouya Valley near Dennery. In that latter scheme, the farmers are more independent, farm sizes are less and overhead costs are lower. Production expectation is also lower. Its existence has not been long enough for meaningful evaluation.

The writer has been involved with the St. Lucia Model Farms Project from its inception, first in the capacity of Project Engineer for four years, being responsible for all the development works, and as Project General Manager for the last four years. This paper, therefore, aims at giving the conference participants an insight into the Project using information based on project and farm records and on the experiences gained by the writer over the years of operation.

HISTORICAL BACKGROUND

The St. Lucia Model Farms Project is situated in the Roseau Valley located on the west coast some six (6) miles south of the city of Castries (see location map).

The valley is approximately 2 1/2 miles long and an average of half a mile wide with the Roseau Valley flowing in an east - west direction to the Caribbean sea. The area is generally flat rising from sea level near the coast to an elevation of 8 meters at the eastern end.

There are three basic soil types in the valley all of alluvial origin varying in clay level and heaviness. Generally the soils are heavy clays with medium to poor internal drainage.

The Project area comprises 1600 acres in total - 1000 acres of flat land and 600 acres of the surrounding hillsides. Approximately 150 acres of the valley land is river rain and subject to periodic flooding.

This area was one of the two Geest Estates up to 1982 when it was sold to the St. Lucia Model Farms Company for the Project.

Prior to the introduction of bananas in the very early sixties the valley was under sugar cane cultivation by the Large Estate. The hillside was also under sugar cane but by peasant farmers, most of them squatters on the same estate lands.

For a number of reasons - inadequate management, labor problems, poor drainage, predial larceny - to mention a few, the Geest Estate was not successful under the plantation system. A different system was to be sought. Mr. J.A.F. Hailwood, then Chairman and

*Project manager, St. Lucia Model Farms Limited.
Managing Director of Geest Industries (W.I.) Ltd. came up with the idea of a small holder scheme in 1978. It took four years of planning, conceptualization and preparation in an unstable political climate in St. Lucia to get the Project off the ground. The Project was finally vested in an implementing body, the St. Lucia Model Farms Company Ltd. on January 1, 1983.

THE ST. LUCIA MODEL FARMS COMPANY

The St. Lucia Model Farms Company is a non-profit making umbrella organization created solely for implementing and managing the project. The shareholders are Geest Industries (W.I.) Ltd., The Commonwealth Development Corporation (CDC) and the Government of St. Lucia whose interest is vested in the National Development Corporation (NDC). Geest and CDC are shareholders by virtue of loan funds injected into the Project.

The shareholders are represented by a Board of Directors, comprising of two members from each concern with the chairman of NDC as chairman of the board. The members of the Board of Directors to date are as follows:
- Mr. Leslie R. Clark, NDC (Chairman)
- Mr. Dunstan Duboulay, NDC
- Mr. F.S. Leonce, Geest
- Mr. W. D. Rapier, Geest
- Mr. D. K. Cheddie, CDC
- Mr. J. A. Taylor, CDC
- Mr. C. V. Griffith, a chartered accountant is the paid secretary to the Board of Directors.

DECISIONMAKING

Decisionmaking takes place at three levels.

1. The Board of Directors

The Board of Directors is the supreme authority of the Project. All matters of major importance must therefore be referred to the Board for consideration, direction and ratification. The Project Manager attends all board meetings but has no voting powers. The Smallholders are not represented on the board, but periodically a small delegation are allowed observer status at meetings.

2. Management Committee

There is in place a Management Committee comprised of one board member representing each shareholder, the Project Manager and the Project Financial Controller. This committee meets on a quarterly basis and makes recommendations to the board on all project matters.

3. The Management Consultative Committee

This committee is comprised of the Management Committee members and four representatives of the farmers. At that level, problems affecting the farmers directly are presented by the representatives. These are discussed thoroughly and solutions are recommended either to the farmers directly or through the Board of Directors who make the final decision.

The day-to-day affairs of the Project are managed by a Central Management team comprising of a General Project Manager and supporting staff as shown on the Organizational Chart (Schedule 1). The General Manager is answerable to the Board of Directors.

SOURCES OF FUNDS (Schedule 2)

(a) Share Capital

Each shareholder contributed the sum of EC$10,000 in shares to the company, totaling EC$30,000. Shares are non-profit making.

(b) Loaned Funds

Geest Industries sold the land and other fixed and movable assets thereon, to the company on a loan basis for the sum of EC$2 million and subsequently injected a supplementary cash loan of EC$1 million.

The CDC funded the pre-operation expenditure and the valley land development costs by a loan of L 1,150,000. (EC $5,750,000 approx.)
Small short term loans totaling EC$582,000 have also been obtained from local commercial banks for the purchase of transport vehicles and fixed assets (model houses). The total capital loan funds now stand at EC$ 9.4 million. All loans are schedules to be repaid by 1997.

(c) **Grant Funds**

The European Development Fund (EDF) has to date contributed EC$ 5,763,000 to the Project as grant funds. The EDF funds were initially designated for the development of the hillside lands, but as from 1987 they were allowed to be used for general development works on the Project. The EDF grant funds constitute the St. Lucia Government's monetary allocation to the Project.

(d) **Proceeds from sales**

All current costs of the project are to be met by revenue from banana and other sales. A record of monthly and annual banana sales is shown on Schedule 4.

(e) **Bank Overdraft**

The day to day cash flow of the project is met by a $2.5 million overdraft facility offered by one of the local banks.

(f) **Other Sources**

Some revenue is generated by the periodic disposal of assets and the hiring out of transport and heavy equipment when not in use in project operations.

**THE FARMER**

The farmer is one of the key elements in the Project, i.e. they can either make or break the Project. The farmer, therefore, has to be very carefully selected. To that end, an application form was designed to allow the interested candidate to give as much information of him/herself as possible. A Selection Committee, comprised of the Project Manager, the Farms Officer, a Board Member and a representative from the Ministry of Agriculture, is then charged with the responsibility of scrutinizing the submitted application, making the final selection and submitting the final listing to the board for ratification.

The basic criteria for selection are as follows:

1. The applicant must be a man or woman in good physical health.
2. Should be between 25 years and 50 years of age, but preferably between 30 and 40 years.
3. The applicant should be living within a zone of radius 5 miles from the Project area.
4. Must have some farming experience.
5. Must be moderately literate.
6. Farming has to be his main occupation.
7. Must have some management ability.
8. Must be prepared to commit him/herself financially by depositing a minimum of EC $1500 towards the cost of the farm.

The farmers are taken into a scheme as the farms are developed, planted and ready to be handed over approximately 4 to 5 months after planting. The number of farmers on the Project increased from five in April 1983 to 141 in 1988-89 as shown on Schedule 3.

Some farms have since then been repossessed due to poor performance on the part of the farmer and the number presently on the scheme is 126, 36 of whom are women. The majority of farmers’ are between the ages of 30 and 45 years.

**THE LEASE**

When farmers come into the scheme, they enter into a fifteen year Lease Purchase agreement with the company.

The lease is in two parts. The first is fixed and spells out the general terms and conditions governing the scheme. The cost of the farm at settlement is amortized over a fifteen-year period, and the farmers are to make monthly
rent payments, to the company. Such payment constitute monthly installments towards the purchase price of the farm. At the end of the 15 year period the farmer has the option to purchase the farm at a nominal amount of $EC 100.00

The lease makes provision for the farmer to be refunded the principal component of the basic rent in the event he/she opts not to purchase the farm at that time. This part of the lease also makes provision for the Company to terminate the lease and evict the farmer from the farm if he/she fails to perform satisfactorily. Changes in this part of the lease can only be by mutual agreement between the farmer and the Company.

The second part is the Manual of Operations. This part spells out the agronomic and other practices the farmer and the company (Central Management) have to carry out to optimize production. As the situations in the field as well as on the project as a whole may change from time to time, this part of the lease is variable and the company has the prerogative to introduce changes as may be necessary for the benefit of the project at large.

At the end of the lease period the company is to be phased out or the composition of the shareholders altered to reflect greater, if not controlling participation by the farmers. It is hoped that, by that time, the farmers will have organized themselves into some form of an association to take over the management of the project.

SERVICES PROVIDED BY THE COMPANY

In accordance with the lease agreement, the Company has to provide a number of services to the farmer:

1. Development
The Company is responsible for all land development and crop establishment. This is done prior to the recruitment of the farmer. It was the responsibility of the St. Lucia Government to provide such facilities as Schools, Day Care Center, Health Centers and recreational facilities for the growing community. All those facilities are to date in place.

2. Transportation
The Company maintains a fleet of five trucks for the transportation of inputs from suppliers to the project area and produce from the project area to the docks. The vehicles are also used for the internal distribution of farm inputs and collection of produce from the farms to the central packing area. Transportation is also provided for the field officers who supervise the activities of the farmers. Four pickup vans are used for that purpose.

3. Accounting
The accounting section prepares the accounts for the individual farmers and the company’s own general accounts. Management Accounts are prepared on a quarterly basis and the farmers’ accounts on a monthly basis. Farmers receive monthly statements of their accounts by the 15th of each month for the previous month. It is also the responsibility of the accounts section to maintain all input stock at a proper level to ensure that inputs are always available and to account for same.

4. Technical Services
Qualified staff are provided to advise farmers in the areas of Agronomy, Engineering Extension and Pest Control. Management also, from time to time acquire the technical services of WINBAN, SLBGA, and the Ministry of Agriculture to assist farmers in solving their farm problems.

5. Irrigation
The company is to provide irrigation facilities when the required resources are available. During the first two years of the scheme, some 80 acres were irrigated with inherited old equipment from Geest. To date, there is no irrigation activity at St. Lucia Model Farms.
When irrigation is provided, farmers who benefit pay according to water use. Irrigation is a definite necessity on the project during the months of January to May, but the main limiting factor is funding for the estimated EC $3,000,000 project.

6. Inputs

The company maintains a proper stock of the following farm inputs as much as possible: fertilizers, nematicides, insecticides, tools, packaging materials, shed building materials, fuel and lubricants and small farm equipment such as input applicators.

The farmer receives inputs by counter signed requisitions and pay for same by deduction from sales revenue. An Inputs Payment Fund (IMP) is about to be established. This fund will be fed by a cess deduction from banana sales.

7. Marketing

The company is responsible for the distribution of empty cartons to the farms, collection of full cartons from the individual field sheds, inspector and weighing of fruits, transportation of fruit to the wharf and accounting to the farmer for the value of his banana sales on a weekly basis. A fruit quality team from SLBGA also monitors the quality of bananas from the project.

8. Training

The company arranges training sessions for both the farmers and the field officers. Expertise is drawn from WINBAN, SLBGA, CARDI, NRDF, Ministry of Agriculture and SLMF staff. These training sessions are in the forms of meetings, lectures and field demonstrations. Arrangements are also made for the training of the farmers’ helpers on the farm.

9. Maintenance

There is an ongoing program of maintenance of farm roads, waterways, main and submain drains. The cost of these works are met by all farmers through an administrative charge. The company from time to time maintains the farmers’ individual field system, but the costs thus incurred are charged directly to the farmer’s account.

10. Monetary advances

The company pays to each farmer, regardless of banana sales, a fixed basic weekly advance. At present it is EC $110.00 per acre farm. A production based advance for EC $1.00 per carton of bananas sold is also paid to the farmer on a weekly basis.

Sometimes the farmer needs additional working money to pay hired help to perform certain nonroutine work on the farm. Once the Farms Officer is satisfied that the work is done satisfactorily, the appropriate amount is advanced to the farmer for that week and charged against his/her account. Schedule 12 indicates the amount of advances paid each year.

11. Security

Predial larceny has been a long term problem in this valley. It is therefore necessary to maintain some level of security for the farmer, the farm, the compound, the equipment, the cash in transit and disbursement and the staff of the project. The Security Officer reports to the Project Manager and seeks Police assistance when necessary.

CHARGES TO THE FARMER

Once the farmer enters into the lease agreement with the company he/she has to meet the following charges:

(a) The Basic Rent

A fixed monthly charge towards the purchase price of the farm. The principal portion is refundable after the farmer has been on the project for five years or longer.

(b) Additional Rent

A variable monthly administrative charge covering the cost of running the project. The entire running cost of the project is to be met by
revenue of sales.

(c) **Transportation**

This is the going fee for transporting the boxed bananas from the project area to the docks for shipment. Farmers are charged by the box shipped.

(d) **Handling**

A fee charged for the post harvest handling of the fruit by hired hands. This includes the cost of distributing empty cartons. This is also charged by the box of bananas shipped.

(e) **R & R Cess**

This is a fund established for periodic rehabilitation and replanting of the farm. It is also used to assist farmers at times of disasters. The fund is built at the rate of 2 cents per lb. of bananas sold up to a ceiling of EC $10,000. This money is kept on a fixed deposit at the bank and the farmer receives quarterly statements of the fund. This fund remains with the respective farms even if the farm is repossessed by the company.

(f) **Deficit Fund**

This is a fund set aside from the farmer’s quarterly net surplus, designed to assist the company in carrying the accounts of other farmers in deficit during the next quarter. It also helps the farmer to meet his/her financial commitments when production is low, thereby evening out his/her net quarterly revenue. The fund is up to a ceiling of SEC 5000.00 refundable thereafter and fed by a 40% retention of quarterly surpluses.

(g) **Irrigation**

This charge is in effect only when irrigation is provided and charged according to water used.

The levels of the charges listed above are shown on Schedule 9-11.

**FARMERS’ RESPONSIBILITIES**

Basically, the farmer’s main responsibility on the project is to make the most efficient use of the land and services provided to maximize his/her yield per acre of top quality fruit (bananas) consistently, thereby fulfilling the objectives of the project of earning sufficient income to meet his financial commitment on the project and in the home. This is achieved by:

1. Carrying out in a proper manner and on a timely basis the field and agronomic practices of weed control, drainage maintenance, nematode control, border control, leafspot control, field sanitation, application of fertilizers, pruning, deflowering, sleeving, propping, harvesting and post - harvest handling of the fruit.

2. Employment of proper financial and farm management skills. The farmer needs to prepare effective farm plans to streamline his farm operations and maximize the use of his labor. He needs to spend time on the farm to manage it properly. He needs to take full control of every aspect of the enterprise so that every unit can be productive. He needs to keep his field losses to a minimum. He needs to be vigilant, particularly when he uses hired help. The farmer must always remember that, more than anything else, appearance and price sell our bananas.

**FARMERS’ REVENUE**

As shown on Schedule 12, farmers receive revenue from the Project in two components: (a) Advances on sales and (b) Surpluses.

**Advances**

In order to carry out the day to day operations on the farm, the farmer has to be on the farm on a full-time basis and/or hire labor to work the farm. For this, he needs money on a weekly basis, regardless of whether he sells produce or not.
To meet those costs, the company pays a weekly advance to the farmer, an amount which is charged to his account. The amounts have been indicated in the list of services provided by the company.

**Surpluses**

All revenue from sales are logged directly in the company’s projects’ accounts. On a monthly basis, deductions are made from these accounts as indicated in Schedule 9-11. The farmer receives monthly statements of his/her accounts, and surpluses, if any, are paid out to the farmer on a quarterly basis. Steps are now being taken to pay out surpluses on a monthly basis so that the farmer can more independently meet the cost of his farm operations.

**PROJECT ASSESSMENT**

The achievement of the project can best be assessed by studying some relevant statistical schedules. Schedules 4-11 have been included for that purpose. It is quite clear that the success of the project depends on production of good quality fruit and the banana price. Consequently, the farmer’s attitude, his managerial ability, the natural productivity of the farm and the weather are all vital factors to be considered.

**Farmers’ Attitude**

There are a number of farmers who have taken time to understand the Project and are making every effort to make it succeed. However, a number of them have failed to do so. They lack confidence in the scheme. Some treat it as a stepping stone to the other goals. They don’t think that they will ever own the farm. They try to make as much money as possible in the quickest possible time. They have the wrong concept.

Farmers who have no interest in the success of the project and who would not make an effort to improve his/her managerial ability should have no place on the project. It is hoped that, with the introduction of new measures, those negative attitudes will be made positive.

**Weather Factors**

This valley, unfortunately, suffers from the major elements of the weather - at least two each year:

- Hurricanes,
- Droughts,
- Floods, and
- Leafspot prone areas.

Over the years all those elements have had serious adverse effects on banana production in the valley. Only three years ago an insurance scheme (WINCROP) was set up to compensate farmers for loss of crop. Prior to this the company had to use reserve and borrowed funds to assist the farmers in their farm rehabilitation.

**PROJECT EVALUATION**

For the purpose of this presentation the Project is evaluated by examining the areas of success and the problem areas of failure.

The Project has succeeded in the following areas:

1. Through the process of good land development, the full agricultural potential of this rich valley has been explored. Proper drain systems, a good road network, riverbank protection and good communal infrastructure have been put in place.

2. High banana production - much higher than island’s average - has been achieved using the available technology.

3. The quality of life of a number of people in the community has been improved as a result of the Project. Several millions of dollars have been circulated among the people during the past eight years of operation.

4. As a result of the successes of SLMF and the examples set, banana production (yield per acre) has increased island wide.
5. The project has generated a great deal of employment. Some 500-600 people are employed weekly (this includes the farmer and his family members).

6. Good or bad, it has been a model for the rest of the island and the region at large.

A number of problems seem to have been posed in the following areas:

1. Selection of farmers. While a number of the farmers may be genuine and willing to work, they lack the managerial ability and educational background to make maximum use of the opportunity given to them.

2. Too many services are offered to the farmer. It takes from him/her the sense of independence and self-employment. He/she has the tendency to feel that he/she is not responsible and that he/she is working for the company.

3. Pre-operating expenses were too high, leaving the farmers and the project at large with the heavy burden of deferred expenditure.

4. Lack of irrigation facilities has caused the droughts to have adverse effects on production of good quality bananas.

5. Financial and farm management training for the farmers have been inadequate.

6. Through lack of financial management training, monies disbursed have been misused, thus affecting the farmers’ cash flow and ability to run the farm efficiently.

7. Negative attitudes towards the project, dishonesty and bad management have resulted in the production of poor quality fruit for the market and thus loss of needed revenue.

8. Natural disasters within a mono crop system. Tremendous set back in production and revenue following those disasters. There is need for diversification.

9. Treating all farmers on equal terms. It is unrealistic to expect that all of the 142 farms will perform well or the same. Those who are performing well must be motivated to do better by giving them due recognition and those lacking can have the good performers as their goal. Differential treatment is required.

10. The company failed to evict poor performing farmers at an early stage, allowing them to get too entrenched in a deficit position. It makes it much harder to recover. The farmers then become frustrated through lack of income and the project as a whole tends to suffer.

11. Lack of confidence of farmers in the project. There is need for more involvement and a greater sense of responsibility.

12. Lack of cooperation among fellow farmers. They should be approaching the farm problems more jointly thus making their solutions easier. The handling of hired labor is a good example. They need to maintain standard rates of pay and jointly stand firm on the quality of work and the number of working hours.

13. Considering the increase in living standards in the community, the greater and increasing domestic financial demands, the need for diversification, the stiffer competition expected with the advent of the unification of the European Market, the need for more rigid fruit inspection and selection for quality control, a five acre farm is too small to sustain the average family under the SLMF system. Serious consideration must soon be given to that aspect of the project if it is to succeed in the medium to long term.

It is the view of the writer that even having gone through the first eight years of operation with all the above problem areas, the project is
still well alive. With the implementation of some operational changes which have been proposed by the farmers and management, the project can become a real model for the Caribbean.
ST. LUCIA MODEL FARMS LIMITED

BOARD OF DIRECTORS

GENERAL MANAGER

SECRETARY

CHIEF SECURITY OFFICER

ADMINISTRATION

ADMINISTRATIVE ASSISTANT / FINANCIAL CONTROLLER

MANAGEMENT ACCOUNTS ASSISTANT

PAYMASTER

STOREKEEPER

ACCOUNTS CLERKS 1. 2. 3.

PRODUCTION

PROGRAMMES COORDINATOR

FARMS OFFICER (AGRONOMY)

FARMS OFFICER (Pest Control Fruit Quality)

MARKETING

IBM MANAGER

ENGINEERING

PROJECT ENGINEER

ENGINEERING ASSISTANT

WORKS SUPERVISOR

HEAD MECHANIC

MECHANIC 21

ASSISTANT STOREKEEPER

JUNIOR OFFICER

JUNIOR OFFICERS 1. 2.

SUPERVISORS 1. 2.

BUYERS 1. 2. 3.

IBD RECORDS CLERKS
SCHEDULE 2.

ST. LUCIA MODEL FARMS LIMITED
SOURCES OF FUNDS (US DOLLARS)

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OTHER: Weekly Banana Sales (see schedule).
       Rental of equipment.
ST. LUCIA MODEL FARMS LIMITED
Number of farmers settled from 1983 to 1990

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TOTAL: $119,680 1,244,669 $3,392,468 $6,564,401 $4,317,021 $7,491,221 $5,966,738 $4,272,765 $33,369,083 4,171,135

AVERAGE: $7.52 $7.11 $7.00 $11.03 $9.69 $9.05 $8.89 $8.51

DATE

SCHEDULE 4.

ST. LUCIA MODEL FARMS LIMITED
SMALLHOLDERS PRODUCTION
(Cartons)
# SCHEDULE 5.

**St. Lucia Model Farms Limited**

**Shall Holders Cost of Banana Production**

From 5 acres (24 tons/acre)

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**Average/acre**

|          |          |          |          |          |          |          |          |
| Ave/Acre | 1920      | 768      | 768      | 2475.2   | 840      | 2440.8   | 2382      | 9674      |

**Average/month**

|          |          |          |          |          |          |          |          |
| Ave/Month| 800       | 320      | 320      | 1031     | 350      | 1017     | 993       | 4031      | 0.18      |

32
ST. LUCIA MODEL FARMS LIMITED
SMALL HOLDERS COST OF BANANA PRODUCTION
From 5 acres (16 tons/acre)

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AVERAGE COST PER POUND: 0.37
ST. LUCIA MODEL FARMS LIMITED
ESTIMATED MONTHLY INPUTS COSTS AND INPUTS CESS DEDUCTIONS
PER FIVE (5) ACRE FARM

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NOTE: Estimated Production 16 tons per acre per year.
Average Box wt = 3016
### Schedule 9.

**ST. LUCIA MODEL FARMS LIMITED**

**Small Holders Estimated Monthly Cash Flow (Low Production)**

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**Yield: 10.7 tons/ac/year.**
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Yield 16 tons/ac/year
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$7,307,393 $70,214 $6,752,889 $69,411 $14,060,282 $139,625
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PREPARING YOUTH FOR THE WORLD OF WORK:
A CALL FOR FAMILY AND COMMUNITY SOCIAL CAPITAL

Lionel J. Beaulieu*

INTRODUCTION

Rarely has the issue of human capital resources held as high a position on the national agenda as it does today. This is evidenced by President Bush’s FY91 budget proposal to Congress in which he asserts that human capital has accounted for much of the nation’s productive stock and human capital investment has made a substantial contribution to U.S. productivity and economic growth throughout our history (Youth Record, 1990:1). The President’s commentary served as the backdrop for his budget package that called, in part, for expanded efforts to better prepare children for entrance into school, for more effective targeting of the school’s resources to assist students in greatest need and for improved job training opportunities for today’s youth.

Why has the subject of human capital investments been elevated to center stage in the Executive branch’s budget proposal? In part, the answer can be traced to a host of damaging reports that have placed the current competitiveness of the American workforce in question vis-à-vis those of other industrial nations of the world. For instance, in her careful examination of the American workforce, former Labor Secretary Elizabeth Dole declared that “as we enter the last decade of this century, America faces a workforce crisis. Simply put, America’s workforce is in a state of unreadiness: unready for the new jobs, unready for the new realities, unready for the new challenges of the ’90s” (Youth Record, 1989:1). Ringing a similar theme, the Joint Economic Committee’s Subcommittee on Education and Health argued (in its report on The Education Deficit: A Report on Hearings on Competitiveness and the Quality of the American Workforce) that the United States is falling behind other world competitors in assuring literacy, solid school achievement and effective job training (Joint Economic Committee, 1988). In its study entitled America’s Shame, America’s Hope: Twelve Million Youth at Risk, the Charles Steward Mott Foundation (MDC, Inc., 1988) outlined the growing number of youngsters who are emerging from school unprepared for post-high school educational opportunities or for the jobs that are likely to be available.

During the next several minutes, I would like to share with you my thoughts on the subject of human capital development. Rather than give treatment to the broad set of human capital resource issues that face our society, I want to take time today to focus principally on those impacting our youth. I’ll begin by briefly profiling the human capital attributes that youth possess as they enter the workforce and see how these compare to the changing needs of the economy. Next I will review human capital theory and raise some question about its ability to fully explain why some youth are more successful than others in the school-to-work transition. I will then propose and elaborate on the notion that our success in better preparing our youth for the world of work will be

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significantly dependent upon our capacity to strengthen the social capital of families and of local communities.

YOUTH, FAMILY AND THE ECONOMY

The statistics are all too well known. Today’s youth are surrounded by a host of social ills that make their elevation to a productive role in adulthood a difficult task at best. Here are but a small sampling of these problems:

- The proportion of high school dropouts in the United States now hovers around the 25 percent mark. Unfortunately, this is a percentage that has not undergone any radical improvement over the course of the last 3 decades (MDC, Inc., 1988).

- Dropout rates tend to be much higher among Black and Hispanic high school students, and in cases where these individuals are suffering from poverty, the dropout figures are even more extensive (Schorr, 1988).

- Nearly one-half of the United States’ young adults 16–24 years end up, either willingly or unwillingly, to be non-college bound persons (William T. Grant Foundation, 1988).

- Youth unemployment rates remain consistently high -- averaging 2 to 2 1/2 times greater than the figure for adult workers above the age of 25.

Aside from the statistics on youth, there are a number of significant changes occurring in the family environment in which these youth live. Over the period of the last thirty years, for example, the proportion of children living with two parents has fallen from 91 percent to 79 percent. While only 7 percent of children lived with one parent in 1960, the figure is now approaching the 20 percent mark. And, the shift is even more startling among Black children. Thirty years ago, 2 in 5 Black children lived with one parent. Today, the number 1 in 2 (see Figure 1).

In addition to these structural changes in the family, we find many are suffering from poverty. Since the early part of the 1970s, poverty among families with children has been on the rise. As of 1987, over 16 percent of families with related children under 18 years of age lived below the poverty level. For Hispanic families the number was 32.1 percent, and in excess of 37 percent for Black families with children (see Figure 2).

A more startling set of statistics are uncovered when poverty status is examined by family type (see Figure 3). For related children who live in two-parent families, poverty rates are relatively low regardless of race or ethnic background. However, these figures change dramatically when the focus shifts to children living in one-parent families. For mother headed households, the proportion of children under 18 living in poverty is 46.1 percent. This figure accelerates to 59.5 among Black female headed families, and to nearly 61 percent among Hispanic mother headed families.

As we study the statistics on students’ educational performance and consider the shifts impacting families, one can began to gain some sense of the complex set of issues confronting today’s youth. There is another trend, however, that is likely to make things even more taxing for today’s young person, that being an economy that is changing significantly in complexion. Most vivid of these changes are the increased demands for a more highly skilled and educated worker. Evidence of this shift is captured in the following statistics:

- Of the new jobs now coming on line, many are knowledge intensive white-color positions requiring a minimum of some college education (Garland et al., 1988).
By the beginning of the next decade, 3 or every 4 new jobs will require better than a high school education (Ong, 1988; MDC, Inc., 1988).

Of all new jobs in the year 2000, only 1 in 4 will be classified as low-skilled; today it is 2 in 5. Further, jobs that are considered middle-skilled in today's environment will be the least skilled occupations of the future (Swain, 1989).

So as we study the conditions of youth and their families, and examine how economic changes has accelerated the demand for a more versatile, educated, and multi-skilled worker, the question we are left with is this, "What is it that must be done to enhance the chances that youth will make a successful entre into the working world?" It is this issue that will guide the remainder of my presentation.

HUMAN CAPITAL THEORY: AN OVERVIEW

One perspective that has enjoyed much favor in explaining how people can be more successful in securing good jobs and in garnering higher wages is that of human capital theory. First introduced by Schultz (1962) and Becker (1962) approximately 30 years ago, this theory was intended to help account for increases in work productivity that could not be explained fully by physical or financial capital enhancements. It suggests that people, being rational individuals, make certain investments in their human capital stock for the purpose (and with an expectation) of realizing benefits -- higher incomes or better jobs -- at some point in the future.

As presented in Figure 4, the notion of human capital suggests that a person can affect his/her stock of human capital resources through a number of avenues. Among the most salient are formal schooling, on the job training, and various forms of nonformal educational programming activities. Investments made via these approaches can effectively alter one's human capital stock, and in turn, improve one's skills and abilities and thus, increase one's productivity and level of earnings (Becker, 1985; Becker and Chiswick, 1966; McNamara et al., 1988a; 1988b).

What is particularly interesting about human capital theory is its exclusive attention to the individual. Because its central focus is on attributes of people, it tends to assume that economic disparities existing among persons (be it their wages, cognitive abilities or types of jobs) can be tied directly to the differential levels of investments that these individuals have made in themselves. By applying the notion of human capital theory to the focus on my presentation, namely, how can we best prepare youth for the world of work, one would have to conclude that the success of youth's transition into the workplace can be realized if they pursue sufficient investments in their human capital stock, be it through formal education or other relevant forms of human resource enhancement activities.

While this may seem reasonable to proponents of human capital theory, the pursuit of this strategy could be far too limiting given its failure to consider forces beyond the individual that may significantly impinge upon his/her capacity to invest in himself/herself (see McCrackin, 1984). There is a relevant body of literature reflected in the work of status attainment researchers, for example, that has found undeniable evidence that individuals' abilities and educational achievements are significantly shaped by key family characteristics (Rumberger, 1983). That is, the socioeconomic status of families has a potent impact on their children's level of schooling -- the higher the socioeconomic resources of the family, the greater the academic accomplishments of the child, and the lower the family resources, the smaller the academic gains (Blau and Duncan, 1967). Further, as Otto suggests (1986:250-51):
Children learn beliefs, values and behaviors in the family context. These give them an educational orientation that defines the kind of career preparation they will receive. Their career preparation readies them for occupational placement and work experience, which in turn affects their adult values and attitudes. Finally, their adult values and attitudes are conveyed to their children, and the process begins anew.

What status attainment researchers have succeeded in doing is to alert us to the fact that our capacity to bring about a successful transition of youth into the world of work must not be dependent solely upon strategies designed to improve their human capital stock. What must even be considered is the important role that the family plays in helping make that transition possible. It is to the subject of the family that I now wish to turn my attention.

SOCIAL CAPITAL AND THE FAMILY

A reasonable question that one might ask at this point is, "What is it, in particular, that families do to influence the development of their children?" Based upon a series of recent works by James S. Coleman and his associates (see Coleman, 1990; Coleman and Hoffer, 1987; Coleman et al., 1982), the influences can be viewed as threefold; families provide financial capital, human capital, and social capital to their children. Financial capital constitutes the wealth and income which the family possesses, resources that can facilitate the child's access to activities that might enhance achievement. The notion of human capital represents the educational level of the parents, a measure that offers some clue of the cognitive environment to which the children may be exposed and which might contribute to learning. Social capital reflects the nature of the relations that exist between children and their parents, or with other members of the family (Coleman, 1988a:334). It represents the norms, the social networks, and the relationships between adults and children that are of value for the children while growing up (Coleman, 1990:334). Coleman (1988a:385) helps, in the following quote, to place these three concepts in their proper context:

The distinction between human capital existing in the family and the social capital existing in the family constitutes the critical difference between what may be called the "traditional disadvantage" of background and what I have termed "family deficiencies." Disadvantage background ordinarily refers to the absence of resources embodied in the parents, represented primarily by the parents' education but also by other variables, such as low economic level or the status of a racial-ethnic minority, which stand as surrogates for low levels of human capital. By family deficiencies, I mean the weakness of the links between adult members of the family and the children constituting an absence of social capital.

What is of particular interest is the argument advanced by Coleman that social capital is on par with human capital investments (as proposed by human capital theorists) in terms of its importance in stimulating the emergence of skilled and capable individuals. In reference to the family, he states that the human capital attributes embedded in the parents (such as their educational level or occupational status) have a more limiting impact on the educational growth of their child when they fail to be complemented with social capital, represented by quality interactions and relations between the parents and the child (Coleman, 1988a:384). Why does Coleman advance this argument? It is due, in part, to Coleman's (1990:336) observation that despite the continued enhancement of the human capital traits of parents over the past several years, the academic performance and success of youth has not kept pace with these human capital improvements. In fact, what is happening is that social capital, represented by the presence of
adults in the home and by strong parent-child interactions on academic, social, economic and personal concerns, is slowly eroding. And it is this continued weakening of the family’s social capital, contends Coleman, that is seriously jeopardizing the academic success of today’s youth.

To add credence to his argument, Coleman undertakes a comprehensive study of a national sample of U.S. high school students to determine how drop-out behaviors are affected by the social capital characteristics of families. A summary of the results of his research are captured in Table 1. His findings provide strong empirical evidence to support the argument that a child’s probability of dropping out of high school accelerates as the number of deficiencies in his/her familial social capital increases, even when human and financial capital attributes of the family are taken into account. What these data suggest, therefore, is that strategies designed to effectively enhance the academic performance of youth and to provide them with a smoother school to work transition are likely to be more effective if a strengthening of the social capital attributes of the family are included as an integral part of these strategies.

SOCIAL CAPITAL AND THE COMMUNITY

There is an additional ingredient that I wish to offer today as being crucial to the effort to help youth successfully prepare themselves for the world of work, and that is the importance of extending the notion of social capital beyond the family and making its presence felt at the local community level. What do I mean by this? It has been suggested by Coleman (1987) that even though social capital is principally rooted in the linkages between parents and children, it is possible for it to be found within the local community arena. In general, it is represented by the genuine concern and interest that adult members of the community have in the activities of another person’s child. Signs of its presence include the enforcement of norms imposed by the family or community, providing a listening ear to youngsters experiencing problems which they are hesitant to discuss with their parents, or dedicating the time and energy necessary to support youth-related activities (Coleman, 1987). Community social capital, much like family social capital, can be an important factor in facilitating and supporting educational attainment among youth (Coleman, 1990: 334). When these types of community resources are in place, a functional community is present, one that "augments the resources available to parents in their interactions with school, in their supervision of their children's behavior, and in their supervision of their children's associations, both with others their own age and with adults" (Coleman and Hoffer, 1987: 7).

This notion of a functional community has been articulated best in research that Coleman and his colleagues have pursued in which the academic performance of students attending Catholic, other private, and public high schools are explored. They offer convincing evidence that Catholic high school students demonstrate higher levels of academic success, and a significantly lower rate of dropping out of school, than do students having similar family backgrounds but who are enrolled in other private or in public high school programs (Coleman et al., 1982; Coleman and Hoffer, 1987). They note that the religious community enveloping the Catholic school constitutes a social network that enforces norms regarding the proper behavior of its students. In effect, it provides a form of social capital beyond the family that assists the family in the education of its children. More importantly, the presence of social capital in the community (represented in this case by the community which surrounds the Catholic high school) often compensates for situations in which the social capital of the family is found to be either weak or nonexistent (Coleman, 1988a; Coleman and Hoffer, 1987).

Unfortunately, Coleman and his associates never examine whether communities defined on the basis of place of residence (be it a city, town, or similar entity) can ever embody the social capital traits that are reflective of the type
of functional community which they have observed surrounding Catholic schools. In fact, they tend to discount the relevance of place in contemporary society by embracing the arguments raised by some that the ever expanding ties of local people to individuals and organizations outside the community have depleted the social fabric of the community as a place and, as a result, has brought about its demise (Nisbet, 1969; Stein, 1960). In essence, they believe that residential communities, while serving as functional communities in years past, have lost this capacity due to geographic mobility of people and the individualism of modern society (Coleman and Hoffer, 1987; Coleman, 1990).

I'm not quite willing to give up on the usefulness of places as functional communities. Why? Simply because there are a host of studies that have made clear that the residential community remains a very vibrant and important concept in today's society (see Kaufman, 1959; 1985; Luloff and Wilkinson, 1979; Wilkinson, 1970; 1974; 1979). This is perhaps best articulated by Wilkinson (1989: 346), who asserts that:

People live together in places, no matter how fuzzy and changing might be the boundaries of those places. They encounter the larger society primarily through interactions in the local society, albeit through organizations with outside ties. And, at crucial moments, they can act together to express a common interest in the place of residence. Local social life is complex, and perhaps it is becoming more so, but complexity and turbulence do not, in and of themselves, rule out community... In the midst of complexity and turbulence, the latest bond of solidarity among people who share a local society can draw them together now and then in the process of community interaction.

By embracing the notion that the residential community remains a viable construct in contemporary society, then it would appear that strategies which are designed to help youth succeed in school and to assist them in their transition to the world of work, must include as their foci the strengthening of the community's social capital.

Let me share with you an example that I feel begins to build a good case for this argument. We undertook an analysis of the same data that Coleman explored on dropout rates among high school students who lived in families having various levels of social capital. What we added, however, were measures that we felt represented social capital attributes of the community. These included variables that suggested how well students were socially integrated into the community and the magnitude of the commitment demonstrated by the community to the activities of the local public high school.

Table 2 captures the major results of our analyses. What we found was that predicted dropout rates for students differed significantly depending upon the specific type of environment in which they found themselves. For students whose parents had a high level of social capital (determined on the basis of five variables examined in Coleman's research) and who lived in a community where the presence of social capital was high (as developed via the use of four variables from our study), the predicted dropout rate was only 1.3 percent. If family social capital was high, but community social capital was low, the percentage of students who dropped out of high school (between their sophomore and senior years) increases to 9.5 percent. A similar outcome was found when community social capital was high and family social capital was low. The most startling outcomes were uncovered in cases where both the family social capital and the community social capital of students were low. In this situation, the predicted dropout rate accelerated to 54.3 percent.

These results make a compelling case for the importance of high social capital being available to students either in the context of the family or the community. More importantly, it
demonstrates the increased chances that youth have in being academically successful when social capital is high both in the family and in the broader community in which they live. In our research, the presence of these two factors virtually assured students of their successful completion of their high school degree.

IMPLICATIONS

What does this all mean for the types of strategies that we might consider in our efforts to influence the chances that youth will make an effective shift from school into the world of work. The Wall Street Journal, in a special issue on education, argued the following (Wall Street Journal, 1990:1):

Jobs are becoming more demanding, more complex. But our schools don't seem up to the task. They are producing students who lack the skills that business so desperately needs to compete in today's global economy. And in doing so, they are condemning students to a life devoid of meaningful employment.

Better corporate retraining may serve as a stopgap. But ultimately the burden of change rests with our schools. While debate rages about how change should come, almost everybody agrees that something has to be done. And quickly.

I must admit that I feel a bit uncomfortable with the Wall Street Journal commentary because I am afraid that it continues to point to schools as the key source of the problem and as the ones that need to change if we are to turn the situation around. If you reflect upon the substance of what I have suggested today, it is more than schools that need to be the focus of our efforts. Attention and resources must be directed at strengthening the capacity of families and communities, to enhance their so called "social capital."

As I think about the mission of the land-grant system in general, and that of the Cooperative Extension Service in particular, I am struck by the fact that the educational vehicle to help bring about this strengthening is in place. The 4-H youth development program, in concert with that of the home economics program, can design and deliver nonformal educational programs which will help nurture strong, positive interactions between parents and children. It is incumbent upon the land-grant system to work aggressively in helping create a strong social capital in the family, even in this period when family structures are undergoing tremendous shifts. As Lizabeth Schorr reminds us, "Children whose families were never able to convey to them a sense of being valued and a feeling of coherence are in a poor position to cope with the world of school or work." I am convinced that Cooperative Extension can help make a difference to families.

The Cooperative Extension Service can be instrumental, as well, at the community level. I suspect that not everyone has connected the success of youth with the strength of their local community. But, as our research suggests, community social capital does make a difference. Among other things, community social capital is reflected in the commitment that the community has to offering youth a set of positive experiences through the establishment of organized youth activities. It is represented by organizations or individuals who are available to listen to youth who may need help with their problems or who long for someone simply to talk to. It is found in the attention and consideration that local people give to the views that youth have with regard to the future direction of their community. But, it is also symbolized by the business sector's active involvement in the school system because of their desire to better assist youth in their school to work transition.

Cooperative Extension Service has the wherewithal to help build and strengthen these coalitions of people and organizations, coalitions that are visible signs of the presence of social capital in the community. But, where
Cooperative Extension can make a most meaningful contribution, in my opinion, is in its capacity to help nurture, via its educational programs, a local leadership that has the vision to work constantly on creating that type of social capital crucial to improving the opportunities and experiences for its local youth.

REFERENCES


Figure 1: Living Arrangements of Children Under 18 Years: 1960-1988

Living Arrangements

- Both parents
  - One parent

- Both parents
  - One parent

- Both parents
  - One parent

Percent

White
Black
Hispanic

Figure 2: Families With Related Children Under 18 Years That Are Below Poverty Level: 1960-1987

- All Families
- White Families
- Black Families
- Hispanic Families
Figure 3: Poverty Status of Families With Children Under 18 Years, By Type of Family, Race, and Hispanic Origin: 1987
Figure 4:
A Model of Human Capital Theory

Investments
- Formal Education
- On the job training
- Nonformal education

Human Capital Stock
- Current levels of education
- Current Workforce Skills

Outcomes
- Increased productivity
- Increase in cognitive skills and abilities
- Higher earnings
Table 1: Dropout Rates for Students Whose Families Differ in Social Capital Coleman Study

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<th>% Dropping Out</th>
<th>% Difference</th>
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<td>1. Parents and children:</td>
<td></td>
<td></td>
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<tr>
<td>Two parents, one sibling</td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td>One parent, four siblings</td>
<td>22.6</td>
<td>12.5</td>
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<td>2. Mother’s expectation for child’s education:</td>
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<td></td>
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<tr>
<td>Expectation of college</td>
<td>11.6</td>
<td>8.6</td>
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<td>No expectation of college</td>
<td>20.2</td>
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<td>3. Three factors together:</td>
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<tr>
<td>mother expects college</td>
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<tr>
<td>One parent, four siblings,</td>
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<tr>
<td>no college expectation</td>
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Table 2:
Predicted Dropout Rates for Students whose Families and Communities Differ in Social Capital, Controlling for Human and Financial Capital

<table>
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<th>Family Social Capital</th>
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<th>High</th>
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<tr>
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<td>54.3%</td>
<td>9.5%</td>
</tr>
<tr>
<td>High</td>
<td>9.5%</td>
<td>1.3%</td>
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Low-Input/Sustainable Agriculture Research 
in the U.S. Caribbean

James E. Rakocy*

INTRODUCTION

The major emphasis in conventional agriculture has been directed towards increasing production per unit of land. In the last half century, production gains for all major crops have been remarkable. The key to this success has been a steady increase in agricultural inputs such as fertilizers, pesticides, irrigation, equipment, energy and antibiotics. The unintended consequence of high yields has been mounting environmental degradation, soil erosion, water pollution and increased health risks. Production orientation has also led to huge surpluses and burgeoning price support programs to stem the flow of farm failures. Nevertheless, increased production costs and competition from abroad have resulted in the loss of 220,000 U.S. farms (11 percent of the total) between 1980 and 1986 (U.S. Department of Agriculture, 1987).

These trends instilled the realization that conventional agriculture, though highly successful now, will not be sustainable for the generations to come. Congress responded by passing the Agriculture Productivity Act in 1985 as part of the Food Security Act, P.L. 99-196. This law granted authority to conduct research and education programs in alternative farming systems described as low-input, renewable, regenerative or sustainable systems. For this program Congress appropriated funds of $3.9 million in 1988/89 and $4.45 million in 1989/90 (Madden et al., 1989).

The initial research and education program in low-input/sustainable agriculture was called "LISA." The name was recently changed to "sustainable agriculture," reducing the low-input emphasis that was often difficult to achieve while maintaining profitability. For the purpose of this paper I will refer to sustainable agriculture by its original name and keep the emphasis on low inputs as a goal.

The U.S. Virgin Islands and Puerto Rico are eligible to receive funds from the Southern Regional Program for LISA research. Neither of these U.S. Caribbean islands has been successful in obtaining LISA funds to date. Competition for the limited initial funding has been fierce. In the Southern Region more than 200 pre-proposals and proposals are submitted each year, but only 10 to 15 receive funding after a rigorous selection process. The U.S. Caribbean is handicapped by its limited geographical area and restricted commodity base. The Southern Region has production acreage in the millions devoted to such major commodities as cotton, rice, soybeans, tobacco, peanuts and citrus that are worth billions of dollars. It is only fitting that initial LISA research be conducted in areas with the greatest potential benefit. However, there is concern for the sustainability of agriculture in the U.S. Caribbean, and projects will certainly be funded there as the LISA Program progresses.

TRENDS AND CHARACTERISTICS OF U.S. CARIBBEAN AGRICULTURE

Caribbean agriculture is distinct from agriculture in the U.S. mainland, and relevant LISA research must be viewed in a different context. Agriculture in the U.S. Caribbean has declined as workers have moved to higher paying jobs in government and the emerging

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manufacturing and tourism industries. Between 1959 and 1987, harvested land decreased from 724,000 to 174,587 acres in Puerto Rico and from 4,272 to 608 acres in the U.S. Virgin Islands (U.S. Department of Commerce, 1959 and 1987a). Reduction of pasture land, which stands at 411,468 acres in Puerto Rico and 13,390 acres in the U.S. Virgin Islands, has been less severe.

Both Puerto Rico and the U.S. Virgin Islands are heavily dependent on food imports. Puerto Rico annually imports food valued at $1.2 billion compared to local production worth $415 million at the farm level (U.S. Department of Commerce, 1987a; Vincente-Chandler, 1986). Production of sugarcane, once a major export crop, declined by 90 percent since 1952 while tobacco production has almost disappeared. Coffee producers still supply 75 percent of the local market. Conversely, milk, eggs, poultry, and pork production have more than doubled since 1952. Meat and dairy production now comprise 60 percent of the agricultural economy. Puerto Rico is self-sufficient in milk and has started to export it.

The U.S. Virgin Islands import $120 million worth of food, compared to local food production valued at only $2.7 million (U.S. Department of Commerce, 1987a; U.S. Department of Commerce, 1987b). After sugarcane production ceased in the mid-1960s, agriculture shifted from cropping to livestock production. Dairy and beef cattle are the U.S. Virgin Islands' two largest agricultural industries, located primarily on St. Croix.

Early in the colonization of the U.S. Caribbean Islands, the ancient forests were cut down to prepare the land for plantations and to harvest the commercially valuable timber species. Plantation crops were planted high up hillsides, causing considerable erosion of the already thin soil.Repeated burning of crop residue degraded the soil further by destroying its structure and reducing its fertility. As plantation agriculture declined, much of the abandoned farmland reverted to secondary scrub growth.

With the abandonment of plantation agriculture the average farm size decreased. More than 60 percent of the farms are now less than 10 acres in the U.S. Virgin Islands, while more than 68 percent of Puerto Rican farms are less than 20 acres (U.S. Department of Commerce, 1987a). The distribution of farm size has become bimodal, with a few large farms devoted to large livestock production and many small farms specializing in vegetables, field crops, fruits and nuts, poultry and small livestock (McElroy and de Albuguerque, 1985). There are approximately 20,245 farms in Puerto Rico and 267 farms in the U.S. Virgin Islands (U.S. Department of Commerce, 1987a).

Small-scale farming in the U.S. Caribbean is generally conducted on either a part-time basis, involving only family members growing crops for the home or market, or on a commercial level, directed mainly for the market and possibly involving a few waged employees. Some large-scale farming operations do exist in Puerto Rico, but recent attempts to develop a large rice project on the north coast and large vegetable project on the south coast have failed. Large-scale farming in the U.S. Caribbean does not compare to U.S. mainland standards. A farm of more than 20 acres with annual gross sales exceeding $20,000 is commonly considered a large-scale operation (U.S. Congress, Office of Technology Assessment, 1987).

Small-scale farms in the U.S. Caribbean utilize highly mixed intercropping systems and achieve high levels of production. Some conservation practices, such as strip and contour cropping, terracing of steep hillsides, pasture rotations and mulching are used. There has been an increase in inputs such as fertilizer, feed, pesticides, irrigation and the use of machinery, mainly tractors, but not on a scale practiced in the U.S. mainland. Of the 267 farms in the U.S. Virgin Islands, only 17 percent have tractors, 25 percent use fertilizers and/or manure, and 43 percent use insecticides, fungicides or herbicides (U.S. Department of Commerce, 1987a). In Puerto Rico only 8 percent of the farms use tractors and 20 percent use pesticides. However, most (81 percent) of the farms purchased commercial fertilizers in 1987 compared to 65 percent of the farms in 1982 (U.S. Department of Commerce, 1982 and 1987a). Livestock producers import approximately 500,000 tons of feed annually in
Puerto Rico (Vincente-Chandler, 1986). In the U.S. Virgin Islands, feed valued at approximately $742,000 is imported annually.

APPROPRIATE LISA RESEARCH

LISA technology developed in the southern states cannot be transferred to the U.S. Caribbean without considerable modification. Puerto Rico and the U.S. Virgin Islands have subtropical climates and do not experience the low winter temperatures and freezes that disrupt the cropping cycles in the southern states. The islands are exposed to easterly trade winds, high solar radiation and widely fluctuating patterns of rainfall. The islands are mountainous, and large tracts of level land are uncommon. The soils are derived from rocks of volcanic origin or limestone, and nutrients cycle rapidly due to the high temperatures. Production economics that apply to the South are drastically altered by the high cost of inputs that have to be shipped to the islands.

Caribbean agriculture is in a state of serious decline, perhaps more than in the U.S. mainland, and has not found its way after the collapse of the plantation era. The boom of the tourist industry and some industrial development have absorbed farm workers but expansion in these areas may be drawing to a close. Recent economic developments have shown the fragility of the tourism sector. Recession may force some people back to the land, if only at the subsistence level, as it did in the 1970s in the U.S. Virgin Islands (McElroy, 1981). However, sustained growth will require policies and programs to establish a diversified economic base with a strong agricultural component. It is possible the U.S. Caribbean is on the threshold of an agricultural resurgence.

A good LISA program would be essential to revitalize Caribbean agriculture. Inputs must be kept to a minimum to ensure profitability. In the U.S. mainland LISA concepts are being used to restructure conventional agricultural enterprises. Much of the agriculture in the Caribbean is already low input, but production practices are diverse, inadequately documented and generally grounded on tradition more than current research data. Appropriate LISA research for the U.S. Caribbean should address the following topics:

Production Systems

Conventional agriculture relies on monoculture systems in which large tracts of land are clean-tilled, seeded, fertilized, irrigated, sprayed with pesticides and harvested mechanically. These systems are very productive and efficient but high, uniform yields can easily flood island markets and depress prices unless crops are staggered. Monoculture systems can promote soil erosion, nutrient leaching, reduction of natural pest barriers, pesticide resistance and pesticide residues in the environment. Machinery is expensive and difficult to maintain on islands where salt spray speeds corrosion and spare parts are not readily available. Although monoculture systems may be appropriate in some situations (e.g., large islands, island staples, export crops), research is needed to reduce inputs and protect the environment.

Polyculture systems are more appropriate for small-scale island agriculture. Polyculture covers a wide range of practices (intercropping, relay cropping, alley cropping) and endless combinations of species. Agroforestry systems are polycultures involving a mixture of woody perennial species with annuals and/or livestock. Some Caribbean agroforestry systems include cocoa and coffee grown under the shade of legume trees (Inga sp. and Erythrina sp.), coconut/banana, coconut/livestock grazing, mango/papaya, and citrus/papaya (Wilson, 1988). Polyculture involves mutually beneficial species that capture more solar radiation and produce more food per unit of land, set up natural barriers against the spread of pest and disease organisms, intercept rainfall and minimize soil erosion and utilize nutrients in the soil profile more efficiently. Polyculture systems require less mechanization but need more labor, management and planning. Polyculture systems are generally ecologically balanced and sustainable, but research is needed to develop new systems that are still more productive and economically competitive with
imported food. This research should quantify and enhance the beneficial interactions. Optimizing polyculture systems is a much more challenging task than production research on monoculture systems.

Integrated systems reduce farm inputs by utilizing a by-product from one production system to benefit another. Livestock and cropping systems are frequently integrated. The manure collected from confined or partially confined livestock operations can be applied to field crops, orchards and woodlands to improve soil fertility and structure. Plant by-products can supplement the diet of livestock, completing the cycle while minimizing costly outside inputs. In Panama a system has been developed whereby pigs, chickens, ducks and cattle are partially confined adjacent to ponds containing polycultured fish (tilapia, carp and Cichlasoma managuense, a predattor fish). The manure from the livestock operation is washed into the pond daily to fertilize it and stimulate algae growth. The fish are not given supplemental feed. The enriched pond water is used to irrigate vegetable gardens or woodland areas containing valuable timber species (Lovshin and Pretto, 1983). Studies are needed to demonstrate and quantify the benefits of integrated systems that hold promise for the U.S. Caribbean.

**Nutrient Cycling**

The nutrient levels of tropical soils are often low due to leaching in areas of high rainfall and rapid nutrient cycling. Organic matter in the soil quickly decomposes and does not provide a large nutrient reservoir as it does in temperate regions. Research is needed to find efficient ways of increasing soil fertility using local material such as animal manure, green manures, crop residues and cut vegetation, seaweed, food processing wastes and sewage sludge. Appropriate methods of composting should be studied. Inorganic fertilizers will also be required, but application rates developed in the U.S. mainland seldom apply to island soils. Research is needed to increase the efficiency of nutrient use and establish economically and environmentally optimum levels and methods of fertilization. Emphasis should be placed on finding ways of increasing nutrient availability, especially in very alkaline soils, and methods for minimizing nutrient loss through leaching. There is concern about nitrate buildup in the thin freshwater lenses that is so important to island communities as a source of drinking water. Studies should be conducted on the use of legumes and soil microorganisms (e.g., mycorrhizae) to enhance soil fertility and decrease dependence on inorganic fertilizers. *Leucaena*, a fast growing tropical leguminous tree that has been introduced to the U.S. Caribbean, can fix 500 to 1,300 pounds of nitrogen per acre per year (National Academy of Sciences, 1977).

**Tillage Systems**

Conservation tillage practices are critical for fragile island ecosystems. Tropical storms can erode enormous amounts of soil from fields that are clean-tilled. Studies in Puerto Rico indicate that crops cultivated on clean-tilled slopes lose 17 tons per acre per year (Vincente-Chandler and Figarella, 1962). Roughly half of Puerto Rico has slopes of 45 degrees or more. Much of the eroded sediment enters coastal waters, where it can kill coral and finfish larvae.

Conservation tillage practices minimize soil disruption, thereby reducing erosion and increasing moisture retention. Other benefits include a reduction in labor, fuel costs and equipment costs. Disadvantages include increased use of herbicides to control weeds and the possibility of more pest and disease problems originating from the previous crop residue. Research is needed in the U.S. Caribbean to study the effects of alternative tillage systems on weed, pest and erosion control, fertilizer needs and nutrient availability and cultivation costs.

**Pest Management**

Conventional pest management with chemicals is a high-cost practice that kills beneficial insects, destroys the natural balance, promotes the development of resistant strains and ultimately leads to additional pest outbreaks.
requiring more frequent chemical applications. Many chemicals are not registered for use on tropical crops and cannot be used until special registration, based on field trials and careful monitoring of biocide residues, is obtained from the Environmental Protection Agency.

LISA requires that alternative methods be used, such as biological control, the use of natural enemies (insects, parasites and pathogens) and integrated pest management, a combination of control methods (cultural practices, rotations, allelopathy) that uses chemicals sparingly. Most work on biological control and IPM has been directed at major stateside commodities. A research program of alternative pest control methods should be developed for tropical crops and the conditions in the U.S. Caribbean. Since this research is expensive and requires highly specialized skills, it should be done in cooperation with stateside IPM laboratories and scientists.

Rotations

Crop rotation is one of the best methods to disrupt insect, disease and weed growth cycles safely without synthetic chemicals, to increase nutrient levels without fertilizer additions, to utilize soil nutrients more efficiently and to promote the growth of beneficial soil microorganisms. Some crops produce natural chemicals that inhibit subsequent weed growth, a process known as allelopathy. A legume used as forage or a green manure for incorporation back into the soil is usually part of the rotation. Considerable research has been directed at developing rotation systems for the major stateside commodities, and a similar effort is now needed for crops in the Caribbean. Emphasis should be placed on quantifying the benefits (changes in nutrient levels, yields and the incidence of pest outbreaks) of different rotation sequences.

Species Improvement

A continuing task of island research stations should be the improvement of plant and animal species to maintain or increase productivity under conditions that will require less inputs. Crop varieties should be screened for resistance to pests and diseases and efficient utilization of water and nutrients. Breeding programs should also be initiated, probably at the regional level, to select for these traits. The genetic improvement of livestock with a goal of reducing inputs is a greater task, but some new strains should be introduced and characterized under island conditions. Some crossbreeding work could be undertaken.

Mechanization

Research on farm equipment modification to meet the needs of alternative farming practices is probably beyond the capability of many island research stations. However, these stations could keep track of current developments in this field and purchase promising new equipment, as it becomes available, for the purpose of demonstrating and testing its effectiveness in reducing inputs under island conditions.

Irrigation

About 40 percent of the land area in the U.S. Caribbean is semiarid, including 60,000 acres on the southern coast of Puerto Rico (Morris and Pool, 1986; Vincente-Chandler, 1986). In Puerto Rico 36,000 acres of farmland are irrigated (U.S. Department of Commerce, 1987a). Much of this land is furrow irrigated, which requires high operational costs for pumping, uses water inefficiently and produces less than maximum crop yields because the water cannot be applied evenly at optimum frequency. Excess irrigation water recharges the aquifer and helps maintain a stable groundwater balance (Morris and Pool, 1986). But water that reinfilters the aquifer may also transport dissolved nutrients and pesticides from the surface and contaminate the groundwater.

Drip irrigation is an alternative system that is more appropriate and becoming more popular in the semiarid U.S. Caribbean. Drip irrigation uses much less water than furrow irrigation and wets only a small area around each plant, thereby inhibiting weed growth between rows. Liquid fertilizer can be added to the irrigation
water, which reduces fertilizer costs and increases efficiency. With drip irrigation there is less chance that nutrients and pesticides will be transported to the water table. Drip irrigation systems are also more versatile and can be used on any type of terrain. The major disadvantages of drip irrigation are its initial expense, $1,500 to $2,000 for a typical farm in Puerto Rico, and its more complicated maintenance (Goyal, 1984). Although drip irrigation systems are initially expensive, they reduce subsequent inputs and help to reduce health risks and environmental damage. More research needs to be conducted on drip irrigation systems, using a variety of crops.

**Economics**

A key component of research dealing with low-input, alternative systems is their profitability compared to conventional systems. All research on alternative systems should include an economic analysis that determines their effect on net return to the farm family and per unit production cost (National Research Council, 1989). If alternative farming systems are not profitable, they cannot be sustainable.

**Information Systems**

The findings of LISA research need to be presented in a format that helps farmers in making decisions to adopt alternative systems and management practices. This should be done by traditional means such as field demonstrations and station bulletins and by new technology, such as the development of computer software and farmer decision-aid programs.

**SUBMITTING LISA PROPOSALS**

The LISA program for the Southern Region has been administered by the Georgia Agriculture Experiment Station, but in 1991 this responsibility is being transferred to the Louisiana Agricultural Experiment Station.

Early in August a request for pre-proposals is sent out to all potential LISA grant applicants in the Southern Region. Of the more than 200 pre-proposals that are received, approximately 50 are asked to submit full proposals by early January. These proposals typically request funds for a period of three years, although some proposed work may be one year in duration. The maximum award is limited to $100,000 for a single year proposal and $250,000 for a multi-year proposal. These proposals are reviewed by a Regional Technical Committee representing diverse agricultural disciplines from the university system, governmental agencies, private educational and research institutions and regional farmers. The Technical Committee ranks the proposals and submits their recommendations to the Regional Administrative Council, which has representation from the Agricultural Research Service, the Cooperative Extension Service, State Agricultural Experiment Stations, private research and education organizations, the Soil Conservation Service and producers. The Administrative Council selects approximately 10 to 15 proposals for funding.

There are four categories of LISA research projects:

**Information Projects**

This is a collection and analysis of a specific subject database. It involves the identification, organization, evaluation and dissemination of existing information in a subject area that is highly relevant to LISA concepts and for which there is a substantial body of information available. The output from this project may include publications, databases, computer decision aids, videotapes, slide sets, etc.

**Farm Resource Management Systems.**

Projects in this category document the farm level environmental and economic effects of alternative farm resource management systems and include resource management strategy (RMS) budgets. RMS budgets for cropping systems should identify cropping sequence or rotation, irrigation system (if any), tillage system, fertility system and pest management system. An RMS budget should include the resource requirements, input requirements, input
costs, expected production, expected returns, potential conservation impacts, and potential environmental impacts of the individual crops as components of a cropping system. RMS budget could also be developed for livestock systems.

Whole Farm Systems.

Projects in this category develop and conduct research and educational demonstration of whole farm systems that include practices which enhance producer profitability, minimize adverse environmental impacts, preserve or enhance regional water resources and improve the health and safety of farm families, farm workers and the consumers of farm products. Research and education programs should include multi-discipline, multi-institutional and multi-state involvement and meaningful participation by farmers. Projects may examine a single farming system or compare two or more farming systems that are similar in resources and products produced but differ in some component (e.g., intensity of chemical utilization). Projects should evaluate and combine components into a systems approach to attain greater profitability, sustainability and environmental benefits. The systems must have relevance to the Southern Region, and the information obtained from this project should be prepared in a farmer usable format.

Economic and Environmental Component

Proposals in this category should identify, document and demonstrate farming practices that reduce the use and dependence on chemically based strategies resulting in improved environmental and economic benefits for Southern agriculture. Proposals should define and describe alternative strategies to reduce chemical inputs, determine how current farming systems can maintain profitability during transition to reduced chemical input strategies and provide economic and environmental comparison between current conventional systems and future alternative systems.

Establishment of the LISA program has been an important development for U.S. agriculture. Now farming systems will not only be judged by their productive capacity but also by their sustainability. As the results of the first LISA projects come in, the farming community stands ready to adopt new practices that will reduce inputs, maintain profitability, protect the environment and improve health and safety.

REFERENCES


Establishment of alternative agricultural enterprises is complex. At all scales, an individual farm, a community of farms, a microstate or a macrostate, integration of marketing, economic analysis, production system development and political policy awareness/modification is required. This paper describes critical steps in analyzing the feasibility of alternative agricultural enterprises and highlights the multidisciplinary/interagency efforts necessary to induce positive change in complex economic environmental and/or social and political circumstances.

Lessons are gleaned from examples of governmental and private efforts to establish alternative enterprises. Agricultural enterprises that offer significant potential for the Caribbean Basin are listed with key considerations. The purpose of this document is to facilitate critical thinking and stimulate discussion among professionals in agriculture production and marketing, university research and extension, governmental agencies and the private sector. A detailed analysis of the processes, potentials and problems involved in establishing alternative agricultural enterprises in the Caribbean Pacific Basins is presented in the proceedings of a 1988 workshop on "Alternative Agricultural Enterprises for the Caribbean and Pacific Basins" sponsored by the Caribbean and Pacific Basin Advisory Groups through support of the USDA/CSRS Special Grants in Tropical and Subtropical Agriculture.

Although the feasibility of agricultural enterprises may be different when viewed from the perspective of an individual farm operator compared to the scale of a macrostate, the critical elements remain the same. A systematic analysis that integrates the critical elements in the information-gathering and decision-making processes greatly increases the probability of success. Several systematic approaches have been described in the literature. Quiros (1988) described a methodological approach for analyzing the economic viability of alternative agricultural enterprises in the Caribbean and Pacific Basins. This system is the result of many years of experience through the programs of the InterAmerican Institute for Cooperation on Agriculture (IICA) in the Caribbean and Central America. His approach considers six purchase and sales factors: macroeconomics, production, storage, export-import, distribution, and payment recovery. Failure in any one of these operational stages frequently undermines the entire process. The importance of identifying the critical path for information and product flow through the production/marketing system can not be overemphasized.

Ingram, Zimet and Breeze (1991) developed a workbook and accompanying video tape to assist farm families in analyzing the feasibility of an alternative agriculture enterprise. Beyond
the general determination of the status/potential of an enterprise on the macro scale, this decision aid concentrates on the elements of an enterprise that are at least partially under the control of the individual farm operator. The individual farm operator must be aware of the macro scale and how that relates to his business. However, after that initial awareness and judgement of potential, the individual farm operator usually has little influence on the macro scale.

The following paragraphs outline some of the critical elements in analyzing the feasibility of an agricultural enterprise whether viewed from the perspective of a farm family or a microstate.

Current Industry Status. Industry status includes such elements as the history of the enterprise, the primary location(s) of production and marketing, the recent supply and demand relations, anticipated supply and demand, and inherent risks. Limitations on the production and marketing of a product that are imposed by governmental regulations, trade barriers, infrastructure and communication avenues become apparent when the status of the industry is examined. Changes in supply and demand over the last few years can give a basis for predicting future supply and demand. Product demand can be altered by population changes in the market area, governmental restrictions and other market characteristics. The demand for some products is difficult to understand or predict. Staple goods that are used by most consumers possess inherently lower risks in terms of rapid changes in product demand.

Geographic Suitability. The suitability of conditions in a geographic area must be reviewed as alternative enterprises are considered. The geographic suitability can be limited by maximum or minimum temperatures, rainfall distribution, soil and land characteristics, harvesting/packaging/storage constraints and the distance/ease/cost of transport to markets. Water requirements of each enterprise should be compared to rainfall distribution and the quality and quantity of supplemental water.

Market Characteristics. A thorough understanding of the market system through which the products of a particular enterprise can be sold is required before the market potential can be determined. The requirements of the market in terms of product quality and quantity, packaging and timing of demand/market access must be analyzed. The infrastructure must be in place to provide appropriate and timely transportation and storage. This is especially critical when production is destined for export markets.

Production System(s) Description. General knowledge of successful production systems for a product is required at this stage of the enterprise analysis process. The critical factors in the production system should be determined. For example, if the market demands a particular variety of vegetable, the performance of that variety in the planned location(s) must be answered. The general requirements should be reviewed in terms of inputs and product flow and the minimum business volume necessary to make a reasonable return on investments.

Labor Requirements. The nature of labor required for a particular enterprise may determine the suitability of that enterprise for a region or an individual business. The majority of agricultural enterprises generally considered "alternative" enterprises are labor intensive. The skills required as well as the time frame in which most of the labor is needed must be compared to the available labor supply. In every enterprise some operations require more labor than others. Therefore, labor requirements will differ through the production/marketing cycle.

Relative Management Intensity. Some enterprises require only seasonal or occasional care after establishment while others require daily, almost hourly, monitoring. However, most of the enterprises considered alternatives for the region generally require intensive management. Knowledge of management skills and time requirements must be considered during the analysis and planning phases.
Special Facility Requirements. The need for capital intensive items such as building, landform modifications, irrigation water and water treatment capabilities should be considered. Some required facilities may be designed for specialized operations and can not serve multiple, general purpose needs.

Capital Requirements. The capital needed to purchase necessary equipment and for start-up costs are seldom overlooked in the planning of an agricultural enterprise. However, the investment necessary to cover the required cash flow until the enterprise is established is often overlooked or underestimated. A budget should be developed to delineate variable operation costs, fixed cost, cash flow and enterprise financing requirements.

Sources of Information/Support. It is essential to identify organizations and individuals that can provide technical and managerial support for an enterprise. There will be unexpected challenges, opportunities and problems in the development of alternative agricultural enterprises. When viewed from the microstate frame of reference, it is essential that the information/support be developed through an integrated team effort with a well-defined delivery mechanism. The enterprise manager must have a first-line contact but must be aware of the primary sources of information. Cooperative Extension has successfully served the role of integrating information from different sources and delivering decision aids to the clientele in many instances.

MULTIDISCIPLINARY/INTERAGENCY COOPERATION

When economic feasibility of an agricultural enterprise is considered by a macrostate or microstate, critical factors related to the macro scale must be considered. Modification in the macro economic or political environment generally requires government involvement. Involvement may be directed toward changing the environment through education, research, coordination, policy alteration and/or promotion. History has shown that governments are often the change agent for critical macro-elements. However, the records also show that the lack of integration in governmental agencies, universities and the private sector can undermine the process in one or more of the stages that Quiros (1988) presented. The process of analyzing, planning and implementing an alternative agricultural enterprise is complex, with many integrated functions that require simultaneous attention. Multidisciplinary/interagency involvement, in cooperation with the private sector, is required for program success in Caribbean agriculture diversification.

How can the expertise and responsibilities of various individuals in the academic community and local, national, and international agencies be integrated and focused on holistic problems and opportunities? Some have suggested that team efforts can be achieved in institutions and agencies by one of three basic methods: 1) creation of a professional, social and psychological environment that stimulates and encourages multidisciplinary and interagency teams (I like you. You like me. We have complementary skills and training. We can work together to accomplish more than if we work individually.), 2) provide incentives for team efforts (Often referred to as the "carrot" method.), and 3) force individuals into a team with levels of penalty and reward to each team member based on the accomplishments of the team. It seems that the most efficient and productive circumstances would combine the first two methods. The desire for and commitment to cooperation within and between agencies and institutions must be visually demonstrated by the leadership of the organizations. This means up-front commitment to the team concept and the plan-of-action by the decision-makers of the organizations. Team members must feel a degree of ownership of the project. One way to accomplish this is through rotation of team leadership on a periodic basis to illustrate the contributions of each team member. This can be especially
worthwhile when the team consists of individuals from the same organization.

The need for interagency/multidiscipline/private sector cooperation can be illustrated by considering the complementary potentials and common problems of tourism and agriculture in the Caribbean Basin. Tourism sells the tropical environment: the water, the sun and the fun. Visions of the tropical paradise with the crystal clear water, lush tropical foliage and flowers, and the delicacies of tropical fruits and vegetables are used in advertisements and are among the elements that stimulate return visits. Agriculture can provide field-fresh fruits and vegetables, cut flowers for decorating the hotels and cottages, and foliage and flowering plants for an appealing and functional landscape. The tourist service industry can capitalize on these to increase spending on each visit and the potential for return visits. Mutually beneficial cooperation between the tourism and agricultural sectors is far below the potential. This potential may not be realized because of the lack of definitive evidence of the cost to benefit ratio of agricultural products to tourism profitability, the lack of education of the tourism industry leaders to the potential benefits, and the lack of organization within the agricultural sector to promote, plan, produce and market the appropriate items.

In considering the interrelations between tourism and agriculture, think about what government agencies and research and education institutions are involved. There is probably a governmental office on tourism and a department or ministry of agriculture. There is university research and extension capabilities in agriculture, sociology, marketing and trade. In most cases avenues for communication between these service institutions do not exist. Coordination of research, education and promotion between these professionals would reap great dividends.

A more detailed discussion of the linkage between agriculture and visitor industries is presented by Bowen (1988) in the proceedings of the workshop referenced in the introduction of this paper. The Dole Pineapple Pavilion in Hawaii is one example of direct involvement of agriculture production in tourism.

The government of Guam has involved various agencies in the coordination of agricultural development and tourism (Bradley, 1988). There has been limited success because cooperation was limited. Bradley indicated that dedication in the private and public sectors was a requirement for success. The skills and dedication of individual business managers were also identified as critical factors.

Large companies such as AMFAC-Agribusiness can also play a major role in development of alternative agricultural enterprises (Teranishi, 1988). Companies that are heavily involved in only one agriculture commodity such as sugar are seeking ways to diversify. AMFAC has established a partnership with farmers in Hawaii to integrate the production, processing and marketing of alternative agricultural products such as papaya, macadamia nut, coffee, cacao and guava.

ALTERNATIVE AGRICULTURAL ENTERPRISES FOR CONSIDERATION

The first consideration regarding the establishment of alternative agriculture is "production planning must be market driven." The market system and market potential must be characterized before production is planned. Sometimes the market system does not exist for minor crops but could be created. To test the hypothesis regarding the potential for a new marketing system, sample product must be available. Sample product can come from on-site, small-scale plots or could even be purchased from other sources and marketed through the new system. Therefore, more effort may be required in market development than in market assessment or production planning for alternative agricultural products.

When considering the market potential for a product you must evaluate the effect of additional production on market demand and price. Production can be targeted for local consumption, for transport within the Caribbean or for export to Europe, North America, etc. There could be great value in coordination and
cooperation among islands, considering each island's competitive advantage. Just because one island is successful in producing and marketing a particular crop does not indicate that the crop would be successful on an additional island. Such cooperation and coordination within the region is difficult, considering the independence of the microstates, but the rewards could be worth the effort.

Below is a brief review of some of the agricultural enterprises that have potential for commercial production or further development in the Caribbean. A more detailed discussion of each can be found in the workshop proceedings referenced in the introduction.

Tropical Fruits. Although some traditional fruit, such as pineapple and banana, offer some additional market potential, non-traditional fruits offer significant potential for commercial production (Marte, 1988). Mango, breadfruit and carambola are three fruits with great market potential. Cashew, papaya, guava, passion fruit, soursop, W.I. cherry, litchi and mangosteen offer potential. Most of the countries in the region have the climate to produce these crops. Promotion of the products is essential to increase demand among the populations outside the ethnic groups. Major constraints to increased production of tropical fruits in the Caribbean Basin include the generation and transfer of technology, capital, technical and market information, transportation, experienced and skilled personnel, pests and diseases, seasonality of production and competition from other tropical regions.

Vegetables. Key elements in the successful production and marketing of vegetables within the Caribbean Basin include pest management, adapted cultivars, appropriate packaging and storage. Agriculture product import policies of the larger U. S. and Canada are another limitation to production of vegetables for export.

Processing and other Value-Added Industries. The problems with import restriction on fresh fruits and vegetables could be overcome by processing the products in the Caribbean Basin for export. The development of processing enterprises can link small farmers, sources of capital and technical knowledge (Bates, 1988). In many instances, significant research on processing methods and consumer tastes and preferences would be required in order to reach the potential for processing fruits and vegetables. Other constraints include government economic policies, food standards and regulations, management and labor skills, producer skills and performance, available technology, financing, and knowledge of marketing opportunities.

Ornamentals. Ornamental plants may be produced for use in landscape development or for sale to tourists for enjoyment in their rooms. Unusual or distinctly tropical cut flowers could be marketed to visitors in many areas of the Caribbean. This may be an important avenue for marketing new plants or traditional plants in new packages. Such local marketing may enhance an export market for plants that visitors enjoyed in the Caribbean while on vacation. Although there is a direct link between tourism and the potential increased demand for landscape plants, potted flowering plants, cut foliage, and cut flowers for local consumption, there is also potential for the production of ornamental crops for export. The competition between islands in the Caribbean and with established production in Central America should be studied in detail before planning production for export markets. However, many feel there is potential for export of specialty floral items from the Caribbean Basin.

Landscaping/Environment Enhancement. The potential for increased activity in the landscape service industries depends on the increased realization of the natural linkage between enhanced tropical landscapes and tourism. This service industry is obviously linked to the production of foliage and flowering plants for the landscape. However, great benefits can be realized from the appropriate maintenance of the current landscapes. Attention to detailed maintenance and enhancement of the environment
through the continuous use of flowering plants will increase the enjoyment of the tourist and result in repeat visits and possibly a higher level of spending per visit. Most Caribbean islands do not capitalize on this extremely valuable element of the tropical environment.

Livestock. Cattle, sheep, goats, poultry, pigs and rabbits are currently produced in the region. The amount of usable land limits the potential for production of large animals. A majority of the animal or livestock systems in the Caribbean Basin are integrated with cropping systems. More integration of these two systems should be encouraged. The cropping systems provide a wide range of by-products as animal feed and animal systems provide residual fertility, traction and cartage for sustainable cropping systems.

Aquaculture. Aquaculture is a nontraditional enterprise gaining economic importance on several of the larger Caribbean islands. Small export markets are developing for tilapia and freshwater prawns but most production is consumed locally since local demand for seafood exceeds the supply.

The technology for aquaculture has been developed in other regions and adapted to conditions in the Caribbean. Large islands, with their abundant freshwater supplies and suitable coastal land, have great potential for large scale production. The limited freshwater supplies of smaller islands necessitate the development of culture systems that conserve and reuse water.

Mariculture lags far behind aquaculture and remains undeveloped in the Caribbean. This situation may change soon with the establishment of several shrimp farms. Shrimp farming technology must be adapted to Caribbean conditions and should target local markets.

More basic research is required for the culture of marine finfish, shellfish, other crustaceans, and seaweeds. There is great potential for cultured seafood in the Caribbean with its unlimited clean water, nearly continuous sunshine, and warm temperatures. However, mariculture will continue to lag behind its potential if research funding is not increased. Fresh seafood is part of the lure of the Caribbean for tourists. Unfortunately, Caribbean tourists are increasingly consuming frozen, imported seafood that is often poor quality.

CONCLUSIONS

Successful analysis, planning, promotion and/or implementation of alternative agricultural enterprises in the Caribbean Basin must occur through a systems approach. All the economic, social, production and marketing facets of each enterprise must be considered. Such a systems approach will most often require a multidisciplinary and/or interagency team of professionals from academia, government, and the private sector. A proper environment for cooperation must be developed in order for a team to realize maximum success. The team members must have a degree of ownership to the project and be justly rewarded for their contributions.

Several enterprises offer significant potential for production and marketing for local consumption. Interisland cooperation in the establishment of alternative enterprises will increase the likelihood of success. A few alternative agricultural enterprises offer potential for the export market.

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Dinner Remarks

Honorable Alexander A. Farrelly

I am pleased to be here to commend you for your efforts to foster better and stronger ties between islands and nations of the Caribbean.

During my state of the territory address a few weeks ago, I pledged to continue to forge strong alliances with our neighbors throughout the Eastern Caribbean. In 1990, we entered into consultations with the department of state to obtain the delegation of authority to seek associate membership in the organization of Eastern Caribbean states.

There is a reason for that. An old Chinese philosophy says, give a man a fish and he will eat for a day, but teach him how to fish and he will eat for a lifetime.

If the Caribbean region is to become more self-supportive, it must continuously teach its residents updated techniques of farming, fishing and other trades that are pertinent to the growth of the region.

Too often we import produce and vegetables when we have the land, ideal weather condition, and certainly the manpower who is willing to raise these products. The time has come when we must use our own resources to fulfill our needs.

Items grown in this region result in fresher products, local circulation of money, entrepreneurship and the overall economic development of the Caribbean region.

The universities in the Caribbean must play a key role in developing good farming techniques and providing competitive business and marketing programs so that our youngsters can successfully put those techniques to work.

We must provide vocational training to allow our youngsters to be the primary recipients of construction and other jobs in our area. In this regard, I am proud of this administration’s success in moving ahead with the long awaited Hess Vocational School and I look forward to its completion in 1992.

As we enter the final decade of the 20th century, where the consolidation of economic blocks throughout the world is becoming a reality, it is important that we increase our regional linkages so that we can be at the cutting edge of an ever changing world economy.

We in the Caribbean must forge greater unity in order to develop our region. Cooperation with one another should lead the Caribbean as a region to become an economic and political force the rest of the world will recognize.

Several factors are in our favor. The Caribbean is more or less inhabited by people from the same background and culture. Religious differences, as we have seen in the Middle East, do not prevent unity among ourselves.

So, while it is commendable to help each other in time of crisis, in noncrisis times we must share technologies to enable us to be self-sufficient.

*Governor, U.S. Virgin Islands.*
Natural Resources and Development:
Overview and Perspective on the U.S. Caribbean

Lawrence W. Libby*

INTRODUCTION

There can be little doubt that the place we call the U.S. Caribbean is known and defined by the bundle of natural resources arranged so attractively for human habitation and activity. A major aspect of the region's character, its very identity, is its resource base. The same is true of other places -- the Pacific Northwest, the Great Lakes States, the Sun Belt, the Grain Belt or Breadbasket, all resource-linked shorthand for the people and place. Natural resources became the physical setting for human activity. They establish opportunity and limits for "the games people play." Resources represent flows of commodities and services that are the substance of an economic system and basis for economic growth. Some of those resource products are consumed directly -- fuel wood, minerals, fish or industrial sand. In most cases, however, natural resources are inputs to a production process resulting in something that people will pay for, generating economic activity. Some resource services are delivered on-site, packaged attractively with value-adding ancillary services for the consumer. Examples are the beaches, reefs and breezy seas of the coastal area and mountains of the hinterlands. Some resource attributes of a place have value just because they are there -- they allow all of us to dream about them, plan to experience them some day, whether or not we ever do. I would fight to protect the quality of the marlin fishery off Key West or the deep water reef environment, even though my chances of deriving direct enjoyment from those resources are slim, I fear. The best part of it is that my vicarious enjoyment of the natural resource endowment does not diminish its availability to you. It is when we both decide to exercise that option that we may get in each other's way.

Natural resources are arguably the most critical capital asset of a state or nation. Yet our history of reinvestment in that asset base is dismal. Just as plant and equipment deteriorate with use, so too the natural resource stock is damaged by use. We seem to understand the need to repair and improve an auto assembly line but assume the resource asset can be abused forever (see Nothdurft). Economic "progress" in the U.S. is gauged by Gross National Product, a measure of what flows through the system. There is no logical spot in that calculation for quality of the natural resource asset. Progress means land moves to a "higher and better" use and income is squeezed from a resource stock, giving a clear normative tone to a market as an allocator among users and over time. If it sells it must be good! But resource markets are human institutions, subject to thoughtful modification through public policy.

Purpose of this paper is to clarify the institutional linkages between natural resources and economic change. It is my basic contention that any declines in quality of the capital asset or any unexploited opportunities for resource based economic growth are institutional matters, a consequence of the rules by which we run our society. We know how to protect or improve land and water quality. We know many of the possibilities for development. The technologies are there. Our failure to accomplish either cannot be attributed entirely to greedy resource owners, uninspired political leaders or even an uncaring slothful electorate. We scientists are often frustrated by the reluctance of common

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folk to do what we feel they should. Their caution is predictable, frequently well advised. The point is that all public and private choices, even those by all-knowing scientists, are made in the context of rules and incentives that comprise our institutional framework. I will focus on a particular set of natural resource issues affecting economic change in the U.S. Caribbean and then conclude with recommendations for research and extension work.

**SUSTAINABILITY**

The development community, including donor agencies, is giving increasing attention to the concept of sustainability as a perspective or point of view if not a tightly defined decision rule for the development process (see Brown, et al). The concept drew little attention in economic development literature until quite recently (for example, see Clawson).

While the term "sustainability" may be overused these days, it does seem to capture the concern of resource quality and availability over time. There are both biological and economic dimensions to sustainability, defined in Oxford English Dictionary as "capable of being upheld, maintainable." As a guide to public decisions, sustainability suggests rules and policies that shift discretion toward the future, deliberately protecting options for future use of a certain resource. It also suggests current investment in the natural resource asset, spending something today to maintain the quality and utility of that asset in a future time. In economic terms sustainability implies a social discount rate on future returns from a resource that is less than the market rate on other investments. We are willing to forego some level of economic returns from the land, coastal region, fisheries or forests today to protect the option of returns to those resources in the future. There is risk in such behavior. It could be that evidence of impending physical or economic scarcity of a particular resource would spur new technologies that would mitigate scarcity — opportunities for different fish species, new fast growing trees, even artificial systems that attract tourists. Human perceptions and preferences are shaped by what is available. A whole generation of travelers thinks Florida is Mickey Mouse and tour boats. To many Washingtonians, a wilderness experience is a trip to Rock Creek Park. Who are we to impose our preference for untrammeled coastlines or vast ocean fisheries on the consumers and dreamers of the next century? Having said that, I will reassert my personal belief that sustainability is an important decision rule, to enable future resource users to choose what remains of the natural resource systems I prefer. That may sound selfish, but organized selfishness is the essence of politics.

There is a distributional aspect to sustainability policies as well. Those who are well off are more able to forego current income to improve or sustain natural resource quality than are the poor. Those in need today are less worried about protecting options for future use. The challenge for policy makers is to reconcile the two — provide current economic opportunity that does not irreversibly damage the resource system for the future.

**SUSTAINABLE TOURISM**

Tourism has long been a significant component of the regional economy. The "northern tier" islands, particularly the U.S. Caribbean, have been at it the longest with increasing activity spreading into the eastern Caribbean. The economic multiplier effect of tourist expenditures was estimated more than 20 years ago as 2.3 to 3.0, with 70% of all expenditures going for food and accommodations (Zinder, 1969). Interestingly, this assessment of the future of Caribbean tourism gave nearly full attention to tourism as a growth sector, calling for more investment to attract more visitors and make their stay more pleasant. Long-term recommendations dealt with need for financial and technical assistance for entrepreneurs, more promotion and advertising, better roads and hotels, more congeniality among the hosts. The only reference to protecting natural areas
suggested that primary benefit would be to the indigenous population as part of their island heritage (Zinder, p. 197). Current interest in sustainability of the natural resource base of island tourism emphasizes carrying capacity, preservation of selected resource systems, even discouraging or limiting tourist use of those resources. Both then and now, however, focus is on the willingness of people to pay for the opportunity to experience the island environment and culture. Tourism means revenue, jobs, opportunities for those on the supply side. The challenge is to accommodate effective demand while not destroying the quality being sought.

Environmental Impacts

The costs of tourism were apparently less evident two decades ago than they are today. Impacts include loss of useable fresh water, reduction of bio-diversity, pollution damage to bays, coastal estuaries and reef environments, all results of over-use or misuse. Carrying capacity in that context "refers to a certain threshold level of tourist activity beyond which there will occur physical deterioration..." (Clark, p. 8). There is also a congestion factor, a point at which marginal utility of the tourist experience has declined below the cost of achieving that experience. The concept has been extended to the social environment as well, where visitors and local people get in each other’s way, to the detriment of both (Clark). Insensitive visitors who feel that having paid for an opportunity removes the obligation to respect other people and hostile locals who would like the visitor to leave his contribution on the stump and disappear are an unfortunate mix. In the absence of thoughtful planning and management, a tourism opportunity follows a predictable sequence of events toward self-destruction, beginning with exotic natural beauty that only the wealthy can afford, ending with social and physical deterioration and a disillusioned local populace.

The social impact of tourism growth depends in part on the level of capital intensity. When huge investments are required, greatest returns will likely be to owner of capital whether indigenous or foreign. Local people may lose access to the coastal setting that has been their home. Less intensive development may be less disruptive, more oriented toward the natural systems or cultural features of the island. It will also mean fewer jobs.

Public Actions

Short of specific policy recommendations for sustainable tourism, a few general objectives may be offered. Perhaps these are in place already, or have been tried and found to be impossible. Naivete is the privilege of the visiting "expert."

First, tourism obviously needs to be analyzed and developed in a regional context, not island by island. Multi-jurisdictional collaboration is never easy -- the historical, national and cultural differences among island-nations of the Caribbean would seem to present a special challenge. But it is certainly true that tourism is a regional phenomenon; travel among island destinations is often part of the experience. Opportunities for region-wide management of solid waste and water supply, consistency of land use regulations, water quality protection, shoreline and reef protections should be investigated. A regional management or at least advisory unit is needed (Jackson).

Secondly, a consistent system of fees and taxes should be sought to assure that tourists pay at least part of the cost they impose on the environment and local infrastructure. Differences among islands could distort tourist flows.

Thirdly, as with all aspects of economic development in the U.S. Caribbean, a thorough program of non-formal education is advisable, to help all understand the economic costs and returns of tourism and its environmental and social impacts as well.
SUSTAINABLE FISHERIES

Fisheries are an extractive natural resource industry subject both to depletion and congestion problems. Fisheries are a fugitive renewable resource, a classic common property resource (like groundwater) in which all with access to it are inclined to take all they can. There is no incentive for one user to forego use, since others will merely take that supply, eliminating any conservation motive for an individual on his own. Reproduction rates and the biological conditions required for reproduction vary with species and must be part of a sustainable fishery program. Access to the fishery may be managed in various ways, the substance of fishery policy.

The fishery of the Caribbean region is limited by geology. The region lacks the extensive, shallow continental shelf that characterizes major fishing grounds of the North Atlantic. Water temperatures are more stable, there is less thermal mixing, less nutrient to support fish. Most prolific sources are the near shore lobster, conch and reef species that may already experience depletion in some areas. Deep water species are less exploited, though more expensive to reach. Migratory species are important, giving a seasonal character to the sector (Chakalall). Fisheries are important both commercially, for local markets, and for sport as a component of the tourist sector. The commercial sector is primarily small scale, individual families gaining livelihood from the sea. There are also small fleets of boats under one management, but gear is simple and inexpensive, not approaching operations in the North Atlantic.

Fisheries are important to the economic future of the Caribbean regional, and to the U.S. Caribbean in particular. Chakalall, FAO Regional Fisheries Officer based in Trinidad, has asserted that "...development of small scale fisheries is the best hope for sustained and stable development in the region" (p.22). Since that potential will require public action, a list of policy instruments developed by Chakalall is attached as Appendix 1.

Management

The 1982 Law of the Sea Convention established both the framework and obligation for nations to consider rules governing their fishery within 200 nautical miles of the coast. Perhaps most important to sustainability is a set of rules limiting access to the fishery, or directing that access toward areas and species in least immediate danger of depletion. The most common access restriction is a requirement of a license for the fisherman, the vessel, gear or season. Licenses may be rationed by absolute number and by a price that in some sense reflects both economic return and social cost of the fishing event. Licenses or catch quotas may be transferrable, creating a market not unlike that for taxi-cab medallions in New York City. Access to non-fugitive species like clams and oysters may be limited by land use regulations as has been done along the U.S. east coast. Then there are the informal restrictions. Access to the Maine lobster fishery is controlled by a complex network of "cultural barriers" that exclude anyone but the locals who have fished the area for generations. The unwary outsider who wants to "run a few traps" will be subject to all sorts of unfortunate calamities.

In his analysis of more than thirty fishery access schemes from around the world, Townsend (1990) concluded that degree of restriction does affect success of the management program by protecting economically viable supply. Temporary moratoria or phased limits have little lasting impact. Strict limits on gear and catch technology shift the cost of protection to the fishermen. Multi-species and migratory fisheries, such as that in the Caribbean region, are more difficult to manage than a less complex fishery.

Suggested Priorities for a Sustainable Caribbean Fishery

Observations here suggest general direction rather than specific instruments, the latter clearly
the province of those with more experience in the region.

First, as with tourism, any scheme to encourage long term economic viability of the Caribbean fishery as a component of regional economic improvement should be multi-national, multi-island, multi-cultural, -- whatever the appropriate adjective. There must be cooperation, trust and joint action to avoid a plethora of inconsistent, ineffective restrictions. Fish do not honor national boundaries. More specific targeted restrictions for species that concentrate in certain areas will be needed but should be part of a regional scheme.

Secondly, there is need for attention to the infrastructure of processing and marketing fish products. Facilities for cooling, canning, preparing fish for human consumption are inadequate in many parts of the region. A system of grades and standards supported by a reasonable price structure -- a marketing order for Caribbean fish -- would be helpful as well. There may be opportunities for animal feed or fish meal that could be developed from fish offal or less desirable species with adequate incentives.

Thirdly, a more complete data system on catch rate by species, fishing effort, cost of production, sales patterns, consumer demand and seasonal price fluctuations is needed. Management of any resource depends on quality of information.

Fourth, opportunities for mariculture could stand additional study and communication. Oyster, shrimp and lobster are the most obvious, but investments in other species might return dividends as well. Research by fish biologists and food scientists would suggest the technical possibilities, with economists and sociologists helping decide what will really work and be acceptable.

Fifth, attention to coastal water pollution is essential for a sustained fishery. Loss of mangrove and reef habitat will frustrate the most impressive management scheme. Thus a nation's participation in a multi-island fishery program must entail local protection of water quality. A related concern is multiple use of the harvest and coastal access. If tourism and sports fishing block the coastline, and they will if ability to pay per unit of coastline is the only allocation rule, commercial fisheries will not survive.

Finally, fishery management rules must be acceptable to the people. The policies and restrictions that no one understands or supports are doomed to failure. This fundamental precept that good policy is acceptable policy holds in the area of sustainable fisheries as in other categories of public action.

I turn now to discussion of research and extension priorities related to a sustainable link between natural resources and economic development in the U.S. Caribbean.

RESEARCH NEEDS

Thoughtful action toward sustainable development in the U.S. Caribbean depends upon a reliable information base. Some of that already exists, of course -- purpose here is to identify areas for increased future attention. Order should not imply priority. Emphasis is on the natural resource linkages to development.

Biological

First, better understanding of the relationships between biological conditions and utility of the natural systems is needed. Effect of water quality variations on productivity of the fishery and a reef or mangrove eco-system will establish bases for any changes in access for those resources. We need to better understand the physical and biological consequences of measured changes in water chemistry. Some of this is fairly basic research, not focused on immediate problems. But applied, problem solving work can be built upon such a data base.

Human actions that tend to alter quality of a natural eco-system need analysis as well. That is, what natural resource use patterns tend to
regionalism and inter-dependence are abstract but can be given specific content for citizens, local officials and all policy-relevant clientele. Building a sensitivity to those ideas and their meaning for day-to-day activity should be a major goal of extension programming. Regionalism need not ignore unique cultural and historic differences among the islands. It does not mean homogeneity, only mutual dependence. Data on flows of goods and services among islands, to and from the mainland and major origins of the tourist industry will clarify those linkages.

Secondly, another abstract concept needing attention in a policy education framework is the idea of the public interest. It is a notion poorly developed in most policy education efforts in the U.S. There is no set of definitions to memorize or single answer conclusions to be communicated, just the concepts surrounding relationships between individual right and community responsibility in a complex society. Particularly important to natural resource oriented development is the time dimension of the public interest. Collective time preferences of voters and policy participants will influence choices on quality and sustainability of natural systems. Sustainability appears to be essential to the long term productivity of the resource industries of the islands -- tourism, fisheries, agriculture. A public entity at some level has the responsibility to consider the long run and develop rules on short run private behavior consistent with long term public interest. Acceptance of any present limits in the interest of future possibilities requires general understanding of what is at stake. Without general acceptance and support, public action for the future cannot succeed. Discussion of alternative futures and their likely consequences can help citizens develop informed time preference. The distributional implication of a low implicit discount rate will become apparent and should be acknowledged by the educator.

The third component of extension programming dealing with natural resource linkages to economic change deals with the content of those links -- the facts of the matter. Information is needed on returns to fishing and tourism over time, catch rates and visitation rates, evidence of consumer preferences. Included would be awareness of the issues associated with various patterns of resource use. An understanding of the institutional facts must be a part of this, the collection of regulations, incentives, private property rules, implications of relevant case law, local or national policy statements and agencies that establish the context for resource management. Also included would be discussion of the relevant interest group structure, those who are organized to influence decisions in response to the distributional character of those actions.

Finally, extension programming should include a segment on policy options and their implications. Educators can draw from institutional experience elsewhere to help policy makers and voters anticipate the consequences of various public action. Continuation or modification of the Caribbean Basin Initiative, for example, could affect potential markets for island agriculture or fisheries. U.S. policies focused on improving economic conditions in the islands may help some interests and hurt others. The issue of statehood is on the minds of Puerto Ricans and will influence other parts of the U.S. Caribbean as well as the rest of the region. Economic implications, beyond the political, could be identified. Various free trade initiatives -- GATT and hemispheric agreements -- would affect production and marketing patterns in the region. If certain natural resource industries gain an advantage through expanded markets, competition for those resources could be altered, perhaps to the detriment of sustainable tourism.

Alternatives for limiting access to the fishery need explanation to facilitate informed choice. Equipment limits may raise the cost, leading to a price increase that will affect consumption. Perhaps such limits would alter catch rates among species with further implications for sustainability.
At a more local level, use restrictions on land and shoreline may be accomplished in various ways, each with consequences to be clarified for citizens and policy makers.

CONCLUSIONS

Natural resources are and will always be fundamental to the economies, the very identity, of the U.S. Caribbean. Yet these resources are vulnerable, subject to misuse and under-investment that will constrain choices for citizens of the 21st Century. Defining and protecting future options through actions taken or avoided today are difficult to accomplish. People need to understand the practical relevance of sustainable natural resource systems, what they may imply in foregone opportunity in the present to retain a defined potential for the future. These are difficult matters. The costs are now and painful; the benefits are possible and distributed to people not here to pay the price. The challenge for natural resource scientists and educators from all relevant disciplines is great indeed.

REFERENCES


Brown, Becky, Mark Hanson, Diana Liverman, Robert Merrideth "Global Sustainability: Toward Definition" Environmental Management 11:6, pp. 713-719.


Appendix I
(taken directly from Chakalall, pp. 32-33)

List of Policy Instruments for Fisheries Management and Development in the WECAFC Region

1. Direct Public Involvement and Support

   Regional Cooperation
   Promotion of Small-Scale Fisheries
   State Fishing Cooperation (Processing/Marketing)
   Access Rights to Foreign Fishing Vessels
   Joint Venture and Other Arrangements
   Promotion of Fisheries Management Organizations - Fisheries Division,
   Community Based Management and Advisory Bodies
   Direct Provision of Fishery Inputs through Projects, Grants, Loans, etc.
   Infrastructure (Ice Plants, Processing Plants, Wharfs, Marketing Facilities, etc.)
   Critical habitat/Ecosystem Preservation

2. Regulations and Enforcement

   Price Control
   Import Quotas
   Export Embargoes
   Price Stabilization
   Quality Standards and Grades
   Fisheries Management Regulations
   Licensing Schemes
   Access Tax
   Collective Quotas
   Individual Quotas
   Input Restriction (Mesh Size, Gear Ban, Etc.)
   Closed Seasons

3. Incentives

   Fiscal Incentives
   Duties on Physical Inputs
   Import/Export Duties on Fishery Products
   Taxes - Income, Corporate
Non Fiscal Incentives
Credit
Subsidy in Inputs
Price Support (Guaranteed Minimum Price)

Indirect Incentives
Market Information
Promotion of Fishermen Organizations (Co-operatives Associations)
Product Development and Promotion
Promotion of New Technologies
Human Resource Development
- Vocational and Technical Training
- Extension and Training
Research
The Natural Resource Base for Food Systems and Economic Development in the U.S. Caribbean

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INTRODUCTION

The major food systems in the U.S. Caribbean are associated with the agriculture, agroforestry, livestock and fisheries sectors of the economy. Basically the products of these endeavors are for local consumption, and their input into the local economy is small relative to tourism and industry. The food requirements of the societies of Puerto Rico and the U.S. Virgin Islands far exceed the local supply, with the exception of a few items like coffee in Puerto Rico and milk in the USVI. Hence, the shortfall is met by importation of goods from all over the world, but mainly the mainland U.S. Figures of up to 90% for importation of food have been mentioned for the U.S. Virgin Islands. Although Puerto Rico has the ability to be self reliant in many areas of food production, a number of factors, including changing markets, natural disasters and shifts in economic activity, have combined to limit this potential.

Over the past three decades, the economic structure of each of the islands has been transformed to the point that tourism and industry have increasingly larger roles (and possibly impact), and food production activities have been reduced significantly. Food production and tourism depend on natural resource systems that require balance and/or maintenance of particular characteristics in order to sustain economic yields. Additionally, an organized support system or infrastructure is necessary to link the biological component or product with societal use on an economically viable scale.

This paper briefly addresses the local natural resource base underlying the agriculture/ agroforestry and fisheries sectors of the food production system in the U.S. Caribbean. The impact of these systems and general economic development on the resource base will also be factored into the discussion.

AGRICULTURE/AGROFORESTRY

The agricultural sector of Puerto Rico produces major field crops of sugar and tobacco along with starchy vegetables (sweet potato, bananas), fruits (mango, pineapple, avocado) and other vegetables (tomato, legumes, peppers) in the southern coastal plains of the island. In the early 1970s approximately 50,000 acres of sugarcane were produced using irrigation on the south coast. Presently sugarcane acreage has declined greatly, and thousands of acres that were irrigated in the past are now removed from agricultural production.

In contrast agroforestry in Puerto Rico is best suited to the humid mountain region of the island. The mountain area hosts approximately 20,000 farmers planting tree crops of coffee, citrus and plantains. Agroforestry involves planting trees in a watershed that may or may not impact the food crop, but in either case maintains slopes in permanent production. This type of agriculture may also be seen as a method to rehabilitate previously deforested lands. Puerto Rico’s coffee forests have been categorized as an intermediate agroforestry system with small- to medium-sized land

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holdings, relatively fertile soils, and good communication and market infrastructure (OTA, 1984).

The U.S. Virgin Islands agricultural sector is small, consisting of about 300 small farms mostly located on St. Croix. Steep slopes and extensive urban development severely limit growth of agriculture on St. Thomas, while the combination of a large national park and urban holdings cover the island of St. John. When the local economy changed from agriculture based on sugarcane to tourism and industry, fruit production became the dominant crop farming activity (Dominique, 1989). The farms on St. Croix are characterized as commerical (less than 10 acres in size) or backyard plots. In addition to producing crops of avocado, banana, lime and mango, farmers on St. Croix grow sugarcane, corn, legumes, cassava, sweet potatoes, taniers, yams, carrots, okras, eggplant, tomatoes and celery. The food produced is for local consumption, and no effective marketing infrastructure is currently in place (Dominique, 1989).

In the USVI, agroforestry systems are traditionally subsistence level production oriented to the planting of staples and raising livestock. In the past, this small scale production managed by small farm families has also included utilization of forest species for charcoal, firewood, and construction. The only documented exception was the bay rum plantations in use in 1930-40 (Childers et al., 1948). Typically subsistence agroforestry is conducted in backyard gardens, supporting a mixture of perennial fruit tree crops (e.g. avocado, soursop, citrus, mango) interplanted with short-term food crops (e.g. corn, okra, pigeon peas, beans). On St. Thomas where the flat lands are filled by urbanization, a specialized agroforestry system has been developed by the French farmers for farming on the steep slopes. Herbs and spices are grown clean-tilled on narrow irrigated rock terraces along with fruit trees that serve as windbreaks and field boundaries (Matuszak, 1984). Contour rows of closely spaced, fast-growing trees are used to help control erosion and construct the terraces.

The two areas of significant agricultural activity in the U.S. Caribbean, the southern plains of Puerto Rico and St. Croix, are characterized as semi-arid lands. The annual rainfall averages 30-50 inches in contrast to pan evaporation of approximately 80 inches per year. Consequently economic production has been heavily dependent on the development of suitable irrigation methods to meet water needs of crops. Actually, significant agricultural activity in the semi-arid areas of Puerto Rico and St. Croix requires a crop management system involving programs for soil fertility, pest control and irrigation technology to address the limitations of the major components of the natural resource base, soil and water. Limited high quality water resources and infertile soils tend to characterize the agricultural areas of Puerto Rico and the USVI that do not have steep, erosion prone slopes.

AGRICULTURAL NATURAL RESOURCE BASE: SOIL

Soil can be defined as the surface layer of earth containing organic matter and capable of supporting vegetation. The depth, texture and ability of this particulate matter to supply nutrients determine its value for agriculture. The specific properties of soil are due to the integrated effect of parent material, climate, living matter and topography interacting over time.

The clay loam soils of St. Croix often have an alkaline subsoil of soft marl or limestone due to their parent material resulting from uplifted coral and sediments from the sea. Calcium tends to dominate these soil complexes, resulting in high calcium to magnesium ratios that can retard plant growth. Low organic matter content produces soils with low levels of the critical macronutrients nitrogen, phosphorus and sulfur. The high pH of the soil increases the tendency to make micronutrients like iron, zinc and magnesium insoluble and unavailable to the plant. To compound the problems of infertility, the clay component of these soils contributes to
physical properties that make them crack when dry and expand when wet. The resulting clumping and stickiness cause drainage problems and compaction of soil aeration pores (Stearman, 1984).

Most of the soils of the southern coast of Puerto Rico are clays characterized as infertile, poorly drained, heavy and acidic. The low pH will result in a different set of micronutrients from those in St. Croix soils, limiting crop growth of plants in Puerto Rico. In contrast, the soil resources of the agroforestry areas of Puerto Rico are classified in the ecological life zone system as subtropical moist (39-78 inches rainfall per year) or wet (greater than 78 inches of rainfall per year) deep to medium deep soils. These soils are relatively fertile but very much subject to erosion.

Generally, if soil fertility problems are corrected and effective irrigation systems are established, the soils of Puerto Rico and the U.S. Virgin Islands are adequate for the crops grown on the islands. The Soil Conservation Service of the U.S. Department of Agriculture (SCS) has produced Soil Surveys that classify all the soils of the U.S. Caribbean islands by their productive capacity. Additionally the islands are subdivided into Soil Conservation Districts which should provide leadership to the agriculture sector and local planning agencies with respect to the appropriate utilization of various soil types.

AGRICULTURAL NATURAL RESOURCE BASE: WATER

The second major renewable resource necessary for agriculture and agroforestry is good quality water. Plants require water to maintain metabolic processes and growth, to transport photosynthate and other materials throughout the organism and to maintain the appropriate osmotic balance. A prolonged, significant decrease in the water supply to plants results in wilting (loss of turgor pressure in cells and plasmolysis) and eventually death. A shortage of water to plants fosters growth retardation and a possible decrease in economic yield. Additionally the quality of the water may impact the growth rate and yield of plants. Water containing more than 2,100 part per million of salts of various dissolved minerals can injure plants in a number of ways. Water contaminated with sewage or other pollutants can lead to imbalances in nutrients and microorganisms in the soil that can be detrimental to plants.

The major sources of water for agriculture and agroforestry in Puerto Rico and the U.S. Virgin Islands are ground water and surface water. The U.S. Caribbean Islands are faced with problems emanating from limited water resources and restricted distribution of water for urban and agricultural uses. Precipitation recharges surface and ground water on the islands. However, the topography of the islands creates imbalances in the amount of rainfall received on various parts of each island. For instance, the average rainfall for Puerto Rico is approximately 70 inches per year, but the range is 200 inches in Sierra de Luquillo in the northeast to about 35 inches in the southwest section of the island. Additionally, although rates of evaporation and transpiration tend to remain high, the distribution of rainfall is uneven throughout the year.

The average rainfall for St. Croix is approximately 40 inches per year. There are no rivers or lakes in the U.S. Virgin Islands, and streams in St. Croix generally only flow during heavy rains. Water for irrigation of crops can no longer be taken safely from many ground water sources due to the high salt content. Over-pumping of wells promoting the encroachment of seawater into aquifers in low-lying areas and dissolution of salt forming minerals into the ground water are the two most accepted underlying causes for this condition (Navarro, 1989). Cost effective means of storing high quality water for use in irrigation are being sought by the farmers and the Agricultural Experiment Station of the University of the Virgin Islands. Presently the
drip method of irrigation appears to be the most popular method used by the commercial farmers on St. Croix.

In Puerto Rico water for irrigation comes from reservoirs, ground water and stream diversions. Irrigation technologies, including gravity (furrow), sprinkler, and drip, are used on farms in Puerto Rico to varying degrees. Problems with the infrastructure to ensure the supply of surface water through irrigation districts have led many farmers to rely on ground water supplies for crops. Unless contamination by salt water or sewage has polluted an aquifer, the surface and ground water in Puerto Rico is considered very high in quality.

FISHERIES

The fishing industry of Puerto Rico and the U.S. Virgin Islands is a multi-species, million dollar industry. This activity generally occurs in the water of the shelf area (Puerto Rico, 5538 sq km; USVI, 1967 sq km) of the islands. The three major components of the industry include commercial fishing which is mainly directed at the local market; industrial fishing (U.S. and foreign-based longliners) to supply the tuna factories in Mayaguez and Ponce; and recreational fishing directed toward tourism. Although the number of vessels and fishermen has increased over the years, the level of production does not come close to meeting the local and tourism-generated demand on the islands for fresh seafood.

The commercial fishery in the U.S. Caribbean is primarily a small scale, artisanal fishery, with most of the boats being less than 10 meters in length. Commercial fishermen fish on the reefs associated with the relatively shallow island platform. Very little pelagic fishing is done in the area. Six major species and groups are part of the current harvest. They include the shallow reef fishes (approximately 180 harvested of 300 species), deep sea snapper and grouper species (145-270m) (Peacock, 1976), pelagic species (tuna, shark, dolphin), spiny lobster (Panulirus argus), conch (Strombus gigas), and other species such as the mangrove oysters in Puerto Rico (Crassostrea rhizophorae) and octopi (Octopus vulgaris).

In the 1970s intensive fisheries development efforts were evident in the USVI and even more so in Puerto Rico. Larger vessels and more fishermen with improved equipment made a significant impact on the nearshore resources. By the mid and later 1970s catch per set trap began to decline (Juhl and Dammann, 1976). Estimates of catch of fish, crustaceans and mollusks by Perto Rican fishermen decreased from 2557 metric tons to 1496 metric tons during the period 1980-1986 (Richards and Bohnsack, N.D.). Fishermen in the USVI estimated a decrease in landings from 669 metric tons in 1980 to 549 metric tons in 1987 (Chakalall, 1990). The fisheries of the U.S. Caribbean waters are presently considered to be heavily exploited and essentially overfished.

In an attempt to establish sustainable fisheries with apparently dwindling resources, management plans have been prepared for the spiny lobster, shallow-water reef fish, mollusks, Atlantic billfishes, and shark and coastal migratory pelagic fish resources by the Caribbean Fishery Management Council. The plans, among other things, place restrictions on types of gear that may be used for harvesting organisms, and establish minimum sizes for harvesting of individuals. In 1988, a 5-year moratorium on harvesting conch was declared for St. Thomas/St. John waters, and St. Croix designated closed seasons for the fishery. Recently, the area associated with spawning aggregations of the red hind grouper was closed to fishing activity to allow the population to rebuild its numbers.

The nearshore marine resources are more than a source of food for the U.S. Caribbean. These areas of beauty and diversity are an integral part of the tourism industry for both Puerto Rico and the USVI. The very same ecosystems that contribute to the food system of the islands serve as a major recreational attraction for millions of tourists every year,
providing a major portion of the economy of the islands. The three main ecosystems that form the basis for these two industries (fisheries and tourism) are mangrove forests and lagoons, coral reefs and seagrass beds. These marine communities are often adjacent to each other and interactive through organisms and physical processes.

**FISHERIES RESOURCE BASE: CORAL REEFS**

Coral reefs are complex, productive shallow-water tropical (and subtropical) ecosystems responsible for much of the nearshore fisheries potential of Puerto Rico and the USVI. Living coral reefs are made predominantly by hermatypic (calcium-secreting) corals that require warm, clear, low-nutrient waters and sunlight for growth. The reef structure itself provides shelter and sites of attachment for a large variety of fishes, invertebrates and algae. Coral reefs support a large number of food chains even as they provide protection for shorelines by functioning as a breakwater in certain areas.

Coral growth can be limited by high turbidity, extreme temperatures, depth, pollution and excess nutrients. When the organism is stressed it often loses pigmentation and/or expels zooxanthellae which under normal conditions exist in a symbiotic condition with the animal, contributing to its nutrition and calcification processes (Goenaga 1991). Bleaching and other forms of coral reef degradation have been noted in U.S. Caribbean waters (et al., Goenaga, 1989). It has become increasingly clear that coral reefs in U.S. Caribbean waters, much like the wider Caribbean, are threatened by pollution related to industry, domestic wastes and upland vegetation clearing (Rodriguez, 1981; Goenaga, 1991).

**FISHERIES RESOURCES BASE: SEAGRASS BEDS**

Seagrass beds are productive, shallow-water, grass covered sandy areas of the ocean floor that provide shelter, attachment sites and nutrition for numerous organisms in U.S. Caribbean waters. Seagrasses are flowering plants (hydrophytes) with grass-like blades and interwoven root systems that help to stabilize sediments and reduce shoreline erosion. Turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*), are the three most common species found in seagrass areas around Puerto Rico and the USVI. Seagrass beds are often a mixture of grasses and calcareous green algae growing in the sand bottom. Both the algae and the grasses tend to have epi- and zoophytes associated with them.

Some of the most valuable marine fishery species (e.g. spiny lobster and queen conch) spend at least part of their life cycle in seagrass beds. Conch feed on the algae growing on the seagrass blades. Additionally, a number of commercially valuable species (e.g. snapper and grunts) feed in the seagrass beds at night after sheltering on nearby coral reefs during the daylight hours. Food chains based on the living seagrass blades, its epiphytes and the detritus of the grass blades provide for a high level of productivity in these seemingly quiet ocean meadows.

Tropical seagrasses require warm, relatively calm, clear waters. The plant becomes stressed in highly turbid waters and does not recover naturally from anchor damage or dredging that removes root structures. Although the seagrasses are able to remove nutrients from the water through their blades as well as roots, high levels of nutrients in the water can lead to over-growth by epiphytes that can be stressful to the plants.
FISHERIES RESOURCE BASE: MANGROVES

Mangroves are a group of salt tolerant, woody plants that grow along sheltered tropical and subtropical coasts. The three most common (of seven in the wider Caribbean) species are the red mangrove (Rhizophora mangle), the black mangrove (Avicennia Germinans), and the white mangrove (Laguncularia racemosa). The mangrove ecosystem is best suited to protected shorelines that receive terrestrial runoff and periodic flooding by river discharge. The trees are able to tolerate and grow in saline environments due to a number of physiological adaptations such as excluding salt at the root or removing small amounts allowed to enter through the leaves.

A distinctive feature of the mangrove plant is a root system with adaptations for stabilization in soft sediments and low oxygen conditions. The prop or stilt root system of the red mangrove creates a maze that allows the trees to resist current scour and erosion to the point of building new land in fluid muds and unstable substrates. The tangled root systems of mangroves contribute to shoreline stabilization and protection. The roots slow the flow of water currents, causing suspended particles to settle and deposit on the outer edge of the mangrove fringe. Silt originating on the landward side is also trapped by the mangrove roots, thereby protecting coastal waters.

The mangrove forests and associated estuaries are very productive coastal areas. The roots serve as attachment sites and help to create a variety of habitats for a large number of algae, invertebrates and fishes. The decaying leaves of the mangroves form the basis of a very productive detritus food chain while the maze created by the roots offers larvae and juveniles of a number of species abundant food and protection from predators.

Mangroves sustain their high growth rate by removing large amounts of inorganic nutrients from the sediment and surrounding waters. Additionally, the anaerobic sediments of the area can trap heavy metals and pesticides without harm to the trees. Consequently, mangrove areas help to maintain water quality in coastal areas by incorporating, trapping or immobilizing inorganic nutrients, heavy metals and many pesticides.

In the U.S. Caribbean large mangrove estuaries occur only in Puerto Rico. However, small mangrove forests and lagoons do exist in the USVI and the areas that are still left do serve as nesting and roosting areas for birds (e.g. ospreys, pelicans, egrets, herons). Also the submerged areas have been identified as the location of a number of juvenile reef and pelagic fishes, including commercially-important species (e.g. various species of snapper and grunts) (Boulon, 1985; Kimmel, 1985).

Mangroves and their ability to serve as nurseries for commercially-important fish species and invertebrates have been destroyed in both Puerto Rico and the USVI over the years. Nearly 75% of the mangroves of Puerto Rico have been cleared by large scale reclamation and conversion to other uses (Bossi and Cintron, 1990). In the U.S. Virgin Islands mangrove areas have been lost to reclamation or severely stressed with sewage effluents and other pollutants.

IMPACTS OF FOOD PRODUCTION AND DEVELOPMENT ON THE NATURAL RESOURCE BASE

Agriculture, agroforestry and land development (tourism, residences, industry) have the potential to deplete forest resources and deteriorate watersheds through inappropriate land-cleaning and farming practices. Steep slopes and shallow soils with little vegetation are extremely prone to erosion, which results in lower economic returns on crops and stressful siltation on nearshore marine ecosystems. Sedimentation from dredging and run-off, due to land and port-based development, have been identified as the primary source of reef and near shore habitat degradation in the U.S. Virgin Islands (Rogers, 1988; Hubbard, 1987).
The maintenance of adequate supplies of high quality water for agriculture and other uses can be compromised by ground water contamination. Improper waste disposal practices and the use of agri-chemicals can contribute toxic chemicals, pathogenic bacteria and metals to ground water and distributed surface water. Additionally, over-use of ground water in low-lying areas may cause saline intrusion into the supply. Over-pumping of wells and contamination of water distribution lines are problems that have been faced by the USVI over the years.

The loss or degradation of near shore marine ecosystems that support the fisheries of the U.S. Caribbean appears to have a number of possible causes. Natural stresses or changes observed in recent times include the Diadema die-off of 1983-84, wide-spread coral bleaching incidents, hurricanes and increased ocean temperatures. Human-induced stresses to crucial fishery habitats include increased sedimentation on near shore reefs and seagrass beds and pollution or reclamation of mangrove areas. The decreases in catch size being experienced by fishermen are certainly compounded by the continuing loss of viable habitat for nurseries and feeding.

The food production systems and the new economic growth sector, tourism, rely on an overlapping resource base. Since the resources are interactive and inter-connected on a number of levels, impacts on one or more affect the others. The characteristics and limitations of the resources supporting economic growth should be factored into the cost of these activities, even as the benefits derived from the resource should be included in the value of the product. The relatively small and somewhat fragile natural resource base of the U.S. Caribbean can support sustainable economic growth if policies and approaches factor in the needs and value of the resources.

REFERENCES


Table 1. The 19 most abundant fish species in a line transect survey off a reef of La Parguera, Puerto Rico. Relative abundance is abundance of each species over total abundance of all species, expressed as a percentage. Density is number of fish/hectare. Adapted from Kimmel (1985).

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Relative Abundance</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pomacentridae</td>
<td>bicolor damselfish</td>
<td>Pomacentrus partitus</td>
<td>22.28</td>
<td>9,458</td>
</tr>
<tr>
<td>Labridae</td>
<td>bluehead</td>
<td>Thalassoma bifasciatus</td>
<td>13.60</td>
<td>5,773</td>
</tr>
<tr>
<td>Pomacentridae</td>
<td>blue chromis</td>
<td>Chromis cyaneus</td>
<td>9.27</td>
<td>3,935</td>
</tr>
<tr>
<td>Scaridae</td>
<td>striped parrotfish</td>
<td>Scarus croicensis</td>
<td>4.26</td>
<td>1,808</td>
</tr>
<tr>
<td>Scaridae</td>
<td>redband parrotfish</td>
<td>Sparisoma aurofrenatus</td>
<td>4.22</td>
<td>1,791</td>
</tr>
<tr>
<td>Labridae</td>
<td>yellowhead wrasse</td>
<td>Halichoeres garnoti</td>
<td>4.00</td>
<td>1,698</td>
</tr>
<tr>
<td>Acanthuridae</td>
<td>ocean surgeon</td>
<td>Acanthurus babianus</td>
<td>3.53</td>
<td>1,498</td>
</tr>
<tr>
<td>Holocentridae</td>
<td>longspine squirrelfish</td>
<td>Holocentrus rufus</td>
<td>3.00</td>
<td>1,274</td>
</tr>
<tr>
<td>Holocentridae</td>
<td>blackbar soldierfish</td>
<td>Myripristis jaculus</td>
<td>2.91</td>
<td>1,235</td>
</tr>
<tr>
<td>Labridae</td>
<td>creole wrasse</td>
<td>Clepticus parrai</td>
<td>2.73</td>
<td>1,159</td>
</tr>
<tr>
<td>Chaetodontidae</td>
<td>longsnout butterfly fish</td>
<td>Chaetodon aculeatus</td>
<td>2.39</td>
<td>1,015</td>
</tr>
<tr>
<td>Serranidae</td>
<td>coney</td>
<td>Epinephalus fuscus</td>
<td>2.14</td>
<td>908</td>
</tr>
<tr>
<td>Gobiidae</td>
<td>peppermint goby</td>
<td>Coryphopterus lineatus</td>
<td>1.71</td>
<td>726</td>
</tr>
<tr>
<td>Scaridae</td>
<td>princess parrotfish</td>
<td>Scarus taenioperus</td>
<td>1.61</td>
<td>683</td>
</tr>
<tr>
<td>Scaridae</td>
<td>stoplight parrotfish</td>
<td>Sparisoma viride</td>
<td>1.61</td>
<td>683</td>
</tr>
<tr>
<td>Pomacentridae</td>
<td>brown chromis</td>
<td>Chromis sultilineatus</td>
<td>1.57</td>
<td>666</td>
</tr>
<tr>
<td>Balistidae</td>
<td>black burton</td>
<td>Melichthys niger</td>
<td>1.51</td>
<td>641</td>
</tr>
<tr>
<td>Gobiidae</td>
<td>bridled goby</td>
<td>Coryphopterus glaucofraenus</td>
<td>1.02</td>
<td>433</td>
</tr>
<tr>
<td>Clinidae</td>
<td>spinyhead blenny</td>
<td>Acanthemblemarema spinosa</td>
<td>0.96</td>
<td>408</td>
</tr>
</tbody>
</table>
Table 2. Fish species observed in mangrove shoreline habitat of St. John (adapted from Boulon, unpubl.) Density estimates (total number of fish observed/area censused) calculated from seven visual censuses of area = 201.1 m² each (total area = 1407.43 m²). Average fish size (cm) and sample size provided. Rank abundance lists relative abundance in this study. "X" indicates that the species observed by Boulon not observed by Kimmel (1985).

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
<th>DENSITY</th>
<th>SIZE</th>
<th>M</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>bar jack</td>
<td>Carangus ruber</td>
<td>1.85E-02</td>
<td>27.9</td>
<td>26</td>
<td>11 X</td>
</tr>
<tr>
<td>bluestriped grunt</td>
<td>Haemulon scirurus</td>
<td>2.13E-03</td>
<td>12.7</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>white grunt</td>
<td>H. plumieri</td>
<td>7.10E-04</td>
<td>10.1</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>French grunt</td>
<td>H. flavolineatum</td>
<td>1.32E-01</td>
<td>7.6</td>
<td>186</td>
<td>6</td>
</tr>
<tr>
<td>tomtate</td>
<td>H. aurolineatum</td>
<td>2.17E-01</td>
<td>6.3</td>
<td>305</td>
<td>4 X</td>
</tr>
<tr>
<td>juvenile grunts</td>
<td>Haemulon spp.</td>
<td>8.53E-01</td>
<td>3.8</td>
<td>1200</td>
<td>2</td>
</tr>
<tr>
<td>dog snapper</td>
<td>Lutjanus jocu</td>
<td>3.62E-01</td>
<td>5.0</td>
<td>509</td>
<td>3</td>
</tr>
<tr>
<td>gray snapper</td>
<td>L. griseus</td>
<td>7.10E-03</td>
<td>20.3</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>schoolmaster</td>
<td>L. apodus</td>
<td>1.42E-02</td>
<td>12.7</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>yellowtail snapper</td>
<td>Ocyurus chrysurus</td>
<td>4.12E-02</td>
<td>8.8</td>
<td>58</td>
<td>8</td>
</tr>
<tr>
<td>mahogany snapper</td>
<td>L. mahogoni</td>
<td>1.77E-01</td>
<td>6.3</td>
<td>249</td>
<td>5 X</td>
</tr>
<tr>
<td>angelfish</td>
<td>Pomacanthus spp.</td>
<td>7.10E-04</td>
<td>10.1</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>sea bream</td>
<td>Archosargus rhomboidalis</td>
<td>9.95E-03</td>
<td>7.6</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>doctorfish</td>
<td>Acanthurus sp.</td>
<td>9.95E03</td>
<td>5.0</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>yellow goatfish</td>
<td>Mullloidichthys martincus</td>
<td>4.40E-02</td>
<td>10.1</td>
<td>62</td>
<td>7</td>
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<tr>
<td>spotted goadfish</td>
<td>Pseudupeneus maculatus</td>
<td>2.13E-03</td>
<td>8.8</td>
<td>3</td>
<td>17 X</td>
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<td>parrotfish</td>
<td>Scaridae</td>
<td>2.63E-02</td>
<td>7.6</td>
<td>37</td>
<td>9</td>
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<td>great barracuda</td>
<td>Sphyraena barracuda</td>
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<td>7.6</td>
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<td>20</td>
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<td>snook</td>
<td>Centropomus undecimalis</td>
<td>1.42E-03</td>
<td>30.4</td>
<td>2</td>
<td>19 X</td>
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<tr>
<td>squirrelfish</td>
<td>Holocentridae</td>
<td>7.10E-04</td>
<td>10.1</td>
<td>1</td>
<td>20 X</td>
</tr>
<tr>
<td>mojarra</td>
<td>Gerreidae</td>
<td>2.13E-02</td>
<td>5.0</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>dwarf herring</td>
<td>Jenkinsia lamprotaenia</td>
<td>too numerous to count</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>redear sardine</td>
<td>Harengula humeralis</td>
<td>1.07E-02</td>
<td>10.1</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>
Table 3. Fish species occurring in mangrove of La Parguera, Puerto Rico. The occurrence of a species also found by Boulon (unpubl.) in mangroves of St. John is noted by an X in the column designated B (Boulon). Fish species listed above the dotted lines comprise a "species group", which is a statistically-defined assemblage characteristic of the mangrove habitat of La Parguera. (An X in column designated SG indicates that species is a member of the species group.) Species listed below the line occurred in mangroves but were statistically better associated with other species and habitats, as indicated by an X in the column designated PO (present only). Rank abundance is the overall relative abundance (based on relative abundance numbers) for all species listed as occurring in the mangroves. Adapted from Kimmel (1985).

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
<th>SG</th>
<th>PO</th>
<th>B</th>
<th>RANK ABUNDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>gray snapper</td>
<td>Lutjanus griseus</td>
<td>X</td>
<td></td>
<td>X</td>
<td>10</td>
</tr>
<tr>
<td>checkered puffer</td>
<td>Sphoeroides testudineus</td>
<td>X</td>
<td></td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>dwarf herring</td>
<td>Jenkina is lamprotaenia</td>
<td>X</td>
<td></td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>sea bream</td>
<td>Archosargus rhomboidalis</td>
<td>X</td>
<td></td>
<td>X</td>
<td>13</td>
</tr>
<tr>
<td>mojarras</td>
<td>Bucinostomus sp.</td>
<td>X</td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>yellowfin mojarra</td>
<td>Gerres cinereus</td>
<td>X</td>
<td></td>
<td>X</td>
<td>16</td>
</tr>
<tr>
<td>horse-eye jack</td>
<td>Caranx latus</td>
<td>X</td>
<td></td>
<td></td>
<td>19</td>
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<tr>
<td>sailors choice</td>
<td>Haemulon parra</td>
<td>X</td>
<td></td>
<td></td>
<td>33</td>
</tr>
<tr>
<td>night sergeant</td>
<td>Abudefduf taurus</td>
<td>X</td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>fry</td>
<td>Anchoa spp.</td>
<td>X</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>redear sardine</td>
<td>Harengula humeralis</td>
<td>X</td>
<td></td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>false pilchard</td>
<td>H. clupeola</td>
<td>X</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>postlarval fishes</td>
<td>Antherinomorus stripes</td>
<td>X</td>
<td></td>
<td></td>
<td>57</td>
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<tr>
<td>hardhead silverside</td>
<td>Mugil curema</td>
<td>X</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>white mullet</td>
<td>Caranx spp.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yellowtail snapper</td>
<td>Ocyporus chrysura</td>
<td>-</td>
<td></td>
<td>X</td>
<td>23</td>
</tr>
<tr>
<td>French grunt</td>
<td>Haemulon flavolineatum</td>
<td>-</td>
<td></td>
<td>X</td>
<td>7</td>
</tr>
<tr>
<td>foureye butterflyfish</td>
<td>Chaetodon capistratus</td>
<td>-</td>
<td></td>
<td>X</td>
<td>17</td>
</tr>
<tr>
<td>white grunt</td>
<td>H. plumieri</td>
<td>-</td>
<td></td>
<td>X</td>
<td>34</td>
</tr>
<tr>
<td>striped parrotfish</td>
<td>Scarus cryptocentrus</td>
<td>-</td>
<td></td>
<td>X</td>
<td>28</td>
</tr>
<tr>
<td>stoplight parrotfish</td>
<td>Sparisoma viride</td>
<td>-</td>
<td></td>
<td>X</td>
<td>9</td>
</tr>
<tr>
<td>bluestriped grunt</td>
<td>H. sciuri</td>
<td>-</td>
<td></td>
<td>X</td>
<td>9</td>
</tr>
<tr>
<td>schoolmaster</td>
<td>Lutjanus apodus</td>
<td>-</td>
<td></td>
<td>X</td>
<td>8</td>
</tr>
<tr>
<td>yellow goatfish</td>
<td>Mullloidichthys</td>
<td>-</td>
<td></td>
<td>X</td>
<td>14</td>
</tr>
<tr>
<td>sergeant major</td>
<td>Abudefduf saxatilus</td>
<td>-</td>
<td></td>
<td>X</td>
<td>36</td>
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</table>
CONCEPTUAL SUBSYSTEMS OF THE VANCOUVER

SHELF BREAK

100

183

FATHOMS

METERS

WATER DEPTH

PELAGIC

MANGROVE ESTUARINE

SEAGRASS

CORAL REEF

ALGAL PLAIN

SAND/MUD
Strategic Planning for Agriculture and Food Needs of the Eastern Caribbean

John J. Ambrose*

INTRODUCTION

In this paper we first attempt a definition for strategic planning, state some approaches to strategic planning and then indicate how the principles of strategic planning may be applied to agriculture and food systems in the Caribbean area with special emphasis on the political entities having links with the USA.

The word strategy comes from the Greek strategos, which means "leader of an army." Strategic planning, therefore, is akin to generalship. Considering its origin, it would be reasonable to assume the following about strategic planning:

1. The objective is to win or at least not lose.
2. The planning must be done at the highest level - there must be leadership.
3. It involves gathering data about competitors (the enemy) and about the general environment (environmental scan).
4. It involves assessment of your own capabilities.
5. It should involve consultation with those close to the chief, including trusted allies, where appropriate.
6. The advantages and disadvantages of several alternatives must be weighed.
7. A decision must be made as to what to do and what not to do.
8. Timing is important.
9. Disclosure must be selective, since the competition is also planning and gathering intelligence.

Within the last two decades strategic planning has become popular in business and other areas. In the corporate world strategic planning often involves either the setting of goals or the management of issues, taking into consideration strengths, weaknesses, opportunities and threats.

The strategic planning process may impact on both long-range and short-term planning. This is especially so when there is turbulence in the environment, the threat of war, the coming on stage of new competitors, unstable money markets, etc. In the planning process, the leader's vision is an important element in the development of the organization's goals, objectives and constraints. Strategic planning sets general directions. While conventional planning is concerned with "doing things right," strategic planning emphasizes "doing the right things."

ENVIRONMENTAL SCAN

In strategic planning the scanning of the environment is a very important activity that must take place prior to, and continue during the formulation of the plan, and even during the implementation stages. Based on the information gathered one tries to predict what is likely to happen in the near and distant futures and to plan accordingly. To make the scan more meaningful and useful, it is often organized along different dimensions, such as demographic, economic, political/regulatory, scientific-technological, social/cultural and competitors. Under each dimension significant trends and events in the world, the region and the particular locality would be covered. Experience may

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show that scanning for agricultural and food system planning may need to use different dimensions (such as meteorological) or focus on certain emerging technologies.

A scan of the global, United States, Caribbean and Virgin Islands environments at the time of writing brings to view the following:

global warming
unstable money markets
establishment of trading blocks
cooperation between the Soviet block and the western nations
serious steps toward European unification
growth in world population
debt problem of so-called 3rd world countries
reduction in world food production (2 months' reserve in grain supply)
Middle East crisis
Japanese investment in the USA
threat of AIDS
developments in biotechnology (genetic engineering)
idle US farmlands and overproduction of food in the USA
issue of protecting the world environment
economic recession in the USA
aging and browning of Americas
deficit budgeting in US and elsewhere
Latin American urbanization
increased hunger and poverty in Latin America and Caribbean
birth pains of Haitian democracy
Carcim trading problems - common external tariff
steps toward political unity in OECS
Puerto Rico and Virgin Islands political status issue
expected decline in European demand for Windward Islands bananas
steps toward a Caribbean stock exchange
population growth in Puerto Rico and the Virgin Islands
effects of Hurricane Hugo
new Virgin Islands Legislature
the Virgin Islands as a drug transshipment center
poverty level in the Virgin Islands
high cost of living in the Virgin Islands
water shortage
land use/shoragte in the Virgin Islands
costs of food in the Virgin Islands

The World

President of the Agriculture Council of America and former U.S. Secretary of Agriculture Orville Freeman (1990) has observed that feeding the globe's expected increased population in the next quarter century "may well be the greatest challenge we have ever faced." It is true the United States produces some 40% more food than it needs for local consumption and still has millions of acres idle. Yet according to the Report of the World Food Council (1990), global "cereal production has fallen short of consumption for three consecutive years, leaving stocks at the lowest level since 1981." And according to Sadik (1990) the food situation in the world "looks shakier than at any time in the past 15 years." Possible reasons according to Freeman (1990) are:

1. shortage of land due to erosion
2. scarcity of water due to drought and heavy irrigation
3. absence of dramatic new technology

He calls for "the total mobilization of all global productive resources to prevent massive famine in the decade of the 1990's and beyond."

Meissner (1989), however, points out that "a more important factor than food production in determining vulnerability to hunger is the extent of popular access to gainful employment, to arable land, to suitable technologies and other productive resources." He calls for greater food marketing research.

According to Anderson (1989) agriculture in the 20th century has gone through two stages: (1) mechanization (2) widespread use of agricultural chemicals. The third development, advent of agricultural biotechnology will exert far reaching changes on all facets of agricultural production, all fields of biological science and
all aspects of environmental protection. Biotechnology will pose a grave threat to Third World countries in that Third World agriculture may not be able to participate in the first round of the biotechnology revolution. The world is not prepared to deal with the revolution and planning at the U.S. national level is still sketchy and poorly organized.

The World Food Council (1990), in observing that current trends in environmental deterioration if continued unchecked "will jeopardize the food security of future generations," especially singled out "global warming," desertification and deforestation as causes for concern.

Congresswoman Claudine Schneider (1989) has noted the heat record of the decade of the eighties and the number of natural disasters and their economic cost. While the disasters cannot be directly linked to "global warming," she has noted that the "scientific community is united in warning us that in the future such disasters will occur with increasing frequency and severity if the rise in greenhouse gas emissions go unchecked." Shorelines will be lost and farming shift northward, with some regions suffering crop losses of up to 80% as temperatures increase.

Brown (1989) has observed that climatic changes due to global warming will not affect all countries in the same way. Temperatures are expected to increase more in the middle and higher latitudes and more over the land than over the ocean. This means temperatures in the Caribbean region are likely to remain relatively stable and so encourage farmers to keep growing the same crops. Warming in North America and other temperate areas, however, may result in larger areas having the capability of growing tropical type crops and so lessen demand for certain Caribbean export crops.

The Caribbean

In the Caribbean region many countries are having serious economic problems, due in part to heavy unemployment and to factors outside of the region. As Bourne (1988) has pointed out, trade protectionism, global economic recession, lower commodity prices and the substitution of synthetic raw materials for natural resources based ones have helped to reduce export trade from developing countries. On the positive side, however, he has noted that world demand for fisheries products, tropical hardwoods and ethnic agricultural products in industrial countries is continuing to expand.

According to Bourne (1988), disappointing performance of the agricultural sector in CARICOM countries during the last twenty years has been assisted by reduction in cultivated land and fragmentation of farm holdings, since "small farms are unable to secure economies of scale thereby affecting overall cost efficiency... and militate against developing family farms as commercial enterprises." As a result there is emigration of labor and capital, little modernization of capital, low rates of capital investment, advanced age of farm operators and little product or market innovation.

Another problem is inadequate technological programs in agriculture and food production. This is due in part to the "exclusive concentration of research and development on major export crops," and the inadequacy of extension and dissemination systems. Bourne would like to see regional agriculture meeting more of the regional demand for food products.

Williams (1990), commenting on the East Caribbean currency Board's report, noted that the economies of Eastern Caribbean States have entered a slowdown phase after five straight years of robust growth. "Agricultural output, accounting for 14 percent of the subregion's GDP, declined by 1.6 percent after growing a significant 12.2 percent in 1988." Agricultural exports fell by 9.2% with bananas of the four Windward Islands and cocoa and nutmeg of Grenada showing decline.

With the expected establishment of a united Europe in 1992, preferential status given to Windward Islands bananas in the United Kingdom is expected to cease or be re-examined. The islands are addressing the problem in two ways. One way is to improve the quality of the product and ensure there is greater visual appeal.
when the fruit arrives in Europe. The second approach is to explore the production of other crops for export. For example, St. Vincent is taking steps to revive arrowroot production, which declined from 3,000 acres in 1970 to 140 acres in 1990. The islands need the hard currency to pay for imports.

The message emerging is that in the Caribbean, strategic planning is needed at the regional level as well as at the country or territorial level. It should be noted that CARICOM has taken steps toward this end.

The Virgin Islands

According to the USVI Bureau of Economic Research (1990), interest in agriculture has decreased in the US Virgin Islands, with the number of farms decreasing from 501 in 1960 to 267 in 1987 and the acreage from 44,062 to 17,785 the same period. Harvested cropland was reduced from a peak of 5,134 acres in 1964 to 608 in 1987. While there was a steep decline from 1964 to 1970, the period 1982-1987 remained relatively stable in agricultural activity. As in the case of CARICOM countries, the age of farm operators in the Virgin Islands is on the increase. Agriculture is not attractive to the younger people.

Dominique (1988-89) has noted the shift in agriculture from sugar (3,676 acres in 1960 to 3 acres in 1982) to the less labor intensive fruit crops production, probably on account of "the high labor cost and competition for labor in the more lucrative tourism and industrial sectors." Noting the competition from the US mainland and other Caribbean Islands, Dominique recommended more production planning and central marketing. Rakocz (1988-89), on the other hand, notes the need for innovative methods "to expand food production on small Caribbean islands where resources are limited and most of the food supply is imported."

According to Sprauve (1990), the high cost of food in the Virgin Islands is in part due to the high cost of transporting food to the Virgin Islands, seeing that very often the containers return empty. He proposes (1) the establishment of light industries to provide goods for export to the mainland (2) importing less food from the US mainland and more from neighboring islands (3) growing more food locally (Havland property on St. Croix). He calls for a greater role for agriculture in the long-term plans for the Virgin Islands. International conflict could disrupt sealinks to the mainland so he calls for greater support for farmers and fishermen.

**FACTORS IN AGRICULTURAL PLANNING**

Agriculture in the Caribbean may be engaged in for any or all of the following: (1) supplying food for local consumption (2) providing employment for local population (3) providing goods for the export market mainly to provide cash to pay for imports. The issue of the extent of the dependence of local food needs on local vs. foreign sources must also be considered. The decisions taken on these issues are definitely of a strategic nature.

In order to determine the approaches to agricultural planning in the Caribbean region, the agricultural departments/ministries of selected Caribbean states were surveyed. The survey sought to determine the relative importance of a wide variety of items in agricultural planning in the Caribbean and who does the planning. Respondents were also asked to indicate in what ways the area universities and the US Government could be of assistance and the expected dependence of the local economy on local agriculture.

Responses were received from nine of the eleven states surveyed. The major findings are reported below.

Respondents were asked to indicate the degree of importance of fifty-seven items in planning for the agricultural and food needs of their respective states during the 1990s. For the purposes of this paper only a few items have been selected for discussion. Means and standard deviations of all items are provided, however. A comparison of the U.S. political entities
(Puerto Rico and the Virgin Islands) with the rest may be of some interest and could be made in the future.

On a scale of 1 to 7, where 7 is of greatest importance, the items with a mean of six or greater were profit motive, views and interests of small farmers, adequacy of local water supply, performance of the local economy, availability of financial aid to farmers, cost of producing different crops locally, availability of arable land and threat of disease in plants and economically important animals. The availability of arable land and water discussed in connection with world food situation is regarded as important in the Caribbean region. Technological developments, especially agricultural biotechnology, seemed to be only moderately important for agricultural planning in the Caribbean area. Also, global warming, which is a much discussed topic in North America and elsewhere, is of even less interest to Caribbean agricultural planners. Note also that planners responding in January 1991 just before the outbreak of war in the Persian Gulf considered the threat of war as not having any great effect in the planning for agriculture and food needs of the region.

Of interest is that planners were more concerned about the views and interests of small farmers (6.33) than those of the owners of large agricultural tracts (5.22). This seems to be in keeping with the World Food Council (1990) call for "greater efforts...to increase the productivity and incomes of small farmers."

The food tastes of local population (5.67) were regarded as more important for planning than food tastes of tourists and visitors (5.11) and of Caribbean natives living abroad (3.22). The potential of Caribbean markets (5.45) was only slightly more important than the potential of U.S. and non-Caribbean markets (5.22), however. Local food security (5.78), nevertheless, was considered of great importance.

Respondents were asked how dependent on agriculture the local economy would be by 1995 as compared with the present. Eleven percent expected decreased dependence on local agriculture, twenty-two percent expected things to be about the same, while sixty-seven percent predicted an increased dependence on local agriculture.

**PLANNING PROCESS**

As part of the planning process, some countries routinely conduct sample surveys on crop-land acreage, livestock numbers and farm income and expense. Three of the states indicated such a survey was conducted on a yearly basis; two, every four or five years; three, once in six or more years; and one state on an ad hoc basis.

In four states (44%) planning is done by a broad-based committee representing various sectors of the community, in two states (22%) plans are developed by a single government office and in two others (22%) by a committee of agricultural officers. In the remaining state, plans are developed by a committee involving several government offices.

**ROLE OF THE UNIVERSITY**

The interest of the local university(ies) in planning for the agricultural future and food needs was regarded reasonably important (5.78). According to respondents, the universities could be of greatest assistance by:

1. providing short-term training courses, especially on planning techniques

2. conducting laboratory and field research, including specialized studies in areas critical to agricultural planning and development.

Other suggestions were for personnel exchange, joint educational initiatives, adjusting agricultural curriculum to suit local needs, improvement of cooperative extension services and having university personnel serve on advisory committees.
ROLE OF U.S. GOVERNMENT

Although United States agricultural policies were regarded as only moderately important to planning for the agricultural future and food needs of the various Caribbean states, it was felt that the U.S. Government could provide assistance in the following ways:

(1) provide guaranteed markets for crops produced locally (8 states)
(2) provide technical know-how (8 states)
(3) provide credit facilities for obtaining machines and fertilizers (3 states)
(4) provide aid for infrastructure development
(5) human resource development
(6) assistance with pest/disease control/eradication

CONCLUSIONS AND RECOMMENDATIONS

Considering the situation in the world and region as well as the expected increase in world population, the following conclusions and recommendations are being offered:

* planning for economic development and food system is primarily the business of each country or territory.
* there are a number of problems and issues that are best tackled by regional cooperation.
* universities within the region must not only assist the farming community in the extension services but also provide direct help in strategic planning, including scanning of the environment.
* the region should take a greater interest and become more involved in developments in biotechnology. Ethical considerations must be taken into account.
* steps should be taken to encourage greater trade in agricultural products between the U.S. Caribbean and the non U.S. Caribbean. Given the damages to agriculture by hurricanes and other natural disasters, steps should be taken to develop a regional strategy to minimize crop and food loss resulting from hurricanes.
* each country must decide on the balance between agriculture for export and for food security, taking into account likely developments in the region and the world.
* planning for agriculture and food needs must be realistic as well as robust.
* relevant land use policies must be developed so as to prevent deforestation with resultant erosion, as is the case in Haiti.
* the people directly affected by agricultural planning should be involved in the planning process to provide broad support for any plans developed.
* more attention needs to be paid to food marketing at the state level.

REFERENCES


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### Agricultural Planning Elements in Eastern Caribbean

<table>
<thead>
<tr>
<th>Element</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
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<tbody>
<tr>
<td>1. Employment level of local population</td>
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<td>1.67</td>
</tr>
<tr>
<td>2. Nutritional needs of population</td>
<td>5.22</td>
<td>1.92</td>
</tr>
<tr>
<td>3. Food tastes of Caribbeans</td>
<td>3.22</td>
<td>1.20</td>
</tr>
<tr>
<td>4. Profit motive</td>
<td>6.44</td>
<td>0.73</td>
</tr>
<tr>
<td>5. Providing hard currency</td>
<td>5.00</td>
<td>1.87</td>
</tr>
<tr>
<td>6. Developments in telecommunication</td>
<td>3.89</td>
<td>1.36</td>
</tr>
<tr>
<td>7. Local food security</td>
<td>5.78</td>
<td>1.56</td>
</tr>
<tr>
<td>8. Cost of producing different crops</td>
<td>6.11</td>
<td>0.78</td>
</tr>
<tr>
<td>9. Cost of imported food</td>
<td>5.78</td>
<td>0.83</td>
</tr>
<tr>
<td>10. Past performance of agri. sector</td>
<td>5.44</td>
<td>0.73</td>
</tr>
<tr>
<td>11. Food taste of tourists and visitors</td>
<td>5.11</td>
<td>1.05</td>
</tr>
<tr>
<td>12. Availability of arable land</td>
<td>6.00</td>
<td>0.87</td>
</tr>
<tr>
<td>13. Size of individual farms</td>
<td>4.89</td>
<td>1.05</td>
</tr>
<tr>
<td>14. Food processing capabilities</td>
<td>5.33</td>
<td>1.23</td>
</tr>
<tr>
<td>15. Food storage problems</td>
<td>4.89</td>
<td>1.27</td>
</tr>
<tr>
<td>16. Implications of agreements like Lome IV</td>
<td>4.89</td>
<td>2.21</td>
</tr>
<tr>
<td>17. Local university interest in agriculture</td>
<td>5.33</td>
<td>1.60</td>
</tr>
<tr>
<td>18. Influence of cosmic forces</td>
<td>3.00</td>
<td>0.83</td>
</tr>
<tr>
<td>19. Territorial fishing regulations</td>
<td>5.78</td>
<td>1.13</td>
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<tr>
<td>20. Trends of predial larceny</td>
<td>4.13</td>
<td>1.09</td>
</tr>
<tr>
<td>21. Cost of housing</td>
<td>3.78</td>
<td>1.48</td>
</tr>
<tr>
<td>22. Energy cost</td>
<td>4.22</td>
<td>1.69</td>
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<tr>
<td>23. AIDS and other health problems</td>
<td>3.11</td>
<td>1.39</td>
</tr>
<tr>
<td>24. Establishment of spin off industry</td>
<td>4.78</td>
<td>1.41</td>
</tr>
<tr>
<td>25. Developments in biotechnology</td>
<td>4.67</td>
<td>2.06</td>
</tr>
<tr>
<td>26. International financial market stability</td>
<td>4.33</td>
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</tr>
<tr>
<td>27. Performance of local economy</td>
<td>6.11</td>
<td>1.45</td>
</tr>
<tr>
<td>28. Current and future trading blocks</td>
<td>5.11</td>
<td>1.12</td>
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<tr>
<td>29. Likelihood of natural disaster</td>
<td>5.67</td>
<td>0.73</td>
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<tr>
<td>30. Potential of Caribbean markets</td>
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<td>31. Potential of non-Caribbean markets</td>
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<tr>
<td>32. Transportation problems/cost</td>
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<td>33. Local/regional political developments</td>
<td>5.11</td>
<td>2.22</td>
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<tr>
<td>34. Agricultural extension manpower</td>
<td>5.78</td>
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</tr>
<tr>
<td>35. Financial aid to farmers</td>
<td>6.11</td>
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<tr>
<td>36. Views and interests of small farmers</td>
<td>6.33</td>
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</tr>
<tr>
<td>37. Large tract owners views and interests</td>
<td>5.22</td>
<td>1.22</td>
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<tr>
<td>38. Foreign debts of Caribbean countries</td>
<td>3.78</td>
<td>0.60</td>
</tr>
<tr>
<td>39. Minimum wages</td>
<td>4.89</td>
<td>2.33</td>
</tr>
<tr>
<td>40. Local population education level</td>
<td>4.33</td>
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</tr>
<tr>
<td>41. Mechanization breakthroughs</td>
<td>4.33</td>
<td>1.04</td>
</tr>
<tr>
<td>42. Local population lifestyles</td>
<td>5.67</td>
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<tr>
<td>43. Migration patterns in Caribbean</td>
<td>4.67</td>
<td>1.86</td>
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<tr>
<td>44. Agriculture development plans of Caribbean states</td>
<td>4.78</td>
<td>2.13</td>
</tr>
<tr>
<td>45. U.S. agriculture policies</td>
<td>4.44</td>
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<td>46. Stability of local exchange rate</td>
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</tr>
<tr>
<td>47. Food tastes of local population</td>
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</tr>
<tr>
<td>48. Threat of disease in plants and animals</td>
<td>6.00</td>
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</tr>
<tr>
<td>49. Local religious beliefs</td>
<td>3.00</td>
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<td>50. Global warming</td>
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<td>1.33</td>
</tr>
<tr>
<td>51. Threat of war</td>
<td>3.67</td>
<td>2.00</td>
</tr>
<tr>
<td>52. Life long learning opportunities</td>
<td>3.89</td>
<td>2.00</td>
</tr>
<tr>
<td>53. Financial services institution stability</td>
<td>4.56</td>
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</tr>
<tr>
<td>54. The drug war</td>
<td>4.00</td>
<td>1.41</td>
</tr>
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<td>55. Adequacy of local water supply</td>
<td>6.22</td>
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<tr>
<td>56. Ethical considerations</td>
<td>3.67</td>
<td>1.74</td>
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<td>57. Local population decrease/increase</td>
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*Antigua & Barbuda, Barbados, British Virgin Islands, Dominica, Puerto Rico, St. Kitts, St. Lucia, Trinidad & Tobago, United States Virgin Islands.

*Raw scores are from 1 - 7, where 7 = of greatest importance.*
Strategic Planning for U.S. Caribbean Development

Glen C. Pulver

INTRODUCTION

The clear articulation of the full range of economic options and the ultimate selection of optimum development paths throughout the Caribbean require thoughtful strategic planning at the island and sometimes sub-island level. Each specific locality exists within an economic, social, political, and natural resource environment which, although similar to its neighbors, may in small but very important ways be drastically different. Climate, minerals, forests, agricultural lands, levels of education, entrepreneurship, transportation, telecommunications, financial institutions, population, programs of broader governments and a myriad of other variables have a profound effect on local options.

In a conceptual sense, there is nothing new about strategic planning. It involves little more than a structured analysis of a region's problems, needs, concerns and aspirations; a precise definition of a region's goals; careful analysis of the region's local resources (e.g. human capital, natural resources, public infrastructure) and their strengths and weaknesses; an assessment of external resources that may be available (e.g. private capital, government programs); an overview of all options offering hope of goal achievement; the selection of acceptable development paths; and the description of specific action steps including what will be done by whom and when. It is essentially a mechanism for looking into and planning for the future.

Strategic planning is useful at different political levels. It can provide excellent policy guidance to small communities, cities, islands, territories, states and nations. Logically, for the most positive results, plans at all political levels should be carefully integrated. Effective planning requires wide participation and representation of the region as a whole, including business leaders, citizen organizations, government officials and others often left out. Although there may be arguments over order, technique and responsibility, most people would agree that strategic planning is important both in the public and private sector.

LOOKING AT ALL OPTIONS

Historically the full articulation of development options for most areas, the Caribbean included, has been restrained by a general perception that the economic well-being of any region is determined largely by its natural resource base. If an area is rich in agricultural land, then it is perceived as largely farm dependent. Development planning is focused on increased farm productivity and marketing, farm prices and value-added agriculture industry. If a region is rich in natural forests or mineral resources, similar energy is extended in exploiting these resources.

Early in the industrial age, the perception of development opportunities widened to include manufacturing. Although not as directly tied to the natural resource base, manufacturing is seen as highly desirable because, as a goods-producing industry, it is a generator of exportable products. Much of current economic development logic is tied to export base theory which argues the primary basis for economic growth is the export of products out

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of a region. Manufactured products are generally exportable and can be sold outside of the region, thereby increasing the income captured by local human capital and other resources. The most desired manufacturing industries are viewed as linked to local mineral resources, agricultural outputs, and labor skills.

More recently the exploitation of tourism has been included among acceptable development strategies. The Caribbean region was among the earliest to experience the power of private expenditures on recreation oriented activities. Once again, however, tourism was seen largely as a way of "exporting" the natural resources of the islands - the climate, beaches, harbors, water, hills and sunshine.

When examining the economic growth options of a region, the typical developer asks, what can be done with the land, water and other natural resources? What can be farmed, mined, fished, or otherwise produced from these resources that can be sold elsewhere? How can these goods be produced or marketed more efficiently? These questions are appropriate, for they may lead to a fuller examination of many of a region's basic options. New agricultural products, additional value-added output and different production and marketing methods may all present important mechanisms for generating increased income, employment and wealth.

Unfortunately, all too often, economic development analysis and planning are restricted to the goods producing and natural resource export oriented perspective. Opportunities for import substitution are seldom examined. Most regions of the world import large quantities of goods and services. This is especially true of island economies. Some products, such as automobiles, require massive physical facilities to gain the full scale economies attendant with their production. They can seldom be produced competitively within small economies. Others are produced most efficiently with a relatively large share of costs being labor. Smaller economies can frequently compete in these industries. In any case, most regions have comparative economic advantages in the production of certain goods and services. A specific island economy may be importing substantial quantities of a good or service that is already being produced or could be produced competitively within the local region. By identifying and exploiting these opportunities and substituting them for imports, the local economy might be strengthened. These opportunities can be unearthed by careful analysis.

Strategic planning for economic development would also be strengthened by greater attention to the generation of new products and/or technology that may or may not be associated with the existing natural resource base. Many firms are found in places where there are no rational reasons for their location other than the communities are the birthplace or chosen home of the entrepreneurs who started them. Thus, a major frozen pizza manufacturer is found in a remote forested rural region. A large insurer of religious institutions is operating in a farming community. The creation and exploitation of new technology and products are strongly influenced by the quality of human resources and supportive infrastructure. Political leaders in a region may be able to do little to develop creative genius, but they can do a great deal to exploit native creativity through education, financial institutions, telecommunications and other infrastructure.

Effective strategic planning is dependent on the full analysis of all economic options. Those options include the responsible exploitation of the natural resource base, the development of those export base opportunities (both goods and services) in which the concerned region has a comparative advantage, the substitution of local products that can be produced competitively for those that are imported, the creation and exploitation of new technology and products and a general improvement in production and marketing efficiency of existing firms. This is a much wider agenda than that usually pursued.
OPPORTUNITIES FOR DEVELOPMENT ARE CHANGING

Equally critical to strategic planning is the recognition that continuing shifts in the global economic structure are important in assessing regional development opportunities. Changes in sources of wealth, income, employment, terms-of-trade, applications of technology, and in political conditions have a profound effect on the growth or decline of specific industries and the comparative advantage of individual locations. For example, sharp increases in the value of the dollar against other currencies may reduce the comparative advantage of U.S. agricultural producers. Or, an increase in political instability in other tropical regions may improve the Caribbean's economic prospects.

Short run fluctuations are often unpredictable. Planning for them is difficult. Strategic planning is necessarily more sensitive to long run shifts. Policy leaders must be constantly aware of and respond to long run economic changes. Four changes are dominant at this time: 1) the globalization of the economy; 2) more leisure time in developed economies; 3) the dominance of the services-producing sector in creating new jobs; and 4) the increasing importance of small firms.

The internationalization of corporate ownership and operation has had widespread impacts on production and marketing processes in many industries. A raw product may be produced in one country, shipped to another for the early stages of processing, then to another for finishing and still to others for sales. The movement of animal hides produced in the continental United States, to Brazil for tanning, then to the Caribbean for cutting and sewing into shoes and then to other countries for sales is a prime example. Similarly business data may be generated in the U.S., shipped to low cost labor markets in other parts of the world for processing and then returned to the U.S. for application. A specific location may be chosen for an aspect of a global corporation's operation, the choice having little or nothing to do with natural resource conditions or transportation. The choice is likely to have more to do with labor skills or costs, favorable fiscal regulations, time zone advantages, telecommunications quality and similar variables. If the Caribbean is to participate fully, it must be sensitive to changes in contemporary economic and political institutions.

The growth in leisure based industry has already proven of great value to the Caribbean. There were early arguments as to whether tourism was an asset or liability. The debate is over. Tourism is accepted as having positive economic benefits, but with some less favorable side effects. The world has likely seen only the tip of this iceberg. With the rapid increase in the number of people of retirement age, a large share of whom are relatively well to do financially, the seasonal migration to the Caribbean is bound to increase. With the proper institutional environment, more year round residency is possible. Something more than sunshine and sea will be required to exploit this opportunity fully. Questions regarding access to housing, health care, cultural experiences and transportation remain.

One of the most significant changes in the global economy is the growing dominance of the services-producing sector as the source of employment growth. Almost all of the net job growth in the developed world in the 1980s was generated by service industries. Little or no growth occurred in the goods-producing sector. The implications for economic developers who have concentrated most of their policy initiatives on exploiting natural resource potentials are obvious. The role the Caribbean islands can play in securing future services employment is not yet clear. Surely, they will be a strong part of an ever expanding tourism industry, but what of their potential in the provision of business, legal, and financial services, accounting, consulting, architecture and planning, research and development, testing laboratories, data processing, computer programming, health care and other high growth services. Most demand a highly educated work force. The challenges to
regional human resource development are mountainous.

An interesting shift in the economic structure of much of the world has been the growth in the importance of small business. While mammoth international corporations are enmeshed in buy-outs and economic politics, business start-ups and expansion of firms with fewer than 20 employees have been busy generating a large share of new technology and a growing proportion of net job growth. This has occurred in spite of the international fascination with the attraction of branches of large firms to new locations. Big corporations remain powerful forces in the world economy, but if the smaller islands in the Caribbean are to participate in future growth they will have to concentrate more energy on policies that nurture smaller entrepreneurs.

These four shifts, globalization, leisure time, services-producing industries and small firms have changed the economic development opportunities of the Caribbean dramatically. They are bound to have a lasting impact on the food system as well.

IDENTIFYING SPECIFIC OPTIONS

As indicated earlier, the success of the entire strategic planning process hinges upon the capacity of regional policy leaders to acquire critical bits of knowledge regarding their situation, about external resources that are available and a sense of their realistic development opportunities. Serious gaps in the information and analysis stream can lead to faulty and frustrating conclusions.

Unfortunately, transfers of critical knowledge from their sources to those who need it have not kept pace with the strategic planning process. Most policy makers continue to invest primary energy in the exploitation of their natural resources through farming, fishing, manufacturing and tourism. This is not to suggest that agriculture and other natural resource based industries are not important. Continued emphasis should be placed on development opportunities in these and other industries and on the transfer of knowledge regarding the topic to those who can apply it most effectively. Those interested in the development of the region must be careful not to be constricted by historical natural resources and goods-producing paradigms. There are a host of other alternatives that must be examined if the Caribbean is to develop to its fullest potential.

In recent years economic developers have placed considerable emphasis on industrial targeting. They have, through input-output tables and other sophisticated targeting mechanisms, attempted to identify those specific industries that could be located in an individual region, the theory being that it is possible to identify the critical inputs required by firms within certain industries and then to match a particular region’s conditions to those requirements. Firms from the ideal industries could then be enticed to locate in the region’s communities. Those interested in agriculture have been active in the use of these techniques to identify opportunities to add value to existing farm products (e.g. poultry processing, food packaging). The track record of these efforts in agriculture and other industrial sectors is not encouraging. It is difficult to identify specific industries to be targeted and even more challenging to encourage the location or development of specific firms within these industries.

In most Western economies, the primary control of business start-ups, expansions and locations remains in the hands of the private sector. Public sector choices can influence private sector decisions. Tax policies, financial subsidies, environmental regulations, public education and other variables can have a strong influence. In some cases public decisions will play a direct role in the location of sources of income and employment, for instance, the location of military establishments, the choice of vendors and the allocation of subsidized public housing. As a consequence strategic planners are usually more successful in economic development when emphasis is placed on creating a cultural, economic, political and social environment that nurtures general growth rather than attempting to target specific industries.
Public policy makers can draw on five fundamental strategies in establishing an environment that nurtures economic growth.

- Encourage business formation - There is a continuing need for new enterprises to meet changing demands resulting from population growth, shifts in consumer preference or evolving goods and services (e.g. video cassettes, health clubs, fast food). Historically little public action has been directed at this opportunity. Capital subsidies and business management consultation focused on start ups of less familiar kinds would be helpful.

- Increase the efficiency of existing firms - The growth of existing firms is the largest source of employment increase in most regions. The ability to be competitive over time is the greatest assurance a firm can have of its capacity to maintain or expand an operation in a specific location. The public sector can increase private sectors efficiency by providing a high quality work force, management and technical education, and infrastructure (e.g. transportation and communications systems) that are competitive in quality and price.

- Attract new basic employers - The attraction of branch locations of firms headquartered elsewhere does represent an opportunity, even in some more remote regions. Industries can sometimes be encouraged to locate branches in specific places by the development of industrial, office or commercial sites and supportive infrastructure as well as the provision of labor availability information. It should be noted that attraction opportunities are usually quite limited.

- Improve ability to capture private expenditures - Farmers, the self employed, workers, retirees, tourists, local government and businesses of all types control a substantial amount of money in even the smallest island economies. Every expenditure made within a community for retail and wholesale goods and services as well as industrial inputs adds to local employment and income. The most vibrant retailing centers are those that combine effective product and service marketing with recreational activities. Consumer surveys, marketing education, coordination and promotion and similar public efforts are vital to local economies.

- Increase assistance from broader governments - Not only are broader governments major employers but they return large quantities of funds to local communities through grants, aids and transfer payments. The flow of these monies can be influenced by local organization and education.

These five strategies apply equally to all industrial sectors, including agriculture, fishing and forestry. An analysis of the development prospects of Caribbean food system using this perspective might surface new possibilities.

Successful strategic economic development planning for any specific island or sub-island region will undoubtedly require some combination of these strategies. Thoughtful assessment of regional goals, resources and opportunities will guide political leaders to the appropriate comprehensive plan for each situation.

THE ROLE OF THE UNIVERSITY

Universities can play a number of important roles in improving strategic planning in the Caribbean. Their long term commitment to research and education both in the classroom and in outreach programming places them in a position to generate and dispense relevant new knowledge. Through public education they can create greater awareness of the value of strategic planning. Continuing education programs can provide specific education and technical assistance for policy makers regarding community assessment, strategic planning processes and other leadership and analytical skills.
Access to important local, regional, national and global data is vital in strategic planning. For instance, universities and other institutions regularly gather a great deal of information about global changes that directly influence the development option of specific subregions. The organization and dissemination of this information to local planners on a regular basis would be helpful. If this were done local leaders would be much more aware of their wider opportunities.

The generation of new technology through research often leads to increased efficiency in existing firms and is essential to the creation of enterprises that are dependent on new products and services. Productive linkages between the research components of universities and the private sector can lead to regional employment and income growth. The importance of these linkages has long been recognized. The new ingredient is the criticality of university linkages to both large and small firms. To be most effective universities will need to take a proactive role in establishing these relationships and provide more continuous support to the advancement of new technology from the laboratory to the ultimate consumer. Agriculture's research/instruction/extension structure can serve as a positive role model to the entire university community.

Perhaps the greatest challenge to universities in the Caribbean is the need to play an even more important role than in the past, in developing the human resources of the region. The recognition of the need to examine economic options that are broader than those associated with natural resources, to respond to constant fluctuations in the world economy, to encourage entrepreneurship at the local level, to develop a work force capable of exploiting service sector opportunities, to build the knowledge and leadership skills of local business and public sector leaders and to generate new technology relevant to the region present a tremendous opportunity to higher educational institutions. How effectively universities respond to this challenge may be the most important factor determining the economic future of the Caribbean region.
"Wrap-Up" Comments

R. J. Hildreth

As we come to the final moments of a useful and interesting conference, it may be appropriate to remind you of the purpose of the conference. "The purpose of this regional effort is to offer an opportunity to assist participants in planning interdisciplinary research and extension programs that offer realistic alternatives for addressing microstate development issues and needs." You will note the word "assist" is used. It was not the intention of the planners of the program to plan the programs but to assist the U.S. Caribbean entities in developing programs.

Thus, we have not developed plans, but we have improved communications that will lead to a network of people concerned with research/extension programs in the U.S. Caribbean. I have observed useful interaction during the discussion of the papers, suggestions in the papers themselves, as well as discussions during the break and after the programs between professionals from the Virgin Islands and Puerto Rico. There has also been useful interaction between the U.S. Caribbean and the Down Island professionals. Similar interaction was observed between professionals from Florida and those from the Caribbean.

The success of this conference will be measured five to ten years from now when a research/extension program will be completed that better serves the citizens of the U.S. Caribbean.

Given below are two summary observations from the conference. First, the conference has brought out that there are opportunities in the agriculture and food system for economic development in the U.S. Caribbean. Not all of the opportunities for economic development are in agriculture and the food system, perhaps not the major opportunities. But if the opportunities are not developed, the well-being of the U.S. Caribbean citizens will not be as great as it could be.

My second observation is that there is a need to increase the understanding by citizens of the contribution of research and extension in improving their well-being. This is a difficult task for research and extension workers as well as their administrators. The citizens may perceive such efforts as "feathering the nest" of the research and extension organization. But, without an increased understanding of the contribution and funding, there will not be those development projects undertaken that will increase the well-being of the citizens. This task needs attention in the U.S. Caribbean as well as the Mainland.

My last point is philosophical (perhaps even emotional). A former extension director in Montana, Torlief Aashiem, once said that extension and research should work on the problems that make grown men and women cry. This implies the criterion for choosing projects is their importance from the perspective of citizens. It is not enough that they be interesting to the professional and elegant from the perspective of the professional. The problems should be selected, because if they are not dealt with, grown men and women will cry.

*Manager, Farm Foundation
During the last session of the conference, participants took time to write evaluations and recommendations. The following are taken directly from those comment sheets in response to the question given.

Recommendations

As a result of this conference activity, what actions should now be taken?

- Contact local associations (farm groups, active ones) to assist in the planning stages or recommendations of what is best for farmers.

- Contact all agencies and together have a meeting of the minds. The farmer is the most important of all. Identify funding agencies, plan projects and monitor projects to see how well project is developing.

- Increase communication with policy makers regarding Island short- and long-term plan.

- Integration of research, extension and teaching programs to better please students and rural residents.

- Another conference to discuss, not the problems or the situations, but the specific actions or projects; should be very helpful if held in the near future.

- A copy of the proceedings should be sent to the people in the governments of the Caribbean Islands.

- Applied agro-economic development.

- Applied institution building - application of discoverable incentives to encourage the public and private sectors to build efficient appropriate institutions to achieve assigned results.

- Develop expertise in applying the proposition that there is no macro policy option in small scale economies; only micro policy.

- A follow-up activity involving more in-depth discussion on specific areas. Agriculture in particular requires a much more in-depth focus as it does not get the priority it deserves while all the attention is focused on economic development (Tourism in particular). While most of the energies and inputs are applied to other aspects, agriculture is taken for granted.

- Ask each government in the Islands for their list of priority projects, so that we can work with more specific problems.

- Send recommendations from this conference to Island governments.

- At the macro level, the SRDC, Farm Foundation, UVI, etc. should keep strong linkages and communications ongoing.
Based upon the major findings or outcomes from this conference, see if there can be some movement in getting these issues addressed in some way. Don’t let the issues die. Bring the right actors from the respective land-grant universities together to work on these issues.

Follow-up should be given. I recommend specifically a second conference to be held a few months later on this same general topic. The Puerto Rico perspective might be of interest to those of us involved, and I suggest it as the meeting place. Our university offers a good ground for discussing these issues (along with government officials).

Extension program on the future of the Caribbean region with attempt to attract a large audience. Emphasis on future - Outlook Conference.

- economic trends by sector
- policy directions that are important
- identification of local problems
  - land use
  - water
  - waste management
- local efforts to solve local problems with panels of local people

Follow-up workshops on specific topics, as considered of regional relevance.

Broaden training opportunities at UVI an UPR on subject matters highlighted in the meeting, e.g. planning.

Support reciprocal/horizontal cooperation in biotechnology policy and development in the Caribbean.

Set up a task force to develop a plan/strategy to valorize (take advantage of) indigenous/adapted germplasm resources (plants and animals) in the region.

Use the Caribbean Food Crops Society annual meeting as a forum for future discussions of the topics and related issues pertaining to this meeting.

Plan for establishing mechanisms for implementing recommendations.

Proper integrated plans for economic development now have to be prepared for the various countries, making the most efficient use of their natural resources and giving the people the realistic choices to decide their own destiny.

Organize more frequent conferences of this nature to maintain the communication line.

All ideas must be brought back home and made known to the people they will be affecting in the long term.
Recommend actions for overcoming or working around identified constraints. Be specific.

- Identify constraints first.
- Solicit assistance from a cross-section of affected people.
- Design plan of action.
- Implement process with mechanisms for feedback.
- Regional cooperation to study likely long-term impact of important changes in world order and development strategies: i.e. Europe 1992, Eastern Europe or Russia as competitive economies. This knowledge may then be used by individual nation states to devise their optimum reaction.
- Regional cooperation to build the system of domestic marketing of domestic products up to the standard applied in their export marketing for tourism and commodities.
- On the whole scheme of economic development and food security, agriculture needs to have a higher priority than it presently gets.
- 1992 single European market - St. Lucia should begin to actively seek alternative markets for the sale of their bananas, in addition to an active development of technological packages for the production of other potential and exotic fruits/crops.
- More communication between research institutions.
- Continue working to keep the dialogue between participants alive.
- Work to get Extension to take an active role in public policy education.
- Get relevant agencies and individuals to begin planning together.
- Out of this conference I got a very clear idea that one of the constraints to the region’s development is our lack of communication in this region. This specific activity gave me the opportunity to interact with others who share with me common interests and to establish linkages among institutions. Continue with this.
- Model development/testing/adaption for multidisciplinary/interagency/interisland cooperation/coordination.
- Set up a cooperation mechanism (e.g. regional university network) to bring the five university in the Caribbean together in dealing with development and natural resource management, UWI, NARI/Guyana, UAG/Guadeloupe, UVI/St. Croix-St. Thomas, UPR/Mayaquex-Rio Piedra (for research, extension, education).
• Develop activities to promote and support farmer organizations/training in the Caribbean.

• Emphasis on strong Human Resource development so as to provide the skills and leadership necessary to embark on a new "business" approach to agriculture development.

• Greater involvement of the people affected in the decisionmaking process.

• The authorities need to have the will to set the priorities right.

• Lack of education in the basic concept of economic development.

Comments

Please give your opinion—what was most helpful, suggestions for improvements, etc.

• The different perspectives of the same issue: Caribbean (USVI) and USA - it was a very well thought out way to conduct the conference.

• Conference was excellent. A similar conference should include policy perspectives from elected officials.

• It was an excellent opportunity for thinking and evaluation of the needs and the opportunities of the Caribbean. It set the basis for more close collaboration among the people and the institutions of the Caribbean islands. Making new friends and exchanging information with the rest of the participants was also of great benefit.

• All the areas of discussion were useful. They fit together and were beneficial.

• Suggestion: Let conferees’ have a 48 hour period to FAX their editorial remarks to the conference’s Recommendation after they have typed.

• This conference worked out timely and stimulated thoughts that will be most beneficial toward future economic development plans and projects.

• This conference was pretty useful. Some very important topics were raised. The possibility could be a follow-up from a MICRO perspective.

• Very good conference - we should have a country by country treatment of cases the next time.

• The major strength of the conference is that it brought key people from the Islands together to hopefully nurture important ties with one another. Future conferences of this type might focus more on actual collaborative planning, one that has participants more actively involved in deciding direction - be it research or extension. This first conference was a critical and necessary first step to allow that type of collaborative planning to take place.
The conference was very useful to me. Although I have lived most of my life in the U.S. Caribbean, I have come to realize how little I know about the other islands. We have problems in common, we have information which can be shared so a specific suggestion is to continue this conference, not let it stand alone.

Education of leaders Re: multidisciplinary team development and utilization.

Good mixing of speakers and discussion. Ran out of steam in p.m. session on Thursday. Tried too much for the time. I was particularly impressed with the quality of discussion - broad participation, thoughtful, genuine. There was real learning taking place – good job of picking participants.

More local involvement, video lifestyles examples, do’s/don’ts.

Most helpful - bringing different institutions and disciplines together
- taking a holistic perspective to development
- taking a regional cooperation approach to development

Suggestions - need to make further efforts to identify relevant institutions which could (should be invited to such meetings) eg:
- University of the West Indies (Education)
- Caribbean Economic Society (Economics)
- Caribbean Tourism Organization (Tourism)

Need more discussion; more brevity in papers. Visuals (overheads) effective. Breeze in room wonderful! Need levels of inputs in educational systems on ideas and facts.

Being able to identify the problems and also finding solutions to most of the problems that hinders economic development in the Caribbean. Conference was well organized.

Very interesting. Every session had an excellent idea or two. A bit more basic information - geography, economics, politics, sociology, culture - regarding the islands would have been useful at the start.

This conference was quite helpful in engendering a new perspective on agricultural development through the promotion of a strong entrepreneurial approach to agriculture. In all the sessions this theme emerged as a strong philosophical approach for agricultural and economic development of the Caribbean in the future.

Well coordinated. Good forum for exchange of ideas. Good interaction between people of various disciplines.
Evaluation for
Economic Development and the Food System in the U.S. Caribbean

In order to help us in presenting other conferences, please take a few minutes and fill out this brief evaluation.

Please circle the number best describing your ranking of the following statements.

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This conference provided beneficial information in the area of

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