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# Ecuador

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NATIONAL INTELLIGENCE SURVEY

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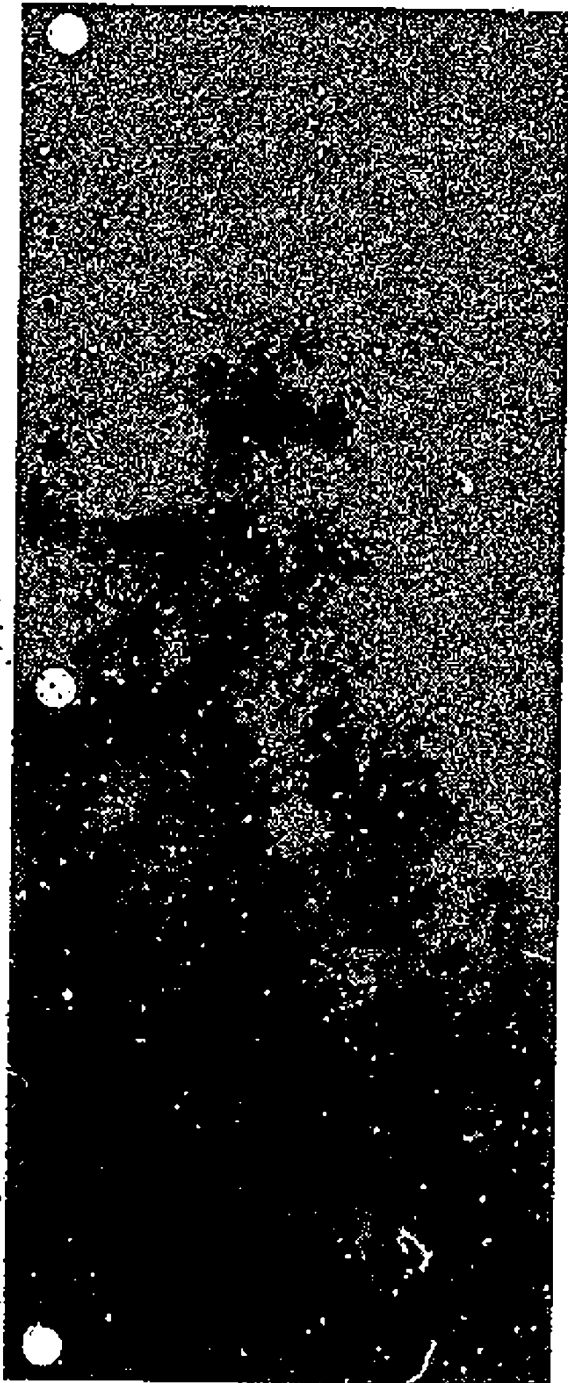
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## Military Geography

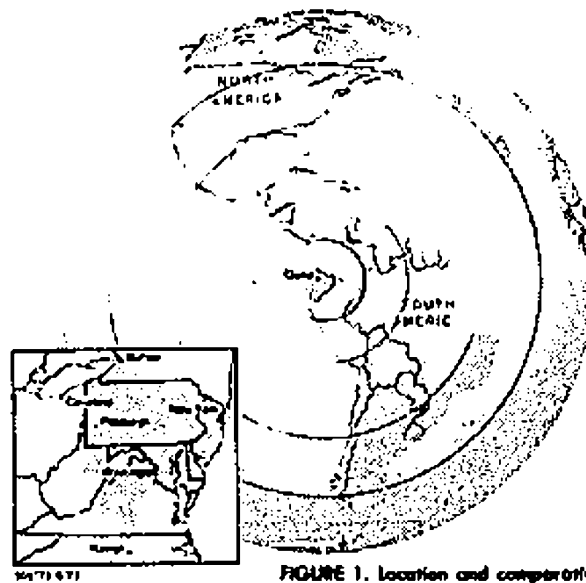


FIGURE 1. Location and comparative area (U/OU)

### A. Location and description (U/OU)

Ecuador is on the northwestern coast of South America between Colombia and Peru and includes the Galapagos Islands in the Pacific Ocean about 600 nautical miles to the west (Figure 1). Northern Ecuador is slightly less than 300 nautical miles from the Panama Canal and about 700 nautical miles from the oilfields of western Venezuela. It is primarily a densely forested, fairly rugged country crissed by numerous streams and is one of the least developed nations in Latin America.

Including the Galapagos Islands, Ecuador has an area of 100,000 square miles, slightly smaller than Pennsylvania, Virginia, and West Virginia combined. The maximum dimensions are about 400 miles<sup>1</sup> east-west and 450 miles north-south (Figure 2). The Galapagos Islands, which have roughly 3,000 square miles of land surface, extend 175 miles east-west and 150 miles north-south. The largest of the islands is about 50 miles wide at its widest point and 80 miles long. The population of Ecuador is 6,600,000, almost

<sup>1</sup>Distances are in statute miles unless nautical miles are specifically stated.



FIGURE 2. Vegetation (U/OU)

one-third that of the Pennsylvania-Virginia, West Virginia area.

### B. Topography (U/OU)

Mainland Ecuador consists of three contrasting topographic regions: a tropical lowland in the east, an irregular belt of plains and hills along the coast in the west, and, separating these two areas, a broad band of north-south trending highlands containing volcano-studded mountain ranges and a series of elevated intermontane basins. The Galapagos Islands are made up of several large and many small, generally and volcanic islands.

The eastern lowlands, a region of flat to severely dissected plains, is a continuation of similar regions in Colombia and Peru, all of which are part of the extensive Amazon Basin. Surfaces are predominantly flat to gently rolling but are dissected near the highlands in the west. The plains are mostly less than 1,400 feet above sea level, and local relief (difference in elevation between tops and bottoms of adjacent topographic features) is generally less than 150 feet. Slopes in most of the region are less than 10%, but in some areas of dissection slopes are 10% to 30% and locally more than 45%. The plains are drained by many eastward-flowing streams, several of which are large. Most streams are more than 7.5 feet deep during the low water periods, mid-August through September and early January to mid-March; locally, shallower stretches exist in upper reaches and where silting occurs. Streams are generally more than 250 feet in

width, a few are over 300 feet wide throughout their courses. Flooding may occur at any time of the year, and there are large areas of swamps along most major streams. The region is covered by a dense broadleaf evergreen rain forest (Figures 2 and 3). The few small settlements in these sparsely populated plains are generally nonexistent, and most transportation is by air or water.

The coastal plains and hills in the west, although only about 25 miles wide at the boundaries with Peru in the south and Colombia in the north, are nearly 120 miles wide in the central portion. The region is mostly flat to severely dissected plains. The discontinuous belt of hills (Figure 1), which increases in width and elevation toward the south, reaches its maximum extent in the Cerros de Colombe. The plains are mainly rolling to severely dissected bordering the hills and in the north but are mostly flat and poorly drained in the center and south. The area is drained by generally wide, deep streams flowing either south and west into the Golfo de Guayaquil or west and northwest directly into the Pacific Ocean; many are silt-laden in their lower courses. Much of the region west of Guayaquil has periods of severe drought (Figure 5), and stream courses may be dry for several years at a time. Most of the region is covered by dense broadleaf evergreen and deciduous forest, but there are large areas, generally west of a line between Guayaquil and a point slightly northeast of Manta, of thorn forest and scrub/dry forest with some grassland, and forest. Some parts of the coast, particularly a narrow belt that extends north from the Peru border,



FIGURE 3. Dense forests of tall broad-leaf evergreen trees cover almost all of the eastern plains. They form an almost continuous canopy, and undergrowth is commonly sparse except near streams and along the forest borders where it is extremely dense and consists of bushes and spiny-thumbed palm. The trees in these dense forests are 100 to 150 feet high, have trunks 3 feet or more in diameter, and have few branches for 65 feet above the ground. Construction timber is abundant but mainly of poor quality. (U/OU)



FIGURE 4. Groups of dissected hills are scattered in a north-south trending belt across the western plains. The hills shown here are east of Portoviejo; they rise 500 to 1,000 feet above adjacent valleys and are covered primarily by deciduous forests interspersed with grassy areas. (U/OU)



FIGURE 5. The plains and hills in the southwest are dry most of the year. Many areas are almost devoid of vegetation, such as the plains northwest of Playas shown here, or are covered by widely scattered thorny shrubs and small trees (background). The dry clay soils are firm most of the year. (U/OU)

another that stretches south from the Colombia border, and many islands in the Golfo de Guayaquil, are covered by mangrove swamp. Large areas in the lower part of the Rio Daule-Rio Vinces watershed, north and south of Guayaquil, are covered by freshwater swamp, and some plains are flooded seasonally. Cultivated vegetation consists primarily of banana plantations, ricefields, and small fields of cacao trees, coffee, sugarcane, and grain. The banana plantations line many of the principal roads (Figure 6), particularly in the area between Santo Domingo and Babahoyo. The population distribution is relatively sparse, the greater concentrations being along the main roads, in the areas of banana cultivation, and in the few cities of the region. Most other settlements are small. Most individual dwellings and buildings are constructed of split bamboo or rough wood planks, have thatch or sheet metal roofs (Figure 7), and, in low areas, may be on stilts. The newer, large buildings in the largest cities are of reinforced concrete. The larger cities and villages are connected by a moderately dense pattern of surfaced roads, but many of the roads are in poor condition; most small settlements are connected by earth roads, tracks, or trails. The railroad network is very sparse.

The rugged, generally north-south trending, hilly and mountainous portion of the highlands (Figure 8), a continuation of the highlands of Colombia and Peru, extends the entire length of the country and has a relatively uniform east-west width of about 120 miles. This area is composed primarily of two parallel, north-south aligned volcanic mountain ranges, the Cordillera Occidental and Cordillera Oriental, with flanking hills and, in the south, a complex of rugged

The dissonance on place names is the list of names on the opposite of the Military Geographic Factors map and the map itself.



FIGURE 6. Extensive banana plantations are scattered throughout the cultivated areas in the western plains. The plantations consist of closely spaced herbaceous plants 10 to 25 feet tall, shown here along the road between Santo Domingo and Babahoyo. In some places, the plantations are interspersed with gardens and areas of evergreen or deciduous forest. (U/OU)

mountains, secondary ranges, dissected hills, small basins, and alluvial valleys. Most of the area is more than 7,000 feet above sea level. Maximum elevations increase from about 13,000 feet in the south to over 15,000 feet in the north; the highest peak, Chimborazo, is 20,577 feet above sea level. Slopes are commonly over 45°, and local relief varies from 1,000 to 2,000 feet in the hills to 3,000 to 6,000 feet or more in the mountains. Many predominantly eastward- or westward-flowing streams drain the highlands. The larger streams are deeply incised, and streambanks may coincide with gorge and valley walls that may be several hundred to several thousand feet high and



FIGURE 7. Most of the small towns in the western plains and hills have buildings constructed of wooden planks or split bamboo and covered by thatch or sheet metal roofs. This village west of Ipipeza has dirt streets, a common feature in small settlements. (U/OU)



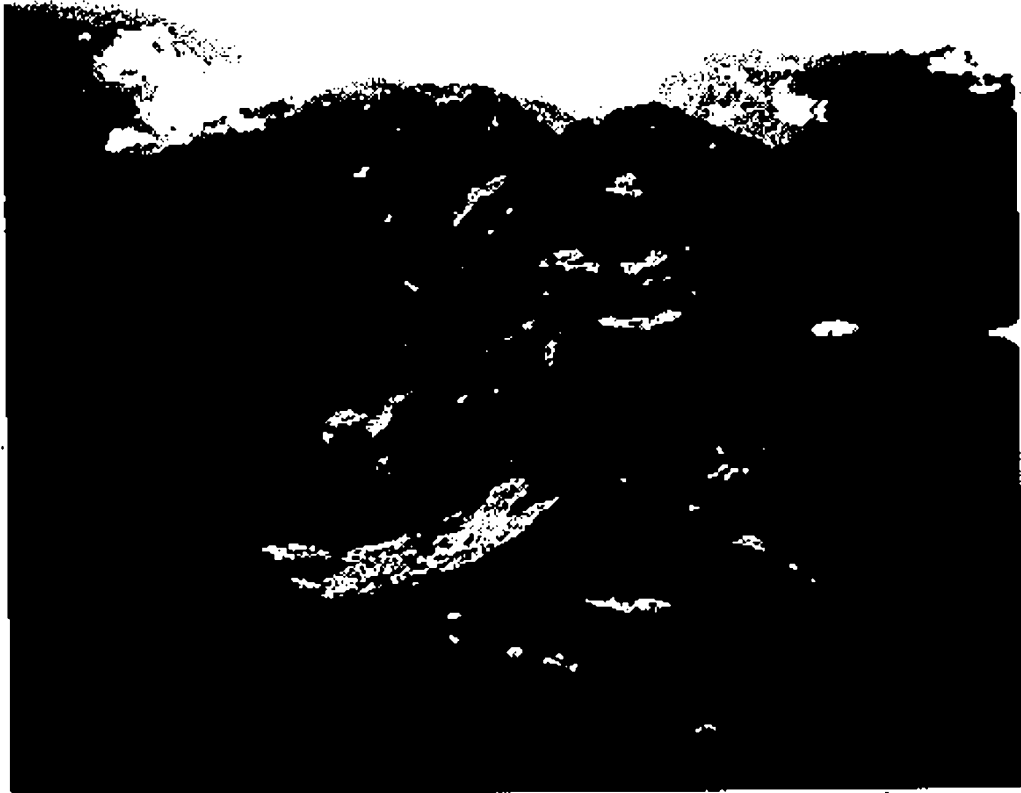


FIGURE 8. The Andes are rugged mountains composed of discontinuous sharp crests, deeply dissected slopes, and a maze of deep V-shaped valleys. Slopes are generally more than 45% and in places are nearly vertical. These sparsely inhabited highlands are covered by grass at the higher elevations and dense forest at lower elevations along the eastern and western fringes. (U/OU)

almost vertical. Nearly all streams are less than 3.5 feet deep mid-June through November on the western slopes and mid-August through mid-September on the eastern slopes. In the interior, streams are less than 3.5 feet deep early July through August and early January through mid-February. Most streams are between 60 and 120 feet wide at high water, mid-January through April on the western slopes and mid-June through July on the eastern slopes, but many are less than 60 feet wide all year, particularly in the upper reaches. In the interior, high water occurs mid-April through May and mid-October through November. The vegetation consists mostly of broadleaf evergreen forests at elevations below 10,000 feet on the western and eastern fringes of the area. Elsewhere, at higher

elevations and in the interior, the predominant type of vegetation is grass. The population of this rugged area is sparse, however, there are some settlements in the low small basins and valleys to the south. A sparse road network connects the larger towns, but most of the region lacks a surface transportation network. The railroad segments are in poor condition. Damaging, occasionally destructive, earthquakes may occur on the average of about once a year. In addition, hazardous physical phenomena include landslides, sometimes triggered by earthquakes or tremors, and volcanic activity with associated lava flows and mudflows.

The elevated intermontane basins of the highlands area are isolated and make up a relatively small part of

the country, however, they contain most of the dense population concentrations and large cities and towns in Ecuador. Together, the basins comprise a generally north-south aligned series extending nearly the entire length of the country. The northern and central basins are relatively large, closely spaced, and compartmentalized by volcanoes (Figure 9), volcanic outpourings, and deep gorges. In the south the basins are smaller and farther apart. The basins range from about 2 to 15 miles in width, 10 to 50 miles in length, and are between 7,000 and 11,000 feet above sea level. In most basins, slopes are less than 10% and local relief is below 300 feet, however, locally, there are areas of deep dissection, particularly from Ambato northward. Streams are mostly less than 60 feet wide during the high water periods, early April through May and early October through November, except for a few major streams that may be from 60 to 250 feet wide. Streams are mostly less than 3.5 feet deep during the low water periods, early January through February and early July through August, and some of the smaller streams are dry. Much of the land in the basins is utilized for either grazing or grain crops (Figure 10), the remainder

portions are grass and scrub covered. Structures in the larger settlements of these densely populated basins are generally constructed of stuccoed adobe or brick, and roofs are mostly tile or sheet metal. In the smaller Indian settlements and rural areas, structures are thatched or sod houses with thatched roofs. Most settlements are connected by a moderately dense pattern of surfaced and unsurfaced roads, and the basins are connected by the Pan American Highway, which extends the entire length of the country. A railroad connects most of the basins. All of the basins are subject to frequent earthquakes, often destructive or damaging.

The Galapagos Islands (Figure 11) are about 600 nautical miles west of mainland Ecuador and are characterized by jagged, arid coasts, porous, scrub-covered, or barren lava fields (Figure 12) and, in the interior of the larger islands, gently to severely dissected hills and volcanic mountains. Each of the five larger islands has one or more volcanic cones, the peaks of which range from nearly 3,000 to over 5,500 feet above sea level. Vegetative cover differs significantly with changes in altitude, eastern and



FIGURE 9. A complex system of intermontane basins trends north-south through the Andes. The basins have flat to rolling surfaces mostly in cultivated fields of small grains or in pasture. The basins are separated by hills or mountains; the one shown here is at the base of Cotacachi (19,344 feet), one of the highest peaks in the eastern Andes. (U/OU)



FIGURE 10. This large intermontane basin south of Latacunga has fields of small grains and pastures separated by hedgerows of low-growing shrubs or by trees. (U/OU)

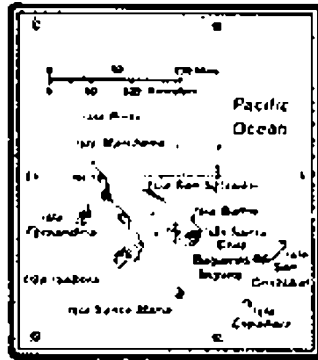


FIGURE 11. Galapagos Islands (U/OU)

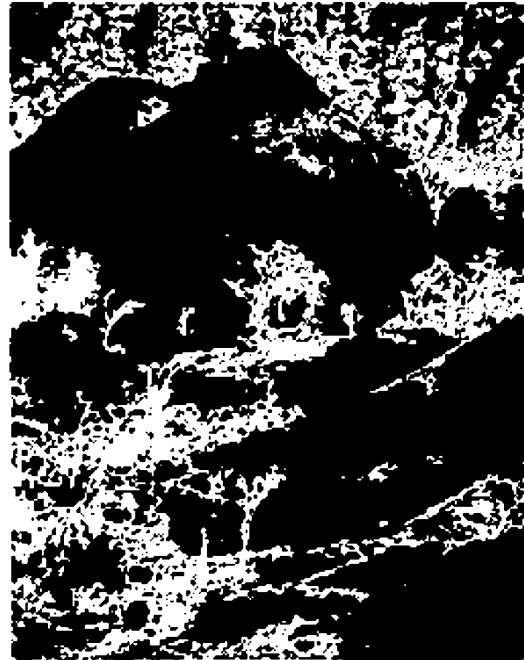


FIGURE 12. Rough, nearly barren, jagged lava fields are common in the coastal plains of the Galapagos Islands. The vegetation shown here consists of thorny shrubs and small trees. (U/OU)

thorn trees are predominant at lower elevations and dense forest is common above 700 feet, increasing in density at higher elevations where slope and depth of soil permit. The islands are sparsely populated, roads and tracks exist only on a few islands and are in poor condition, and there are no railroads.

**C. Climate (U/OU)**

The climate is extremely diversified despite the country's equatorial location. Different combinations of trade winds, ocean currents, and topography produce climates varying from tropical rain forest to tropical desert in the lowlands and, in the mountains, from temperate on the basin floors to tundra and polar at the highest elevations. For purposes of discussion, three very generalized climatic regions can be delineated, the coastal sections and west Andean slopes, the mountains, and the interior lowlands and east Andean slopes.

The climate in the coastal region is greatly influenced by two markedly different ocean currents. The warm southward-flowing Equatorial Current completely dominates the coastal waters in summer (December through February) and autumn (March through May) and the weak outflows imbore across

this current accumulate considerable heat and moisture. The result is abundant cloudiness and rainfall, high temperatures and high relative humidity, and scattered thunderstorms on the windward mountain slopes and hills. Mean monthly cloudiness varies between 60% and 95% throughout these seasons (Figure 13). Rainfall is heaviest in January through April, when normal amounts are 5 to 20 inches per month at most places except on the arid southwest coast. Thunderstorms occur on about 3 to 9 days monthly in January through May along the western slopes of the Andes and on some windward coastal hills; they are infrequent elsewhere in this region. Summer and autumn temperatures vary between mean daily maximums in the 80's (°F) and mean daily minimums in the low 70's. Relative humidity is usually high during these seasons, ranging between morning maximums in the 80's (°) and 90's and afternoon minimums in the 60's and 70's. The combination of high temperatures and high relative humidity produces a sultry, enervating condition which severely limits human activity, especially in autumn. Visibility is good in summer along the immediate coast, but, inland, summer visibility is frequently restricted by morning fog, haze, and showers. In winter (June through August) and

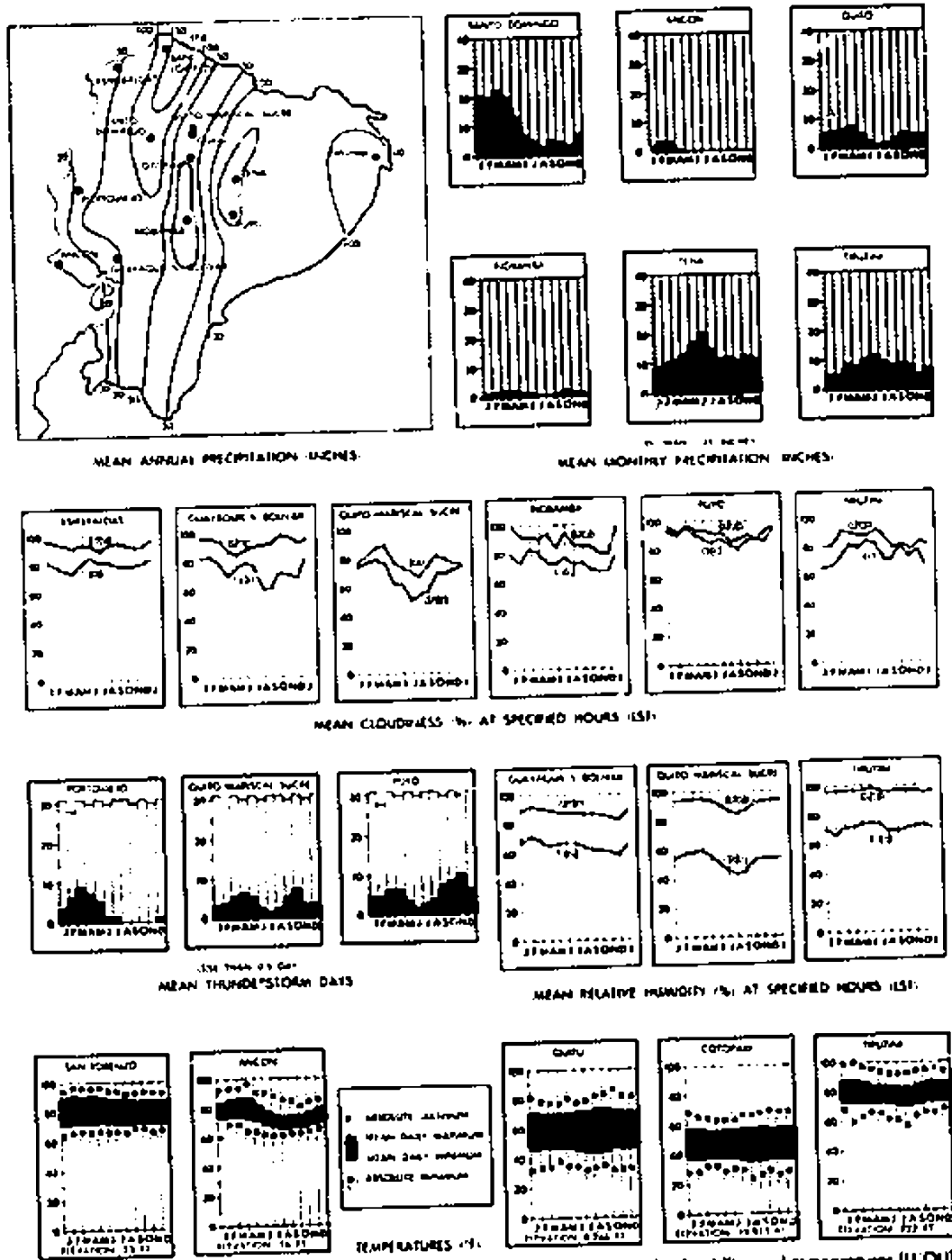


FIGURE 13. Precipitation, cloudiness, thunderstorm days, relative humidity, and temperatures (U.S.)

spring (September through November) the climate differs noticeably in some aspects. The cold northward-flowing Peru Current becomes the dominant influence and air moving onshore across these colder waters becomes more stable in the lower layers. The primary change is the greatly reduced rainfall in most sections. Temperatures in these seasons are lower, especially on the southwest coast where frequent incursions of low stratus off the coast also reduce visibility. Cloud amounts and relative humidity, however, remain high throughout and spring sea breezes are prominent along the entire coast in all seasons.

In the mountain region, large differences in elevation and exposure to winds cause many variations in the local climate. In general, the sections exposed to the prevailing winds are invariably cloudy and receive the largest precipitation amounts; these sections also have the greatest number of thunderstorms. Conversely, the leeward sections are practically cloud free and receive scanty precipitation; drought is common in these sections and thunderstorms are rare. Annual precipitation ranges from as much as 100 inches in exposed sections to as little as 15 inches in sheltered sections. Both temperature and relative humidity have a large diurnal range throughout the mountain region all year. In the intermontane basins mean daily maximum temperatures warm to the 60's (°F) or low 70's and mean minimums cool to the 40's or low 50's. Temperatures are much cooler at the highest elevations and some peaks have a perennial snow cover. Diurnal humidities vary between morning maximums in the 80's (5%) and 90's and afternoon minimums mostly in the 40% to 65% range; the lowest humidities are in the leeward sections. Fog and haze commonly restrict visibility in the evenings and mornings throughout the mountain region, but afternoon visibility is extremely good at most places. Mountain valley breezes and strong winds caused by the channeling of airflow through narrow passes or canyons are pronounced all year.

The interior lowlands and adjacent east Andean slopes have still another climate regime. Weak trade winds from the Atlantic Ocean traverse the Amazon Basin and arrive in this region laden with heat and moisture. This creates a hot and humid climate that is extremely oppressive and debilitating. Mean daily temperatures oscillate between afternoon maximums in the 80's (°F) or low 90's and morning minimums in the upper 60's or low 70's. Relative humidity remains fairly high, ranging from early morning maximums in the 90's (5%) to afternoon minimums in the 70's or upper 60's. Skies are cloudy most of the day. The

morning stratus burns off by noon and is replaced by cumulus clouds which rapidly build to great heights and release showers nearly every afternoon. Average monthly rainfall ranges between about 5 and 15 inches in the lowlands; monthly amounts are greater on the east Andean slopes where orographic lifting also produces fairly frequent thunderstorm activity. Morning fog and haze are the chief restrictions on visibility. Calms and light easterly winds prevail in all months.

The Galapagos Islands are subjected all year to the stabilizing influences of the southeast trades and the cold Peru Current. Skies are seldom either completely clear or overcast; stratus clouds are more prominent than cumulus. Moderate amounts of rain occur only on the windward slopes; rainfall is sparse over the flat sections and leeward slopes, giving semiarid conditions. The rather high humidity is alleviated by the steady winds and moderated temperatures. Thunderstorms are extremely rare, but fog and haze are common.

#### D. Military geographic regions (C)

Differences in terrain afford a basis for dividing the country into six military geographic regions—the Eastern Plains, Andean Highlands, Inter-Andean Basin, Western Plains and Hills, Central and Southern Plains, and Galapagos Islands. The combination of environmental conditions within each region would have a relatively uniform effect on military operations, but there would be marked differences between regions.

##### 1. Eastern Plains

Comprising about one-fourth of Ecuador, this region is made up of densely forested plains ranging from nearly flat in the eastern parts to severely dissected adjacent to the Andean Highlands in the west. Forest cover forms an almost continuous canopy in many places and only a few clearings exist, principally along the major streams. The population is extremely sparse, located almost exclusively in small Indian settlements in the cleared areas.

The Eastern Plains region is unsuited for conventional military operations and is one of the least favorable regions in which to conduct large-scale ground operations. The movement of vehicles would be precluded, and even the movement of foot troops would be slow and tortuous because of the dense forests, deep and wide streams, seasonally flooded areas, and the almost total absence of a road network. Construction of roads would be difficult in most of the

region, it would require extensive clearing everywhere, restricted alignments and much grading in the dissected plains, raised roadbeds in seasonally flooded areas along some of the major streams, and many long bridges. Concealment from air and ground observation would be excellent in the dense forests, and some cover from flat-trajectory fire would be available from the large trees. Surface irregularities would permit cover from bunker-type installations could be built in most of the region, but considerable construction effort would be required. Access to sites would be difficult, and much clearing would be necessary. Drainage facilities would be required for most bunkers because of the heavy rainfall. There are no suitable sites for tunnel-type installations.

Airmobile and airborne operations would generally be precluded throughout the region because of the dense vegetation. Sites suitable for parachute operations and the landing of assault-type aircraft are lacking in the dense rain forest, but the few landing strips at the larger settlements could be used for minor operations. Helicopter landing sites are largely limited to clearings near the settlements and some of the sandbars in the major streams. The region has many sites suitable for the construction of large and small airfields, but extensive clearing would be necessary, and access to most potential sites would be difficult. In some areas the construction of raised runways, taxiways, and parking aprons and of drainage systems to control flooding would be required because of the heavy rainfall.

The Eastern Plains are generally suitable for irregular force operations. The dense rain forest provides excellent concealment from both air and ground observation, and the large tree trunks afford some cover from small arms fire; additional cover would be available from surface irregularities near the highlands in the west. However, the dense rain forest presents a problem to cross-country movement; movement of small groups on foot would be slowed and vehicular cross-country movement would be precluded. There are no railroads, very few roads, and the main transportation routes are the larger streams. The lack of a developed transportation network, however, would restrict accessibility to and detection of irregular forces by conventional forces. Most of the people in this sparsely inhabited area live in hamlets or mud dwellings which have dirt floors and thatched roofs and are situated in small, widely scattered settlements along the major streams. Although it would be difficult to transport supplies into the region, fresh water, material for building shelters, and food, primarily from natural sources, are generally

available. Numerous physiological and psychological conditions detrimental to personnel are also indigenous to the region; temperatures and humidities are extremely enervating much of the time and the region abounds with mosquitoes, vectors of yellow fever and malaria, and with dangerous wild animals, including poisonous snakes. The national boundaries along the region are inadequately patrolled. They are either along forest-lined streams, or across densely forested interflaves and could be crossed by small groups of irregular forces with little chance of detection.

## 2. Andean Highlands

This region consists of a broad belt of rugged hills and mountains extending through central Ecuador from Colombia in the north to Peru in the south. Steep slopes, sharp crests, volcanic peaks, and elevations between 7,000 and 18,000 feet are characteristic of the topography. The exterior slopes below 10,000 feet in elevation, facing the plains east and west of the highlands, and some lower elevations elsewhere, are generally forest covered. The higher elevations, mainly over 10,000 feet, and the interior part of the region are chiefly grass or scrub covered or barren. Most of the region is thinly populated or uninhabited and has a sparse ground transportation network.

The Andean Highlands region is generally unsuited for conventional ground operations. The high altitudes severely restrict military operations; the rarified atmosphere requires modification of military equipment and periods of acclimatization for most troops. Ground movement would be slowed by steep grades, narrow roads, poor surfaces, and sharp curves. Roads may be blocked for considerable distances by landslides. Vehicular cross-country movement and off-road dispersal would be precluded in most of the region by steep slopes and dense vegetation; even foot troop movement would be slowed or precluded by the rough surfaces and, in places, by the dense undergrowth in the forests. Locally, cross-country movement of vehicles and foot troops would be possible in the scattered basins in the south during the dry season, mid-June through November. The construction of roads would be difficult; extensive clearing, blasting, grading, cut and fill, and restricted alignments would be required in most of the region. Concealment from air and ground observation would be provided by the dense vegetation. Cover from flat-trajectory fire would be afforded by surface irregularities and, in part, by large trees in the forests. Tunnel-type installations could be constructed in most of the region, but drilling, blasting, and clearing

would be necessary, and access to many sites would be difficult. Sites suitable for the construction of bunkers exist in areas of thick walls in the northern half of the region.

Because of the rugged highlands and extensive forests, this region is mostly unfavorable for airborne and airborne operations and the construction of airfields. In general, the only sites suitable for parachute operations are in the few basin and valley areas in the south. Landings of assault-type aircraft would, for the most part, be restricted to the few existing airfields. Helicopter landing areas are slightly more numerous, with possible sites on a few scattered, rounded ridgetops as well as in the basins and valleys in the south, however, special equipment or modifications would be necessary in many places because of the crowded air. Sites suitable for the construction of large airfields are limited to the flat, cultivated basins in the south. Small airfields could be constructed at scattered sites on low hills and in mountain valleys, but runway orientations and air approaches would be restricted.

Conditions for irregular force operations in the Andean Highlands are favorable in the forested areas at elevations up to 10,000 feet on the western slopes of the Cordillera Occidental and the eastern slopes of the Cordillera Oriental but are largely unsuited in the sparsely vegetated areas of elevations above 10,000 feet and in the interior. In most of the forested sections of the region, irregular force operations would be concealed from both air and ground observation in addition to having access to supplies from natural sources such as fresh drinking water, timber for fuel and shelter construction, and, in places, food. Throughout this region, the predominantly rugged terrain restricts movement on foot and largely precludes vehicular movement but provides good cover from flat-trajectory fire. Aspects adversely affecting personnel physiologically and psychologically in the forested areas are generally more severe at lower elevations where the climate is enervating and diseases and dangerous reptiles and other animals are common. At higher elevations, thin air and extreme diurnal variations in temperature present problems to unacclimated personnel. In areas above 10,000 feet in elevation and in the interior, the detrimental aspects are primarily the general lack of sufficient vegetation for concealment from air observation, the lack of indigenous supplies for sustenance, and the difficulty of obtaining supplies from outside the area. Moreover, the limitations caused by the great diurnal range in temperature and the rarefied atmosphere would increase in severity with increased elevation.

### 3. Inter-Andean Basins

This region is made up of a discontinuous series of flat to severely dissected intermontane basins separated by hills and mountains. High altitudes characterize the entire region, most basin floors are between 7,000 and 9,000 feet above sea level. In general the flat to rolling portions of the basins are either cultivated or in pasture, and the surrounding hilly areas are generally in pasture or covered by a mixture of low scrub and grass. The region is relatively densely populated and contains a moderately dense transportation network.

The region is fairly well suited for conventional ground operations during the dry seasons, early July through August and early January through February, but poor during much of the wet seasons, early April through May and early October through November. The high altitude of the basins has an adverse effect on military operations. The thin air requires modification of certain military equipment, and troops would tire quickly. Some personnel would require oxygen to function effectively, and periods of acclimatization would be required for most personnel. The Pan American Highway and the surfaced roads in the basins are traversable all year, but the unsurfaced roads are passable only during the dry seasons. Construction of additional roads would be possible during the dry seasons on most of the basin floors, but alignments would be restricted and grading would be necessary in the more rugged areas. Vehicular cross-country movement and offroad dispersal would be possible on most of the plains and on the lower slopes of the hills during the dry seasons, but during the wet season soft ground precludes the movement of vehicles and hinders the movement of troops on foot. Direction of movement would be restricted in some of the plains by the banks of deeply incised streams. Opportunities for concealment from air and ground observation are generally lacking except in buildings in the towns and cities and in the scattered small patches of forest; concealment from ground observation also would be available from surface irregularities in the hill and mountain areas. Cover from flat-trajectory fire would be offered by surface irregularities in the dissected parts of the basins and in the hills and mountains, and, to a limited extent, by the thick-walled adobe or brick structures of the towns and cities. The region is only partially suited to the construction of underground installations. Sites suitable for the construction of bunker-type installations are generally lacking because of a high water table. Sites suitable for tunnel-type installations

are available in the hills that have steep slopes and in the mountains.

The Inter-Andean Basin is one of the best suited regions for airmobile and airborne operations. The predominantly flat grasslands and cultivated grainfields contain numerous sites for airbases, helicopter landings, and the construction of large airfields. Difficulties would be encountered in the hill and mountain areas and dissected portions of the basin. In addition, the high altitude necessitates oversize parachutes for personnel and equipment and longer runways for aircraft. The landing of assault-type aircraft would generally be limited to the several existing airfields.

Because of the lack of sufficient vegetation for concealment and the general suitability for conventional forces, the region is poorly suited for irregular force operations. Conditions for the movement of small groups would be favorable in most of the flat to rolling basin floors containing a moderately dense network of roads, tracks, and trails; however, they would also be favorable for large groups of conventional forces except during the wet season when soft ground would preclude vehicular cross-country movement and would slow movement on foot. Conditions in the dissected areas and hilly hills, although difficult even for small groups, would best befit irregular force operations because of the general preclusion of most conventional operations. Cover from flat-trajectory fire would be lacking in most of the basins but would be available from surface irregularities in the more rugged areas. The basin contains a relatively dense concentration of population. Although material for constructing shelters is limited, many existing dwellings are available; however, in the smaller settlements and rural areas, most are primitively constructed and often infested with disease-carrying insects. In general, small groups would be able to obtain adequate supplies of food and fresh water from indigenous sites, but timber for fuel and shelter construction is limited. The muggy air and associated wide diurnal range in temperature, common in this region because of the high average elevation, lessens the effectiveness of unacclimatized personnel.

#### 4. Western Plains and Hills

This region, an extension of the coastal plain of Colombia, is an area of flat to severely dissected plain and hills. The hills are highest and most extensive in the south, and the plains are largely dissected except along the coast. Most of the region is forested, and the predominant type ranges from broadleaf evergreen in

the north to thorny shrubs and small trees in the south. There is a scanty distribution of culture features except in the few cities and towns and along the sparse road network.

The Western Plains and Hills are poorly suited for conventional ground operations. Movement between the larger cities would be possible on the surfaced roads but many of these have low capacities and would deteriorate under sustained heavy military traffic. The earth roads, tracks, and trails connecting the smaller settlements are narrow, in poor condition, have low-capacity bridges, and would rapidly become impassable under sustained use by even moderate traffic. Conditions for the construction of roads are poor in most of the region, and much clearing would be required. Roads having unrestricted alignments could be built on the coastal plains and in scattered areas elsewhere, but road alignments would be moderately to severely restricted in the areas of severely dissected plains and hills. Cross-country movement and offroad dispersal of vehicles would be precluded in most of the region by dense vegetation or steep slopes. Where movement is possible, conditions are at best only fair during most of the year and poor or unsuited for brief periods following rains. Even the movement of foot troops would be slowed by the dense vegetation and steep slopes. The direction of movement would also be restricted in some areas by streams too deep to ford. Concealment from air and ground observation would be available in the dense vegetation and in the structures of the cities, towns, and villages. Cover from flat-trajectory fire would be available from surface irregularities. Some additional cover would be available from trunks of closely spaced trees in the forests and the more substantial structures in the large cities. The region is poorly suited for the construction of underground installations because of thin soils, poor rock stability, or a high water table. Tunnels could, however, be constructed in some of the hills in the west, but access to many sites would be difficult. Some sites for bunkers exist in the well-drained, thick soils along the coast, in the dissected plains, and on higher interstream areas. No sites for the construction of underground installations are available in the plains adjacent to the larger streams; relief is inadequate for the construction of tunnels, and a high water table combined with some seasonal flooding makes these plains unsuited for the construction of bunkers.

Airmobile and airborne operations would be difficult in the Western Plains and Hills. Sites suitable for parachute operations are mostly in the areas of low crops and banana plantations, although there are



some open spaces suitable for drop zones in the arid areas near the coast. Paratroops would have difficulty reassembling in the banana areas, but movement from the drop zones would be facilitated by the principal roads that pass through most plantation areas. Helicopters are the best aircraft for use in this region, although most flat or nearly flat clearings of sufficient area are in the central or southern parts. Small airfields with restricted approaches and runway orientations could be constructed in about half the region; clearing of forests would be required at most sites. Sites for large airfields are available in the flat coastal plains, but clearing would be a problem at many of these sites also.

Although sandy shores predominate, the coast of this region is poorly suited for large-scale amphibious operations, mainly because of poor exits. Offshore approaches are generally clear, but nearshore approaches are partly obstructed, mostly by scattered rocks and fringing reefs. Much of the coast is immediately or closely backed by high bluffs and escarpments that are interrupted in many places by rivers, valleys, and swamp-fringed estuaries. A large debris swamp is located in the extreme northern part of the region. There are numerous sandy beaches, most of which contain some pebbles and cobbles. Exits are generally by cross-country movement to unsurfaced roads but in most places would be difficult because of the rugged topography or wet soil backing the beaches; locally, streets or scattered tracks and trails could be used.

Conditions are favorable for irregular force operations in most of this region. The predominantly dense vegetative cover, although a hindrance to the movement of small groups on foot, affords good concealment from both air and ground observation and limited cover from small arms fire. Surface irregularities in the more dissected or hilly parts of the region provide additional concealment from ground observation and cover from flat-trajectory fire. The region is sparsely populated and has a poorly developed transportation network, except in the vicinities of a few fishing settlements along the coast or in scattered agricultural areas inland. Sustenance for small groups would be available in much of the region. With only local exceptions, food from natural or cultivated sources, timber for fuel and shelter construction, and fresh water are available. Numerous physiological and psychological aspects detrimental to personnel are characteristic of the Western Plains and Hills region; high temperatures and, in the north, high humidities are common, dangerous animals are abundant, sanitation conditions in the settlements are

extremely poor, and the use of mud and thatch as building material contributes to the propagation of disease-carrying insects. The international border with Colombia, mostly along river lined by dense forest or mangrove, is inadequately patrolled and could be crossed by small groups with little possibility of detection.

### 5. Central and Southern Plains

This region, a continuation of the coastal plain of Peru, is composed mostly of flat to rolling plains, there are some hills and, bordering the Cerros de Colombia, some areas of moderately dissected plains. Local relief is generally less than 50 feet and slopes are mostly below 10%. Vegetative cover in the region consists of large banana plantations in much of the north, dryland scrub and grass on the Peninsula de Santa Elena, mangrove swamp along the Peru border and in the Rio Guayas delta, fresh-water marsh and ricefields along the lower reaches of the Rio Daule and Rio Vinces, scattered areas of cropland and grassland south and east of Guayaquil, and dense forest in the remainder. Overall, there is a sparse concentration of population and manmade features, although there are dense concentrations of both in the vicinity of Guayaquil and local concentrations elsewhere, particularly in the banana-growing areas and in the oil-producing portion of the Peninsula de Santa Elena.

Conditions for conventional ground operations would be only moderately favorable in the Central and Southern Plains. On-foot movement would be possible on the relatively dense system of surfaced roads in the northern and central parts of the region, but in the south the sparse road network would permit only limited movement. The construction of additional roads would be possible in most of the region. Alignments would be unrestricted, and only minor problems would be encountered on the flat plains, although clearing would be required in many places. Road alignments would be restricted in some of the dissected plains, and drainage systems, raised roadbeds, and numerous bridges would be required in the mangrove and fresh-water swamps, marshes, and seasonally flooded plains. Vehicular cross-country movement and offroad dispersal would be possible in about one-third of the region, but these favorable areas are separated by dense forests, incised streams, rugged surfaces, soft wet soils, or swamps and marshes. In addition, most of the areas favorable for cross-country movement become unsuited for varying periods during the wet season, when movement would be precluded by unfordable streams, flooded areas, or

wild milk. Most of the region is suited for the movement of foot troops, although restrictions would be imposed by the same conditions that preclude vehicular movement. Concealment from air and ground observation would be available in the dense forests and banana plantations and in structures of the urban centers. Surface irregularities in the dissected plain and hills also provide both concealment from ground observation and cover from flat-trajectory fire. To a limited degree, widely spaced tree trunks in the forests would provide additional cover. Some sites for bunkers exist on plains west and southwest of Guayaquil, but there are none in most of the north and south because of a high water table. There are few sites for tunnels because of low relief and poor rock stability. Clearing would be required at most sites, and access would be difficult in some areas. Excavation would be easy in most places and could be accomplished by handtools or light power equipment.

The Central and Southern Plains region is fairly well suited for airborne and airborne operations. Many sites suitable for parachute operations are available on the grassy plains, in banana plantations, and on barren surfaces near Salinas and northward along the coast. Some problems would be encountered in reassembling in the banana plantations, but good roads in most of these areas permit rapid movement from the drop zone. Sites suitable for helicopter landings are numerous on the Peninsula de Santa Elena and in areas in low crops or grassland in the south and east but are restricted to scattered clearings elsewhere. In general, assault-type aircraft landings would be limited to the several existing airfields; however, landings on unprepared surfaces might be possible locally on the Peninsula de Santa Elena. The construction of airfields would be possible in most of the region. There are numerous sites for large airfields having unrestricted runways and approaches on the low, flat plain, but clearing would be required at many of them. In the dissected plain southwest of Guayaquil there are many sites for small fields but only a few for large fields; runway orientations would be restricted and much grading would be necessary.

The coast of this region is mostly unsuited for large-scale amphibious operations because of obstructions in the sea approaches and poor exits. Offshore approaches are partly obstructed, mostly by shoal areas, and nearshore approaches are also partly obstructed, mainly by shoal areas, mudflats, scattered rocks, and patches of fringing reef. The southeastern part of the coast, most of which is fringed by the Golfo de Guayaquil, is fringed by a wide belt of almost continuous swamp. Narrow lowlands fringing the

northwestern part are generally fringed by sandy shores and commonly backed and interrupted by cliffs or escarpments rising to an elevated plain. The beaches in the region are concentrated in the northwestern part and consist of sand, most of them containing some pebbles, cobbles, boulders, or mud. Exits are generally by cross-country movement to surfaced and unsurfaced roads but would be difficult in many places because of cliffs, dense forest or swamps; streets or tracks and trails could be utilized in the vicinities of the larger coastal towns and cities.

Conditions for irregular force operations are favorable in most of this region but unfavorable locally, particularly in the mostly arid areas to the west along the Peninsula de Santa Elena and in the open, marshy or cultivated parts of the lower Rio Daule-Rio Vinces watershed. Cross-country movement by small groups would be generally easy on the arid Peninsula de Santa Elena and in scattered cultivated areas, moderately restricted in the forested and marshy sectors, and extremely difficult in the mangrove swamps. Dense forests, predominant in most of the region, afford excellent concealment from air and ground observation and some cover from small arms fire; locally, however, in the areas unfavorable for irregular forces, cover and concealment would be largely unavailable. Most of the region's relatively sparse population and poorly developed transportation system are concentrated in the cultivated areas, along the coastal portion of the Peninsula de Santa Elena, and in the vicinity of Guayaquil. In general, small groups would be able to obtain sustenance from indigenous supplies except in the swampy or marshy areas or in the drier west; fresh drinking water, wood for fuel and constructing shelters, and food from natural or cultivated sources are available. Conditions that could cause adverse physiological and psychological effects on irregular forces in this region are similar to those prevalent in the Western Plains and Hills region. Border crossings would probably encounter little difficulty along the forest-lined, fordable river that forms the boundary of this region with Peru. Like most of the Ecuador boundaries, this segment is insufficiently patrolled.

#### 6. Galapagos Islands

This region consists of a group of sparsely populated, relatively arid volcanic islands. Fresh water is scarce on some of the larger islands and completely lacking on the remainder. Vegetation on most of the islands ranges from cactus and other thorny scrub xerophytic types along the coastal areas to dense forest on the hills and volcanic mountains in the interior.

The region is largely unsuited for conventional ground operations. In general, cross-country movement would be precluded for wheeled vehicles and difficult for tracked vehicles and foot troops. The construction of roads would be possible in the plains, but much grading and filling would be required in the more dissected areas. In the hills and mountains, alignments would be restricted and heavy grading, drilling, and blasting would be required. Little concealment from air observation would be available except on the forested upper slopes. Some concealment from ground observation and cover from flat-trajectory fire would be available from surface irregularities. Some sites suitable for bunker-type installations are available in the thick soils of the plains, but the construction of tunnel-type installations would be precluded in the areas with adequate relief because of volcanic activity.

The Galapagos Islands are largely unsuited for airborne operations. Helicopter landing sites are scarce on most of the islands, and sites suitable for parachute operations and the landing of assault-type aircraft on unprepared surfaces are generally lacking. Of the two airfields on Isla Baltra, one is abandoned, but both could be used as drop zones or for the landing of assault-type aircraft. Sites suitable for the construction of large airfields exist on some of the larger islands, but much grading would be required in areas of lava blocks. Volcanic peaks restrict air approaches.

The coasts are unsuited for large-scale amphibious operations because of obstructions in the sea approaches, lack of good beaches, and poor exits. Offshore approaches to most of the islands are partly obstructed by rocks and islets, and nearshore approaches are partly obstructed by islets, rocks, and reefs. The coasts are fringed mainly by cliffs or low, rocky seeps, and, in places, by mostly sandy beaches. Rats are difficult and chiefly over jagged lava fields or thorny-scrub-covered plains.

Conditions for irregular force operations in the Galapagos Islands are favorable on parts of most of the larger islands but unsuited on the westernmost large island (Isla Fernandina) and most of the smaller islands. The primary criterion is the availability of fresh surface water; there are only limited quantities on most of the larger islands and an absence on the remainder. Movement of small groups on foot would be tortuous on the jagged lava fields and moderately restricted in the forested areas inland. There are only a few trails and hardly any roads. Sufficient vegetation for concealment from air and ground observation is lacking near the coasts but of ample size and density

at higher elevations toward the centers of the larger islands. Natural foods and shelter materials are available only locally. Only a few of the islands are populated, and these are very thinly settled. Supplying irregular forces by sea and air would be difficult because of the rocky coastlines, rugged surfaces, and dense vegetation in the interior.

## E. Strategic areas (C)

There are three strategic areas—Guayaquil, Quito, and Western Oilfields (Figure 23). The first two contain the major industrial and commercial concentrations and are the principal transportation and telecommunication centers; the third is the main oil processing area of the country.

### 1. Guayaquil

Guayaquil (Figures 14 and 15) is the principal port and the largest (estimated 1972 population 1,000,000) and most important city in the country. It is a commercial, financial, and communication center and contains most of the industry in the nation. The city handles most of the imports, more than half of the exports, and accounts for almost half the gross value of the industrial production of the nation. The industrial installations in the city are primarily devoted to food processing, the manufacture of building materials, and other consumer goods. The leading commodities are cement, lumber, beer, soft drinks, wheat flour, shoes, paint, alcohol, cigarettes, and soap. The major naval base in the country is in the southern part of Guayaquil. The area also contains boatyards and railroad repair shops. POL (petroleum fuels, oils, and lubricants) storage facilities have a total capacity of 308,000 barrels, about half of which are at Allam. In addition, the area handles virtually all the POL products consumed in the country. Simon Bolivar Airfield, north of Guayaquil, is a joint military-civil facility, and Taura Airfield, southeast of Guayaquil, is an important jet base of the Ecuadorian Air Force.

### 2. Quito

This area (Figure 18) is the principal transportation and industrial center in the Ecuadorian Andes. In addition, it is the principal military and educational center of the country and contains the national capital (Figure 17), the second largest city (estimated 1972 population, 600,000). The industrial output of the Quito area represents about one-fourth of the national total. The largest industrial installations produce

textiles, but there are also pharmaceutical plants, flour mills, aluminum fabrication shops, metalworks, lumber mills, railroad repair shops, and brickyards. POL storage facilities are small, representing less than 1% of the national total. The Quito area has the principal military installations of the country. They include the Eloy Alfaro Military Academy, numerous army units, and units of the National Civil Police and Ecuadorian Air Force. Mariscal Sucre Airfield, south of Quito, is the largest in the country and is a joint military-civil field.

### 3. Western Oilfields

Located approximately 75 miles west of Guayaquil, this area (Figure 18) is of significance because of its two refineries and oilfields. The total crude throughput capacity for the refineries is 33,300 barrels per day. After refining, most POL products are shipped to Guayaquil. POL storage facilities in the area have a total capacity of more than 1,700,000 barrels. The urban centers are small (total combined estimated population about 10,000). Two oilfields are located in the area. General Ulpiano Paez Airfield west of Salinas (Figure 19) includes the Aviation School of the Ecuadorian Air Force; the field near La Libertad is small. Salinas is also the site of a naval base and the Naval Academy. Salinas and La Libertad are minor ports. The importance of this strategic area is undergoing significant changes because of the opening of oilfields and storage areas in the northeast and the completion of the pipeline from the interior to the coast at Esmeraldas. When a planned refinery at Esmeraldas is built, it is possible that the refineries in the Western Oilfields strategic area will be dismantled.

### F. Internal routes (C)

The internal routes (Figure 23) provide the easiest avenues of movement between land approaches and strategic areas, between amphibious landing areas and strategic areas, and between strategic areas. The amphibious landing area at Salinas provides direct access to the Western Oilfields strategic area. Data on the internal routes are given in Figure 20.

### G. Approaches

The perimeter of mainland Ecuador is about 1,910 miles; of this, land boundaries comprise 1,200 miles. There are no permanent fortifications along the borders, although there has been an effort to control movement across the border with Peru. The coast of

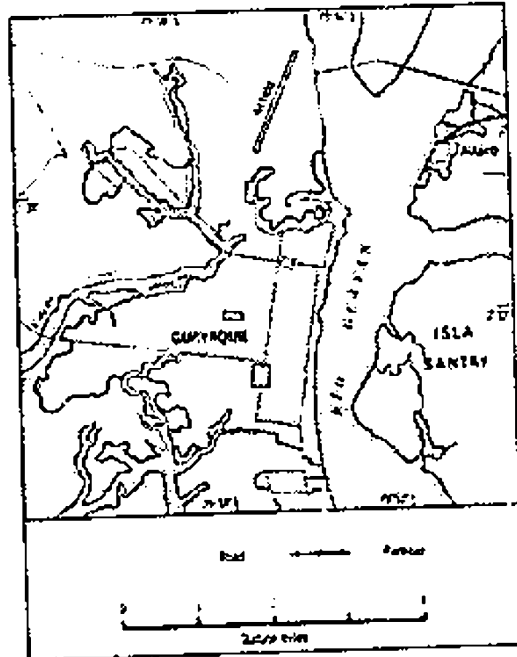


FIGURE 14. Guayaquil strategic area (C)

FIGURE 15. Guayaquil, the largest city in the country, is on the low, nearly level plains along the west bank of the Rio Guayas. The urban area is densely built up and has a rectangular grid of wide streets. (C)



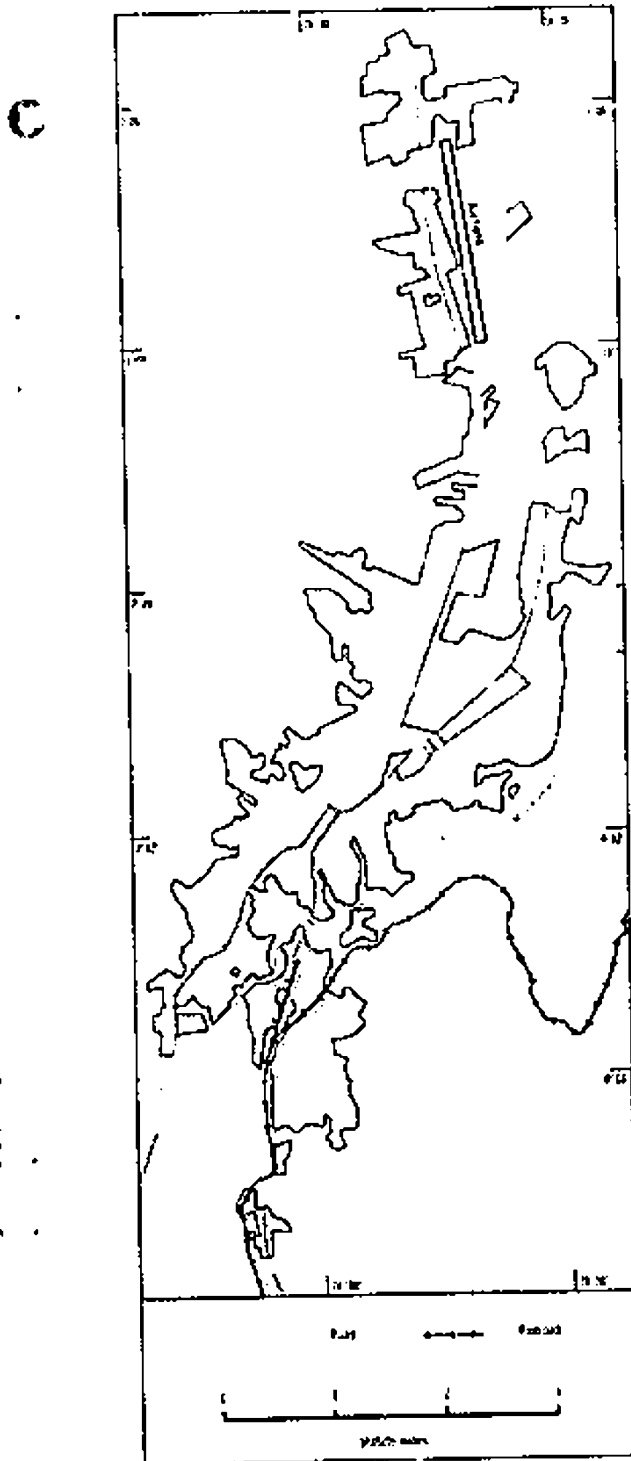


FIGURE 16. Quito strategic area (C)



FIGURE 17. Quito is in an intermontane basin in the Andes at an elevation of about 9,000 feet. Many of the streets have been widened into boulevards divided by grassy or concrete strips. This view shows part of a residential area. (C)

the mainland is about 600 miles long and that of the Galapagos Islands is about 750 miles. Ecuador claims offshore jurisdiction of territorial waters to a distance of 200 nautical miles. (C) (OU)

The boundary with Colombia is 360 miles and is demarcated and undisputed. It is primarily aligned along streams winding across a narrow, densely forested coastal plain in the west, the high rugged Andes Mountains in the central section, and through dense tropical rain forest in the east. The mountainous section generally is forested below 10,000 feet elevation on exterior slopes and grass or scrub-covered on higher slopes and in the interior. (C) (OU)

The boundary with Peru is 810 miles and in places is undefined and in dispute. The boundary is almost equally across flat to rolling plains and rugged highlands. Rivers mark the boundary in the narrow coastal plain and the central part of the mountains. The eastern plains and western slopes of the mountains are chiefly forested, but elsewhere the vegetation is varied, ranging from deciduous forest along the coast to large areas of low scrub and grass in the highlands. (C) (OU)

#### 1. Land (C)

Ecuador is not easily accessible by land. The boundaries with Colombia and Peru are in densely forested plains and rugged highlands and are crossed by only three developed land transportation routes. Conditions for cross-country movement in the border

FIGURE 18. Western Oilfields strategic area (C)

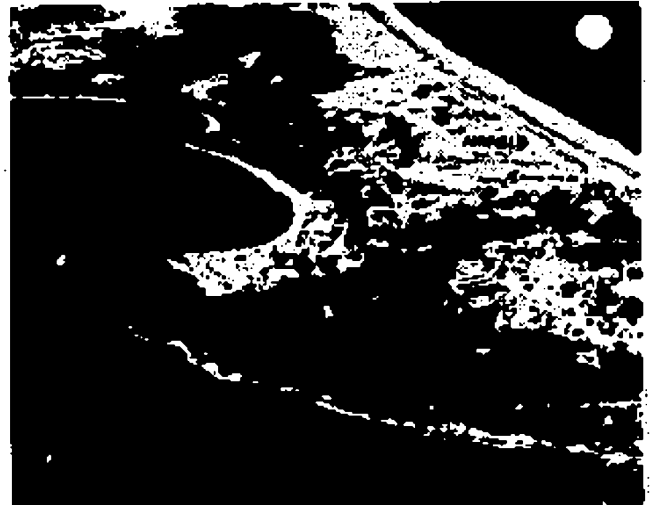
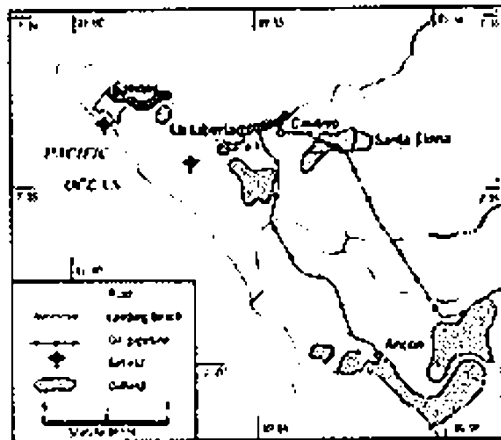


FIGURE 19. Salinas is on a low, nearly level peninsula that juts into the Pacific Ocean. The airfield west of the city is a military field, the General Ulpiano Foa. (C)

zones would be precluded almost everywhere by either steep slopes, dense forests, or streams too deep to ford. The approaches shown on Figure 21 are the best means of land access to Ecuador. Detailed information on land approaches is presented in Figure 21.

2. Sea (C)

Offshore approaches to the mainland coast (seaward of the 5-fathom depth curve) are generally clear except for Juan's areas in the southern part. Nearshore approaches (shoreward of the 5-fathom depth curve) are partly obstructed, mostly by scattered rocks and fringing reefs along much of the coast and by shoal areas and mudflats in the southern part. Surf 4 feet or higher occurs up to 35% of the time during October through December along exposed shores. The tide is semidiurnal and has a spring range of 6 1/2 to nearly 13 feet. In the nearshore zone the bottom material is probably sand, but in some places there is mud, shell, or rock; the bottom gradients are predominantly mild to moderate. Beaches suitable for landing are widely scattered along the northern and southern parts of the mainland coast and are concentrated along the central part. The beaches are composed mostly of sand with pebbles, cobbles, boulders, and mud in places. Beach lengths range

from 100 yards to 1 1/2 miles, and most are over 1/4 mile. Widths range from 20 to 800 yards at low water and 0 to 60 yards at high water; gradients between the low water and high water lines are predominantly moderate. The beaches are generally backed by narrow coastal plains. Prepared exits are generally lacking, and movement inland would be difficult in most places because of wet ground, dense vegetation, or rough terrain.

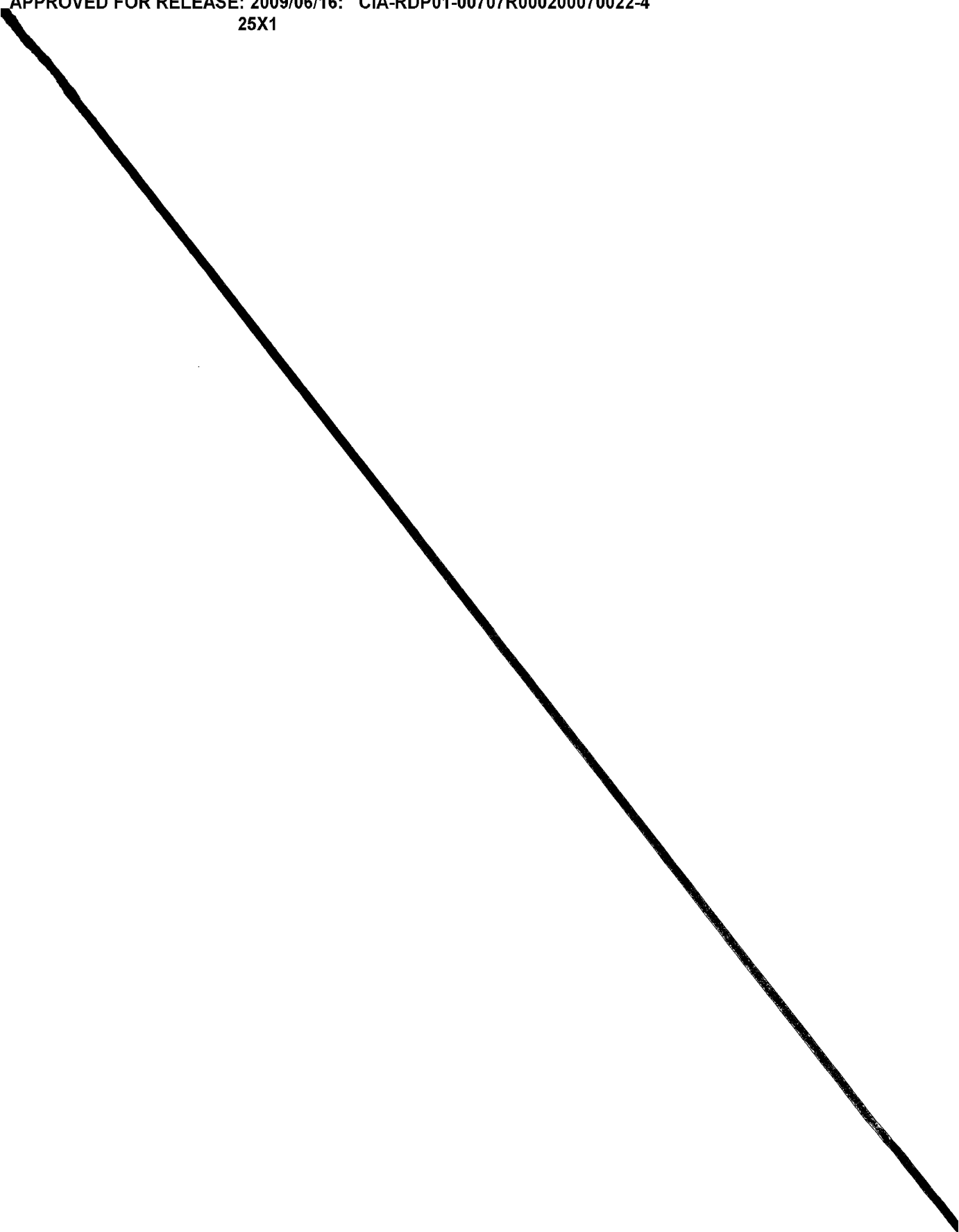
Offshore approaches to the Galapagos Islands are partly obstructed by rocks and islets. Nearshore approaches are partly obstructed, mostly by islets, rocks, and reefs. Surf 4 feet or higher occurs as much as 20% of the time during April through September on a few beaches but is infrequent on most. The tide is semidiurnal and has a spring range of 5 to 8 1/2 feet. Nearshore bottom material is probably sand and rock, and gradients are predominantly gentle. The beaches suitable for landings are predominantly sand, are scattered among the islands, and range from 250 to 1,600 yards in length. Known widths range from 15 to 200 yards at low water and 2 to 80 yards at high water. The beaches are generally backed by dissected lava fields, and exits are predominantly by cross-country movement and are extremely difficult.

The amphibious landing areas described in Figure 22 provide access either directly to a strategic area or to internal routes leading to the strategic areas.

FIGURE 20. Internal routes (C)

ROUTE	ROAD	ELEVATION	SPECIAL FEATURES AND COMMENTS
<p>Pera border near Maraca through Andes to Quito strategic area. Southern half of route traverses rugged, sparsely or scrub-covered hills and mountains and northern half a series of largely cultivated or pastured highland basins.</p>	<p>Pan American Highway, between Pera border and Babamba, mostly 2 lanes and gravel surfaced, some narrow sections and sections of rubblestone. Paving operations in progress in vicinity of Loja and Ibarra. Severe Babamba and Quito, 2 lanes of bituminous surface treatment; some narrow bridges. South of Babamba, some steep grades and sharp curves. Subject to landslides in mountainous areas.</p>	<p>Single track, 3'6" gauge, in poor condition. Parallel road in route from Cuzco to Quito. Numerous bridges, longest 373 feet.</p>	<p>Prohibited by steep slopes in most of southern half of route. Possible in many places in southern half of route on low hills and on plateau of highland basins.</p>
<p>Pera border southeast of Tumbaco, Pera, to point south of Cuzco. Crosses chiefly forested or cultivated plains from border to Paucari and rugged hills and mountains in remainder; rugged portion mostly forested in area and scrub or grass covered in rest.</p>	<p>Alameda Pan American Highway; mostly 2 lanes, gravel surfaced; some narrow sections. Some bituminous surface treatment in vicinity of Paucari. Deteriorated surface, narrow, low-capacity bridges, sharp curves, and steep grades.</p>	<p>Single track, 3'6" gauge, in poor condition. Parallel short segment of route south of Babamba.</p>	<p>Restricted or prohibited on plains by forest or scrub. Prohibited by steep, forested slopes in mountains.</p>
<p>Columbia border near Tulcan in Quito strategic area. Traverses series of cultivated or pastured highland basins and grass- or scrub-covered hills and mountains.</p>	<p>Pan American Highway; improvement, including bituminous surface treatment, has been in progress for some time. The route route should be completed in 1972. Two lanes, bituminous-treated surface. Sharp curves and steep grades in mountainous basins. Some bridges and Quito. Mountainous sections subject to landslides.</p>	<p>Single track, 3'6" gauge, in poor condition from Ibarra to Quito. Many tunnels and bridges.</p>	<p>Fair on flatter parts of basins, although at times poor in mountainous areas of wet hills; prohibited elsewhere by steep slopes.</p>
<p>Amphibious landing area at Yumballoo across densely forested western slopes of Andes to Quito strategic area.</p>	<p>Two lanes, bituminous or bituminous-treated. Narrow bridge near Guayaquil only major potential bottleneck.</p>	<p>None.</p>	<p>Prohibited nearly everywhere by dense forest on steep slopes.</p>
<p>Comarca Wiroto (Guayaquil strategic area to Guayaquil strategic area. Traverses hills and flats to moderately dissected plains traversed by three lanes, scrub, and grassland scrub near Guayaquil, where steppes forest predominant.</p>	<p>Two lanes, bituminous or bituminous-treated. Surface 1/2 to 2 lanes, gravel. Minimum-treated surface. Sharp curves and steep grades in mountainous. Western half 2 lanes, bituminous-treated surface.</p>	<p>Single track, 3'6" gauge, in poor condition, generally parallel road in route to Guayaquil to north. Excessive grades and short-radius curves in east.</p>	<p>Fair on steep plains in west, but restricted or prohibited by steep slopes or forest in most of central and eastern segments.</p>
<p>Between Guayaquil strategic area and Quito Pera border route at Latacunga. Widely varied topography and vegetation along route. Immediately north of Guayaquil route follows nearby Rio Duche headwaters, in place of road in river. Central section in vicinity of Quercos crosses flat to rolling forested plains with many banana plantations. Eastern section traverses densely forested western slopes of Andes and, near Latacunga, scrub- and grass-covered, interior-facing slopes.</p>	<p>Two lanes, bituminous-treated surface. In mountainous, some steep curves and steep grades and subject to landslides.</p>	<p>None.</p>	<p>Fair in parts of Rio Duche headwaters although restricted or prohibited at times by wet soils; generally prohibited elsewhere because of dense forest on steep slopes.</p>

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## 3. Air (U/OU)

Air approaches<sup>1</sup> to Ecuador from the north are mostly over Colombia, those from the east and south are mainly over Peru, and those from the west are principally over the Pacific Ocean. Weather conditions are generally favorable all year in the air approaches over the Pacific Ocean. Here, thunderstorms are infrequent, the hazard of aircraft icing and turbulence are at a minimum, and cloudiness, although considerable in most months, is seldom overcast for extended periods. February through May has the most favorable weather.

Air approaches over the land areas have a greater incidence of clouds, thunderstorms, and severe turbulence, and a greater potential for aircraft icing than the overwater approaches. The most hazardous weather conditions mainly occur during afternoons when convective activity is strongest. Towering cumulus and especially cumulonimbus clouds, which occasionally build to heights near 55,000 feet, generally contain areas of moderate to severe turbulence and icing potential. Thunderstorm clouds are most frequent at widely separated sections along the windward slopes of the Andes and in the mountains, where thunderstorms are extremely violent

<sup>1</sup>The discussion area for air approaches extends approximately 200 nautical miles beyond the border of Ecuador.

in some cases. Average thunderstorm incidence in these sections, however, infrequently exceeds 10 per month during the periods of greatest activity. Elsewhere in the approaches over land, thunderstorm activity is quite limited. Overall cloudiness is abundant throughout the year in most sectors; mean monthly values range between 60% and 90% except over the coastal deserts in northern Peru, where clear to partly cloudy skies prevail. In the Andes, low-hanging clouds often impinge on the slopes and peaks and make visual flight extremely dangerous at these levels.

In all approaches the average height of the freezing level is near 16,000 feet in all months, except in winter in the Peruvian Andes where the freezing level may be several thousand feet lower. Ice accretion on aircraft may be encountered when flying through clouds above the freezing level; it usually is most severe in thunderstorms and in cloud formations over the Andes. Light easterly winds prevail in all approaches at all levels to at least 35,000 feet; the mean speeds vary between 15 and 30 knots.

Mountains are the principal terrain hazard. Maximum elevations are nearly 19,000 feet in the Colombian Andes, about 170 nautical miles from the Ecuadorian border, and approximately 15,000 feet in the mountains in Peru, about 150 nautical miles from Ecuador. Relief in the Amazon Basin is low, and maximum elevations are less than 3,000 feet.

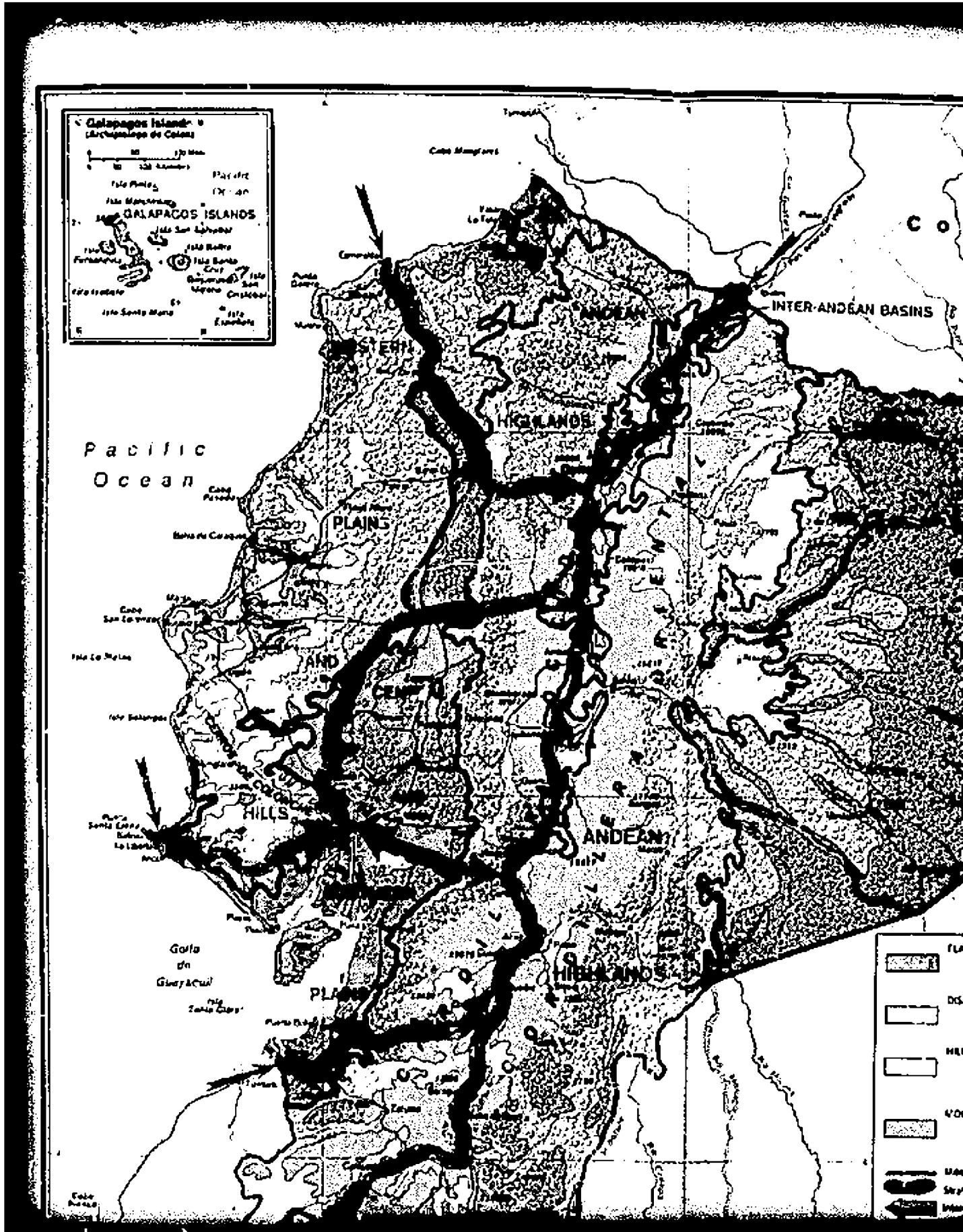
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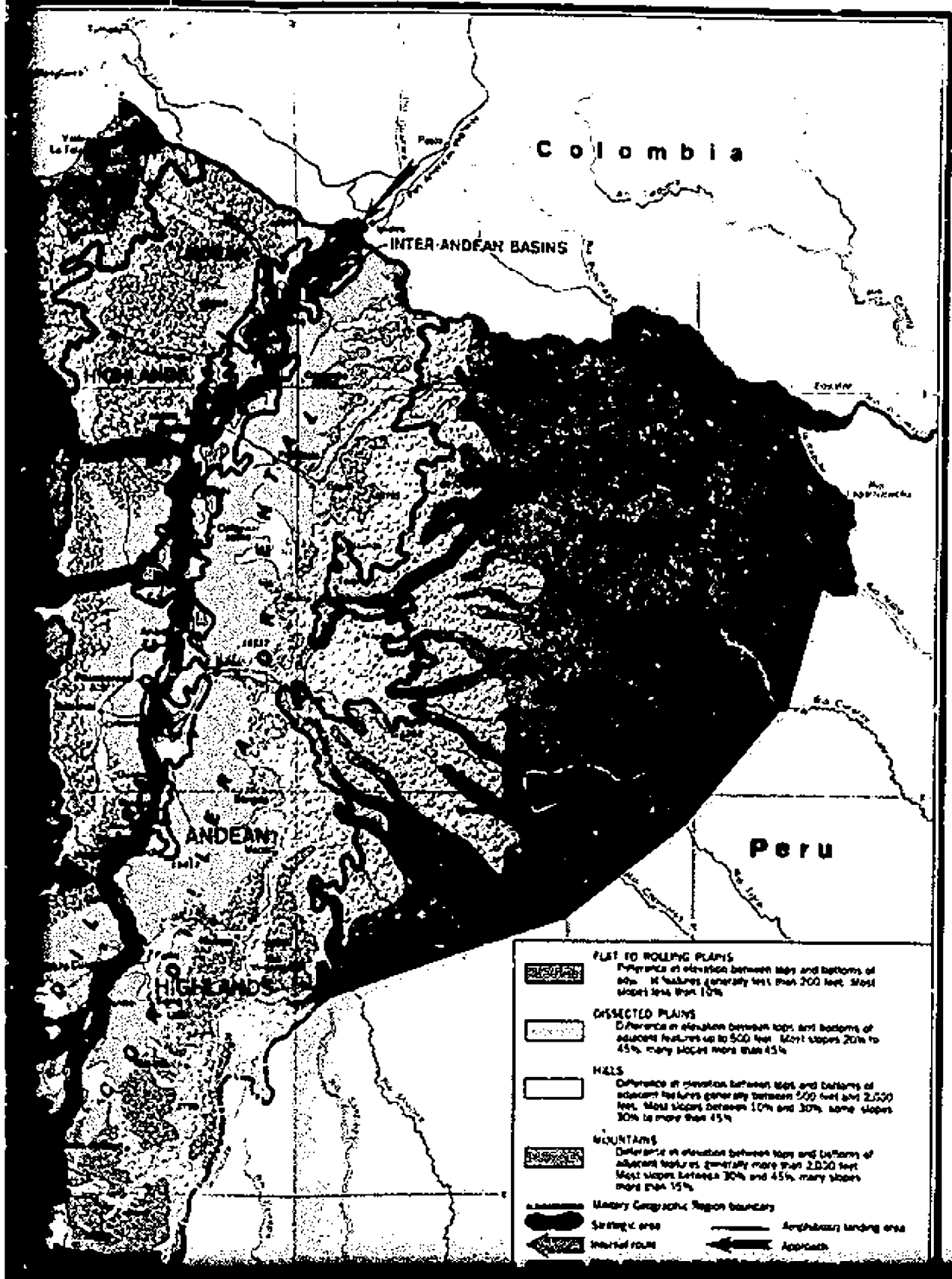
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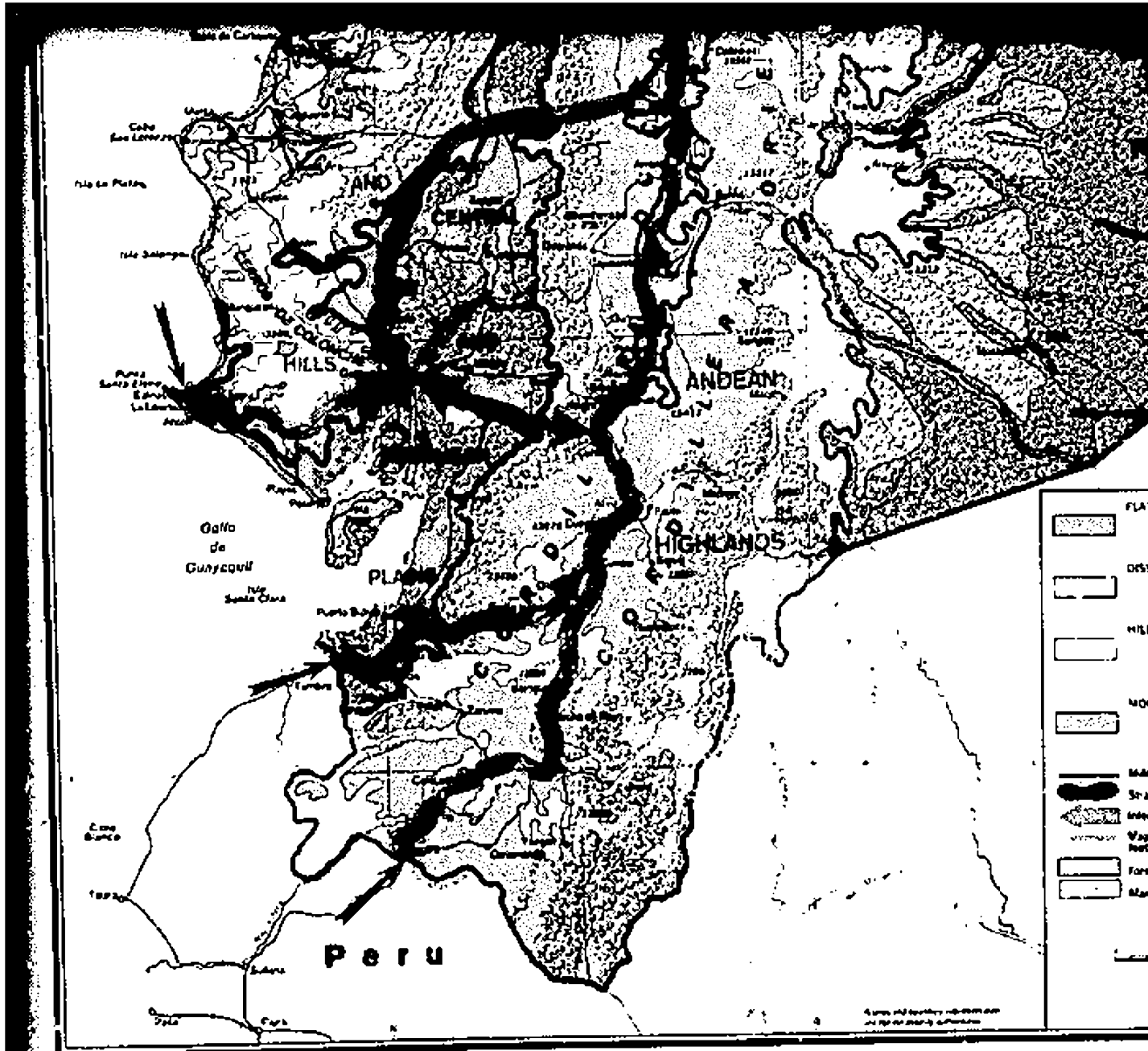
Floors and features referred to in this chapter (v/vu)

	COORDINATES	
	"	'N
Afaro	2 52	79 54
Ambato	1 25	78 27
Anden (mt)	2 00	78 00
Bahabayo	1 19	79 31
Cerro de Colambo (mt)	2 00	80 20
Chimborazo (mt)	1 28	78 14
Cordillera Occidental (mt)	1 30	78 55
Cordillera Oriental (mt)	1 30	78 30
Catapal (mt)	0 40	78 26
Cuena	2 53	78 49
Esmeraldas	0 59N	79 47
Galapagos Islands (isls)	0 38	80 20
Guayaquil	2 10	78 50
Guía de Guayaquil (pt)	2 00	80 20
Ibarrá	0 31N	78 07
Isla Baltra (is)	0 28	90 16
Isla Fernandina (is)	0 25	91 21
Jipijapa	1 20	80 25
La Libertad	2 41	80 57
Latacunga	2 56	78 37
Loja	4 00	78 12
Macará	4 23	79 57
Marchal	2 18	79 38
Manta	0 37	80 44
Paute	3 20	79 49
Paute, Colombia	1 12N	77 17
Península de Santa Elena (peninsula)	2 15	80 50
Playas	2 28	80 22
Portoviejo	1 03	80 57
Quevedo	1 07	78 29
Quito	0 13	78 20
Riobamba	1 44	78 25
Rio Daule (strm)	2 10	78 52
Rio Guayas (strm)	2 36	79 52
Rio Yacora (strm)	1 29	78 47
Saltora	2 13	80 56
Santa Domingo	0 15	79 09
Saltora, Peru	4 53	80 41
Tukula	0 14N	77 42
Tumbes, Peru	3 31	80 23



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