



## TEMPERATE REGIONS: INFLUENCES ON MILITARY OPERATIONS, PART 2

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*EDITOR'S NOTE: This article is the second in a two-part series on the temperate regions of the world and their environmental effects on military operations. Part 1, in the July-August 1993 issue, discussed the unique aspects of temperate regions, the terrain and its military effects, observation and fields of fire, obstacles, cover and concealment, and avenues of approach. Part 2 deals with the effects of the weather and terrain on soldiers, equipment and facilities, and combat and support operations.*

*This article concludes Colonel Clegg's INFANTRY series on the various regions of the world. The earlier articles are*

*"Environmental Influences on Desert Operations" (May-June 1992); the two-part "Cold Regions: Environmental Influences on Military Operations," co-authored with Brigadier General Peter W. Clegg (July-August and September-October 1992); and the two-part "Tropical Regions: Influences on Military Operations" (March-April and May-June 1993).*

*Together, these articles provide a complete reference that military leaders can use in preparing their units to train or operate in any part of the world to which they may be deployed in the future. Reprints and some back issues of INFANTRY may be ordered directly from the magazine.*

In the temperate regions, the extremes of the arid, tropical, and cold regions that affect soldiers are significantly more moderate. The cold, heat, wetness, and disease do exist, but their effects are far less severe. The chief problems are caused by the rapid changes in weather conditions.

In the Korean War, for example, a battalion-sized relief was conducted in the late afternoon on a 4,500-foot mountain. Temperatures were high, and the soldiers were appropriately

dressed. With the higher elevation and an advancing cold front, however, temperatures dropped to below freezing, and three-fourths of the soldiers sustained cold injuries.

The seasonal and daily changes can be so drastic that it is difficult for people to adjust. Elements of the weather and the terrain affect both the physical and the psychological well-being of soldiers.

In summer, in the mediterranean and humid subtropical

*congratulated me for taking Nicosia. I told him we could not be sure it was anyone from the 3d Battalion since we had no communication with Company I. Teddy put on his helmet, placed his carbine at the ready on his lap, and said: "Let's go see."*

*The three-mile trip up the winding road was a scary one to say the least. Nicosia sat on a dominating hill. The road, of course, had not been swept for mines so our jeep moved rather slowly. At the edge of town I found one of our artillery forward observers who confirmed Company I was in Nicosia. White sheets hung from the windows of each house. We continued into the town square where hundreds of Italian prisoners were being assembled. [According to the official U.S. Army history, "Before the day was over the 16th Infantry had captured seven hundred Italians and a few Germans who failed to escape from Nicosia."] Our machineguns on main street corners covered exits from town.*

*We found Captain Kim Richmond having wine and cheese in the Mayor's office. Words of praise for the successful attack flowed from Roosevelt's gravelly voice. Both he and I joined in the cheese and wine feast!*

*After General Roosevelt departed I asked Kim why he hadn't followed my instructions . . . to meet me in Sperlinga. Kim said that he realized by going cross country he would get to Nicosia much faster. Also, he had received the battalion S-3's permission to by-pass Sperlinga. All was forgiven! Success overcomes everything! Kim's aggressive, offensive spirit won the day in a quick and decisive manner.*

Back in Sperlinga, the people gave my Company L a warm welcome. Weary of war and the German-led military occupation, they opened their hearts and homes to my soldiers and even butchered a prize steer to provide beef for our kitchens.

My executive officer, our interpreter Joe, and I were invited to dinner that first night by the acting mayor. We entered his home on the ground-level that sheltered a variety of farm animals, feed supplies, and piles of manure. Happily, the second story (at the top of steep wooden steps) housed clean, comfortable living quarters. We enjoyed the meal, lively conversation, and warm hospitality. I had to say "no," however, when our hosts asked for help in obtaining the release of relatives who were prisoners of war. They were the lucky ones; the war was over for them.

Following the capture of Nicosia, the 16th Infantry RCT continued its attack to the northeast astride Highway 120. By dark on 29 July, the 16th had seized a key enemy delaying position, capturing or killing many Germans in the process.

The 39th Infantry RCT, U.S. 9th Infantry Division, commanded by Colonel "Paddy" Flint, was attached to the 1st Division effective midnight 29 July. On the following day, the division ordered the 39th to pass through the 16th's front lines and attack Troina. According to General Bradley, "The Germans were not yet ready to abandon Troina. It developed into our toughest fight in the Sicily Campaign."

Meanwhile, on 31 July our battalion S-3 was wounded by enemy artillery fire and was evacuated. Fortunately, with the regiment in division reserve, Major Horner could make some

immediate reassignments: I became the battalion S-3, and my company executive officer, Lieutenant Ed Montague, took command of Company L. Obviously, it was a major personal readjustment for both of us.

Following a much needed two-day rest, the 16th Infantry RCT was ordered to attack due east at 0300, 3 August, and seize Troina. We moved out shortly after midnight with the 2d Battalion on our left. From daylight on 3 August until the seizure of Troina on 6 August, the action was fierce; American casualties were high, and German resistance was as determined as ever. Enemy observation posts covered our every movement during the day, and German mines, especially the antipersonnel "bouncing Betties," made our night attacks a frightening experience. Perhaps the toughest thing to take was being an individual target for German flat trajectory guns—anytime, anywhere.

Resupplying forward battalions and companies was always difficult, and getting ammunition, rations, and water to those companies was sometimes impossible. Mule trains helped, but we were inexperienced in using them. Jeeps and three-quarter-ton trucks sometimes got through. Here again, though, enemy mines still took a heavy toll. Tragically, our battalion S-1, Captain Paul Altomerianos, was killed as he tried to get supplies to us through a heavily mined area.

The volume, intensity, and accuracy of the German weapons exacted a heavy toll throughout the division. Too many brave company and platoon commanders were either killed or seriously wounded as they led the way. Among the latter were Lieutenant Montague and Platoon Sergeant Arthur White. Lieutenant Bob Cutler took over Company L for the final assault on Troina.

Our division artillery, reinforced by corps and army artillery battalions, consistently provided the best support possible. The professionalism of artillerymen at every level—observers, gunners, commanders—reduced our infantry casualties immeasurably. As I recall from after-action reports, the 7th Field Artillery Battalion fired about 10,000 shells in support of our 16th Infantry attacks between 3 and 6 August.

The 1st Engineer Battalion did an equally superb support job during every phase of the battle. Engineer soldiers cleared paths through threatening minefields, repaired roads and bridges under fire so we could get our supplies forward, and added their firepower whenever it was needed. Infantrymen respected combat engineers and vice versa.

It was during our final attack against Troina, after almost four weeks of campaigning, that we experienced close air support—if you could call it that—from the U.S. Army Air Corps. Early on 6 August, just as Company L was making its assault, we were attacked by twelve P-47 fighter-bombers, each with six .50-caliber machineguns blazing. They hit us from our lead scouts back to battalion headquarters. Along with others in our battalion command group, I dove into a shallow drainage ditch along that narrow dirt road leading into the town. Then the planes all made a second strafing pass.

Fortunately, our group had no personnel casualties; the only damage we suffered was one burned-out artillery liaison truck. Still, from rifleman to battalion commander, we were boiling

mad—not just at the Air Corps but also at our regimental headquarters, which had scheduled the strike and then failed to call it off.

Aside from the threat of omnipresent mines and a few final enemy rounds, we in the 3d Battalion occupied Troina on the morning of 6 August without further fighting. Although we didn't realize it then, as it turned out, the division's part in the campaign was over. General Bradley passed the 9th Division through our units for the final push to Randazzo and Messina. The 1st Division became the II Corps reserve, with the 16th Infantry in assembly areas near Mount Etna.

On 7 August 1943, the 1st Division commander, Major General Terry Allen, was reassigned to the United States and Major General Clarence Huebner became the new division commander.

Before closing my story, I must add a few recollections on health and medical matters. In 1943 the island of Sicily, except for the larger coastal cities, was an environmental disaster, one of the unhealthiest places in the world for Americans to fight a war. Over the centuries, rains had washed animal and human waste, plus garbage and trash of every description, through the hilltop towns and down into the valleys. Rivers, streams, and dry watercourses were totally polluted. Untold millions of flies tormented the villagers and spread diarrhea. Countless millions of mosquitoes spread malaria among all the troop units. As a result, during the entire campaign, hospital admissions for disease far exceeded the number of admissions for wounds and injuries.

According to the Army's official history of the campaign, *Sicily and the Surrender of Italy*, by Albert N. Garland and Harold McGaw Smith (page 419):

*The Seventh Army Medical Corps personnel . . . processed 20,734 hospital admissions of U.S. personnel and established two field and six evacuation hospitals. Of the total admissions, 7,714 were for wounds or injuries; the other 13,320 were for diseases, with malaria and diarrhea accounting for two-thirds of these. Roughly half of the hospital cases were evacuated to North Africa, an equal number each by air and water.*

I recall taking Atabrine pills daily and using water purification tablets every time my canteen needed filling, and my soldiers did likewise. Even with these precautions, I suffered from diarrhea throughout the campaign and had a brief bout with malaria. Most of us in the regiment ended up with some degree of jaundice.

My gums started bleeding midway through the campaign and weren't healed until late August. About that same time, I lost my vision for two days for reasons still unknown. Large sores on the backs of my hands (caused by something in the dirt) mystified our battalion surgeon from July until late November. Then, back in England, thrice-daily hydrogen peroxide cleanings, followed by coatings of sulfanilamide powder, finally worked the cure.

Incidentally, because of the diarrhea, heat, and lack of regular meals, I lost a pound a day during the campaign, and my men had similar health problems. But we were the fortunate ones, because we didn't have to be evacuated for treatment during the fighting.

## Epilogue

• The Sicily ground campaign, which started on 9 July 1943, ended on 17 August as American and British troops arrived in Messina, a city just evacuated by a rear guard of German and Italian forces. Page 553 of the official history summarizes the effect of that campaign on World War II:

*The campaign on Sicily that led to the capitulation of Italy proved several things. Like the invasion of North Africa, the Sicilian landings showed that Axis-held Europe was vulnerable to amphibious and airborne attack. It demonstrated the superiority of Allied weapons and equipment. It illustrated the resourcefulness and skill of the German foot soldier, who, despite numerical and technological inferiority, demonstrated once again the fundamental importance of terrain and its use in a struggle between ground forces. It gave the American field commanders in Europe experience, and particularly with respect to the British ally, a maturity not achieved before. Most of all, the Sicilian Campaign, by making possible the Italian surrender, marked a milestone on the Allied road to victory.*

• German retrograde operations in Sicily were well planned and superbly executed. They are worthy of study by today's military professionals.

• Our combat experience in Sicily was the best possible preparation for the invasion of France in June 1944. The lessons we learned there undoubtedly reduced our casualties at Normandy.

• Platoon Sergeant Arthur White, permanently disabled as a result of wounds he received in the battle for Troina, completed training as a watchmaker following World War II. He eventually bought a home and learned to drive in spite of his injuries. We stayed in touch over the years, and enjoyed our good long talks each year at a 1st Division dinner in New York. Art was a cheerful, ardent supporter of our Army until the day he died.

• The Company L private—we'll call him Jones—who did not want to accompany the unit into Sicily conducted himself well during the fighting and came out of it a proud veteran. After the battle, I had not seen him for some time, but one day, as I was returning from the hospital to my unit in a jeep, I stopped to pick up a hitchhiking soldier, and there he was. We recognized each other immediately and happily there were no ill feelings.

• Finally, no one could have imagined at the time that both the 55-year-old General Roosevelt and the 26-year-old Lieutenant Monteith, who hiked with the rest of us along the road out of Niscemi on that hot July day, would be heroes of the Normandy invasion 11 months later. General Roosevelt received the Medal of Honor for his courageous and inspiring leadership on UTAH Beach. Lieutenant Monteith was awarded the Medal of Honor posthumously for his brave deeds on the eastern end of OMAHA Beach.

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and hurricanes with winds from 74 to 150 miles per hour, high intensity rains, and storm surge waves from the ocean.

Although casualties from disease are less numerous in the temperate regions, they are still a concern, and proper sanitation is just as important as in other regions. In summer, heat injuries can be prevented by ample water intake, while in winter, cold injuries can be prevented by exercise and proper layering of clothes. In World War I a soldier's daily winter ritual was to rub his feet with whale oil and change socks to prevent trench-foot and inflammation from prolonged exposure to cold and wetness and a lack of exercise.

In the warm summer months, diseases carried by insects can be a problem. Mosquitoes, flies, bees, and ticks are bothersome. Some poisonous spiders and snakes exist in the mountains and swamps. There is little danger from large animals, because most avoid humans. Some may become nuisances, however, as they look for food. Soldiers must be cautioned to dispose of leftovers and properly store snack foods. Rats are a concern in defensive positions that are occupied for long periods, as in the trenches of World War I.

The terrain in temperate areas poses risks. Steep slopes and thorny vegetation in the mediterranean and humid subtropical areas can cause injury. Negotiating steep slopes, especially in hot weather, can lead to physical exhaustion. Irritating cuts from thorns can lead to infection if not properly cleansed. Rocky slopes can cause twisted ankles—not dangerous in themselves, but a soldier with a twisted ankle cannot carry his load and it must be divided among others. He may even need help walking. Other terrain-associated hazards, such as floods, volcanoes, earthquakes, and landslides, also occur in temperate regions.

The environmental conditions in temperate regions pose less risk to soldiers. Still, the dangers are ever-present and soldiers must be aware of them and of the countermeasures that will help reduce casualties and conserve combat power.

### **Effects on Equipment and Facilities**

The extremes in arid, tropical, and cold regions require close attention to their effects on equipment and facilities. Neglect in temperate regions can also lead to disaster. Because the extremes occur less often, leaders and soldiers alike may not have the sense of urgency to inspect equipment. For example, coolant and battery acid levels must be checked frequently, particularly in the summer heat of the mediterranean and humid subtropical areas where significant evaporation occurs, just as it does in desert areas. Sudden cold spells in the marine west coast winter require that antifreeze levels be checked frequently and that preparations be made for worst-case conditions. Leaders must recognize and fight the complacency that mild conditions tend to induce.

The variability of temperature also affects equipment. The alternate freezing and thawing of the fall and spring causes expansion and contraction in metals, plastics, and rubber. Containers are particularly affected as the liquids in them freeze or expand. Constant expansion and contraction reduce the strength of equipment, loosen connections, and cause equipment to crack or fall apart.

Temperature, precipitation, and wind all affect equipment and facilities. Catastrophic events (floods, earthquakes, landslides, volcanoes) and surface cover (vegetation, rock, mud) can also damage vehicles, aircraft, sensors, and weapons as well as structures, roads, bridges, and runways.

Seasonal changes affect vehicle maintenance requirements. Tire pressures, fluid levels, and batteries must be regularly checked as the seasonal temperature changes also change requirements. The influences of heat, such as loss of vehicle power (one percent for every 10 degrees Fahrenheit over 60 degrees) and strain on transmissions, gaskets, plastics, and brake lines, are a concern in the humid subtropical and mediterranean areas.

The effects of cold (sticking gauges, freezing brakes, blocking fuel lines, stiffening linkages, and hard-to-start engines) apply in the marine west coast subclimate areas. The constant moisture of the marine west coast areas—and to a lesser extent, the humid subtropical areas and seasonal precipitation in the mediterranean areas—cause other problems for vehicles: Electrical components short out, rubber parts such as gaskets deteriorate, moisture collects in gauges and fuel systems, and metals rust. (Rust occurs much slower than in tropical areas and can easily go unnoticed). Rust also hides cracks that make metals unserviceable. The wetness also reduces the tensile strength of rappelling ropes by 18 percent. Winds cause loose straps to flap and break connectors, chip paint, or crack glass. A real danger from the wind is the trees that blow down and land on vehicles.

Because of the thick underbrush in the humid subtropical areas, cross-country movement taxes engines and transmissions; vegetation entangles axles and wheel hubs, causing damage. Even tracked vehicles can be damaged by vegetation debris in the sprockets, road wheels, and guides. The rocky mediterranean terrain plays havoc with tires, increasing wear and causing punctures.

The mud that results from the deep clay soils and ample moisture of the temperate regions places strain on engines and transmissions. It clings to axles, wheels, brakes, steering linkages, and track suspensions. The alternating freeze-thaw and wet-dry of the temperate regions cause additional problems as the mud dries or freezes in large clumps that can throw tracks and bind wheels. During extended dry periods (usually in mediterranean areas), dust clogs filters, contaminates fuels and lubricants, and endangers operating conditions for both vehicles and aircraft.

Since temperature controls pressure, it also determines the lift and performance of aircraft. In the hot summer of the mediterranean and humid subtropical areas, a decrease in capability is common, especially in the afternoon. The reduced lift may preclude the movement of needed artillery. Heavy sling-load operations should be planned for early morning.

Icing is a problem in the marine west coast areas in winter. The frequent fog and frontal storms make for dangerous flying conditions. High winds associated with the storms can overturn aircraft. Aircraft must be protected in hangars or tied down with chains and weights. In the mountains, air currents can be tricky, producing dangerous flying conditions.

The modern Army relies on sensors, radios, computers, and a host of other electronic equipment. Moisture and temperature changes cause this equipment to fail or malfunction. High humidity causes interference with signals and shorts out components. Excessive heat buildup in equipment can lead to burnout. Optics are especially sensitive to temperature changes as their mounts expand and contract. Icing on antennas reduces range and increases noise. Wire gets lost in the mud. Fog and heavy rain or snow affect the returns on sensors; false readings and reduced ranges can be expected. Electronic equipment needs to be kept dry and cool. Again, moderate conditions may lead to complacency and neglect.

Standard maintenance and cleaning of weapons is just as critical in temperate regions as in other climatic areas. Although conditions are well within the design characteristics of the Army's weapons, mud is again the major problem. Dirty cartridges and rifle parts jam, and soldiers may have to take extraordinary measures to keep them operational. (In the trenches of World War I, soldiers urinated on their weapons to keep them free of dirt and mud, not necessarily a recommended measure.) Indirect fire munitions are less effective in mud and thick underbrush. Artillery and missiles are susceptible to freeze-and-thaw cycles that cause metal to expand and contract; this in turn affects wear and accuracy, propellant performance, and munitions effects.

Changing temperatures also affect such structures as buildings, bridges, roads, and runways. The ground shifts in the freeze-thaw process, causing movement in buildings and bridges that weakens them and leads to their collapse. Roads and runways crack and develop potholes that cause accidents. Storms associated with frontal systems (lightning, heavy rain), hurricanes, and high winds or tornadoes are obvious concerns for facilities.

Although the conditions of the temperate regions do not place equipment and facilities in the same degree of jeopardy as more extreme climates, the freeze-thaw and the tendency to laxity produce factors that require attention to normal maintenance and care for equipment and facilities.

### Effects on Combat Operations

Combat operations require both movement and visibility, and weather and terrain affect both. On land, at sea, or in the air, weather is the primary consideration in determining visibility. Weather conditions, particularly the changing conditions characteristic of temperate regions, influence surface conditions; these in turn affect trafficability or movement.

The principal weather elements that affect combat operations are wind and moisture. Wind and turbulence reduce flying opportunities, thereby restricting airborne, air assault, tactical air support, and logistical support operations. (Winds of more than 30 knots at jump altitude or 13 knots at the surface preclude airborne operations. Winds over 6 knots in air assault operations preclude landing with the wind, and gusts of 15 knots or wind speeds of 30 knots preclude helicopter flights—except for UH-60s, which can fly in winds up to 45 knots. Winds over 15 knots begin to cause problems for take-offs and landings in tactical air support and air logistical sup-

port.) Winds can also retard ground movement, slowing advances.

Atmospheric moisture, either condensation or precipitation, greatly hinders combat operations. Condensation in the form of clouds and fog reduces visibility to the point that air operations are suspended and ground movement is slow and dangerous (less than one-half mile of visibility and a cloud ceiling of less than 500 feet preclude air operations). Precipitation (rain, snow, ice) also reduces visibility and interferes with aircraft safety, often halting operations. Moisture interacting with soil, particularly clay, reduces trafficability while moisture with sand can increase trafficability.

Several terrain factors reduce movement: Slope, surface material, surface cover, man-made features, vegetation, and water. Slopes of more than 30 degrees and 45 degrees, respectively, preclude wheeled and tracked vehicle movement. Trees with stem thicknesses over four inches and six inches, respectively, and tree spacing of 12 feet and 15 feet, respectively, preclude wheeled and tracked vehicle movement). Hedgerows, vineyard lines, rivers, and swamps all restrict movement as well.

In many cases, the combination of weather and terrain has outweighed the effects of good tactics and firepower and the courage of soldiers on the battlefield. In October 1916 the Somme battlefields were subjected to five weeks of constant rain. The fields had been pitted and churned by massive artillery fire and transformed into a sea of mud where soldiers and horses drowned. The deep clay soil created a mud that sucked the boots and the pants off the soldiers. Shell holes became pools of water that lasted for months. Wood and stone were imported to shore up roads and trenches. Visibility was reduced, enabling the Germans to bring their reserves forward undetected, adjust their lines, strengthen their defenses, and prepare to counterattack. The British attacked first. The soldiers helped each other out of waist-deep water, over the walls of collapsing trenches, and across the saturated ground of standing water and mud into merciless machinegun fire.

On 14 November a high pressure system brought cold, clear conditions that drastically changed the tactical situation. The soil froze into a hard surface, allowing movement but also excellent visibility. (It seems that whenever movement is easy, concealment is difficult because visibility improves; and when weather conditions provide easy concealment, trafficability deteriorates.) Before nightfall on 18 November, a warm front brought a thaw and more rain. A heavy fog resulted, limiting visibility, and the mud returned, reducing trafficability. In the alternating fronts and storms—freeze and thaw—the attack died in the mud. The 140 German divisions still suffered a 50-percent casualty rate (one-half million soldiers).

In World War II weather and terrain dominated in Hitler's last major offensive, which plunged through the Ardennes, creating a bulge in the front. The Battle of the Bulge occurred because overcast skies with low cloud ceiling and rolling hills with deeply cut ravines and forest vegetation permitted German forces to mass for this major offensive practically undetected. In December 1944 warm moist air from the Atlantic Ocean moved east over the snow of the Ardennes. As the



**Obstacles on the Normandy beaches during World War II. Note the high ground to the rear where machinegun positions were emplaced and forward observers adjusted fire.**

warm air moved over colder snow, the air at the surface cooled, increasing relative humidity to the dew point. Condensation occurred, creating a thick advection fog that drifted across the area and lasted for days. With snow on the ground and fog in the air, the Allied offensive halted and German preparations continued.

The selection of the Eifel region, of which the Ardennes is a part, for the attack surprised the Allies, although the Germans had used this avenue in 1914 and again in 1940. Parallel ridges extend northeast to southwest across the region (with the higher Ardennes ridge to the west facing Belgium). The terrain is compartmented, channeling movement in the valley floor. Steep stream banks and slopes, as well as thick evergreen forests, further restrict movement. The Losheim Gap, a relatively flat, cleared corridor through the region, was the traditional avenue used by the Germans. Their objective, Antwerp (a major logistics base), was only about 100 miles to the west. With the aid of inclement weather and the restricted nature of the Ardennes (lightly held by the Allies), Hitler felt that success was in his grasp.

The attack had been scheduled for 25 November to take full advantage of poor weather, which would preclude the use of Allied air power and provide ground concealment for security. At this time, the new moon provided little illumination. The German plan required ten days of poor weather. But the complex terrain and poor weather also affected them, and it took two weeks longer to assemble their force. The weather depended on the relative strengths of the competing Siberian high (cold and clear) and the frontal North Atlantic or Icelandic low pressure systems (warmer and cloudy) brought across the continent by westerly air flows. The Eifel ridges, particularly the Ardennes or western ridge—the first high ground to affect the frontal air—elevates air causing cooling, condensation, and precipitation. The Icelandic low usually dominates in winter, bringing heavy rains to the Ardennes, saturating the soil and producing mud. Although temperatures hover around freezing, the afternoon sun warms temperatures above the 32-degree mark, creating the freeze-thaw cycle.

In the early morning of 16 December 1944, in the fog and rain, three German armies (30 divisions) attacked with more

than 200,000 soldiers and 500 tanks. The Sixth Panzer Army, to the north near Aachen, would exploit the Losheim Gap. The Fifth Panzer Army attacked in the center through Saint Vith, and the Seventh Army was in the south. The U.S. 2d and 99th Divisions of V Corps in the north and the 4th, 9th, 28th, and 106th Divisions of the VII Corps in the south (with only 75,000 soldiers) met the attack. The Losheim Gap was the corps boundary. Fog and drizzle obscured the battlefield, as warm moist air pushed in from the Atlantic. The fog was so thick that Germans entered U.S. mess and bivouac areas undetected.

For a week, visibility was less than 100 meters. Artillery could not adjust fire, but bazooka teams used the concealment of the fog to advantage, hiding while German tanks passed, then firing at them from behind. Holding key terrain (the Elsenborn Ridge) in the north, the 99th U.S. Division held but breakthroughs occurred in the Losheim Gap. Bastogne, in the center sector, was also key terrain. The Germans inflicted 9,000 casualties on U.S. units in an attempt to gain this crossroads of seven main arteries. The 101st Airborne Division and the 10th Mountain Division were dispatched to reinforce. In the south, river crossing operations slowed the Germans.

The Germans took advantage of the poor weather and rugged terrain for concealment, but their undoing was the effect of the weather on the ground and hence on their ability to move. The heavy snows began to melt, creating quagmires in the fields and totally eliminating cross-country movement. Tanks caught in the muddy fields sank up to their turrets in some cases. Roads were still slick with ice, which further complicated movement. Rivers swelled, making crossings dangerous. Additionally, the Siberian high pressure, dominant farther to the east (in Germany) brought snow that slowed resupply operations. It then brought cold and clear air west, displacing the warmer front on 23 December and allowing 294 Allied sorties to be flown, destroying German supply trains and combat equipment as well as bringing needed food and ammunition to U.S. soldiers. As the ground solidified, Patton's Third Army reinforced, moving 120 miles in seven days. Air strikes continued for another five days, and Allied air superiority took its toll. On the 28th a subsequent warm

front again changed conditions, but the weather cleared again on 3 January 1945, by which time the battle was over and the Allies were headed for the Rhine River.

These quick frontal changes and the associated freeze-thaw cycles are the menace the temperate regions present to combat operations. The REFORGER (return of forces to Germany) exercise in 1987 serves as yet another example. The exercise was scheduled for February, a time when the Siberian air moves into Germany, freezing the ground solid (ideal for training). The exercise began with great success, but after a few days a warm front from the Atlantic pushed across western Europe and into the heart of Germany. During the night a thick fog developed and the ground turned soft. By morning, tanks and trucks had sunk deep into the dark rich soils of the agricultural fields and in the woods. Trafficability was so bad, and so many vehicles were mired in the mud, that the exercise was terminated.

Both weather and terrain conditions can easily be overlooked in the temperate regions because they are not as life-threatening and severe as in the other climatic regions. But as far as combat operations are concerned the effect of these environmental influences can mean the difference between victory and defeat.

### Effects on Support

Logistics operations are less affected by environmental factors in temperate regions than in other climatic areas; nevertheless, the uniqueness of the weather (the seasonal and daily changes) requires certain support considerations that are not always necessary in other climatic areas.

Logistical support for military operations involves the type and quantity of supplies and equipment required, establishing supply bases, transporting and storing the supplies, and finally distributing the supplies to soldiers and units.

In temperate regions the types of supplies required vary with the season and the rapid changes in weather. The supply system must stock clothing and equipment for both warm and cold weather. Wet-weather equipment is also required, as is regional camouflage. Stocking supplies to accommodate the weather changes obviously increases the quantities to be procured, stored, and issued. The workload for logisticians, therefore, is multiplied. Repeated issue and turn-in procedures are complex and time-consuming. One advantage is that there is no need for specialized equipment as in cold and hot regions. Standard issue equipment and supply specifications are well within the ranges of weather conditions in the temperate region. Although the terrain can be a challenge, the equipment to provide mobility, countermobility, and survivability is also standard issue.

Selecting and establishing supply bases is far easier in temperate regions, because these regions have well-developed transportation and materiel handling facilities. Major ports and urban centers abound, each with numerous and varied transportation hubs and storage facilities such as warehouses and refrigeration units. The requirement to build facilities is therefore far less than in cold or hot regions, where the necessary infrastructure does not exist.

Transportation in the temperate regions is also a lesser problem. Road networks are dense with alternate routes available; rail connections are common with larger rail yards and more rail cars available; numerous airports connect almost all medium-sized cities; river and coastal shipping is well developed; and pipeline density is significantly higher.

Because battles occur in both the flat plains and the mountains, near settled areas and at more remote locations, distributing supplies and equipment is the biggest challenge for logisticians. The U.S. Army can be confident that the needed supplies will arrive on time in a temperate region battle area. Getting the items to the right unit and to the individual soldier is then a matter of careful planning, coordination, and supervision by commanders and logisticians on the ground.

Maintenance support is also easier in temperate regions. The U.S. Army in Europe instituted "the village concept," in which support (such as maintenance) is based in the towns and villages, making use of hardstands and existing garages. This obviously does not preclude the use of field maintenance sites, but dry, concealed, well-lit facilities that are often available are preferable. Medical support is also appreciably easier in these built-up areas.

The rapid changes in weather that can reduce visibility and mobility must be considered during planning. In the backward planning sequence, time should be allowed for units to prepare for unforeseen contingencies. It takes time to adjust to a sudden snowfall, a thick fog, or a mud-producing thaw. Support planners who allow extra time in consideration of the weather and terrain effects will get the support where it is needed on time, accomplishing their mission and permitting the combat elements to accomplish theirs.

The environmental influences of temperate regions on military operations may well be dominant, just as they are in other climatic regions. In the temperate regions, it is not so much extreme conditions that complicate and disrupt operations but rather the sudden changes in conditions. The U.S. Army has considerable combat experience in the temperate regions of the world. The decades of training in Germany and at installations in the southeastern United States have prepared soldiers and units for combat in this environment. Only a few years ago it seemed unlikely that a war involving the United States would break out in this climatic region, but with the victory in the cold war, traditional animosities have surfaced and have again brought armed conflict to the region. The U.S. Army may be the only viable force that can restore order; therefore, training and readiness are essential to success, and an appreciation of the environment and its effects is the first step.

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