Geography of the Río Mayo

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RIVERS AND TRIBUTARIES

The Río Mayo is one of the principal rivers in the state of Sonora, Mexico, originating in the Sierra Madre of western Chihuahua and discharging into the Gulf of California 40 miles north of the boundary between Sonora and Sinaloa. The area of its drainage basin is approximately 6,800 square miles. The boundary of the basin is a ragged line following the mountain divides which separate it from the Río Yaqui watershed on the north and from the Río Fuerte watershed on the South. The general direction of its long axis is northeast by east from its mouth. Though the area includes parts of two states, it constitutes a definite geographic area highly convenient for biological studies. It is a northern cross section of the poorly known barranca region of western Mexico, the northern limits of which lie in the valley of the Río Yaqui to the north.

On the broad coastal plain the Río Mayo becomes an intermittent stream with its flow of water partly subterranean. Its bed is a broad expanse of white shifting sand, through which the stream wanders when its discharge is sufficient to carry it over the sands as well as below them. In time of floods, which come in late winter and more heavily again in summer, it overflows its broad shallow channel and deposits alluvial pockets of silt. In this respect it is a Nile river, enriching the adjacent agricultural lands. Except for a short period in the fall and another in the spring, travelers must depend on the small ferries to cross the Río Mayo at Navojoa. The river in its upper reaches through the foothills and mountains ordinarily carries a flow, highly variable in volume, throughout the year. This fact is due to the proximity of bedrock and a consequent shallowness of sand. Short rapids commonly alternate with long,
quiet pools backed against high basaltic or conglomerate cliffs. Between San Bernardo and Chorijoa the river cuts through a hill of basalt between steep cliffs and with no alluvial shelf. Among the large rivers of the west coast the Río Mayo is exceeded in length and flow of water by its two neighboring streams, the Río Yaqui and the Río Fuerte.

The principal tributaries of the Río Mayo are the following:

The Río Cedros, the first northern arm, drains the Quiriego-Tesopaco area, eroding the surrounding volcanic slopes and, in the Tesopaco area, channeling Tertiary lake sediments of clay. At Quiriego the channel is a valley 2 miles wide with the actual stream running intermittently on the east side over very coarse rock and gravel. Agriculture by irrigation is found along the river valley.

The Arroyo Guajaráy carries the heaviest surface flow of all the lowland tributaries of the Río Mayo, and one that is relatively great as compared with that of the parent river. This fact is due to the constant volcanic bedrock over which it flows. Coarse gravel bars are moving inevitably down the stream beds, propelled by clear water rushing over them continuously. Alternating with these shallow rapids are long pools, sometimes a mile in length, commonly 75 to 150 feet in width and reaching the depths of 20 or 30 feet. The stream is bordered for most of its length on one side or the other by volcanic cliffs, often several hundred feet high. There is very little riparian land and a consequent dearth of inhabitants. The stream drains, in its origins, a comparatively large area of oak savannah.

Arroyo San Bernardo [Arroyo Taymuco] drains a small part of the Sierra Charuco (southwestern) and the west side of Sierra Saguaribo. Its tributaries are many and complex, cutting deep canyons back into the sierran axis. The whole system consists of arroyos bedded with sand, with occasional alluvial margins of soil, and traveling boulders which increase in size and number toward the headwaters. The Arroyo de los Mescales, Arroyo Gochico (Wochico), and Arroyo de Corohui also carry water the year round over a considerable part of their courses. In others, springs and seeps are commonly found during the dry periods.

Arroyo de Loreto cuts a profound canyon between Sierra Charuco and Sierra Canelo and hurries down from the highlands in the vicinity of Loreto. In the “tierra templada” (temperate land) it is a stream of constant flow; in the “tierra caliente” (hot land) it relapses into the typical arroyo, with its water running under a cover of sand except in flood seasons. All along its narrow lower reaches it provides little if any margi-
nal soil, being but a winding trough in wild, precipitous mountains.

Arroyo Güicorichi drains Cerro Güicorichi on the west and part of Sierra Canelo, and enters the Río Mayo a few miles below Carimechi.

At Carimechi three short canyons from Sierra de la Ventana and Sierra García enter the river. These are called by the natives, beginning with the lowest, Cañon Narcissus, Cañon Salitrero (so named on account of a cave containing deposits of potassium nitrate), and Cañon Carrizo.

Arroyo Barbarocos enters the river at San Luis Barbarocos and cuts deep canyons back into Sierra García and Sierra Oscura ("Escura"), which it partially drains.

The Río Babanore or Arroyo de Bermudes also forms profound canyons, several thousand feet in depth, as it cuts back into the Upper Mayo Plateau.

The Río Batopilillas, uniting with the Arroyo de Santísismo, drains a broad basin which, although in a young topographic state, contains steppe and oak savanna and is surrounded by mountains reaching elevations over 8,000 feet. I have been unable to find the Río Batopilillas on any map. When I crossed its meandering course near the village of Batopilillas in the summer of 1936, it carried a smooth flow of water 2 feet in depth and 50 to 60 feet in width. It issues from the valley through a gorge of massive igneous rock, below which it probably assumes the character of a rapidly falling stream. It enters the valley tumultuously through another rocky gorge.

The Río Moris and the Río Candameña are the two principal northern tributaries. These with the Río Babanore drain high mountain masses of the Sierra Madre proper. On the Río Candameña between Basaseáchic and Cajurichi is a high waterfall, the Cascada Candameña, which the natives claim to be the highest in the world. It is reported to fall out of the tierra templada into the tierra caliente (from Pine Forest to Short-tree Forest), which would indicate a drop of about 3000 feet. [Actual drop is 240 m, 850 feet.]

MOUNTAINS

There is no general name for the mountain mass in extreme western Chihuahua above the Río Mayo, hence I have referred to it as the Upper Mayo plateau. Except for my brief stay on its western edge at La Mesa Colorada, it has never been visited by biologists. On the west it is bor-
dered by a spectacular basaltic escarpment, the Guajaray Rim, rising one
to two thousand feet above the oak country. It is thus a distinct line
between Oak Forest and Pine Forest. The oak region is in a stage of
physiographic maturity, and, except for occasional volcanic cones foot-
ing the rim, presents gentle rolling contours of grassy oak savanna cov-
ered with a coarse calcareous soil. The plateau region is riven with great
canyons, their depths revealing a heterogeneous virgin forest of great
beauty, which in September appears more tropical than temperate.

Running southward from the Upper Mayo Plateau is a mountain axis
carried on in turn by Sierra Oscura and Sierra García, and ending in the
long, attenuated, knifelike high ridge of Sierra de la Ventana. This range
has blocked the Río Mayo on the west and turned it southward.

The southeastern boundary of the Río Mayo basin is formed, from
north to South, by Sierra Cajurichi, Sierra Chuchupate, Sierra Canelo,
Sierra Charuco, Sierra Saguaribo (Sierra Chiribo), and Sierra de Alamos.
The general direction of the axis from the Sierra Madre is southwest,
with its lower tip turning southward. Floristically, Sierra Saguaribo is
the most interesting of these mountains, for it supports the greatest
number of species in a wide range of relationships. Though it is adjacent
to a generally arid region, it contains many forms which are related to
those of tropical or subtropical environments. Its flora is partially rep-
resented on the Sierra de Alamos, an isolated peak of small area and less
favored with soil and rainfall. Tepopa and Curohui, on the northwestern
lap of Sierra Saguaribo, display a highly varied and interesting flora.

Sierra Sutucame, like the Sierra de Alamos, is an isolated peak with
pines on the summit. Its area is larger than that of Sierra de Alamos,
and since it remains unvisited, the exact relationships of its flora are
unknown.

Though the entire Mayo Valley is forested, it is in a stage of moderate
degradation. The river is eating back into the central plateau and in time
may rob the Río Yaqui of part of its drainage area, particularly the tribu-
taries Tutuaca and Papagóchic. Such a capture would be favored by the
fact that the course of the Río Mayo offers a more direct outlet with a
consequently steeper gradient. The only features known that resemble
lakes are one small playa high in the Guajaray country, another in the
“hanging” valley of Guasaremos, and the mineral-spring lagoon at Agua
Caliente, north of Alamos along the bank of the Río Mayo. In none of
them does the area of inundation exceed 20 or 30 acres.

The slopes of the canyons commonly rise at an angle of 30° to 60°,
bearing loose soil, talus, humus, and rocks of unstable position. The greater part of the area is volcanic and limestone. Basaltic rocks break quickly under the action of sun, temperature, and rain. Roots quickly gain access to cracks and contribute materially to the weathering and degradation. The limestones are variously soluble in water, erode comparatively rapidly, and contribute the calcium common in the argillaceous soils. Normally the streams are clear, but in rainy seasons the waters are gray or brown with vast loads of organic and soil particles.

THE BARRANCA REGION

The barranca region may be defined as the precipitous belt along the west coast in which the rivers have eaten back into the central plateau. To the south, in Nayarit and Jalisco, it is coastal; to the north in Sonora it lies inland, separated from the sea by a distance of 75 to 225 miles and several ranges of low mountains. It is, in effect, a long, narrow, intermittent strip of land, across which the rivers and tributaries cut, forming an infinite number of salient corners jutting into the eastern highland. Because of these conditions it must remain a roughly designated area, without clear-cut and distinct borders. The name "barranca" designates the area and describes its nature better than any other term that has been suggested.

In the Río Mayo region the barrancas are entered immediately east of San Bernardo. The traveler soon finds himself surrounded by the innumerable ridges flanking out from the major sierran axis. Except for the arroyo beds and their occasional margins of alluviation, there is no level terrain until the indeterminate mesas of the hilltops are reached.

GEOLOGICAL FORMATIONS

Aside from the major factors responsible for the formation of the Sierra Madre, the mountains of the Río Mayo region in their present outlines have been formed by volcanism, uplift, and erosion.

Judging from the volcanics in the vicinity of Tesopaco, the volcanic period appears to have been contemporaneous with lacustrine clays of the Upper Tertiary, probably Pliocene. Late Pleistocene fossiliferous caliche beds in the same vicinity carry considerable ash of riparian deposition. They have been undisturbed by volcanism, a fact which shows that they
followed the volcanic period, though rather closely. The volcanic period must have ended about the Middle Pleistocene. Near Sahuaro and Tablón, lavas have capped massive bedrocks of a dark volcanic breccia or agglomerate. Sierra Sutucame, Sierra de Alamos, and countless other smaller hills throughout the foothill area are of volcanic origin and flanked in many instances with conspicuous flows of lava. Stringers of rhyolite, andalusite, andesite, and porphyry are common across arroyo beds. On La Mesa Colorada and Sierra Saguaribo, lavas overlie massive limestones of marine origin. Calcareous gravels are common on the slopes of the oak zone. In the canyon of the Río Yaqui near Guaynopita, Hovey (1905) found nineteen successive flows of lava, a fact which gives an indication of the part played by volcanism in the northern barranca area.

Over much of the lowland area a dark, massive volcanic breccia is evident in exposures from Tablón and Sahuaro to the Arroyo Cuchujaqui; in the latter place water has worn a clear channel. Along with lavas and conglomerates, it often forms cliffs banking arroyos and canyons. Near Memelichi along the summit of the mountain eastward is a sandstone eroded into strangely convoluted and comblike shapes.

Limestone is common in the sierras east of San Bernardo, where it occurs in stalactites on canyon cliffs. In Sierra de las Colas, a hard blue limestone carrying fossil shells forms the core of the mountain, as may be seen in the exposure of a recent mining development, La Esperanza. A massive limestone also occurs in the sierras of La Mesa Colorada and Canelo, where it is evident in the sides of deep canyons, and thus appears to be a substratum of major importance. This may be the same stone that Hovey (1905: 539) mentions: “Waterworn fragments of bluish limestone occurring loose in the river gravel terraces of the canyon of the Mayo (Río Moris) prove the existence farther upstream of marine beds, apparently of Cretaceous age.”

Granites are relatively scarce. Decomposed granite is to be found at the eastern foot of Sierra de Alamos, again on the mesa near San Bernardo, and in other lowland localities. In the Arroyo San Bernardo [Arroyo Taymuco] and its tributaries granitic boulders are common, and in the Arroyo de los Mescales, between Mescales and Jecopaco, the canyon stream has exposed stringers of a hard granite. In Sierra Canelo granite appears on the surface. At Canelo it shows a peculiar grooved surface, suggesting glaciation.

Hovey makes further comments on the geology of the northern Río Mayo country (1905: 539–43). In the canyon of the Río Moris, he found:
The dark blue conglomerate is massive, hundreds, if not thousands of feet thick, is tilted at an angle of about 15 degrees towards the southeast, and is separated from the later overlying beds by a long erosion interval, during which there was considerable deformation of the conglomerate. We propose to call this formation the Navosaigame. . . .

The trail led out of the Mayo canyon over the Cumbre Potrero into the Arroyo Rosario, which is tributary to the canyon in which Ocampo is located. The region is one of decomposed tuffs and lava beds lying unconformably upon Navosaigame conglomerate, and the whole series is cut by dikes of all sizes. . . .

The journey to Minaca (from Ocampo) lies over the high mesa at altitudes from 6,000 to 7,300 feet above the sea. The mesa is partly dissected by the headwaters of the Río de Mayo, the Tutuaca, the Verde and their tributaries, and north northwest-south southeast ridges rise from 1,000 to 2,900 feet above the general level. The highest points are said to be about 9,000 feet above tide. Extensive flows of basalt are associated with beds of rhyolite, andesite, and tuffs. Beds of sandstones apparently old mesa formations dip toward the northeast at an angle of about 20 degrees.

Aside from local conglomerates, Tertiary sedimentaries are represented by the following: "caliche beds" pocketed through the lowland and representing the Upper Pleistocene; the Tablón and Río Cedros lake sediments (Upper Pliocene?), the latter beautifully stratified in anticlinal exposure of the river bank at Quiriego, showing limes, clays, and sandstones; stratified sediments in Los Tanques Valley (Pliocene?); and a few pocket exposures of tuffs and clays around the base of Sierra de Alamos.

Except for this local lowland intermission in the Upper Tertiary, the country has been in a state of erosion rather than deposition since earlier times, when the massive limestones and conglomerates were placed. Recent local alluviation is also being rapidly carried off, partly because of an erosive lowering of arroyo bedrock locally, and partly because of the general uplift of the coastal region now going on. Studies along the coast of Sonora and Baja California and the presence of shell in several of the lime beds indicate that the sea covered nearly the entire coastal plain in uppermost Pleistocene or lowermost Recent.

The Río Mayo slopes widen into a comparatively broad basin above San Luis Barbarocos. The topography suggests that at one time the river
may have been upheld to a meandering or even a lake level, by a massive core of intrusive rock, known as Sierra Bajura. Through this the river has cut a narrow gorge about two leagues below San Luis Barbarocos.

CLIMATE

The Mayo Valley lies in a region of moderate temperatures and of rainfall which is unequally distributed through the year. The range of elevation, from sea level to over 8,000 feet, is responsible for the great difference between lowland and mountain climate, which leads the inhabitants to designate these regions as the "tierra caliente" and "tierra templada." The primary influence of altitude on climatic conditions is strongly modified by the complex topography. The paths and behavior of rainstorms and the ascending and descending currents of air are profoundly influenced by the abrupt mountain ridges and deep canyons. Not only is there the great difference of climate between the coastal plains and the pine-clad summits, but very strong contrasts may be found in close proximity throughout the middle elevations.

The lowlands are annually subjected to long periods of drought and are nearly frostless. The climate of the lower mountain elevations is essentially semiarid, and the mesic vegetation found there owes its existence to the ever running streams, the moist alluvial margins, the moist soil of the lower slopes, and the shade afforded on mountainsides of northern aspect.

In the high mountains are evergreen coniferous forests, on the coastal plain is a stunted arid Thorn Forest, and between the two extremes are an infinite number of plant forms which have adjusted themselves to the numberless gradations of climatic and soil conditions.

Rainfall

Throughout the lowlands and mountains below 6,000 feet elevation the importance of the annual total of rain is overshadowed by its being chiefly restricted to two well defined seasons. These periods fall in the midsummer and midwinter. The heavy rains of the summer are called by the people "las aguas" and the gentler ones of winter "las equipatas."

"Las aguas" begin in the sierras, at Cajurichi and Canelo, and southward in the mountains of the Río Fuerte in May, but they do not reach San Bernardo and Alamos until late June (Dia de San Juan, June 24,
often bringing the first showers), and they first reach the low country of Navojoa and Cajeme (Ciudad Obregón) in July. These dates are based on two summers of observation, Mexican weather reports, and reports of the resident natives. Exceptions and local variations occur, which this paper does not attempt to treat, its purpose being rather to give a general summation of climatic features. The vegetation is another source of verification, for in traveling from Navojoa (lowland) to Sierra Charuco (highland) in the first part of July 1936, I found the vegetation in a progressively advanced stage of leaf and general activity. That of the Thorn Forest near Navojoa was still in the drought condition of late spring, that around Alamos was already green with new summer leaf, and that of the barranca forest beyond San Bernardo was even farther advanced, in almost a full spread of leaf. The corn at Alamos was knee-high, that at Algodones over head-high. Both had been planted following the first substantial summer rain and both were lowland varieties with the same requirements.

Observation indicates that the summer rains increase in proportion to altitude and distance from the coast. Clouds originate over the high mountains, which therefore receive the first precipitation. As the summer rainy period progresses, the storms spread widely out over the lower western area, until by August storm centers develop around outlying peaks, such as Sierra de la Ventana, Sierra Sutucame, and Sierra de Alamos. The Thorn Forest area, lying farthest from the center of the storms, thus receives the least precipitation, which is, as it were, a mere spillage from the heavy “rain sponge” to the east.

Thus the rainy season, which inaugurates the summer growing period, may be roughly computed for the four vegetative areas as follows:

**Period of Summer Rains**

<table>
<thead>
<tr>
<th>Forest Type</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorn Forest</td>
<td>July 10–September 15; 10 weeks</td>
</tr>
<tr>
<td>Short-tree Forest</td>
<td>June 24–September 15; 12 weeks</td>
</tr>
<tr>
<td>Oak Forest</td>
<td>June 15–September 15; 13 weeks</td>
</tr>
<tr>
<td>Pine Forest</td>
<td>May 20–September 25; 22 weeks</td>
</tr>
</tbody>
</table>

The summer rains tend to follow certain variable paths as they form and move out of the sierras. At Guasaremos they were observed to sweep most often along the western rim of Sierra Canelo. Bartolo Hernandez, a resident of the valley for twenty years, confirmed the observation, saying it was generally true from year to year. As the clouds began to
form in the late afternoon and the white films changed to dark, he would predict with variable success whether they would follow the sierran route or cross the valley.

The paths of the rainstorms often leave a marked impression on the vegetation. It was noticed at Bachaca in July that while part of the hill area northward was out in green leaf, a part of it remained in the dormant condition of the spring dry season, forming a strong contrast in the landscape. An instance of localized drought was observed in a small area crossed by the road 2 leagues southwest of Los Tanques, where during the entire summer of 1935 not enough rain fell to bring leaves to maturity.

The light rains of winter apparently move in from two different sources: directly from the sea (southwest), and indirectly from the north. Though the high elevations receive more rainfall, the storms are usually general over the area, so that all localities within certain altitudinal limits receive approximately equal amounts of precipitation. Because of temperatures, immediate plant reaction is least in the Pine Forest, greater in the Thorn Forest, and probably greatest in the Short-tree and Oak forests, where the temperatures are highest.

The only rainfall data available for the Short-tree Forest area are the author's measurements for the year from June 1, 1936 to June 1, 1937. The winter rain and the early summer showers were caught in a Sykes rain gauge in Alamos, and the rest was obtained in the barrancas, principally at Guasaremos. The rainfall figures obtained are: winter, 4.48 inches; summer, 14.64 inches; annual total, 19.12 inches.

On account of the lack of data it is difficult to compute rainfall for the different vegetational areas judging from the author's meager measurements, limited data from the Servicio Meteorológico Mexicano for neighboring localities, observation of storm trends, and the vegetation, the respective rainfalls may be estimated tentatively as follows:

<table>
<thead>
<tr>
<th>Rainfall</th>
<th>Winter</th>
<th>Summer</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorn Forest</td>
<td>4</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Short-Tree Forest</td>
<td>5</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Oak Forest</td>
<td>6</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Pine Forest</td>
<td>10</td>
<td>28</td>
<td>38</td>
</tr>
</tbody>
</table>
Temperature

The temperatures for the area vary from the extremes of the low country (tierra caliente) to those of the high country (tierra templada). For brief periods in the dry season temperatures may show a daily variation of 40° or 50°, reflecting a condition comparable to that in desert regions. During winter and the long summer months the daily fluctuation rarely exceeds and commonly remains near 20°. This evenness in temperature is highly advantageous to plant growth, particularly through the summer growing season.

The most equable and pleasant climates are to be found in localities in the Lower Pine Forest or the Oak Forest, as at Tepopa where banana and papaya trees grow at the same elevation as the lower pines. Yet in the valley of Guasaremos, 20 miles to the north and occupying a comparable position, frosts are of regular winter occurrence. The natives have unable to grow bananas and papayas there, though a league away in a Short-tree Forest canyon, on the same slope of the sierra, stands a thriving clump of bananas. This all indicates a local complex of conditions highly variable in nature, but playing an important part in the distribution and nature of the vegetation.

In the Thorn Forest frost occasionally occurs, and during the excessive cold wave of January 1937 frost struck into the Short-tree Forest region (Turnage and Hinckley 1938). Its effect was registered by the plants active during winter, such as Ficus, Guazuma ulmifolia, Ipomoea arborescens (flowers), and Albizia sinaloensis. No damage was detected in plants of the Thorn Forest and Short-tree Forest, which were in a leafless condition. Their winter dormancy is a habit fitting these plants to survive not only drought, but frost as well. The minimum recorded at Cedros for the freeze was 29°. Frost occurred during five nights, and no doubt minima 2° or 3° lower occurred in many neighboring localities.

Old dead tops of Pithecellobium dulce, Ficus cotinifolia, and other trees are commonly seen in the low country and appear to represent frost visitations of earlier years.

In Sierras Saguariibo and Charuco snow is practically unknown, but it falls regularly in the sierras from Loreto eastward and over the Upper Mayo Plateau.

Temperature records, other than those of the writer, are not available for the Río Mayo. The Richardson Construction Company, of Ciudad Obregón, has, however, kindly made available data for various localities
in the neighboring Río Yaqui watershed. Using these figures with my own, it is possible to make an approximation of temperature conditions for the four vegetative areas during the summer growing season. To obtain a general figure, the means between recorded extremes for the summer have been computed. Thus, at Tepopa, in the Oak Forest, the maximum reading obtained was 87° and the minimum 61° F, from which an average of 74° was computed.

### Temperatures for the summer growing season, “Las Aguas”

(\textit{in degrees Fahrenheit})

<table>
<thead>
<tr>
<th>Forest Type</th>
<th>Max.</th>
<th>Min.</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorn Forest</td>
<td>105</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Short-tree Forest (San Bernardo-Guaseremos)</td>
<td>102</td>
<td>63</td>
<td>82</td>
</tr>
<tr>
<td>Oak Forest (Tepopa-Guasaremos)</td>
<td>87</td>
<td>61</td>
<td>74</td>
</tr>
<tr>
<td>Pine Forest (Canelo-Memelichi)</td>
<td>84</td>
<td>51</td>
<td>68</td>
</tr>
</tbody>
</table>

#### Wind

The ground winds of las aguas are highly variable in direction, velocity, and frequency. They ordinarily accompany as a direct prelude the afternoon thunderstorms, and at such times reach considerable violence. On crossing the plaza in San Bernardo during the start of a thunderstorm, I found after I had gained the shelter on the other side that my hair contained as much dirt as water. The rain, striking the ground furiously at a sharp angle, raised loose soil, which, caught by the wind, was carried onward and upward with the air. The thunderstorm is usually followed by gentle nocturnal breezes cooled by the day’s rain.

During the fall the air moves in sporadic gusts, which seem to have no other direction than that of the colored autumnal leaves they disturb and carry downward from the trees. They suddenly startle the great infinity of forest silence into a local multitudinous rustle of descending leaves, of flapping paper-like copal bark, of rubbing branches, only to drop as suddenly back again into a pervasive silence.

Out of the sea in the spring come the westerlies which blow over the coastal valleys and the Thorn Forest. They are hardly felt over the Short-tree Forest, for the outer ranges buffet the winds aloft and they gain little purchase against the canyon sides and bottoms. On the plains the...
forest stands withering under the clear sun, until nearly all but the riparian plants are stayed into a spring dormancy. The arid breath of the westerlies aggravates the dry season and increases the transpiration of the plants, and during its continuation many of the deciduous trees shed the last of their leaves: *Acacia cochliacantha*, *Guazuma ulmifolia*, *Ficus cotinifolia*, *Quercus albocinta*, *Q. tuberculata*.

**ROAD AND TRAILS**

The Río Mayo country may at present be entered by automobile from the east and from the west. The eastward route lies through Chihuahua, and may be followed from Chihuahua City by proceeding westward via Guerrero to Basaseáchic. The condition of the road from Guerrero to Basaseáchic is primitive, and difficulties are encountered by cars with little under-clearance. Basaseáchic is in the high mountains of the Río Mayo headwaters, and farther travel proceeds by foot.

The natural entrance to the Río Mayo country is from the west. From Nogales south to Guaymas, a distance of 285 miles, there is a nearly complete graded gravel road, which can be covered in one day. From Guaymas to Ciudad Obregón (Cajeme) there is a very slow road, running in many parallel tracks across the coastal alluvium. A cloud of dust often trails and envelops the traveler, of the fineness of powder, entering everything that is not airtight. Care against it should be taken for equipment, such as cameras and films. Travel on this stretch during July, August, and the first half of September is uncertain because of the rains, which turn the road into a mire. Motorists often put their cars on a flat-car and so travel the distance by rail. From Ciudad Obregón to Navojoa the road improves.

The road from Navojoa to Alamos and San Bernardo is open throughout the year. It is of course also visited by summer rains, which cause local washouts, but since the roadbeds contain more gravel than clay, travel is very little hindered. From Navojoa, a railroad station, mail and passenger busses run daily to Alamos and, beginning in 1936, to San Bernardo also.

From San Bernardo, lying at the foot of the mountains, all travel is by mule or by foot over mountain trails. Because of the coming and going of the natives, trails are a labyrinth over the wilderness and thus provide a way for visiting any point, no matter how remote. Guides are essential,
and one can find them in San Bernardo. Animals may be hired from Don Juan Argüelles or Renalda Matan at 1.00 to 1.50 pesos a day, and these people will also recommend or furnish guides. One should go prepared for rough riding over rocky mountains. Side trails are usually crowded by brush, "monte," and low limbs.

Two dangerous trails are to be mentioned: the lumber trail down Sierra Charuco to Algodones, which is precipitous, full of loose rock, and with precarious footing; and one in the narrow, steep defile ascending Sierra Saguaribo above Tepopa. Either is perfectly safe by foot, but loaded animals may fall and be lost. [In 1993 Southwest Center-sponsored researchers found a dead mule that had recently fallen off the Tepopa trail.]

REFERENCES
