# CULTURAL CHANGE AND ENVIRONMENTAL AWARENESS: A CASE STUDY OF THE SIERRA NEVADA DE SANTA MARTA, COLOMBIA

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## INTRODUCTION

The present-day native population of the mountain flanks of the Colombian section of the Northern Andes is characterized by its adaptation to sloping terrains which offer a wide variety of subsistence resources. The principal Indian groups in this particular situation are, from south to north, the Kwaiker of the southwestern ranges of the Nariño district, the Sibundoy and Kamsa of the Putumayo headwaters, the Paez and Guambiano of the Andean Massif, the Tunebo of the eastern slopes of the Nevado del Cocuy, the Yuko of the Sierra de Perijá, and the Kogi, Ika, and Sanha of the Sierra Nevada de Santa Marta. In all cases the ecological adaptation of these tribal and peasant societies to an extremely rugged topography seems to have been remarkably successful; in fact, effective slope adaptation appears to have been practised in prehistoric times (Reichel-Dolmatoff, 1961, 1978a).

NOTA DEL AUTOR

El presente artículo se escribió originalmente en inglés y fue publicado en la Revista *Mountain Research and Development*, Vol. 2, No. 3, pp. 289-197, (1982), por la United Nations University, bajo el patrocinio de UNESCO. Posteriormente la oficina de UNESCO en Montevideo (ROSTLA) tradujo el artículo al castellano y, sin haber sido aprobado por el autor, se publicó en 1985 en: *Informe sobre los conocimientos actuales de los ecosistemas andinos: Vol. 3: Los Andes Septentrionales: Cambios ambientales y culturales*, pp. 81-96, Montevideo. La traducción al castellano es del todo errónea y por consiguiente dicha publicación de ROSTLA fue desautorizada por el autor, debido a que los lectores de habla castellana quedaron desinformados sobre el tema del artículo el cual perdió toda su validez y sentido. Lo transcribo en su forma original en testimonio de mi vieja amistad con el Profesor Richard Evans Schultes, cuyos estudios etnobotánicos han sido para mí un estímulo permanente.

Nevertheless, few detailed studies have been carried out in Colombia on native land use, be it historic or modern. Some archaeological reports contain information on terracing and irrigation; Donkin (1979) provides a general overview; Eidt (1959) and Broadbent (1964, 1968) describe terraces and ancient field systems in Muiska territory; Mason (1931-1939), Reichel-Dolmatoff (1950-1951, 1953, 1954), and others describe terraces and irrigation channels in the Sierra Nevada de Santa Marta; Parsons and Bowen (1966) refer to extensive ridged fields on the north coast, and West (1959) writes of ridged and "era" cultivation in the Central Cordillera. But none of these publications provides a detailed analysis of agricultural practices; few measurements are given and no pollen diagrams are presented. The engineering features are not placed within a wider context of prehistoric developments and hardly any excavations have been carried out. Historial information on ecological adaptation and agricultural practices during the colonial period, when far-reaching changes were introduced by the Spaniards, is scattered throughout the literature concerned with the *encomienda* system, land tenure, and similar topics, but lacks quantitative data and demographic correlations. An important source is Colmenares (1975, 1978); Reichel-Dolmatoff (1961) has published on slope adaptation of the sub-Andean chiefdoms; on the Chibcha (Muiska), Hernández (1949), Eidt (1954), and Friede (1974) provide some information.

## RESEARCH ON CONTEMPORARY INDIAN GROUPS

Research studies on the modern Indian groups of the Andean slopes of Colombia are only sligtly

more numerous. Exceptional in scope and depth of analysis is the study of Ortiz (1973) which describes the productive strategy of the Paez Indians and discusses decision-making processes. A previous study of Paez economy by Bernal (1954) deserves mention; Schwarz (1973) has studied culture change and stability among the neighbouring Guambiano and has published a short section on agricultural activities; Schorr (1968), in a brief study of land tenure in the adjacent Cauca Valley, uses early colonial ethnographic data in his discussion of *minifundio* structure. Farther to the south, Bristol (1958) describes the agricultural plants of the Sibundoy and Ingano Indians of the upper reaches of the Putumayo River. A study of shifting cultivation among the slope-dwelling Yuko of the Sierra de Perijá has been made by Ruddle (1974) and constitutes a valuable source. Beckerman (1975), following Leslie White's theoretical approach, has studied energy flow among the Barí Indians of the southwestern Maracaibo Basin bordering on Yuko territory; the study provides general data on food resources and concentrates on human energy expenditures.

Although this paper is not concerned with native ecological adaptation to rain-forest environments the following studies may be mentioned here: Isacson (1976) on Chocó slash-mulch cultivation; Reichel-Dolmatoff (1976) on ecological concepts of the Tukano Indians of the Northwest Amazon, and Von Hildebrand (1975) on land use and shifting cultivation among the Indians of the Miritiparaná River, also in the Northwest Amazon. Some additional data are contained in Friedemann (1976).

## STUDIES ON THE SIERRA NEVADA DE SANTA MARTA

In the extreme north of Colombia the slopes and foothills of the Sierra Nevada de Santa Marta have been described by many travellers but very few of them refer in any detail to ecological problems or to native adaptative strategies. A historical outline has been presented by Reichel-Dolmatoff (1951, 1953); geographical studies of altitudinal levels, settlements, and soil degradation have been made by Taylor (1931), Seifriz (1934), Schultze (1937), Krogzemis (1967), Bartels (1970), Amaya (1975), Guhl (1975), and others, but no systematic work on the landscape history of the Sierra Nevada has been undertaken. Specific climatological data are found in Hermann (n.d.), Wilhelmy (1954), and Raasveldt (1957). Ethnological data referring to slope adaptation are mentioned in Reichel-Dolmatoff (1950-1951).

A summary evaluation of the existing literature on native adaptation to the northern Andean environment of Colombia indicates a lack of intensive studies on slope-dwelling societies. In fact, the study of indigenous man-land relationships has been grossly neglected. So far, concepts such as vertical control (Murra, 1972), partial system theory (Conklin, 1954, 1963), niche theory (Hardesty, 1975), micro-environments in prehistory (Coe and Flannery, 1964), and others, have not yet been applied and tested in the study of aboriginal agricultural systems in Colombia. Also the theoretical contributions of authors such as Conklin (1957), Flannery (1968), Rappaport (1969), Janzen (1973), and Brush (1976), to mention only a few, have not been appreciated.

## THE KOGI INDIANS AND THEIR ENVIRONMENT

This paper is concerned with the analysis of a specific case of adaptation and change: that of the Kogi Indians of the Sierra Nevada de Santa Marta. The Kogi, a Chibcha-speaking tribe of about 6,000 individuals, are among the very few surviving native groups whose social, political, and religious institutions still contain many elements characteristic of the ranked societies of the ancient chiefdoms of northwestern South America. A study of their highly efficient agro-ecosystem, developed in the course of major periods of change, therefore, is of interest to the assessment of the wider northern Andean scene.

The Sierra Nevada de Santa Marta is an isolated, domeshaped massif separated from the neighbouring ranges by low-lying alluvial plains. It is the highest (5,775 m) coastal mountain in the world, and its narrow base is roughly triangular in outline, each side measuring about 150 km. A large number of fast-flowing streams, fed from the snowfields of the high sierra, drain in all directions, descending toward the coastal flats. Temperature depends not only on altitude but also on the proximity of snow-fields, on cold air currents descending the valleys, and on the geographical orientation of the respective slope. Two rainy and two dry seasons occur during the year; the main dry season lasts from December until the end of March and is followed by a rainy season lasting until the end of June when a minor dry season, with showers at noon, sets in. This is followed by another rainy season lasting from late September to December. Although this overall seasonal pattern is fairly predictable, local rainfall is often unpredictable, depending upon many regional factors. During the main dry season the eastern slopes, together with the northern and northwestern foothills, are exposed to strong northeast trade winds while some east-west trending valleys on the northern slopes, such as the Palomino and the lower Piedras and Manzanares river valleys, are known for foehnlike wind storms. The southeastern slopes lie in the tradewind belt and in the mountain's rain-shadow and are driest; the northern slopes are considerably wetter owing to longer rainy seasons and orographic precipitation. The entire mountain massif can be divided into a series of thermic belts which range from the tropical coastal plain to subtropical, temperate, cold, and paramo belts. The characteristic dense cloud forest begins at about 2,000 m; the snowline is at 5,000 m.

## SETTLEMENT OF THE SIERRA NEVADA DE SANTA MARTA

The Sierra Nevada de Santa Marta and the surrounding lowlands have been inhabited for thousands of years. On the arrival of the Spaniards in the early sixteenth century, the region of Santa Marta (founded in 1526) and the northern foothills and ascending slopes of the massif were occupied by the Tairona Indians who formed a major chiefdom. They lived in nucleated settlements consisting of a large number of houses built on stone foundations on terraced sites containing architectural and engineering features such as retaining walls, stairs, slab-paved roads, drainage channels, and other structures. The economic basis of the dense population consisted of intensive maize cultivation combined with many other crops, cultivated fruit trees, marine resources, and trade relations (Reichel-Dolmatoff, 1951) Tairona irrigation engenerring was openly admired by the Spaniards. From archaeological and ethnographical comparisons it seems that the Tairona originally came from Central America, more precisely from the Atlantic slopes of what is today Costa Rica, and that they first arrived in the tenth or eleventh century A.D. (Dussan, 1967; Aguilar, 1972; Reichel-Dolmatoff, 1975, 1978a; Fonseca, 1979). The year 1600 marks the final defeat of the Tairona at the hand of Spanish troops; their remnants, together with survivors from other tribes, fled into the mountain fastnesses while Spanish colonizing interests turned to other regions of the country.

From the seventeenth century to present times this mixed Indian population became known under the generic name of Aruacos; in present-day ethnographic literature three tribes are distinguished: the Kogi, living mainly on the northern slopes of the Palomino, San Miguel, and San Francisco valleys; the Ika of the southern slopes; and the Sanha of the eastern slopes. The Kogi claim to be the direct descendants of the ancient Tairona, a belief that is supported by considerable evidence (Reichel-Dolmatoff, 1953, 1965); at present they are the least-acculturated tribe.

The roughly pyramidal shape of the Sierra Nevada, with its narrow base and its radiating drainage pattern is characterized by deeply-cut valleys which broaden only in their lower courses where they erode downward to the coastal plain. The edaphic and climatic characteristics of these valleys vary widely and form a complex mosaic of microenvironments which are particularly notable in the temperature belt; it is this wide climatic belt that is occupied by the Kogi.

## KOGI AGRICULTURAL SYSTEMS

Kogi villages, consisting of up to one hundred circular straw-thatched, single-family houses, are not permanently inhabited but are social and ritual centres where people gather only at certain times of the year; people spend most of the time on their scattered homesteads spread over the mountain flanks at different altitudes. An individual family may own up to five or more houses, each one located in a small one-half to one hectare field clinging to a steep slope or nestling in a narrow valley bottom. Each family will also own a house in the next village but this will be used only on rare occasions. Because of fluctuating rainfall patterns the carrying capacity of each field, or of a cluster of neighbouring fields, varies from one year to another and from one region to another; moreover, certain crops thrive in a slighty warmer or cooler environment, and for these reasons Kogi families frequently move from one field to another, spending at each plot the time necessary for harvesting, weeding, and otherwise attending to the crops. The entire population is actively engaged in agricultural pursuits and this transhumance pattern is the main characteristic of Kogi subsistence.

Much of Kogi territory bears the lasting marks of age-old previous human occupations. Centuries of burnings have produced a landscape of barren mountains covered with coarse grass and fire-blackened boulders. The treeless slopes are badly eroded and only along the creeks and rivers do some stands of trees survive; at some spots primary or secondary forest is present. Although some Kogi fields are found on the limited valley floors and on small alluvial terraces some 20 or 30 m above the river bed, most are located on slopes where they occupy at most 2 ha of mixed crops. Kogi agriculture is based on the following crops: at about 1,000 m, which is approximately the lower limit of the habitat, there are plantains, bananas, sweet manioc, some maize, squash, sapote, pineapple, together with coffee and sugar-cane as cash crops. At about 1,500 m beans are added to this complex but fewer fruit trees are present; above 1,500 m some maize, beans, arracacha, and sweet potatoes are grown while higher up potatoes and onions are planted.

The standard procedure consists in clearing a field in December and January and in firing it by late February or early March. But there is no definite harvest season; harvesting is a year-round activity because of the variety of crops planted and because of variations in soil quality, and diversity in the altitudes of fields. Under these conditions it would be misleading to say that the Kogi practise shifting cultivation. In fact, they do not "shift"; a field may be cultivated for some five years and then left to fallow for ten years, but it is never completely abandoned during this period; even after the soil is fairly exhausted there will always be some food plants, such as curcurbits, peppers, beans, or a fruit tree, left in some corner. Since a family's fields are in different stages of production, there are no clear-cut harvesting or fallowing seasons. Plantain gardens and sugar-cane fields have been observed under production with hardly any change in over 30 years. A comparison between cropping and fallowing frequencies is therefore useless; some fields are practically perennial. This type of escala-

ted cultivation on mountain flanks differs from true shifting cultivation in a flat rain-forest environment in that it provides more spatial and temporal crop variety, an interlinking of growth cycles, and has less dependence on rainfall, since it is likely that even during an unexpected drought some rain will fall at some spot in the mountains. The effective variety of Kogi crops varies throughout the year and must always be supplemented from other levels and environments, but the overall system is that of a very stable subsistence agriculture.

## ARCHAEOLOGICAL TERRACES

In order to put this agricultural system into perspective, one must look back in time. In many parts of the present Kogi habitat one can see extensive archaeological terraces the structural details of which are very similar to those of the ancient Tairona territory in the Santa Marta region. These linear sloping terraces are built of rows of boulders and rocks of varying sizes which not only collect eroded top soil, but also collect runoff water behind the embankments; this water is then drained off by a slight lateral sloping of the embankment. Occasionally the prehistoric Indians dug long narrow drainage channels obliquely across a slope. A contoured pattern of terraces can be observed at some points on hillsides varying in slope from a few degrees to 45° and more; but in other regions the pattern formed by the stone rows is rather one of imbrications, of an all-over crescentic pattern of semi-circular terraces. Associated traits are small stone platforms and dressed slabs or markers set upright in the ground. These traces of former terracing activity indicate that the Tairona or other ancient tribes were quite aware of the necessity to minimize soil erosion and provide drainage. And so are the present-day Kogi; they know the benefits of soil conservation and irrigation, but use them only in a limited way. Field debris (rocks, small pebbles, branches, old tree trunks) are sometimes located at points where they might serve as small soil traps, and minor garden plots are sometimes irrigated, or narrow drainage channels are dug obliquely on a slope; but intensive irrigation is lacking although the necessary technological knowledge is plainly present.

It is a striking fact that the archaeological terraces, so prominent on the barren slopes of the Kogi habitat, are not integrated with the present agricultural work organization, nor with the prevailing settlement pattern. In the prehistoric past, when they accompanied large nucleated settlements, they probably constituted artificial ecosystems, but at present they are hardly in use. They contain good soils but sometimes are distant from settlements; and then the Kogi shy away from them because, in a sense, the terraces are sacred spots that belong to the ancestors. In sum, while the Tairona reworked the natural environment and thereby increased its yield, the Kogi maintain their natural environment by planting their scattered fields and gardens with a mixture of subsistence crops.

## CURRENT FOOD PRODUCTION

Random finds of archaeological grinding stones suggest that the relic terraces had been used for maize cultivation, as was stated by the early Spanish chroniclers. At present, however, maize, although still surrounded by many ritual observances, is of little importance as a dietary item. The staple food of the Kogi throughout the year consists of cooking plantains, a fruit which can be harvested almost perennially; it is also clear that the important subsistence items are plants most of which are of post-Columbian origin, such a plantains, bananas, yams, potatoes (post-Conquest in the Sierra Nevada), pigeon peas, sugar-cane, mango, and others. Autochthonous American plants such as maize, manioc, sweet potatoes, and beans, although distinguished by the Kogi as "belonging", are of less importance. This indicates that, to a large degree, the Kogi have had to reorientate their agricultural production and with it many other aspects of their traditional lifestyle, such as their settlement patterns. According to the Indians, maize cultivation is not profitable in their present environment and their preference is for starchy foods such as plantains, tubers, and squash, with tree crops being of considerable importance. The use of animal resources is limited both by environmental factors and by cultural mechanisms, for most animal proteins are thought to be dangerous to health and unclean in ritual contexts. Game is very scarce and there is little garden-hunting. River crabs and beetles are occasionally consumed. Oxen, acquired in the lowlands, are used exclusively as animals of burden and to operate the primitive sugar mills; chicken is an emergency food. It should be mentioned here that the Kogi and their neighbours are avid consumers of coca, the toasted leaves of which they chew with the addition of lime obtained from burning marine shells.

The change in subsistence patterns, from intensive irrigation agriculture to mixed starchy crops, from seashore and tropical resources to subtropical and highland products, was made possible mainly by the adoption of cash crops, oxen, and subsequent trade relationships with neighbouring creole peasants. Agricultural practices not only regressed in technical complexity but became completely reoriented when foreign crops were adopted. By colonial times the Kogi had adopted sugar-cane, potatoes, onions, and more recently, coffee, to exchange or sell in the lowlands. Trade relations have been going on for centuries. Dietary supplements obtained at present in this manner are dried fish and salt, but most of the proceeds of this trade are spent on bush-knives, axes, cast-iron vessels, needles, and similar items. The Kogi weave their own cotton cloth and steadfastly refuse all other manufactured goods. There is no market system, and even among families hardly any exchange is carried out.

This reorientation has developed over the last three centuries and its success must be measured by the biological and cultural survival of thousands of Indians who, although exposed to strong acculturational pressures, have been able to retain their cultural autonomy. Present-day agricultural practices, therefore, are not a carry-over from the Tairona but differ significantly from those of the prehistoric and early historic tribes. The period of disintegration of Tairona communal life was thus overcome by adaptive mechanisms of great efficiency.

## MECHANISMS OF CULTURAL CHANGE

Two main aspects must be taken into account here: first, the prevailing agro-ecosystem must be analysed in detail and second, the intellectual premises formulated by the Kogi leadership, which initially made this ecological adaptation possible, must be described.

The overall gradient of the Sierra Nevada is not steep, except where it approaches the snow-covered peaks, but the radiating rivers form V-shaped valleys with steep slopes on which an entire range of life-zones can be observed. A single valley or mountain flank may offer a range of different climatic belts spanning hundreds and even several thousand metres of altitude, and in deep valleys insolation may be severely limited. But the lower one descends, the wider become the valleys, and their slopes are less steeply inclined. The lowlands, however, are avoided and no Kogi settlements are found in the tropical thorn woodlands of xerophytic vegetation which is characteristic of the base of the Sierra Nevada. The principal valleys of the Kogi habitat have two or more nucleated villages located at different altitudes and thus they provide convenient stopping places for people moving between fields. Most valleys are about 30 km long and an entire valley, from the coast up to the paramo can be walked in three days. Since altitudinal belts are often very compressed, a large number of different resources are available within a day's walking distance from any village. To walk up or down a valley is easy enough because of the gentle gradient, but to cross from one valley –however small– to another, requires a major effort because of the very steep slopes and rocky trails. There is no seasonal migration but people move according to their needs which might vary from one family to another according to the location of their fields and kinds of crops they contain. People continuously move up and down the rivers and cross from one valley to the next in a pattern which is sometimes described by them as an almost sacred network, a huge textile in which warp and woof come to symbolize life (Reichel-Dolmatoff, 1978b). To see entire families walking through wind and rain over steep mountain trails, carrying heavy loads of field fruits, small children, raw sugar cakes, and firewood, may easily create in the observer an image of abject poverty and call to mind the plight of an impoverished people trying to wrest a living from a degraded environment. This image, however, is erroneous; neither do the Indians think of their part-time nomadism as a heavy task, nor are the resources of the environment as scarce as might appear to the outsider. In reality, what one is witnessing here are the normal workings of a system of effective adaptation developed over long time periods and maintained by precise rules and prescriptions.

Under the distinctive ecological circumstances here described, the Kogi have made their choice from these resource environments and each settlement has worked out its own particular mode of adaptation. In exploiting a series of horizontally and vertically different microenvironments the Kogi have achieved a workable balance. In the course of centuries of being forced higher and higher into the mountains by encroaching settlers, the Indians' ecological awareness has been sharpened to a point where a precise knowledge of soil characteristics, temperature, plant cover, rainfall, drainage, slope exposure, and winds has begun to form a coherent body of procedures and expectancies. In their sloping fields the Kogi will plant a variety of species but a relatively small number of individuals, thus creating a generalized ecosystem, but on terraced or level ground near villages or on valley floors, they will do the contrary and create a specialized system by planting a small number of species, such as plantains, pigeon peas, sugar-cane, or coca. To sum up, the Kogi practise a sustained-yield, non-expanding economy within the carrying capacity of their environment (Janzen, 1973). Fluctuations in annual productivity, resulting from prolonged dry seasons for example, are not disastrous because of this resource variety; there is always some spot where food can be found. It should be pointed out here that, in their daily food procurement, the Kogi do not attempt to produce a surplus; there is no storage of food beyond a few days and only some sun-dried plantains may be kept for emergency use.

When discussing their semi-nomadic migrations and the problem of available land resources most Indians will say that there is no real shortage of land; they will point out areas of primary and secondary forest, fallowed land, or even some unused level terrain in a valley bottom, all available for agricultural purposes. In fact, potential cultivable land is not as scarce as it would appear at first sight; by having a large number of fields at different stages of production and in different ecological niches, the Kogi have been able to accumulate certain reserves of agriculturally usable lands. One must also recognize the fact that, by not living in nucleated settlements, the Kogi preserve the lands adjacent to the villages from degradation and, at the same time, guarantee crop protection.

As seen from the outside one might suggest that the Indians could well live permanently in their villages and exploit a limited range of neighbouring lands; their agricultural tradition and technological

knowledge of watercontrol engineering would make this possible. But no Kogi would ever accept this alternative; their life-style is to occupy their scattered homesteads, to roam over the mountain flanks, and only occasionally to gather in a village or a small ceremonial centre to celebrate some periodic rituals. The urban tradition of the Tairona (if there ever was one) has disappeared among their modern descendants. It seems, then, that the reasons for their present, diffused agricultural pattern must be sought in another dimension of tribal tradition.

## KOGI LEADERSHIP AND ECOLOGICAL ADAPTATION

The Kogi live in a complex, ranked society in which priestly and lordly lineages continue to play a major role. However, none of these lineages, membership in which is determined by the principle of parallel descent, are privileged in any way by landholdings, better housing, or other physical advantage. Even the highest-ranking Kogi shares in the subsistence level, wears the same threadbare clothes, and lives in the same small hut as his lower-ranking compatriot. The difference consists in traditional power, in authority, and in the ability to establish rules of correct procedure. Although most Kogi villages have a headman who nominally represents civil authority, the true power of decision in personal and community affairs is concentrated in the hands of the native priesthood. These men, many of whom possess a profound knowledge of astronomy, meteorology, and ecology (Reichel-Dolmatoff, 1977), base their authority, in part, on their continuous intelligent leaderhip, in part on strong religious principles. Perhaps the most important religious mechanism is confession. Public confession of misbehaviour and offences –in action or intent– constitutes a periodic ritual and the truthfulness of the confessants is guaranteed by priestly threats of illness and impending death. Kogi priests believe that between man and nature exists an equilibrium which might easily be disturbed by irresponsible human action. Although this equilibrium refers not only to subsistence resources, water management, and forest conservation, but also to a spiritual and moral balance of the indivual, nevertheless, agricultural rituals occupy a very prominent place in Kogi religion. The repetitive sequence of the major collective rituals is timed according to astronomically determined seasons; that is, the ritual calendar corresponds to the agricultural cycle. Individual agricultural practices are subject to many ritual rules. It is believed that all native food plants have their other-worldly "fathers" and "mothers" and that crop fertility has to be insured by frequent offerings to these spirit-beings. Soil Types (humus, clay, sand, and so on) are ritually named, as are categories of rains, winds, lagoons, and the different cardinal directions with which they are associated. The planting or harvesting of any crop needs a specific "permit" *(sewa)* which only a priest can give and similar permits are required to fell a tree, fire a field, or dig a drainage ditch. These permits consist of small stone beads or other talisman-like objects and their acquisition may be costly, protracted, or may be withheld altogether. The possession of these *sewa* depends, in part, upon the user's lineage, and in part, upon priestly approval; each member of a lineage is the "owner" of certain *sewa*, while the principal priestly lineages are associated with fertility symbols such as water, rain, lagoons, rock crystals, semen, or similar concepts.

Kogi priests and, indeed, most adult men are aware of the relationship between population size and carrying capacity, and are greatly concerned about undesirable population pressure. Kogi society is sexually very repressed; sex is sinful and women are said to constitute a dangerous element in society, bent upon disturbing its precarious balance. Large families are criticized and complex birthcontrol calendars are in use. A moral tenet which is repeated over and over by priests and elders states that people should not multiply like ants, but that their model should be a squash plant which produces only here and there a single clearly traceable fruit. The ant-hill/squash antithesis not only emphasizes the necessity for population control, but also tries to keep the population from disorderly dispersal and attempts to orient it toward the maintenance of interdependent social and economic units. This native statement on a basic ecological principle is only one example of the prevalent Kogi world view. Kogi religion and philosophy are extremely severe and demanding, being based upon a harsh discipline of frugality, continence, obedience to a moral code, and meditation upon ultimate realities.

The principal cultural mechanism for any economic, social, or religious activity is priestly divination. Divinatory techniques are many and consist of simple yes-or-no alternatives, but often take the form of complex interpretations of signs and symbols, such as the reading of cloud formations, animal voices, or the shape and number of air bubbles rising from a tubular necklace bead which has been submerged in water. Other mechanisms are muscle twitching, deep meditation, and the listening to sudden sounds or voices from within. Divination is practised mainly to ascertain whether or not a certain action is feasible. The decision may concern the planting of a crop, the clearing of a field, or any aspect of a wide range of major or minor alternatives of resource management, housing, family affairs, travel, trade, or other activities. People must continually consult these priestly oracles in order to have their actions guided by divination; should they disregard these rules, symptoms of illness will soon come to express the displeasure of the divine forces and the priests will impose penalties which, occasionally, can be very harsh. Priestly divination undoubtedly introduces a random element (Moore, 1965) but much of it appears to be manipulated and the final decision most often represents a personal choice made by the priest. This is almost always the case in matters

of mate selection; in agricultural and general subsistence decision making, divination is an effective device in ecological planning because the priest's practical environmental knowledge is truly outstanding. Priestly divinations provide guidance not only for small-scale decisions in daily life but may determine major strategies such as the foundation or relocation of settlements, the intensification of a certain crop, or the nature of trade relationships with neighbouring creole settlers. The effectiveness of this, to a large degree, ritually controlled agro-ecosystem (Rappaport, 1969) is recognized by most Kogi Indians. In fact, the underlying reason why Kogi culture has been able to resist harmful change, is that it gives a strong backing to priestly authority.

In all these planning activities Kogi priests are concerned with two aims: to keep population density below the carrying capacity limit of the fields and their associated technology; and to maintain areas of undegraded environment which might constitute reserves in times of need. A case in point are the relic terraces and other archaeological sites which are tabooed for all immediate purposes, but whose untapped resources can be exploited at any given time if need be; a priest might simply "divine" that a certain extension can be used for cultivation. In most cases observed, permission was granted to plant single crops of high-protein yielding plants such as pigeon peas; on other occasions, when a local food shortage was arising, the usually restricted consumption of a tree fruit *(Metteniusa edulis)* with high protein content was relaxed and its use widely recommended. All kinds of ritual food restrictions, which are very common among the Kogi, may thus be removed when the priests see fit to do so after due divination.

This kind of resource control provides power; it determines the elite which administers the many "permits", but what in other societies would be grossly exploited, among the Kogi is being handled with great social responsibility. Kogi priests will never put themselves outside this chain and will always form part of it. They obtain no material benefit whatsoever and have no special resource rights; on the contrary, by their living conditions they always exemplify the austere ideals of Kogi life. It is true that the priests command the support of their followers by threatening them with illness, but at the same time they alleviate stress and provide experienced leadership.

The agricultural system by which the Kogi tend to occupy somewhat more land than is actually necessary for subsistence, has its beginnings in several traditional aspects of Kogi culture. On the one hand, from historical experience the Indians know that any forced movement farther into the mountains would seriously reduce the choices of resources; indeed, there is a critical ecological threshold at about 2,000 m, a level beyond which they would be deprived of their staple food of plantains. The upper limit of plantain cultivation constitutes an effective check to expansion into the high-altitude areas. The possession of a large number of fields in the temperate belt, many of them almost inaccessible to the creoles, thus constitutes a reserve in times of future encroachments. On the other hand, the widely scattered field system is a means by which tribal territorial rights are being upheld. The Kogi have not forgotten the past when their Tairona ancestors dominated these regions and at present, by thinly spreading their settlements and fields over the mountain flanks, they continue to lay claim to these traditional lands. The entire headwater region of the San Miguel River above about 800 m is considered to be a sacred legacy from the ancients and the innumerable fields, houses, trails, stone markers, or ritually named landmarks express symbolic property rights to these lands. In any event, the Kogi declare they would never migrate to the lowlands and become wage labourers; their tendency would always be one of retreat into the highland regions, even if such a movement would severely reduce their present ecological diversity.

## TRADITION VERSUS EXTERIOR FORCES

The situation described above does not present any truly pressing problems as long as conditions continue to evolve at the slow pace of past developments, and as long as the Sierra Nevada remains an island whose inhabitants can retain their tribal identities. But this is a hypothetical situation. The fact is that the period of isolation is coming to an end; the Sierra Nevada has ceased to be an out-of-the way mountain retreat and it is necessary to evaluate its physical resources and human problems in the context of international developments. The real problems of change and adaptation, if not of physical survival, are threatening from the outside. A realistic assessment of the present situation (1981) of the Sierra Nevada de Santa Marta and its Indian population must take into account a number of stark facts which become evident as soon as one places this small area of the world into its evolving national and international context. In the first place, a broad climatic belt, located mainly on the northern flanks where it party overlaps with the lower limits of Indian territory, is occupied by widespread illegal marihuana crops which form part of the international narcotics trade. Although governmental controls are active, the trade is spreading and its inevitable consequences of violence and corruption are beginning to be strongly felt in the tribal territories. In the second place, owing to its particular geographical position and its favourable climatic conditions, the Sierra Nevada is of potential strategic value, especially as a base for modern communication systems. A third aspect is this: not only the Sierra Nevada but also other isolated mountainous regions are potential strongholds of political insurgence. The Northern Andes constitute a natural link between the Andean core lands and the Caribbean sphere and, in the future,

political and military action may be expected to affect some regions presently inhabited by aboriginal groups or subsistence farmers. Another, even more striking, fact is that directly at the base of the Sierra Nevada, between the massif and the Venezuelan border, one of the hemisphere's largest coal deposits at El Cerrejón has been discovered and large-scale strip mining will begin in the near future. There is no need to elaborate on the eventual impact of all these developments upon the Sierra Nevada. Modernization, with the worst effects of cultural decline, wage labour, debt bondage, alcoholism, disease, and violence will take its toll and, since there exist no refuge areas for the native peoples, they are likely to be left at the mercy of modern industrialization and all its consequences. There is but little consolation in the fact that the spectacular beauty of the mountain landscape will eventually lead to the development of the international tourist trade, another prospect of doubtful benefit for the local scene. In any event, the Sierra Nevada is already well on the way to becoming connected with the world market, whatever its promises and demands.

It would be unrealistic to ignore these facts and to propose instead the usual local agricultural programmes, health services, and the like. Territorial encroachment, marihuana, violence, and large-scale industrialization are not mere problems of acculturation but are bound to have destructive aspects which, in the case of the Sierra Nevada, are likely to lead to serious problems. There can be no easy solutions; future directions must be based upon a clear awareness of the increasing threats and must attempt to prepare the native peoples for a time of far-reaching, accelerated change.

## CONCLUSION

Two aspects deserve immediate attention: one concerns scientific interst in Kogi adaptive strategies; the particular agro-ecosystem should be studied in detail, preferably in one of the larger valleys such as that of the San Miguel River. The study should attempt to provide a coherent picture of land tenure and land use in different ecological niches, crop diversity, and seasonal variations. Soil analyses and meteorological data should be obtained and case studies of the semi-nomadic pattern of individual families should be made. The nutritional and general health status of the Indians should be assessed and demographic data should be analysed. This body of qualitative and quantitative information should be related to Kogi social organization, power structure, and their overall religious and philosophical world view. The value of such a study would lie in its analysis of a native strategy of zero-growth development, and in its comparability with other, similar adaptive strategies elsewhere in the Northern Andes. The other aspect that deserves priority treatment refers to the urgent need for establishing a biosphere reserve, as envisaged by the Man and the Biosphere (MAB) Programme, where Kogi culture would be protected against destructive influences while long-term research could be carried on by teams of specialists in ecology, plant geography, hydrology, geomorphology, and many other disciplines. The physical characteristics of the Sierra Nevada provide ideal laboratory conditions for this kind of research.

In conclusion, the Sierra Nevada de Santa Marta is not an isolated case; many other regions of the Northern Andes present similar patterns of ecological adaptation and find themselves exposed to similar impending changes. It is evident that development of proper resource management practices to anticipate and diminish the impacts of the oncoming changes remains a major problem; the biggest challenge will lie in providing the institutional mechanisms which will protect small traditional societies from disruptive changes imposed from the outside. In this respect, the resilience of their age-old ecological awarenees may contain important lessons. It is essential, then, that specialists in all spheres of planning, training, and research be made equally conscious of the cultural complexities of the material conditions for survival.

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