A Trailscape in the Barrancas of Central Veracruz; Land Use and Transportation in Sloping Terrain

By

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ABSTRACT

The canyons, or *barrancas* of Central Veracruz remain as major voids in the region's cultural history. The inherited view of the *barrancas* as difficult in terms of movement and marginal in terms of potential for subsistence is no longer adequate. The region's inhabitants organize themselves to carry out construction and engineering projects in order to maintain trail links to a variety of local resources and activities ranging from cultivation to less apparent social objectives. Interaction between people in social, political and ritual contexts is made possible. The trails are utilized locally and their reach is extended with the road network, particularly as accessibility to the regional economy becomes necessary; adding trails to the region's transportation network results in a doubly interconnected transportation facility. The trail system thus provides a basis for adaptive strategies utilized to render local physiographic "*limitations*" less forbidding. Whether with the cultivation of coffee or cane, or the persisting *traditional* cropping strategies, land typically considered marginal is successfully exploited. The trails not only form part of the economic basis for the region's subsistence economy, but they are consequential in terms of land use strategies. Further, they are primal in terms of the region's transportation facility; this primal characteristic is confirmed when we re-evaluate the region's transportation history.

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Chapter 1 Introduction

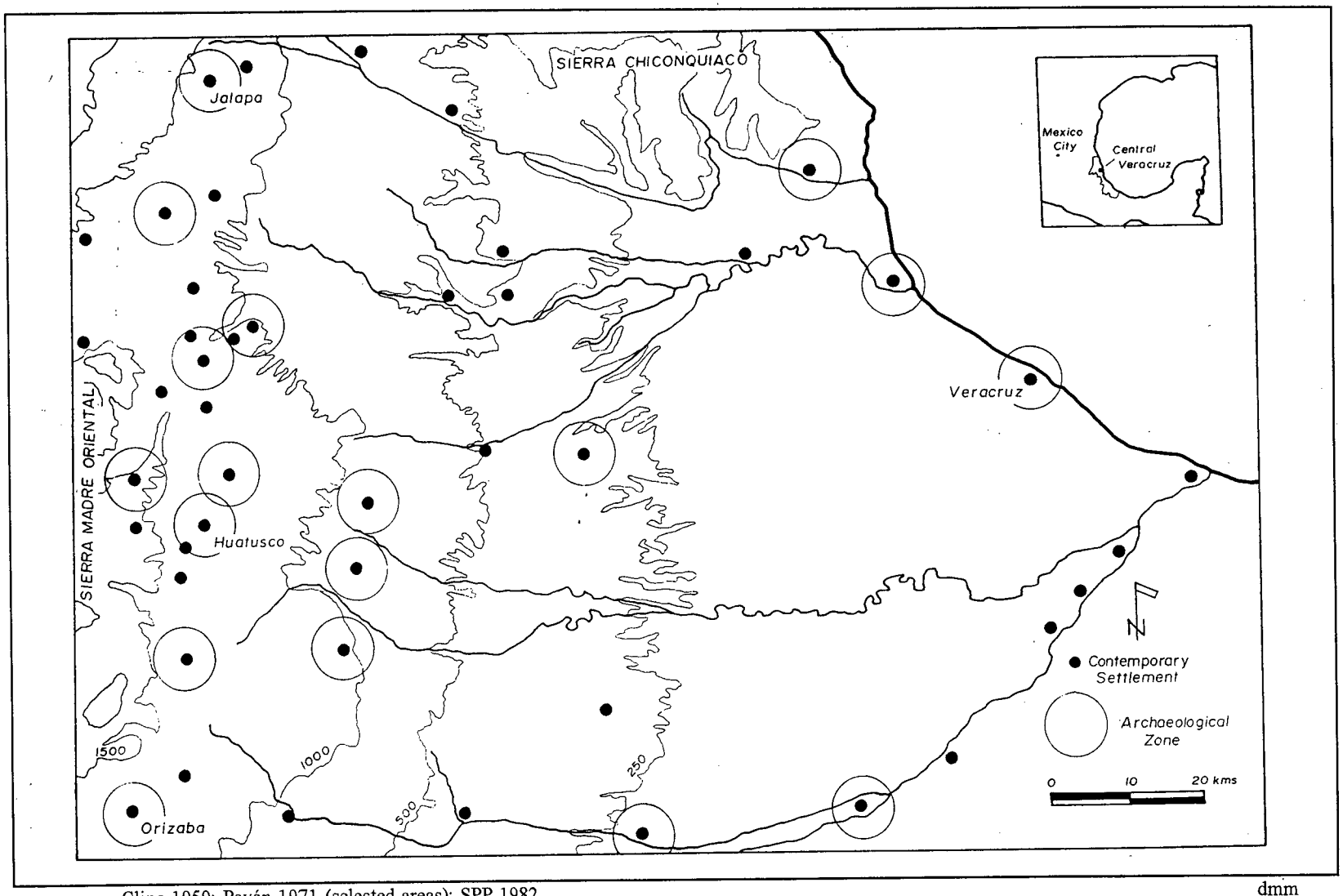
> "Mexico, like most lands of Latin America, has its own main and living roots in a deep, rich past. The continuity with ages long gone is fundamental in this country. An invasion by the modern, Western world is under way, but this conquest will remain partial, as earlier did the assault of the Spanish conquerors upon native ways."
>
> Sauer 1941, 353.

1.1 Setting

"*¡Dos horas!*" ("Two hours!") The woman in the fourth house on the western edge of town told me it would take two hours to get to Totutla from Azoyatla. That was over seven hours ago. I had left early, knowing that there would be a lot of ground to cover and undoubtedly more than one trail to explore. The path immediately to the east of the woman's house had certainly seemed like the obvious choice; travellers came from its vicinity and it appeared to head in the general direction of Totutla. But there are now five trails for me to choose from...!

Thus began my preliminary field explorations of the trails within the canyons, or *barrancas,* situated along the eastern escarpment of the *Sierra Madre Oriental* and the southern flanks of one of its spurs, the Sierra Chiconquiaco in Central Veracruz. The *barrancas* remain as major voids in the region's cultural history, yet paradoxically the archaeological record suggests that the region has been inhabited since the pre-contact era (figure 1) (Coe 1984, 88; Payón 1971, 505-10). Further, the *barranca* areas continue to be interspersed with small communities and a web-

Figure 1 - Central Veracruz



sources: Cline 1959; Payón 1971 (selected areas); SPP 1982.

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like set of trails seemingly extending throughout the landscape.

The few references in the literature are laconic at best. Hugo Fink (1870) for example, notes in a report to the Smithsonian that the "*barrancas* have precipitous sides from three hundred to one thousand feet deep, which guarded the inhabitants on their flanks" (374). Contemporaneously, Sartorious (1961 [1858]) reports that "[t]hese chasms interfere sadly with the communication of the interior...[and] are frequently inaccessible for a distance of many leagues" (43). At about the same time, Calderon de la Barca (1952 [1840]) was writing to a family member, describing a day trip to a "mountain gulley"; evocatively alluding to the *barrancas* as "formidable" (249). More recently, Aguirre Beltrán (1991) highlights his belief that it is difficult to situate one's self within individual *barrancas*, writing that "*[e]n esas regiones...el hombre está de tal manera inmerso en la naturaleza que es difícil desligarlo de su ambiente*" (56). And in a historical rendition of the Veracruz-Jalapa road, Siemens (1991) refers to the *barrancas* as convenient guerilla hideouts during the nineteenth century (141-42). References are brief and general, primarily accentuating the areas as difficult to access and marginal, in terms of potential for subsistence.

Situated on the Gulf Coast, the state of Veracruz has been expanding economically since the early 1940's. Cattle ranching in the northern and San Luis Potosí areas, state-sponsored agricultural schemes within the central low lying floodplains, and new settlement within the southern areas have altered the rural

landscape. More recently, oil discoveries in the Gulf have caused a slight population shift as people moved from rural areas to the port of Veracruz in search of construction and other oil-related jobs. The jobs, however, have been ephemeral, with urban unemployment on the rise. These recent changes in the Veracruz economy have affected the *barrancas* areas very little; people continue to persist in a subsistence lifestyle within the seemingly *limiting* region.

1.2 Argument

Physiographically, the *barrancas* certainly seem to obstruct movement; the deep gorges and ravines give an impression of complete inaccessibility (figure 2). The eastern escarpment of the *Sierra Madre Oriental* is made up of a set of sharp folds aligned north to south in the limestone bedrock. A complex arrangement of cretaceous limestone cliff forming members results, with conglomerate rock and volcanic debris providing partial terrain cover. The folds form ridges while erosion processes create deep incisions which in turn form the east to west *barrancas*, resulting in a jagged series of topographic lines (figure 3a). Because the Palaeopacific Plate dips towards the east, a tilting effect occurs as the Gulf is approached while a series of north to south oriented normal-faults create descending steps (figure 3b) (Mossmann and Viniegra 1976, 370; West 1966, 25). At the base of the steps lie relatively flat piedmont areas and along the faults, the east to west

Figure 2 - *Barrancas* at Rio Santa Maria (facing west)

January 13, 1995.

rivers break into rapids. At times, depth of individual *barrancas* significantly surpasses width and typically the ridges are topped by flat plateaus, or *mesas,* with a steep plunge at their eastern extremities. In the wider *barrancas* the *mesas* are usually echoed on their flanks by benches bounded by steep slopes in upward and downward directions (figure 4).

These features were highlighted by the early observers as they travelled within the region. Martín (1943 [1805]) noted that "*en las Barranquillas un conglomerado bastante duro con las mismas rocas dichas y fragmentos muy*

Figure 3 - Topography and Schematic Profile; Central Veracruz (note *barranca* locations along main rivers)

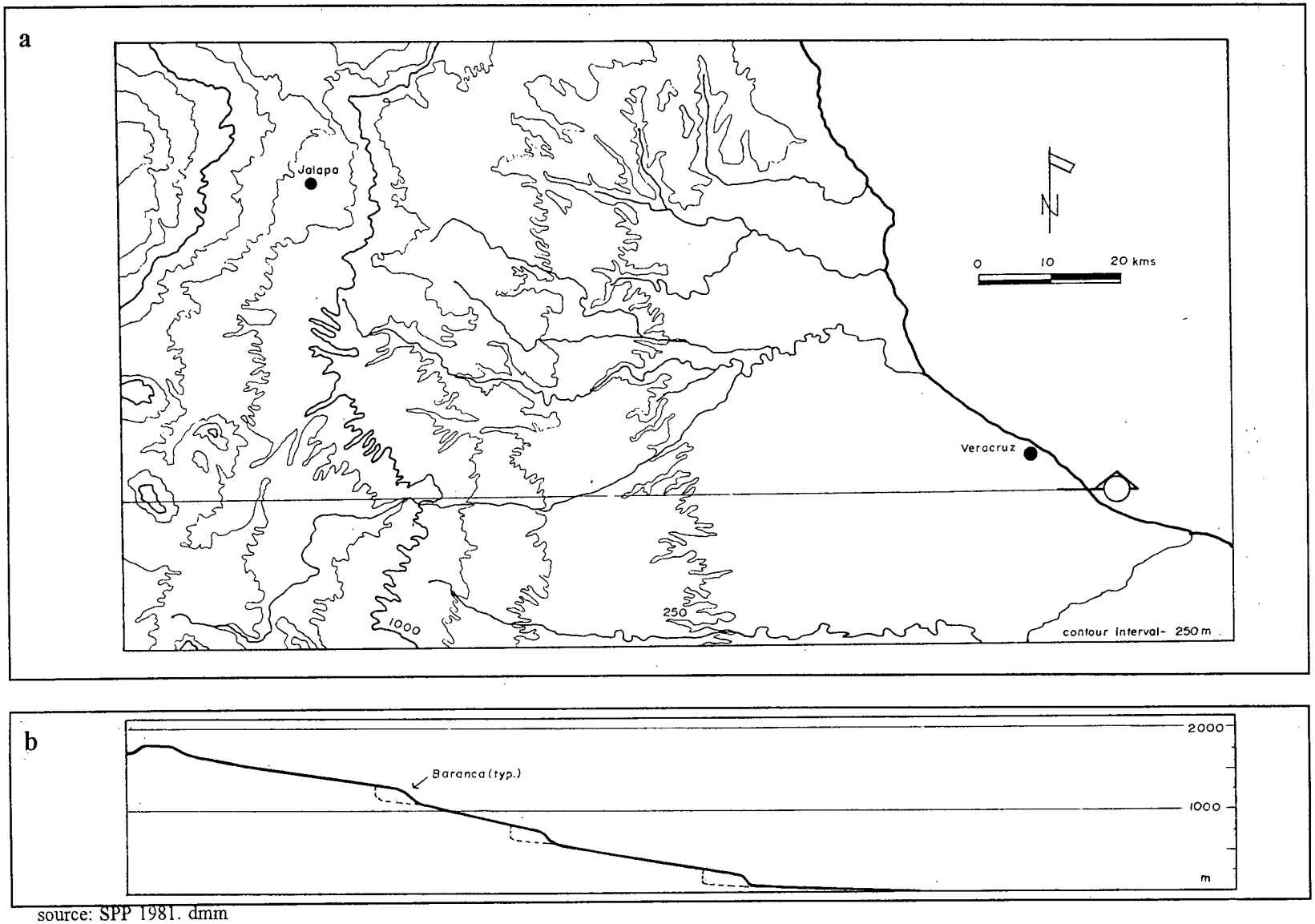

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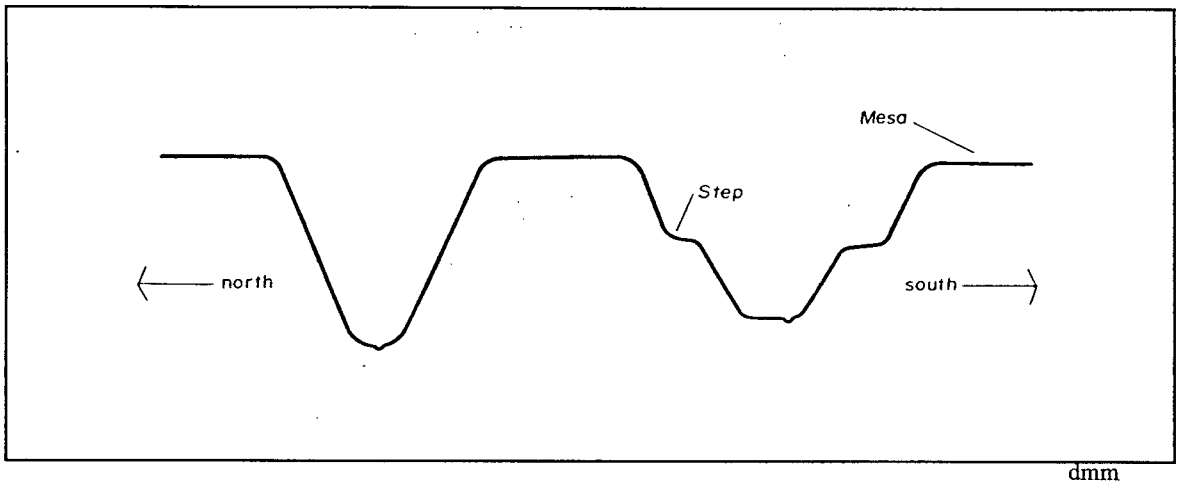
Figure 4 - Schematic Profiles



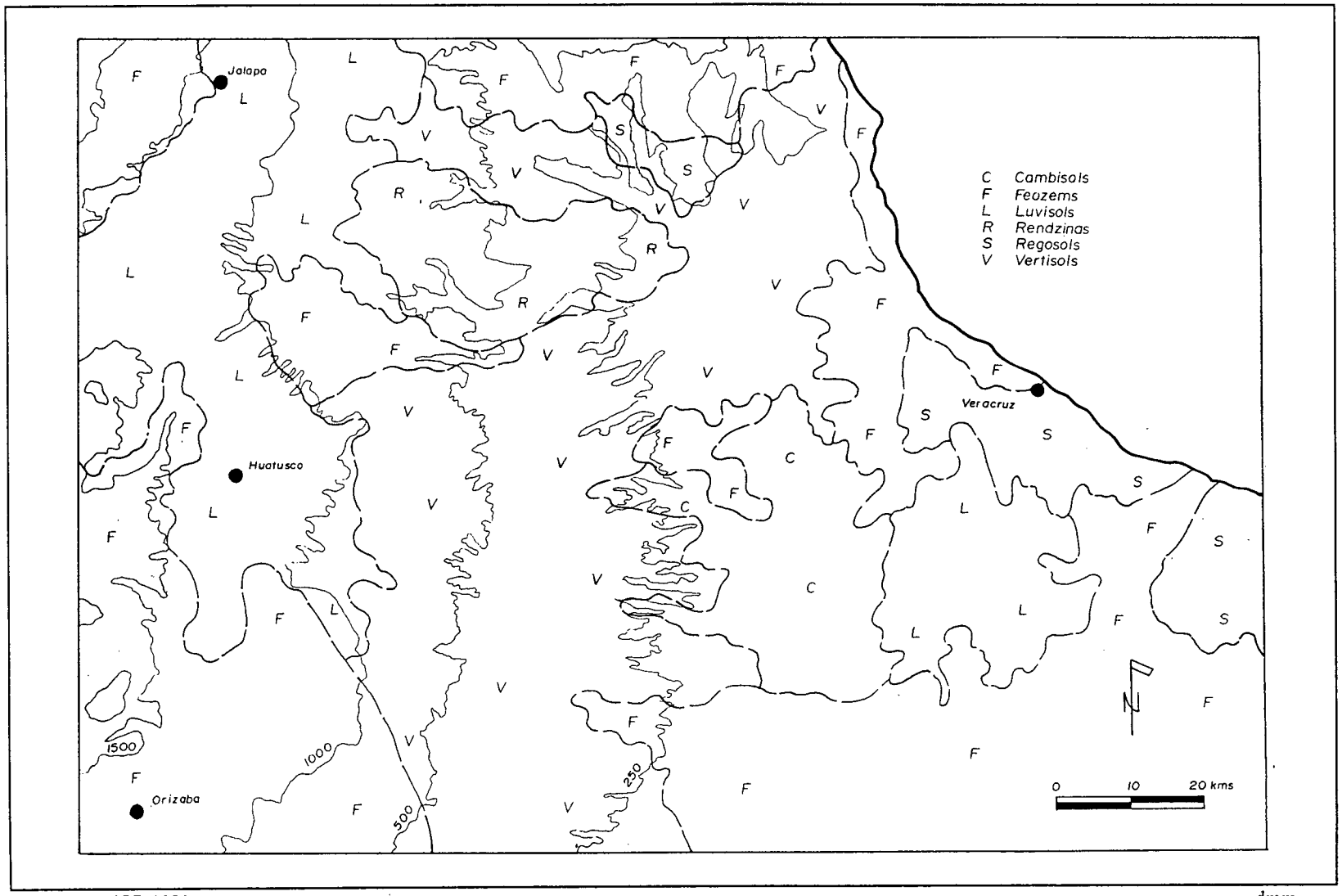
pequeños de tezontle, todos angulesos...[renders the terrain extremely difficult to traverse]" (163). And Sartorious (1961 [1858]) pointed out that "[t]he sides of the chasms, often rising perpendicularly from 1000 to 1500 feet, consist in many places of sandstone, mixed with...blocks of basalt in massive layers, separated horizontally by patches of rubble [which are] sometimes three feet in thickness..." (15). The observations are generally accurate; the vertical faces are indeed complex, with layers of dark black volcanic material combined with conglomerate and limestone layers exposed through weathering (Böhnel and Negendank 1981, 237-38; Bretz 1955, 364; West 1964, 52). With such a sharply defined terrain, it is not surprising to find a focus on *remoteness* in the literature.

The tendency, however, has been to focus primarily on the topography of the region while making few other distinctions between the *barrancas* and the lowlands;

simply put, there is more to the *barrancas* region than seemingly difficult topography. For example, while the topographical complexities of *barrancas* along the eastern Sierra Madre slopes are emphasized, soil material and climate on the *mesas* and within the *barrancas* is discussed only in terms of the Central Veracruz **region**. Consider the following generalizations:

Sanders (1953) points out that the clay soils of Central Veracruz are for the most part lateritic, implying that their surfaces may become hard and difficult for cultivation, especially where they are also rocky (36). While laterization can certainly limit the extent of successful soil use, *barranca* soils are not necessarily subject to the same weathering conditions that form lateritic soils. Local environmental conditions, as we shall see, are too varied for such a sweeping conclusion. Typically, the soil maps are also generalized, outlining the presence of vertisols, feozems and luvisols throughout the region, yet not representing *barranca* soils *per se* (figure 5); both the soil maps and Sanders do not highlight the volcanic parent material existing within the *barrancas*. Clearly, volcanic materials can form soils that are quite suitable for cultivation! Further, while Sanders points out that clay soils can be "strongly cohesive" when wet and therefore exceedingly difficult to till, not all cultivation techniques require extensive tilling (Farr and Henderson 1986, 37). And although rocky soils can hinder some crop cultivation techniques, they do not arbitrarily prevent other crops from being planted; coffee, for example, grows well in rocky soils.

Figure 5 - Main Surficial Soil Types



source: SPP 1981.

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Palerm and Wolf (1957) also point to the region's soil and topography when generalizing that the whole of Central Veracruz has had, to them, limited cultivation potential (15-16). They note that while the rivers originating in the eastern hill lands provide moisture and nutrient flow along their respective banks, the water supply and level can be erratic, especially where ephemeral rivers, or *arroyos*, are affected by karst topography. The presence of karst topography, however, does not in itself mean that there is inadequate moisture for cultivation! Generally, the later stages of karst landscape formation result in relatively flat areas with surface streams; areas that are highly amenable to cultivation (Strahler and Strahler 1984, 266-67).

Regional climate characteristics are also highly generalized, often framed within Humbolt's (1972 [1811]) tripartite system of *Tierra Caliente, Tierra Templada* and *Tierra Fria* zones. The *barrancas* lie within the region where the sub-humid coastal zone (0 to 800 metres a.s.l.) meets the elevated zone along the slopes of the eastern escarpment and upper plateaus (800 to 1600 metres a.s.l.). Although these correspond to Humbolt's *Tierra Caliente* and *Tierra Templada* zones, the usually accepted notion of an altitude-temperature climate is misleading. The climate cycle is not one based uniquely on altitude and temperature, but rather, one based mostly on altitude and rainfall (Palerm 1967, 28). For example, Jalcomulco at approximately 300 metres a.s.l. has a December to May change in mean temperature from 11° to 16°, and much higher at 1500 metres a.s.l., Huatusco

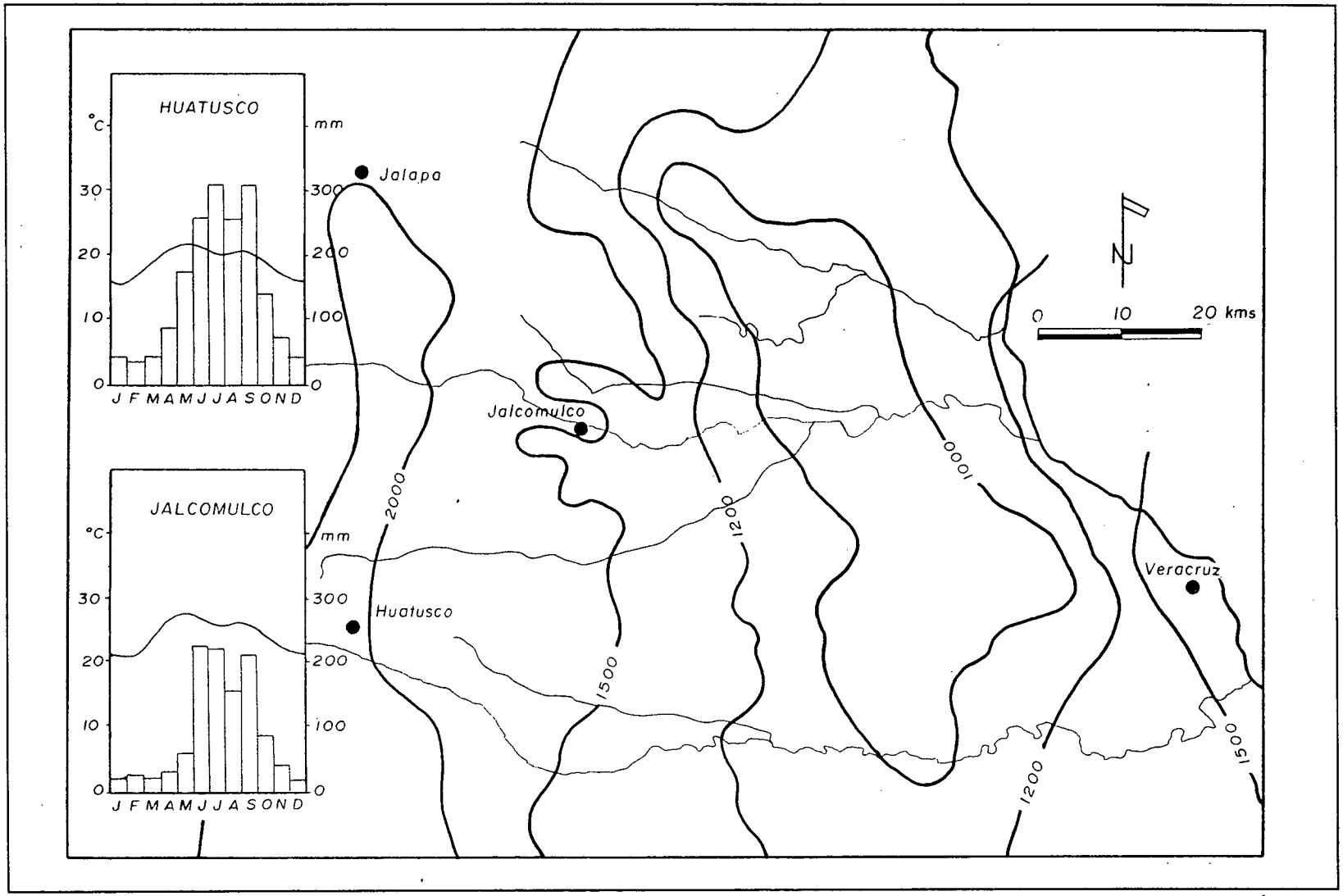
has a mean change of 9° to 17° during the same period (figure 6) (Garcia 1970, 15-18; Soto and Garcia 1989, figures 82 and 115; Troll 1968, 15). Clearly, the difference of 3° in terms of mean temperature change is not substantial. It is only when we consider climate differences in terms of the region's rainfall characteristics that variation becomes more apparent.

Rainfall begins towards the end of May and continues until the end of October. In the higher areas of the hill lands, such as at Huatusco, the season is more prolonged, peaking in late July and mid September while diminishing in early August and late September. Some erratic rainfall is carried to the region by the north-east winds, or *Nortes* from the Sierra Chiconquiaco and Gulf areas, but overall, there is little precipitation during November and May (Coe 1984, 14; Troll 1968, 14).

Precipitation varies with exposure (the easternmost flanks are more prone to the effects of the Caribbean trade winds), distance from the coast, and invariably, altitude. Within the lower altitudes precipitation is lower; on the upper escarpment orographic precipitation via the Caribbean trade winds supplements the *Nortes* and increases the total rainfall. The annual precipitation at Jalcomulco (300 metres a.s.l.) is 1119 mm, and 1200 metres higher at Huatusco, 1741 mm of precipitation is received annually. The difference of 622 mm is substantial and can be even more important when considering individual *barrancas*.

Not only do the *barrancas* lie within the region where the sub-humid coastal

Figure 6 - Precipitation Distribution and Climographs



sources: Garcia 1970; Soto and Garcia 1989, 82-115.

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and the mid-range temperate zones meet, they are themselves zones of climatic change due to altitude and pressure variation within their immediate confines. The rains can occur simultaneously over many *barrancas* but each has its own particular system of convection and evaporation. As average daily temperatures increase, low clouds take shape within the valleys, rising and in turn creating rain storms that occur locally. In this way, altitudinal zonation replaces latitudinal location within the confines of the individual *barrancas* (Moran 1982, 144; Rivera Cambas 1959 [1805], 174). Combined, local variation in terms of precipitation and more subtle localized temperature variances affect biomes according to altitude (Collier 1975, 25; Medina Abreo 1986; Rhoades and Thompson 1975, 539). Regional variation in terms of topography and local conditions related to soils, altitude and climate render individual *barrancas* unique and indeed amenable to various forms of cultivation.

The inherited view of the *barrancas* as difficult to access and marginal in terms of potential for subsistence is no longer adequate. In spite of the generalized characterizations, preliminary explorations hint that the *barrancas* may not be as remote as the literature and physiography would suggest. Recent air reconnaissance reveals activities ranging from small scale horticulture to agriculture and ranching throughout many *barrancas* (figure 7); activities all linked by trails! And interviews hint that the previously considered unplanned and unmaintained trails,

Figure 7 - *Barranca Los Pescados*

Air Reconnaissance Flight; June 26, 1993.

in addition to providing access to fields and linking settlements together, have a host of other *raison-d'êtres*. It is from these recent observations that this study takes its cues; exploring these trails and the ways surrounding land is utilized presents a unique opportunity to characterize the *barranca* landscape.

1.3 Opportunity

One of the main ways culture manifests itself within the landscape is through

its transportation facilities. Roads and trails provide for the transfer of products within regions and provide for the interaction of people, as economic, social and ritual functions become combined and amplified by exchanges through space. And as significant, land use along a culture's routes further distinguishes the landscape. Indeed, land use can be seen as a *consequence* of routes (Armillas 1971, 65 4; Dickinson 1970, 82; Gordon Childe 1962, 211; Hassig 1991, 13; Hyslop 1985, 225-26; Trombold 1991, 1). Therefore, by investigating this region's trail system on the one hand and the region's land use schemes on the other, it is possible to characterize the *barranca* landscape. In other words, why not utilize the trails as a means by which to study the region's landscape?

Two research questions can be formulated to provide a framework for such an analysis:

(i) To what extent are the *barranca* trails planned and maintained, and what type of network do they form?

(ii) What are the functions of the trails, and how is their use reflected in the way the surrounding land is utilized?

1.4 Study Area and Preliminary Research Hypothesis

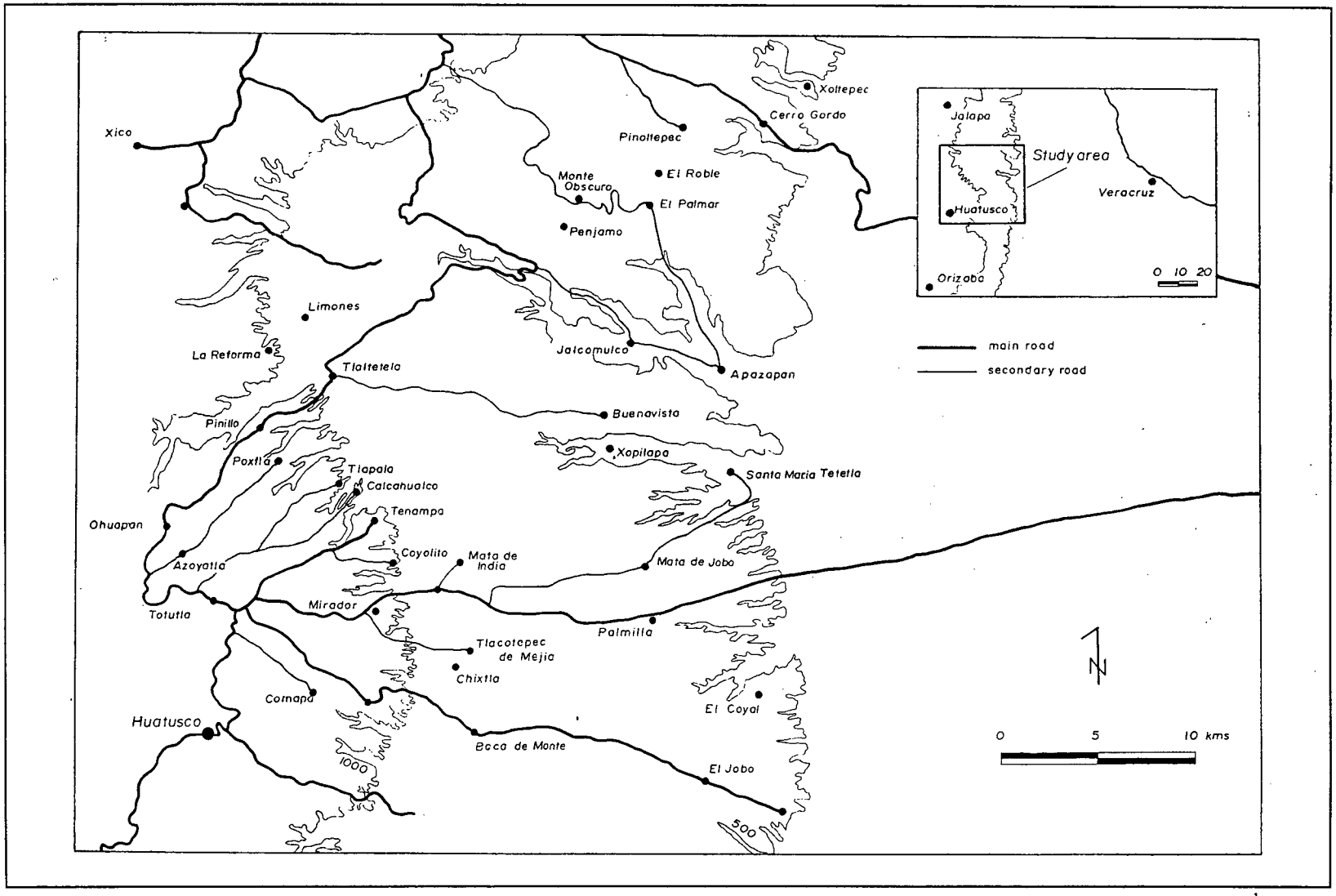
The roads of Central Veracruz are typically oriented east to west, paralleling the *barrancas* and favouring long distance communications and travel (Rees 1971, 2; 1975, 324). There are few roads that are oriented north to south. Settlements

can be as close as one kilometre from each other, north to south, but up to 28 kilometres apart using the east to west roads (SPP 1982). We know from preliminary ground forays and ethnographic queries that trails oriented in various directions, including north to south, exist throughout the *barranca* landscape. For this reason, it seems likely that north to south trail connectivity exists between proximate settlements, regardless of the perceived obstructiveness of the east to west *barrancas*. A preliminary hypothesis that counters the inherited views can thus be formulated as follows:

> **Settlements within the region are connected to adjacent settlements, to the north or south, by trails that cut across individual east-west *barrancas* and that are ultimately integrated within the regional transportation network.**

The region's expanse suggested sampling a smaller study area. Selection of the study area was initially determined by field logistics: Hypothesized north to south settlement-linking trail segments had to be accessible by road to permit access and egress at each end, within the same day. Vertical (1:70,000) and oblique (400 metre altitude) air photographs were analyzed, focusing on markers such as bridges and houses to select potential trail segments for exploration. Based on this preliminary analysis, the area to the north-east of Huatusco was chosen for field research (figure 8). Here, the east to west roads provide access to settlements that are in relatively close north-south proximity to each other. Because the settlements are separated by *barrancas* which lie in a transverse juxtaposition to the

Figure 8 - Field Work Area



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hypothesized north to south settlement linking trails, it is not only possible to verify north-south settlement connectivity, but it is also possible to obtain a cross-*barranca* sampling of land use.

In order to test the validity of the research hypothesis, a two pronged research approach was undertaken including field explorations and ethnographic enquiry. A sampling of twelve pairs of hypothetically linked settlements was selected based on further air photograph and cartographic analysis. The sample size was dictated by field research time. Preliminary forays had suggested that two and a half days would be required to explore each trail transect; six weeks of field research time had been allotted. Informants were interviewed regarding the existence and location of settlement linking trails at either end of the hypothesized trail segments. Field explorations followed, supplemented with additional interviews carried out along the trail segments.

Because people are preoccupied with travel objectives and work plans, their time and willingness to participate in structured interviews is limited. Particular attention was therefore given to the interview strategy. An unstructured intercept interview strategy was adopted to enable interviews to be on-the-spot and brief. Informants were asked about specific activities while engaged within the context of these same activities; they were therefore less prone to miscalculate or leave out facts. The unstructured intercept strategy was therefore adopted using Dixon's (1978, 17) limit of ten minutes per intercept, but extended when interviewees

showed an interest to continue (Lofland 1971, in Mishler 1986, 27; Sheskin 1985, 24). The data from the intercept interviews were supplemented by field observations pertaining to trail location, function and surrounding land use.

With field explorations and ethnographic enquiry, therefore, it was possible to "lift" a set of trails from the landscape, enabling network and land use analyses. The study considers the region as a **trailscape** which not only includes the trails *per se*, but also the land area surrounding the trails. The trails are first examined in terms of their morphology, outlining their complexity in terms of planning and maintenance, uses and overall role as local communication networks and as part of the regional transportation facility. Then they are utilized as transects by which land use is assessed. Historical issues pertaining to the trails and routes of the Central Veracruz hill lands follows, outlining and highlighting the primal nature of the transportation facility.

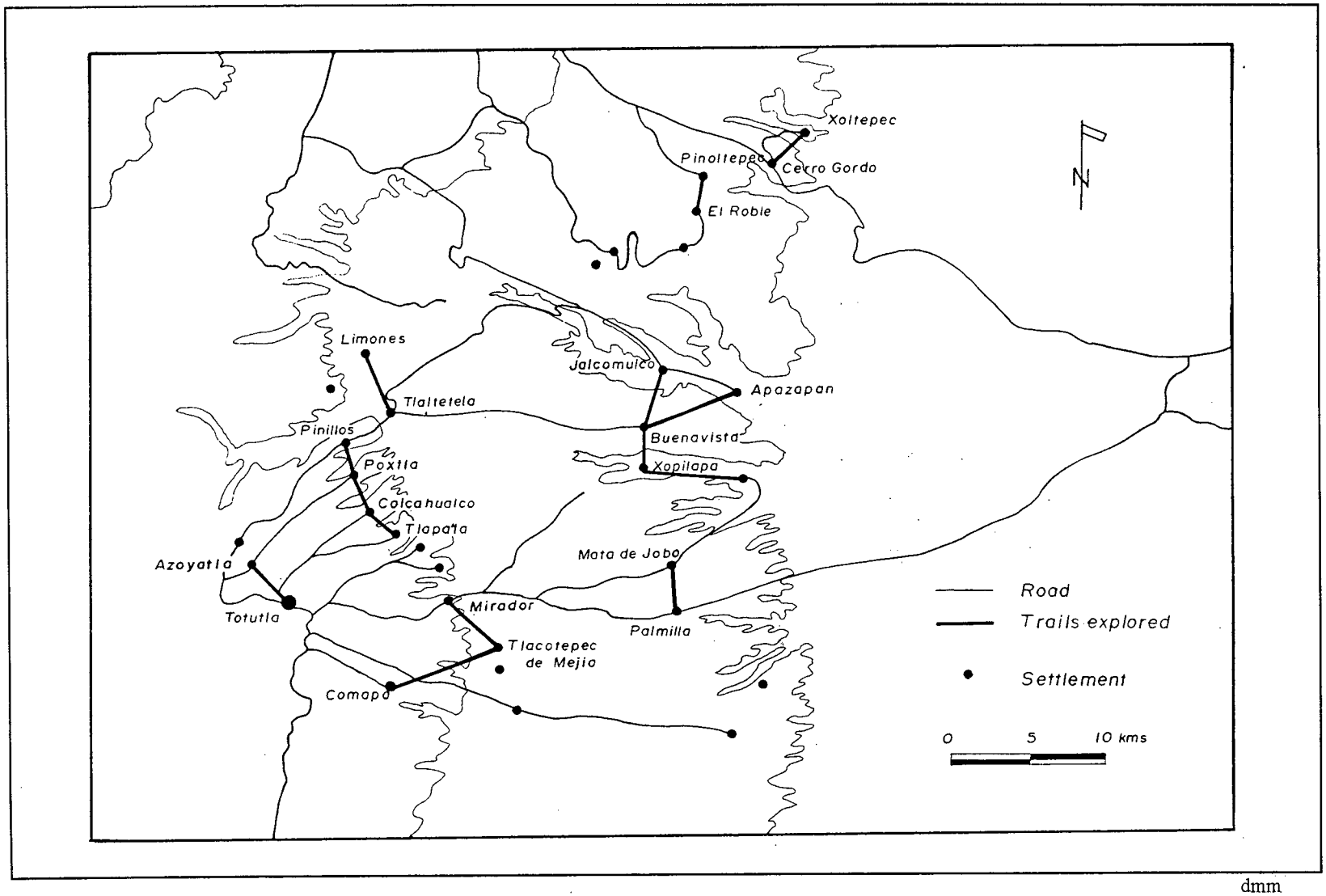
Chapter 2 The Trailscape

"*¡Todos condocimos a Totutla!*" ("They all lead to Totutla!") As I continue my trek towards Totutla, a man helps me by indicating that each of the five trails in front of me leads to Totutla; my choice, however, depends on what I want to do along the way! I choose the one he suggests is shortest. The trail lies on a ridge, heading southeast in a relatively straight path, built of compacted clay soil and conglomerate rock fragments. At the end of an initial 1.2 kilometre stretch lies a set of steps, cut deep into the orange clay soil and descending steeply towards the Tlapala river below. At the top of the stairway, a small niche is cut into the rock face, approximately 35 by 45 centimetres wide and 20 centimetres deep, containing a crucifix, three lit candles, and a set of small religious icons. From this vantage point, I can see that I will have more choices to make; the descending trail links to a series of secondary trails heading towards various fields within the *barranca* below...!

2.1 Trails

Twelve main north to south settlement connecting trails were initially located and explored along with two additional trails running east to west (figure 9). From the onset of the trail explorations, a trailscape became evident with trails marking

Figure 9 - Field Explored Settlement-Connecting Trail Segments



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the terrain surface throughout the inner and outer *barrancas*. The trails seem to be **the** organizing feature of the landscape, with the grazing and cultivation fields organized around them.

Not surprisingly, each trail segment varies in terms of its physical features and functions. Locally, the trails are geomorphic, tending to follow the lay of the land and avoiding small obstacles. The main trails are not always evident because various secondary segments branch off towards fields and homes. At a broader scale, the main trails follow relatively direct, or linear paths from settlement to settlement with some deviation as the negotiation of steep slopes becomes necessary. Along the Jalcomulco to Buenavista trail, for example, the orientation is clearly north to south and although it changes direction to avoid small boulders at a local level, the orientation is maintained even when the small *barranca* at the Xocuato *arroyo* is encountered (figure 10).

In contrast to the direct north to south orientation, the main trails along the Mirador to Tlacotepec de Mejia and the Pinillos to Poxtla segments are indirect, detouring somewhat along the upper reaches of the *mesas* near Mirador and Poxtla (figures 11 and 12). At Mirador, the main trail appears to have been modified with evidence of new and abandoned segments existing in at least four localized areas. And at Poxtla, the main trail has been modified to detour around newly planted fields of coffee trees. These indirect main trails, however, are exceptions.

Particularly apparent along the Mata de Jobo to Palmilla trail (figure 13) are

Figure 10 - Main Trail; Jalcomulco to Buenavista

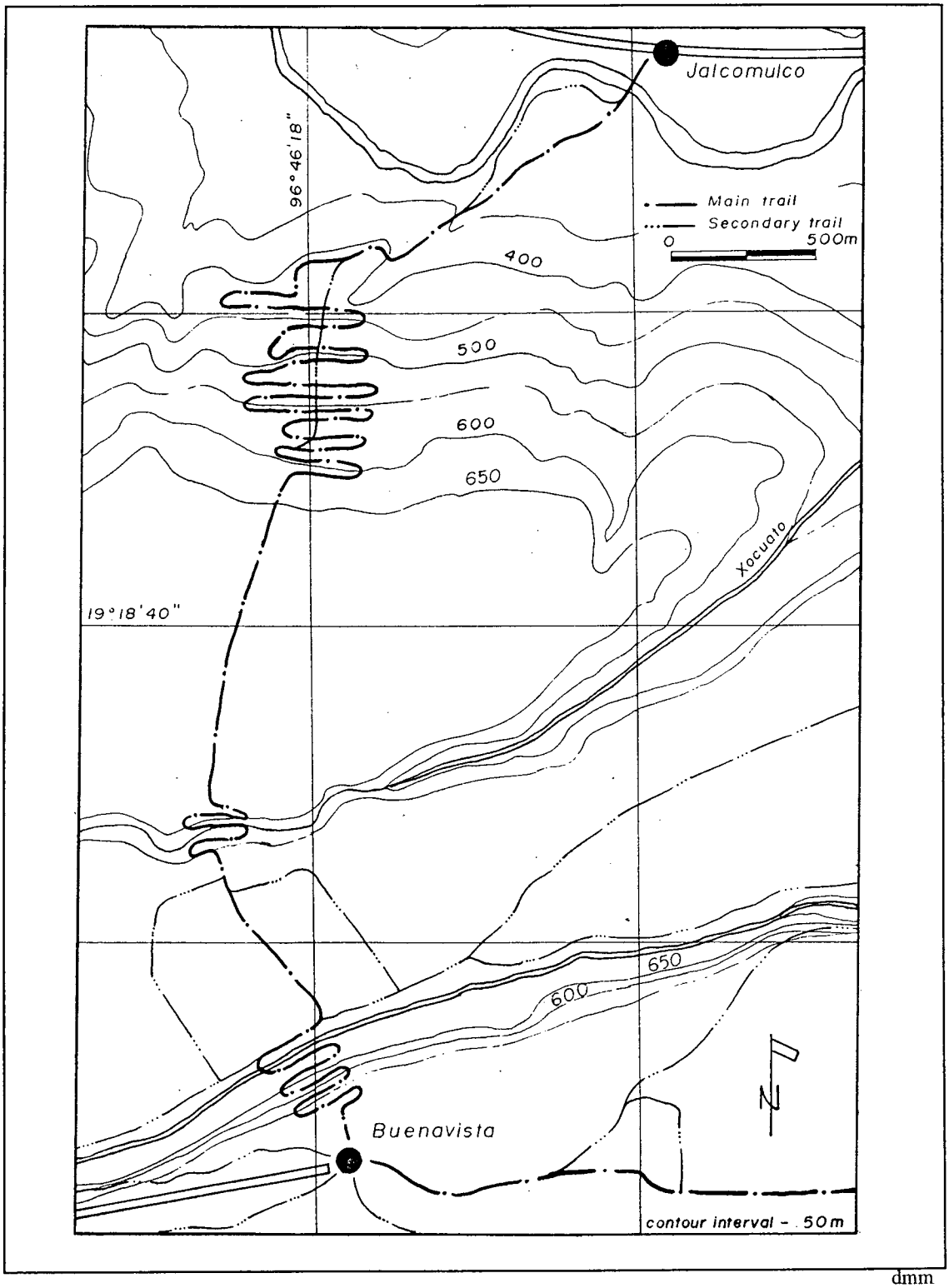

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Figure 11 - Main Trail; Mirador - Tlacotepec de Mejia

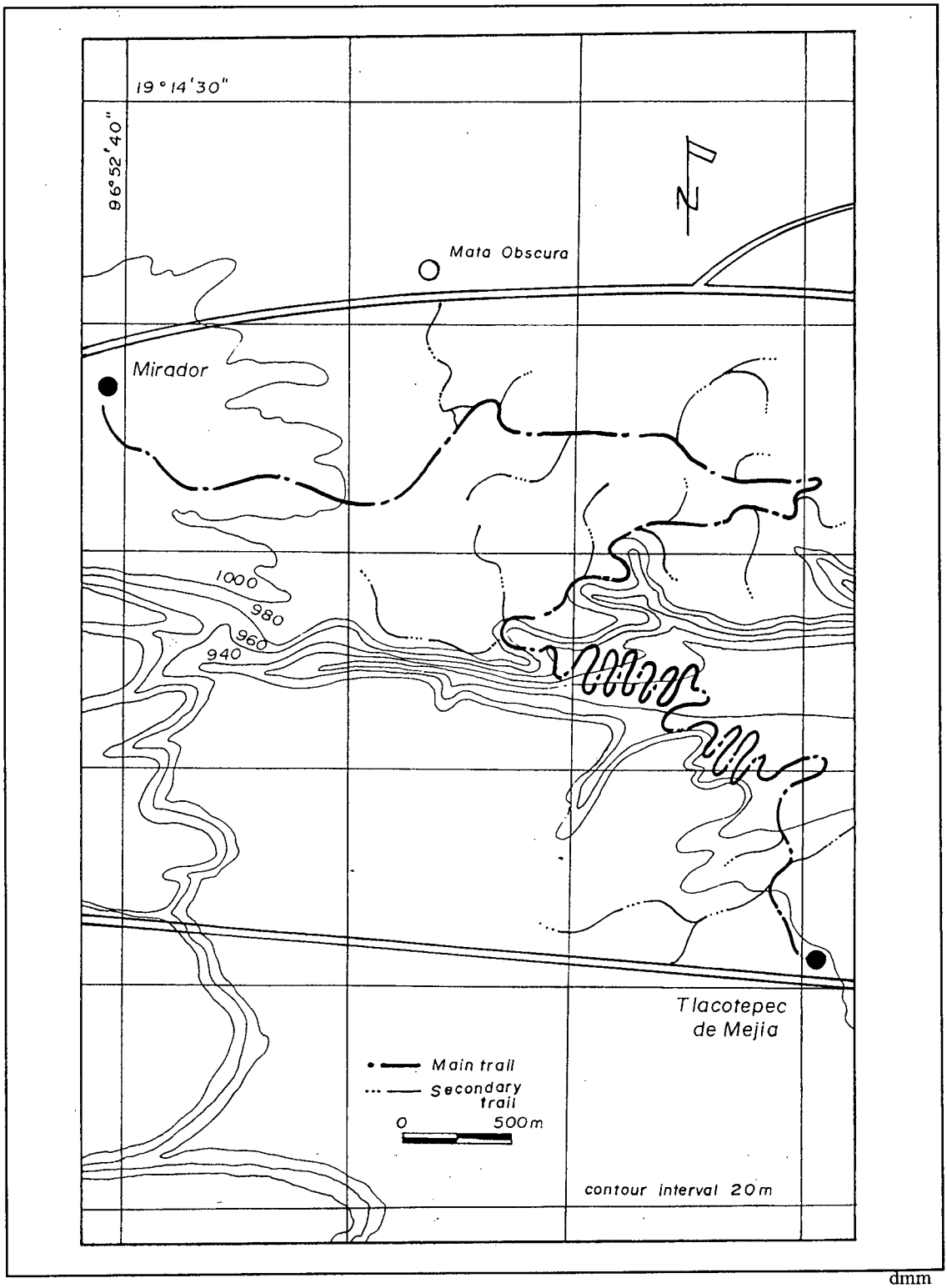

Figure 12 - Main Trail; Pinillos to Poxtla

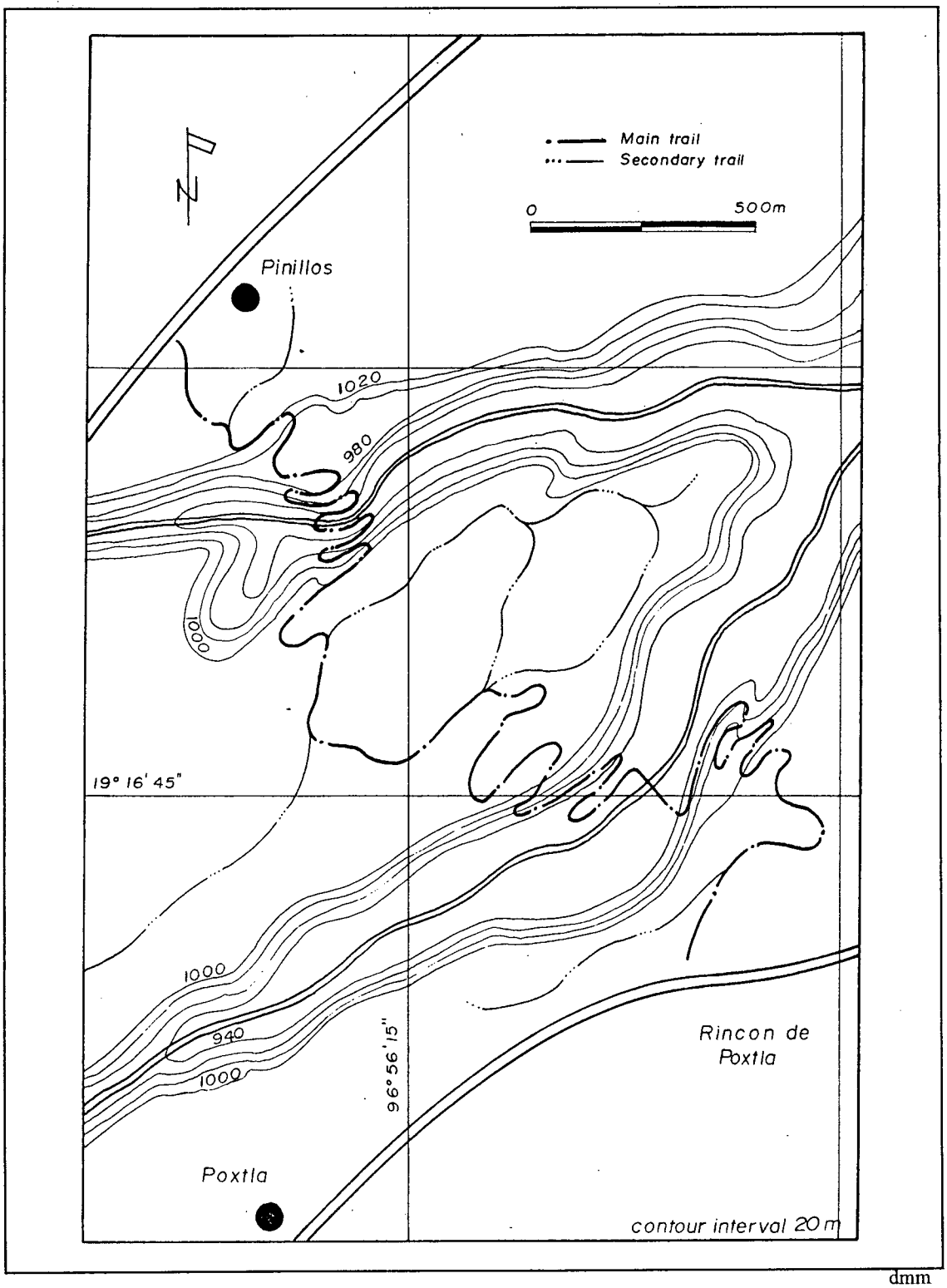

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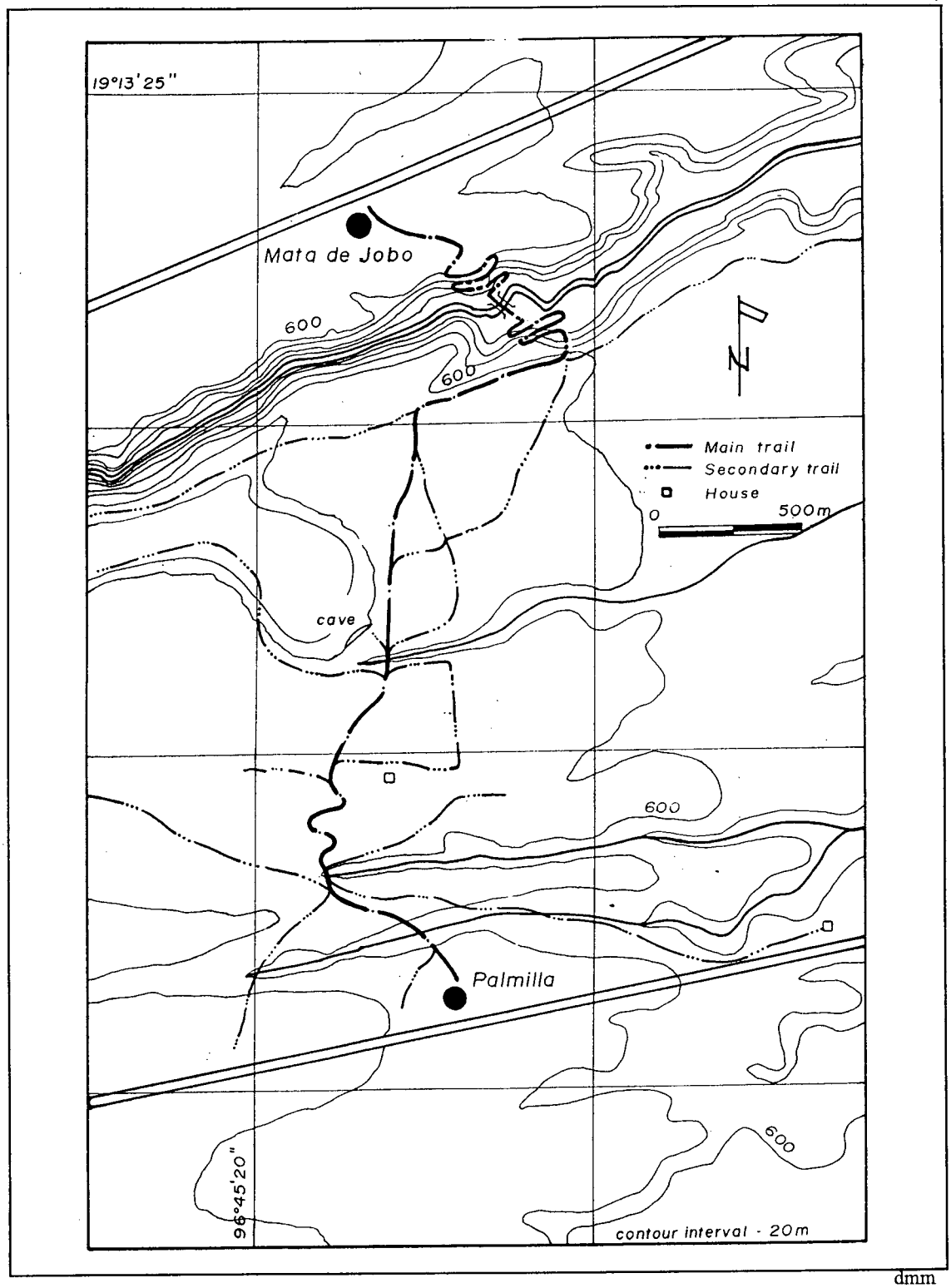
Figure 13 - Main Trail; Mata de Jobo to Palmilla



secondary trails that emanate from the main trails, leading towards agricultural fields and homes. At the onset, a pattern begins to emerge with linear paths existing **between** *barrancas* and curvilinear paths predominating **within** *barrancas*. In terms of linearity, the trails therefore fall within two generalized types: Inter*barranca* trails which lie outside the immediate area of the *barrancas*, have relatively straight paths and tend to traverse the landscape in directions perpendicular to the *barrancas*. And intra*barranca* trails, existing throughout the *barrancas* and tending to change direction often in sloping terrain (ie., switchbacks). Although Butzer (1982) briefly alludes to two similar broad trail types, there are variations as secondary intra*barranca* trails, for example, run in straight lines across the switchbacks for shortest distance travel and regardless of slope incline (see figure 10, for example).

Trail width varies according to terrain topography and land use. Within the level surfaces found on *mesas*, benches and piedmont areas, individual width can exceed 3.5 metres; on steep inclines and in rougher terrain, widths of 0.4 metres tightly accommodate travellers walking single-file. While one would expect to find trails in pasture and ranching areas to be wider to accommodate animal transfer, this is not apparent. Narrow trails predominate as terrain becomes more rugged, inclined, or utilized for cultivation. The latter reflects a desire for safety in dangerous terrain and a wish to minimize unproductive land use where land could be utilized for cultivation or pasture. Along poorly constructed segments,

mudholes form and width increases as travellers continuously realign the paths seeking drier surfaces.

Linearity and width characteristics are therefore relatively straightforward. Based on these initial observations it is tempting to concur with the typical view that trails are constructed haphazardly and *simply as a result of their use* and that trails are a simple, basic and unsophisticated means of access (Beck 1979, 89; Obenauf 1980, 13; Trombold 1991, 3). Yet closer observation of trail construction and engineered features together with the overall network arrangement within the broader landscape indicate that the *a priori* notion of haphazard trail formation does not hold. The trails are not haphazard phenomena; sophisticated planning and maintenance strategies are apparent throughout the explored areas. Consider their constructed surface characteristics and engineered features:

Most of the explored trails have sections that are without rock or stones, where, as Obenauf (1980) infers, the surface is simply the traversed terrain and the result of "repeated foot passage" (12-13). But within many of the areas, the hard clay base is often cut, or carved, creating level walking surfaces with vertical walls which can exceed two metres in height. The advantage to this technique lies in its simplicity of construction; the disadvantage lies in the clay's inability to absorb moisture. On the other hand, conglomerate rock offers good drainage, especially along the steeply sloped surfaces where weathering has occurred and little soil cover remains. In many areas the rock is also carved, forming square shaped walking

channels with walls exceeding one metre in depth, complete with smaller drainage grooves carved into their base. At times the work is carried out by individuals; more often it is undertaken by communities.

Mortared stone segments are constructed, usually by *corvé*, where heavily travelled and dangerous passes exist. Other stone segments are built without the use of mortar; the stones are carefully lock-fitted together (figure 14). This type of arrangement almost always appears as one approaches rivers. Typically, stone lining begins at the river bank and continues up, beyond 100 metres. As regular trail users traverse the river crossing, they gather one or two stones, carrying these to the upper limit of the stone-lined segment. The stones are carefully arranged in decreasing width in a practice of progressive construction; the process never really ends because of the ongoing maintenance requirement.

Steps are the most common engineered features. They are usually carved into sloping surfaces, be it clay or conglomerate, but can also be constructed of poured concrete or of placed field stones. The trail to the *barranca* bottom at Tlaltetela is typical with its sets of step sections (figure 15). Some shallow sloped sections consist of a series of stepped platforms, often individually exceeding 10 metres in horizontal length.

While ramps are utilized to traverse poorly drained surfaces or small *arroyos*, bridges provide for river and gorge crossing (figure 16). Concrete or steel cable suspension bridges, or *hamacas*, are constructed using steel tendons stretched across

Figure 14 - Inlaid Stone Trail Segment;
Limones to Tlaltetela Trail

January 16, 1995.

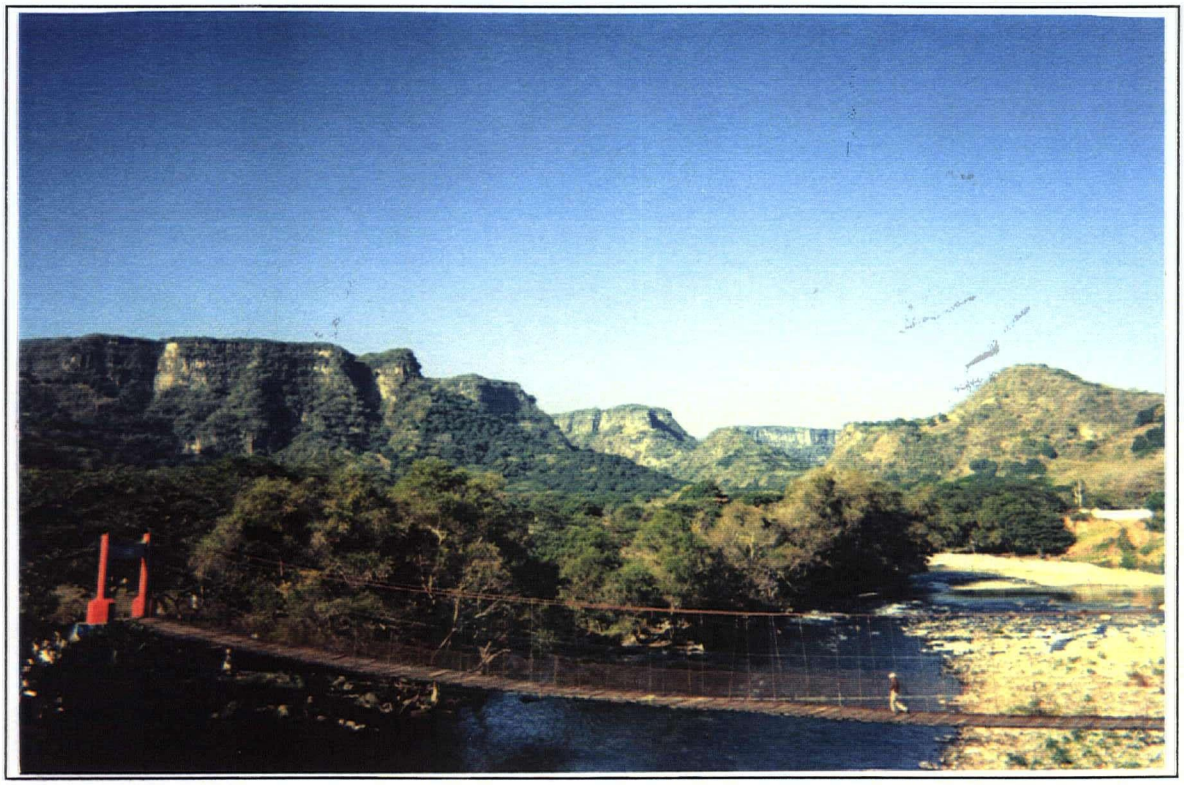
Figure 15 - Steps; Limones to Tlaltetela Trail

January 16, 1995

the void with wooden members serving as walking platforms. *Hamaca* construction involves major undertakings by area communities on both sides of the required crossing. Sizes range from 1 metre wide and 3 metres long at Tenampa, to 2.5 metres wide and 35 metres long at Jalcomulco (figure 16). Where bridges are in disrepair or non-existent, determined travellers utilize rope crossings located at strategic points along the higher reaches of seasonally flooded areas; the river is forded using the rope for safety. Finally, drainage devices are apparent throughout, with clay, wood, stone and concrete utilized to direct water away from the trails.

These labour intensive arrangements confirm that the trails are clearly beyond

Figure 16 - *Hamaca*; Jalcomulco to Buenavista Trail



August 31, 1994.

the rudimentary. A conscious attempt is made to maintain the trails while modifying segments and constructing new ones according to specific needs. Steps and bridges are well maintained for safety with the work not necessarily carried out by single individuals. In fact, the importance of trail construction and maintenance is highlighted by the large-scale labour and organized efforts of the local communities, often working in collaboration to complete specific projects. From the onset, therefore, it is evident that the trails are an important part of *barranca* life.

2.2 Trail Objectives

Routes are multifunctional: They have more than the obvious function of "access"; they function as interregional communication systems and, as we shall see, as facilities by which social and physical resources can be exploited. Here we examine how the trails are utilized and in turn what functions they serve within their cultural context.

The data summarized in figure 17 reflects the travel objectives of the informants as they were intercepted along the trails. Not surprisingly, sixty-one percent of the intercepted informants utilize the trails for work-related purposes. Although main inter*barranca* trails are generally utilized for intersettlement transit, secondary trails are used for access to cultivation and ranch field areas. Clearly, the trails are inextricably linked to land use activities.

Consider small-scale irrigation as a land use related activity. Because the trails provide access to the east-west flowing rivers located at the bottom of the *barrancas*, several different crop irrigation strategies are possible. In at least seven *barranca* areas, pumps have become commonly used. Large diesel installations such as at Tlacotepec de Mejia are used to pump water to community gardens and agricultural fields situated along the upper *mesas*, and smaller installations, as at Xoltepec, provide water for community use and garden irrigation, also on the upper *mesas*. Where pumps are not available, irrigation is undertaken by transferring

Figure 17 - Trail Related Objectives

Intercept location	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Num. of informants	8	8	8	2	2	3	7	12	6	15	8	12	7	4
Work	-	4	6	2	1	1	7	9	6	7	5	6	5	-
Social activities	4	-	1	-	1	1	-	2	-	1	1	1	2	4
Ritual activities	4	4	-	1	-	-	-	-	-	-	-	-	-	-
Economic exchange	-	-	1	-	-	1	-	-	-	7	2	1	-	-

Location key (refer to figure 8)

1. Azoyatla to Totutla
2. Limones to Tlaltetela
3. Pinillo to Poxtla
4. Poxtla to Tlapala
5. Tlapala to Calcahualco
6. Mirador to Tlacotepec de Mejia
7. Tlacotepec de Mejia to Comapa
8. Xoltepec to Cerro Gordo
9. Pinoltepec to El Roble
10. Jalcomulco to Buenavista
11. Buenavista to Apazapan
12. Buenavista to Xopilapa
13. Mata de Jobo to Palmilla
14. Xopilapa to Santa Maria Tetetla

water from the lower *barrancas* to higher ground with the help of animals. At Buenavista for example, mules are utilized to carry water from the lower *arroyo* to house gardens above.

In many areas, secondary trails along the rivers provide access to ingenious constructions engineered to capture water in the event of rapid decreases in *arroyo* water levels. At the edge of river banks, usually next to vertical rock embankments, stone or concrete walls are constructed against the embankment to a point just below the peak river water level. When the river rises, the catch basins become

full; when sudden decreases in water levels occur, the catch basins remain full, providing water for the short term. Observed sizes vary from 1.5 x 6.5 metres at Azoyatla to beyond 8 x 9 metres at Pinoltepec (figure 18). The catch basins operate as back-up systems that allow for the continuous cultivation of gardens through periods of drought.

Social objectives were identified by 15% of the trail informants. While activities obviously include visiting family and friends living within or across the main trail segments, encounters along the trails also have a social aspect as news and information is exchanged among travellers. In this way, travellers obtain information without actually moving great distances. Although some inhabitants have radio and television, information related to social and family matters as well as weather conditions and neighbouring crop conditions is relayed via the trail network. Sports activities are organized and take place within the vicinity of existing main trails. Along the Xopilapa to Santa Maria Tetetla trail, for example, weekly football tournaments take place in a central field used by the people of not only Xopilapa and Santa Maria Tetetla, but as far off as Buenavista and Mata de India. The closest road to the field is approximately 8 kilometres away.

Generally, each settlement includes a school. Trails are obviously required for school access for people living within the *barrancas*. Informants note that one of the main reasons the trails are kept clear of debris is to ensure the safety of children.

Figure 18 - Catch Basin; Pinoltepec to El Roble Trail

August 22, 1994

Other secondary trails have combined work and social functions. For example, a large community-maintained bread oven is utilized on special occasions at Poxtla. And various types of gardens are accessed by secondary trails; the number of terms within the research literature is particularly indicative of the variety in garden morphology and use. Killian (1992) uses the term *garden plot* to identify the small vegetable gardens found close to homes outside settlements and Vassey (1992) utilizes *mixed gardens* and *door yard gardens* to distinguish the gardens within settlements and adjacent to homes. Both Killian's and Vassey's terms seem to be equivalent to the local vernacular term of *huerto*, meaning a small

vegetable garden. Similarly, Wolf's (1966) *specialized horticulture* is applicable to the large garden found along the Tlacotepec de Mejia to Mirador trail. The garden is well maintained and irrigated, planted with maize, potatoes, tomatoes, squash, beans and coffee. Bananas and platáno trees provide shade at strategic locations and a live fence surrounds the plot, presumably to repel pests. The trail between the garden and Tlacotepec de Mejia is, not surprisingly, well maintained. Access to family and community gardens is integral to the subsistence lifestyle.

Field surveys along the Azoyatla to Totutla and Limones to Tlaltetela trails reveal that most *barranca* dwellers travel to church on Sundays. Some funeral processions go along the trails. Surprisingly, one procession was observed leading **away** from the cemetery along the Poxtla to Tlapala trail. This may reflect a desire to bury some dead within the *barranca* itself; informants refer to folklore based on the *barranca* as a source of life. To some, the *barranca* is seen as a place of birth and rebirth; burial within offers hope of rebirth. Ritual activities also include the visiting of shrines placed at strategic locations along trails (figure 19). According to informants, some of the shrines are linked to a planting ritual where red or white coloured flags are placed along agricultural field trails during seeding periods. Interviewees suggest that this activity is part of a ritual performed to protect the crops from the wind. The wind is seen as harming crops with its force while the flags represent lightning which forces the wind to remain high above. Candles are lit and small meals are consumed at the shrine and in field areas on days when the

Figure 19 - Shrine; Buenavista - Apazapan Trail

August 14, 1994

flags are installed. Interestingly, the ritual is quite similar to the Field Ritual performed in conjunction with maize cultivation within the hill land regions of Chiapas (Collier 1975, 33).

According to Collier, the Tzotzil Field Ritual takes place after weeding has been undertaken, in the hope of avoiding damage from the wind. The wind is perceived as an entity which steals the soul of the maize plant, thereby ruining the crop; lightning, represented by the red flags, is seen as a protector of maize, "frightening" the wind away. A shaman presides over a ceremony which includes the installation of the red flags, prayer, incense burning and feasting. Although

informants did not wish to discuss prayer or the role of the shaman, if any, the two rituals seem remarkably similar.

Economic objectives include the delivery of agricultural products to strategic points along roads, travelling to purchase goods and services, and selling goods along trails to field workers within the *barranca* and ranch areas. With the exception of the latter, economic objectives are directly tied to the area road network. Produce is transported to gathering points along the east to west roads where truck transport is accessed. But travelling to places to purchase and sell goods and services, however, involves a more complex strategy: Individuals utilize combinations of trail walking, road walking, public bus, taxi and *coche* services (private cars that travel between places and pick up passengers along the way for a fee). For example, an informant at Poxtla indicates that in order to travel to Totutla, four options are available: One can walk the 13 kilometres (4.25 hours), one can walk to Pinillos and travel to Totutla by public bus (2 *pesos* and 2.25 hours), one can hire a private taxi (10 *pesos* and approximately 30 minutes), or one can walk along the Poxtla road in the hope of encountering one of the *coches* that move along the secondary roads, picking up walkers who are willing to pay for the ride. Each of these strategies is considered, depending on the amount of time and money available, as well as what activities are to be carried out along the way, if any.

Taken as individual phenomena, the trails facilitate the transfer of people,

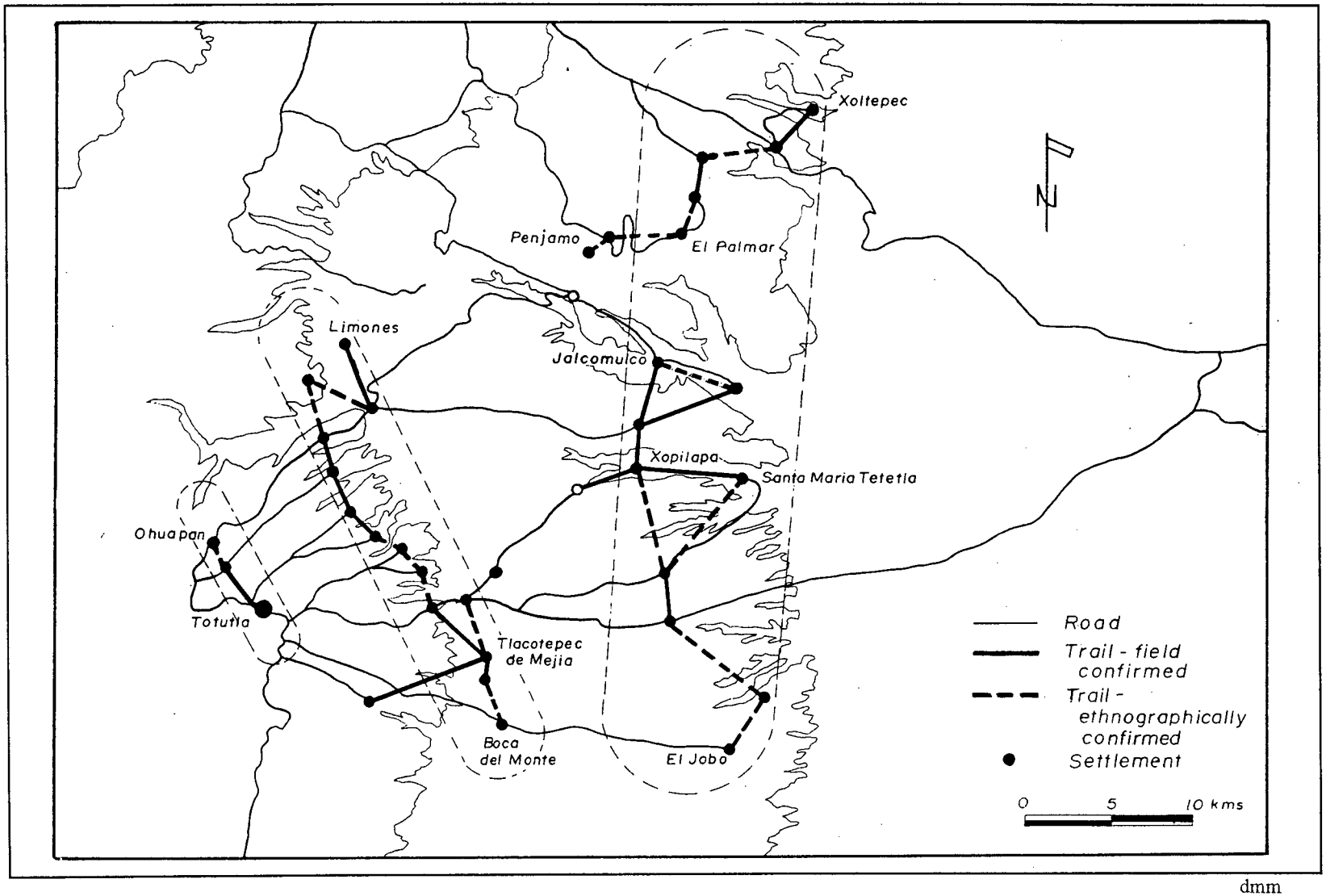
goods and ideas within their localized areas; clearly, local access to physical and social resources is provided via the set of paths. In a broader regional context, a foot-vehicular travel strategy gained by coupling trails to roads is utilized, especially to facilitate economic objectives. How this trail-road coupling takes place highlights the importance of the trails within the local and regional landscape. It is helpful, therefore, to consider the linked trails as networks interacting with the road network.

2.3 Trail Networks

The intercept interviews conducted along the main trails revealed the presence of sixteen additional settlement linking trails. The trails join with the explored trails to form interconnected north to south intraregional foot transportation networks, although a direct trail link between Jalcomulco and El Palmar to the north was not confirmed (figure 20). The north to south routes are aligned in simple "minimum distance networks", forming arrangements where travellers must retrace their steps to return to their point of origin, should they elect not to utilize the east to west roads (Haggett 1969, 115; Trombold 1991, 80-82).

When we consider the trail networks as independent of the east to west roads and we assume briefly that there are no roads, the settlements are minimally connected. Route choice is limited as travellers from one end of the network are

Figure 20 - Combined Field Explored and Ethnographically Confirmed Trails



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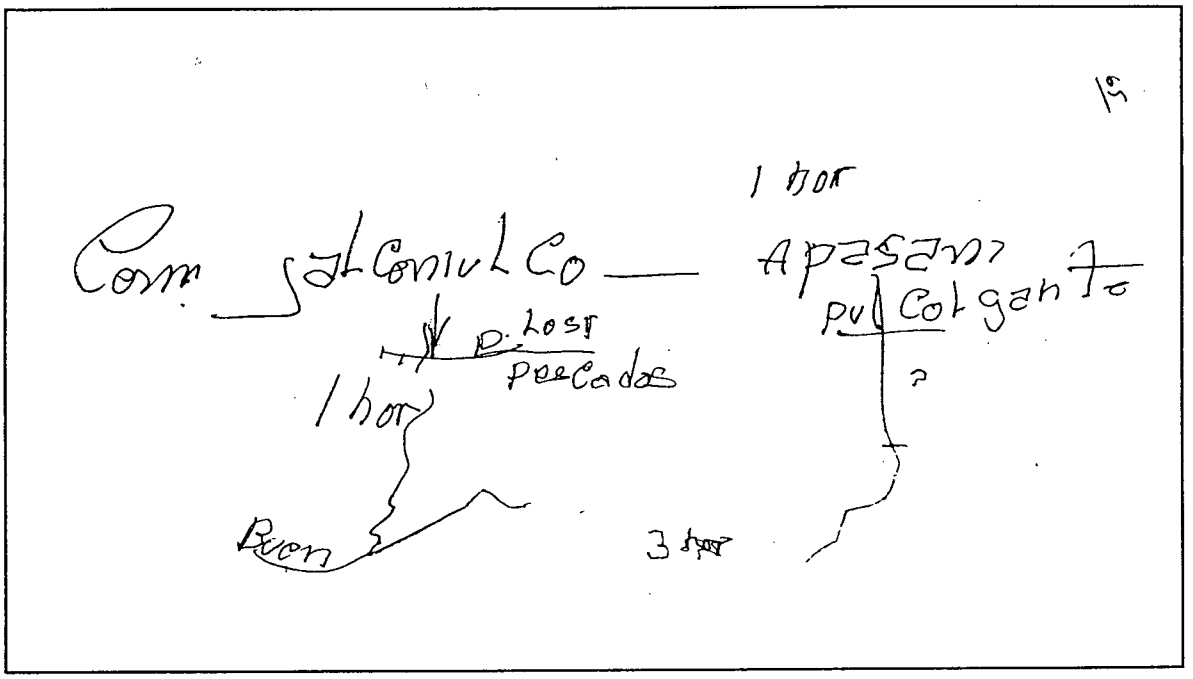
forced to traverse all settlements in order to reach the other end of the network. Accessibility, or the opportunity for contact between places, is therefore limited. Yet there is an advantage to this type of arrangement: As travellers are forced to walk **through** settlements, social, economic and political exchanges are inevitable. The spatial context within which these exchanges take place becomes "discrete", with travellers benefitting from the unavoidable contacts they make with others (Gorenflo and Bell 1991, 81). How the roads are utilized in conjunction with the trails is dependent on a number of factors including availability of public transit, money and time. Further, there is a limit to the distance people are willing to travel by foot. Intercept surveys indicate that the average time to travel from any one settlement to a neighbouring settlement by foot is 2.25 hours, varying slightly from 2 to 3 hours. Interestingly, informants convey distance in **walking** time, even when road access exists. And interviewees stress that they rarely travel by foot when a journey represents a distance beyond one settlement away. When travel to settlements beyond adjacent ones, a foot-vehicular strategy is preferred.

Illustrative of this point is Figure 21, a location map drawn by an informant at the secondary road leading to Jalcomulco from the main Jalapa to Huatusco highway. There is no road between Jalcomulco ("Com. Jalcomulco") and Buenavista ("Buen") or between Apazapan ("Apasam Pulcolgante") and Buenavista. It makes sense, therefore, that the Jalcomulco to Buenavista and Apazapan to Buenavista distances be conveyed in walking time (1 hour; "1 hor" and 3 hours "3 hor" respectively). But although there is a road between Jalcomulco and Apazapan, the

Figure 21 - Informant Location Map; Jalcomulco



August 19, 1994

informant still conveys this distance in walking time (1 hour; "1 hor"). For the informant, foot travel is the first main consideration. According to the informant, a 3 hour "distance" is walkable, but beyond that, tapping into the road network would be preferred. "Local," in this case, therefore implies travel to a neighbouring settlement only; a 3 hour "radius" from one's departure point. This confirms that the trail networks are not utilized independently of roads for interregional transit.

Clearly, the trail and road networks have to be viewed as a single regional transportation facility. Interestingly, informants note that many local service roads have their origin in trails, as evidenced along the Jalcomulco to Apazapan road where a pre-existing trail parallels the road. And as we have above alluded to, a

more complex foot-vehicular strategy is utilized to traverse the landscape. The positioning of taxis and *coches* at the main trail terminal at Santa Maria Tetetla typifies this strategy. Travellers can walk from Xopilapa to Santa Maria Tetetla and ride a taxi to Totutla (refer to figure 8 for locations). The trails connect with the road system at numerous strategic locations, enabling travellers to extend their reach into the landscape. At Totutla and Jalcomulco, the local public transportation system links to the regional system, allowing for interregional travel.

We know that the trail and road networks enhance each other. Less clear is the **extent** to which they are enhanced. To assess this enhancement, we must compare the road network with the combined trail-road network. Graph Theory is particularly useful in assessing transportation networks. We cannot assess time and cost of travel for the networks as a whole; because there are limitless combinations of walking and motorized transportation strategies, the complexities of travel strategies make it impossible. We can, however, measure relative ease (or difficulty) of travel within the networks. Determining how many segments a traveller must traverse in order to get from one place to another is a way of assessing the ease of moving through the landscape. For example, on figure 8 we can see that to travel from Pinillo to Poxtla by road would involve travelling through three road segments, including Pinillo to Ohuapan, Ohuapan to Azoyatla, and finally, Azoyatla to Poxtla. With the addition of trails, however, travel between the two places is much simpler, involving a single trail segment.

In order to undertake Graph Theory analysis, networks are first reduced to

graphs, simplifying the map features to straight lines and points. By transforming the maps into graphs, it becomes relatively easy to obtain an ease-of-travel measure by which the two networks can be compared. To analyze the networks with Graph Theory, absolute location is disregarded and replaced by relative position; distance is measured in intervals and not real length. Distance and direction of places and routes therefore become strictly topological where the relation between places is abstracted from their exact quantitative measurement and where the only two elements that are important are the settlements and the links between them. In this way, the networks are simplified and their characteristics can be assessed in terms of shape, connectivity and accessibility (Hassigg 1969, 32-39; Gorenflo and Bell 1991, 81):

Shape can vary from a basic network resembling a drainage system to a complex web-like network. Clearly, with a fully integrated web-like arrangement, a higher degree of interchange is possible for network travellers. **Connectivity** is a measure which assesses the extent to which settlements are interconnected. Individual place connectivity is measured as the amount of places one must pass through to get to it. The network's total connectivity is calculated as the ratio between the number of routes and settlements within the network; the higher the number, the more interconnected the network is. The derived ratio is referred to as the Beta Index. **Accessibility** is a measure of the ease by which travellers can move from one place to another. To determine accessibility, a three step approach is undertaken. First, the distance between each place in terms of the number of route segments to be traversed to get to each of the other places within the network is calculated, measured along the

shortest paths possible. Second, these distances are summed. And finally, the sum of these topological distances, the Dispersion Index, is calculated for the network as a whole. The higher the Dispersion Index Number, the more accessible a place is. With high **local** accessibility, individual settlements can be accessed by a maximum amount of people within a region. And with relatively high **regional** accessibility, no settlement within the region has an accessibility advantage in-so-far as interaction with other settlements is concerned. Shape and settlement connectivity and accessibility numbers can therefore provide a means for comparing the networks (Gorenflo and Bell 1991, 81; Kansky 1963, 15-16; Taaffee 1973, 101).

Consider the road and trail-road networks transformed into their respective graphs (figures 22 and 23). In terms of network shape, the road network graph resembles a tree where branches stem away from Totutla, the main terminal point in the hierarchical road transportation network (figure 22). This shape is characteristic of transportation systems existing in regions where economies are less developed; connectivity and accessibility is theoretically minimal (de Souza and Foust 1979, 387-89). The pattern is the result of a least-cost-to-the-builder construction strategy where cost and effort in construction are minimized, regardless of being less convenient to users. The trail-road graph, on the other hand, is made up of a web-like pattern extending throughout the region. It is characteristic of regions with more developed economies and least-cost-to-the-user approaches to transportation networks (figure 23). The latter network type offers "a higher degree of internal spatial interchange

Figure 22 - Graph of Study Area Road Network

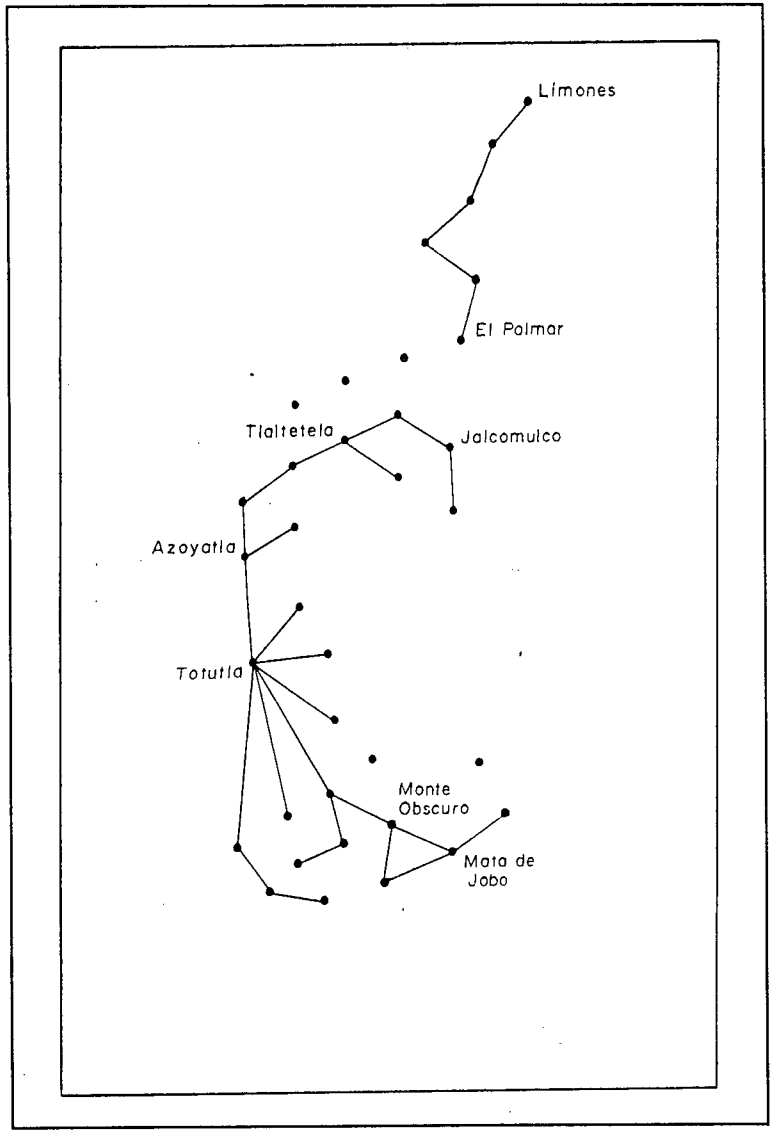
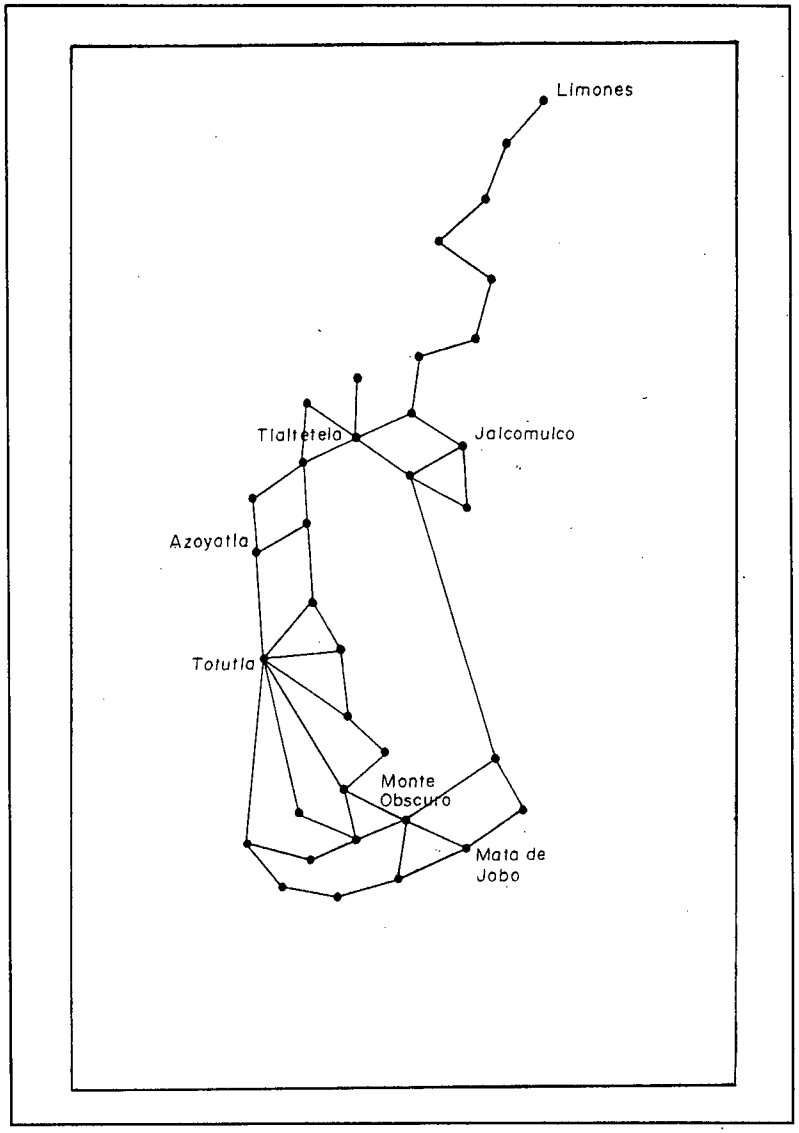


Figure 23 - Graph of Study Area Trail-Road Network



allow[ing for] a more even distribution of locations", where, clearly, more interconnection leads to an increase in exchange (de Souza and Foust 1979, 387). Within the trail-road network, movement becomes relatively unrestricted and optimized. The difference between the two network configurations is clear. Calculating network connectivity and accessibility, in this case, simply confirms the optimization effects the trails have when added to the road network.

In terms of connectivity, the road network's Beta index value is 0.82. Clearly, adding routes enables a network to be increasingly interconnected. It is surprising, however, to find overall network connectivity to be almost doubled when the trails are added to the roads to form a single network: The Beta index is 1.40 for the trail-road network! In terms of individual place connectivity, Totutla is the most interconnected place within the region, followed by Mata Obscuro, Mata de Jobo, Azoyatla and Tlaltetela. Totutla's position at the top of the hierarchical road network is obvious; it is the area's main road transportation hub with interregional road transportation interfacing with local secondary roads which in turn are interconnected with the trail networks. However, within the trail-road network Monte Obscuro and Tlaltetela increase in terms of relative connectivity, confirming a more **even** pattern of regional settlement interconnection. Because other places increase in connectivity, the relative importance of Totutla decreases when the trails form part of the network. This should not be surprising, given that the more places are interconnected, the less opportunity individual places have of having accessibility advantages in terms of interaction with other settlements. As alluded to in the above network shape

comparison, this is characteristic of fully developed transportation networks.

In terms of accessibility, the Dispersion Index value for the road network is 2485. When the trails are added to the network, the Index value more than doubles to 5763. Again, as trails are added to the road network, access to places becomes easier and route choices increase. However, when we consider individual places, and although we saw that Totutla is the most interconnected place in terms of links, it is Tlaltetela, Mata Obscura and Buenavista that have the highest accessibility rating. What is intriguing is that Totutla and Jalcomulco rank 13th and 10th within the trail-road network in terms of accessibility. What this suggests is that although Totutla and Jalcomulco are hubs of the regional road transportation network, they are not necessarily rendered more accessible with the addition of trails within the regional landscape. The main trails do not exist to provide better access to Totutla and Jalcomulco; they exist to render communication possible between settlements that are otherwise not connected by the east to west roads. When we consider this last point with the earlier point that many roads originated as trails, it seems that we have a primal quality to the network which is based on trails.

Briefly then, the addition of the trails to the region's transportation facility virtually doubles interconnectivity between places, provided one is willing to walk. Not surprisingly, the trails are utilized in a local context, extending the road network to otherwise inaccessible areas. Conversely, the trails are extended by the roads, rendering a wider reach within the landscape, especially for economic related

activities. Connectivity and accessibility calculations merely confirm what is obvious from the network shapes. The localized trail use is most closely related to land use activities.

2.4 Land use

At first glance, land use along the trails appears heterogenous. Fields of coffee, cane and maize are predominant among cultivated areas, while pasture, fallow and *tacotal*, a weedy, brush-like growth including cacti, dominate in other places. Houses and gardens appear within the thick brush while domesticated animals seem to forage freely. In some places, land use seems to change with altitude and topography; in other areas crops are continuous despite relatively steep vertical inclines. Here we consider the main trail segments as land use study transects, establishing the extent to which altitude and local topography are determining factors in *barranca* and *mesa* land use strategies.

Land use according to altitudinal variation has been of interest to many geographers and anthropologists. Brush (1977), Troll (1968a, b) and Stein (1961) focus on land use in conjunction with transhumance in mountainous regions. To them, the use of different altitudinal zones by agriculturalists, herders and animals in conjunction with changes in climate within micro-altitudinal zones is of central concern. Movement, however, is not the only adaptive strategy undertaken in regions of varied altitude. Rhoades and Thompson (1975) and Kirkby (1972) show

that choice of specific crops, cultivation techniques and landholding scenarios can also be highly successful strategies in coping with the effects of changing altitude within small areas (542; 18-28). And Price (1968) outlines the changes people make to local topography in order to cultivate desired crops within hill lands (3). How people adapt to their surroundings is determine by culture and place (Palerm 1967, 29). But the choice of adaptive strategy is inextricably linked to specific local physiographic conditions ultimately falling within three sets of ecological and environmental factors.

The first set of factors refers to vertical zonation. Vertically arrayed biomes are subject to varying climatic and edaphic characteristics where the effects are similar to that of latitudinal change. The effects are compressed, however, as the biomes and climate changes which normally occur over hundreds of latitudinal kilometres occur within a few hundred metres of vertical variation. Within the *barrancas*, micro-climates vary from one local area to another as altitude is gained or lost; temperature, precipitation and pressure have localized effects on vegetation. For this reason, the diversity and arrangement of biomes vary within sloped areas, based on the same characteristics that determine climate, including change due to altitude and pressure variation within their immediate confines, and precipitation, which can occur simultaneously over many *barrancas*, each having its own particular system of convection and evaporation (Jochim 1981, 47; Troll 1968b, 17-23).

Adding to the complexities of vertical zonation, the second set of environmental conditions affecting land use is related to irregular biotic distribution due firstly to *barranca* orientation to the sun. Local climate becomes increasingly varied while creating different optimal conditions for specific vegetation types (Jochim 1981, 47-49). *Barranca* "slopes oriented toward the sun absorb a greater amount of sunshine and [thus] have ... greater potential for cultivation", while shaded areas can be adequate for other uses such as pasture (Rhoades and Thompson 1975, 543). Variation in rainfall also affects specific localized areas. On the exposed eastern Sierra Madre slopes, for example, more rain is received than **within** *barrancas*. Biotic zones therefore vary locally, based on altitude, angle of orientation to the sun, and rainfall. The variation in vertical zonation and biotic distribution is especially apparent in areas where vegetation is left to its own devices; mostly within *barrancas* with slopes too steep for cultivation and along *barranca* bottom gallery forests.

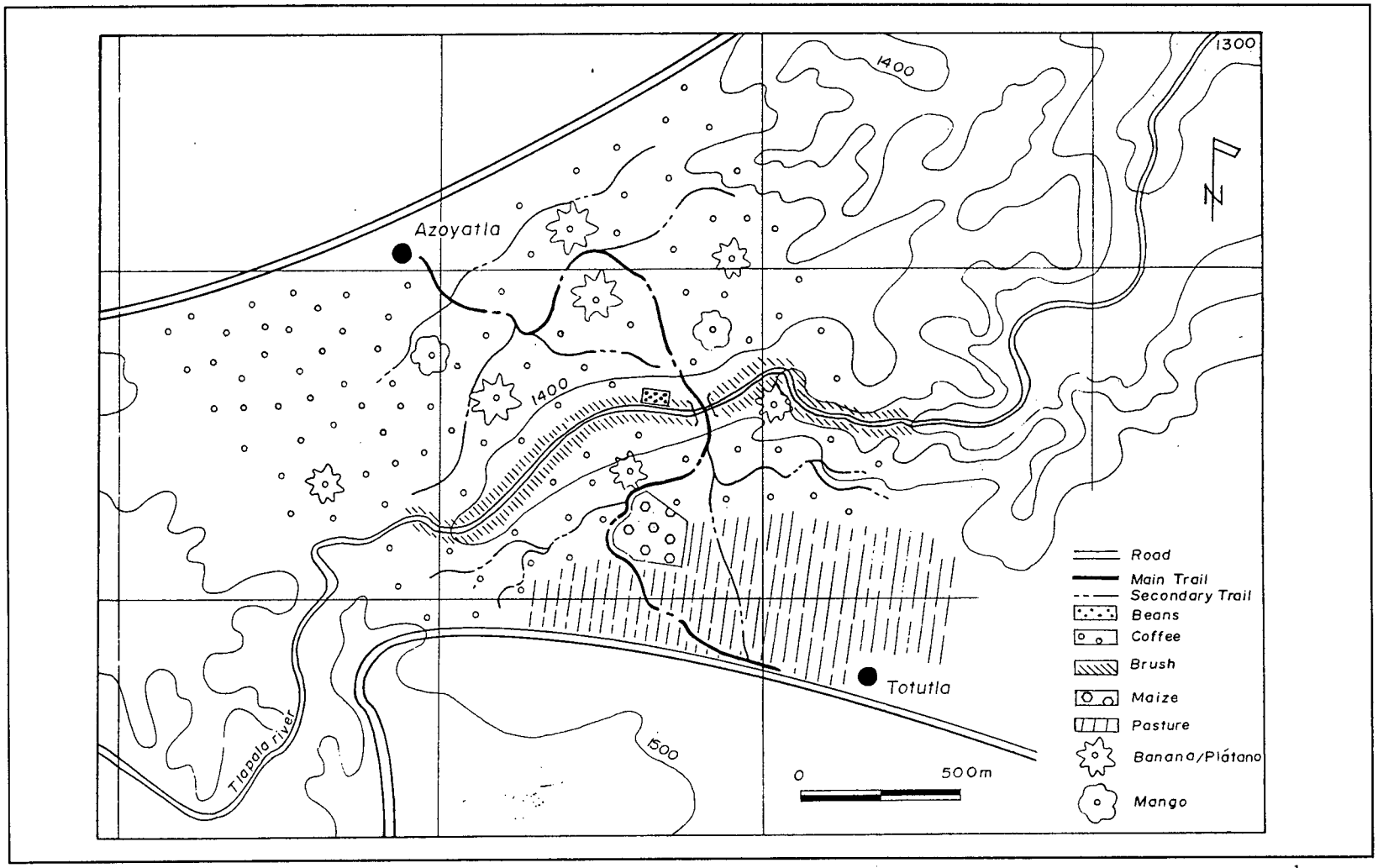
The third set of environmental conditions affecting land use within *barranca* regions is created by the terrain features; slope and ruggedness. These include land slides which can alter valley floors, erosion processes which affect soils locally and in a regional context, lack of adequate soil cover which can limit the capacity of the soil to absorb ground water, and related to erosion processes, slope incline which can affect the choice of specific terrain use and crop types (Moran 1982, 144; Strahler and Strahler 1987).

The *barrancas* explored in this study vary in altitude from a low point at Jalcomulco, located at the bottom of the *Barranca* Los Pescados at approximately 300 metres a.s.l., to a high point at Totutla, situated on a *mesa* at slightly over 1500 metres a.s.l.. Based on the above described environmental factors, one would expect to find some difference in terms of land use between the highest and lowest elevations of the Huatusco region on the one hand, and the highest and lowest points within individual *barrancas* on the other. Consider first the transects located at the highest and lowest altitudes within the region: the Azoyatla to Totutla and Jalcomulco to Buenavista trails.

The *barranca* along the Azoyatla to Totutla trail is shallow, approximately 60 metres deep, forming a relatively wide "U" shape (figures 24 and 25). At 1490 metres a.s.l., the main trail leaves Azoyatla through coffee fields. Secondary trails connecting and delineating large field sections and accessing smaller and more isolated patches are apparent along most of the main trail. The soil is stoney, with some fields having been cleared. Banana, plantain, or *platáno* and larger mango trees are grown throughout the coffee areas; in addition to fruit, they provide shade for the coffee trees. Locally, they are referred to as *madre de café* trees. Irrigation is apparent in areas where the terrain is relatively level.

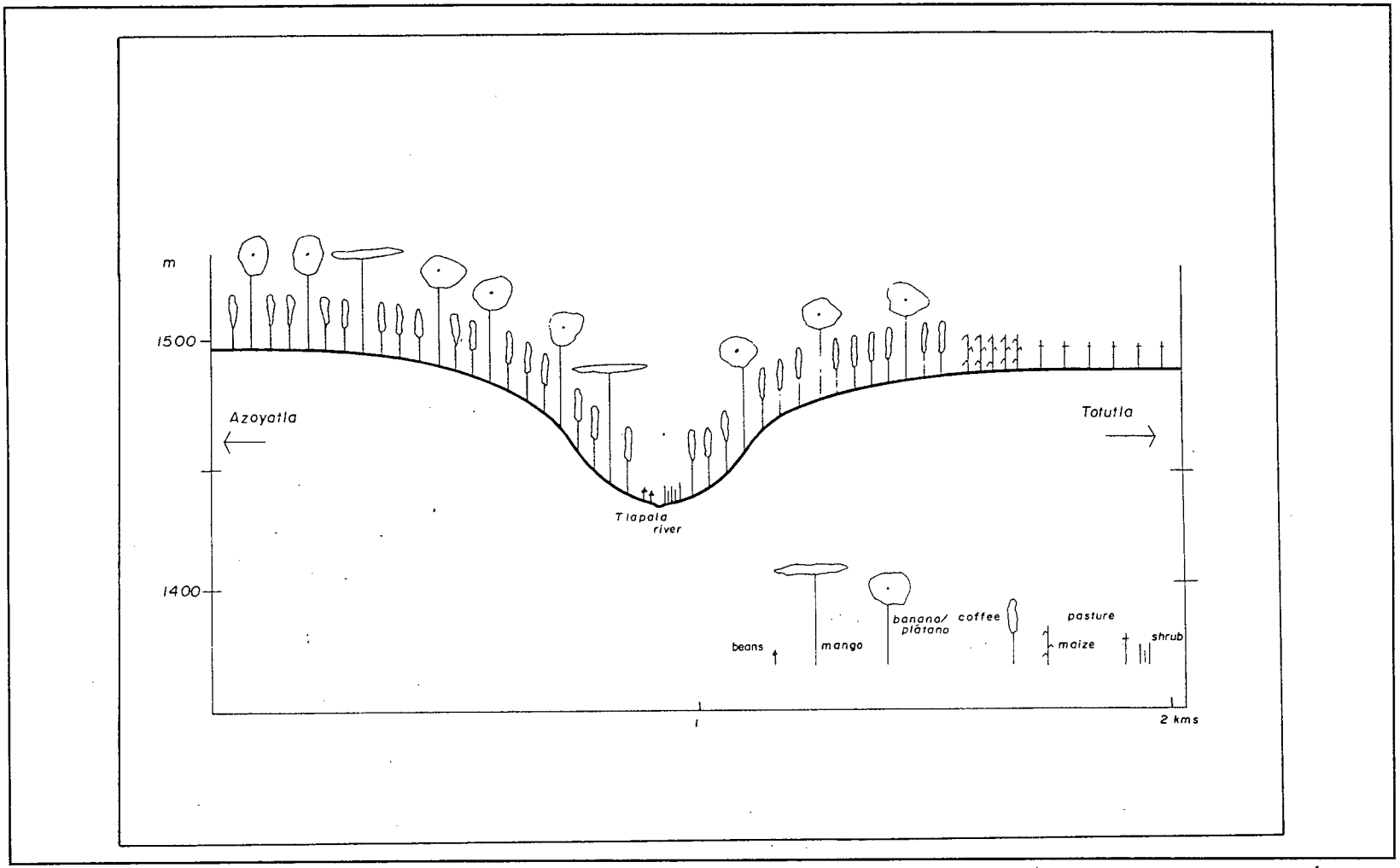
From across the Tlapala river, one can look back and see that the coffee almost reaches the edge of the water, leaving a band of brush, 2 to 3 metres wide on either side. Fallen litter is collected for fuel within the brush cordon. The water

Figure 24 - Land Use; Azoyatla to Totutla Trail



dmm

Figure 25 - Schematic Profile; Azoyatla to Totutla Trail (profile follows the trail transect)



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appears contaminated with fertilizers and pesticides which are utilized throughout the sloped terrain. With the exception of a plot of beans cultivated within a small area of sandy soil on the north shore, coffee (and its associated shade trees) is the dominating cultivar within the *barranca*. The shade trees appear to be more sparsely planted on the south slopes; the sloped terrain is utilized to its maximum for coffee. At the top the terrain becomes relatively flat and a large field of maize is cultivated among predominating pasture and *tacotal* areas.

The trail thus traverses a shallow *barranca* where cultivation activity revolves almost entirely around coffee, regardless of stoney soils and rock outcrops. A small plot of beans is planted along the valley bottom in spite of flooding probabilities; the risk is calculated. Maximization of useable terrain is evident with the exception of *tacotal* on the Totutla side of the *mesa*.

Jalcomulco lies at the bottom of the deep and wide "U" shaped *barranca* along the Los Pescados river, at 300 metres a.s.l. (figures 26 and 27). We do not consider the complete *barranca* here; the trail transect only runs from the bottom-up and not through the entire *barranca*. A *hamaca* provides access to the first part of the transect. Across the Los Pescados river, coffee is planted throughout the lower flood plain, with sparsely planted mango and banana trees providing shade. Interestingly, the larger shade trees along the base of the slope are protected from rock debris with stones placed in semicircular arrangements on the slope side of the

Figure 26 - Land Use; Jalcomulco to Buenavista Trail

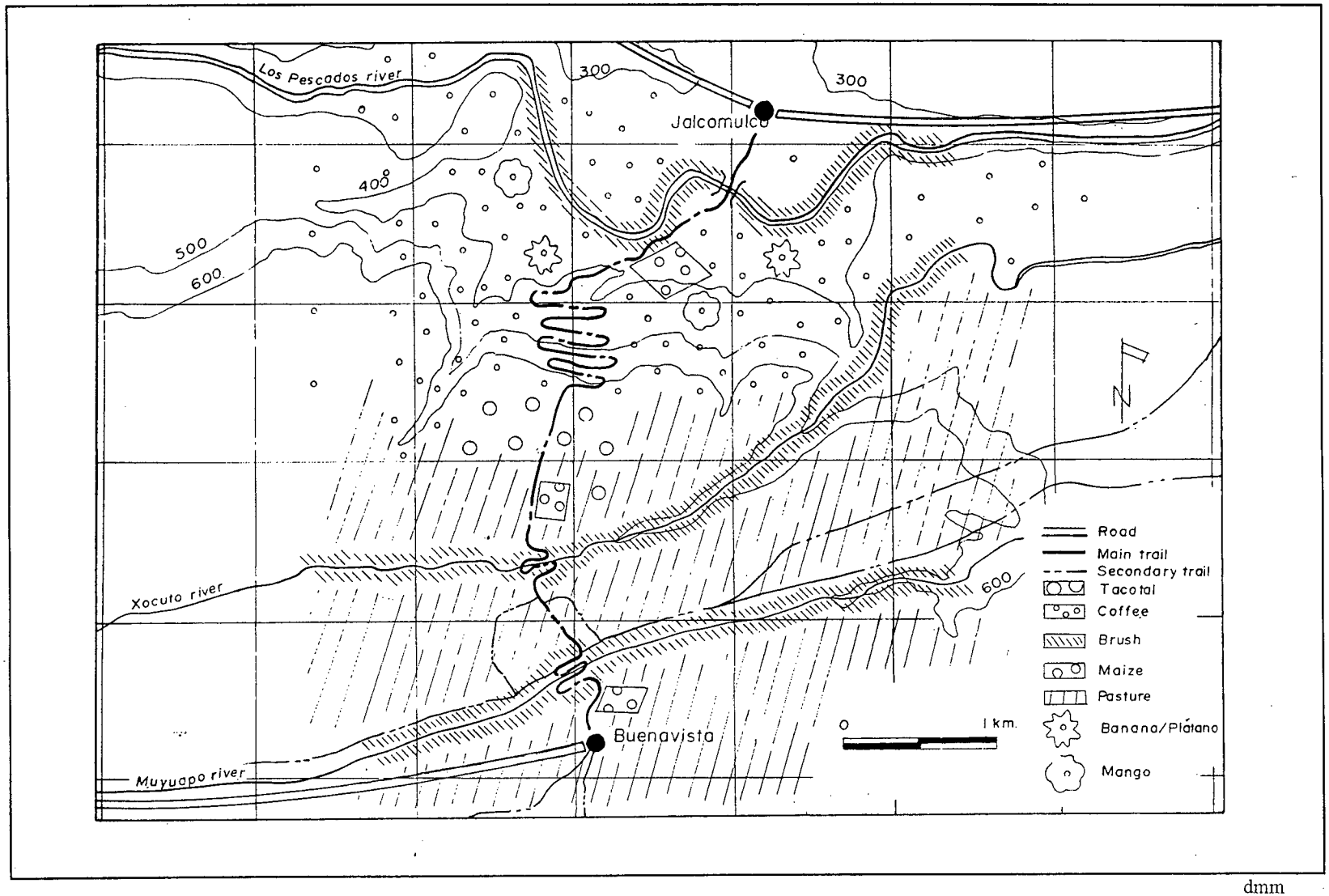

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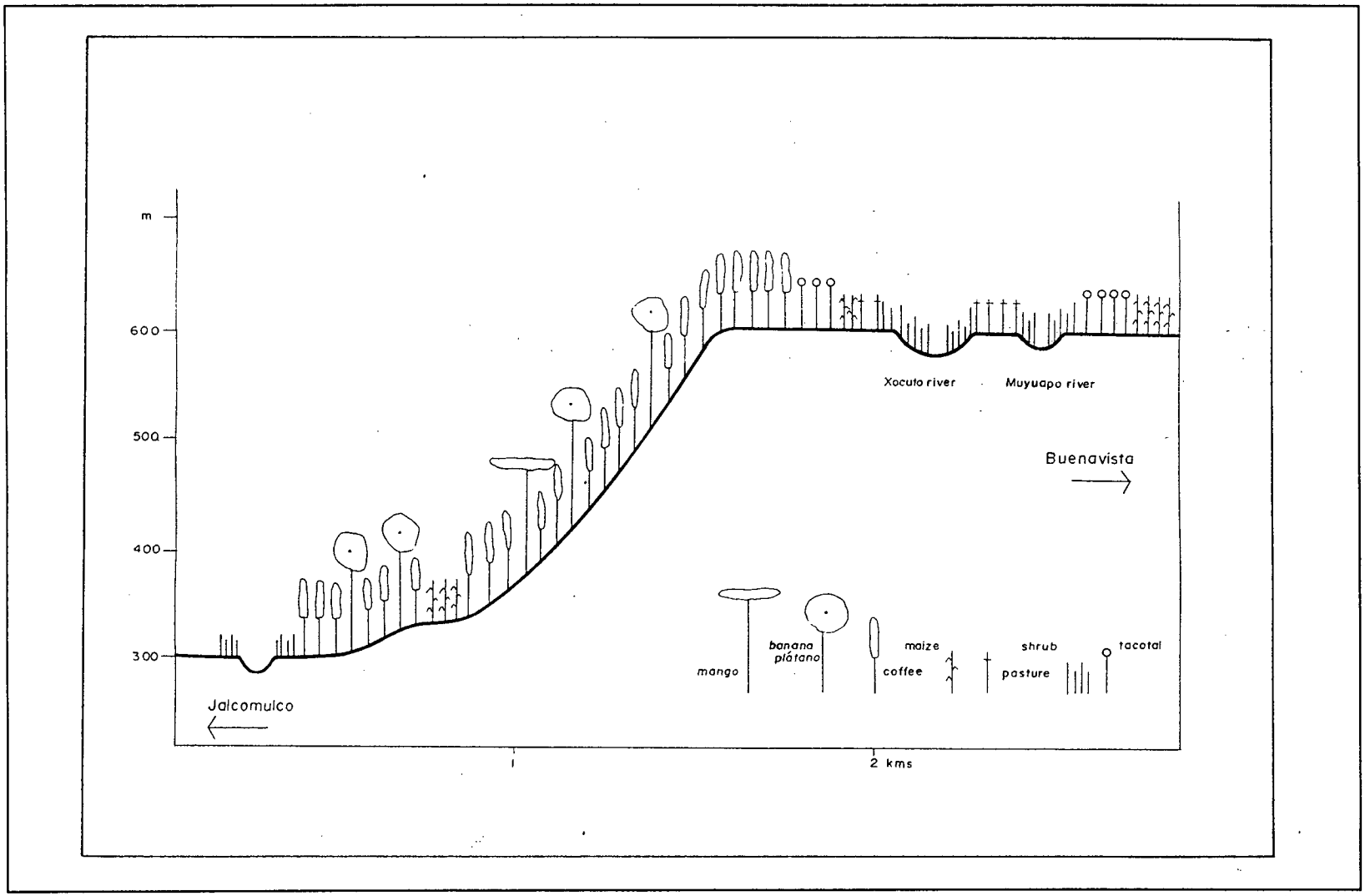
Figure 27 - Schematic profile; Jalcomulco to Buenavista Trail (profile follows the trail transect)



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trees. Some small fields of maize are enclosed within fenced areas along a bench located on the lower half of the slope. The banana and large mango trees also provide shade for the coffee trees within the lower and middle areas of the slope. On the upper edges, coffee continues to be the main crop, with fields of *tacotal* becoming increasingly apparent as soon as the flat *mesa* is gained.

In addition to the predominating *tacotal*, pasture and fields of maize are located on the *mesa* area. Where the Xocuato and Muyuape *arroyos* form small *barrancas* the water is surrounded by brush on either side. Hydrophytes and tall grasses add to the lush appearance of the areas utilized by the people of Buenavista for wood-fuel gathering. Closer to Buenavista, *tacotal* alternates with maize fields. The land use scenario is therefore similar to that of the Azoyatla area, predominated by the cultivation of coffee, and to some extent maize, pasture and *tacotal* fields.

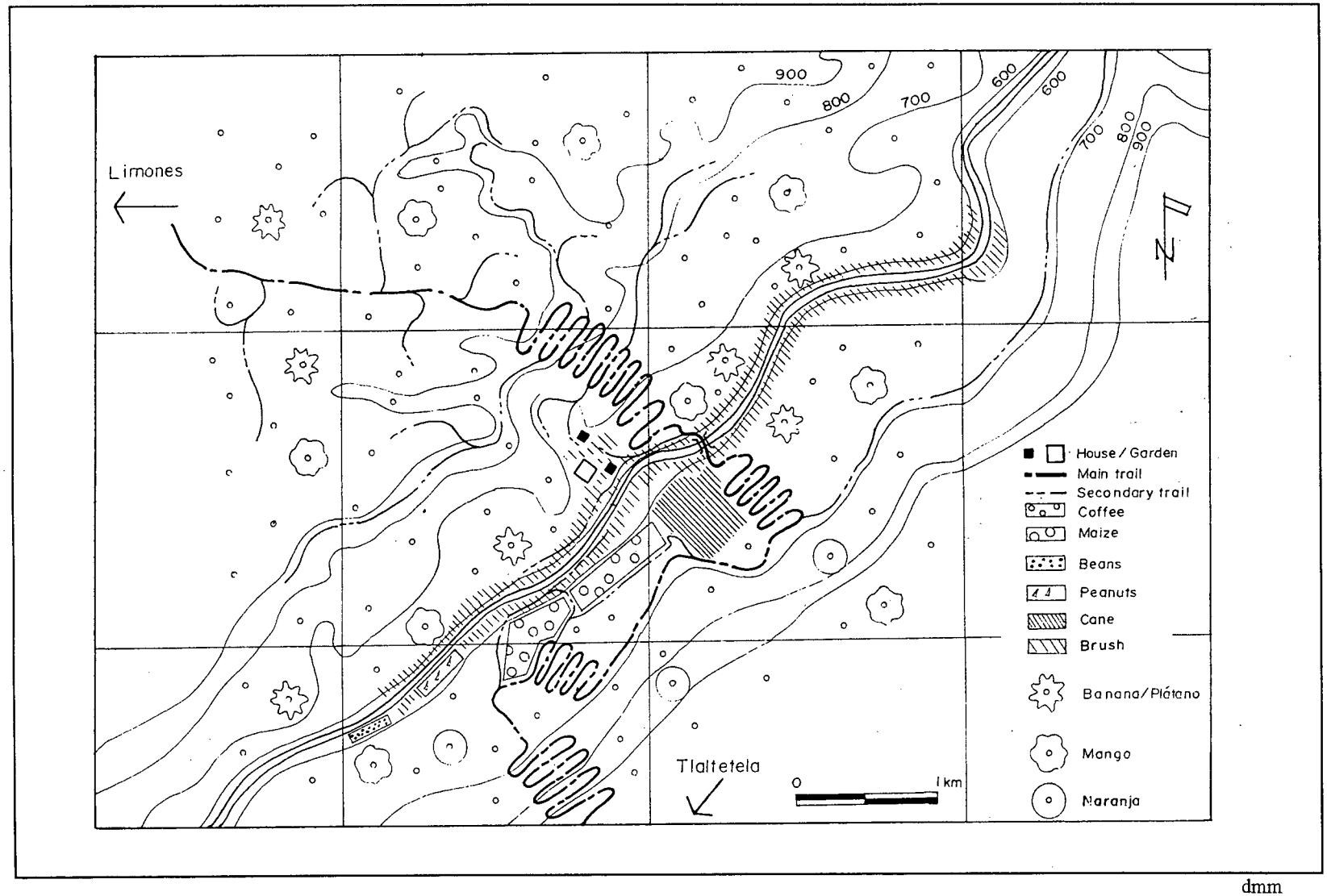
Coffee grows best at elevations of approximately 1500 metres a.s.l. (Moran 1982,145). It would seem logical then, to find it cultivated in the areas around Azoyatla at 1490 metres a.s.l.. But it also seems to thrive at 300 metres a.s.l.! Further, the rocky slopes of the Jalcomulco and Azoyatla *barrancas* with their narrow ledges and relatively thin soil cover do not deter people from planting the crop. While the exceedingly dry *mesas* at 600 and 1480 metres a.s.l. are utilized for maize cultivation and pasture, and much of the areas appear to be abandoned and in the process of becoming *tacotal*, coffee is also grown on the *mesas*!

Initially, therefore, there appears to be little differentiation in terms of crop selection from 300 to 1490 metres a.s.l.. But what happens within deeper *barrancas* where **local** biome conditions are susceptible to varying precipitation and temperature factors?

The Limones to Tlaltetela trail also runs through the Los Pescados river *barranca* (figures 28 and 29). The trail transect cuts the *barranca* which varies in altitude, from top to bottom, by 360 metres. It is relatively wide, "U" shaped, with acutely sloped walls appearing to be impractical for cultivation. Along the trail out of Limones, coffee is the main crop and as at Azoyatla and Jalcomulco, bananas, *plátano*, and mango trees provide shade, with the *madre de café* trees increasing in number as one approaches the *barranca* edges. The reason for the increase appears to be linked to wind protection. Although the descent is extremely steep, coffee trees are planted throughout the slopes on small ledges where soil cover is minimal and access is challenging. Although not initially apparent, paths to individual trees are maintained throughout the slope.

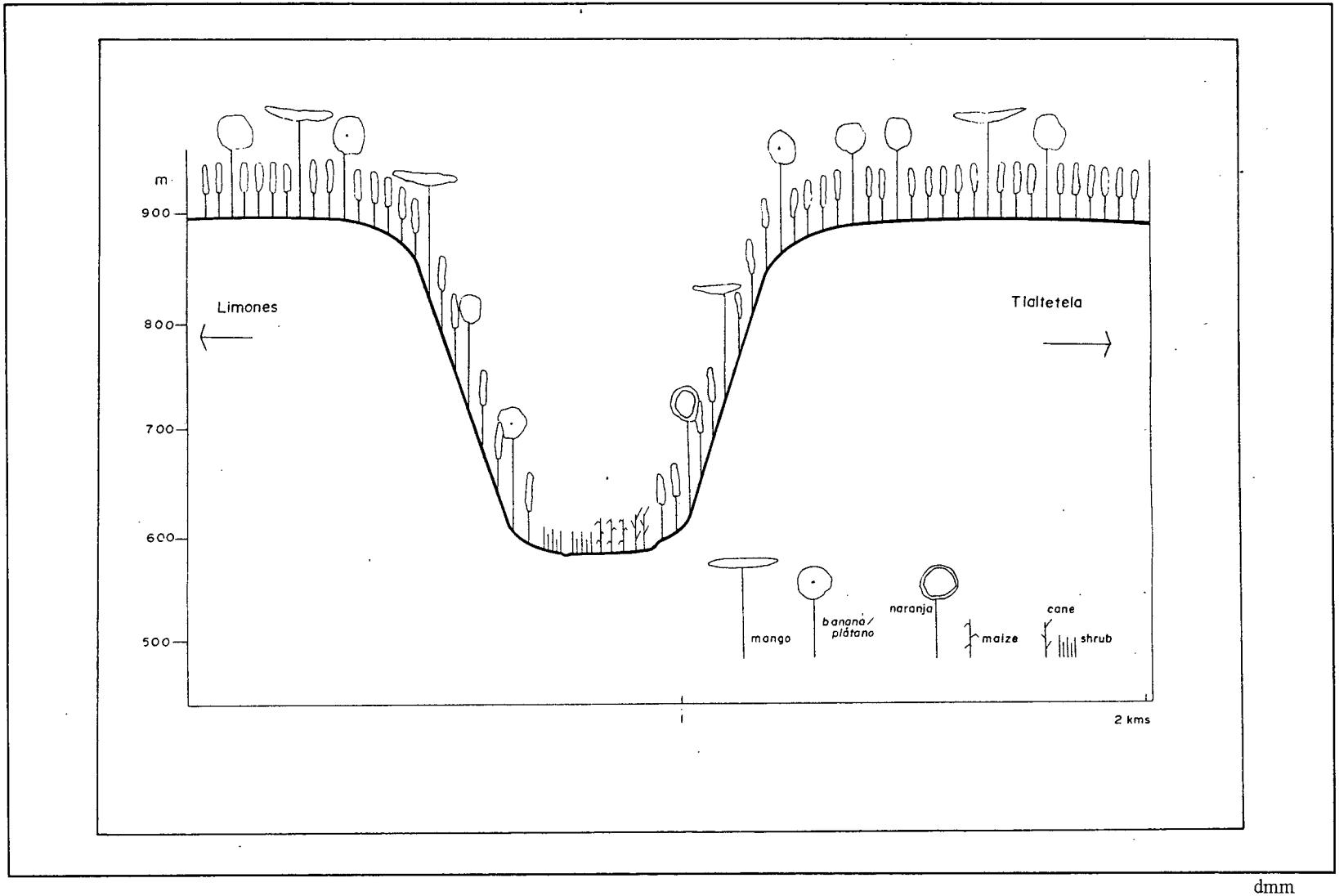
The river plain on the Limones side of the Los Pescados river is also utilized for coffee with its accompanying shade trees. A secondary trail runs southwest, parallel to the river, accessing two houses separated by some 300 metres of brush and coffee trees sporadically planted within. Along the river a thin cordon of brush follows the bank, mostly made up of hydrophites, tall grasses and small trees. The

Figure 28 - Land Use; Limones to Tlaltetela Trail



dmm

Figure 29 - Schematic Profile; Limones to Tlaltetela Trail (profile follows the trail transect)



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brush cordon increases in width as the seasonal water level drops. Informants indicate that the brush is utilized for browsing; three cattle were observed. The southwest trail leads to a small garden with beans, banana, maize, *plátano* and *naranja* trees.

The river plain is much wider on the Tlaltetela side of the river. Two small plots of beans and peanuts are planted close to the water's edge. Maize is cultivated on the flattest areas beyond the cordon of brush where the soil has been partially cleared of rock. Where larger fields have been cleared, the rocks are utilized to delineate fields in lines perpendicular to the river, approximately 1 metre wide by 0.5 metres in height. There does not appear to be any other purpose to the stone constructions. Surprisingly, a large field of cane is located on the flattest section of the river plain. The field is fenced but there is no road access to it; only a trail leads from the field. Although no homes are apparent on this side of the river, field huts are located throughout the lower plain, linked by a secondary river- paralleling trail. Informants indicate that the huts are utilized during planting and harvest periods.

Ditches are maintained for irrigation and drainage purposes. A 0.5 metre deep by 1 metre wide ditch is located at the base of the slope, parallel to the river. It captures slope runoff and distributes the water to the smaller canals arranged in a pattern perpendicular to the river. There is evidence of erosion along the slope, with debris lying its base. A rough trail runs along the river to transport cane to the Los Pescados bridge some 4.5 kilometres to the northeast, using pack animals.

The river-parallelling trail appears permanent and follows a path along a small bench at the bottom section of the *barranca* slope; the bench is located above high water, ensuring travel access during high floods. Coffee remains as the main crop along the angled slope and the *mesa* edges where soil nutrients are supplemented with chemical fertilizers. Shade trees also include *naranja* trees on this side of the *barranca*. In some places, clearing has been neglected and natural vegetation grows among the coffee trees.

As with the previously discussed trail transects, altitude does not seem to be a determining factor in crop selection. Coffee is planted on the flat *mesa*, the steep slopes and within the lower reaches of the *barranca*. Once again, altitude does not seem to affect crop choice. Even when field sections have been cleared of rocks, the presence of coffee in both stoney and stoneless soils suggests no preference between cleared and uncleared fields. Additional crops planted within the *barranca* include cane, beans and peanuts.

Another deep barranca was sampled along the Mata de Jobo to Palmilla trail. It is almost 200 metres deep and "V" shaped (figures 30 and 31). While cane is cultivated along the Mata de Jobo side of the *barranca*, as soon as the main trail leading away from Mata de Jobo begins to descend, all cultivation is discontinued, with the exception of a small area on the *mesa* edge planted with coffee trees. The slope is acute and because weathering has removed most of the soil cover, the

Figure 30 - Land Use; Mata de Jobo to Palmilla Trail

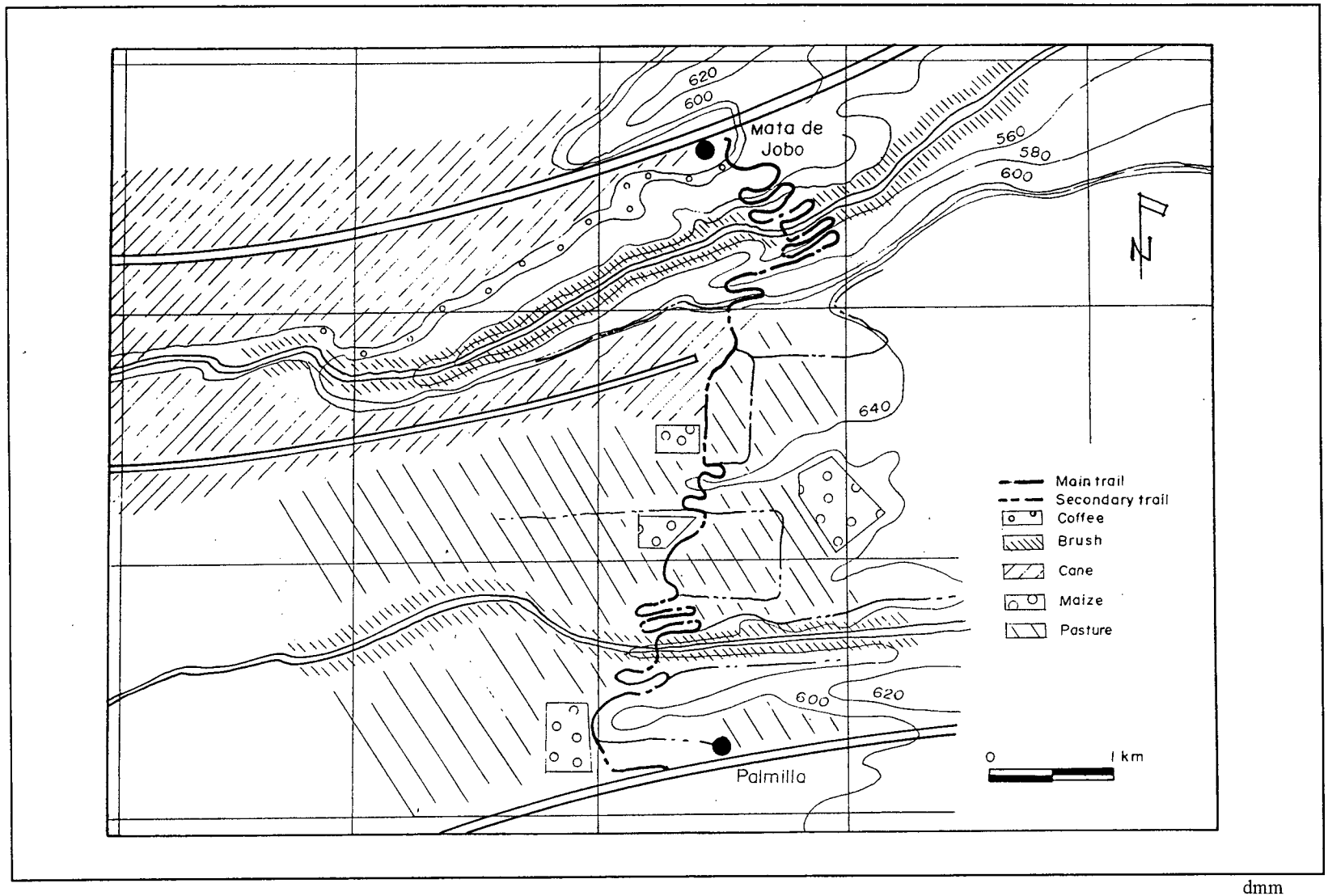

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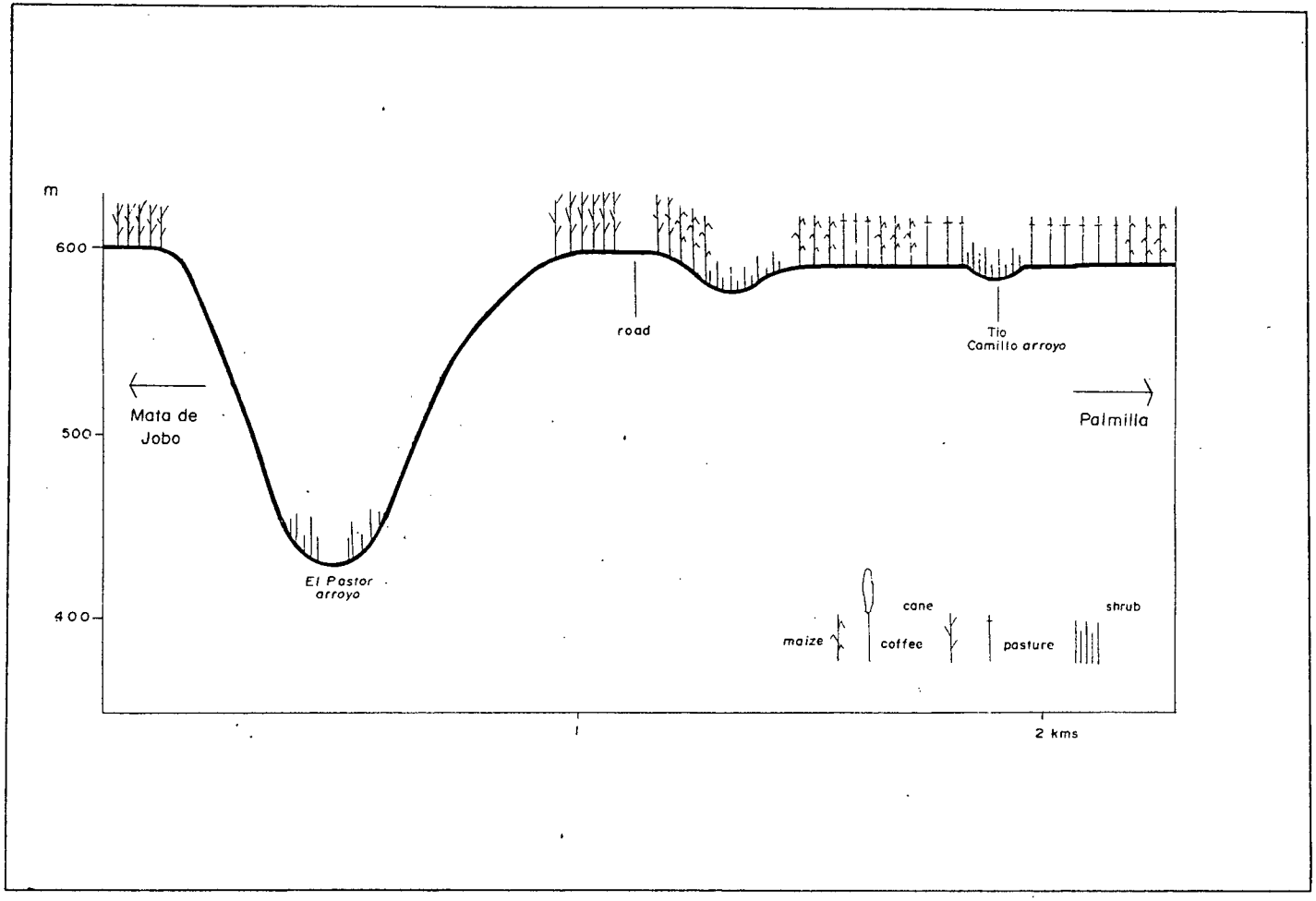
Figure 31 - Schematic Profile; Mata de Jobo to Palmilla Trail (profile follows trail transect)



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remaining conglomerate rock provides no surface adequate for any type of planting.

A 25 metre cordon of brush is located on both sides of the *arroyo*. Although without noticeable trail access, piles of firewood can be observed along the river banks. Heading west and using the *arroyo* as a trail, one can confirm that the *barranca* bottom is utilized mostly for the gathering of wood and carrying out domestic washing activities. However, a road is being constructed to the *barranca* bottom for the installation of a diesel irrigation pump to provide water along the upper *mesa* edges. According to informants, the terrain along the upper edges will be levelled and planted with additional cane, where the small patches of coffee plants presently exist.

Across the *arroyo*, the vertical face is slightly less acute, but still too steep for planting. The conglomerate rock is visible, with a few patches of natural vegetation growing on tiny ledges. A band of approximately 22 metres of cane exists along the upper *barranca* edge. Across the cane field, a rough east to west road provides access to the cane. The terrain to the south of the road is made up of relatively flat terrain; fenced pasture predominates. Small maize fields are occasionally encountered and informants indicate that the use of fields for maize cultivation is permitted by a local rancher in exchange for services rendered on his ranch. The work includes fence repair, general maintenance around the ranch buildings and herding.

Closer to Palmilla, the frequency of maize fields increases with the trail

becoming wider and increasingly branching in various directions, leading to individual homes and smaller fields of maize and pasture. Eventually, the main trail crosses a rough road heading east to west; fields of maize and pasture alternate with fallow fields. A second small east to west brush covered *barranca* at the Tio Camillo river is also utilized for cattle browsing.

Along this transect, the land use strategy is based on cane cultivation along the upper *mesa* edges at Mata de Jobo and pasture within the flat areas near Palmilla. The main *barranca* is deep and while no crops are planted within, we cannot conclude that crop planting is based on altitude; it is the terrain that is unsuitable for planting.

Transects are only slices across the landscape. For this reason, it is difficult to ascertain the extent of land use practices away from the main trails. Although vertical (1:70,000) and oblique (400 metre altitude) air photographs were utilized as part of this analysis, it was not possible to determine exactly how the land is utilized at different elevations. The commercially available vertical photographs date back almost 25 years and simply do not reflect the increase in coffee cultivation. And the oblique air photographs, although recent, only provide partial coverage of the Huatusco area. Two east to west trails were explored to verify land use schemes through *mesa* and *barranca* areas: the Xopilapa to Santa Maria Tetetla trail that follows the east to west Santa Maria river, and the Buenavista to Apazapan

trail which lies almost entirely on the Mesa El Limon.

Xopilapa lies at the bottom of the *barranca* Santa Maria, at approximately 310 metres a.s.l., 300 metres below the Mesa El Limon (figure 32). The river is surrounded by a gallery forest. Most of the vegetation is hydrophytic, with small to medium size trees and tall grasses. A trail follows the river, crossing it many times and where the river narrows, the tree branches touch, forming a *galeria.* The forest is utilized primarily for wood gathering and partially as a wild pasture area, although there is evidence of recent burning, presumably for new cultivation. Secondary trails emanate from the main path, utilized solely for access to tiny wild grazing areas emanate from the main trail. Land use does not change as one travels east to west, roughly following the same elevation.

The Buenavista to Apazapan transect lies mostly along the *Mesa El Limon* at 610 metres a.s.l. (figures 33 and 34). Within a maze-like set of five trails leading away from Buenavista, the trail to Apazapan delineates the edges of pasture and browsing fields. Although the fields appear to be overtaken by *tacotal* there are cattle browsing. Trails lead away from the main segment, following well maintained fences and accessing various small fields measuring approximately 30 metres by 30 metres. The fences are made up of stones removed from the fields. The pattern of fenced pasture continues until the main trail reaches a small *barranca* and the Muyuapa *arroyo*, some 2.5 kilometres north-east of Buenavista.

Figure 32 - Land Use and Schematic Profile (along the trail segement); Xopilapa to Santa Maria Tetetla Trail

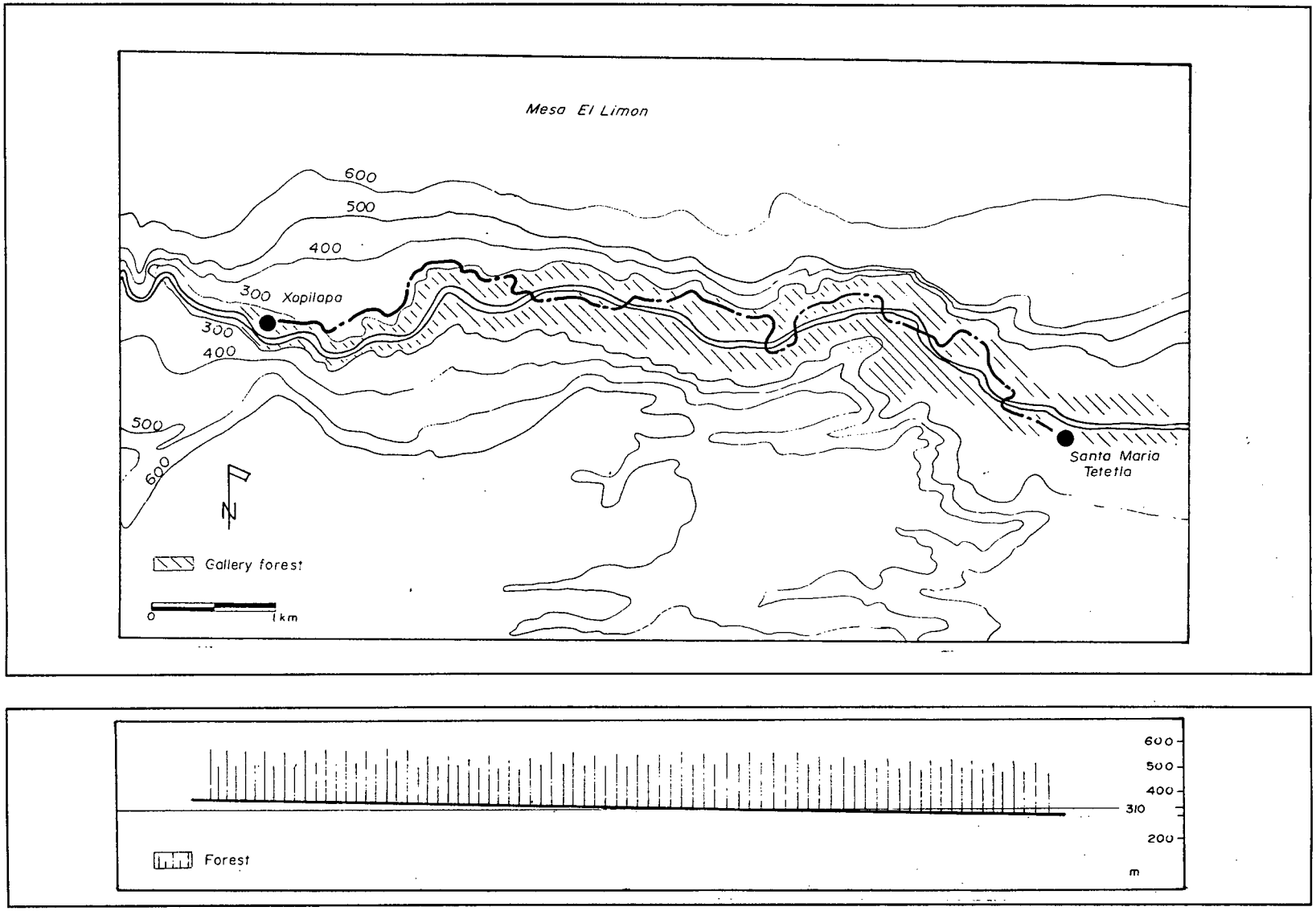

Figure 33 - Land Use; Buenavista to Apazapan Trail

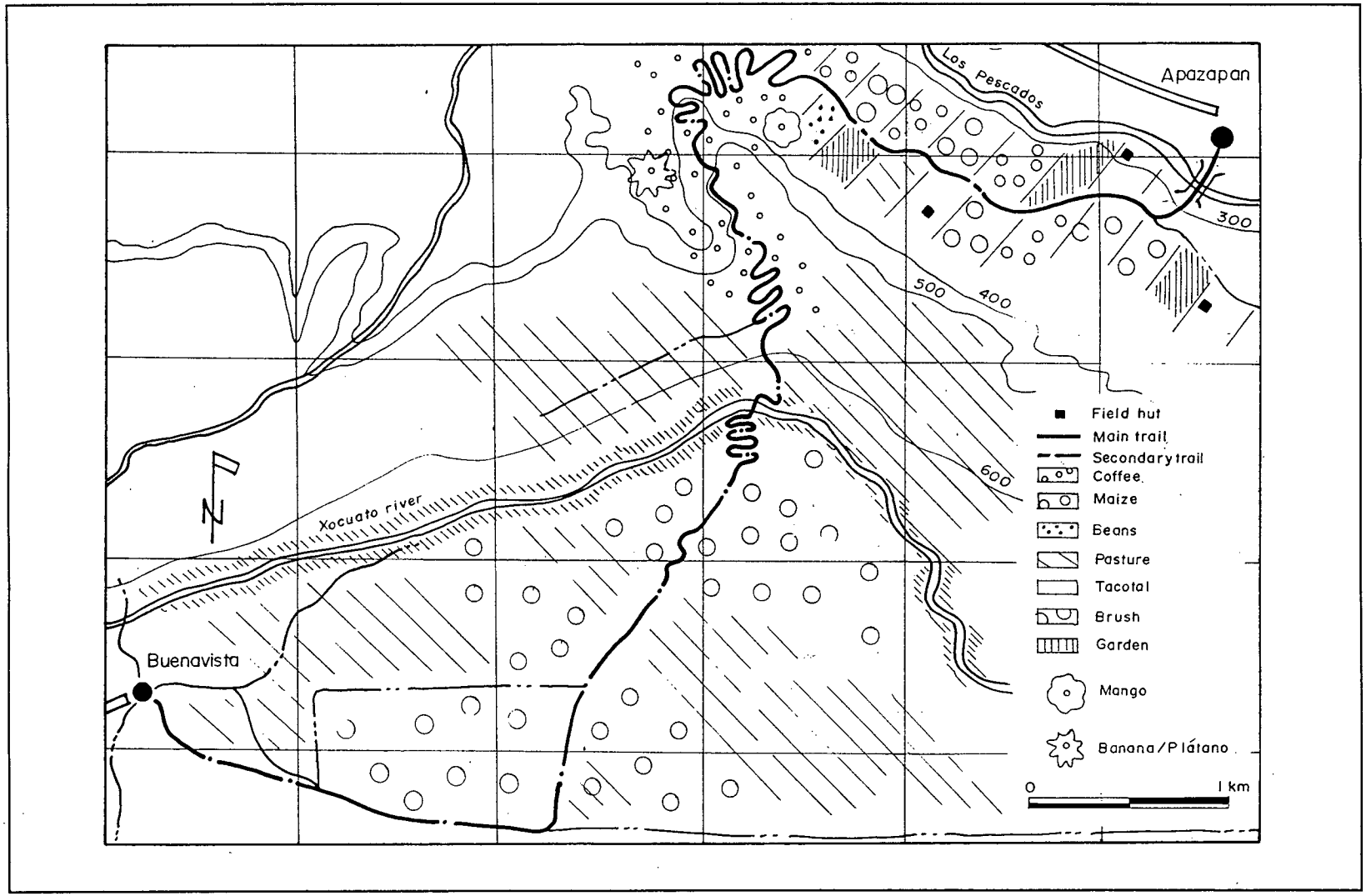

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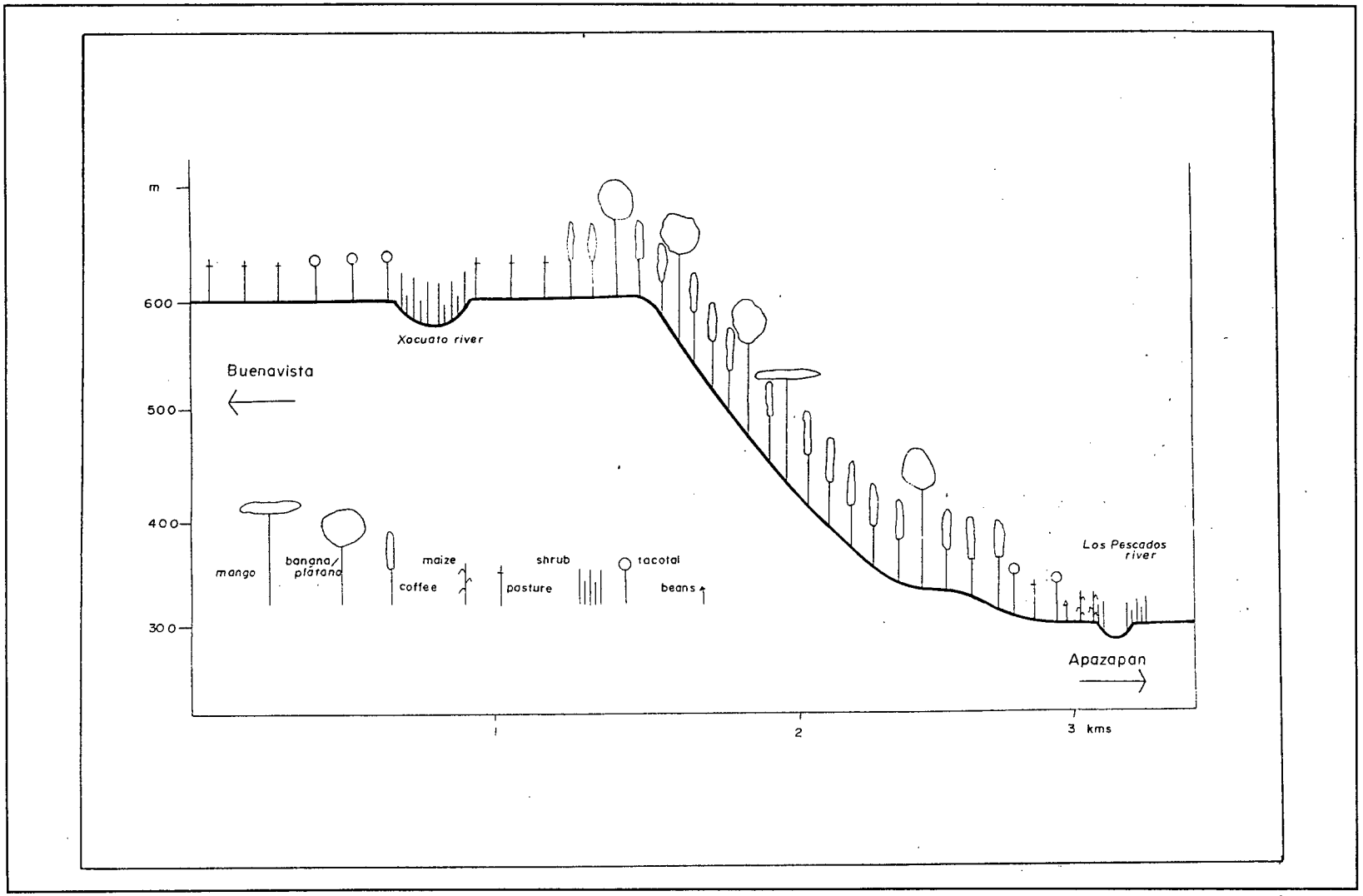
Figure 34 - Schematic Profile; Buenavista to Apazapan Trail (profile follows trail transect)



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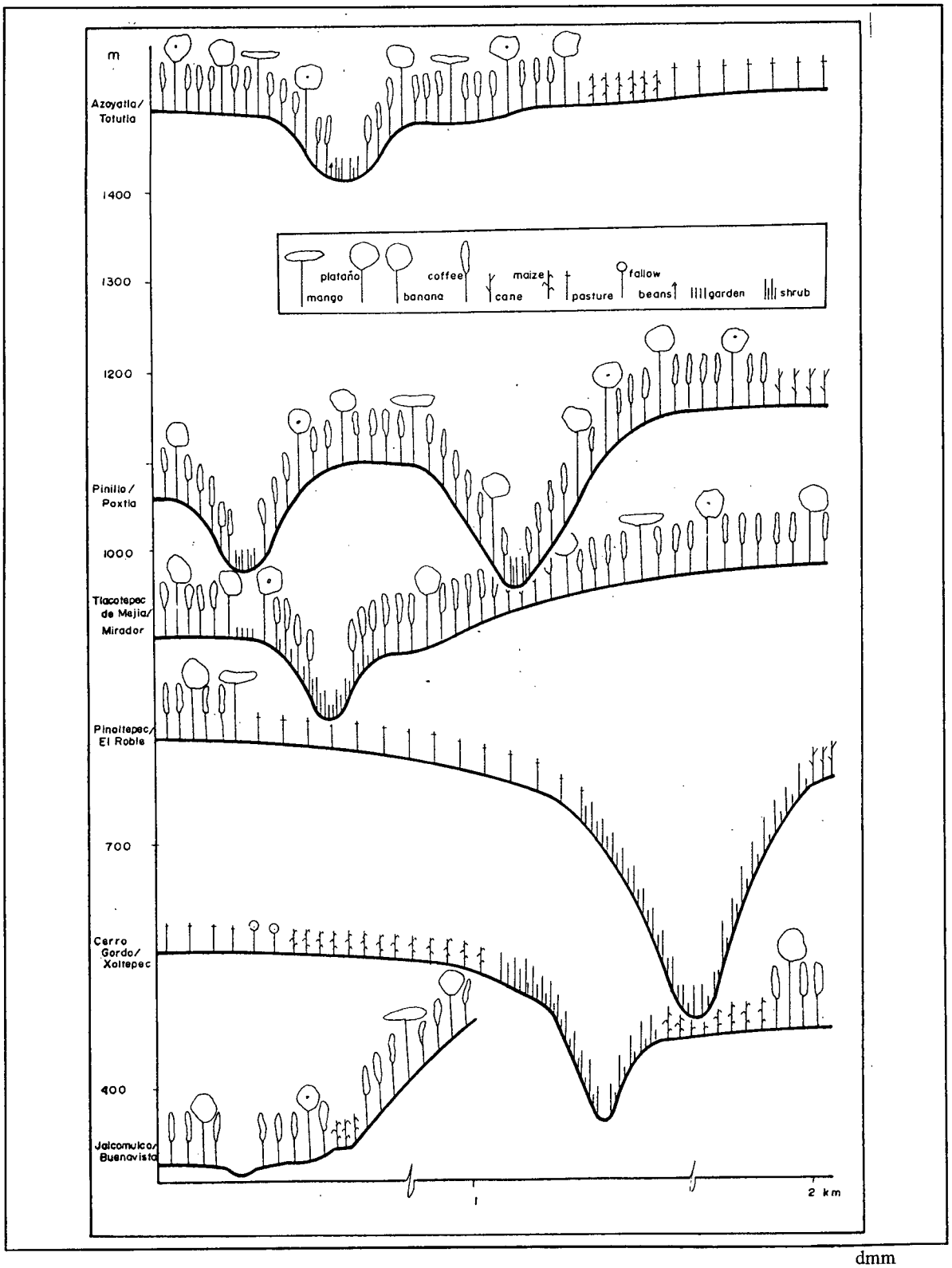
This first small *barranca* is approximately 45 metres deep, covered with thick brush and utilized by cattle for browsing. Once across the small *barranca*, land use begins to change as the edge of the *mesa* reached. Coffee is cultivated along the slope. Following the descending trail into the wide Los Pescados *barranca*, the land becomes subdivided into plots of alternating rocky fields of fallow and pasture, and smaller fields of beans and maize. The trail at this point becomes wider, 3.5 metres across, and is utilized for the transfer of animals from Apazapan and the bottom portions of the *barranca*. Informants indicate that there is no animal transfer, however, between low lying areas around Apazapan and the *mesa* above. The fields are arranged within a grid-like pattern paralleling the river. Some of the lots have field huts, while others are utilized as large gardens with yet others appearing to be completely abandoned. The pattern therefore consists of ranching activities dominating the *mesa* and small scale cultivation and pasture along the lower Los Pescados river.

With these five examples, a land use pattern begins to emerge which does not seem to be based on altitude. In fact, when we add the land use profiles of other explored *barrancas*, we can clearly see that land use is based almost entirely on local physical terrain characteristics (figure 35). Coffee is planted along either rocky or cleared surfaces, as well as undulating or steeply sloped terrain. Altitude seems to have no bearing.

Figure 35 Schematic *Barranca* Profiles; Altitude vs. Dominant Crops



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Harvesting is carried out using small trails to access individual planting areas. As the region's main crop, the coffee is cultivated with shade trees. Irrigation is sometimes utilized where the terrain is flat or slightly hilly; it does not appear to be utilized along steep slopes. Cane is also grown within most altitude areas, although it requires relatively flat terrain and usually road access for efficient cultivation and harvest.

Given that maize is highly adaptable, it too is found throughout the terrain elevations. It is grown on the flood plains, benches and *mesas*. Beans and peanuts are cultivated in small quantities along sandy river shores, although highly risky due to flooding. Locations of plots can be remote; the energy required to carry small amounts of beans or peanuts is low when compared to their economic worth. Pasture does not necessarily require flat terrain, but it is mostly situated on the *mesas*. The brush covered areas are also utilized as wild pasture. In many areas, land use is affected by land slides and inadequate soil cover which can limit planting.

In terms of access, three tiers of transportation correspond to the types of cultivation. At the most basic level, coffee requires tiny, rudimentary trails to access individual trees on ledges, remote and varied terrain. The beans are transported by either human carriers or *burros* along main trails to strategic points where the east to west roads link with the trails. Secondary east to west trails allow access to areas located between main north to south trails. By following these, we

can see that land use changes very little when local terrain characteristics do not change. Pasture requires the use of main trails and to some extent, roads along relatively flat terrain. Some browsing takes place but this is at a very localized scale; large herds require main trails for movement. Finally, cane requires the use of roads along flat terrain. Planting and harvesting in particular require truck access, although we have seen that it is possible to cultivate cane where no roads exist within the Limones to Tlaltetela trail. Three main parameters therefore affect land use choice: Verticality in terms of slope acuteness, soil type as it relates to stoniness, and in a consequential sense, transportation type.

2.4.1 On *Traditional* Cultivation Techniques

As we have seen, coffee and cane crops predominate in the Huatusco area. In fact, large scale planting of coffee is undertaken at Mirador and mechanized slope modification for cane cultivation is being carried out at Mata de Jobo to supply new processing plants along the Mata de Jobo to Totutla roadway. Yet small scale cultivation of other crops, especially maize, persists, as evidenced by the gardens and small fields throughout the *barranca* areas. Farmers continue to utilize cultivation techniques that have been passed on from parent to child. Indeed, the continued *traditional* practices are at the base of the local subsistence lifestyle. Evidence of traditional cultivation practices is corroborated when we consider the

many cultigens found within the *barrancas* that have their origin in pre-contact era (figure 36).

Three types of small scale cultivation systems were observed. The most predominant is the *barbecho* system (Siemens 1995, personal communication). The practice begins with clearing of fallowed areas, where cultivation has been halted to allow for the soil nutrients to regenerate. The regeneration period is roughly equivalent to the period of cultivation. The initial clearing is done by burning. Most of the small trees are cut prior to burning to be utilized for construction materials and fuel. Once cleared (burned), little tilling takes place before planting of the maize in linear rows. Figure 37 outlines planted rows; the harvest is poor due to drought. Weeding is carried out throughout the growth period. The maize fields are harvested as soon as the ears begin to mature. Typically, the main harvest for summer planted crops takes place at the beginning of October.

The second small scale cultivation system which is practiced can be characterized as a *secano-intensivo* system (Palerm 1967, 35). No fallow period is required because the soil is cultivated continuously with alternated crops. Gardens fall into this category; they are generally located adjacent to homes, where manure and other fertilizers can be added. Considerable effort in planting, tilling and weeding is required.

More rarely observed, the slash and burn, or *roza* system is employed where more cultivation area is required and forest cover is cleared. In late May, the lower

Figure 36 - *Traditionally* cultivated crops within the *barranca* areas having pre-contact origins.

Cultigen	Latin Name
Avocado	Persea americana
Banana	M. sapientum
Black sapote	Sechium edule
Century plant	Agare americana
Chayoti	Sechium edule
Chili pepper	Capsium frutescens
Common bean	Phaseolus vulgaris
Jack bean	Canaralia ensiformis
Maize	Zea mays
Peanut	Arachis hypogaea
Pita haya	Hylocereus undatus
Plátano	M. paradisiaca
Sapota	Pouteria mammosa
Sweet potato	Ipomoea batatas
Tobacco	Nicotiana tabacuum

tree branches and brush are cut and cleared, followed by larger trees which are left *in situ* to dry. The trunks are split for easier burning. Trees suitable for firewood and construction uses are collected prior to burning the vegetation mass. Planting takes place in late June, among the ash and wood remains. Weeding and pest control is undertaken throughout the growth period and harvesting takes place in stages, as the maize ripens. Usually, two crops are cultivated without fallow periods

Figure 37 - Dry Season Maize Field; Apazapan to Buenavista Trail

August 17, 1994

between them; the dry season crop is slightly risky, as evidence by the maize in figure 37. After two crops, or roughly one year, the field is left fallow for periods varying from one year to four or five (figure 38).

With the *barbecho, secano-intensivo* and *roza* systems, cultivation is undertaken in areas which are difficult to reach and deemed marginal by the large landholders. The small fields are generally located on small benches or relatively flat areas along *barranca* rivers. Exceptions to this rule take place where a large landowner lets out a small land parcel to individual farmers in exchange for services

Figure 38 - Harvested Maize Field; Xopilapa to Santa Maria Tetetla Trail

January 8, 1995

rendered on the large farm or ranch. Clearly, *traditional* cultivation practices thus persist in the *barrancas* and along the *mesas*.

2.4.2 On Stones and Ditches

References have been made to stoney soils and ditches throughout this chapter. Coffee, as we have seen, grows well in soils regardless of the presence of stones. And irrigation canals as well as larger gullies are apparent in numerous areas. How stones and gullies are utilized by *barranca* agriculturalists is key to

successful cropping.

Typically, eroded conglomerate rock within *barrancas* leads to very stoney soils. Clearance is required where one of two factors is involved: Where ploughing is necessary, and where stones compete with available cultivable space (including root space) (Fowler 1981, 18). However, stones continue to crop up as tillage takes place and removal must repeatedly be undertaken. We know that during the colonial period, stone removal took place as new lands were opened up and the result was a series of stone fences delineating fields especially on *mesas* but also within the *barrancas* (Aguirre Beltrán 1989). This would seem to explain the presence of so many stone fences along the transects. But Sartorius, travelling within the region during the mid-nineteenth century, alludes to similar constructions having been in existence before the colonial period. Consider his first mention of the features:

> "When the tall grass is burnt down, we can see that the whole of the country was formed into terraces with the assistance of masonry; everywhere provision had been made against the ravages of the tropical rains; they were carried out on every slope, descending even to the deepest spots, where they are often only a few feet in width. In the flat valleys are countless remains of dams and reservoirs, mostly of large stones and clay, many of solid masonry, naturally all rent by the floods at the lowest part, and filled with earth" (1961 [1858], 10).

While it is possible that the stones were piled into lines partly to protect crops against the rains and partly to operate as dams, this is clearly no longer the case; the coffee plants are higher than the linear stone piles.

Sluyter and Siemens (1992) examined similar stone lines throughout the Central Veracruz piedmont, concluding that most of the arrangements were part of terrace construction. Stone barriers were erected along sloping terrain and with earth was placed behind, forming relatively level planting surfaces. Yet this is not the case here. The stone lines are perpendicular to the slopes and no evidence was found that could support the same type of arrangement; in fact very little soil covers the lower stones.

Coffee planting does not necessarily require extensive tilling. A hole is dug, approximately 30 centimetres in diameter by 40 centimetres deep, and the small trees are then transplanted. Stones are removed from the immediate planting area and because the trees are planted approximately 1 metre apart, the space between them does not necessarily require clearing. In fact, stones can be a positive attribute to soil composition. A surface layer of stone protects the soil from losing too much moisture to the atmosphere and can even accelerate moisture absorption to the soil during periods of precipitation. Further, stones can absorb the shock of rainfall, releasing their own nutrients into the soil as rain comes into contact with them (Epstein, Grant and Struchtemeyer 1966, 640). The presence of stones, therefore, is not a deterrent to a cropping strategy that requires little or no tilling such as coffee planting.

Ditches are also utilized to delimit individual fields and are often utilized as

field accessing trails. But their presence is more related to drainage as slope runoff is captured and the water is distributed along a set of smaller ditches perpendicular to the large ditches along the slope bases. The general arrangement is of a larger ditch following the base of slopes, with secondary connected ditches running perpendicular, delivering water to individual field areas. The configuration is similar to that of a large rake. At times, water is pumped directly into the ditches allowing for immediate moisture delivery. The ditches are not especially predominant where the cane and coffee is grown.

A larger ditch is located along the base of the Tlaltetela slope of the Los Pescados *barranca*. It measures 2 metres across and is approximately 1 metre deep and informants indicate that it was also utilized for drainage. At various places, the soil from the slope side of the ditch has eroded into it, resembling to some extent the process of gullying. In gullying, the erosion of the slope soil is accelerated by digging large ditches along the base of slopes (Kirkby 1972, 16-19). As slope soil erodes and fills the large ditch, or gully, the amount of available surface for planting is increased. Eventually, another ditch is dug on top of the filled gully and the process is repeated. A valley's cultivable soil surface can in this way be doubled (Goudie 1981, 137-39). But there are no lateral or side retaining walls in gullying and the stone lines at the Los Pescados *barranca* do not appear to be related to this phenomena. Certainly, the ditch would have been utilized for drainage and agriculturalists probably unknowingly extended their planting surface

by continuously re-digging the ditch.

To summarize this chapter then, the *barranca* region's inhabitants organize themselves to carry out construction and engineering projects in order to maintain links to a variety of local resources and activities ranging from the expected cultivation related activities to less apparent social activities such as news exchanges. Interaction between people in social, political and ritual contexts is made possible. The foot paths are utilized locally, especially when distance in walking time involves less than 3 hours. The reach of foot travellers is extended with the road network particularly as accessibility to the regional economy becomes necessary. Adding trails to the region's transportation network results in a doubly interconnected transportation facility.

The trail system thus provides a basis for adaptive strategies utilized to render local physiographic "*limitations*" less forbidding. Whether with the cultivation of coffee or cane, or with the persisting *traditional* cropping strategies, land typically considered marginal is accessed and cultivated. The trails not only form part of the economic basis for the region's subsistence economy, but they are consequential in terms of land use strategies. Further, they are primal in terms of the region's transportation facility. This primal characteristic of the trail network suggests a re-evaluation of the region's transportation history.

Chapter 3 Historical Issues; Antecedents to Today's Trails

"*¡Vaya todo derecho!*" ("Go straight ahead!") Still trying to make my way to Totutla, I am told to head straight ahead by a man travelling north with his family towards Ohuapan. After passing seemingly abandoned cultivation fields, the vegetation becomes lush as the sound of rushing water increases. And as it approaches the river, the trail becomes stone-lined, leading to a simple, yet well constructed stone bridge. Across the bridge lies a choice of two more trails; one leading upslope to a field appearing to have recently undergone burning, and the other heading southeast towards a series of fenced pasture fields. Travellers are occasionally met along the way and field workers are observable on the distant slopes and flatter benches. Most of the travellers tell me the trails have *always been there...*

Local folklore? Perhaps. But an evaluation of the literature suggests that the region has had a route system in operation since the pre-contact era. It is therefore likely that the *barrancas* may have had a more significant role in the development of Central Veracruz culture than previously acknowledged. Until recently, it was generally believed that the colonial roads and eventually the modern transportation networks of the Americas resulted from the Europeans having adapted existing trails to their own needs. Bancroft (1883) notes that the "internal commerce of New Spain was conducted for a long time along the routes of the Indian trails; but these

narrow lines of communication were soon widened and made practicable for pack trains and wagons" (635). And Hulbert (1920) suggests that "the main lines of travel and transportation for the most part still cling to these primevil [sic] pathways" (14). Transportation network development is typically outlined in terms of three tenets. First, that humans initially adapted the paths of animals easiest for foot travel; second, that topography was the main determinant in trail route choice; and third, that the Europeans adapted the foot paths of the people initially occupying the land (Gregory 1931, 4-11).

While the Spanish did adopt, to some extent, some of the existing trails for their own needs, Rees (1975; 1971) shows that route choice, at least in eastern Mexico, was not necessarily predicated upon existing path networks (155; 55). Similarly, Burghardt (1969) concludes that "Indian trails did not predetermine the road alignments" eventually adopted by the Europeans (417). And while the emergence of a new route network does not necessarily follow old routes, clearly, preceding routes do not simply vanish as new ones are adopted. This, as we shall see, is particularly true of the *barrancas* region.

Five stages in the unfolding of the region's trail and road transportation system are postulated: The trade routes existing prior to Spanish contact, the early colonial routes, the late colonial route network, the nineteenth century transportation network, and finally, the modern transportation network.

3.1 Pre-contact trade routes

Direct physical evidence of a route network having existed during the time before Contact is difficult to pinpoint as little archaeological, ethnoarchaeological, or historical research focuses on the problem (Hassig 1991, 17; Trombold 1991, 2-7). Historians and the early chroniclers, however, remark that public trailways did join communities throughout the Aztec world. Vaillant's (1941, 249) reference of bridges to be traversed and removed at the threat of approaching enemies and Cortéz's (1963 [1519], 108) note of paths located on top of dikes illustrate this point. While the references are scarce, we can begin to reconstruct the trail network by taking into consideration two of the basic facets of Aztec society: trade and tribute.

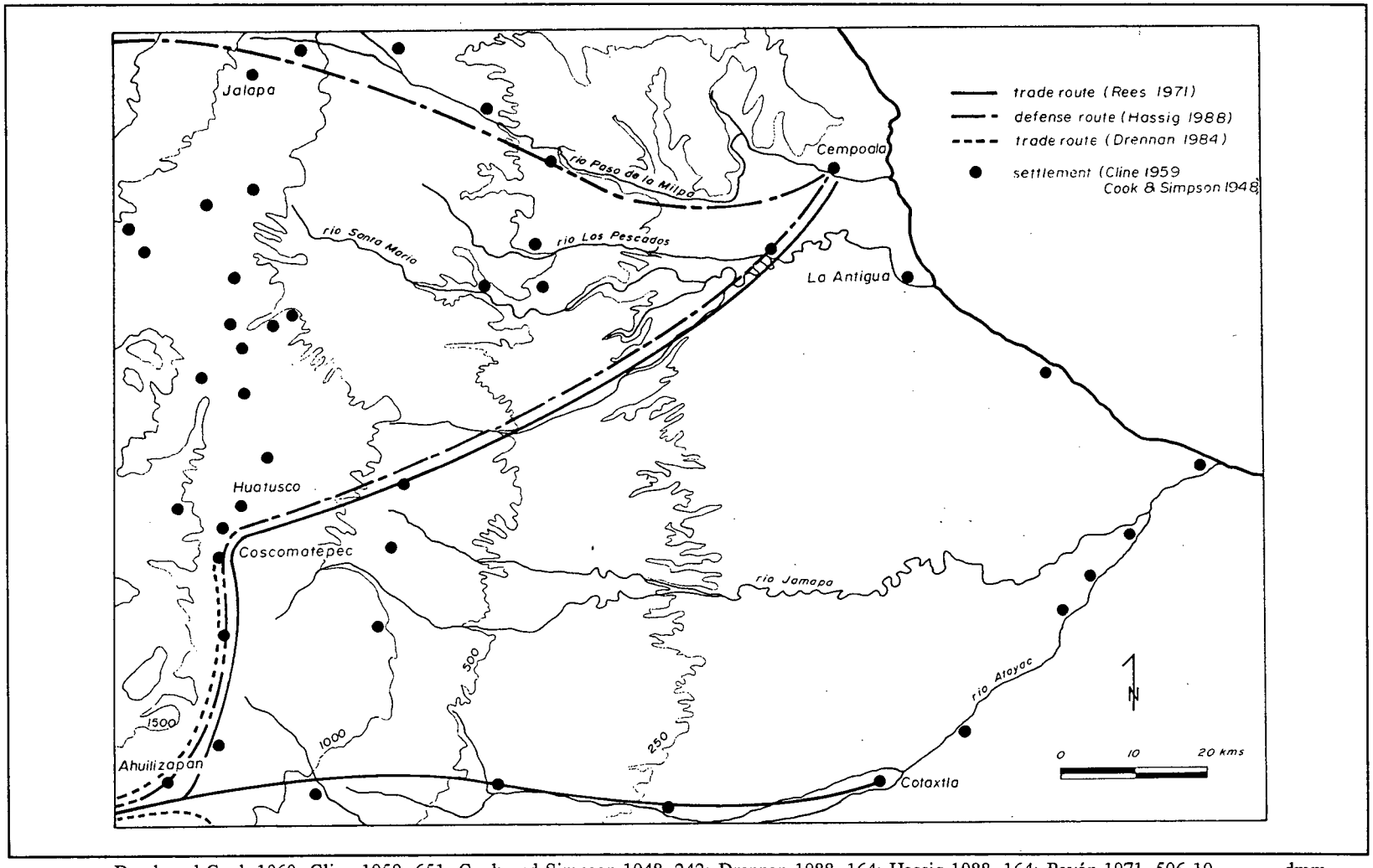
Diehl (1981) argues that commercial competition (and the eventual elimination of this competition) for otherwise unavailable products was the goal behind Aztec trading and trail maintenance policy (293-94). Indeed, at the eve of Contact the *pochteca* merchant group was communicating with neighbouring peoples and aggressively pursuing trade via regional exchange networks (Bittmann and Sullivan 1978, 213; Chapman 1957, 11; Charlton 1978; Dibble and Anderson 1959, 22). And trade with more distant groups necessitated routes through at least part of the Central Veracruz region as centres and *rendez-vous* points became established to the southeast and as far off as what is now Guatemala (Berdan 1982,

35; Durán 1964, 112-13; Gadasz 1979, 89; Hardoy 1973, 136).

While the transfer of goods was the motivating factor in establishing a trail network in Aztec culture, it was not strictly a trade-motivated system (Barlow 1949, 73-99). Tribute was also part of the Aztec economy. On the Gulf Coast, Cempoala, as the "last capital of the Totonac kingdom paying tribute to the Aztec empire", was linked to the Capital via a southern route (figure 39). Gendrop (1991) refers to this route as one which appears to be a secondary path stemming from the main commercial route postulated by Drennan (1971), travelling from Teotihuacan, extending through the Orizaba pass, Ahuilizápan (Orizaba) and linking with Mayan trading partners to the southeast (106). Rees (1971) retraces this "principle and oldest transportation axe" , although he offers no detail related to the main branch leading to Cempoala. Briefly, he traces the route through Cholula, Tepeaca, Acatzingo and eventually Ahuilizápan via the Orizaba pass, branching off towards Coscomatepec and Cempoala to the northeast, and extending to Cotaxtla to the west (Rees 1971, 26-27).

Although the exact route leading to Cempoala is not clear, we know from Durán (1965) that it did exist as he refers to a group of *pochteca*, who, travelling from Cempoala are murdered by the people of Ahuilizápan (12-13). According to Sanders (1953), this was the most important pre-contact transportation route of the region (75-76) because it was the key in obtaining products from the coast for trade at Tenochtitlan and collecting tribute along its path (Scholes and Roys 1948, 33).

Figure 39 - Pre-contact Trade Routes (generalized)



sources: Borah and Cook 1960; Cline 1959, 651; Cook and Simpson 1948, 242; Drennan 1988, 164; Hassig 1988, 164; Payón 1971, 506-10. dmm

Important logistical implications in terms of trade and military caravan stops at settlements and shrines within its vicinity would also involve trail links to other settlements. Caravans were supplied by area settlements and in turn left goods from the coast and Tenochtitlan.

In addition to the Rees and Drennan trade-based route hypotheses, Hassig (1988) postulates that Moteuczomah Ilhuicamina (Montezuma) travelled along the same route during his 1454 conquering march. Hassig notes that after reaching Cempoala, Moteuczomah headed due east towards the Sierra pass north of Jalapa (163-165). This would seem to indicate that a north route was also known and utilized by the Aztec. And the segment from Coscomatepec to Ahuilizápan (Orizaba) would have therefore been one of the most travelled trail routes in the region as each of the above postulated paths ran along it. Interestingly, the trail section roughly parallels today's highway from Orizaba to Huatusco; this further indicates the primal nature of today's trails.

But surely there were more than main trade and defense trail routes in Aztec territory, especially where pockets of settlements existed away from the main routes. Given that all settlements were subject to tribute obligations, trails links from remote settlements to major routes would have been required (Borah and Cook 1968, 8-18; Santley 1991, 203). While settlements along the main trails were utilized for *tameme* caravan stopovers and shrine visits; the caravans required food and lodging, the smaller settlements lying away from the main trails would have

had to deliver various goods at strategic points (Sanders and Price 1968, 10). It is in this light that Smith (1979) posits a commercial organization in which the Aztec settlement pattern closely resembled Christaller's (1966) Central Place model. According to Smith, each settlement was connected in a hierarchial pattern with, not surprisingly, Tenochtitlan at the top. Smith regards all settlements as connected within a single interregional trail network.

Within the eastern slope areas, Sartorious (1869) notes a multitude of settlements that have their origin in pre-contact Aztec culture. Consider his reference to the area around Jalapa and Huatusco: "*Ultimamente se dió alguna noticia en un diario de Jalapa, sobre fortificaciones, varias pirámides y un depósito de cadáveres momificados...A tres leguas de Huatusco, en un despañadero espantoso entre dos barrancas, hay un castillo muy interesante...*" (821). According to Sartorious then, the area is covered with pre-contact forts and burials. These observations are corroborated by Borah and Cook (1960), Cline (1959, 651), Cook and Simpson (1948, 242) and Payón (1971, 506-10) as they offer extensive lists of pre-contact sites within their research. If Smith is correct, the eastern slope settlements observed by Sartorious were interconnected within a vast trail network. When the eastern slope pre-contact settlements are mapped, an interesting north to south axial juxtaposition occurs (figure 1). It is difficult to ponder an unconnected series of settlements when we acknowledge that tribute was required by all groups within Aztec society (Ashmore 1977).

A further clue we have on pre-contact trails involves the many maps that were produced during the first 100 years of colonial rule. Phillip II first requested colony related graphic and geographic information from his colonial officials in 1579. Responses were received from most of the officials, including one individual already referred to: Alvaro Patiño de Vera Cruz. The requests from Spain continued under various rules and the result has been a series of representative maps throughout the colonial period, outlining, however sketchily, trail routes throughout Central Veracruz and in at least on instance, the Huatusco area. References to Huatusco, for example, can be found on various *relaciones* maps.

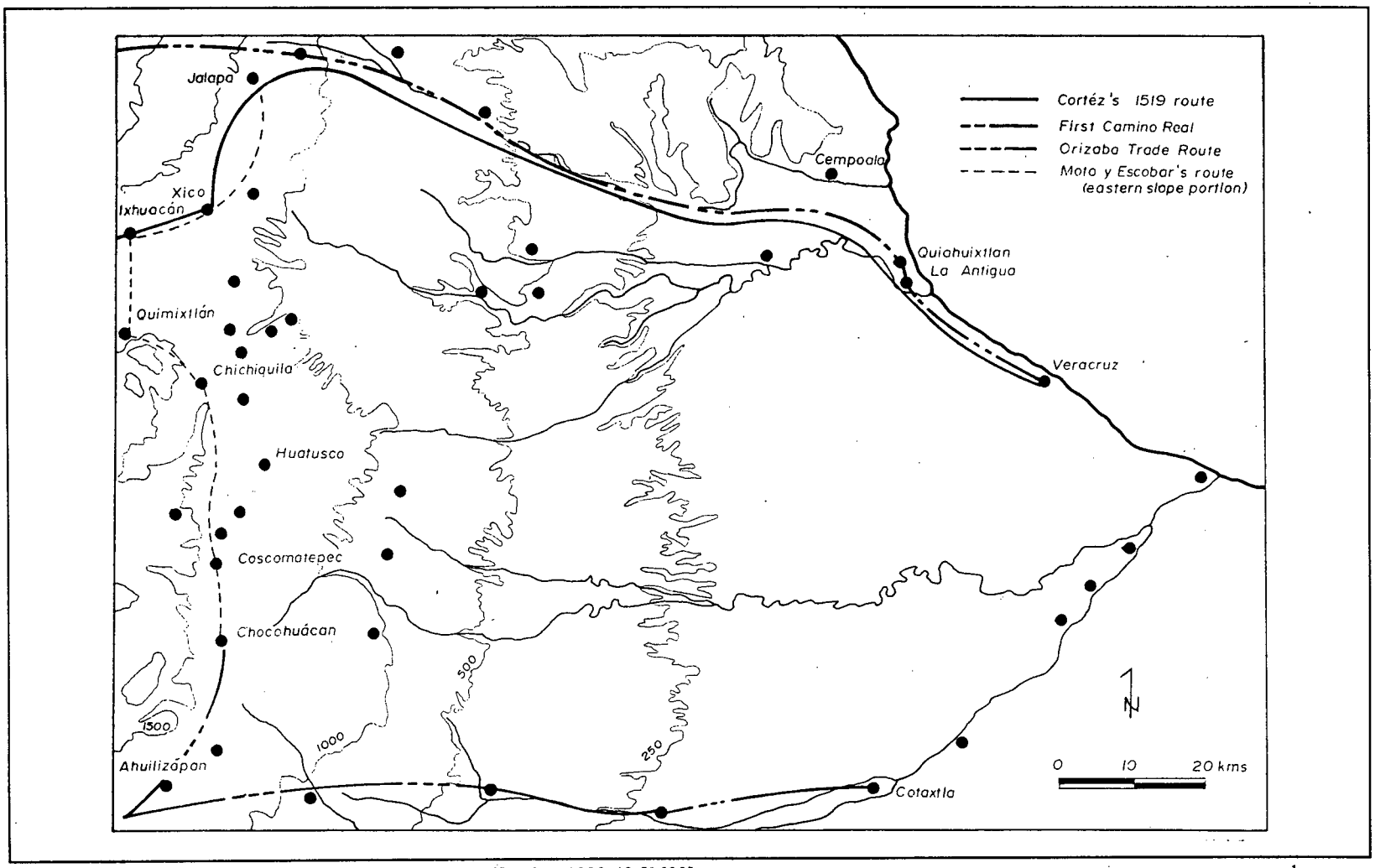
One final pre-contact routing network requires consideration. As main travel axes, regional hydrology can be important not only as water transport itself, but also as an influential factor in trail route delineation. We know that water transport was common throughout central and eastern Mexico (Scholes and Roys 1948, 31; Spencer and Jennings 1965, 493), and the use of navigable rivers in conjunction with trails would have offered a juxtaposition that would permit quick communication and the relatively easy transfer of goods. The Atoyac, for example, is navigable with small craft and linked at least 50,000 people living within the proximity of its shores (Sanders 1953, 75). Settlements along rivers were joined by water in east-west directions, and as with main land routes, settlements located inland would have required access with north to south trails (Hassig 1991, 25; Palerm and Wolf 1957, 14; Sanders and Santley 1993).

In summary, we can deduce that a network of major trail routes complemented by settlement connecting trails existed throughout the *barranca* region prior to the Spanish arrival. At least two trail passes existed: One at Orizaba and the other just north of Jalapa. Because tribute applied to all groups of people under Aztec rule, and because of trade caravan logistics, each settlement was responsible for access to main trail routes, regardless of local topography. Many of these settlements were on opposing sides of the east to west *barrancas*; the trails would have had to be oriented north to south. When Cortéz arrived in 1519, he immediately dispatched his agents throughout the eastern countryside to follow and inspect existing Aztec routes (Diaz de Castillo 1956 [1908], 52). He would quickly learn of the rapid communication existing between the coast and Tenochtitlan; the messengers travelling through Cotaxtla could reach the Tenochtitlan in less than four days (Durán 1964, 271-77).

3.2 Early Colonial Routes

At the onset of his arrival, Cortéz began to amass information related to Aztec routes (Borth 1969, 100). He utilized this information to plot the first stages of the inland trek through Cempoala, Jalapa and eventually Tenochtitlan. Using Orozco y Berra's account, Genero Garcia (1956) provides a detailed itinerary of the trek from the coast. Briefly, after reaching Jalapa, the party headed along a trail

Figure 40 - Early Colonial Routes (generalized)



sources: Cortéz 1962 [1519-20]; Mayer 1961; Mota y Escobar 1939-40 [1609].

dmm

towards Xico and Ixhuacán, crossing the Sierras through the middle Sierra pass south of the Cofre de Perote and west of Xico, making its way towards the altiplano (figure 40) (Genero Garcia 1956, 472).

The choice of the middle pass is significant for two reasons. First, it confirms that at least one trail linking the lowlands with the altiplano had existed other than the Orizaba and Jalapa passes. But slightly more intriguing is that it seems to add to the credence that a link between the Jalapa pass route utilized by Moteuczomah and the Orizaba pass trade route may have existed. Consider first the size of the landing party.

The Spanish army consisted of at least three hundred men accompanied by no less than two thousand porters (Cortéz 1908 [1520] volume 1, 188). It had a very real and immediate requirement for food and logistical support. For this reason, it seems likely that their Totonac guides would direct then through an inhabited area that could service the group. We know from the archaeological record that settlements existed along the slopes, south of Jalapa, in relatively close proximity (Cline 1959, 651). While the army would have had no need to head further south, it is certainly possible that the settlements south of Xico would be linked to the middle pass route which would be, depending on the proximity of settlements *vis-à-vis* Xico, a shorter route to the altiplano and Tenochtitlan.

In spite of a knowledge of trail routes lying within the immediate vicinity of the Gulf coast, the main Orizaba trade route and the less important pass through

Xico, Cortéz chose a route north of the Cofre de Perote for the first Camino Real. The rationale for selecting this particular trajectory is not clear, but as Rees (1971) points out, because the Spaniards had no interest in the Aztec trade economy, the main long distance Orizaba route lost its importance to a more direct link between the coast and the Capital (55). Interestingly, no mention is found of the Cempoala to Coscomatepec route after 1519. The emphasis would be on transporting goods between the coast (Spain) and Tenochtitlan **only**. While at first glance it might appear that the Jalapa route choice was not necessarily the shortest route, it quickly becomes clear that because the main point of inland departure from the coast was initially at Quiahuixtlán (San Francisco), some six kilometres north of the mouth of the rio La Antigua and its tributaries, this northern track was the shortest route. It allowed travellers to circumvent the La Antigua river, a major obstacle in travelling to Jalapa where treks through the northern pass were organized.

By 1525 the first *Camino Real* was established with a series of hosteleries, or *ventas*, linked together to provide "permanent" points where travellers could seek refuge from the arduous trek. The initial route appears to have been made up of a series of existing trail segments with wooden bridges constructed across rivers, and no provision for wagon transport (Kubler 1948, 162). In 1530, however Friar Sebastián de Aparicio introduced wider road segments throughout the Jalapa-Perote areas as he began taking part in grain trading activities; mule-powered wagon trails were becoming increasingly popular. According to both Rees (1971) and Kubler

(1948), by 1570 Sebastián de Aparicio was utilizing existing trails in combination with segments of the *Camino Real* to establish a wagon road network along the eastern slopes and the western areas of the altiplano (72; 161-63). Although the location of these segments remains enigmatic, they were certainly located at along this study's region.

It is within the initial colonial period that we find corroboration for a north to south trail link along the eastern slopes between the Jalapa and Orizaba routes. During his 1609 visit to the region, Bishop Mota y Escobar recorded his itinerary as he made his way south from Jalapa. Briefly, he travelled from Jalapa to Xicochimalco (Xico), Ihuacán (Yshuacàn), Quimixtlán, Chichiquila and eventually Coscomatepec and Chocohuácan (Hocoman) (Mota y Escobar 1987 [1609], 42-48; 1945 [1609], 204-07). While the remaining stops along his trek remain somewhat ambiguous, he describes the trip through a populous area of trail linked settlements ([1609] 1987, 46-47). This would appear to confirm a route running north to south, roughly paralleling today's Huatusco route. The pre-contact trails seem to have persisted.

Initially, the Orizaba route following the Atoyac river through Cotaxtla and Ahuilizápan was not used by the Spanish, although missionaries, adventurers and the lowland population, however dwindling, continued to utilized the route (Gibson 1964, 91). We find evidence for its continued use as a proposal for the reconstruction of some route segments is advanced by Veracruz and Orizaba

merchants during the first years of the seventeenth century. We know that the Orizaba valley soils were considered "*muy fertiles*" (Sartorious 1869, 819), and it is these fertile soils that attracted Spanish settlement to the area. Merchants wanted to provide this new market with goods as well as capitalize on what could be relatively efficient wagon roads, given the proper reconstruction of existing segments. Unfortunately, however, new reconstructed segments were not approved by the colonial government and merchants continued to use foot trails as they traversed the slope areas throughout the first half of the seventeenth century (Arróniz 1959 [1650], 100-19, 29).

The colonial government favoured long distance traffic from the onset of the colonial period. Yet within the eastern slope areas, trail routes other than the main Jalapa *Camino Real* continued to service local needs. In fact, where mule cart roads did not exist, a strategy was derived based on the Aztec *tameme* carrier tradition, enabling existing trails to continue to be utilized. The *carga* system was conceived to regulate human carriers, or *cargadores*, complete with maximum allowed carried weights (Carrera Stampa 1949, 11-16; Simpson 1940, 67-68; West and Augelli 1966, 250).

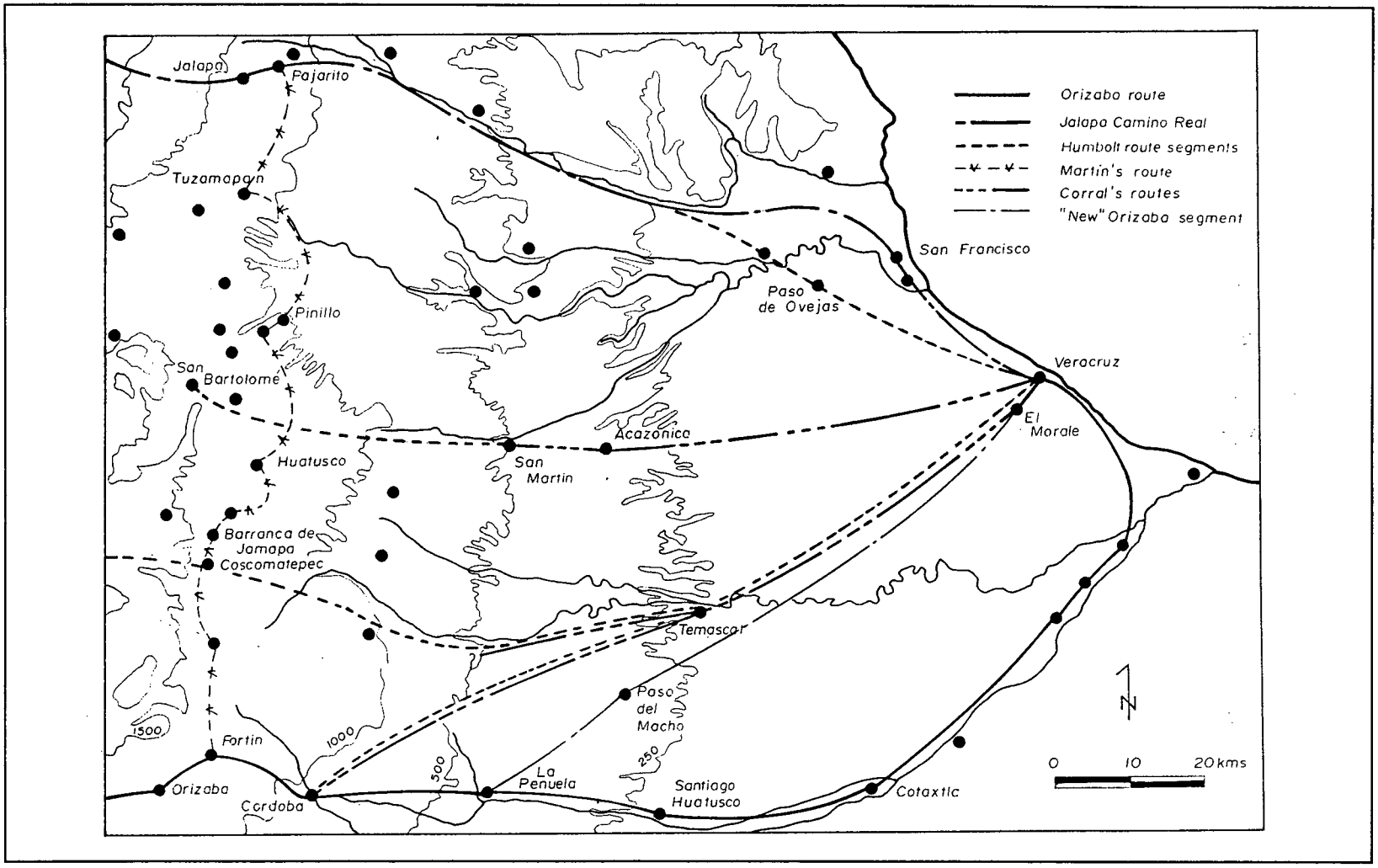
We therefore have the main Jalapa *Camino Real*, a secondary yet well utilized trail route along the Atoyac, and a host of trails utilized by the *cargadores* for access to the slope areas at the end of the early colonial period. In terms of

cultivation, *barranca* and piedmont land use remains enigmatic, although it is known that cane and to some extent tobacco cultivation begins to take place in the late sixteenth and early part of the seventeenth century (Arróniz 1959 [1650], 149).

3.3 Late Colonial Route Network

Cortéz's first *Camino Real* through Jalapa formed the basis for the main transportation link between Veracruz and Mexico City during the sixteenth and seventeenth centuries (Siemens 1990, 100-01) (figure 41). He brought horses and other animals and only twenty years after his arrival the main route was already accommodating various pack animals, and, as we have seen, mule powered wagon trains (Borth 1969, 102; Ringrose 1970, 34-40). Although new settlements emerged along the route, they were entirely transportation dependent, established solely to service long distance travel, with raising and feeding mules as their principle raisons d'être. However, major economic changes would affect the Camino Real during the mid seventeenth century, however. A decline in mining activities with corresponding labour changes translated into less capital available for road maintenance or new segment construction (Borah 1951, 8-12). And this was not limited to the Jalapa *Camino Real*. According to Ringrose (1970) bridges were no longer being reconstructed along the Orizaba trail after flood washouts (34-36).

Figure 41 - Late Colonial Route Network (generalized)



sources: Corral 1784; Humbolt 1972 [1811]; Martin 1943 [1805]; Mayer 1961, 163; Rees 1971 (Fortin-Tuzamapan Segment). dmm

This seems conflicting when we consider that "justices of the road", or *justicias*, were established at both Jalapa and Orizaba during the early 1630's, presumably as a result of increased traffic (Rees 1971, 175). Nonetheless, both Ringrose and Rees seem to agree that by 1640, long distance mule pulled wagon traffic moved along the Orizaba route.

Coinciding with the increase in traffic along the Orizaba route was an increase in settlements founded within the eastern slope areas. Cane and tobacco workers, and especially escaped slaves, or *cimarrones*, were attracted to the *barrancas* where perceived land marginality combined with trails would enable them to reach and work new cultivation fields (Arróniz 1959 [1650], 149); colonial authorities had initially seen no potential in the *barranca* lands (Aguirre Beltrán 1991). So important was this new group of settlers that after establishing a fort just south of Orizaba at San Lorenzo, a military force was sent out by the colonial government to subdue the local group which was deemed overly organized. The indigenous population that had been forced to retreat to the slopes during the first fifty years after contact was therefore complemented by a new group of dwellers moving to the hill lands during the mid-seventeenth century.

Cimarrones increased in number, as did the trade of goods and new slave workers for the cane refineries. An increase in trade coincided with the establishment of *justicias*, or justices of the road, in charge of taxing goods. This led to the practice of utilizing pre-existing yet lesser known trail routes to bypass

Jalapa and Orizaba in order to keep from paying taxes. *Contrabandistas* also utilized the routes, for example, south through Tuzamapan or north through Huatepec to avoid Jalapa (Gemelli Carerri 1955, 242-43). The exact routes are no longer known but the practice is clear evidence of alternative trail routes being utilized within the slope areas.

Route competition between Orizaba and Jalapa increased as a new route between Cordoba and Veracruz, via Paso del Macho and La Penuela was established (Siemens 1990, 100). With the establishment of *ferias*, or fairs at Orizaba and Jalapa, merchants wanted easier access to their areas to increase their trade potential with the coast (Spain) and the Capital. The Orizaba route was shortened and its new alignment made it less susceptible to seasonal flooding. Although this would presumably render it more attractive, the Jalapa road continued to be better maintained and more travelled. A north-south route was established during the mid eighteenth century from Jalapa to Fortin through Pajarito, Tuzamapan, Pinillo, Huatusco and the *Barranca de Jamapa* located between Huatusco and Coscomatepec (Martín 1943, [1805] 157-162). It crossed the grain of the *barrancas* and we can safely assume that it followed the pre-contact trail described by Mota y Escobar.

About the time Martín was recording the Jalapa to Fortin road, Corral (1864 [1777]) was preparing a map of the eastern lowlands. On his map, rivers and roads are not clearly defined, but three main east to west trail routes can be discerned. The first is the Veracruz to Jalapa road, as it travels near the *ventas*. A second road

leaves Veracruz and heads towards Acazonica and eventually San Martin (Santa Maria Tetetla). And a third route branches off twice as it heads from Veracruz to Cordoba; the route is first bisected at El Moral, heading southwest towards Santiago Huatusco (Huatusco), presumably rejoining the principle Orizaba route. Then it is bisected at a point just beyond Temascal to lead travellers almost directly to Cordoba. The main road, however, appears to head directly west towards Orizaba. With eastern limits of Jalapa, San Martin and Cordoba, Corral provides no further elucidation of trail routes in the eastern hill lands. It is noticeable, however, that a trail route through Santa Mara Tetetla was in use; it connected the hill lands directly to Veracruz.

Humbolt based his work on Corral. Using Corral's maps, he clarifies some of the routes and in his *Atlas du Méxique*, he provides a map drawn in 1805 which clearly depicts the three east to west trails previously outlined by Corral (1969 [1812] plate 9). The first is the Jalapa road, which by this time includes a shorter segment from Veracruz, bypassing La Antigua to a point near Paso de Ovejas. The second main trail is the same as Corral's second trail, from Veracruz to Acazonica and San Martin. Humbolt, however, traces the route to a further location onto the slopes through Totutla and eventually San Bartolomé, linking the upper reaches of the hill lands to the port. Other than a church existing at San Bartolomé, explanation for the route's directness remains unclear. The third route traced by Humbolt does not appear to branch off at El Moral, although this may simply be

an omission. It does, however, branch off at the same point as Corral's, beyond Temascal towards Cordoba with a main segment heading relatively directly east through Coscomatepec and eventually the Pico de Orizaba. Interestingly, Humbolt annotates this road segment as a "*route par laquelle on porte la neige du Pic d'Orizaba à Veracruz*", suggesting a service route by which snow and ice were transported to the port, presumably for the safe transport of perishable goods either inland towards the Capital or to Spain.

By the end of the colonial period the two main routes through Orizaba and Jalapa were fully integrated within the national economy. The Veracruz to Jalapa road was the well maintained principle path to the Capital, providing relatively rapid access inland or to Spain. And the Veracruz to Orizaba route, although poorly maintained, was increasingly utilized by mule trains and *cargadores* for cargo transport. Other routes located in the region between these two main axes also provided access to the slopes. The Veracruz to San Bartolomé and Veracruz to Pico de Orizaba routes provided relatively direct access to escarpment areas. And the two main axes were linked, according to Martín, by a trail route stemming from Tuzamapan, Pimillo and Huatusco. The slope areas became increasingly inhabited by *cimarrones* supplementing the existing indigenous population. Although Rees (1971) states that the "communities along the Sierra Madre slopes...[accessed] one or the other [main road via existing trails] to market products...rather than forge

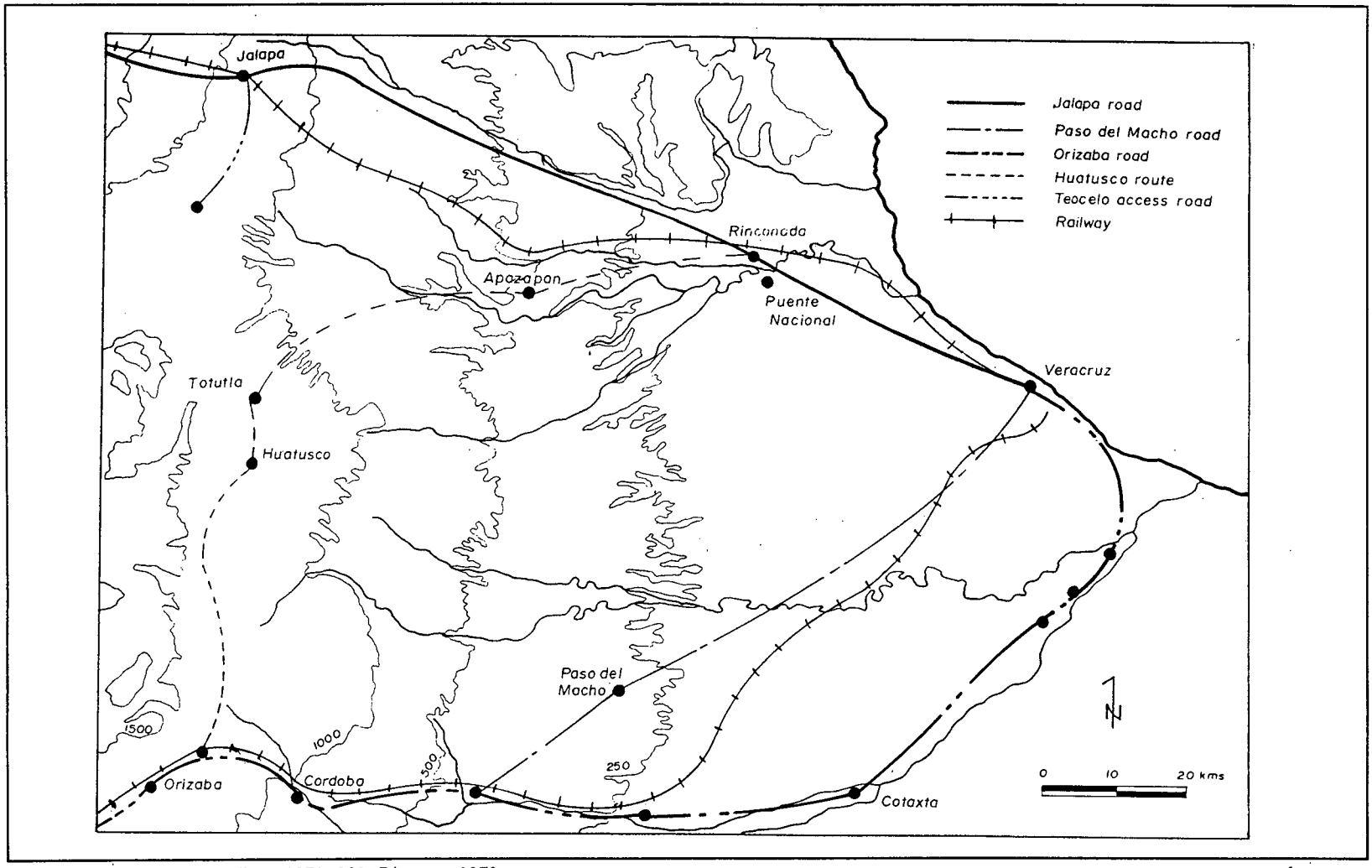
roads directly to the port" (210), the maps of Corral and Humbolt would seem to suggest that some secondary coast accessing roads leading to the slopes were present. Although long range transportation priorities between the coast and Capital thus became the focus, pre-existing trail routes continued to be utilized.

3.4 Nineteenth Century Transportation Network

The early nineteenth century saw a continued emphasis on the Jalapa *Camino Real*. The road was improved with newly constructed segments and a reoriented transect from Puente Nacional to Veracruz. The new bridge at Puente Nacional across the La Antigua river represented a major work which would shorten the Veracruz to Mexico City trek and render the detour through La Antigua unnecessary (Ringrose 1970, 48-50). The Orizaba route, on the other hand, suffered neglect; the Orizaba merchants pleaded to the colonial government for improvements. Segments were reoriented slightly in the areas of Paso del Macho as Cotaxtla traffic declined (figure 42) (Rees 1971, 260-62).

A increased focus on coffee and tobacco cultivation amplified the requirement for routes to Jalapa, Huatusco and Orizaba. And as with the late Colonial period, routes along the eastern slopes persisted. So important did tobacco cultivation become, that even where areas around Huatusco were disallowed from tobacco cultivation (the reason for this legal exclusion remains unclear but

Figure 42 - Nineteenth Century Transportation Network



sources: Pletcher 1950; Rees 1971, 302; Ringrose 1970.

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may be linked to monopoly-driven laws), "local people...[headed] into the mountains [to] grow the plant clandestinely" (Chavez Orozco and Florescano 1965, 25). Interestingly, this may be the *raison d'être* behind Sartorious' (1850) reference to "*reuniones clandestinas*" within *barranca* areas (826). Based on the increase in population which had begun during the late colonial period, an increase in cultivation was taking place. This intensifies regional travel and the need for better roads.

A new road was built through Huatusco, aligned out of Orizaba through Totutla, Apazapan and eventually Rinconada. The road ran against *barranca* orientation, and although its exact location remains unclear, we can be reasonably certain that it followed the Mesa El Limon, descending into the *barranca* south of Apazapan, crossing the Los Pescados river at Apazapan, and following the Los Pescados river to Rinconada. Tobacco could now be relatively easily transported from the slopes to Rinconada and on to Veracruz via the new route. And while the Jalapa road continued to be well maintained and the Orizaba was to some extent shortened, new technological improvements in the form of railway transportation were already revolutionizing European transport.

The escarpment area in particular had been subject to dangers of robbery and local merchant pressure on the authorities for the securing of the areas around Jalapa and Orizaba translated into rail construction (Robertson 1853, 302-03). The faster mode capable of replacing wagon and mule caravans was considered by the

colonial government for the eastern region (Pletcher 1950, 26-35). It is not surprising, therefore, to find that railway construction in the areas closest to the two commonly used passes at Jalapa (1873) and Fortin (1871) were selected for links between Veracruz to upper *mesa*. The rail lines were not completed until late in the nineteenth century.

The result of the new focus on rail was initially detrimental to the road network. De Vigneaux (1850), in referring to the Jalapa road states in a worried tone: "God knows the state in which it is found..." (2). Maintenance and new construction of roads halted as rail construction started, and because the rail lines tended to follow the east to west axes and could provide more efficient and cheaper rates, cargo was moved utilizing the rail lines (Pletcher 1950, 22-27). The general feeling of unsafe roads was echoed by an outcry, again from the local merchants, who gained sympathy from the post-1820 Revolution authorities who issued maintenance and reconstruction contracts during the mid century (Rees 1971, 255). But if the east to west Jalapa and Orizaba routes did not entirely favour long distance traffic, the rail lines certainly did. Few stops were planned for and little emphasis was placed upon the settlements in the area lying between the two main east to west routes until the later part of the century.

Various road sections were realigned and the railway network was sightly expanded, including a line south from Jalapa to Teocelo and a reorientation of the main Jalapa line through Apazapan during the 1850's and a line north from Fortin

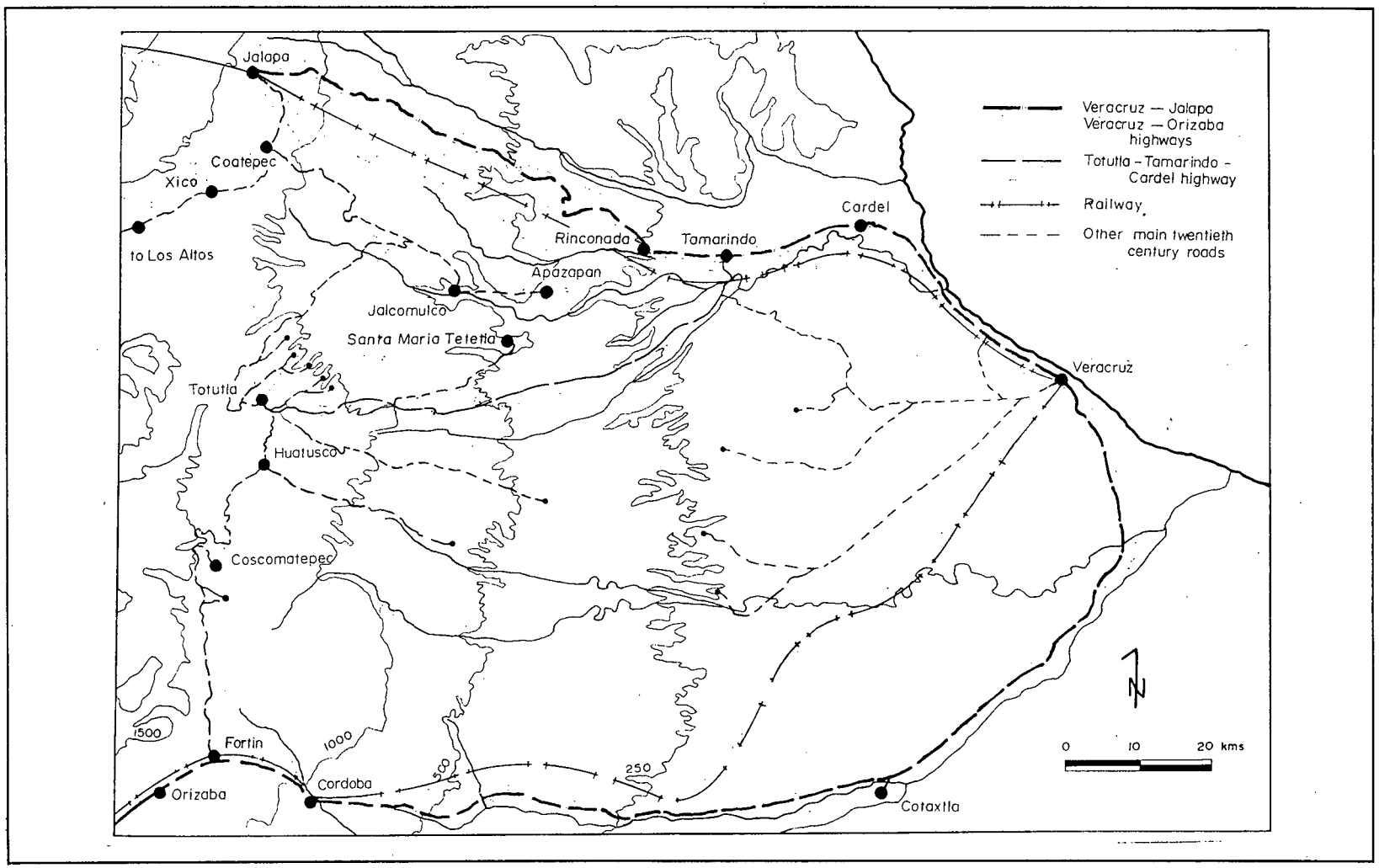
to Huatusco during the later part of the century (Rees 1975). Rees gives no source for the latter. The two east to west axes, however, were never completely joined by rail (Pletcher 1950, 26). The settlements along the slope areas thus joined the Teocelo and Huatusco terminals via the previously constructed roads and pre-existing trails, enabling coffee and tobacco to be transported by train to Veracruz.

4.5 Modern Transportation Network

The period of neglect in road construction and maintenance coinciding with new railway line assembly continued into the early twentieth century. By 1910 the Revolution was taking place; the lack of focus on road maintenance of the late nineteenth century continued and entire road and rail segments were destroyed by revolutionaries. The Revolutionary movement, seeing the rail lines as key elements in its disruptive campaign, had blown up various remaining segments. Until 1925, little attention was paid to roads. The railways, however, were almost immediately rebuilt (figure 43) (Pletcher 1950).

Thus a short period of railway reconstruction took place, mostly because infrastructure in the form of stations and steel rails was still, for the most part, intact (Hardy 1934, 249-52). The reconstruction involved little foreign financing and therefore little foreign control which represented a departure from the

Figure 43 - Modern Transportation Network



sources: Pletcher 1950; SPP 1982.

dmm

previously foreign controlled rail operations; the French and British had financed main lines with a clear focus on traffic between the port and the Capital. A regional, rather than long distance emphasis evolved out of the reconstruction period with regularized local stops (Delpar 1974, 519). The post-Revolution agricultural recovery, with cane and coffee being cultivated prompted the scheduling of local rail stops.

Although little road development took place prior to 1925, the National Road Program set off a construction period for the region. The post-revolution government wanted a renewed focus on *modern*, paved roads. Pavement, buses and lower freight and road travel costs competed with the railways (Delpar 1974, 519; Pletcher 1950, 30-34). Road transportation as the main mode of travel (for people **and** cargo) reappeared by 1930, with traits similar to those of the colonial and nineteenth century networks once again favouring long over short distance travel. With a renewed emphasis on road transportation, rivalry between Jalapa and Orizaba resumed and although this allowed for a period of reconstruction and represented a major opportunity to redirect road axes and flow, most new roads were simply designed to replace, in function and location, existing destroyed or neglected roadways. Although the reconstruction was politically independent of the past, with less outside influences, the same route location choices were made with the two east to west axes dominating (Rees 1971, 397).

A few new roads began to emerge within the eastern slopes, extending south

from Jalapa and Coatepec, and out of Fortin through Coscomatepec, Huatusco and as far north as Totutla. In effect these new roads resembled quite closely the Fortin to Totutla and Jalapa to Tuzamapan segments of the nineteenth century; the Totutla to Apazapan segment was no longer used, however as it was replaced by a segment still out of Totutla, but extending to Cardel. And the late colonial Fortin to Pajarito segment was also no longer used; it was not re-established until the late 1970's. By 1966, the *autopista* construction began and the long distance Mexico City - Veracruz focus is renewed. During the 1970's and 1980's, a trend of linking trail-linked settlements began taking place. Related to this study's region, for example, the main Totutla to Tamarindo and Cardel highway and more minor roads from Jalcomulco to Apazapan, Cerro Gordo to Xoltepec were all constructed during this period. And at the western extremity of the region, the Xico to Los Altos, through the original Middle Pass used by Cortéz was also made suitable for vehicular traffic.

In summary, three main points can be derived from this historical analysis. First, the main colonial routes, and eventually modern road locations were not predicated upon pre-contact routes. Rees (1971, 1975) and Burghardt (1969) have clearly shown this for Mexico and the Americas as a whole and it indeed applies to the Central Veracruz *barrancas* region. Second, as the region's transportation network developed, it involved primarily the construction of two axial routes stemming from Veracruz, utilizing the north and south Sierra passes, eventually

heading towards Mexico City. The two roads continue to be politically motivated where the focus is on the national economy, transporting goods from the port to the Capital and vice versa. National, rather than regional interests are served; the eastern slope region's volume of goods and individual human travel needs are outweighed by those of the nation. Although a north-south road link connecting Jalapa to Orizaba was constructed, few roads exist within the eastern slope areas. And third, at the end of each period, path networks persist throughout the slopes, connecting local communities to the main roads. During each period, routes tend to follow pre-contact trail alignments. The north to south Jalapa to Orizaba path has persisted since the pre-contact era. And trails continue to be used during this century as evidenced by agriculturalists delivering produce at strategic points along main roads (Hoffmann 1993).

While main national routes have taken precedence along the east to west axes, local settlement economies have continued to **improvise** routes by utilizing the persisting trails; this enables small settlements to participate within the wider regional economy.

Chapter 4 Summary and Conclusions

"*¡Veinte minutos!*" ("Twenty minutes!") Someone said I was just twenty minutes from Totutla; that was forty-five minutes ago. The trail curves south, then east, then back again towards the southeast with occasional forks splitting it into different directions. At each opportunity, I choose the one that seems most likely to keep me on a southeast path. The stone-lined trail leads me up some 200 metres, mirroring the river's opposite side. From the edge of the *mesa*, I begin to see a settlement in the distance...

Various means of explaining the *barranca* trails have been presented. Examining their morphology has shown that they are a planned and well engineered facility. Not surprisingly, ethnographic evidence outlines the trails as a facility providing a means to exploit physical resources; the resources are bound to the local subsistence lifestyle. Locally, intra*barranca* trails provide access to resources by facilitating intraregional social, ritual and work activities while inter*barranca* trails amplify these functions, providing for economic and intersettlement exchange. Surprisingly, travel distance less than three hours by foot are undertaken for most purposes. Distance is generally measured in time and topography is not a main factor in route choice. Trips beyond neighbouring settlements are planned within a foot-vehicular strategy where taxis, *coches* and buses are utilized to extend

travellers' reaches over the landscape. Similarly, most economic exchanges are carried out by utilizing a trail-road strategy.

Network analysis suggests that the trails are more than short-cuts and field access paths; settlements are linked, north to south and together with the east to west roads, the whole forms a web-like network allowing efficient movement strategies. Settlement accessibility and connectivity is virtually doubled when a trail-road strategy is employed.

Land use analysis further confirms that it is the trails that have and continue to enable *barranca* lands to be utilized to their potential. Even where roads have recently been built, trails persist, parallelling the roads. The more rugged the terrain, the more important the trails become. Ledges, overhangs and remote benches are accessed by small trails where cultivation is enabled. Along level surfaces at *barranca* bottoms, a variety of cultivation strategies is undertaken. The effort required to transfer crops to the upper east to west roads located on *mesas* is considerable and this is partly why more weight-valuable crops such as peanuts are chosen for the most remote areas of *barranca* bottoms. Cordons of brush are left along rivers, providing firewood, wild grazing and buffer zones, in the event of flooding. On the relatively flat *mesas*, cane is grown where road access is available; coffee is grown on the *mesas* where there are fewer roads or where the terrain is hilly or rocky.

The importance of trails, therefore, is one which is bound to the juxtaposition

of different terrain types combined with social functions. Specific land use activities such as irrigation and gardening are enabled, and social and ritual functions, linked to crop planting cycles take place at strategic trail locations. All of these functions are in turn linked to economic activities, eventually promoting interregional exchanges. Local communities exploit resource zones not only near their settlements, but with the use of trails, they also utilize available lands within seemingly inaccessible *barranca* areas.

Historically, the routes of the eastern hill lands have persisted since the pre-contact era. The trails can be seen as primal, and although hypothetical, many of the routes would have had to exist along the same axes as today's trails. Settlement connectivity during the pre-contact era through the colonial and modern periods clearly suggests this. Interestingly, Aguirre Beltrán (1967; 1991) suggests that although the colonial government controlled these marginal areas with *haciendas*, the areas have maintained a "traditional" character, based to a large extent on a link of today's cultivation techniques with those of the past (Aguirre Beltrán 2-11; 183-92). Other scholars agree with Aguirre Beltrán (Brush, 1987; Kirby 1973, 28). Indeed, as we have seen, *traditional* cultivation practices still take place, even where coffee and cane are the main widespread crops. In fact, the pattern that began as a response to post-contact society dominated by Spanish and eventually national elites, was one where culture "pockets" became established within areas considered less desirable, or marginal, by the elites. It is perhaps because of this perceived

marginality that land use within these areas became maximized with a series of adaptive strategies including trails and traditional cultivation techniques.

The *barranca* trails require more research. Their extent within the landscape is obviously broader than work in the limited study area around Huatusco shows. Archaeological excavation in selected areas would probably confirm trail existence since pre-contact times. Selected excavations at strategic locations such as rock shelters, narrow trail passes and stone lines or other "built" features would undoubtedly confirm long-standing area occupancy; the many caves along the routes, for example, almost certainly had their role in not only the pre-contact era, but throughout the colonial and modern eras.

In terms of route network analysis, research is required to elucidate the trail information contained in the various *relaciones*. Past settlement and route links must be established in order to provide a clearer understanding of the lowland-*barranca*-highland links of the pre-contact era.

We have inherited a view of a *marginal* barranca region. Aguirre Beltrán (1991) suggests in his *refugio* hypothesis that refuge regions can not only be marginal in terms of their physiographic nature, but more importantly, marginal in terms of social, economic and political parameters, relative to Mexico as a whole. While this seems clear, *marginality* must be understood in terms of a perceived, inherited notion: A new paradigm is required that looks beyond topographic determinism; the region which has been seen (since the early colonial period) as

"limiting" due a perception of physiographic complexity is made up of a trailscape characterized by connected settlements, cultivation fields and people. Only by considering these and other features as a whole will an understanding of the region's circumstance be attained.

"*¡Totutla!*" The town lies along the main Jalapa to Orizaba highway, some 90 kilometres north of Huatusco. On the outskirts, people can be seen walking along the roads, sometimes seemingly disappearing as they turn towards the less apparent connecting trails. Closer to town, buses arrive from the dirt roads and the paved highway, each with full loads of passengers. At the town's centre, taxis pick up and drop off passengers with bags of produce while private *coches* stop in front of the *farmacia* to collect prescriptions for people who presumably stayed home. Through the shop windows, one can see people anxiously waiting as their sacks of coffee beans, maize and other produce are being weighed. At the *zócalo*, friends meet, exchanging news and rekindling friendships. Today is market day, just as it has been for hundreds of years...

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