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Morocco

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NATIONAL INTELLIGENCE SURVEY

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Military Geography

NATIONAL INTELLIGENCE SURVEY PUBLICATIONS

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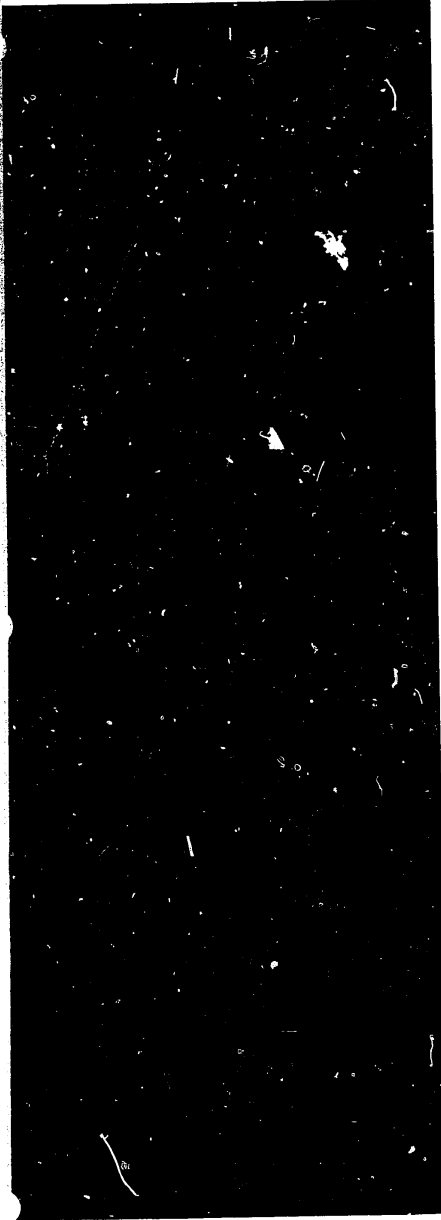
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Morocco

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Military Geography

A. Location and description (U/OU)

Morocco, located in the extreme northwestern part of Africa, occupies the important southern flank of the Strait of Gibraltar (Figure 19). The country has an area of approximately 158,100 square miles, slightly over one-half the size of the state of Texas. It has a maximum northeast-southwest length of about 850 miles.¹ The population of the country, estimated in mid-1972 at 15.8 million, is now about 16 million. Two Spanish enclaves are also mentioned in this discussion: the cities of Ceuta, population 88,000, and Melilla, population 77,000.

1. Topography

Morocco consists of the rugged hills and mountains of the Atlas Mountains, which occupy most of the country, and two narrow plains, one along the Atlantic coast and the other along the southern and southeastern border of the country (Figure 1). The hills and mountains (Figures 2 and 3) extend in generally parallel ridges along almost the entire northeast-southwest axis of the country. The hills north and west of the mountains are deeply dissected and have elevations generally ranging between 1,000 and 4,000 feet; those east and south of the mountains are equally rugged but have elevations primarily ranging between 2,000 and 5,000 feet. The mountains range from 5,000 to 6,000 feet above sea level, although some high ridges reach over 10,000 feet and isolated crests reach maximum elevations of over 13,000 feet; the highest elevation is 13,665 feet, south of Marrakech. Most valley floors are from 3,000 to 5,000 feet below adjacent mountain crests. Lower slopes range from 10% to 30% and upper slopes from 50% to more than 100%. There are a few, scattered, broad intermontane basins (Figure 4), and large flat to rolling plains are in the high elevations in the northeast and along the southwestern Atlantic coast, south of Agadir. Vegetation consists primarily of brush and grasses on the slopes of the mountains and, to a lesser extent, in

¹Distances are in statute miles unless nautical miles are specifically indicated.

the intermontane valleys. Bunch grass covers most hills and the easternmost mountains. Moderately dense needle-leaf evergreen forests are scattered throughout the hills and mountains but are most prevalent north of the major crestline. Slopes adjacent to the Sahara desert are barren. The density of vegetation tends to decrease from northwest to southeast. Numerous narrow and deep perennial streams flow toward the Atlantic Ocean or Mediterranean Sea through steep-sided valleys in the hills and mountains and through wide, shallow streambeds in the coastal plain. Intermittent streams are characteristic of the southern and eastern parts of the hills and mountains. During mid-November through March, the wet season, the ground is frequently wet in large areas and is snow covered and frozen at elevations exceeding 7,000 feet on the northern mountain flanks and above 10,000 feet on the southern mountain flanks. Washouts and landslides occur in many places during the wet season. Flooding is most common in March and April, when snowmelt coincides with the relatively heavy spring rains. The few large urban centers in the highlands, Fes,² Meknes, and Marrakech, contain buildings of mud-brick, stone, brick, and concrete and are connected by roads in generally poor to fair condition. Numerous towns and villages with buildings generally of mud-brick or stone (Figure 5) are connected by tracks and roads in generally poor condition.

The narrow coastal plain extends along the Atlantic Ocean from near Essaouira to Tangier. The surface is flat to rolling (Figure 6) and has elevations ranging from sea level to 760 feet. Most slopes are gentle, between 2% and 10%. The plain is a mosaic of small grainfields, orchards, fallow fields, uncultivated areas partially covered by patches of grass and low brush, and very small park-like evergreen forests. Soils are composed of silty sand and are predominantly dry except in the north. Northeast of Kenitra, a large area is wet continuously from early November through May. Along major streams in the north there are several relatively large areas that are often wet or are

²For diacritics on place names, see the list of names on the apron of the Transportation Map, Figure 19, the map itself, and maps in the text.

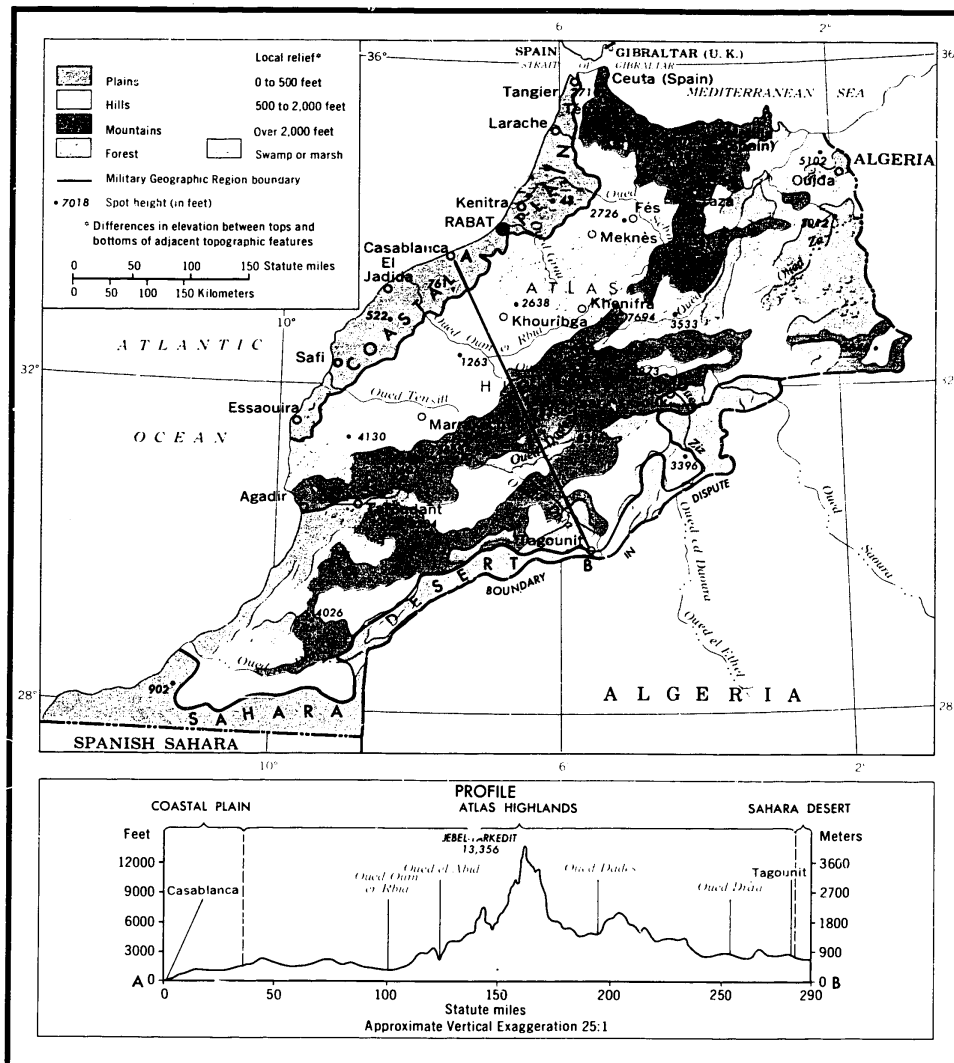


FIGURE 1. Military geographic regions and terrain (C)



FIGURE 2. The western Atlas Mountains are deeply dissected by numerous narrow winding valleys. Slopes are steep and covered predominantly by brush and grass. At the higher elevations snow cover is persistent during winter. (U/OU)



FIGURE 3. In the southeastern Atlas Mountains sharp crestlines and steep, deeply eroded slopes are characteristic features. Scattered shrubs are the predominant vegetation. (U/OU)

subject to flooding from early November to mid-April. Coastal dunes constrict some river mouths in the north, and these streams commonly flood during the wet season. During April through October nearly all streams are dry or have only limited amounts of poor-quality water. Many of the major urban centers of the country are located on the coastal plain and are connected by railroads and paved roads. Casablanca, Rabat, and Tangier, the principal cities, have large sections of modern one- to 10-story buildings of concrete and steel, cut stone, and brick and wide, straight streets. Smaller cities and towns, as well as the older sections of the principal cities, are characterized by closely spaced one- to three-story buildings commonly constructed of mud-brick or stone and narrow, winding streets.

The narrow irregular plain that flanks the Atlas Mountains in the south is a dry, sandy, and rocky section of the Sahara desert. Elevations range from sea

level on the Atlantic coast to 1,500 feet in the south-central part and to over 3,000 feet in the northeast. The surface is flat to rolling but is broken in places by broad, deep, river valleys, escarpments, long, low, sinuous ridges (Figure 7), and a few small, scattered areas of dunes. Vegetation is sparse and consists mostly of tufts of grass, low shrubs, and, along the courses of the major streams, a few date-palm oases. The steep-sided wadies contain water only for short periods during the winter rains. Oases and a few fish-processing plants along the coast are the sites of the only permanent settlements in the desert plain and are connected by a sparse network of tracks, trails, and roads in generally poor condition.

2. Climate

The climate of Morocco is essentially Mediterranean north of and well into the Atlas Mountains and mostly desert south of the mountains. The northern



FIGURE 4. The few intermontane plains scattered throughout the Atlas Mountains have nearly flat to gently rolling surfaces with low hills in places (C)



FIGURE 5. Most villages are constructed of closely spaced mud-brick or stone buildings; roofs generally are flat (U/OU)

region has mild, wet winters (December through February) and hot, dry summers (June through August). In the southern region, winters are similarly mild but summers are exceedingly hot; rainfall is meager all year in this region (Figure 8). Migratory lows and attendant fronts from the Atlantic are the primary cause of inclement weather, while incursions of the Azores high mainly bring fine, sunny weather.

Weather conditions during winter are quite changeable. Periods of cool, cloudy, and showery weather alternate with periods of sunny, pleasant weather. Cloudiness is variable, with monthly averages of 35% to 55% cloud cover; cloud amounts

are greatest in the northern sections and least south of the Atlas range. Cumulus is the most common cloud type. Precipitation is mostly local intermittent showers, heavy at times, and only occasionally widespread and prolonged. Thunderstorms are infrequent. Monthly precipitation amounts, of 2 to 7 inches in the northern sections and 1 to 3 inches in the south are usual. Heaviest falls occur on the northern slopes and on the high ground of the Atlas Mountains, where snow is common and a snow cover may persist throughout the winter. Afternoon temperatures are mild on the coasts and at low elevations in the interior, averaging in the upper 50's (°F.) and 60's, but are 10

FIGURE 6. The plains along the northern and central Atlantic coast have flat to gently rolling surfaces less than 1,000 feet above sea level. In this area near Casablanca, vegetation is a mosaic of cultivated field crops, fallow fields, brush pastures, and small park-like evergreen forests. (C)



to 20 degrees colder in the mountains. Nights are cool in all sections except in the mountains, where freezing temperatures and frosts are common. Relative humidity remains high throughout the day at most places except over the desert, where humidity is low in the afternoon. The prevailing good visibilities are briefly interrupted during occasional showers and morning fog. Surface winds are mostly light and variable.

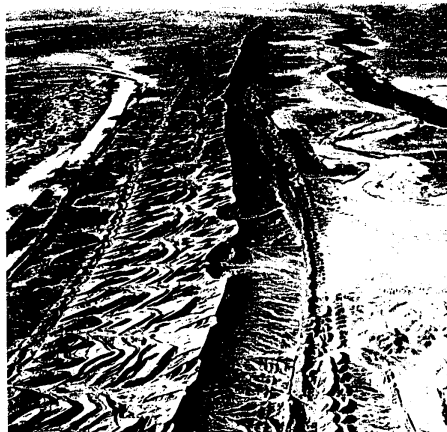


FIGURE 7. The desert plains southwest of the Atlas Mountains are deeply dissected; escarpments and low, sinuous ridges are common features. Vegetation is sparse. (U/OU)

Conversely, weather conditions during summer are quite monotonous. Long periods of cloudless skies occur throughout the interior, where average cloud cover is only 20% to 40%. On the coasts, average cloud cover is slightly greater mainly because of frequent low stratus overcasts at night and in early morning. This condition is especially marked on the Atlantic coast south of 32°N. Long periods of rainless days are common everywhere except on the northern slopes and high ground of the Atlas Mountains; here, thunderstorms occur on about 5 days monthly in May through September. The most prominent summer feature is the intense heat. Daily temperatures are moderated by the sea along the immediate coast and, along with moderate humidity, produce a relatively comfortable condition. Afternoon temperatures average in the 70's (°F.) and low 80's, decreasing to the middle 60's by early morning. In the interior, however, temperatures rapidly rise to the upper 90's and 100's daily; some of the highest temperatures in the world, exceeding 120°F., are recorded on the desert. The extreme heat in conjunction with the very low afternoon humidity is severely desiccating and causes exposed skin to crack. Temperatures decrease rapidly at night to the upper 60's or low 70's, while relative humidities increase. Visibility continues good in most sections except where occasionally restricted by dust in the interior and by morning fog along the coast. On the coast, land and sea breezes are well developed during this season. Elsewhere, surface winds continue light and variable, becoming locally strong only during severe thunderstorms.

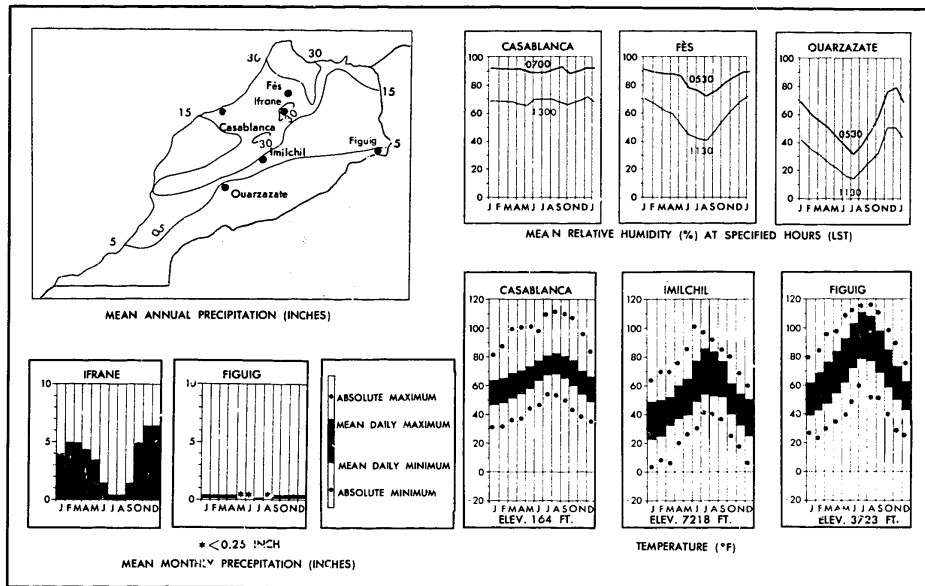


FIGURE 8. Precipitation, cloudiness, relative humidity, thunderstorm days, and temperatures (U/OU)

B. Military geographic regions (C)

There are three military geographic regions—the Coastal Plain, the Atlas Highlands, and the Sahara Desert (Figure 1). The combination of environmental conditions within each region would have a relatively uniform effect on military operations, but there would be marked differences between adjacent regions.

1. Atlas Highlands

This region extends northeast-southwest through more than 75% of the country and consists mainly of high hills and mountains, which are covered primarily by brush and grass and are dotted with small towns and villages.

Most of the region is unfavorable for conventional ground operations. The steep slopes and rough, rocky surfaces of the generally continuous hills and mountains of the Atlas Mountains preclude the movement of tracked and wheeled vehicles except through narrow highland valleys, in the broad intermontane basins, and in the large flat to rolling plains in the northeast and southwest, where

movement would be moderately easy. Movement would be difficult in the valleys, basins, and plains only during the period mid-November through March, when the ground is frequently wet in large areas and is snow covered and frozen at the higher elevations. Onroad movement would be fairly easy on the few major roads that connect the large urban centers but would be difficult on other roads because of steep grades and poor surface conditions. Dispersal from the roads would be limited in the hill and mountain areas by the steep slopes and rough, rocky surfaces but would be fairly easy in the broad intermontane basins and valleys and in the large plains. The scattered forests afford the only good concealment from air observation. Surface irregularities provide concealment from ground observation and cover from flat-trajectory fire in extensive areas of the region. Conditions are mostly unsuited for road construction in the hills and mountains because of the steep slopes, which necessitate much-cut and fill, steep grades, and short-radius curves. Landslides and washouts during the wet season would hinder construction in the valleys. Conditions are favorable for the construction of roads

in the plains and larger basins, where gentle grades and long, straight alignments would be possible. The mountains provide numerous sites for the construction of tunnel-type installations in hard rock; wide spans would be feasible with only minimum support, and little interior lining would be required. The construction of bunker-type installations would be possible only in the valley floors, plains, and basins, where soils are deep. All construction efforts in the southern and eastern parts of the region would be hampered by the lack of adequate water supplies. Destructive earthquakes are frequent in the western part of the region.

The region is generally unsuited for airborne and airmobile operations. Sites suitable for parachute drop zones, helicopter landings, and assault-type aircraft landings are greatly restricted by the rugged surfaces and steep slopes of the hills and mountains. The flat to rolling plains along the western coast and in the northeast and the broad intermontane basins are the best areas for parachute drops and helicopter landing areas. Airfields located near the urban areas and large towns provide the only favorable sites for the landing of assault-type aircraft, although approaches would be restricted by rugged terrain. Most of the region is unsuited for airfield construction because of the rugged surfaces and obstructed approaches, although some small airfields with restricted approaches could be constructed in the plains and in the broader intermontane valleys and basins.

Both the Atlantic and Mediterranean coasts generally are unsuitable for large-scale amphibious operations because of hazardous nearshore approaches, rugged coastal terrain, and poor exits. Except for a shoal and a wreck off the Mediterranean coast and, during the period June to October, fishing nets off both coasts, offshore approaches are generally clear. Nearshore approaches to both coasts are partly obstructed by sandbars, shoals, reefs, rocks, islands, and scattered wrecks. Surf 4 feet or higher occurs throughout the year with a maximum frequency of 37% April to June along the Atlantic coast. The coastal terrain along the Atlantic consists mainly of steep cliffs and bluffs near the central part by the broad alluvial plain of the Sous River (Oued Sous); the Mediterranean coast is characterized by an extremely narrow area of rolling foothills interspersed with a few small plains and river valleys, all backed by mountains. Several beaches fringe the coasts and are connected near the Sous River plain on the Atlantic coast and on the northwestern part of the Mediterranean coast; they are largely composed of sand, with some shell, gravel, or cobble. Most are less

than 3 miles long, although some range up to 32 miles in length. Exits are mostly by cross-country movement or by tracks and trails; there are a few exits by roads and city streets in the plains.

Conditions are moderately favorable for irregular force operations. Cover from flat-trajectory fire and concealment from ground observation would be afforded throughout the hills and mountains by the dissected terrain. Conditions for concealment from air observation are good in the moderately dense evergreen forests scattered throughout the northern and western hills and mountains but are poor in the rest of the region, which is primarily brush and grass covered. Movement cross country on foot would be possible in most of the region, although rocky slopes make movement difficult in parts of the hills and mountains. Tracks and roads in poor condition connect the numerous small villages and towns; fair to poor roads connect the few urban centers. Small amounts of cultivated crops, principally grains and vegetables, are available in the moderately densely populated northern and western parts of the region. Water supplies are limited in most of the Atlas Mountains and are bacterially impure near the towns and villages. Materials for use as shelter are abundant only in the forested areas, but brush for firewood is available throughout the region. Supply by sea would be facilitated by several beaches along both coasts, but nearshore approaches are partly obstructed. Supply by air would be limited primarily to the plains and broad intermontane basins and valleys.

2. Coastal Plain

This region, located along the Atlantic Ocean consists of a narrow, dry, flat to rolling plain that is intensively cultivated and densely populated.

Terrain in most of the region is favorable for conventional ground operations throughout the year. Cross-country movement of vehicles on the flat to rolling plain generally would be easy. The silty sand soil is dry throughout the year except for an area northeast of Kenitra, where the soil is wet continuously from early November through May, and along the major streams, where the ground is wet and subject to flooding from early November to mid-April. Onroad movement would be easy on most roads that connect the major urban centers; on other roads, however, narrow bridges and, in places, poor surface conditions are hindrances to movement. Offroad dispersal would be easy except in the seasonally wet areas along the major streams and for up to 50 miles along the road extending northeastward from Kenitra. Roads with long straight stretches, easy grades, and long radius

curves could be constructed with only minor difficulties, although the limited water supply during April through October is a significant problem. Only limited concealment from air observation would be provided by the small patches of forest on the otherwise cultivated or grass- and brush-covered plain. The rolling surfaces and, during the dry season, streambanks provide concealment from ground observation and cover from flat-trajectory fire. The construction of bunker-type installations would be hindered in most places by shallow soils. No area of the flat to rolling coastal plain is suitable for the construction of tunnel-type installations.

The region is well suited for airmobile and airborne operations. Most parts of the plain are suitable for parachute drops and helicopter landings; operations would be precluded only in the seasonally wet areas northeast of Kenitra and along the major streams and in the forested areas southeast of Kenitra and near Essaouira. Sites suitable for the landing of assault-type aircraft are fairly numerous on the flat, dry areas, which are located throughout the region, as well as on the numerous well-distributed airfields, several of which are among the largest in the country. Numerous sites for the construction of airfields with relatively unobstructed approaches, unrestricted alignments, good drainage, and firm foundations are available on the plain.

The coast of the region is generally favorable for large-scale amphibious operations. Offshore approaches are generally clear; some nearshore approaches, however, are partly obstructed by rocks, reefs, and sandbars. Surf 4 feet or higher occurs throughout the year with a maximum frequency of 37% January to March. The coastal terrain is mostly a flat to rolling cultivated plain fronted in a few places by high sand dunes and escarpments. Several beaches fringe this coast and are concentrated along the northeastern half; they are largely composed of sand, with some gravel and cobble, and range up to 14 1/2 miles in length but are mostly less than 2 miles. Exits from the beaches are by cross-country movement or by tracks, trails, and city streets to loose- and hard-surfaced coastal roads. During World War II, amphibious landing operations were successfully carried out by U.S. military units in the Casablanca and Kenitra areas and at Safi.

Conditions generally are unfavorable for irregular force operations. Movement cross country on the primarily dry, flat to rolling plain would be easy but concealment and cover would be almost nonexistent. Concealment from air observation on the predominantly grass- and brush-covered plain would be

provided only by a few small patches of forest. Concealment from ground observation and cover from flat-trajectory fire would be limited to minor surface irregularities and to streambanks during the dry season. Population is relatively dense, and numerous roads connect the urban areas and the many small towns and villages which are scattered throughout the area. Cultivated crops, primarily grain and fruit, generally are available. Water supplies during April through October are limited, however, and materials for use as shelter and firewood are scarce. Supply by sea and air would be relatively easy; there are many beaches, and drop sites are numerous.

3. Sahara Desert

This long, narrow region stretches along the southern and southeastern borders of the country and is composed of a sandy and gravelly desert plain that is almost devoid of culture features.

Terrain in most of the region is unfavorable for conventional ground operations. In the greater part of the region, vehicular movement would be hindered by the steep-sided wadies, escarpments, low, sinuous ridges, and small, scattered areas of dunes. Movement would be largely unobstructed on the flat to rolling gravelly or rocky surfaces that comprise much of the southwestern part of the region. The few widely spaced roads and desert tracks are in poor condition and would not be able to support sustained heavy traffic. Dispersal from the roads would be easy in the flat to rolling southwestern part of the region but would be difficult in the remainder of the region because of dissected terrain. Concealment from air observation would be generally lacking because of the sparse vegetation, but concealment from ground observation and cover from flat-trajectory fire would be provided by escarpments, low ridges, scattered, small areas of dunes, and, during dry periods, by the steep sides of wadies. In general, roads with unrestricted alignments could be constructed in the southwest on the flat to rolling, open surfaces, but sharp curves and steep grades would be common in the remainder of the region because of dissected surfaces. Construction of bunker-type installations would be precluded on most of the flat to rolling surfaces of the plains because soils are mostly shallow and gravelly. Tunnel-type installations could be constructed in the ridges and escarpments, where rocks are hard, stable, and at or very near the surface. Extreme heat, sandstorms, and the lack of an adequate water supply would hinder all construction activities in the region.

In most of the region, conditions are favorable for airmobile and airborne operations. Numerous sites for parachute drops, helicopter landings, and assault-type aircraft landings are available on the flat to rolling plains that constitute the southwestern part of the region. In the areas of escarpments, long, low ridges, and steep-sided wadies, sites are restricted to the broader valleys. Airfields with long runways and relatively unobstructed approaches could be constructed with little grading on the areas of flat to rolling plains; in the more dissected parts of the region, construction would be limited to short runways with approaches restricted by escarpments and long, sinuous ridges.

The coast of the region generally is unsuitable for large-scale amphibious operations because of hazardous nearshore approaches and poor exits. Offshore approaches are clear; nearshore approaches are partly obstructed by rocks, reefs, and sandbars. Surf 4 feet or higher occurs a maximum of 54% of the time from July to September. The coastal terrain is predominantly sandy with some rocky stretches and is backed by a flat to rolling desert plain. Only seven beaches fringe this coast, and most are located along the southern half; they are largely composed of sand, with some shell or gravel, and range up to 21 miles in length but are mostly less than 4 miles. Exits from the beaches are by cross-country movement or by widely separated tracks and trails.

The region is unsuited for irregular force operations. Although movement on foot would be possible almost everywhere, there are very limited opportunities for cover and concealment on the predominantly barren, flat to rolling areas. Cover from flat-trajectory fire and concealment from ground observation would be provided only in the dissected areas, by the slopes of low, sinuous ridges, widely scattered dunes, escarpments, and, during dry periods, streambanks. The nomadic character of the sparse population and the lack of permanent settlements nearly preclude obtaining supplies from indigenous sources, although supplies could be airdropped in many parts of the region or brought in by sea along much of the coast. Very high summer temperatures, a lack of adequate water supplies, and dust storms combine to make the area particularly unfavorable for irregular force operations.

C. Strategic areas (C)

The Casablanca-Rabat and Strait of Gibraltar strategic areas (Figure 9) contain the two largest cities,

major seaports, key transportation and communication centers, important airfields, most of the industry, and extensive petroleum storage facilities.

1. Casablanca-Rabat

This area (Figure 10), economically and administratively the most important part of the country, includes the cities of Casablanca (population 1,500,000 in 1971), Rabat (population 374,800 in 1971), Sale (population 155,600 in 1971), and Kenitra (population 139,200 in 1971). Casablanca (Figure 11) is the major industrial center and principal port of Morocco; it is also a key transportation and telecommunications center. Major industrial centers in and near the city include automobile and truck assembly plants and factories that produce industrial machinery, railroad cars, automotive parts, cement, plastics, explosives, and chemicals; one factory produces more than half of the requirements of the country for rubber tires. Among the numerous small installations are food processing plants, a soap factory, a glass factory, paint factories, and textile mills. A shipbuilding yard and petroleum storage facilities for approximately 3,832,000 barrels of refined products are in Casablanca.

Rabat (Figure 12) and the adjacent city of Sale have a combined population of about 530,400 and together constitute the country's second largest urban area. Rabat is the administrative capital of Morocco and a commercial and telecommunication center; the relatively few industrial installations include a foundry and plants manufacturing bricks, cement, ceramics, glass, textiles, farm equipment, and soap. Sale is principally a residential extension of Rabat, but it also contains several significant government and medical installations. Kenitra is a port and contains telecommunication facilities and petroleum storage for approximately 338,000 barrels of refined products. The city has some industries—chiefly food processing, brick, paper chemical, and textile.

A large modern petroleum refinery with a throughput capacity of 48,000 barrels per day is located at Mohammedia, 15 miles northeast of Casablanca. It has storage facilities for 818,000 barrels of crude oil and 270,000 barrels of refined products. Additional refined products storage facilities at Mohammedia have a total capacity of 705,000 barrels. Another refinery, with a throughput capacity of 16,000 barrels a day and storage facilities for 233,000 barrels of crude oil and 98,000 barrels of refined products, is located at Sidi Kacem, the center of the most significant producing oilfield in the country; production, however, is declining rapidly.

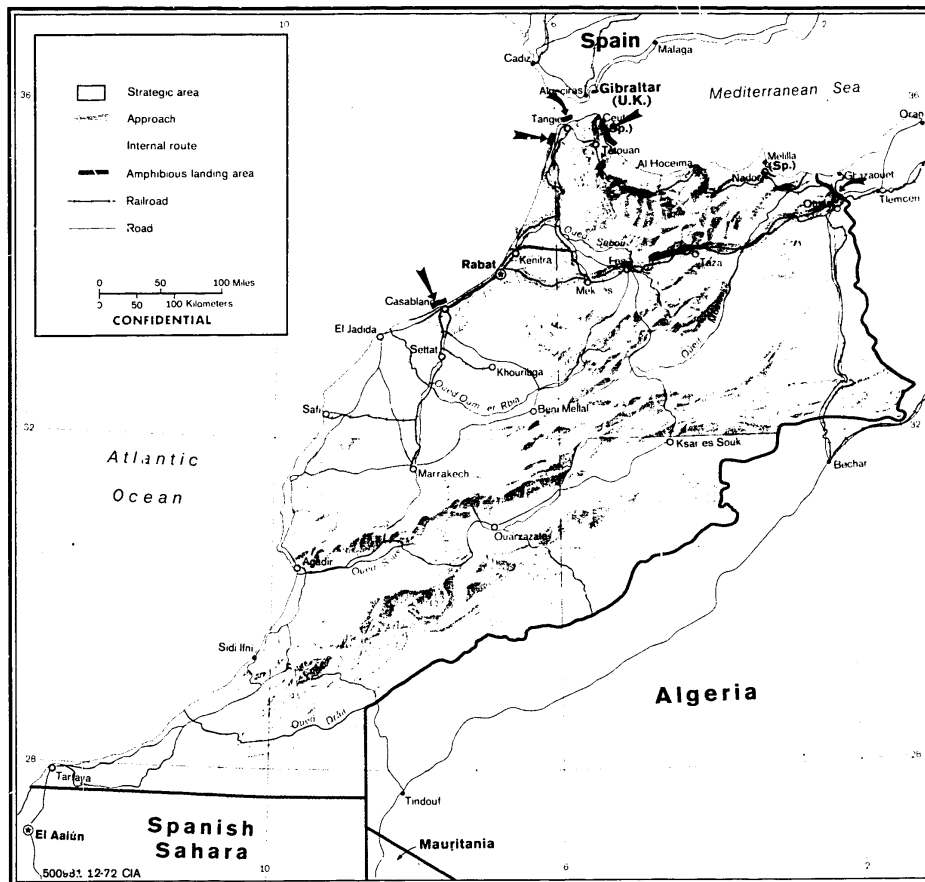


FIGURE 9. Strategic areas, internal routes, and approaches (C)

Other petroleum storage facilities are available at the several large former U.S. military airfields. A pipeline system, formerly operated by the U.S. Air Force, connects these airfields with Casablanca, Mohammedia, Rabat-Sale, and Kenitra; however, the pipeline system and some of the storage facilities are no longer in operation. Several pipelines, all less than 10 miles in length, transport crude oil to the Sidi Kacem refinery from drilling sites in the vicinity.

The best transportation and telecommunications systems in Morocco link the major cities in the

strategic area and connect with other parts of the country. Four principal airfields are located within the strategic area. Casablanca/Nouasseur International Airfield, located 16 miles south of Casablanca, is the country's principal international airfield.

2. Strait of Gibraltar

This strategic area (Figure 13) owes its importance mainly to its position on the southern shore of the Strait of Gibraltar. The three principal cities, Tangier

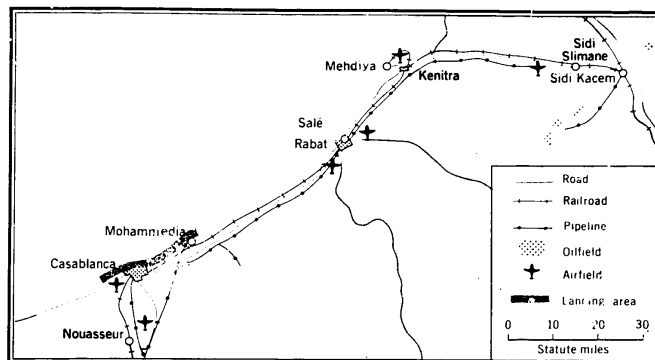


FIGURE 10. Casablanca-Rabat strategic area (C)

(population 187,900 in 1971). Tetouan (population 139,100 in 1971), and the Spanish enclave of Ceuta (population 88,000 in 1971), are transportation, communication, and commercial centers for the northern part of Morocco. Ceuta is a seaport and contains petroleum storage facilities in excess of 1 million barrels. Tangier (Figure 14), although primarily a commercial city and seaport, contains a plant that produces cement and concrete blocks, several small brickyards, plants specializing in the processing of food and the manufacture of textiles and soap, and about 108,000 barrels storage for refined petroleum products. The city is also one of the major telecommunication centers in Morocco. Tetouan, in

the southern part of the strategic area, contains plants that produce concrete pipes and chemicals. Two airfields are in the strategic area, one about 7 miles southwest of Tangier and one about 2 miles northeast of Tetouan.

D. Internal routes (C)

The internal routes provide the easiest avenues of movement between the land approach and the strategic areas and between the strategic areas (Figure 9). Figure 15 describes each route in detail.

E. Approaches

The perimeter of Morocco is 2,380 miles, of which about 1,140 miles are coastline. Morocco claims territorial jurisdiction for 12 nautical miles off shore except at the Strait of Gibraltar, where jurisdiction is claimed to the median line. Figure 16 presents data on land boundaries. (U/OU)

1. Land (C)

Conditions are generally favorable for cross-country movement on the hard desert plains in most of the border zones. Conditions are unfavorable only in the rugged hills and mountains of the northern part of the border with Algeria. Transportation lines that cross the borders are limited to a railroad and a few widely spaced roads and desert tracks and trails.

The approach shown on Figure 9 is the best means of land access to Morocco. This approach from Tlemcen, Algeria, is across flat to gently rolling plains and scattered rugged hills. The road has a one- to two-



FIGURE 11. The commercial section of Casablanca consists of wide streets lined by many one- to 10-story buildings constructed of concrete and steel, cut stone, and brick (C)

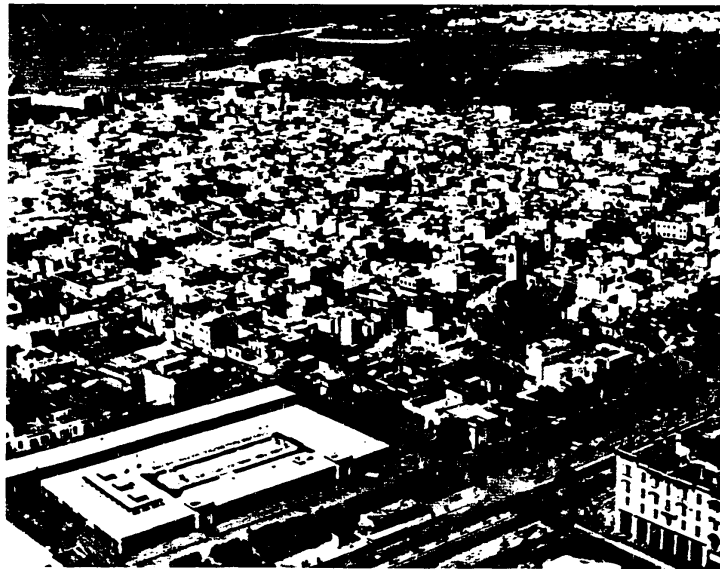


FIGURE 12. Rabat, together with the city of Sale (upper right corner), constitutes the second largest urban area in Morocco (U/OU)

lane bituminous-treated surface in generally fair to poor condition. There are steep grades west of Tlemcen and a narrow bridge near the Algeria border. A single-track 4'8 1/2"-gauge railroad connects Tlemcen with the Algeria border. Offroad dispersal and cross-country movement generally would be easy.

2. Sea (C)

Sea approaches from the west and northwest are open and from the north and northeast are through the Strait of Gibraltar and the Mediterranean Sea. Conditions are generally unfavorable for large-scale amphibious operations because of partly obstructed approaches and high seasonal surf along some stretches of coast. Offshore approaches generally are clear except for a wreck, a shoal, and seasonal fishing nets. Nearshore approaches are partly obstructed by islands, reefs, shoals, sandbars, rocks, and scattered wrecks. Nearshore bottom slopes range from flat to moderate but are mostly gentle; bottom material is mainly sand. Surf 4 feet or higher may occur at any time of the year along the coast, with a maximum occurrence on the Atlantic coast of 54% during July through September and on the Mediterranean coast of 15% during January through June. Tides are semidiurnal, with spring ranges of about 8 feet on the Atlantic coast and 2 feet on the Mediterranean coast. Most of the beaches are located along the northeastern part of the Atlantic coast and the northwestern part of the Mediterranean coast. In general, the beaches are composed of sand, are less than 4 miles in length, and

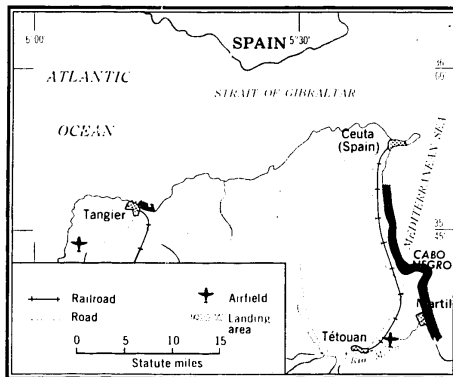


FIGURE 13. Strait of Gibraltar strategic area (C)

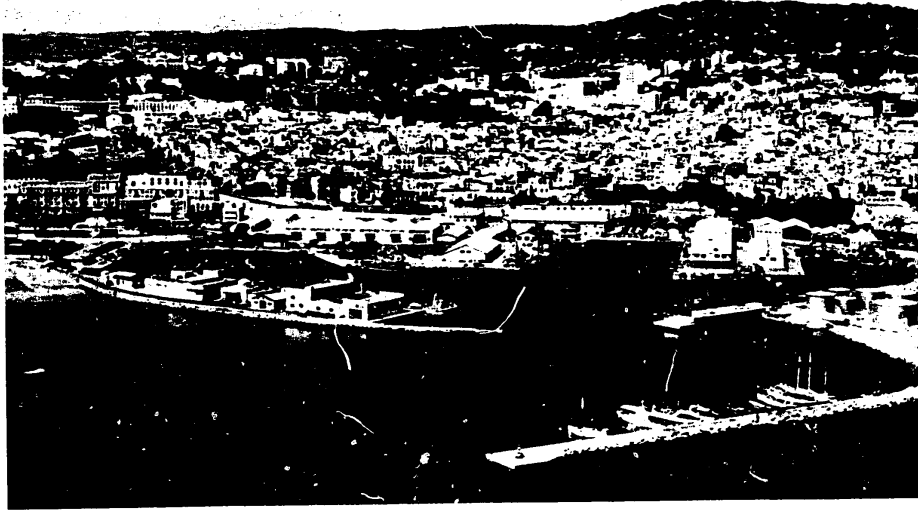


FIGURE 14. Tangier, adjacent to the Strait of Gibraltar, has numerous multistory buildings in the built-up area between the artificial harbor and the foothills of the Atlas Mountains (U/OU)

have a mild to steep gradient. The beaches along the Atlantic coast are predominantly backed by a low, cultivated plain in the northeastern part of the coast and by steep cliffs and bluffs along most of the remainder; the Mediterranean coast beaches are mostly backed by mountainous terrain. Exits from the beaches are by cross-country movement and by tracks, trails, or streets to the main roads.

The amphibious landing areas shown on Figure 9 provide access to strategic areas or to internal routes leading to strategic areas. These landing areas are described in Figure 17.

3. Air (U/OU)

Air approaches³ to Morocco are divided into those north of 33°N. latitude and those south of this latitude. The approaches from the north are over the Atlantic Ocean, southern Portugal and Spain, the western Mediterranean Sea, and part of northwestern

³The discussion zone for air approaches extends approximately 300 nautical miles beyond the borders of Morocco.

Algeria. The southern approaches are over western Algeria, northern Mauritania and Spanish Sahara, and the Atlantic Ocean. In general, weather conditions in both approaches are favorable for flight throughout most of the year. The most unfavorable weather in the northern approaches, sometimes severe, occurs in winter during the passage of lows and associated frontal systems. Widespread multilayered cloudiness, scattered thunderstorms, and frequent turbulence and aircraft icing are the principal hazards. Similar hazards occur in summer in the southern approaches when the intertropical convergence zone (ICZ) is active. Winds aloft in all approaches are predominantly westerly all year below 55,000 feet except at low levels in the southern approaches, where weak southerlies occur in summer. Mean wind speeds are strongest between 35,000 and 45,000 feet, where they vary between 50 and 75 knots in winter and average 30 knots in summer. The strongest winds generally occur in the southern approaches. Additional information on the general weather conditions in the two air approaches is given in Figure 18.

FIGURE 15. Internal routes (C)

ROUTE	ROAD	RAILROAD	OFFROAD DISPERSAL AND CROSS-COUNTRY MOVEMENT
Between Algeria and Strait of Gibraltar strategic area. Principally across hills and mountains.	Two-lane bituminous-treated surface, mostly good to fair condition except for 65-mile section east from Chechaouene, which has narrow, gravel surface in poor condition. A few narrow bridges and one tunnel, and, in places, steep grades and sharp curves.	None.....	Difficult or precluded along most of route by steep hill and mountain slopes and narrow steep-sided valleys. Locally favorable in small plains areas north of Oujda.
Between Algeria and Rabat-Casablanca strategic area. Branch at Meknes leads north to Sidi Kacem. Principally across hills and mountains.	Two-lane bituminous-treated surface, in predominantly good condition. Several narrow bridges, sharp curves, and steep grades.	Extends between Oujda and Sidi Kacem. Single-track 4'8 1/2" gage; electrified between Fes and Sidi Kacem. Numerous bridges and several tunnels between Oujda and Meknes.	Difficult or precluded in much of route by steep hill and mountain slopes and narrow, steep-sided valleys. Locally favorable in most plains areas particularly near Oued Moulouya and west of Oujda.
Between Strait of Gibraltar strategic area and Rabat-Casablanca strategic area. Branch at Souk el Arba du Rharb leads southeast to Sidi Kacem. Principally across flat to rolling plains.	Two- to four-lane bituminous-treated surface, in fair to good condition. Several bridges and a few sharp curves.	Extends between Tangier and Sidi Kacem. Single-track 4'8 1/2" gage. Numerous bridges and a few tunnels.	Relatively easy on flat to rolling coastal plain except for area northeast of Kenitra, which is wet continuously from early Nov. through May.

FIGURE 16. Boundaries (U/OU)

BOUNDARY	LENGTH	STATUS	TERRAIN
	<i>Miles</i>		
Algeria.....	965.....	Northern 102 miles demarcated, north-central 200 miles defined, remainder has been disputed and is not yet demarcated.	In north, small hill and mountain areas in places forest covered, and extensive brush- and grass-covered high plains. In south, primarily across flat to rolling desert plains interrupted in places by steep-sided valleys and small sand areas.
Spanish Sahara.....	275.....	Demarcated, undisputed.....	Primarily desert plain with dissected areas in central and western parts. Narrow dune area near coast.
Ceuta (Spain).....	City limits.....do.....	On small plain backed by brush-covered mountains.
Melilla (Spain).....do.....do.....	Do.

FIGURE 17. Amphibious landing areas (C)

LOCATION	APPROACH	BEACH	TERRAIN BEHIND BEACH AND EXIT
From 8 mi. southwest of Casablanca northwest for about 20 mi. (Figure 10).	Seaward of 3-fathom curve clear; shoreward, partly obstructed by scattered reefs, shoals, rocks, and jetties. Nearshore bottom sand; gradient mostly 1 on 20 to less than 1 on 140; many places suitable for dry-ramp LST landings.	<p>Contains 8 main beaches. Beach centered 7³/₄ mi. southwest of Casablanca 5¹/₄ mi. long; 3³/₄ mi. usable; 90 to 180 yd. wide at L.W. and 20 yd. wide at H.W.; gradient 1 on 15 to 1 on 30, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand and shells with some cobble; rock outcrops on beach.</p> <p>Beach centered 4 mi. west-southwest of Casablanca 1¹/₄ mi. long; all usable; 250 yd. wide at L.W. and 56 yd. wide at H.W.; gradient 1 on 70 to 1 on 120, L.W. to H.W., and 1 on 60 or steeper in H.W. zone; material sand and shells.</p> <p>Beach centered 2¹/₂ mi. west of Casablanca 1,350 yd. long; 900 yd. usable; 125 to 290 yd. wide at L.W. and 50 yd. wide at H.W.; gradient 1 on 70 to 1 on 120, L.W. to H.W., and 1 on 60 or steeper in H.W. zone; material sand and shells; rock outcrops and bldgs. on beach.</p> <p>Beach centered 7 mi. northeast of Casablanca 3¹/₂ mi. long; 3 mi. usable; 120 to 175 yd. wide at L.W. and 20 to 50 yd. wide at H.W.; gradient 1 on 70 to 1 on 120, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand and shell; scattered rock outcrops and bldgs. on beach; sewage pipe encased in concrete block near beach center.</p> <p>Beach centered 5 mi. southwest of Mohammedia 1,250 yd. long; all usable; 190 to 200 yd. wide at L.W. and 10 yd. wide at H.W.; gradient 1 on 20 to 1 on 60, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand and shell; scattered rock outcrops on beach.</p> <p>Beach centered 1¹/₄ mi. southwest of Mohammedia 1,400 yd. long; all usable; 150 to 235 yd. wide at L.W. and 15 to 50 yd. wide at H.W.; gradient 1 on 20 to 1 on 60, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand.</p> <p>Beach at Mohammedia 1¹/₄ mi. long; 1 mi. usable; 115 to 250 yd. at L.W. and 10 to 25 yd. at H.W.; gradient 1 on 20 to 1 on 60, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand with some gravel and cobble in central part.</p> <p>Beach centered 2³/₄ mi. northeast of Mohammedia 1¹/₂ mi. long; nearly all usable; 60 to 325 yd. wide at L.W. and 10 to 75 yd. wide at H.W.; gradient 1 on 20 to 1 on 60, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand.</p>	Most parts of beaches backed by partly stabilized sand dunes and escarpments 10 to 50 ft. high; terrain behind dunes mainly cultivated plain with scattered bldgs.; marsh-fringed stream behind beach southwest of Mohammedia. Exits by tracks, trails, loose- and hard-surfaced roads and city streets or by cross-country movement to hard-surfaced coastal road 800 yd. to 2 mi. inland.

<p>From Asilah north-northeastward for about 12 mi.</p>	<p>Seaward of 5-fathom curve partly obstructed by shoal, reefs, and seasonal fishing nets; shoreward, partly obstructed by rocks; wreck off southwest part. Nearshore bottom sand; gradient mostly 1 on 40 to less than 1 on 80; most places suitable for dry-ramp LST landings. Minimum surf 4 ft. or higher, 21% of time, July-Sept.; maximum 31% Jan.-Mar. Tidal range 7 1/2 ft., springs.</p>	<p>Contains 2 main beaches. Beach north-northeast of Asilah 6 1/2 mi. long; 6 mi. usable; 100 to 175 yd. wide at L.W. and 10 to 75 yd. wide at H.W.; gradient 1 on 20 to 1 on 60, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand.</p> <p>Beach centered 10 mi. northeast of Asilah 2 1/2 mi. long; all usable; 150 to 200 yd. wide at L.W. and 50 to 100 yd. wide at H.W.; gradient 1 on 20 to 1 on 60, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand.</p>	<p>Most part of beaches backed by dunes or sandy area; in places, sand hills, cliffs, and bluffs; in turn backed by partly cultivated, marshy plain cut by several rivers. Exits by tracks, trails, and by cross-country movement to hard-surfaced road 200 to 1,500 yd. behind beaches.</p>
<p>East of Tangier (Figure 13)...</p>	<p>Clear seaward of 5-fathom curve; restricted by breakwater and submerged rocks; shoreward, partly obstructed by rocks; wreck off eastern half. Nearshore bottom sand and rocks; gradient 1 on 25 to less than 1 on 80; most places suitable for dry-ramp LST landings. Minimum occurrence of surf 4 ft. or higher, 5% of time Jan.-Mar.; maximum occurrence 7% Apr.-June. Tidal range 6 1/2 ft., springs.</p>	<p>Beach 1 1/4 mi. long; all usable; 100 to 200 yd. wide at L.W. and 70 to 150 yd. wide at H.W.; gradient 1 on 20 to 1 on 60, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand.</p>	<p>Beach backed by sandy area, with several bldgs., extending inland 50 to 170 yd. to low wall fronting railroad yards and highway; beach interrupted near southeast flank by river mouth; all backed by partly grass-covered and marshy plain; outskirts of Tangier behind southwest part. Exits through gaps in wall to streets and hard-surfaced road leading inland.</p>
<p>Scattered from 12 1/2 mi. north of Ras el Aswad (Cap Negro) south for about 23 mi. (Figure 13).</p>	<p>Clear seaward of 5-fathom curve; fishing nets in offshore June to Oct.; shoreward, partly obstructed by rocks, reefs, shoals, and river-mouth bar; submarine cable off central part. Nearshore bottom mostly sand with some gravel; gradient mostly 1 on 16 to less than 1 on 80; many places suitable for dry-ramp LST landings. Minimum occurrence of surf 4 ft. or higher, 9% of time Apr.-June; maximum occurrence 15% Jan.-Mar. Tidal range 2 1/2 ft., springs.</p>	<p>Contains 3 main beaches. Beach centered 8 mi. north of Ras el Aswad 1 3/4 mi. long; 8 3/4 mi. usable; 50 to 100 yd. wide at L.W. and 35 to 75 yd. wide at H.W.; gradient 1 on 15 to 1 on 30, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand, gravel and shells.</p> <p>Beach centered 7 mi. south of Ras el Aswad 8 1/2 mi. long; 7 1/4 mi. usable; 50 to 250 yd. wide at L.W. and 30 yd. wide at H.W.; gradient 1 on 20 to 1 on 30, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand and gravel.</p> <p>Beach centered 10 mi. south of Ras el Aswad 1,500 yd. long; all usable; 75 to 100 yd. wide at L.W. and 60 to 70 yd. wide at H.W.; gradient 1 on 20 to 1 on 30, L.W. to H.W., and 1 on 15 or steeper in H.W. zone; material sand and gravel.</p>	<p>Most parts of beaches backed by partly stabilized sand dunes up to 15 ft. high; parts of northernmost beach backed by seawall 5 to 30 ft. high; all in turn backed by scrub-covered hills, valleys, and plains; in places, marsh-fringed wadies; river interrupts central part; exits by tracks, trails, loose-surfaced roads, city streets, or by cross-country movement to hard-surfaced coastal road 400 yd. to 6 mi. inland.</p>

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FIGURE 18. Critical weather and terrain factors in air approaches (U/OU)

FACTORS	NORTHERN APPROACHES	SOUTHERN APPROACHES
Cloudiness:		
Summer.....	Minimum. Mostly scattered clouds. About 10 or fewer days per month average $\frac{1}{2}$ or more cloud cover.	Clear skies predominant. Overcast skies rare except over Atlantic and along coast.
Winter.....	Migratory systems bring extensive cloudiness, averaging 10 to 20 days per month with $\frac{1}{2}$ or more cloud cover.	Clear skies predominant. Overcast skies infrequent. Most cloudiness associated with weak migratory frontal systems.
Thunderstorms and turbulence:		
Summer.....	Season of maximum thunderstorm frequency, averaging 6 days or fewer per month; few frontal, mostly airmass type, widely scattered. Severe turbulence in thunderstorms.	Thunderstorms occur on average of 3 days or fewer per month. Moderate to severe turbulence in thunderstorms, and strong localized duststorms and sandstorms. Turbulence common at low levels over hot desert.
Winter.....	Thunderstorms occur 3 days or fewer per month, mostly along fronts. Moderate to severe turbulence in frontal zones and in thunderstorms.	Thunderstorms infrequent, one or fewer per month. Turbulence occasionally occurs, mostly along weak frontal systems.
Freezing level and aircraft icing:		
Summer.....	8,000 to 15,000 feet. Severe icing conditions in thunderstorms and in other strong convective cloud systems.	15,000 to 17,000 feet. Minimum icing conditions.
Winter.....	5,000 to 10,000 feet. Season of maximum risk of aircraft icing. Icing conditions common along frontal systems and in thunderstorms.	Near 15,000 feet. Icing conditions uncommon except in thunderstorms and weak frontal systems.
Visibility:		
Summer.....	Visibility generally good, only occasionally restricted by dust and haze aloft.	Visibility frequently restricted by haze aloft and severely restricted at times in local duststorms and sandstorms.
Winter.....	Visibility generally good.....	Visibility generally good. Occasionally restricted at times by dust and haze aloft.
Critical terrain.....	In Portugal, about 300 nautical miles from Morocco, maximum elevation 6,530 feet; in southern Spain, about 100 nautical miles from Morocco, maximum elevation about 11,420 feet; in northern Algeria, Atlas Mountains range mostly from 3,000 to 5,000 feet, with highest elevation, about 7,300 feet, 40 miles from Morocco border.	Canary Islands have peak elevation of about 12,160 feet, about 190 nautical miles from Morocco. In southern Algeria, northern Mauritania, and Spanish Sahara, elevation of desert mostly 2,000 to 3,000 feet.

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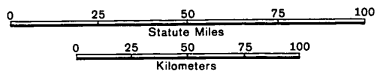
Morocco

- International boundary
- - - Province or préfecture boundary
- ⊙ National capital
- ⊙ Casablanca Province or préfecture capital
- +— Railroad
- Surfacéd road
- - - Unsurfaced road or track
- ✈ Airfield
- ⚓ Major port

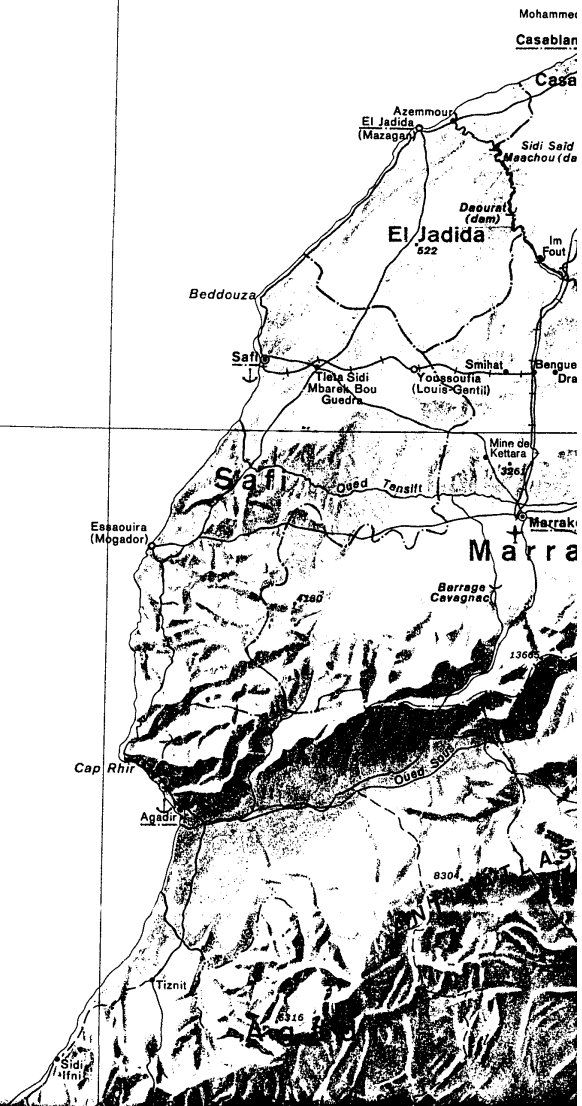
Populated places
 ⊙ Over 100,000
 ○ 25,000 to 100,000
 • Under 25,000

Spot elevations in feet

Scale 1:2,430,000



Atlantic Ocean



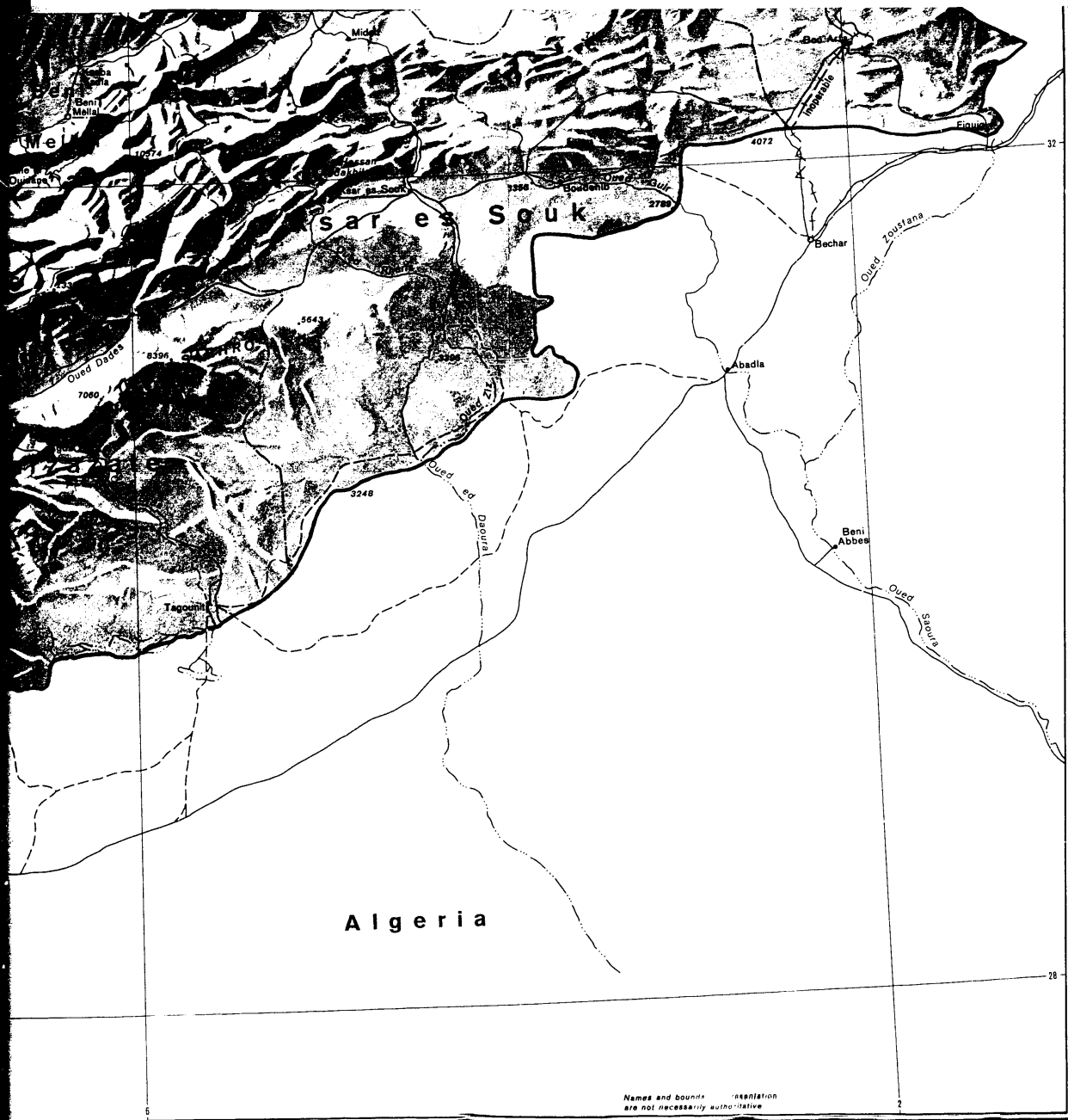


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Terrain and Transportation Map Figure 19

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