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Crop Substitution in the Andes

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Foreword

Solutions to the problems of drug abuse must include the resurrection of hope in the inner cities of the United States, where the young people who are our future are dying from drugs and violence. But the loss of hope is not confined to the United States. It was the despair of many ordinary people in producing nations that resulted in the expansion of narcotics production and trafficking into a vast illegal industry. Their economies generated few opportunities. Without options, these people took whatever chance they had to provide for themselves and their families. Some—too many—became coca farmers in the Upper Huallaga Valley of Peru or in the Chapare region of Bolivia, but not because they were criminals or because they wanted to cause harm to American youth. They became coca farmers because they had no other way to go; like our children dying on the streets of Washington and Detroit, of Miami and Los Angeles, they had no hope. While we work to save our young and our cities, our responsibility as a nation and our decency as a people and as individuals demands that we join with our international partners to help in bringing hope to their peoples as well.

This paper contributes to our understanding of how to work with our Andean neighbors. Not surprisingly, the paper shows us that transferring money into areas which have no economic base other than narcotics crops has failed to have a positive counternarcotics effect. We see that coca, like any profitable crop, will be difficult to defeat. Through a discussion of some of the efforts made piecemeal over the past decade and a half, the authors identify weaknesses and flaws. They remind us of an old lesson we learned in Thailand twenty years ago: partial solutions do not work.

Specifically, crop substitution has not worked. However, the authors do not claim that the effort has no redeeming qualities. Crop substitution may indeed be useful. However, for it to make a useful contribution, crop substitution must be part of a balanced program that includes generation of broad-based economic growth sustained over long periods and the continuation of well-considered enforcement efforts.

The paper argues convincingly that the creation of opportunities by focusing efforts and concentrating resources on producing nations' strengths, where they can be efficient, competitive producers of licit goods and services, is the most effective means of solving the problem. In fact, this is probably the only way to achieve our goals given the overall scarcity of resources we face in the world today.

But we have to recognize that there is no way to compete with the narcotics industry on the basis of positive incentives alone. We must keep up our efforts in the areas of law enforcement to make the farmers believe they are at risk when they take part in the narcotics industry. By doing so these farmers begin to work in a direction favorable to our counternarcotics goals; they start looking for other alternatives that a growing economy is generating. We must also continue to press the narcotraffickers through our interdiction efforts and keep pushing their organizational capabilities beyond the limits. As we do so and as some of these organizations break down, as has happened to the Medellin Cartel, we introduce uncertainty into a system that has only known impunity and this will increase the difficulty of its future operations.

This paper, with its sobering message of years and resources lost, causes us to reconsider what has and had not worked and reminds us that success is to be reinforced and failure to be abandoned. But more importantly, it brings to us a reminder that the loss of hope is a root cause of the plague of drugs and violence here and in the cities and countrysides of our partners in the counternarcotics effort.

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Summary

More than a decade of crop substitution programs in cocaine-source countries has had little impact on the dynamics of Andean coca cultivation. There has been little actual crop substitution. In the most important coca-growing regions, the Upper Huallaga Valley, the Chapare, and the Colombian Llanos, coca continues to supply the lion's share of farm income and to employ the vast majority of inhabitants. Furthermore, coca trends are headed in the wrong direction: from 1988 to 1992—despite extensive transfers of economic, law enforcement, and military assistance from Washington—coca cultivation increased approximately 10 percent and potential coca leaf output increased by 13 percent.

What have we learned from the crop substitution experience? Two lessons seem especially relevant. The first is that coca cultivation, despite a secular decline in coca prices since the mid-1980's, continues to be an attractive proposition for farmers. Coca does not necessarily generate a higher per-hectare income than legal crops; yet it offers farmers a secure profit. Most competitive cash crops, in contrast to coca, require several years to mature and are expensive to handle and transport; moreover, markets for some nontraditional products may not fulfill expectations. Such problems are highlighted by the difficult conditions in coca growing regions themselves, including extreme ecological fragility (which limits development of most legal crops), physical isolation from major markets, weak or intermittent government control, and the presence of hostile traffickers and guerrilla forces. Crop substitution programs under these circumstances tend to produce "parallel development" of coca and legal agriculture; risk-averse farmers introduce legal crops when offered incentives (e.g., extension services, low-cost seedlings, credits, and the like). Yet they continue to harvest their

coca and—when expectations of future profits are sufficiently high—to plant new bushes.

A second lesson is that farmers have adopted successful strategies to "remain in" coca in the face of government pressure to switch to legal economic activities. Take, for example, in-country interdiction. While interdiction can disrupt coca markets and lower leaf prices, the concept of a "break-even" price below which farmers will cease to cultivate coca is not a useful evaluation concept. Farmers adapt to lower prices by devoting less time and fewer inputs to tending plants, or by changing the mix of family and hired labor. Maintenance costs for a coca field can be reduced to near-zero levels by such measures. Another farmer response to price drops has been to diversify downstream into production of coca paste and cocaine base. Interdiction (and in earlier years eradication) also expands the coca frontier in the jungle. In Peru, for example, cultivation has moved from the floor of the Upper Huallaga Valley "upward" to inaccessible slopes, northward along the Huallaga river and eastward to Aguaytia—that is to regions out of helicopter range of the U.S.-Peruvian antinarcotics forces in the valley.

Economic inducements also have had disappointing results. Crop substitution has meant mostly agricultural diversification, not replacement of coca with other crops. Agricultural extension services and roads have helped the coca trade as well as legal agriculture. In Peru, the area devoted to legal crops grew in the 1980's and early 1990's, but coca cultivation grew at an equivalent or faster pace. The Bolivian government's compensation payments for coca reduction have resulted in elimination of more than 20,000 hectares of coca; yet such payments also have financed the planting of new coca bushes. More land has been planted in coca over the life of the compensation program than has been planted in alternative crops. Moreover, Bolivian farmers are using agronomic techniques to increase yields from reduced hectarage (coca leaf output reached an all-time high in Bolivia in 1992); in addition, they are maximizing income from reduced hectarage by obtaining faster yields and by processing their leaves into intermediate cocaine products.

Coca's preeminence, of course, should not be taken for granted. Farmers suffer from the effects of coca's illegality—fluctuating prices, violence from traffickers, police abuses, and exactions from guerrillas. In Bolivia, intensified law enforcement and lower coca prices have decreased the attractiveness of coca: the amount of new cultivation recorded in Bolivia has declined every year since 1988, and the number of inhabitants of the Chapare has declined by an estimated two-thirds

since 1988. Such developments, though, are mostly unrelated to crop substitution—United States Agency for International Development's (USAID's) efforts to date have yielded only some 4,000 hectares of exportable crops in the Chapare. Farmers are finding the coca "life style" less appealing and they are capitalizing on the expansion of income opportunities elsewhere in the Bolivian economy.

The outlook for crop substitution programs appears particularly bleak in Peru and Colombia. In Peru, the sheer size of the coca trade represents a daunting challenge: coca occupies almost 130,000 hectares, accounts for 15 to 20 percent of Peru's legal agricultural product and employs 9 percent of the agricultural workforce in the country. In Colombia, coca (as opposed to cocaine) represents a smaller factor in the economy, but the vast majority of cultivation occurs in regions where the Colombian state exercises no effective control. In Peru and Colombia, prices of coca (or coca products) are sufficiently high to discourage replacement of coca with legal crops. In Colombia, though, farmers are turning in droves to an illegal crop that promises even higher profits than coca—as the almost 10-fold expansion of opium cultivation between 1991 and 1992 (from 2,500 hectares to 20,000 hectares) suggests.

Why then practice crop substitution at all? The best arguments for retaining crop substitution programs are political rather than economic. Such programs function as useful negotiating tools in dialogues with coca producers, who can form an important lobby opposing counter-narcotics. By promising programs to raise farmers' legal incomes—even if those programs do nothing more than allow coca farmers to diversify into other activities while still growing coca—assistance to coca-growing regions may improve the image of the U.S. and of the national government. Furthermore, as United Nations Drug Control Program's (UNDCP's) Colombian experience shows, crop substitution can increase the government's political access to insecure zones where guerrilla groups or drug dealers are dominant.

Still, the best hope for reducing coca in the Andes lies not in crop substitution but rather in (1) enforcement measures that depress coca prices and wear down farmers and (2) development programs that promote solid growth throughout the national economy as a whole. Less attention should be devoted to introducing new crops and raising living standards in isolated, infertile, and insecure regions that grow coca; rather creating new job prospects in the cities and in agriculturally promising regions (such as Bolivia's eastern plains) should be the focus of a new development strategy. Aside from absorbing labor now dedi-

cated to coca cultivation and processing, stronger national economies also will contribute to a healthier political climate for counter-narcotics efforts: legitimate elites will squeeze out illegitimate ones and political leaders will agonize less over the economic consequence of attacking the cocaine industry. Still, given unfavorable trends and conditions in the Andes, no significant decline of coca and cocaine production can probably be expected for 10 or 20 years. Even that timetable may prove optimistic if the United States and other industrialized nations fail to curb their voracious appetite for drugs.

Basic Concepts

Crop Substitution and Area Development

Crop substitution programs identify legal crops that replace the income from illegal narcotic-producing crops; they also provide farmers with materials and technical assistance for growing the legal crops. The best review to date of crop substitution programs, by the United States Agency for International Development (USAID) in 1986, concluded:

> The crop substitution strategy. . . has been unsuccessful in introducing substitute crops and in controlling illicit cultivation, at least in the limited span of a typical development initiative. Viable substitute crops are difficult to identify given the generally unfavorable climatic conditions and poorly developed infrastructures that characterize most remote poppy- and coca-growing areas. In many instances, there are not alternative crops that can be grown profitably.[1]

Consistent with the recommendations of the evaluation team, USAID shifted from narrow crop substitution to "area development," which entailed providing physical and social infrastructure as well as agricultural input and services. Variations of an "area development" strategy now guide all major crop substitution efforts, including those of USAID and the United Nations Drug Control Program (UNDCP). Such a strategy consists of a chain of activities considered necessary to lure farmers away from cultivating drug crops. The chain comprises at least five interrelated elements.

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The first of these—corresponding to crop substitution in the narrowest sense—is to identify and introduce replacement crops that promise a reasonable income, and that can thrive in regions where drug crops are cultivated. Agricultural research and extension activities are of course basic to this phase of the substitution process. A substitution project may seek both to increase the profitability of traditional agriculture in such regions (for example, coffee in the Upper Huallaga Valley or rice in Thailand) and to introduce high-value nontraditional crops (such as macadamia nuts in the Upper Huallaga Valley and the Bolivian Chapare). Crop substitution does not necessarily occur on lands formerly planted in coca or opium, lands which are often ecologically unsuited to most legal farming; decisions by farmers to abandon illegal cultivation and to expand planting of legal crops on more fertile lands elsewhere within the same area accomplish the same purpose.

A second aspect involves the development of markets for legal agricultural products. Here, increasing producers' access to buyers and exporters is the central objective. Transport costs from the isolated areas that grow coca or opium are typically so high that the only profitable economic activities are those that have a high value per pound or cubic foot, typically the case with illegal products. USAID or United Nations (UN) initiatives that facilitate marketing include building or upgrading farm-to-market roads and bridges, constructing packing sheds, and storage facilities, and providing trucks which haul produce to major markets at a fraction of the price charged by commercial truckers. In Bolivia, identifying potential domestic and foreign markets for non-traditional crops being cultivated in the Chapare (e.g., pineapples, export-grade bananas, and passion fruit) is an important part of USAID's market development strategy.

A third important link in the substitution chain is "industrialization"—the introduction of processing facilities that improve the salability and increase the value-to-weight ratio of alternative cash crops. Technologies required range from elementary (fans for drying coffee beans) to medium (dehydration facilities for yucca, or machinery for extracting raw sugar from cane) to sophisticated (juice-making and canning plants). Processing is a necessity for certain crops—yucca, papaya, passion fruit, and palm hearts—that are perishable. For some bulky products—citrus fruits, for example—industrialization is essential for successful competition in international markets. USAID and UNDCP development experts stress the importance of value-added processing; however, little investment in processing capacity has yet occurred in

coca-growing regions—a situation that doubtless limits farmers' enthusiasm for expanding cultivation of legal crops.

A fourth aspect of area development involves providing social infrastructure—facilities or services designed to improve the quality of life in the zones that produce narcotics crops. U.S. and UN programs have provided a variety of amenities to residents of such zones; for example, schools, roads, clinics, and potable water systems. Such benefits contribute only indirectly (if at all) to the actual process of crop substitution. Politically, though, they may serve to limit farmers' resistance to coca or poppy reduction programs. USAID and UNDCP administrators see quality-of-life as a bargaining issue. As one UN development expert in Colombia observed, "we have to improve farmers' standard of living as a quid pro quo for the reduced income that they receive from substituting other crops for coca."[2]

A fifth aspect can be described as organizational development. This entails promoting cooperatives of farmers that can aggregate products for sale to processors, intermediaries, or consumers and that can deliver government services to scattered peasant households. Some USAID and UNDCP substitution build on existing farmers' organizations; others, such as the UNDCP projects in Colombia, must build such organizations virtually from scratch. The purposes here are largely economic: to strengthen farmers' bargaining power vis-á-vis buyers and to improve their technical skills and hence increase their ability to cultivate profitable legal crops. Also, producers' associations are said to foster self-respect and a stronger sense of connection to the legal, economic, and political order. UNDCP's activities in Colombia—most of which are centered in areas controlled or dominated by guerrilla groups—may help to reclaim these isolated and forgotten communities for the government; this is certainly a political selling-point for such programs.

Though conceptually an improvement over crop substitution in the restricted sense of the term, area development approaches have yet to be applied successfully in practice. As RAND economist Peter Reuter notes, "There are no instances in which crop substitution has actually been achieved on a large scale."[3] To be sure, successes have been recorded within the confines of project areas—for example, the UNDCP projects in Cauca, Colombia, and in the Upper Huallaga Valley and USAID's projects in Pakistan's Northwest Frontier Province. Yet such results are usually obscured by the expansion (indeed the explosion) of drug crop cultivation in neighboring areas or by the shift of cultivation

to other countries. With respect to the Andes, returns on USAID and UNDCP development projects have been meager. Cultivation of coca in Peru, Colombia, and Bolivia increased steadily during the 1980's. In Peru and Bolivia, the amount of new coca planted was greater than the amount eliminated in the period from 1986 to 1992; in Peru new planting exceeded eradication by an astounding 5 to 1 margin (see Table 1). Since 1989 some redistribution of coca production has occurred with Peru's market share increasing at the expense of Colombia's and Bolivia's (see Table 2).

Such figures, of course, are a commentary on the overall U.S. Andean strategy, including the efficacy of enforcement programs—not just on the effectiveness of crop substitution per se. Moreover, the money spent by USAID on substitution-related projects in the Andes—approximately $50 million since the early 1980's—seems a small sum compared to the magnitude of the problem. A 1991 report by the Andean Commission of Jurists proposed spending a total of $1.3 billion in credits and technical assistance in a multi-pronged effort to replace 80,000 hectare of coca in the Upper and Central Huallaga region with 9 different alternative crops; this works out to a substitution cost of $17,000 per hectare—perhaps not an unreasonable figure if net coca cultivation in Peru could be reduced by the specified 80,000 hectares. Unfortunately, the experience of the Andean coca boom of the 1980's and of illicit cultivation trends in other parts of the world suggest that even well-funded projects of the sort proposed by the Commission will not solve the Andean cocaine problem. General economic conditions in drug-source countries and the inherent mobility of agricultural labor and narcotics crops themselves argue for a more holistic approach to substitution and development—a subject that is addressed in the next section.

Table 1. Cultivation Trends in Peru and Bolivia 1986 Through 1992, in Hectares (ha)

Peru

Year	Gross Cultivation	Eradication	Net Cultivation	New Cultivation[1]
1986	107,500	2,575	104,925	17,130
1987	109,500	335	109,145	4,575
1988	115,630	5,130	110,500	6,485
1989	121,685	1,285	120,400	11,185
1990	121,300	0	121,300	900
1991	120,800	0	120,800	(500)
1992	129,100	0	129,100	8,300

Total new planting 1986-1992: 47,285 ha
Total eradication 1986-1992: 9,345 ha

Bolivia

Year	Gross Cultivation	Eradication	Net Cultivation	New Cultivation[1]
1986	37,000	200	36,800	3,030
1987	40,300	1,042	39,258	3,500
1988	49,976	1,476	48,500	10,718
1989	55,400	2,500	52,900	6,900
1990	58,400	8,100	50,300	5,500
1991	53,386	5,486	47,900	3,086
1992	50,549	5,149	45,500	2,749

Total new planting 1986-1992: 35,483 ha
Total eradication 1986-1992: 23,947 ha

[1] Calculated by subtracting net cultivation in the previous year from gross cultivation in the current year.

Source: Department of State. Bureau of International Narcotics Matters. International Narcotics Control Strategy reports for various years.

Table 2. Share of Andean Net Coca Cultivation and Coca Leaf Output by Country and by Year, 1989 to 1992

	1989	1990	1991	1992
Peru				
Area (hectares)	120,400	121,300	120,800	129,100
Output (metric tons)	186,300	196,900	222,700	223,900
Bolivia				
Area (hectares)	52,900	50,300	47,900	45,500
Output (metric tons)	78,200	77,000	78,000	80,300
Colombia				
Area (hectares)	42,400	40,100	37,500	37,100
Output (metric tons)	33,900	32,100	30,000	29,600
Total area	215,700	211,700	206,200	211,700
Total output	298,400	306,000	330,700	333,800
Peru				
Percent area	55.8	57.3	58.6	61.0
Percent output	62.4	64.3	67.3	67.0
Bolivia				
Percent area	24.5	23.8	23.2	21.5
Percent output	26.2	25.2	23.6	24.1
Colombia				
Percent area	19.7	18.9	18.2	17.5
Percent output	11.4	10.5	8.9	8.9

Source: International Narcotics Matters. "Major Coca and Opium-Producing Nations: Sample Survey-Based Cultivation Estimates." Chart, 1993.

From Area Development to Alternative Development

From USAID's perspective, area development approaches represented an inadequate response to the challenges posed by deeply entrenched narcotics industries such as cocaine. The argument for a more widely-gauged development strategy was well expressed in a recent review of USAID's narcotics programs, which concluded:

> AID's extensive experience with crop substitution in both Latin America and Asia has clearly demonstrated that economic assistance to illicit growing areas alone is not effective. Both illicit labs and illicit crop production are dynamic and mobile. Alternative economic opportunities depend on sound economic policies to generate demand for diversified economic growth and job creation nationwide.[4]

Under this broader rubric, a "substitute crop" could be a mango plantation on the Peruvian coast, a soybean plantation in Santa Cruz or even a factory in Lima or Cochabamba producing goods for the international market. Alternative development means improving economic opportunities in impoverished regions, such as the Peruvian altiplano or the high valleys of Cochabamba, that are important sources of migration to coca-growing zones. The concept could imply developing commercial agriculture or agribusiness in agriculturally promising regions—Bolivia's eastern plains, for example—in order to attract farmers and processors away from the coca economy.

In other words, USAID's current Andean strategy is to promote economic development throughout the coca-producing countries, not just to substitute coca for legal crops in remote jungle locations. USAID still regards crop substitution and work in coca-producing areas as components of its alternative development strategy, but most of the money and attention now goes to other aspects, such as establishing a sound economic environment for growth. Overall, counternarcotics development is about creating employment with high incomes so that those now growing coca will stop doing so, whether they go into farming in other regions, the urban informal sector, industry, or farming of new crops in the coca regions. The challenge facing such a strategy is the large number of still-poor potential migrants, especially in the rural mountain areas of Peru and Bolivia. On the other hand, generations of migrants have been absorbed in cities and rich agricultural areas, which suggests that a restoration of normal national economic growth

would create jobs for the migrants in areas more attractive than the unhealthy and isolated coca regions.

The part of USAID's effort devoted to crop substitution aims to make growing legal crops more attractive. Promoting substitution of legal crops for coca by making growing coca unattractive has been the responsibility of law enforcement agencies. Those agencies typically measure the effectiveness of their operations by the amount of destruction of coca fields, coca products, and coca-processing facilities, not by the economic effect on farmers of their operations. Yet most USAID officials believe that farmers will not give up cultivation of lucrative drug crops on their own. "Effective enforcement measures designed to control or prevent narcotics crops production are an essential requirement for the success of any project," noted an USAID review of substitution programs in 1986.[5] It is not clear, though, what mix of enforcement or economic inducements will advance the process of substitution in illicit crop areas—or whether successful substitution in these areas is possible at all. This analysis will examine the carrot and stick efforts on coca cultivation trends; also, the analysis will assess the impact of crop substitution policies on overall U.S. objectives of reducing coca and cocaine production in the Andes.

Endnotes

1 Kumar, K. et al., *A Review of AID's Narcotic Control Development Assistance Program*, AID Evaluation Special Study No. 29, March 1986, pp. 38-9.

2 Interview with Jukka Pietkainen, UNDCP advisor. Pepayan, February 1993.

3 Quoted in Seyler, D. "AID and Narcotics Control: An Issue Brief." April 3, 1991, p. 5.

4 USAID. *Andean Counter-Drug Initiative.* Annual Report 1992. Washington, DC. February 1993, p. 3.

5 Kumar et al. op. cit., p. 39.

Coca Cultivation

Cultivation Trends

Coca, a perennial shrub with several subpieces, is cultivated in the Andean countries of South America, generally at an elevation below 2000 meters. After planting, the bush grows 12 to 18 months before the first crop of leaves can be picked and 3 to 4 years before full production is reached, when the bush is 3 to 5 feet high; the bush produces for 10 to 25 years depending on how well it is cared for. Coca is a hardy and adaptable plant that flourishes on steep slopes and in infertile acidic soils, that is, in conditions that restrict the growth of other crops. While coca can grow almost anywhere in tropical South America (and in other tropical regions of the world) much of the land now planted in coca in the Andean countries is simply unsuitable for legal agriculture.[1]

Virtually all of the world's coca is cultivated in Peru, Bolivia, and Colombia. Peru is the largest producer, accounting in 1992 for 61 percent of the land area devoted to coca and 67 percent of the Andean output of coca leaves, according to U.S. Government estimates. Bolivia and Colombia account, respectively, for 21 percent and 18 percent of the land area and 24 percent and 9 percent of the leaf output. Since 1989, Peru's share of Andean coca production has increased while the shares of Colombia and Bolivia have declined (see Table 2). The two most important coca-producing regions in South America are Peru's Upper Huallaga Valley and the tropical provinces of Cochabamba department, collectively called the Chapare, in Bolivia. Together these areas produce an estimated 70 percent of South America's supply of coca leaves. In Colombia, more than 90 percent of the coca-growing area and coca leaf production is concentrated in three departments—Guaviare, Putumayo,

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and Caqueta—in the southern and eastern portions of the country (see the maps that appear at the end of this paper).

Coca yields—output per unit of land—vary by country and by region within countries. Per hectare yields in Peru and Bolivia average more than double those of Colombia. Also, Colombian coca has a relatively low alkaloid content (0.32 percent on the average), about half that found in Peruvian and Bolivian coca. Coca productivity in the Chapare and the Upper Huallaga generally ranges from 2 to 3 metric tons per hectare compared to 1.0 to 1.5 metric tons in other areas of Peru and Bolivia. Andean sources report yields as high as 4 to 5 metric tons per hectare in those two regions.

Also, productivity has tended to increase over time. USAID's Special Upper Huallaga Valley project has compiled data showing a more than 40 percent increase in yields from 1983-1985 to 1989-1991. In Bolivia, average national yields have risen about 20 percent since 1989, according to State Department data. Between 1989 and 1992 total hectarage devoted to coca leaf in South America actually declined slightly (from 215,700 hectares to 211,700 hectares) but potential leaf production increased almost 12 percent (298,400 metric tons to 333,800 metric tons). Such trends reflect the growth to maturity of coca bushes planted during the boom years of the 1980's, but they also suggest that coca farmers are applying techniques to increase the efficiency of production.[2]

Legal and Illegal Markets

The vast majority of Andean coca leaf production is destined for conversion to illegal cocaine. According to U.S. Government estimates, the cocaine market, like the production of coca leaf, has grown steadily in the past five years. A legal market, however, does exist for coca leaves in Peru and Bolivia where coca has been used for chewing and medicinal or ritual purposes since pre-Incan times. (In Colombia, coca plays little social role and has no legal status.) Most legal coca originates in the Yungas region of the La Paz Department in Bolivia and in the provinces of La Convencion and Calca in the Cuzco Department in Peru. The legal market absorbed an estimated 4 to 5 percent of Peru's coca output in 1992, and an estimated 12 to 13 percent of Bolivia's output.

What are the components of the legal coca market? Most of the leaf is consumed by households; in general, it is chewed (coca is both a stimu-

lant and an appetite suppressant) or used as a remedy for stomach ailments and other illnesses. Some leaf is exported—Coca-Cola uses small quantities from which it extracts flavoring coca after leaching out the cocaine and other alkaloids. Some is converted to legal cocaine for pharmaceutical markets abroad (in the United States cocaine is still used in eye drops and nose drops and is widely administered during rhinoplasty or "nose jobs;" its traditional role as an anesthetic, however, has been largely supplanted by new generations of synthetic drugs). Also, coca has some limited use as a food additive and commercially packaged coca tea is a popular brew in Andean highland regions. According to a report by Bolivia's planning minister, Samuel Doria Medina, 15 percent of Bolivia's coca leaf output in 1990 went to household consumption, 1 percent to the manufacture of foods and chemical substances, 1 percent to exports and unspecified legal uses, and 83 percent to the illegal cocaine market.[3]

Pro-coca leaders in the Andean countries view expansion of legal coca markets as an alternative to both eradication and substitution. The argument is that "industrialization" of coca—conversion to foods, medicines, and household products—could absorb much of the "excess" leaf now destined for illegal markets. Some trial production of such products as coca crackers, coca toothpaste, and coca wine has already occurred in the Andes. The Bolivian government is actively promoting foreign sales of coca tea. Yet the potential legal market for coca probably is exaggerated by industrialization advocates. Even if industrial countries were to permit free imports of coca leaf tea and similar products—now subject to varying and inconsistent restrictions—it is difficult to see such products being a significant source of income for Andean farmers in face of competition from other beverages. Furthermore, the economic consequences of industrialization might be different from those envisioned by its promoters. A significant expansion of legal production would precipitate a bidding war between traffickers and legal entrepreneurs for available supplies of both coca leaf and agricultural labor. Both leaf prices and wages in the illegal sector would rise, resulting possibly in an expansion of the amount of coca under cultivation—an undesirable outcome.

Economic Significance

The difficulty of the crop substitution task is largely a function of coca's role in the agricultural economies of the Andean nations. According to USAID estimates, the production value of illegal coca leaves in Peru

amounted to almost $329 million in 1991—16 percent of Peru's legal agricultural product. In Bolivia, the corresponding figures in 1992 were $66 million or 6 percent of the legal product. While no equivalent numbers exist for Colombia, where there is virtually no market for leaves (leaves are converted to cocaine base at or near the cultivation site), base production in 1991 probably represented less than 2 percent of the Colombian agricultural product. The total direct and indirect economic impact of the cocaine industry, counting value added in the production of illegal coca leaf and its derivatives, was estimated by USAID to be $1,027 million in Peru in 1991, or 4.2 percent of that country's gross domestic product (GDP). In Bolivia the equivalent figures were $148 million to $212 million, or 2.3 to 3.3 percent of the GDP in 1992.[4]

The number of those directly employed in illegal coca cultivation according to USAID is 102,600 farm workers in Bolivia (1992) and 150,600 in Peru (1991). Peru's employment figure is almost certainly an underestimate (or the Bolivian figure is too high) since Peru's coca leaf output is estimated to be almost three times that of Bolivia's. (Also, production surveys indicate Bolivian workers are as productive as Peruvian workers.) The Andean Commission of Jurists cites an "active coca-growing population" in Peru of 260,000 circa 1991, which seems closer to the mark. Using the USAID Bolivian employment figure and the Andean Commission's Peruvian employment estimate, one can calculate illicit coca employment at approximately 9 percent of the agricultural workforce in both Bolivia and Peru in 1991-1992. In Colombia, which specializes in cocaine refining rather than in coca cultivation, the coca-growing population was 61,300 in 1991, or 1 percent of the agricultural workforce, according to the Commission's estimate.[5]

At the regional level, indications of economic dependency on coca are especially pronounced. The value of illegal coca cultivation in the Upper Huallaga Valley—calculated at more than $250 million in 1991—was more than 12 times that of legal agriculture in the peak year of 1988 (approximately $20 million).[6] In 1987, coca composed 92.5 percent of the Chapare's agricultural income, according to a Bolivian presidential report in 1990; this regional proportion remains high despite cocaine's declining importance in the Bolivian economy as a whole. A study by a Peruvian consulting firm, Cuanto S.A., estimates that 54 percent of the total economically active population in the Upper Huallaga Valley (71,152 out of 131,742 inhabitants) was engaged in the "informal agricultural sector"—that is, in coca farming.[7] According to the 1992 Rural Household Survey in Bolivia, 95 percent of the farmers in the Chapare cultivate at least some coca on their land holdings.[8]

As the above discussion suggests, replacing the coca economy with legal crops would be an awesomely difficult task in Peru—requiring the shift of more than 250,000 agricultural workers into legal agricultural activities that could generate gross revenues of nearly one-third of $1 billion. In Bolivia, the task appears more modest; indeed, some U.S. development experts seem optimistic about the prospects for substitution. A recent USAID study of agricultural conditions in the Chapare identifies 8 nontraditional crops that could be planted on 43,200 hectares in the region, requiring a total investment of $48.7 million, and generating a net income of $48.8 million, which possibly compares favorably to that produced now by coca.[9] The critical issues are whether real markets exist for these new crops and whether farmers would plant these crops in addition to coca or in place of it. Getting farmers to grow legal crops is probably less difficult than getting them to abandon coca—as the next section of this report makes clear.

Coca Leaf Prices

Farmers base decisions on prices and costs (or expected prices and expected costs); hence, information on these factors must guide any analysis of the prospects for crop substitution in the Andes. Price data are drawn from several sources. In Bolivia, they are collected by Bolivia's coca-reduction agency (DIRECO) via surreptitious observation of quasi-legal coca markets operating in three Chapare locations. U.S. Embassy officials in La Paz believe that the price of coca in these markets is as much as one-third higher than the price paid by traffickers at the farm, but there is no way to confirm this conclusion. In Peru, recorded prices are averages of data collected by three different organizations operating in the Upper Huallaga Valley: (1) the USAID-funded Special Huallaga Valley Project (PEAH), (2) the United Nations Drug Control Program (UNDCP), and (3) the U.S. Drug Enforcement Agency (DEA). The averages can be considered an approximation of farm gate prices; there are no legal or quasi-legal coca markets operating in the Valley.

What do the price data show? First, prices for Peruvian leaf are consistently higher than the prices for Bolivian leaf; moreover, the disparity has been increasing over time—in 1992, the Peruvian price was almost double the Bolivian price (the difference might be even greater if the Bolivian data recorded farm prices, as opposed to legal market prices).[10] Secondly, in Bolivia, the data show a clear downward trend from April 1986 through September 1992; on the average, the price of a carga (100-pound unit) fell each year by $5.57—and the price did in fact fall in

every year except 1991, when there was a partial recovery from the nadir period of 1990. By contrast, the Peru data set (which does not extend to the pre-1989 period) shows a clear upward price trend since 1990—again, a significant contrast to the situation in Bolivia (see Tables 3 and 4).

Finally, conclusions can be drawn about the behavior of prices. In Bolivia, prices have been extremely volatile since April 1986. Major price drops accompanied both "Operation Blast Furnace" in the summer of 1986 (a U.S. military-supported assault against cocaine laboratories in Santa Cruz and Beni Departments) and the Colombian government's 1989-1990 crackdown on the Medellin Cartel, which significantly disrupted trafficking operations upstream in Bolivia and Peru. On the other hand, prices have been less variable in Bolivia since March 1991. In Peru, price volatility also has decreased since early 1991. (Figures 1 and 2 provide visual evidence of this change.) Comparing prices in the periods October 1989 through March 1991 and April 1991 through September 1992, the standard deviation as a percent of the mean dropped from 39 percent to 26 percent in Peru, and from 57 percent to 20 percent in Bolivia.

Overall, recent price developments have mixed implications for the cause of crop substitution in the Andes. In Peru, trends are clearly unfavorable: from June through December 1992, leaf prices did not drop below $2 per kilogram ($91 per hundred-weight) and rose as high as $3.70 per kilogram ($168 per hundred-weight) in September 1992. At these prices, farmers' gross annualized incomes per hectare would have ranged from $4,000 to $7,400 or even higher, depending on yields. The price differential between Peruvian and Bolivian leaf may reflect a combination of factors; among them weaker interdiction efforts, higher production costs, and the conversion of larger amounts of leaf to coca paste on the farm (which could constrict available supplies of leaf). Yet, unless Peruvian farmers' profit margins are incredibly low, the behavior of leaf prices in Peru is bad news for crop substitution. In Bolivia, the direction of prices in the past several years is encouraging; however, there has been no clear trend over the 1991 to 1992 period. A constraint on substitution in both countries is the declining variability of prices. Fluctuating prices reduce the predictability of income flows and may make planting coca appear less attractive compared to planting other crops.

Less variable prices may reflect a reduction in interdiction efforts; alternatively, they may signal a conscious purchasing strategy by cocaine

Table 3. Coca Prices in Peru and Bolivia in Comparable Periods[1]

Country	Unit	1989 (April to December)	1990	1991	1992
Peru	Kilogram	1.33	0.93	1.89	2.15 (2.34) [2]
	100 lbs.	60.45	42.27	85.9	98.18 (108.36) [2]
Bolivia	Kilogram	1.17	0.53	0.99	0.9
	100 lbs.	53.39	24.15	44.88	41.13

[1] Prices in U.S. dollars.
[2] Prices for January through December 1992.

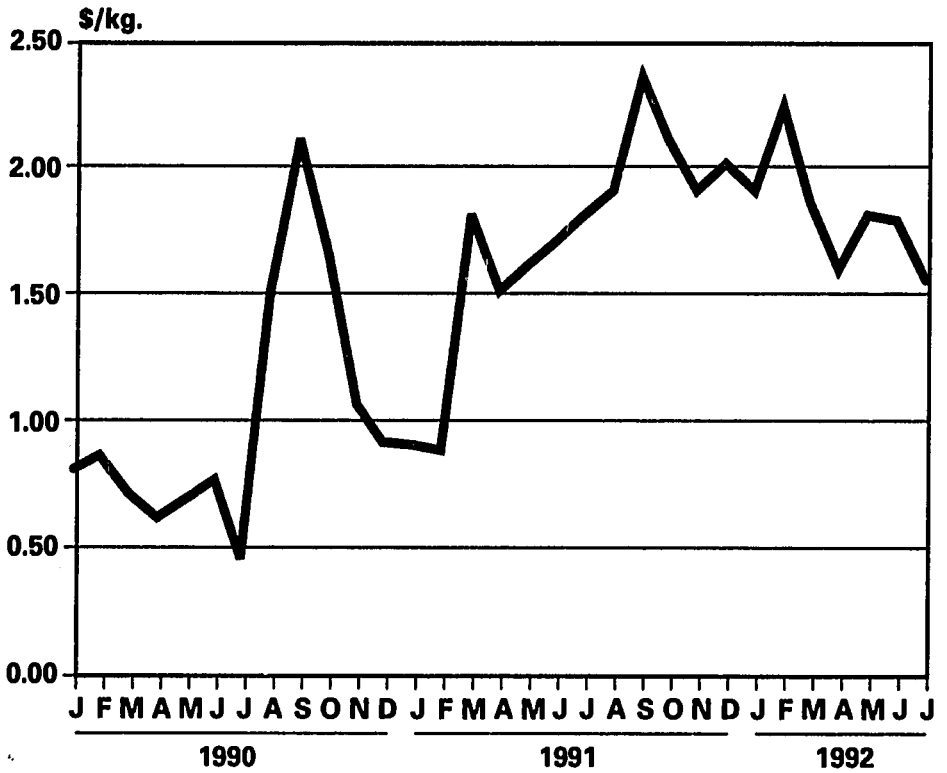
Source: USAID.

Table 4. Average Coca Leaf Prices in Bolivia (in Dollars per 100 Pounds)

Apr	- Dec	1986	74.56
Jan	- Dec	1987	72.18
Jan	- Dec	1988	62.76
Jan	- Dec	1989	57.42
Jan	- Dec	1990	24.15
Jan	- Dec	1991	44.88
Jan	- Dec	1992	41.13

Source: Seylar, D. USAID.

Figure 1. Upper Huallaga Valley Coca Leaf Price, 1990-1992



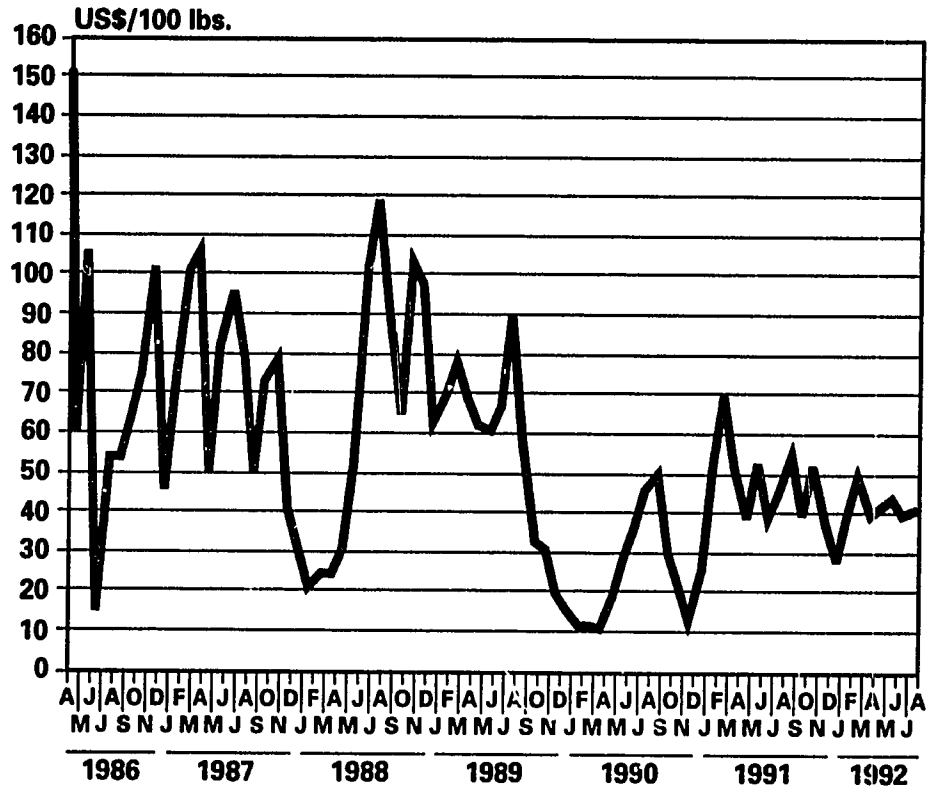
Source: PEAH, Planning Office

dealers. As USAID economist Kenneth Beasley has written, "It is in the interest of processors and traffickers to encourage coca leaf farmers. Stable, attractive prices could be important vehicles for doing this."[11] The evidence is consistent with the interpretation that traffickers may be learning to stabilize prices, though we have no confirmation that this is so.

Production Costs

Coca farmers' production costs, like the prices that farmers receive for leaves, may vary within a wide range. Techniques for producing coca differ substantially from farmer to farmer. There are no credible estimates of what constitutes an average coca farm. The estimates used by Andean governments and different U.S. Government agencies vary by as much as 5,000 percent on technical coefficients; there is no agreement on the average amount of labor required for each stage of the crop, the physical amounts of inputs needed, or on crop yields.

Figure 2. Bolivian Coca Prices, April 1986-August 1992



Source: USAID

Approximations of coca production costs and profitability, based on USAID and UNDCP sources, are indicated in Tables 5 and 6. UNDCP's Peru model tracks three different production strategies and examines the cost of different stages in the lifecycle of a coca bush. The main conclusions from the data are that (1) when prices rise, more intensive cultivation (more fertilizer, more frequent weeding, etc.) becomes profitable, and (2) when prices fall, farmers can still make a profit using a simpler production method. Yet in USAID's Bolivian analysis, high-technology production is fairly successful even at low prices for coca: Profit margins are more than 50 percent in Bolivia compared to 22 to 25 percent in Peru. Note that in both representations, outlays for labor are by far the most significant factor in farmers' production costs, ranging from 64 percent to 92 percent, depending on the technology level and the production stage. U.S. law enforcement and development officials have sought to identify a single break-even price for coca—a definitive income threshold below which farmers will abandon coca cultivation. There are several difficulties with the "break-even" concept. First of all, the literature on coca cultivation records wide disparities in per-unit

Table 5. Peru: Variable Cost of Production of Coca, March 1991 (U.S. Dollars)

	Low Technology		High Technology					
			Total 1st 3 Yrs.		Production Phase		Last Phase	
	Quantity Per ha	U.S.$ Per kg	Quantity Per ha	U.S.$ Per kg	Quantity Per ha	U.S.$ Per kg	Quantity Per ha	U.S.$ Per kg
	(kilos)	(price)	(kilos)	(price)	(kilos)	(price)	(kilos)	(price)
Dry leaf output	667 (days/ year)	1.56 (cost)	707 (days/ year)	1.56 (cost)	2,070 (days/ year)	1.56 (cost)	2,013 (days/ year)	1.56 (cost)
Labor (days/yr.)								
Harvest	56	0.38	59	0.38	173	0.38	168	0.38
Drying, packing	10	0.07	8	0.05	30	0.07	30	0.07
Transport	3	0.02	4	0.03	9	0.02	9	0.02
Construction	0	0	80	0.51	0	0	0	0
Transplant	0	0	60	0.39	0	0	0	0
Weeding, other	0	0	113	0.73	156	0.34	130	0.29
Total Labor	69	0.47	324	2.09	368	0.81	337	0.76
Materials	—	0	—	1.02	—	0.31	—	0.32
Unforeseen (10%)	—	0.05	—	0.31	—	0.11	—	0.11
TOTAL COST		0.52		3.42		1.23		1.19
TOTAL PROFIT		1.04		-1.86		0.33		0.37

Note: Excludes fixed costs, especially the cost of recovering initial investment. Also excludes costs from law enforcement, such as seizure or destruction of the crop. Assumes buyers can be readily found for the crop, without having to wait while the crop deteriorates and financing costs mount.

Source: United Nations Development Program, Regional Development and Agroindustrial Promotion Project.

Table 6. Coca Cost, Revenue, and Profit Per Hectare,[1] Bolivia, 1992

	Production Costs Per Hectare (ha)		
	Quantity	Unit Price (U.S.$/ha)	Total (U.S.$/ha)
Investment (excl. land)			
Land Preparation (M/D)	40	3	120
Equipment (various)	0	-	418
Coca Seeds (qq)	4	12	48
Hole Digging (M/D)	30	3	90
Transplanting (M/D)	25	3	75
TOTAL			751
Divided by 8 Yrs.[2]			93.9 ha/yr.
Labor Costs			
Hand Weed	48	3	144
Fumigation	24	3	72
Agrochemical Application (M/D)	70	3	210
Harvesting (M/D)	135	3	405
TOTAL			831 ha/yr.
	Amount/ha/yr.	**Unit Price (U.S.$)**	**Total/ha/yr. (U.S.$)**
Agrochemicals			
Fertilizers (lts)	1	15.0	15
Herbicides (lts)	3	7.7	23
Insecticides (lts)	4	24.0	96
TOTAL			134 ha/yr.
REVENUE (2.625 metric tons at $41 per 100-lb. carga minus 5-percent loss rate)			$2,256
TOTAL COST			$1,059
PROFIT			$1,197

(M/D) = Man/Day

[1] For illegal coca in the Chapare and in the Apolo region of the La Paz Department.
[2] Assuming that the older coca plantations have been eradicated, and that the existing plantations are no more than 8 years old.

Source: USAID.

Table 7. Production Costs Using Different Assumptions

Year	Production Cost Per Carga	Technology Level	Country	Assumed Yield Per Hectare	Source
1992	$30	medium	Bolivia	2.2 MT	USAID
1992	$17	high	Bolivia	2.7 MT	USAID
1991 (March)	$54 to $56	high	Peru	2.0 MT	UNDCP
1991 (March)	$30	low	Peru	0.7 MT	UNDCP
1991 (August)	$18	N/A	Peru	2.7 MT	PEAH

MT = Metric Ton

production costs, as indicated in Table 7. Farmers use different mixes of inputs and cultivate their fields with varying efficiency. Secondly, farmers are likely to change their production strategy depending on prevailing prices. At low prices, farmers may opt to concentrate on harvesting the leaves, devoting little or no labor time to tending the plant (weeding or fertilizing) and applying few inputs, such as fertilizer and insecticides. Harvest costs may be as little as 30 percent to 50 percent of total production costs, according to USAID and UNDCP data.

Third, a major complication in any analysis of coca production costs is that farmers make use of family labor when they need to cut costs. If leaf prices are high, the farmer will hire more pickers; if prices drop, the farmer's spouse and children will be pressed into service as pickers. This provides a flexibility that is not necessarily available with other crops, for which the prices, production techniques, and harvesting requirements may not justify using hired labor. Note that in the Peru and Bolivia cases represented above, eliminating labor costs in the production phase would reduce production costs to only about $4 per carga in Bolivia to less than $2 per carga in the low-technology Peruvian case and to approximately $20 per hectare in the high-technology Peruvian case. That is, coca can be cultivated almost indefinitely even at very low prices.

Finally, what influences farmers' production decisions is the anticipated future price of leaves, not the current price. For example, in 1990—when coca prices plummeted to record low levels—Bolivian farmers planted approximately 3,000 hectares. In the following year, when average coca prices had rebounded to almost double their 1990 level ($43 per carga compared to $25 per carga) farmers planted only 2,700 hectares. In effect, in 1990, farmers predicted that prices would stabilize at a higher level, which they did. In 1991, farmers were less confident about a future rise in price so they planted less coca.

Endnotes

[1] During the coca boom at the turn of the century, some coca was cultivated on the island of Java in modern-day Indonesia. The historical importance of coca leaf in Andean culture, geographical proximity to the U.S. market, and the extraordinary entrepreneurship of Colombian trafficking organization partly explains why coca leaf cultivation is currently concentrated in the Andean region. Yet coca's ecological range clearly is not limited to South America.

[2] PEAH charts on coca production in Huanuco and San Martin, 1983-1991. U.S. State Department. Bureau of International Narcotics Matters. International Narcotics Control Strategy Reports for various years.

[3] Medina, S.D. "Coca por Desarollo." *SEAMOS*. La Paz. October 1991, Appendix, Table 8.

[4] USAID. "Estimates of Economic Impact of Coca and Coca By-Products Production." Cable. July 8, 1992, pp. 1-3.

USAID. "Bolivia's Coca Sub-Economy in 1992, a Computer Model." Bolivia. February 1993, Table 4, p. 4.

[5] Ibid. and Comision Andina de Juristas. "Cultivos de Coca y Propuesta de Desarollo Alternativo." Lima. 1991, Table 1.

[6] Arbusada, R. "The Economies of Coca Leaf Production." Lima. July 1990, p. 27. Presidenciá de la Republica de Bolivia. *Estrategia Nacional del Desarollo Alternativo*. La Paz. 1990, p. 3.

[7] Cuanto, S.A. *Huallaga Valley, Population, Growth, Distribution, Labor Force, Migration and Social Services*. Lima. 1991, p. 50A.

[8] Clawson, P. Interview with Jose Salinas Castro, Ministry of Agriculture. La Paz. August 1992.

[9] Joel, C. *Alternative Development of the Chapare*. La Paz. June 9, 1992, p. 24.

[10] The difference is not due to lower cocaine content in Peruvian leaf; in fact, DEA and INM sources report that cocaine content is higher in Bolivia. The price difference is due in part to the higher cost of transporting leaves from Bolivia to Colombia.

[11] Beasley, K. "Comments on Interdiction, Eradication, and Alternative Development, and the Use of Changes in Coca Prices as a Measure of Success." Memorandum, USAID La Paz, July 30, 1992, p. 1.

Rather paradoxically, U.S. interdiction policy seeks to drive coca prices down for Andean farmers and to drive cocaine prices up for U.S. consumers.

Coca and Alternative Crops

Prospects for crop substitution in the Andes simply do not revolve around coca prices and production costs; they also depend on the economic attractiveness of legal crops. Contrary to a widely held belief, net income from coca per unit of land is not always higher than that from legal crops. For instance, in the Upper Huallaga Valley, returns from local citrus, bananas, and agriculture have compared favorably with those from coca, according to data from the Special Upper Huallaga Valley Project (PEAH) (see Table 8). In Bolivia, USAID administrators have identified a range of non-traditional crops that could compete successfully, on a per hectare basis, with coca at leaf prices prevailing in 1991 and 1992 (see Table 9).

Such comparisons tend to obscure the relative disadvantages of cultivating legal crops in coca-growing zones. First, most legitimate agricultural production in the Upper Huallaga and the Chapare is sold locally. Internal markets in both regions are too small to support significant production expansion. Although certain crops designated for local consumption may be as profitable as coca in the Upper Huallaga Valley, a larger harvest of the same crop—for example, citrus and bananas—would require selling the surplus in Lima, which would be unprofitable because of transport costs.

Second, prices for most traditional agricultural products in the Upper Huallaga Valley have been severely depressed. During much of the 18-month period from January 1990 through August 1991, farmers actually lost money cultivating coffee, corn, and cacao, according to PEAH data. Furthermore, during 1990 and 1991 price trends for coca were more favorable than those for most legal crops in the Valley, as Figure 3

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Table 8. Profitability of Coca Per Hectare (ha) Compared to Other Crops in the Upper Huallaga Valley, August 1991

Crop or Product	Production kg	Production Costs U.S.$	Sale Price Per kg U.S.$	Gross Income U.S.$	Net Income U.S.$	Profitability %
Bananas	10,000	1,566.82	0.64	6,400.00	4,833.18	308.47
Citrus Fruits	30,000	2,200.75	0.192	5,760.00	3,559.25	161.00
Beans	1,000	592.82	1.53	1,530.00	937.17	158.08
Rice	5,000	1,294.67	0.47	2,350.00	1,055.33	81.51
Corn	3,800	1,061.02	0.38	1,444.00	382.98	36.09
Yucca	20,000	2,941.60	0.192	3,840.00	898.40	30.54
Cacao	800	670.32	0.935	748.00	77.68	11.58
Coffee	800	646.16	0.83	664.00	17.84	2.76
Agriculture	7,000	7,989.54	3.20	22,400.00	14,410.46	180.36
Coca	2,700	1,097.09	1.91	5,157.00	4,059.91	370.06

Source: Upper Huallaga Valley Project (PEAH).

Table 9. Revenues, Costs, and Profitability Per Hectare (ha) Planted to Coca and Alternative Crops: Bolivian Chapare (in U.S. Dollars)

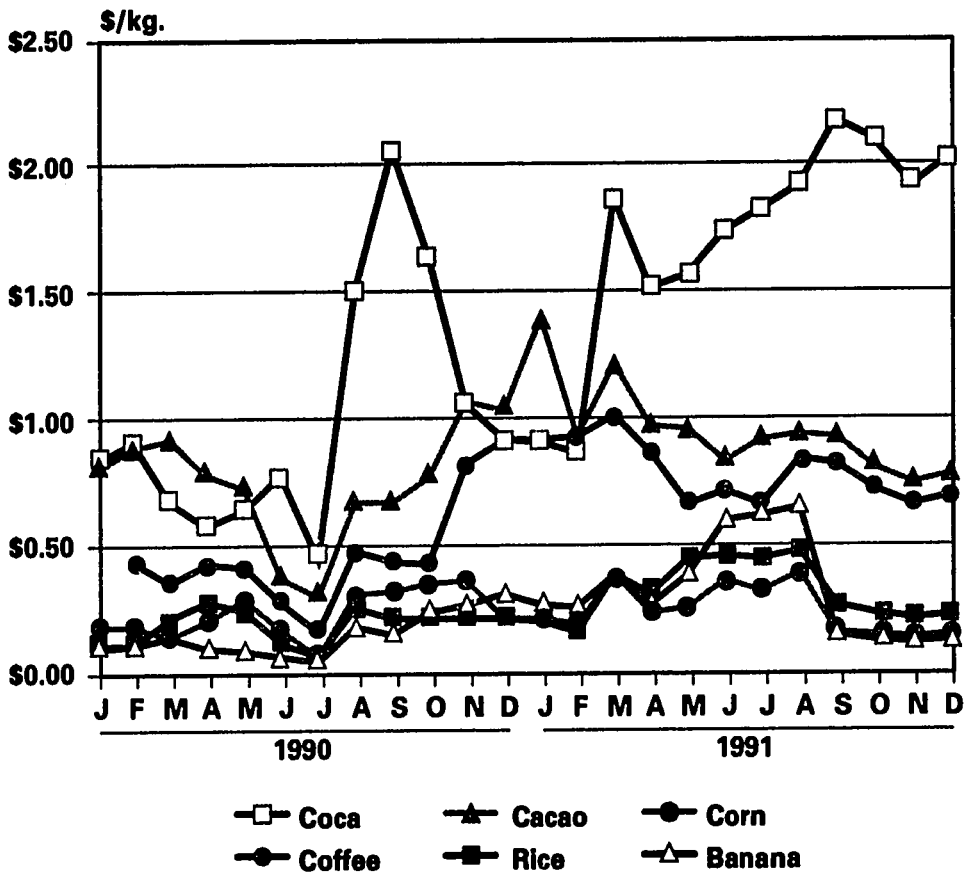
	Gross Revenue Per ha	Cost of Production Per ha	Net Income Per ha
Macadamia (1)	$4,640	$1,000	$3,640
Black Pepper (2)	$3,360	$2,413	$1,217
Rubber (3)	$2,750	$736	$2,014
Cacao (4)	$1,500	$912	$588
Corn (5)	$447	$301	$146
Coffee (6)	$2,250	$1,343	$907
Annatto (7)	$720	$308	$412
Banana (8)	$560	$403	$157
Palm Heart (9)	$2,200	$1,129	$1,071
Pineapple (10)	$3,750	$2,071	$1,679
Oranges (11)	$1,980	$824	$1,156
Coca (12)			
at $40 per carga	$1,490 to $2,381	$1,455 to $1,786	$485 to $595
at $50 per carga	$2,426 to $2,977	$1,455 to $1,786	$970 to $1,191
at $60 per carga	$2,911 to $3,572	$1,455 to $1,786	$1,455 to $1,786

(1) Macadamia begins producing commercially in the seventh year after seeding, and reaches full production in the ninth year.
(2) Black pepper begins producing commercially in the fourth year after seeding, with full production in the fifth year.
(3) Rubber begins producing commercially in the 10th year after seeding, with full production in the 15th year.
(4) Cacao begins producing commercially in the fourth year after seeding, with full production in the eighth year.
(5) Corn begins producing in the first year after seeding.
(6) Coffee begins producing commercially in the fourth year after seeding, with full production in the sixth year.
(7) Annatto begins producing in the third year after seeding and reaches the maximum in the fifth year.
(8) Banana begins producing in the second year after seeding.
(9) Palm Heart begins producing in the first year after seeding, with full production in the fifth year.
(10) Pineapple begins producing in the first year after seeding, with full production in the second year.
(11) Oranges begins producing in the fourth year after seeding and reach the maximum in the seventh year.
(12) Coca begins producing in the second year after seeding, with full maturity after 24 months. Output is 2.2 to 2.7 metric tons per year. Cost of production is assumed to be $30 per 100-pound carga.

Note: Production and cost figures assume medium technology. Cost figures include amortization of initial investment.

Source: Clark, J. AID Mission, La Paz. Data for alternative crops developed by AID agronomist Hernan Muñoz. (Note: Prices for legal crops are actual or estimated Chapare prices as of mid-1990.)

Figure 3. Upper Huallaga Valley Coca and Legal Crop Prices, 1990-1991 (in U.S. Dollars per Kilogram)



Source: PEAH, Planning Office

graphically demonstrates. While more recent data for legal agriculture are not available, coca prices have continued their upward movement in 1992 and early 1993, a situation that obviously augurs poorly for crop substitution efforts in the Valley.

A third problem is uncertain prospects for crops which require years to grow before the first harvest. The data in Table 9 indicate that the cash-flow from most of the alternative crops becomes positive only after three or more years compared to two years or less for coca; this requires farmers to trust that the markets will remain favorable for these crops, some of which have not been sold before outside the region. From the farmer's perspective, coca—which produces relatively quick returns and enjoys a guaranteed market—offers a superior cashflow picture (internal rate of return) to that of most other crops, as Table 10 shows.

Table 10. Bolivia's Internal Rate of Return from Chapare Agriculture, 1992 (in Percent)

Coca	316
Papaya	273
Pineapple	114
Bananas	92
Palm Hearts	75
Citrus	38
Black Pepper	31
Macadamia Nuts	29
Hogs	14

Note: Data from the source do not permit restatement as the percent rate of return that can be earned on each crop.

Source: Clark, J. *Alternative Development for the Chapare.* USAID, La Paz, July 1992.

The calculations in the table suggest that farmers might be willing to diversify production—experimenting with nontraditional crops while continuing to cultivate coca would be the best business strategy for the farmers.

Fourth, markets for nontraditional crops may not materialize as expected. The history of achiote as a substitute crop in Peru illustrates this difficulty. At one time, peasants in the Upper Huallaga Valley were convinced by the arguments of some USAID workers that achiote could be more profitable than coca. However, when the farmers planted achiote in large quantities, the price dropped, and farm incomes fell sharply. A similar problem conceivably could be encountered with specialty crops, such as macadamia nuts. Although prices may now be favorable, demand may be limited; increasing sales may require sharply lower prices. To be sure, USAID's strategy stresses diversified development, as opposed to reliance on a single crop, but still the risk of oversupplying the market is considerable—especially if both Peru and Bolivia launch large crop substitution programs. A further problem is that certain particularly promising crops—such as passion fruit and papaya in the Chapare—cannot be exported in fresh form. Farmers will not even consider growing such crops unless processing facilities are introduced into the region, a development that could take years.

Finally, any analysis of the relative profitability of coca must consider Andean farmers' propensity to "integrate forward"—to capture more of the value added in cocaine production. The distinction between farmers and traffickers is becoming increasingly blurred in the Andes. In the Upper Huallaga Valley, according to a September 1992 World Bank Report, "While farmers sold drug coca leaf to traffickers up to the mid-1980's, more than two-thirds of them now carry out the production of basic coca paste."[1] In Colombia and Bolivia almost all coca leaf is converted into cocaine base, a second-stage intermediate product, at or the near the cultivation site.

How much can farmers add to their income by diversifying downstream? The crude cost and price data in Tables 11, 12, and 13 provide clues to the new economics of Andean coca farming. The Peru and Bolivia data indicate that while paste production is marginal economically, base production apparently is extremely profitable. In Bolivia, a coca farmer could double his per hectare earnings by converting his leaf output to base. In Colombia, as Table 13 indicates, a cocaine base

"crop" yields much higher returns than other selected crops but is less profitable than opium. If these judgments are correct, downstream integration into base could make coca-growing vastly more attractive to farmers than cultivating any legal crop.

Endnote

[1] The World Bank. *Peru: Agricultural Policies for Economic Efficiency.* Washington, DC. September 11, 1992, p. 69.

Table 11. Forward Integration in Peru (Coca)

Leaf Production		
Revenues:		
Yield	1,200 kg	
Price	U.S. $1.7/kg	
Gross Revenue		U.S. $2,040
Costs:		
Protection Fees	U.S. $204	
Fertilizer, Pesticides, and Herbicides	$100	
Transport	$125	
Total Costs		U.S. $429
Net Income/ha		U.S. $1,611
Basic Paste Production		
Revenues:		
Yield	12 kg	
Price	U.S. $250/kg	
Gross Revenue		U.S. $3,000
Costs:		
Processing Materials (chemicals)	U.S. $960	
Protection Fees	$204	
Fertilizer, Pesticides, and Herbicides	$100	
Transport	$25	
Total Costs		U.S. $1,289
Net Income/ha		U.S. $1,711

Source: The World Bank.

Table 12. Net Family Income Per Hectare Coca Leaf, Coca Paste, and Cocaine Base in Bolivia, 1992[1]

Stage[2]	Revenue and Cost
Leaf Cultivation	
Gross Income	$ 2,258
Cost of inputs	$ 228
Net income	$ 2,030
Paste Production	
Gross Income	$ 1,901 to $ 2,696
Cost of inputs	$ 568
Net income	$ 1,433 to $ 2,128
Base Production	
Gross Income	$ 4,216 to $ 5,270
Cost of inputs	$ 527
Net income	$ 3,689 to $ 4,743

[1] Assume only family labor except in the investment phase of coca cultivation.
[2] Leaf price, $41 per hundred pound carga; paste price, $67 to $95 per kg; coca price, $400 to $500 per kilo; yield: 2,625 kg per hectare; 5 percent loss; 92.5 kilos of leaf; 1 kilo of paste; 2.8 kilos of paste; 1 kilo of paste.

Source: USAID

Table 13. Per Hectare Yields in Colombia UNDCP Project Areas, Early 1993

Crop	Gross Income	Costs	Net Income	Percent Profit
Sugar Cane	$1,185	$931	$254	21
Coffee	$1,385	$1,077	$308	22
Bananas	$369	$277	$92	25
Maize	$288	$264	$19	7
Yucca	$492	$385	$107	22
Cacao	$184	$154	$30	16
Vegetables	$31	$28	$3	10
Coca (cocaine base)	$4,462	$2,676	$1,784	40
Opium Poppy (opium gum)	$7,388	$2,767	$4,615	62

Source: UNDCP, Bogota, and Popayan

Preliminary Results of Crop Substitution in the Andes

A Review of U.S. Efforts in Bolivia, Colombia, and Peru

The largest USAID crop substitution program is in Bolivia. USAID implemented the Agricultural Development in the Coca Zones Project between 1975 and 1980, spending $1.9 million.[1] The Chapare Regional Development Program (CRDP) began in August 1983 after the return to civil government, the U.S. having withdrawn from the region between 1980 and 1983. In 1987 the program was broadened to include the high valleys of the Cochabamba Department; the aim was to stop or slow the out-migration of agricultural labor to the Chapare.

In the early CRDP years, the efforts concentrated on agronomic research at a research station; there were plans for agricultural extension services to farmers, but opposition by pro-coca organizations severely limited CRDP's ability to deliver such services. In recent years agricultural extension has flourished as described below; millions of dollars in credits have been delivered to farmers; and the program has broadened to include the provision of a variety of other services, such as roads, community projects, and marketing services—a trend which has accelerated since the June 1992 effective start of the Cochabamba Regional Development Project (CORDEP), the successor to the CRDP. CRDP spent approximately $38 million from 1983 through 1992, an estimated two-thirds in the Chapare and one-third in the Cochabamba high valleys. CORDEP, which is designed to develop alternative sources of income and employment for people in the Department of Cochabamba (a focus not significantly different from that of CRDP), will spend $80 million between 1991 and 1997, assuming that funding is available.[2]

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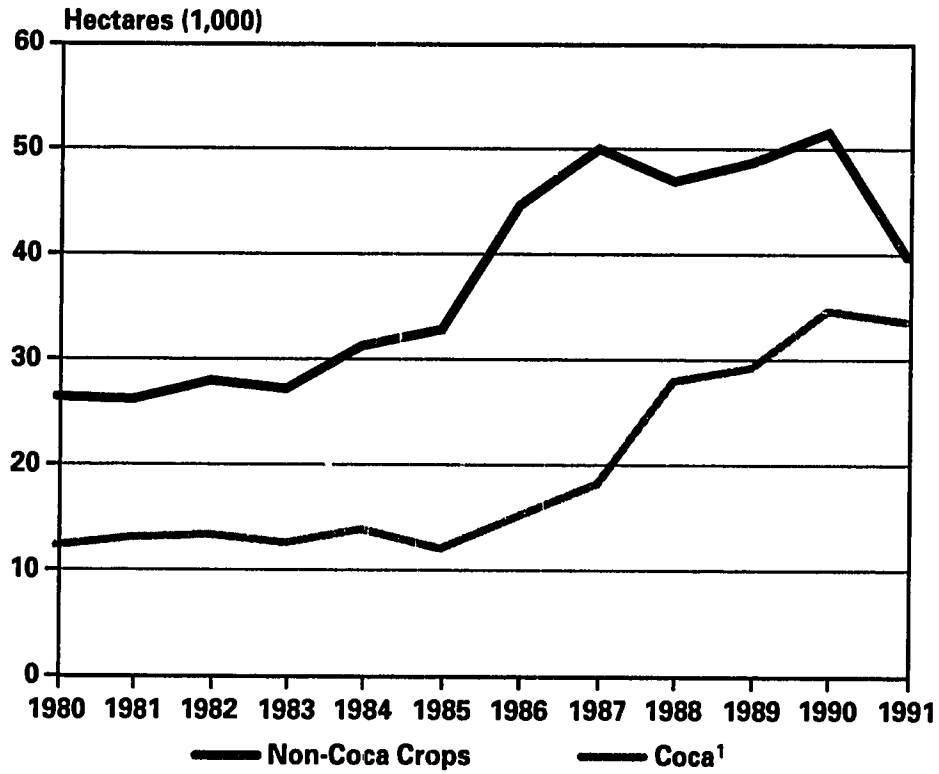
The Chapare Regional Development Program has recorded some achievements. Agronomic research efforts have identified a number of legal crops that could provide a competitive income. Furthermore, certain nontraditional products introduced with USAID's help—pineapples, processed turmeric, and improved varieties of bananas and citrus—are now being exported from the Chapare; sales of pineapples alone have increased from zero in 1990 to $1 million in 1992, obviously a positive development from USAID's perspective. Yet the actual impact of CRDP on coca cultivation in the Chapare has been slight thus far. Only approximately 4,000 hectares of nontraditional crops have been planted since the inception of CRDP, in part because the program was for years confined to agricultural research, without support for planting non-coca crops. The legal agricultural economy in the Chapare is still minuscule. Coca cultivation has declined more than 10 percent in the Chapare since the peak year of 1989 (and no significant increases in cultivation have been recorded elsewhere in Bolivia); yet the decline is mainly attributable to low coca prices—a consequence of interdiction efforts and perhaps sheer overproduction—and to job growth elsewhere in the Bolivian economy. That is, the attractiveness of legal crops had little to do with farmers' decisions to abandon some of their coca. The proposed introduction of approximately 43,000 hectares of high-yielding crops would diversify the economy of the region, but not necessarily replace the coca that is already there. Pineapples and bananas notwithstanding, the prospects for crop substitution in the Chapare remain murky at best.

USAID has been active in crop substitution in Peru since the 1981 start of the Upper Huallaga Area Development Program (UHADP) in 1981, usually referred to as PEAH (for the administrating agency, the Special Projects Office for the Upper Huallaga). The program was from the beginning plagued with security problems which grew progressively worse for a decade, as guerrillas overran the project area. PEAH has also been hampered by association in farmers' minds with the U.S.-financed Peruvian eradication agency (CORAH), which eliminated some 18,000 hectares in the Valley between 1983 and 1989. PEAH had limited success providing extension services to "eradicated" farmers; Peruvian terrorist groups' or traffickers' defacto control of many growing areas made access to cultivators difficult and dangerous. The approximately $25 million spent by PEAH since 1981 has had no perceptible impact on the coca situation in the Upper Huallaga. While legal cultivation has increased since the early 1980's—a development for which PEAH can claim partial credit—coca cultivation has increased at an equal or faster rate, as Figure 4 shows. The Upper Huallaga is a classic case of "parallel development" of the drug economy and the legal econo-

Figure 4. Upper Huallaga Valley 1980-1991 Land Cultivated-Principal Crops



[1] Data only for accessible areas; these may comprise only one-third of total coca land area in the Valley

Source: Project Paper (80'); Compendio Estadistico PEAH/CEA (81'-91')

my. However, legal agricultural accounts for an insignificant (less than 10 percent) share of the total agricultural product in the Valley.

Future trends in the Valley are unpromising. Coca prices have risen to the point where crop substitution is hardly a serious alternative for farmers. Security conditions have improved somewhat in recent months; this has been a consequence of several factors—the Peruvian government's decision to increase the military presence in the Valley by 30 percent; the Shining Path guerrillas' disarray following the capture of their leader, Abimael Guzman; and the government's clear signals to farmers that it would not forcibly eradicate their coca. Effective decriminalization of coca cultivation probably reduced the level of farmer support for the Shining Path, which had reaped political benefits by opposing eradication. On the other hand, farmers in the Upper Huallaga and elsewhere in Peru now have little reason not to cultivate coca; as a result, cultivation of Peruvian coca leaf is expanding inexorably in the 1990's.

U.S. Efforts Compared With Those of Other Agencies

The principal crop substitution efforts in the Andes, besides those of USAID, have been sponsored by the Bolivian government and by the United Nations Drug Control Program (UNDCP, formerly the United Nations Fund for Drug Abuse Control or UNFDAC). Since 1988 the Bolivian government has operated a voluntary program of compensation for farmers who agree to eliminate their coca. The program is run entirely by Bolivians who make all payments for eradication. However, progress in crop reduction is a condition for release of U.S. Economic Support Funds (ESF), with the result that many Bolivians regard eradication as being effectively U.S.-financed. Payments to farmers under the program amount to $2,000 per hectare eradicated. The results of the Bolivian program have been decidedly mixed. Between 1988 and 1992, Bolivian farmers eliminated mostly voluntarily 23,000 hectares, at an imputed cost of $45 million; but over the same period almost 29,000 new hectares were planted or discovered in Bolivia (see Table 1). That is, the $45 million has purchased a net coca reduction of minus 6,000 hectares over the 1988 to 1992 period. These figures suggest that some farmers have invested eradication payments in planting new coca; the ratio of eradication to new planting has steadily increased since 1990, as Table 1 shows, but farmers simply may be replacing less productive older bushes with more productive newer ones.

The United Nations finances crop substitution projects in all three cocaine-producing countries. In Colombia, projects are under way in coca zones in several departments: Cauca, Nariño, Guaviare, Putumayo, and Caqueta. Most of these efforts are located in regions where the Colombian government's authority is weak and where Marxist guerrilla organizations have established strong political or military footholds. In Bolivia; UNDCP operates programs in both the Yungas and (on a very minor scale) in the Chapare. In Peru, UNDCP is active in the Upper Huallaga Valley—a guerrilla-afflicted region—and in the Cuzco Department.

UNDCP's record in the Andes, like that of other development agencies, includes successes and failures, but has had little impact on coca cultivation overall. Certain UNDCP projects seem poorly conceived: for instance, in the Cuzco Department in Peru and in the Bolivian Yungas, coca is cultivated overwhelmingly for the legal market; hence, the value of UNDCP projects in these regions are questionable, at least from the standpoint of narcotics control. In the Yungas, UNDCP made the mistake of financing a coffee processing facility that competed with a private operation; in the Chapare, UNDCP built a milk processing plant that turned

out to be a "white elephant"—the specific area selected was unsuitable for dairy cattle and lacks the refrigeration facilities needed to store milk.

On the other hand, UNDCP has a promising if small substitution program operating in the Upper Huallaga Valley. Between 1987 and 1992, nearly 7,000 hectares of coca reportedly were eradicated voluntarily by farmers in the project area (oddly, these figures do not show up in U.S. eradication statistics): UNDCP works closely with a local farmers' association, the Naranjillo Cooperative, to promote cultivation of licit crops and to process cacao beans and citrus into salable products. Naranjillo was already operating in the Valley when the UN began the project; the cooperative has been described as a sophisticated agribusiness operation with a fax connection to Lima to get daily market quotes on crop prices.[3] Cooperative members have planted 7,800 hectares of new, legal crops since 1987; how much of this new cultivation is due directly to UNDCP assistance is difficult to determine.

UNDCP's involvement in Colombia began in 1986 with a project in Southern Cauca and expanded in 1990 to include several adjoining counties in the Northern Nariño Department. In 1992 UNDCP initiated projects in the Llanos and Amazon regions in southeastern Colombia, specifically in the departments of Guaviare, Caqueta, and Putumayo. The projects stress "integrated rural development" to reduce coca cultivation in favor of profitable agricultural and livestock alternatives. According to UNDCP officials, more than 3,000 hectares of coca have been eliminated in the Cauca-Nariño project area, amounting to approximately 60 percent of the area's total coca cultivation. This was accomplished at a cost of $9 million, or less than $3,000 per hectare. The UNDCP practiced substitution in its purest form in Cauca and Nariño—that is, legal crops were introduced in fields that were formerly planted in coca. Substitution has occurred by degrees—with new crops gradually taking the place of coca. Currently there is some intercropping among coca and newly planted coffee, bananas, and beans.

UNDCP's effort has had and is likely to have little impact on the Colombian coca scene. Most plantations are grown on large (15 hectares or more) trafficker-financed plantations in areas that are both geographically remote and (even for the UN) politically impenetrable. UNDCP officials worry that current price trends for coffee and coca may undo some of its work in Cauca-Nariño; coffee prices are plummeting and costs of production are rising, while cocaine base prices have reached their highest levels since 1990.[4] However, the political benefits of the Cauca-Nariño project, and potentially of the UNDCP's other efforts, are impor-

tant. To give credit where it is due: UNDCP officials have chosen to work in a politically contested region in which the influence of guerrilla groups is strong. They have taught farmers organizational and technical skills, reduced the isolation of rural communities, and possibly changed peasants' attitudes toward the Colombian state and the Colombian system. Such achievements must be weighed in the balance when contemplating the net effects of crop substitution programs.

A noteworthy aspect of UNDCP's projects has been their emphasis on voluntary and uncompensated reduction of coca production. Peasants within UNDCP project areas agree to reduce coca plantations within a specified time period and also not to plant new coca. Generally, the process is voluntary, although police intervene to eradicate seed beds in Peru (which UN representatives strongly oppose) and to eradicate new coca (cultivated in violation of project agreements) in Colombia. UNDCP officials constantly stress that law enforcement should be directed against traffickers and not farmers. Many USAID officials, by contrast, are skeptical that crop substitution can work without at least the threat of forcible eradication. Yet the UN experience suggests that substitution on a small scale can occur via negotiation and dialogue. Furthermore, UNDCP does not compensate farmers for coca hectarage eradicated (a practice that only "corrupts the farmers and detracts from community organization" according to one UNDCP official);[5] on the other hand, UNDCP projects provide significant infrastructure and services to coca growers in an effort to wean them away from illicit activities. Perhaps USAID's approaches to crop substitution are too driven by economic models of peasant behavior; in any event, the UN experience in Colombia and Peru seems to merit careful study.

Endnotes

1 Kumar et al., *op. cit.*, p. E-4.

2 USAID. *Andean Counter-Drug Initiative.* Annual Report, 1992, February 1993, p. 9.

3 Ann W. McDonald. Trip Report. December 9-17, 1992, p. 18.

4 Interview with John Jairo Rendon Tobon, Technical Coordinator. UNDCP. Bogota. February 1993.

5 See endnote 2 on page 14.

Dynamics of Crop Substitution

Incentives to Crop Substitution

Crop substitution programs provide a variety of incentives to farmers to shift to legal crops; for example, these programs explain to farmers how to grow new crops, provide seedlings for these crops (sold at cost with financing), and offer a range of marketing services. However, the most important incentives for crop substitution may come not from economic assistance to coca growing areas but from factors that affect the intrinsic attractiveness of coca growing and from developments in the national economy as a whole.

The most powerful incentive for crop substitution is lower coca prices. In Bolivia, leaf prices have been on a secular downward trend for six years, with many peaks and valleys around the trend line. Lower coca leaf prices could eventually lead to lower coca production. This is predicted both by economic theory and by coca farmers themselves.[1] Although Bolivia farmers are still planting coca, the amount of new cultivation has declined each year since 1988 (see Table 1). In Peru and Colombia, on the other hand, recent prices have been sufficiently high to discourage replacement of coca with legal crops, although farmers may contemplate illegal alternatives, as the recent opium boom in Colombia indicates. Recently in the town of Argelia in the UNDCP project area in Cauca-Nariño, UNDCP extension workers were approached by local farmers wanting seeds to plant opium poppy as a substitute crop for coca.[2] Lower prices are, unfortunately, an incentive with strict limits, because as the coca crop shrinks, the price will rise (*ceteris paribus*). Only if some outside factor is pushing prices down (e.g., law

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enforcement that reduces demand for leaf by traffickers) will falling prices promote a reduction in the coca crop.

Another possible incentive is higher production costs. Effective interdiction constricts supplies and raises prices of chemical products used in first- or second-stage processing of coca leaves. In Peru, producers have been hit by the removal of subsidies on kerosene which is used in converting leaves to basic coca paste. Coca production costs in Bolivia also may have been affected by outmigration from the Chapare (to be discussed below) which could push up costs of hired labor and require substitution of more capital-intensive techniques of cultivation—for example, sustaining yields by using more fertilizer and less weeding.

A third incentive relates to the consequences of illegality or quasi-legality. Cultivation of illicit crops occurs in a high-risk environment. While Andean governments have more or less abandoned forcible eradication of coca, police can confiscate farmers' leaves, paste, or base. Police in search of drugs have reportedly invaded homes, stolen money and other valuables, killed livestock, and violated peasants' wives and daughters. Drug farmers have no contractual rights and no access to the judicial system. They have little recourse against police abuses or (in Peru and Colombia) against protection fees charged by local guerrilla groups. Conflict with traffickers over selling prices for leaves or paste are as likely to be resolved violently as peacefully. Such factors work to diminish the allure of farming coca, and to increase farmers' interest in legal alternatives.

Also influencing farmers' economic decisions are conditions in the legal economy. The higher the growth rate in the legal economy, the more labor is being absorbed there and the more attractive leaving the drug economy becomes. It is no coincidence that drug problems are concentrated in countries in economic crisis (e.g., Burma, Afghanistan, and Peru), while countries with rapid growth find their drug problems are shrinking sharply (e.g., Thailand). Instead of replacing their coca, farmers might opt to emigrate from coca zones altogether—to return to the highlands or the coast, to migrate to promising agricultural regions, or to find industrial jobs in the cities. In Bolivia, outmigration appears to be an increasingly viable alternative. After a catastrophic decline from 1980 through 1986, the Bolivian economy recovered slowly in 1987; grew at an average rate of 2.8 percent between 1987 and 1990; and recorded an impressive rate of 4.1 percent with a strong performance in agriculture, mining, and manufacturing in 1991. According to Bolivian

President Paz Zamora, 100,000 jobs were created in the legal economy in 1991 while only 50,000 new entrants entered the labor force: this margin allows the marginally and illegally employed to be absorbed.

As Bolivia's legal economy has picked up, the relative weight of cocaine in the economy has declined. According to a recent World Bank report, the value added of the coca-cocaine industry declined from 26 percent of the Gross Domestic Product (GDP) in 1987 to only 6 percent in 1991. (Falling cocaine prices and Peru's increasing preeminence as a coca supplier over the period also contributed to the decline.) Accompanying and perhaps contributing to this trend has been the outmigration of a portion of the population from Chapare. At the peak of the coca boom in the late 1980's, the Chapare population was 350,000 compared to 110,000 in 1976. By 1990, the population had diminished to 100,000 or less, according to some surveys. As an indirect indicator, Bolivian sociologist Alberto Rivera cites a dramatic drop in the number of businesses and in the sales of those remaining open (e.g., a Chapare restaurant that went from serving 300 breakfasts daily to between 20 and 30, and a bar that saw its beer sales fall from 20 to 30 cases per week to 1 case). The 1991 Rural Household Survey, the 1992 census, and drug police (UMOPAR) reports suggest that the population has if anything declined further since then.[3] Most of those who left, however, were landless laborers, sharecroppers, and various hangers-on, not established farmers. Outmigration slowed the rate of increase in coca hectarage. However, as the coca bushes planted in the late 1980's reached their peak productive years, the crop increased in size. Farmers adjusted to the lower labor supply by reducing labor-intensive operations (weeding and planting) and concentrating on harvesting. The effect of reduced labor availability on coca output will be felt only slowly, as aging coca bushes are not replaced as soon as their peak is past (about ten years).

Unfortunately, successes of coca reduction efforts in Bolivia have been offset by the expansion of coca cultivation and production in Peru (see Tables 1 and 2). Peru's coca dynamic has been quite different from Bolivia's, largely because the Peruvian legal economy has shown continued weakness. The dramatic economic reforms begun in August 1990 are likely to lead to strong economic growth in the mid-1990's, but the initial effects of restoring macroeconomics equilibrium, opening up the economy to international trade, and eliminating State-protected oligopolies was to reduce employment in the previously favored sectors. Furthermore, the deterioration in the security situation in 1991 and 1992 was a significant deterrent to investment, although the government's

recent successes against the Shining Path may improve the investment outlook this year. All in all, the continuing if not deepening economic crisis in the early 1990's may have impelled Peruvians to migrate to coca-growing regions rather than to coastal cities or to other rural areas.

Conditions in the Upper Huallaga Valley do not represent a strong inducement to migrate there. The available anecdotal accounts suggest that farmers in the Valley continue to pay protection to the Shining Path (or to the security forces) and that they suffer from conflicts among the multiple armed power centers in the Valley, including guerrillas, traffickers, the antidrug police, and the Peruvian military. Yet farmers have responded to this situation not by abandoning the coca trade, but by moving to new areas, where losses to law enforcement and charges by guerrillas are less. There are already indications that new coca plantings are occurring increasingly in the Aguaytia region east of the Upper Huallaga Valley, as well as in the Central and Lower Huallaga Valleys. The area potentially suitable for coca cultivation in Peru has been estimated at nearly 2 million hectares. Only a significant turnaround in Peru's economy can slow new cultivation by absorbing labor in legal industries and agriculture.

Constraints to Crop Substitution

The constraints to crop substitution fall into two major categories: (1) those which make coca attractive and (2) those which make legal crops unattractive. Andean farmers like coca because it produces a secure profit. The emphasis is on the word "secure." Evidence presented in the previous section indicates that coca is not severalfold more profitable than any alternative crop. In Bolivia, coca's comparative advantage has shrunk sharply since 1987, as leaf price has declined and as market opportunities for legal crops in the Chapare have improved. Yet coca has three compelling advantages over other crops. First, it produces quick yields. Even in Bolivia, the internal rate of return for coca, even at the relatively low prices prevailing in 1991 and 1992, compares favorably to that of other crops. Second, coca has a virtually guaranteed market—at least as long as demand for cocaine in the industrialized countries remains high. Third, coca has a high value-to-weight ratio and presents few handling problems for the farmers. As a farmer in the Upper Huallaga Valley told a PEAH official last December, "Buyers go to the farms to get the coca. If I plant any other crop I must get it to market and spend money transporting it. This does not happen with coca."[4] These advantages can be enhanced to the extent that farmers

capture the value added in preliminary cocaine processing. Production of cocaine base presents particularly lucrative prospects. Of course, legitimate agricultural products can be processed too; but the economies of scale are different. A moderate-sized coca farm can support a paste or base laboratory, but a huge citrus grove or pineapple plantation or multiple smaller farms would be required to support a juice canning factory. Not every farmer necessarily wants to be a trafficker—again, we must be wary of overreliance on economic models; yet the potential for forward integration clearly expands coca farmers ' economic options and (should they become processors) improves their profit and loss calculations.

While coca offers many advantages to the farmers, switching to legal crops presents a number of drawbacks. Some of the problems intrinsic to legal agricultural products—long gestation periods, bulkiness, and requirements for special handling or processing—have been mentioned already in this report. Problems of substitution, however, are compounded by the characteristics of coca growing zones themselves; such characteristics include fragile ecologies with dubious potential for legal cultivation, isolation from major markets, and severe political and law-and-order problems.

Consider first the ecological factors. Coca flourishes in the agricultural conditions in many jungle regions of South America which include excessive rainfall; extremely acidic soils; soils with toxic concentration of iron, aluminum, and manganese; and steep slopes which limit mechanization. Other crops do poorly or cannot be grown at all in these conditions. In ecological terms, vast areas of the Chapare and the Upper Huallaga Valley that are cultivated in coca should remain in coca or revert to forest. Coca also grows in fertile soils, where substitution-in-place is possible, as demonstrated by the UN project in Colombia. Yet "substitution" for many Andean farmers now cultivating coca means migrating to more fertile zones within a region, or leaving the region altogether. At best, only 10 percent of the Upper Huallaga Valley and 5 percent of the Chapare (each region comprises an estimated 2 million hectares) are suitable for legal farming, according to USAID and Andean officials. The Chapare's prospects seem especially problematical. Kenneth Eubanks, a contractor for USAID, noted in a 1991 report on the Chapare that because of soil conditions in most of the region, "suitable alternative crops with acceptable marketing margins will be difficult if not impossible to identify." Also, in areas of excessive rainfall "productivity will decline over time and unit production costs will increase

accordingly."[5] James Jones, an anthropologist specializing in the Chapare came to a similar conclusion: "Some areas of the Chapare, because of their ecological fragility, should have neither roads nor agriculture. And anyway, it is unlikely that sustainable markets will be found for production in such areas. So why build roads there? Why try to develop these areas?"[6]

Geographical remoteness is another curse of the coca growing regions. Tingo Maria, near the southern terminus of the Upper Huallaga Valley, is 12 hours from Lima by a road that is unpaved in sections and poorly maintained; rain, frost, and guerrilla sabotage can delay travel further along this route. To reach UNDCP projects in Guaviare and Putumayo, Colombia requires, respectively, 15 to 25 hours, and 25 hours of travel time from Bogota. The Chapare is closer to major markets—normally 3 to 4 hours driving time to Cochabamba and 5 to 6 hours to Santa Cruz—but poor weather conditions and landslides frequently obstruct travel.

The principal consequence of remoteness is high transport costs. Such costs can average 60 percent of the FOB value of products from the Upper Huallaga Valley, according to UNDCP official Iban de Rementeria.[7] A USAID representative in Cochabamba, Marion Ford, notes that transport costs comprise 80 to 85 percent of the sales price of Chapare business in that city. Poor transport links within coca growing regions also complicate the marketing picture. According to a 1990 Peruvian study, shipping costs between Uchiza and Tingo Maria (in the Upper Huallaga Valley), a distance of less than 200 kilometers, reached $49 per ton; while for an equivalent distance along the coast—for example, from Lima to Pisco—such costs were only $15 per ton.[8] Legal crops grown nearer major markets can provide incomes comparable to coca. Bruce Bagley, a political scientist specializing in Colombia, notes that bananas and mangos could earn gross income per hectare of $6,650 and $11,900, respectively, in 1991.[9]

Finally, there is the law and order problem. In the Upper Huallaga Valley, the Shining Path guerrillas, who are eager to drive a wedge between coca farmers and the Peruvian government, seem generally opposed to legitimate agricultural development. The Shining Path's rhetoric depicts agro-industrial enterprises as outposts of "Yankee imperialism" or "bureaucratic capitalism." The guerillas' tactics include the destruction of roads and bridges needed to take legal crops to market, which also has discouraged peasants from engaging in legal agriculture. (The

Shining Path reportedly allows peasants in areas that it controls to cultivate only enough legal crops for subsistence—the idea is to make coca the only cash crop for peasants.) The Shining Path's large revenues from cocaine traffic in the Valley, estimated at $20 million or more annually, also condition the guerrillas' attitudes toward substitution. In Colombia, the main guerrilla groups —the Army of National Liberation (ELN) and the Revolutionary Armed Forces of Colombia (FARC)—have adopted a more benign stance toward crop substitution and rural development. (FARC's rhetoric actually supports cultivation of legal crops in place of coca.) Yet it was reported in 1991 that FARC collected an estimated $80 to $85 million annually from the coca trade (including the output of cocaine base laboratories) and $25 to $30 million from opium in 1991—two-thirds of FARC's total estimated revenues in that year.[10] Such figures suggest that FARC would strongly oppose crop substitution on a massive scale in Colombia. A further source of opposition to substitution in coca regions is the traffickers themselves. Traffickers may use the threat of violence to compel farmers to remain in the coca business, or they may offer above-market prices when the price is temporarily depressed in order to persuade farmers that coca is an attractive crop. Farmers, in fact, may be obligated to grow coca to repay trafficking organizations' initial investments in their enterprises. As Bagley notes,

> Trafficker networks typically establish close ties with coca growers in specific regions after providing them with seed, tools, supplier credits, and other forms of assistance that obligate the farmers to sell their crops exclusively to the trafficking group that sponsored them. The traffickers' brutal enforcement techniques and their patron-client relations give them considerable social and political control in coca growing regions and greatly limit the Colombian state's ability to execute alternative development projects in these areas.[11]

Clearly, extension of government control and establishment of the rule of law is a necessary condition for legitimate development in some coca growing regions. The added constraints of geographical remoteness, the uncertainty of markets and ecological fragility, however, argue against committing large economic resources to developing these lands.

Perverse Consequences of Narcotics Control Policies

A variety of measures have been employed over the years in the Andes to encourage farmers to abandon coca cultivation. These include forcible eradication of coca, interdiction (attacking the cocaine industry at points downstream from the farms), and the use of positive incentives such as social infrastructure projects and compensation payments for eradication. Such policies have not always produced the desired outcome—indeed, these policies may have been counterproductive in certain instances.

For example, eradication has been counterproductive in certain instances. Crop substitution projects in the Upper Huallaga Valley functioned in association with a U.S.-supported eradication program that operated from 1983 through early 1989. Some 18,000 hectares were forcibly eliminated under the program. As fields were eradicated in fertile areas on the Valley floor, farmers simply planted coca on the Valley's more inaccessible slopes. Coca cultivation in the Valley actually increased from 30,000 or 40,000 hectares in the early 1980's to an estimated 80,000 hectares by the end of the decade. That is, 2 to 3 hectares were planted for every hectare eradicated. Farmers planted additional hectares partly as insurance against the chances of destruction by the authorities (although they also anticipated higher prices for their crop). Eradication also was counterproductive politically; in particular, the program allowed the Shining Path, which opposes both eradication and crop substitution, to establish a powerful political foothold among coca growers and other disaffected populations; this, in turn, contributed to the general deterioration of law and order in the Valley in the 1980's.

Andean governments have effectively abandoned eradication of coca in favor of interdiction—a strategy which imposes fewer direct costs on peasant producers and generates less political unrest. Interdiction in theory reduces local demand for coca leaves and therefore cuts the prices paid to the farmer. Price trends for coca leaf apparently testify to the success of interdiction. Yet certain interdiction strategies—seizing leaves and cocaine products, for instance—can actually increase coca prices as traffickers scramble for more product to replace losses and to fulfill delivery contracts. Interdiction that targets production and transport facilities (e.g., laboratories, planes, clandestine airstrips, and other vehicles) is likely to disrupt coca markets more effectively than seizures of product; the relationship between these two types of interdiction and behavior of coca leaf prices, however, needs to be explored in more

detail.

Perhaps more successful than interdiction efforts in Peru and Bolivia locally have been those further down the production-logistics chain. The Colombian government's offensive against the Medellin cartel that began in August 1989 produced a 60-percent drop in average leaf prices in Bolivia from 1989 to 1990 and a smaller but substantial decline in Peru over the same period. The result was a record spate of voluntary eradication in Bolivia in 1990 (although farmers also replanted thousands of hectares in 1989 and 1990 in expectation of higher leaf prices). Local law enforcement in Bolivia has helped keep prices at near the $40 per carga level in the past two years, but no major drop in prices has occurred. In Peru rampant corruption within the antinarcotics police and the armed forces (the latter reportedly now are renting military helicopters to traffickers for the transport of cocaine) and the government's fears of offending local campesinos have severely compromised drug law enforcement in the Upper Huallaga Valley. Moreover, cultivation continues to spread to adjoining areas north and east of the Valley which are outside the range of Drug Enforcement Agency (DEA) and Peruvian police helicopters.

Positive inducement to farmers also has mixed results. Take, for example, the $2,000-per hectare eradication payment in Bolivia. Consider that the investment cost of planting a hectare in of coca in Bolivia is $1,000 to $1,500 or less according to some estimates. This means that 1.5 to 2 or more hectares of coca can be planted for the price of one hectare destroyed. USAID economist James Elliott, estimates that farmers will find it profitable to replant coca at a leaf price anywhere from $34 to $53 per 100-pound carga, depending on the age of their fields, interest rates, and perceived returns from other crops and other factors.[12] If farmers eradicate older, longer yield plants to get the cash to plant new vigorous plants on the smaller area remaining, the compensation program eventually will raise coca output.

In addition, there is a danger that USAID's work in the coca-producing regions may provide infrastructure that facilitates coca production and makes life attractive in those regions so that farmers move there and plant more coca. Two examples illustrate this danger. First, the development of schools and clinics in the Chapare may make it a more attractive region in which to settle, thereby discouraging outmigration to the Cochabamba highlands, the Santa Cruz area, or other regions that could absorb labor. Second, USAID and other agencies provide technical assistance, such as training in how to use fertilizer, which can be used by coca growers just as well as by legal farmers. Certain types

of assistance—road improvements, for example—arguably lower costs for legal farmers more than for coca farmers. (Roads and vehicles are essential to get legal crops to market; coca can be carried cheaply on farmers' backs.) Still, roads which facilitate transport and (in the Chapare) also serve as traffickers' airstrips, help coca producers as well as other residents. The best that can be achieved is to limit this spillover. A further problem is that infrastructure represents a fixed investment. USAID can dole out infrastructure and services according to the amount of coca that a community eradicates (this indeed is USAID's current policy); yet USAID cannot exactly tear down schoolhouses and destroy roads if farmers revert to coca—certainly a possibility given the always-uncertain markets for legal crops.

Even successful crop substitution programs may carry the seeds of failure. Suppose that substitution reduces the coca area. In that case, crop substitution may have the same effect as the crop area reduction programs in the U.S.—that is, to encourage farmers to devote more effort and agronomic improvements to the smaller area, thereby raising yield to fully offset the reduced acreage. Indeed, according to the 1993 INCSR, between 1989 and 1992, in Bolivia, the area cultivated in coca fell 14 percent while the harvestable leaf rose almost 3 percent; in Peru, the area increased 7 percent, and the potential harvest rose 20 percent. The problem—increasing yields offsetting decreasing areas—is particularly likely under a program of voluntary compensated eradication. In Bolivia—unless Bolivian authorities can monitor and control replanting—farmers may replace lower yield older bushes with higher yield younger bushes. Another way to increase profitability is to reduce the time from planting to first harvest. If the interval from seedling (plantula) transplant to first harvest is on the order of 15 months,[13] then the internal rate of return is about 100 percent, whereas if the period is reduced to 9 months, the internal rate of return rises to about 300 percent, according to the rate of return model developed by Clark Joel for USAID La Paz. Farmers may also seek to expand income from reduced hectarage by diversifying downstream; such a pattern represents a response to lower leaf prices (the case throughout the Andes) as well as to shrinking coca plots. All these strategies ensure the continued economic attractiveness of coca to the farmer, although only the first—raising coca yields—is relevant to the cocaine output obtainable from farmers' plots.

But let us further suppose that crop substitution (or eradication) is successful in reducing temporarily both the area planted with coca as well as the volume of coca harvested. In this case, crop substitution would

reduce the coca supply, which means that traffickers would pay higher prices for leaves. To be blunt, a crop substitution program that achieves its goals is, in many ways, also a coca support program which raises coca prices and makes coca a more profitable crop to grow. This means that the remaining coca farmers are more reluctant to abandon the crop and that more farmers are eager to start growing coca. Hence, ever-increasing amounts of agricultural support services and law enforcement resources will be needed in the future to prevent new plantings of coca and to get farmers to eradicate a large enough area to offset any rise in yields. It seems quite possible that a crop substitution program that succeeded in reducing the volume of coca harvested in Year One would encourage new plantings and more attention to yields that would raise output in Year Three, when the first crop is harvested from the new bushes.

These unintended consequences of U.S. and Andean policies partly explain why the cocaine industry continues to flourish even while resources committed to fighting the industry expand. To be sure, if nothing is done the outlook may grow even bleaker; also, recent trends in Bolivia offer some grounds for hope that growth of the coca trade has peaked in that country. Still, a reappraisal of the cocaine war in the Andes is in order—especially on the crop substitution and rural development fronts—where results of past programs have been meager, compared to the level of effort expended.

Endnotes

1 Sociological surveys and USAID personnel working in the Chapare cited below all report comments by farmers to this effect. Of course, if reduced production generates cocaine shortages in the face of continuing demand, prices will rise again.

2 See endnote 2 on page 14.

3 The Rural Household Survey found 11,000 households in the coca-growing regions; using the average household size of 4.76, that implies about 50,000 residents. However, it is not clear if the coverage of migrants was as thorough as in the Jones and Rivera data, nor if the survey reached the communities newly established in isolated regions to avoid the authorities. The 1992 census shows similar results and may similarly not include many of the migrants. The UMOPAR evaluation of continuing population decline was in *La Presencia*, April 14, 1992.

4 Mineo, L. "While Policies Fail, Coca Prospers." *Expreso*. Lima. December 25, 1992, p. A12.

[5] Eubanks, K. "Cochabamba Regional Development Project. Analysis and Recommendations." Report for USAID. August 1991, pp. 7, 11.

[6] Jones, J. "Farmer Perspectives on the Economics and Sociology of Coca Production in the Chapare." IDA. January 1991, p. 61.

[7] Iban de Rementeria. *Sustitucion de Cultivos de Coca Acciones y Estrategia.* Lima, October 1989, p. 15.

[8] Patrick Clawson interview with Marion Ford. Cochabamba. August 1992. Also Roberto Arbusada, *op. cit.*, p. 57.

[9] Bagley, B. *Sustainability of Coca Eradication and Crop Substitution.* February 1993, p. 1.

[10] "The Guerrillas' Big Business." *Semana.* July 7, 1992, pp. 26-32.

[11] Bagley, op. cit., p. 3.

[12] Elliott, J. "Getting People to Abandon Coca Growing: The Economics of Price and Rate of Return in the Andean Countries." Unpublished Paper. November 15, 1992, pp. 3-8.

[13] As appears to be assumed in the cost calculations in PDAR, "Costos de Operación, Guiá Para 9 Cultivos," (Cochabamba, July, 1991) using data from DIRECO.

Conclusion

Crop substitution is not a promising strategy for reducing coca cultivation in the Andes. Probably the best hope for reducing coca cultivation in the Andes lies in a combination of interdiction (the kind of interdiction that attacks supply lines and production facilities) and national economic development. Interdiction imposes fewer direct costs on coca growers than forcible eradication of their crops, although the political risks of this strategy are increasing as more farmers participate directly in trafficking by producing paste or base. Of course, sustaining enforcement efforts over a long time period against a widening number of targets (for example, peasants' base laboratories) presents logistical and financial problems for Andean governments. Attacking the cocaine industry downstream—destroying hydrochloride laboratories and seizing trafficking assets such as aircraft—may produce a more powerful effect on prices, as Colombia's 1989 and 1990 assault against the Medellin cartel demonstrated.

National economic development can expand jobs, stimulate exports, and attract labor out of coca growing regions. The decline in the cocaine industry's share of Bolivian Gross Domestic Product from 1987 to 1991 (from 26 percent to 6 percent according to World Bank estimates) and the apparently significant outflow of population from the Chapare during this period are possible cases in point. Neither of these developments, though, had much or anything to do with crop substitution efforts within the Chapare. USAID's effort should continue to focus on strengthening Bolivia's legal economy—perhaps funneling more resources to promoting commercial agriculture and agribusiness development in the Santa Cruz region, where Bolivia's economic future really lies. Economic programs in Peru might stem both migration to coca-growing regions

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and expansion of coca cultivation—although the outlook for any successful coca reduction program in that country must be considered bleak at present.

Furthermore, economic reform and growth reduce the relative weight of narcotics industries in the national economy and hence in the national political system. As a result, governments become more willing to pursue counter-narcotics efforts, and less apprehensive about the economic and political costs of such efforts. A lesson can be drawn from those societies that once were major producers of narcotics products but are no longer. The USAID review referred to above discusses the case of Turkey, which all but eliminated illicit opium production after 1971.[1] The key to that success was that Turkey had developed to the stage where it possessed an efficient government and where opium was a minor element in the local economy—conditions possible in the Andes only after sustained economic growth and structural change diversify the economy and increase the power of legitimate economic elites. Another case is post-World War I Iran, for which the U.S. financed a major crop substitution mission (through the League of Nations); the poppy crop became less significant only as infrastructure improved, reducing transport costs for alternative products.[2]

This argument is advanced with caveats: growth and prosperity will not in themselves discourage narcotics production. As development proceeds, the cocaine industry will continue to compete with the legal economy (embodied in new farms and factories) for the services of the labor force.[3] Moreover, successful economic development may not result in the desired enforcement outcomes. For example, Mexico, with a legal Gross National Product per capita more than five times Bolivia's ($3,200 compared to $630 in 1991) remains a principal foreign producer of heroin and marijuana for the U.S. market. Also, if an enforcement-cum-substitution effort succeeds in one country or region, producers elsewhere may take up the slack. The redistribution of production between Bolivia and Peru in the past four years is an apparent case in point. Still, expanding economies and rising living standards throughout the Andean region represent the best hope for meaningful U.S.-Andean cooperation in containing and ultimately reducing regional production of cocaine products. Broadly based economic growth can be thought of as the medicine that will cure the cocaine infection while—in the Andean context—law enforcement is the lance that spears the boil of the infection. Through growth promoted by sound policy and accompanied by diminishing world demand for cocaine, significant reductions in cocaine output can be achieved over a time span of ten to twenty

years: not a cheerful prognosis, perhaps, but the best that may be available.

Endnotes

[1] Kumar et al., op. cit., pp. A-1 – A-15.

[2] Clawson, P. "The Emergence of the National Market in Iran 1919-41." *Iranian Studies* (forthcoming).

[3] For a pessimistic evaluation of the effects of economic development on cocaine production, see Kevin Riley, Michael Kennedy, and Peter Reuter. "A Simple Economic Model of Cocaine Production." *Mathematical and Computer Modeling*, 17 (2) 19–36.

Maps

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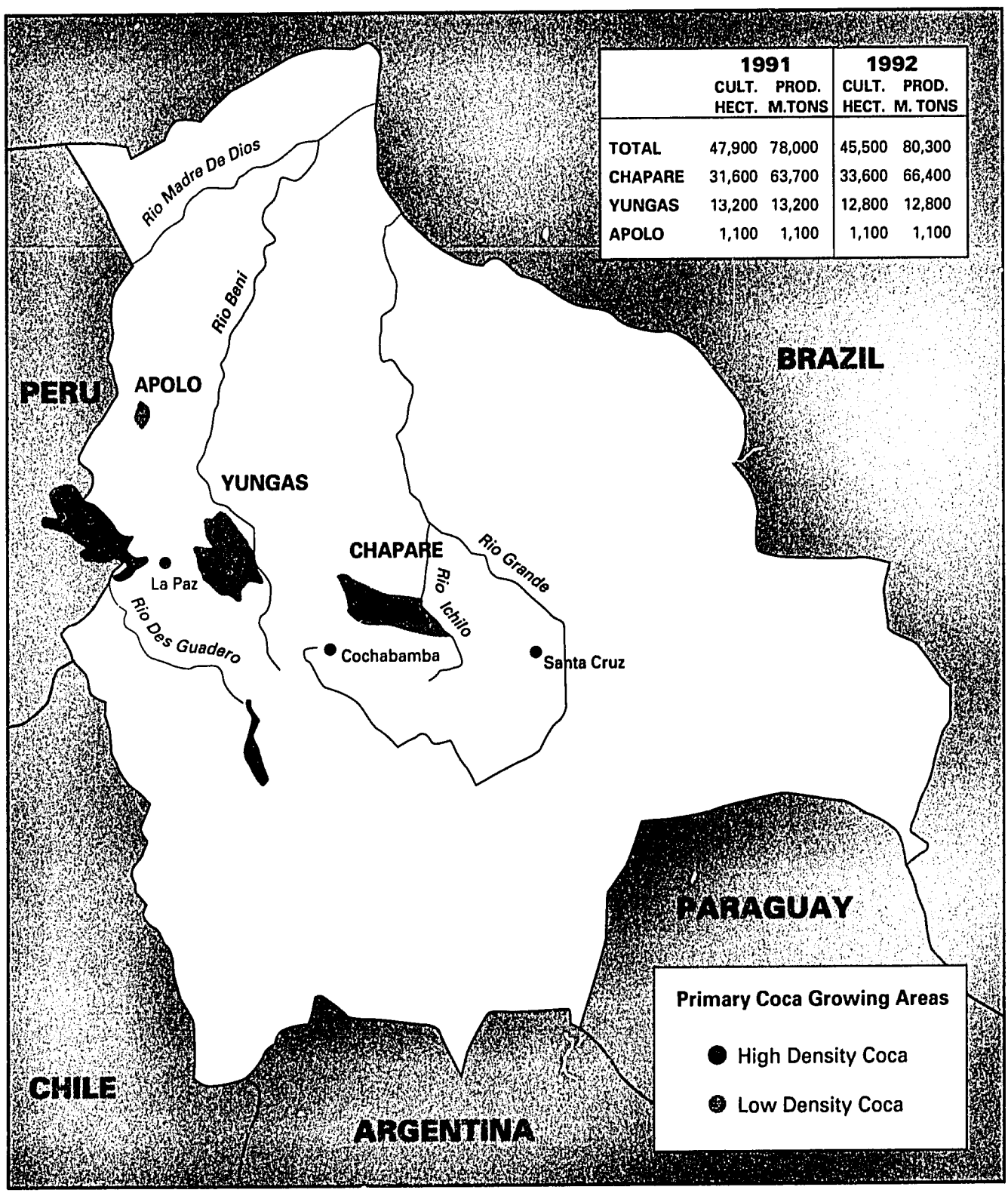
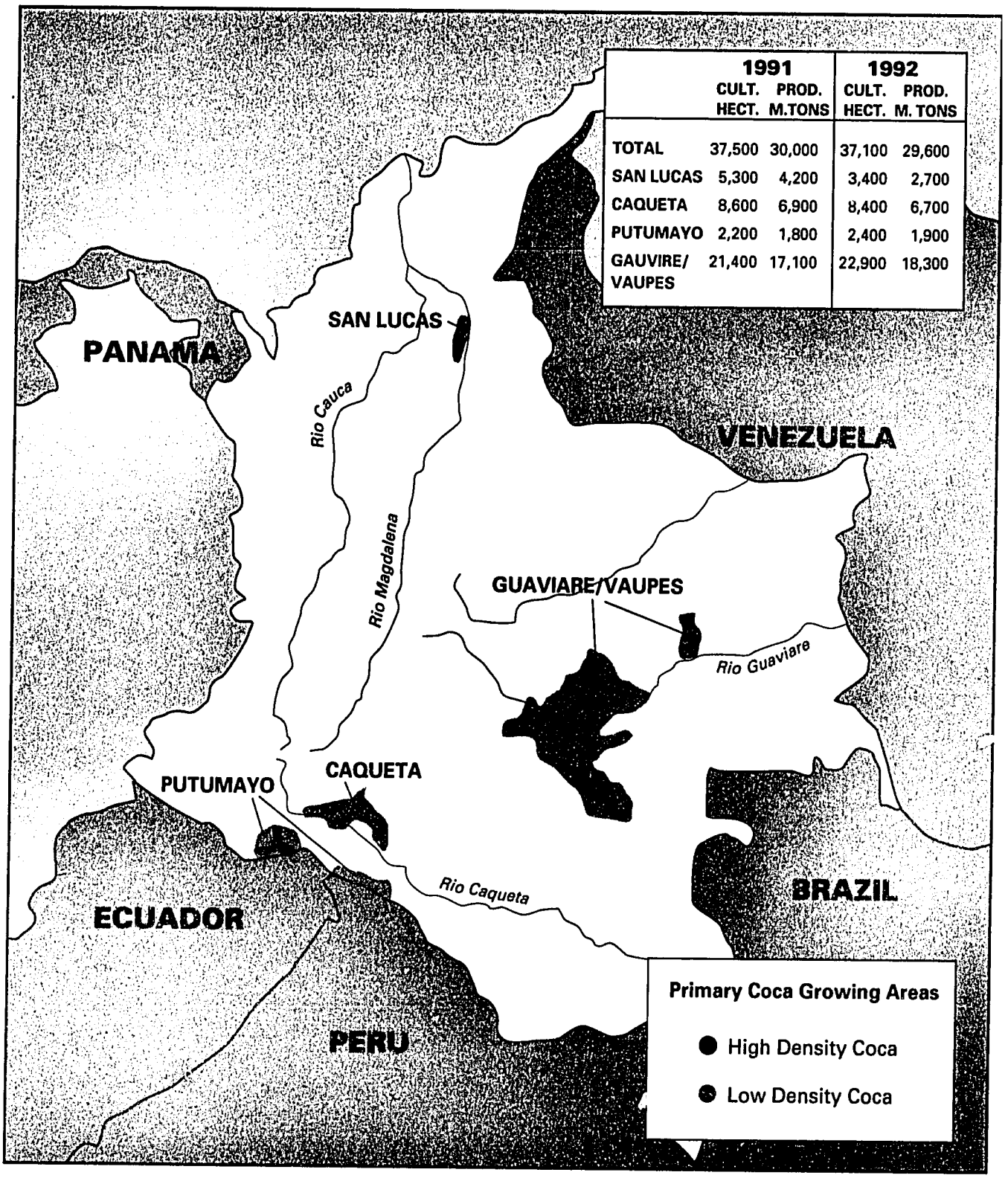
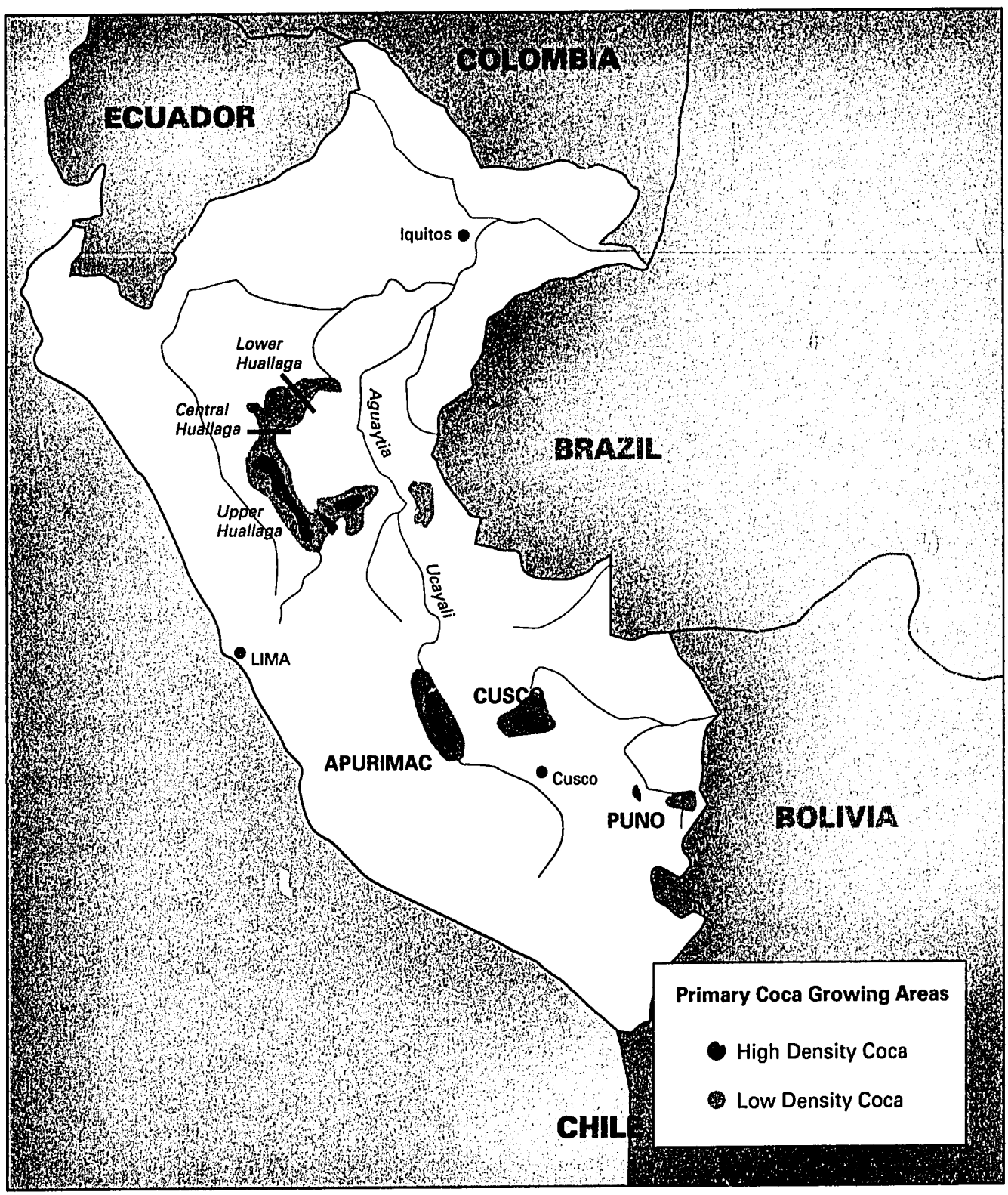
BOLIVIA COCA CULTIVATION, 1992



	1991		1992	
	CULT. HECT.	PROD. M.TONS	CULT. HECT.	PROD. M. TONS
TOTAL	47,900	78,000	45,500	80,300
CHAPARE	31,600	63,700	33,600	66,400
YUNGAS	13,200	13,200	12,800	12,800
APOLO	1,100	1,100	1,100	1,100

COLOMBIA COCA CULTIVATION, 1992



	1991 CULT. HECT.	1991 PROD. M.TONS	1992 CULT. HECT.	1992 PROD. M. TONS
TOTAL	37,500	30,000	37,100	29,600
SAN LUCAS	5,300	4,200	3,400	2,700
CAQUETA	8,600	6,900	8,400	6,700
PUTUMAYO	2,200	1,800	2,400	1,900
GAUVIRE/ VAUPES	21,400	17,100	22,900	18,300

PERU COCA CULTIVATION, 1992