

Q. CLIMATE AND TERRAIN

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Q.1. Introduction

This chapter cannot provide a lesson in world geography; it can only summarise types of climates and terrains. While it is vital to research conditions in areas the UNDAC team may operate in, knowledge of climate zones will help if circumstances throw you into unfamiliar territory.

Temperate climates cover much of the globe and offer the best chances for functioning without special skills or knowledge. These territories are also the most heavily urbanised. Heavy winter conditions may call for polar skills.

Q.2. Climate and terrain zones

Polar regions

Polar regions include Arctic, Antarctic, northern territories of Alaska, Canada, Greenland, Iceland, Scandinavia and parts of Russia, Central Asia and the Himalayas, but cold weather skills may be needed at high altitudes everywhere.

Tundra

Tundra is found mostly in the northern hemisphere, but may occasionally be found south of it. It describes a terrain where the subsoil is permanently frozen and vegetation stunted.

Northern coniferous forest

Up to 1300 km (800 miles) deep, this terrain lies between arctic tundra and temperate lands. Winters are long and severe. Trees and plants flourish along the great rivers that flow to the Arctic Ocean. Game, ranging from elk and bear to squirrels and birds, is plentiful. Melted snow creates swamps in the brief summer. Fallen trees and dense growth make the going difficult and mosquitoes may be a nuisance. Movement is easier in winter. There is gravel along the rivers, where fishing is good; a raft may be made from dead fall.

Deciduous forest

Oak, beech, maple and hickory are the main species in America; oak, beech, chestnut and lime, in Eurasia. The rich soil supports many plants. Survival is easy, except in very high altitudes where tundra or snowfield conditions apply.

Temperate grassland

These areas are found in the central continental areas of North America and Eurasia. Hot summers, cold winters and moderate rainfall have made these the great food producing areas.

Mediterranean regions

Lands bordering the Mediterranean are semi-arid with long hot summers and short dry winters. Trees are few and water is scarce.

Tropical jungle

Equatorial rain jungle, subtropical rain forest and mountainous forest all feature high rainfall and rugged mountains, which drain into large, swift-flowing rivers with coastal and low-lying regions as swamp land.

Savannah

Tropical grasslands found in Australia, Venezuela, Colombia, Brazil and Africa. Grass grows up to 3 m (10 ft). Temperatures are high all year round. Water is scarce but where it is found there will be lush vegetation and plenty of wildlife.

Desert

One-fifth of the earth's land surface is desert, of which only small parts are sand; most is flat gravel cut by dried-up water courses (wadis). Very high temperatures occur by day, falling to below freezing at night. Survival is difficult.

High altitude mountains

There are large portion of Central Asia and the Himalayan Region as well as mountain ranges in South America where there is significant habitation in high altitude mountainous areas, i.e., over 10,000 feet. Functioning at these altitudes means normally taking into account low atmospheric pressure, extreme cold and strong winds. Such areas require special acclimatisation procedures.

Q.3. Polar Regions

Winter temperatures are well below freezing and hurricane force winds can whip snow 30 m (100 ft) into the air. A 32 kmph (20 mph) wind brings a -14°C (5°F) thermometer reading down to an actual temperature of -34°C (-30°F). Days vary from total darkness mid-winter to 24-hour daylight midsummer.

Q.3.1. Travel

- Establish shelter as near to the aircraft or vehicle as possible. Move only if rescue improbable. Cold dulls the mind. Plan while you can still think clearly.
- Navigation is difficult in featureless terrain and the going is treacherous. Don't move in a blizzard. Sea ice turns to slush in summer and the tundra is boggy.
- Don't make shelter near water, the habitat of black fly, mosquito and deerfly. Cover skin; wear a net over the head and burn green wood to keep them at bay.

Q.3.2. Navigation

- Compasses are unreliable near the Poles so be guided by the constellations and travel by night.
- Do not use icebergs or distant landmarks to fix direction: floes move constantly, and relative positions change. If breaking ice forces you to another floe, leap from and to a spot at least 60 cm (2-ft) from the edge.
- Observe birds: in the thaw wildfowl fly to land; seabirds fly out to sea by day, returning at night.
- Clouds over open water, timber or snow-free ground appear black below; over sea ice and snow-fields, white. New ice produces greyish reflections; mottled ones indicate pack ice or drifted snow.
- Follow rivers and travel downstream - by raft or on ice except in northern Siberia where rivers flow north. On frozen rivers keep to edges and outer curve on bends. Where rivers join follow the outside edge or take to outer bank. If river has many bends, take to land.
- Ice cold water is a killer. Falling into icy water knocks the breath out of you. The body loses muscular control, consciousness fades, and death follows in 15-20 minutes. Be

thoughtful before taking action. To rescue a colleague who has fallen through the ice, use a rope. If you have no ropes; use a long stick. Do not attempt to walk to the person. Approach the person by lying prone on the ice so as to spread your body weight across the greatest possible area. If you fall through move to the edge of the crack and float on your back. Lift your leg up onto the ice and then your shoulder and attempt to roll up onto the ice again distributing your weight across as broad an area as possible. Move to the land. Roll in snow to absorb water. Get to shelter and dry kit at once.

Q.3.3. Clothing

Severe cold freezes exposed flesh in minutes. Cover every part of the body and especially the head which is the most vulnerable – and important - part. Wear a woollen hat and cover it with a drawstring hood; a fur trim prevents breath freezing on the face and injuring the skin. If clothing has no drawstring, tie sleeves above cuffs, tuck trousers in to prevent heat escaping. If you sweat, loosen collar or cuffs or remove a layer.

Outer garments should be wind proof, but not waterproof, which could trap vapour inside - animal skins are ideal. Under layers should trap air for insulation. Wool is best for inner garments. It does not absorb water and is warm even when damp. Cotton absorbs moisture and rapidly loses heat when wet. Waterproof clothing should only be used in rain and then only when properly ventilated.

Several layers of clothing are better than one heavy layer. The outer layer should be of a breathable material (Gore-Tex, cotton). Non-breathable materials contain damp and moisture near your body. Remember the key-phrase C.O.L.D.

- **Clean.** Keep yourself and your clothing clean as dirt and grease block air spaces.
- **Overheating.** Avoid overheating your body. Ventilate when perspiring.
- **Loose.** Wear clothing loose and allow air to circulate.
- **Dry.** Moisture conducts cold and dry air insulates. Keep dry – keep warm!

Q.3.4. Footwear

- Mukluks, waterproof canvas or leather boots with rubber soles, are ideal. They should have an insulated liner.
- Wear several pairs of socks, graded in size to fit over each other and not wrinkle. To improvise footwear use layers of fabric. Canvas seat covers make good boots.
- Skiing is fine for firm snow but snow shoes are best in soft snow. Lift each foot without angling it, keeping shoe as flat to the ground as possible. Both methods require sufficient training of skills before use.

Q.3.5. Shelter

- Get out of the wind! Look for natural shelter to improve on but avoid sites where a snowdrift, avalanche or rock fall might bury you. Avoid snow-laden trees (branches may fall) unless lower boughs are supported.
- Don't block every hole against draughts. You must have ventilation, especially if your shelter has a fire.

Q.3.6. Fire

- Fuel sources are limited. Driftwood, seal and bird fat, fuel from wreckage - in extreme cold drain oil from sump before it congeals. It may be used solid if drained on ground. High-octane fuel may be left in the tanks.
- On the tundra, willow, birch scrub and juniper may be found.
- Cassiopeia is a low, spreading heather-like plant with tiny leaves and white bell-shaped flowers. It contains so much resin it burns when wet.

Q.3.7. Water

- In summer water is plentiful. Pond water may look brown and taste brackish but vegetation growing in it keeps it fresh. However, running water is always better than still. If in doubt, boil it.
- In winter always melt ice and snow. Do not eat crushed ice or snow; it can injure your mouth and cause further dehydration. Un-thawed ice or snow will reduce your core temperature and chill your body - especially if already cold and tired.
- If there are no other options for thawing of snow put some snow in a water bottle and wear it close to the body until it melts.

Q.3.8. Arctic health

- Frostbite, hypothermia and snow blindness are the main hazards. Efforts to exclude draughts in shelters may lead to lack of oxygen and carbon monoxide poisoning.
- Thinking may become sluggish. Keep alert and active but avoid fatigue and conserve energy for useful tasks. Sleep as much as possible - you won't freeze in your sleep unless you are so exhausted you cannot regenerate the heat you lose to the air. Exercise fingers and toes to improve circulation. Take precautions against frostbite.
- Avoid spilling petrol on bare flesh it will freeze at once and damage the skin.
- Don't put off defecation - this can cause constipation. Try to time it conveniently before leaving your shelter so you can take waste out with you.
- Snow glare can cause blindness. Protect the eyes with goggles or a strip of cloth with narrow slits cut for eyes. Blacken underneath the eye with charcoal to reduce glare further.
- Core temperature (body and head) is vital. When the body freezes it extracts blood from the limbs to warm the core. The head is where the human body loses the most of its body temperature when exposed to low temperatures. Remember the old saying; if your toes freeze - cover your head!
- Eat and drink more than regularly as the body uses more energy in cold climates than in temperate. Food should be rich in fat and protein to restore the calories that burn off more rapidly as the body works to keep warm.

Q.4. High altitude regions

Q.4.1. General

It is possible that UNDAC missions may take you to altitudes over 2700 m (9000 ft). These are considered High Altitude Regions and special attention to your well-being has to be paid in such areas.

Q.4.2. Effects of high altitude

In medical terms High Altitude is generally accepted to be heights above 9000-ft (2700 m), and the resultant medical conditions are associated with these altitudes. On the other hand, Extreme Altitude is regarded as those areas above 18000-19000 ft (5500-5800 m). While humans have survived, and lived at extreme altitudes, there is no successful and permanent acclimatisation for such altitudes.

Insufficient oxygen in the rarefied air at High Altitude imposes certain stresses on the human body. Overcoming those identifiable physiological changes, if successful, will lead to satisfactory acclimatisation. Failure to do so might prove life threatening. Other than the cold and the rarefied atmosphere, other contributors to illnesses peculiar to High Altitude are low humidity, solar and ultraviolet radiation.

Although there is, as yet, no universal classification of High Altitude medical problems, experience at these heights allows a tentative listing. Should the process of acclimatisation be affected in any way, the illnesses may vary from the acute to the chronic:

- **Acute Mountain Sickness (AMS)** - a throbbing frontal headache that is aggravated by exertion and particularly in the mornings is the most common ailment. Other symptoms include malaise, lassitude, disinclination to work, loss of appetite, nausea vomiting, shortness of breath on exertion and disturbed sleep. If untreated this may progress to -
- **High Altitude Pulmonary Oedema (HAPO)** - Caused primarily by rapid ascent, cold, re-entry and exertion, it is potentially life threatening. Beginning with a headache, there is body ache, cough, and breathlessness on exertion (which is progressive), non-anginal chest pain, lack of appetite, disturbed sleep, vomiting and giddiness. At times a fever may be the presenting symptom. In severe cases there may be associated symptoms of
- **High Altitude Cerebral Oedema (HACO)** - the most dreaded but also the least common of high altitude illnesses. The onset is as with AMS and the alteration of consciousness is the most important feature of HACO. Complaints of dimness of vision, dizziness, vomiting and which may progress to stupor and coma.
- **Pulmonary Arterial Hypertension of High Altitude** - The onset is usually with effort intolerance, anginal chest pain, haemoptysis and swelling of the feet and face along with diminution in the urine output.

- **Chronic Mountain Sickness** - is largely restricted to young or middle-aged men and particularly amongst smokers. The early and dominant symptoms are found in the central nervous system with headache, somnolence, loss of memory, dizziness, paraesthesias, and neuropsychiatric symptoms as the most common. Others symptoms include effort intolerance, bleeding manifestations and later, also, mild cardiac failure.

High altitude illness unrelated to acclimatisation

- **High altitude Retinopathy** - About a third to almost half of those exposed to extreme high altitudes are likely to be affected by retinal haemorrhages. While the exact cause is not known, there is an increase in retinal blood flow with vasodilatation. In addition, sudden surges in blood pressure on exertion may aggravate or precipitate retinal haemorrhage. It may be resolved spontaneously.
- **Snow blindness** - is less common than is believed and is caused by the exposure to ultraviolet radiation that is relatively higher at these altitudes, as well as the increased reflection of such radiation from the snow surface.
- **Hypothermia** - is diagnosed when the core body temperature falls below 35° C, and below 25° C it is lethal. Up to 33° C the onset is subtle and there is a decrease in shivering. As the core temperature falls further the individual becomes careless about clothing leading to a vicious circle. The individual becomes uncooperative, memory is affected, there is somnolence leading to stupor, coma and, finally, death.

Local cold injury includes:

- **Chill blains** - the non-freezing injury to the skin occurs at temperatures just above freezing. The affected part is red and causes intense irritation.
- **Trench foot** - This occurs when a limb has experienced prolonged contact with moist cold such as water or mud at temperatures above freezing. Symptoms are loss of feeling and a numbness of the area that may last for days after the exposure.
- **Frost bite** - The most serious of these injuries usually occurs at temperatures below freezing and is caused by the freezing of extra cellular fluid with the formation of ice crystals. This is aggravated by freezing of water in the cells and inhibition of enzyme systems. The onset is usually insidious with pain and numbness followed by loss of sensation. The severity of frost bite depends upon the duration of exposure and the temperature and at its most serious may lead to the loss of limbs.

Q.4.3. Effects of low temperatures

The summer temperatures at high altitudes vary from 10° C to minus 20° C. The winter average temperature bracket is minus 15° C to minus 35° C. Sometimes, the temperatures fall as low as minus 55° C. This, combined with wind chill factor, creates extreme subzero polar effects and causes:

- A large number of cold injury casualties. It is essential to have special extreme cold clothing and special shelters for such environment.
- Failure of equipment like radios because of cold arrest. Special extreme winterized equipment is necessary.
- Failure of “over-snow” vehicles due to a frozen system. This requires special shelters, maintenance routines and expert handling of such vehicles.

- Inability of the available helicopters to undertake mission till late in the mornings, because of inability of the ground technical crew to do pre-flight servicing.

Q.4.4. Operational imperatives

The following operational imperatives emerge in high altitudes:

- **Survival** - The focus of all logistic support at these altitudes has to be foremost on survival in the extreme harsh environment providing the proper clothing, high value rations and safe and comfortable shelters. The environmental casualty rate is very high.
- **Psychological motivation** - People who understand the environment, prepare for it properly, deal with it with a positive frame of mind will survive and perform well in the environment. Very careful and positive psychological motivation is essential.
- **Training** - For the special environment of high altitudes, pre-induction training is a must.
- **Logistics** - A sound logistics plan to support the team committed to the environment is a must. It must integrate all logistics resources and provide for adequate safety margins to provide for disruptions due to prolonged spells of bad weather and other environmental hazards like avalanches.
- **Acclimatization** - It is imperative for all personnel operating at high altitudes to acclimatize. There is no cure for High Altitude sicknesses such as pulmonary oedema except moving the person to below 10,000 ft (3000 m).
- **Logistics air support** - The lifeline and the tactical capability of the team is entirely dependent on logistics air support based on a mix of aircraft and helicopters. Adequate level of this support has to be ensured.

Q.5. Tropical regions

This section deals with survival in tropical jungle areas. It is unlikely that UNDAC members will be placed in such a situation, however reference knowledge of such skills is considered desirable as UNDAC teams do function in tropical climates.

Everything in the jungle thrives, including disease and parasites. Even if saturated by perspiration, clothing affords protection from stings and bites. Except at high altitudes, equatorial and subtropical regions are characterized by high temperatures, heavy rainfall and oppressive humidity. Violent storms may occur towards the end of the summer. In choosing camp sites make sure you are above potential flooding.

Equatorial rain forests

Temperatures range from 30° C (86° F) to 20° C (68° F) at night. Jungle trees rise from buttress roots to 60 m (200 ft). In this primary jungle the canopy prevents light reaching the jungle floor. It is relatively cool, with little undergrowth to hamper movement, but visibility is limited. It is easy to lose a sense of direction and difficult for rescuers to spot you.

Secondary jungle

Along riverbanks and the fringes of the jungle sunlight does penetrate to the floor and growth is prolific. Undergrowth reaches heights of 3 m (10 ft) in a year. Moving is slow, hot work, hacking a way with a machete.

Sub-tropical rain forests

Found within 10° of the Equator, these forests have a season of reduced rainfall, even drought, with monsoons coming in cycles. More deciduous trees grow here and undergrowth is dense.

Mountain forests

At altitudes above 1000 m (3000 ft) - the Ruwenzori Range of Central Africa is typical - a crater-like landscape covered in moss between ice-capped peaks. Plant growth is sparse, trees stunted and distorted. Low branches make the going hard. Nights are cold; days hot and misty. Survival is difficult; make your way down the slopes to tropical rain forest.

Saltwater swamps

In coastal areas subject to tidal flooding, mangrove trees thrive, reaching heights of 12 m (40 ft). Their tangled roots are an obstacle above and below the waterline. Visibility is low and passage difficult. Sometimes channels are wide enough to raft but generally progress is on foot. You won't starve - fish, molluscs, aquatic animals and vegetation are plentiful - but it is a hostile environment with water leeches, caiman and crocodiles. Where river channels intersect the swamp you may be able to make a raft. If forced to stay in a swamp determine the high-tide level by the line of salt and debris on the trees and fit a raised bed above it. Cover yourself for protection against ants and mosquitoes.

Freshwater swamps

Found in low-lying inland areas, their thorny undergrowth makes the going difficult and reduces visibility - but survival is easy and swamps are often dotted with islands so you won't be chest deep in water all the time. There are often navigable channels and raw materials available from which to build a raft.

Q.5.1. Shelter

There are ample materials for building shelter in most tropical regions. Where temperatures are high and shelters exposed to the sun make roofs in two layers with airspace 20-30 cm (8-12 in) between to aid cooling. Double layers of cloth will help keep out rain if angled.

Q.5.2. Fire

Everything is likely to be damp. Take standing dead wood, shave off the outside and use that to start your fire. Dry bamboo and termite nests make good tinder.

Q.5.3. Food

A wide variety of fruits, roots and leaves are available. Banana, papaya, mango and figs are easily recognized, but you may find the wealth of tropical foods bewildering. A wide range of mammals, reptiles, birds and fish may be hunted, trapped and fished. Fish are easily digested, but in the tropics they spoil quickly. Clean thoroughly, discard entrails and eat as soon as possible. Do not preserve them by smoking or drying.

Fish in slow-moving water may be infested with tapeworms and other human parasites: boil for 20 minutes. Water itself may be infected with amoebas that cause dysentery, therefore always boil it.

Q.5.4. Dangers of jungle movement

Insect attack

Moving through the jungle may disturb bee, wasp or hornet nests. Any bare skin is vulnerable to attack. Run! Don't drop anything - you won't want to go back for it. Goggles will protect the eyes. Insects, searching for salt, will make for the sweaty parts of your body. Protect armpits and groin against their painful stings.

Mosquito protection

Wear a net or T-shirt over your head, especially at dawn and dusk. Better, take a strip of cloth 45 cm (18 in) deep and long enough to tie round your head; cut it to make a fringe of vertical strips hanging from a band that will dangle round your face and over your neck. Keep covered at night, including your hands. Oil, fat or mud spread on hands and face may help repel insects. Use bamboo or a sapling to support a tent of clothing and large leaves rigged over your upper half. A smoky fire will help keep insects at bay.

Cover your feet

Good footwear and protection for the legs is essential. Bind bark or cloth round feet and tie it to make wrappings for the legs as a defence against leeches and centipedes.

Beware hairy caterpillars

Always brush off in the direction they are travelling or small irritant hairs may stay in your skin and cause an itchy rash, which may fester in the heat.

Beware of invaders

Keep clothing and footwear off the ground so that scorpions, snakes and spiders don't creep in. Shake out clothes and check boots before putting them on; be wary when putting hands in pockets. Take care on waking: centipedes nestle for warmth in the more private body regions. Protect armpits and groin against stinging insects attracted by sweat.

Leeches

Their bite is messy but not painful. Left alone they drop off when they have their fill. Do not pull them off the head may come off leaving the jaws in the bite, which could turn septic. Remove with a dab of salt, alcohol or a burning cigarette end, ember or flame.

Danger in rivers

Rivers may be home to dangerous creatures such as piranhas, stingrays and electric eels. Look out for crocodiles or alligators and take care in handling catfish, which have sharp dorsal fins and spines on their gill covers.

Q.5.5. Travel in jungles

Ground observation in the jungle areas varies according to the type of vegetation. In some types of jungle, the forest canopy is so thick that it cuts off most of sunlight and ground observation is limited to approximately 20 metres.

In the jungle with a tangle of secondary growth, ground observation may be limited to 5 metres or less. In other types of jungle, the visibility may vary from 15 to 20 metres to as much as 100 metres.

Observation will be greatly restricted during the monsoon period and winter months due to heavy rain and ground fog which may persist in the valleys for several hours after sunrise. The heights of ridges and hills offer slightly improved observation as the vegetation towards the heights is thinner than that found in the valleys.

Movement in the jungle, both on foot and in mechanical transport, is a slow and laborious process owing to the slush caused by the rains and the difficulty of leaving the track. Movement on foot particularly poses a number of difficult problems. The route has to be carefully selected to avoid unnecessary climbs and descents and hacking through thick jungle foliage. The traveller is also subjected to the discomforts of high humidity especially when moving through cane and bamboo forests.

There is a tendency to under estimate the time taken to move between two points in the jungle. Since conditions of climate and terrain may cause wide variations in the time taken to complete a move, all moves in the jungle should be planned on the basis of time taken to move between the two points, rather than the distance between them.

Q.5.6. Navigation in jungles

Jungle navigation is not easy but the difficulties are often overstated, provided methodical map study and planning are undertaken, followed by careful use of the map, compass and protractor.

The elements of navigation are keeping direction and knowing the distance travelled. The ability to use the following aids as a collective means to jungle navigation may only be gained from constant practice:

- **A watch** - Every jungle navigator must have a reliable and waterproof watch set to the correct time.
- **Maps** - These may be reasonably accurate as regards features, e.g., hills and streams. It should be borne in mind however, that most maps are produced from air photos which, when taken over areas of jungle, show the form of the tree canopy and not the ground formation. Therefore, small features such as cliffs and waterfalls often exist on the ground but are not shown on the map. Maps are often inaccurate as regards cultivation jungle boundaries, roads, tracks, villages and clearings because these features are subject to continual change.
- **Air photographs** - A valuable supplement to maps and often the only means of bringing a map up to date or of obtaining cover of unmapped areas. They are, however, of very limited use in jungle covered areas.
- **Compass** - The compass is the most accurate means of maintaining direction. In some areas magnetic variation may be present due to the presence of minerals. Rely on the compass and avoid the temptation to use one's sense of direction. No party should attempt to move in the jungle without a compass, unless this is unavoidable and in an emergency.

Distance travelled will vary with the physical condition and will of the individual. The normal error is to over estimate the distance travelled but time is a more practical measure of the going. The following may be regarded as a rough guide to the distance covered in one hour:

- Through primary jungle 1000 to 2000 metres (contouring).
- Through primary jungle 700 to 1000 metres (cross grain).
- Through secondary jungle 500 to 800 metres.
- Through swamps 100 to 200 metres.
- Through tall grass 500 to 1000 metres.

Q.5.7. Health and sanitation

In the jungle, sanitation and personal hygiene are more important. Intestinal diseases are diseases usually transmitted by contaminated food or impure water. Contamination of the food may be caused by use of dirty utensils, flies or other such insects and food handlers. Water borne diseases may be caused by impure water that is used for drinking, cooking and bathing purposes. Examples of this type of disease are dysentery, cholera, etc. Insects and animal borne diseases are transmitted directly through bites of blood sucking insects like mosquitoes and ticks. Diseases of this type are malaria, yellow fever, filariasis and typhus.

Fungus disease merits special attention because the climate in the jungle favours the growth of microscopic plants called fungi, which produce these diseases. Sweat soaked skin invites attack by fungus. The principal fungus diseases are ring worm and athlete's foot.

Every person is responsible for her/his own cleanliness and that of her/his surroundings. Frequent inspections of the body must be carried out for the lice or tick bites. Clothes impregnated with DBP, i.e., insect repellent for clothing are very effective against mite bites and reduce the incidence of typhus. All scratches and wounds must be attended to at an early stage. Excessive heat and humidity create moist sweaty conditions because of which the scratches are likely to become septic. The body should be protected against insect bites by use of insect repellents or mosquito nets.

Whenever possible, the body should be bathed and exposed to sun and air. The clothes should be loose fitting, clean and dry. When possible, the boots should be removed and the feet massaged and dusted with foot powder. Boots should be removed before sleeping.

Q.6. Desert regions

Q.6.1. Desert conditions

The desert is a vast arid waste land with little vegetation and sparse population. It is generally featureless but it contains sand dunes, rocky outcrops and clay plains. The desert, therefore, is not impossible and difficult except in stretches. The going is generally good over almost all types of terrain. This is particularly true when using tracked or half-tracked vehicles. Wheeled vehicles or four-wheel drive category may also be driven over most desert terrain provided the drivers are well trained. However, areas of soft sand and those areas which collect water due to rainfall become impassable to traffic for certain periods of time.

Sand dunes may be from 70 to 100 metres in height and 3 to 5 kilometres in length. Distance between dunes may vary from 400 to 1200 metres. The steep portion of a sand dune is normally referred to as its knuckle and the gradual portion as its fingers. It is essential that the configuration of sand dunes be clearly understood. Sand dunes areas provide the greatest obstacles to mobility.

Rocky outcrops

These outcrops may be from 50 to 100 metres in height and 3 to 5 kilometres in length. Their ingredients are generally weathered rocks of sedimentary nature and hard gravel. This material is the main item of road construction in the area. The going in these areas is generally good.

Clay plain

These are open plains found in depressions due to the deposition of clay from the flow of rain water. The going in this area is very good as long as it is dry. If there is rain, then the area becomes impassable to all types of vehicles for prolonged periods.

Climate

The climate of desert terrain has the following facets:

- **Rainfall** - The average rainfall is very low. Long spells of drought are quite frequent.
- **Temperature** - The desert is generally associated with extreme conditions of temperature. During summer, the maximum temperature exceeds 45 degrees C., while during winter; temperatures fall down nearly to the freezing point. Days are hot and may be pleasant during winter and unbearable during summer, while nights are generally cool throughout the year.
- **Wind** - Hot winds and sandstorms are a regular feature. Sometimes, these reach a velocity of up to 40 kmph and may last for a number of hours at a stretch. Consequently dust and haze are prevalent and restrict visibility both from the air as well as from the ground. Observation becomes a major problem during such conditions. Visibility, however, is good during moonlit nights.
- **Water** - There is an acute scarcity of water. Almost all available water is brackish. Planning for water assumes significance in logistics planning. Storage and transportation of water are prerequisites for operations.
- **Desert tracks** - The area is criss-crossed by camel tracks. Tracks generally connect water sources on which various villages depend. Normally the roads and tracks follow the grain of the country except where shorter routes are required to water sources. Most desert tracks are well defined when in use otherwise they get obliterated quickly by blowing sands.

To survive you must make the most of any available shade, create protection from the sun, cut moisture loss and restrict activity during the heat of the day. Where great temperature differences between night and day occur condensation is a source of water. When rain does come - years may pass with none at all - it may be in torrential downpours which create flash floods before being quickly absorbed. Dust or sand storms reduce visibility. Protection is needed against sand entering every orifice.

Q.6.2. Water

Water is vital. If you have it, ration it immediately. If you are stranded by mechanical failure during a desert crossing, hopefully you will have planned your route with an awareness of oases, wells and waterholes. Wells may require a container lowered on a line to reach water. Small waterholes in wadi (watercourse) bottoms are often seasonal. They are usually covered with a stone or brushwood.

Away from known waterholes, dig at the lowest point of the outside bend of a dry stream bed or the lowest point between dunes. Do not dig in the heat of day - you'll sweat liquid you may not be able to replace. Always balance fluid loss against possible gain.

Life expectancy depends on the water available and your ability to minimize perspiration. Without water you will last 2 days at 48° C (120° F) if you rest in the shade and do nothing. If you must walk to safety the distance you cover will relate to the water available. With none, a temperature of 48° C, walking at night and resting by day, you could cover 40 km (25 miles). Walking by day you would cover 8 km (5 miles) before collapse. At 48° C with 2 litres (4 pints) of water you might cover 56 km (35 miles) and last 3 days.

Drink 1.5 litres for every 2 lost (3:4 pints). Less fluid will not result in less sweat. If more fluid is drunk than needed it will be excreted and used to no purpose.

Q.6.3. Shelter and fire

Find immediate shade. In the evening cool build a shelter. Do not stay in a metal vehicle or plane. Use it to support a shelter or make use of the shadow beneath an aircraft's wing. Pile rocks to make a windbreak and make use of wadi walls (except when flash floods seem likely). Use the double-layer technique to aid cooling. If using fabrics, leave bottom edges lifted and loose by day to increase air circulation. Weight them down with rocks at night. Avoid lying directly on hot ground: air can circulate under a raised bed.

You will need fire for warmth at night and for boiling water. Smoke will be useful for signalling. Desert scrub is dry and burns easily. If the land is totally barren, vehicle fuel and oil mixed with sand in a container will burn. Animal dung is also flammable.

Q.6.4. Clothing

Clothing helps reduce fluid loss and gives protection from sunburn and insect bites, as well as warmth at night. Clothes should be light and loose fitting, with air space between the garments and the body. Copy the flowing, layered garments of the Arab world. Trousers give more protection from insects and guard against serious sunburn on the legs. Cover the head and feet.

Keep covered! Apart from risking severe sunburn, an uncovered body will lose sweat by evaporation. Keep clothing loose with a layer of insulating air. Sweating will then cool you more efficiently.

Headgear

A hat with a piece of cloth attached to the back will protect but, better still, copy Arab headwear: make a handkerchief into a wad on top of the head, fold diagonally a piece of cloth about 120 cm (4 ft) square, place it over the handkerchief, long edge forward, and secure with a cord tied round the head. This traps pockets of air and protects from sand. Wrap round the face for warmth at night.

Eye protection

Sunglasses may not be enough. Soot from the fire smeared below the eyes will reduce glare. Shield eyes from glare and windborne sand with a strip of material. Cut narrow slits to see through.

Footwear

Do not walk barefoot until your feet have hardened or they will burn and blister. Do not leave tops of feet exposed. Wrappings around your legs keep sand out of boots; wrap them round the feet over open sandals.

Q.6.5. Food

Heat causes loss of appetite - don't force yourself to eat. Protein foods increase metabolic heat and water loss. If water is scarce, keep eating to a minimum and try to eat only moisture-containing foods, e.g., fruit and vegetables. Food spoils quickly in the desert. Once open, eat stores at once or keep covered and shaded.

Vegetation is scarce, but deserts often support a variety of animals. Insects, reptiles, rodents and some small mammals burrow or hide during the day; large mammals are an indication that there is water close at hand.

Q.6.6. Health

Most desert illnesses are caused by excessive exposure to sun and heat. They may be avoided by keeping head and body covered and remaining in the shade.

- Constipation and pain in passing urine are common and salt deficiency may lead to cramps.
- Heavy sweating coupled with garments that rub may block the sweat glands and result in an uncomfortable skin irritation known as prickly heat.
- Heat cramps, leading to heat exhaustion, heat stroke and serious sunburn are all dangers. A gradual increase in activity and daily exposure to the sun will build up a defence, provided that plenty of drinking water is available.
- Keep moist areas of the body - crevices of armpits, groin and toes - clean and dry to prevent infection.
- Even the most trivial sore will become infected if not dealt with straight away. Pull out thorns as soon as possible. Where the skin is broken a large and painful sore may develop which could prevent walking. Bandage all cuts with clean dressings and use what medical aids are available.

Q.6.7. Don'ts while driving in the desert

- Don't break the continuity of motion.
- Don't accelerate when wheels have lost contact with the ground.
- Don't drive in low gear unnecessarily.
- Don't allow engines to overheat.
- Don't apply breaks abruptly in soft sand but allow the vehicle to roll to a halt.
- Don't overtake in sandy patches.
- Don't follow the tracks of vehicles in front in sandy patches.
- Don't turn sharply in soft sand.
- Don't drive too closely on the tail of the vehicle in front.
- Don't drive right up to the vehicle in front which is stuck or you will get stuck yourself.
- Don't halt your vehicle while crossing a soft sandy patch.
- Don't overload your vehicle.