

Original article

Influence of selected aspects of logistic terrain assessment on the provision of logistic support for troops during tactical operations

Grzegorz Stankiewicz* , Sławomir Hajt 

Faculty of Management,

General Tadeusz Kościuszko Military University of Land Forces, Wrocław, Poland,

e-mail: grzegorz.stankiewicz@awl.edu.pl; slawek672472@wp.pl

INFORMATION

Article history:

Submitted: 20 October 2021

Accepted: 29 August 2022

Published: 15 September 2022

* Corresponding author



ABSTRACT

The purpose of the prepared material is to demonstrate the selected aspects of logistic terrain assessment in the context of the provision of logistic support for troops during tactical operations. The development of the article was preceded by a series of multifaceted analyses of professional literature and periodicals devoted to the military terrain analysis and specific combat environments, as well as determinants of logistical support, which consequently enabled the synthesis and formulation of conclusions.

KEYWORDS

logistics, logistic support, terrain assessment, terrain conditions, weather conditions

© 2022 by Author(s). This is an open access article under the Creative Commons Attribution International License (CC BY). <http://creativecommons.org/licenses/by/4.0/>

These form the great book of war; and he who cannot read it must be forever content with the title of a brave soldier and never aspire to that of a great general.

gen. H. LLOYD (1718-1783) [1, p. 191]

Introduction

The assessment of terrain, understood as any defined fragment of land surface [2], and atmospheric conditions is a process consisting in collecting, analysing, processing and interpreting geographic information on both natural and man-made objects in order to predict their impact on the implementation of missions and operations [2] in the combat area¹. The topic of terrain analysis has been addressed by many theorists and practitioners of the art of war throughout the centuries. The study of a number of source materials indicates that this

¹ Combat – a set of battles involving troops and subunits conducted in accordance with the intent of the tactical commander and under his or her direct command to achieve an operational objective(s). *Leksykon obronności. Polska i Europa*. Huzarski M, Wołęjszo J (sci. eds.). Warszawa: Bellona; 2014.

issue was discussed, for example, by Sun Tzu in his work *The Art of War*: “if you know Heaven and know Earth, you may make your victory complete” [3, p. 8]. Another example can be found in the publication by Karl von Clausewitz: “[t]here are three properties through which the ground has an influence on action in war; that is, as presenting an obstacle to approach, as an obstacle to an extensive view, and as protection against the effect of fire-arms” [4, p. 305].

The synthesis of views of military theoreticians on the essence of the impact of terrain and weather conditions on the conduct of combat found in the available literature allows the formulation of a thesis that the lack of reflection on the aforementioned issues with regard to their effect on the implementation of logistic support undertakings may lead to unpredictable events on the battlefield, which may have potentially negative consequences for the protected subunits. It is worth pointing out that extreme conditions may prevent the goal of operations from being achieved at all.

In view of the above, according to the authors, the examination (analysis) of the influence of terrain and atmospheric factors (positive – working in our favour; negative – having a negative impact on the operations) should aim to generate constructive conclusions during the development of logistic support plans, which should significantly contribute to their implementation. This is all the more important since the influence of terrain and atmospheric conditions is a multidimensional issue within which it is often difficult to find fixed relationships between individual elements.

A confirmation of the above statements can be found in the literature on the history of armed conflicts, which shows that the skilful use of terrain and weather conditions has often contributed to success in battles, frequently against superior enemy forces.

1. Military terrain assessment

The analyses and evaluations of military periodicals, as well as scientific and research works, enable formulating a thesis that combat, regardless of whether it is conducted on the territory of a given country or outside its borders, will always take place either under normal conditions (average) or in what is classified in the literature on the subject as a specific combat environment. Normal (average) conditions are considered to include flat terrain or terrain separated by small hills, the relative height of which does not exceed 50 m and the slopes of which are gentle, which allows combat vehicles to navigate, if woodland, marshes, water and buildings do not exceed 50% of the total area of the terrain. The visibility in these conditions is no less than 4 km, the temperature ranges from -5°C to $+30^{\circ}\text{C}$, and the snow cover does not exceed 15 cm [5, p. 11]. Failure to meet these parameters indicates that we are dealing with specific combat environments, the general characteristics of which are included in Table 1.

In the light of these considerations, this means that it will be necessary to take into account how the area in which the operations are carried out will affect the possibility of their preparation and execution due to its natural shape and cover, the prevailing climatic conditions and the time of day. The statement “let the terrain do the fighting” is a metaphor for the need to organise operations in a manner that allows the specific characteristics of the terrain, integrated into the battle plan, to enhance the defensive or offensive power of one’s own troops. This is a difficult task, feasible only if one learns to evaluate qualities of the terrain and adapt them to the established operation concepts [6, p. 3].

Table 1. General characteristics of different types of specific combat environments

No.	Type of specific combat environment	Set of characteristics identifying particular specific combat environments
1.	Urbanised/ built-up area	An area (of urban agglomerations) featuring large industrial plants and the existing infrastructure, characterised by a high concentration of buildings, as well as a dense network of roads and transport nodes. Due to the size of this area, operations conducted on this territory require the engagement of forces of at least a battalion level. Built-up area – a small town, an urban settlement, a village or a settlement with a low density of buildings and scattered layout, where operations are usually conducted by subunits of company (platoon) level.
2.	Mountainous terrain	An area with an altitude of more than 600 m a.s.l., which is characterised by steep slopes and deep valleys, as well as includes towns, settlements and plateaux between mountain ridges along with passages running through them. This terrain is difficult to cross. Defensive operations conducted in such a region are facilitated while offensive operations are hindered – in some sections, even impossible.
3.	Coastal area	A coastal area is characterised by specific relief, land cover and climatic conditions. This terrain is often crossed by numerous rivers flowing towards the sea, the depth and width of which frequently depend on the sea state.
4.	Forested area	This is an area completely or mostly covered with forests, where vehicle traffic is, in most cases, restricted to roads, passes, fire lanes and gaps, which necessitates the use of different tactics than in open terrain.
5.	Desert terrain and extremely hot conditions	A land devoid of dense vegetation due to low rainfall and at least periodic high air temperatures that cause the evaporation to exceed rainfall, where the ground is generally made up of rock, sand or gravel. Other features include sand dunes, sand seas, escarpments, dried-up river beds and depressions. Deserts have extreme temperatures – in summer, they reach from 50°C to 70°C and in winter they go down to –45°C.
6.	Extremely cold conditions	Operations in extremely cold conditions require specific training methods and equipment. They are associated with geographical areas where the terrain is covered with snow and ice for the majority of the year and is characterised by low or very low temperatures throughout the year.
7.	Low visibility conditions	Visibility may be limited by conditions caused by darkness, suspended or airborne water particles (fog, mist, blizzards, etc.) or other weather phenomena (e.g. sandstorms, smoke) [7, p. 8-14].

Source: Own study based on [Cf. 7, p. 8-14; 8].

The analysis of research results and conclusions formulated on their basis confirm, for example, that terrain conditions prevailing in the territory of Poland can be described as quite diverse, as only 41% do not differ from normal conditions, which is illustrated in Figure 1.

The data presented in Figure 1 illustrate which diverse terrain conditions are dominant in our country. According to the presented values (excluding normal conditions), they include

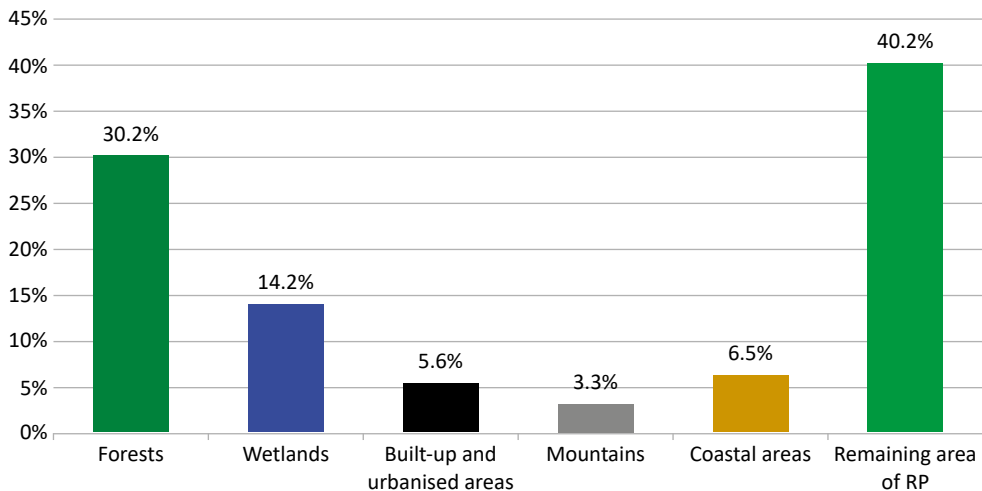


Fig. 1. Variability of terrain conditions in Poland

Source: Own study based on [9-12].

mainly forests, wetlands², coastal areas³, built-up and urbanised areas, as well as mountainous terrain.

At the same time, according to the authors, it is justified to assume that the largest percentage of wetlands occurs in forested areas, slightly smaller in coastal areas, and the smallest percentage can be found in urbanised and built-up areas. The proposed generalisations enabled the formulation of a thesis that wetlands and the aforementioned terrain conditions constitute an inseparable whole. Therefore, in the further part of the study, they will not be considered individually.

Taking the above into account, in order to gain a proper picture of the area, i.e. draw appropriate conclusions regarding the influence of the terrain on tactical operations, it is highly recommended to conduct an in-depth analysis, which can be carried out using one of many methods, for instance, OCOKA – Observation and Fields of Fire, Cover and Concealment, Obstacles, Key Terrain, Avenues of Approach. It is one of the generally accepted and recommended methods. It assumes that the following elements should be subject to analysis and assessment [Cf. 2, p. 10]:

- ability to fire and observe,
- conditions of cover and concealment,

² According to the Ramsar Convention, a wetland is not only an area on the boundary between aquatic and terrestrial environments, i.e. both wetlands (marshes) and all inland waters, but also shallow foreshore marine waters. In Poland, according to data from the Institute for Land Reclamation and Grassland Farming, wetlands cover an area of about 4.4 million ha, which is almost 14% of the country. Among this, 4% is occupied by peatlands larger than 1 ha. *Mokradła są potrzebne w walce ze zmianami klimatu*, [online]. Available at: <https://www.lasy.gov.pl/pl/informacje/aktualnosci/mokradla-sa-potrzebne-w-walce-ze-zmianami-klimatu> [Accessed: 18 January 2021].

³ A coastal area is a coastal strip of land where the influence of the sea on the natural environment – climate, waters, vegetation, animals and also on human activity – is visible. Usually its width varies from several to tens of kilometres. Sometimes it is assumed that the conventional border of the coastal area is the level of 50 m a.s.l. *Środowisko naturalne Pobrzeży Południowobałtyckich*, [online]. Available at: <https://zpe.gov.pl/a/srodowisko-naturalne-pobrzezypoludniowobaltyckich/DRkO80Fv8> [Accessed: 18 January 2021].

- existing terrain obstacles,
- key terrain,
- approach routes and manoeuvring corridors.

Studies of source materials also show that a particularly important criterion is the classification of terrain from the tactical point of view (in terms of the manner and possibilities of preparation and conduct of combat), and thus its accessibility for troops, understood as the susceptibility of the geographical environment of the area of operations to create the desired conditions for camouflage and movement of troops and subunits [Cf. 2, p. 2], with the minimum possible effort and own resources. The method of classifying terrain in terms of passability conditions is depicted in Figure 2.

A number of analyses and evaluations of the content of fairly extensive contemporary literature devoted to the broadly-understood influence of terrain and weather (climatic) conditions on the execution of tactical operations, as well as personal observations carried out by the authors during military exercises indicate that the presented technique, along with the method of classifying terrain in terms of its passability, is, in fact, commonly used by military units.

2. Influence of selected terrain conditions prevailing in Poland on tactical operations

Armed combat may be conducted in geographically diverse areas, during various seasons and in all types of weather. It may require the use of specific resources of the armed forces, such as human resources, materials and equipment, which are necessary to execute tactical operations. The military should deploy them in an efficient manner, according to the nature and scale of the tasks received [Cf. 13, p. 48].

As one of the main rules of war theory, the logistic effectiveness of operations, expressed by the principle of economy of forces, consists in striving to mobilise only those logistic resources (military units, personnel, equipment, stocks, sources of funding, as well as the ability to transport and sustain forces for a specified period of time [Cf. 14, p. 225]), which are necessary at the moment in a given situation (operational, logistic) for the troops to conduct operations effectively [Cf. 13, p. 50]. In turn, the very success of providing support for the conducted operations will result from both the proper preparation of the concept of logistic support, as well as personnel and means of combat, taking into account the positive and negative impact of the characteristics of the combat environment [Cf. 15, p. 14].

Based on the literature on the subject, it is possible to point out that the ability to assess the terrain, as well as the art of using it, is one of the essential assets of any commander. As a rule, the area in which military operations are taking place often gives rise to problems that are very difficult to solve for the commander and staff, but also for soldiers and equipment at his or her disposal. Therefore, the terrain, which is a constant element of every battlefield, has a significant impact on the capacity to use personnel and military equipment, and thus on the concept of operations. In view of the above, both personnel and means of combat will often require appropriate adaptation to the prevailing conditions, as specific environments necessitate the use of a different approach to the preparation and conduct of combat than the one applicable under normal conditions, which will be outlined in a further section of the publication.

CLASSIFICATION OF TERRAIN WITH REGARD TO PASSABILITY CONDITIONS

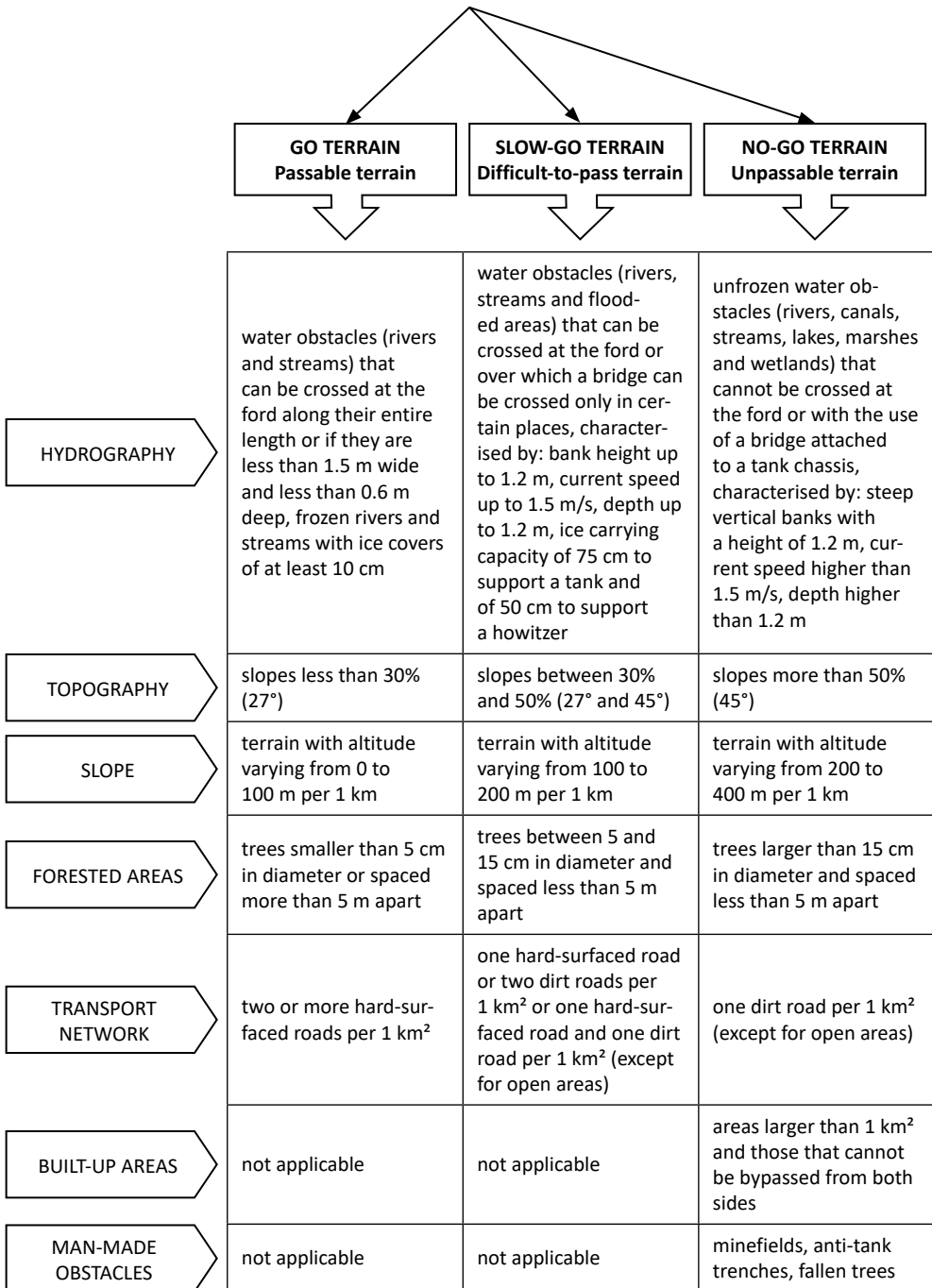


Fig. 2. Classification of terrain with regard to passability conditions

Source: Own study based on [2].

The occurrence of forested areas is associated with a set of diverse factors that significantly affect the organisation and execution of tactical operations, especially since this environment features high variability depending on the season and topography. In spring and autumn, soil moisture and softness increase, causing marshy sections to become difficult to cross. The condition of roads, which frequently are not hard-surfaced, also deteriorates. In turn, dry and hot weather entails an increased risk of fires (this phenomenon is particularly dangerous for logistic facilities, where there is a large number of people requiring care or evacuation, as well as significant quantities of materials and means of combat and military equipment). During this period, roads are usually in a good state and suitable conditions for camouflage occur. In winter, the forest makes hiding from aerial reconnaissance almost impossible while movement is hampered by snow cover and drifts [Cf. 16, p. 54-55]. Additionally, during periods of high humidity, visibility limitations caused by fog are to be expected.

The main characteristics of operations executed in this area include [Cf. 8, p. 131-134]:

- the necessity to accurately allocate roads and monitor traffic on them, as well as strengthen the protection on the most probable directions taken by the enemy to prevent flanking and bypassing to avoid surprise,
- decentralisation of armoured resources and means of combat support,
- the maintenance of advanced, decentralised reserves,
- the prolonged duration of exposure to poisonous agents,
- the limited capacity to use armoured vehicles and incomplete use of optical and electro-optical equipment, as well as battlefield reconnaissance devices,
- systems of barricades and forest barriers created by the army,
- difficulties in the introduction of changes in the formation of fighting troops during operations.

Therefore, taking the above into consideration, it must be stated that from a tactical point of view, the most relevant problems for the operations carried out in this environment will primarily consist of restrictions (the need to move only along marked roads and forest clearings) on freedom of manoeuvre caused by:

- insufficiently developed network of hard-surfaced roads,
- high forest density and significant tree trunk thickness,
- waterlogged soils, marshes and lakes connected by watercourse beds,
- frequent undulations of the terrain, which affect the pace of subunits.

If further restrictions that result, for example, from nighttime or the occurrence of fog are imposed on these conditions, the risk of subunits getting lost will significantly increase, which may lead to a delay in the performance of a combat task or, in extreme conditions, to its non-execution.

The coastal area, whose integral element is the coast, is defined as the border zone between the land and the sea, divided by the coastline (an area temporarily submerged by water fluctuations) into an underwater part, up to a depth of about 10 m and an above-water part – steep or flat (shore). From a defensive point of view, the coast is divided into convenient (narrow and deep foreshore, flat shore, and easily accessible adjacent terrain) and inconvenient (wide and shallow foreshore, steep shore, and difficult to access adjacent terrain) to conduct landing operations [17, p. 160].

The specificity of activities conducted in this environment (in particular on the coast itself) results mainly from the properties of the coast and the fact that the area borders the sea. Characteristic features of terrain near the sea coast are primarily dunes, cliffs, spits and beaches, which are often crossed by numerous watercourses (streams and rivers, the width and depth of which very often depend on the sea level) and lakes. It should be added that the majority of coastal lakes in Poland are large and shallow, with a poorly developed shoreline and large fluctuations of water level that may exceed 100 cm. Features typical of such reservoirs include strong undulations, eutrophication, good oxygenation of waters up to the bottom, turbidity (visibility from 0.5 to 1 m) and slight salinity. In such bodies, underwater vegetation develops very poorly due to poor transparency and strong undulations. The coastal area is usually overgrown with rush plants [18]. Another characteristic of this region is a well-developed communication network in the onshore area.

In a situation of an armed conflict in the southern basin of the Baltic Sea, the expected course of action involves air-naval-landing activities combined with operations of land forces directed towards the coast [15, p. 14]. Therefore, in this area, one should anticipate the occurrence of several, sometimes considerably distant from each other, regions convenient for amphibious and air landings.

In the context of the presented considerations, it should be stated that operations conducted in the coastal area are characterised by [19]:

- close cooperation of air, land and naval forces,
- continuous reconnaissance to determine, with the highest possible accuracy, the areas of amphibious and air landings, as well as directions of movement of the enemy's air-mobile forces,
- maximum use of the manoeuvrability of defending troops, since wide areas of responsibility and deployment of the majority of forces and means further in the coastal area are to be expected, until the amphibious landing areas are determined,
- use of long-range firepower as a priority to destroy the enemy beyond the range of direct firepower.

In the course of operations conducted on the sea coast, one must additionally take into account the uncertainty regarding: first – the direction and place of landing of particular waves of enemy troops, and second – their composition. As a consequence, commanders will search for and decide on the unconventional use of their forces and resources, including to adopt a non-standard combat formation [Cf. 20, p. 20].

The urbanised area, as a territory that is almost entirely man-made, has been, is and will be (its surface area continues to increase as urbanisation progresses) an important and very challenging environment for future military operations. This is evidenced, among other things, by the analysis of experiences and findings from local conflicts of the second half of the 20th century, which shows that this terrain was dominant for 90% of operations conducted by land troops since 1945 [Cf. 16, p. 39].

Operations in this combat environment are characterised by [Cf. 8, p. 119-121; 16, p. 39-40]:

- the need for accurate information on the topographical layout of the area,
- a narrowed field of observation and firing, as well as difficulties in conducting radio communications due to significant limitations in the propagation of radio waves,

- fewer possibilities of executing a manoeuvre, especially by armoured and mechanised units, mainly when it is necessary to overcome collapsed structures and barricades,
- the intensive use of short-range weapons and hand grenades, organising fire from the flanks, crossfire and multi-layer fire,
- the decentralised use of troop types – tanks and artillery will often be deployed to direct fire toward the front, where a lot of artillery fire will be deployed on the lower floors and basements of buildings,
- difficulties in commanding and directing organised elements of a battle formation,
- the necessity to seize and defend specific communication routes to enable manoeuvring, but also to protect industrial plants or important elements of the city infrastructure,
- the greater capacity of the enemy to infiltrate and bypass battle zones,
- combat conducted on three levels – in the street, above the ground (on roofs and buildings) and underground (in basements, tunnels and sewers) – distinguished by high persistence,
- the involvement of a disproportionate number of troops in combat,
- the presence of civilians.

When assessing military factors influencing the operation of troops in urbanised areas, consideration is given to terrain (surface), location (position in the region of operations) and type (residential, industrial, commercial). Without a doubt, the most critical elements of urbanised areas are cities whose topography is created by the layout of streets and quarters, the distribution of neighbourhoods, as well as technical facilities and engineering structures (e.g. bridges, overpasses) and the character (type) of buildings [Cf. 21, p. 65].

Mountainous terrain, as a high area of land (located more than 500 m a.s.l.), frequently forms mountain chains. In terms of height, it is possible to distinguish low mountains (up to 500-600 m), such as the Świętokrzyskie Mountains, often similar to the uplands, medium mountains (up to approx. 1,500 m), such as the Sudetes and Beskids, and high mountains, such as the Tatra Mountains, Alps and Himalayas. However, at high latitudes, the features of a high-mountain landscape may include mountains whose height does not exceed 1,000 m, e.g. in Spitsbergen [22]. Despite a number of differences in altitude, their geological structure, storied vegetation and climate, they share certain common traits that affect both the execution of tactical operations and the implementation of undertakings focused on the provision of support for troops.

The essential common features of mountainous terrains occurring in a given country include the undulating relief, numerous dead and covered places, dynamically changing weather conditions, many rivers and streams with different characteristics than other objects of this kind found in the rest of the country, limitations in the operation of communication means (especially radio and radio-electronic devices), the possibility of long-term presence of poisonous substances in valleys and gorges [Cf. 1, p. 191]. The literature analysis also shows that in mountainous regions, it is necessary to take into account the occurrence of a number of serious obstacles to the movement of both soldiers and military equipment. They may be caused by the presence of cliffs, mounds, gorges and dense vegetation.

The above conditions were reflected in the provisions of the Regulations of Tactical Operations of Land Forces [8, p. 192], where the characteristic feature of the implementation of operations in this environment included:

- significant differences in relative heights ensuring effective observation or capable of completely camouflaging the actions of troops,
- lack of a sufficient number of roads, railways and airports (places for landing grounds), which limits the movement of troops, manoeuvres in action and the possibility of using supporting forces,
- topography, as well as a network of communication routes and watercourses channelling the directions of military operations,
- most of the low parts of the mountains covered with forest,
- rocky ground, which makes it difficult to pursue engineering development,
- activities of armoured troops limited to road network,
- increased physical effort of engaged forces, especially those operating on foot,
- terrain that limits mutual support,
- high variability of weather,
- difficulties in maintaining communications.

After reviewing the content relating to the influence of selected terrain conditions on the performance of tactical operations, it should be stated that each of the characterised specific combat environments has a defined set of traits that significantly affect the need to adopt a different manner of preparation and execution of operations, which in turn requires drawing appropriate conclusions from the analysis of field and weather conditions prevailing in a given period.

3. Identification of the purpose of providing logistic support for troops

Provision of logistic support for land forces is a process designed to replenish supplies and services necessary for operations, training and combat to take place. It includes military equipment, i.e. equipment specially designed or adapted to military needs and intended for use as weapons, ammunition, war material, technical means of warfare or technical equipment, as well as its accessories and supplies, along with software, products and technologies, service animals and equipment of general use [Cf. 23]. In turn, logistic services are undertakings performed by units (subunits), as well as facilities⁴ and other elements [Cf. 24, p. 151]. The course of the process of providing logistic support is illustrated in Figure 3.

Both the analysis of provisions found in normative documents and the synthesis of views on the essence of the goal of logistic support presented by military theoreticians in the available literature clearly indicate that the said goal is considered to be achieved if the needs of troops relating to necessary resources (logistic resources) required to live and fight, as well as to

⁴ Logistic facilities are forces and means of logistic divisions and subunits developed in the field or at the place of permanent deployment and intended for delivery of supplies, provision of social and living services, execution of projects related to the use of weapons and military equipment, i.e. its use and technical protection during military operations, medical protection including medical evacuation of the injured, wounded and sick, as well as medical supplies. *Doktryna logistyczna wojsk lądowych (DD/4.2)*. Warszawa: Dowództwo Wojsk Lądowych; 2007.

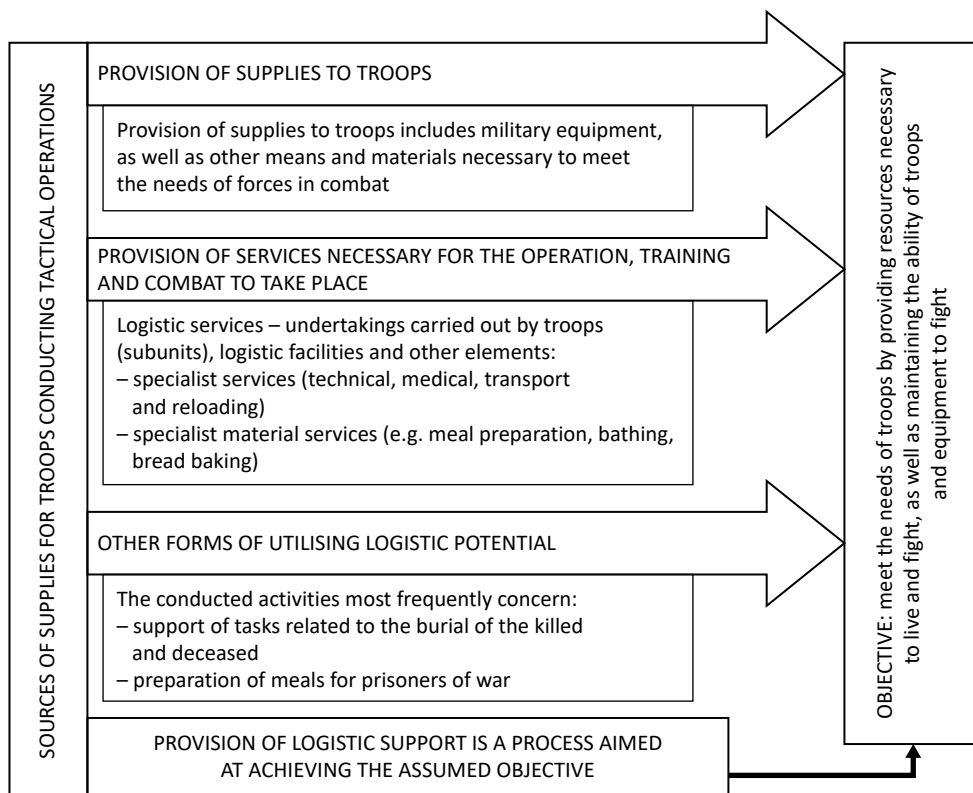


Fig. 3. The course of the process of providing logistic support
Source: Own study based on [24].

maintain the ability of people and military equipment to carry out operations regardless of terrain and weather conditions, are satisfied [Cf. 25, p. 13].

4. Determinants of logistic support of troops

The extent and manner of logistic support for fighting troops are different in every case, as they are influenced by a number of variables, such as the type of operations being conducted, place in the force, equipment, men and supplies [Cf. 26, p. 11; 27, p. 10-11].

The starting point for further consideration is the establishment of what are the determinants of logistic support and their influence on the implementation of logistic support undertakings. Research based on a critical analysis of the literature on the subject allows one to state that determinants of logistic support are defined as conditions affecting the provision of logistic support during tactical operations, and in particular, the achievement of its objective, which have been categorized into three groups, i.e.:

- tactical determinants,
- terrain and atmospheric determinants,
- logistic determinants.

The analyses and assessments conducted by the authors confirm that tactical factors constitute the basis of all planning activities in the field of logistic support and fundamentally

influence the scope of undertakings executed by logistic subunits for the benefit of combat troops.

The essential tactical (operational) factors conditioning the manner and content of planning and organising, as well as the scope of logistic support undertakings are [Cf. 26, p. 11]:

- the period (timing) and manner of preparation (transition) of operations,
- the ratio of forces of fighting parties,
- the place in the combat structure,
- the content of the commander's decision and the resulting needs of subunits for supply and provision of specialist services,
- the method of leading the battle.

Based on the previous considerations and the research results obtained, it is safe to conclude that the group of terrain-atmospheric determinants particularly affect the conduct of all tactical activities, and thus also the logistic support.

The climatic zone, season and the related weather conditions combined with terrain conditions can determine:

- the logistic response time,
- the necessity to increase consumption standards for selected groups of supplies – especially fuels [Cf. 28, p. 139; 29],
- a higher level of damage and losses of combat vehicles [Cf. 28, p. 153-154; 30, p. 135-136],
- the magnitude of losses in personnel [26, p. 53].

The last group of determinants results from tactical, terrain and atmospheric conditions. The place of the superior and the protected subunit in the combat structure, the type of tasks they perform and the combat potential, among other things, are the basis for the organisation of logistic support, also in specific terrain and atmospheric conditions [31, p. 67].

In the literature on the subject, the group of basic logistic determinants that significantly influence the organisation and provision of logistic support for troops include, but are not limited to: the current material, technical and medical situation of troops; the projected consumption of supplies and losses in military equipment and personnel; the expected (possible) scope of military-civilian cooperation; the scope and manner of utilisation of field logistic infrastructure, as well as the level of training of logistic management bodies, commanding authorities and personnel of logistic subunits [Cf. 26, p. 13].

According to the information presented above, it can be concluded that the comprehensive logistic support for troops will always require careful consideration of each of the aforementioned groups of determinants.

5. Logistic terrain assessment as a factor influencing the provision of logistic support for troops – selected aspects

A logistic terrain assessment is conducted mainly as part of the decision-making cycle in the command process, of which planning is the most relevant phase. It is in this phase that the task received from the superior and all factors influencing its execution, thus also the environment of future activities, are carefully analysed [Cf. 32, p. 74]. Consequently, it is necessary to identify both positive and negative impacts that the terrain, atmospheric conditions,

visibility and other factors will have – not only on the operation of own and enemy military subunits but also on the military logistic potential, which is defined as the maximum capacity of logistic troops and subunits to provide logistic services necessary to support troops during tactical operations [Cf. 13, p. 50; 33, p. 79].

In the light of the presented considerations, it is necessary to determine which of the selected environmental components within the framework of logistic terrain assessment will have a decisive influence on the operation of subunits and logistic facilities, and thus on the achievement of the objective of logistic support.

The pursuit of this goal requires a synthetic logistic terrain assessment, which should provide the following information [Cf. 34, p. 39]:

- to what extent the terrain facilitates or hinders the provision of logistic support for fighting troops,
- how to select optimal for a given tactical situation forces and means for the provision of logistic support, depending on terrain conditions, in order to avoid e.g. the “counter-mobility effect”,
- how to prepare personnel, equipment and area where logistic support is to be provided in order to ensure the highest possible effectiveness and efficiency in achieving the set objective,
- which of the terrain objects can determine the efficient movement of forces and means for the provision of logistic support,
- how to organise protection, defence and camouflage of subunits and logistic facilities,
- how to group logistics subunits.

Additionally, the logistic terrain assessment should include a certain type of forecast of possible changes in land elements that may result from damage, flooding, fires, etc. At the same time, the influence of time of day and year, as well as weather conditions, should be taken into account. The generation of conclusions from the conducted assessment should also involve the determination of their impact on personnel and equipment, including logistic resources and their consumption, as well as the operation of troops.

In Table 2, the authors present the selected elements of the assessment of terrain of specific combat environments with regard to the provision of logistic support for troops.

The high complexity of tasks performed by contemporary armed forces directly influences the course of the provision of logistic support. It is worth emphasising that the process of providing logistics support for troops, regardless of circumstances resulting from terrain, weather and atmospheric conditions, should constitute the basis for fulfilling tactical tasks in accordance with the commander’s expectations. Therefore, the issue of assessing the influence of terrain and weather conditions on the functioning and needs of the logistic system of troops and subunits remains extremely important in this field.

Conclusions

The considerations presented in this publication allow concluding that at the moment, it seems necessary and desirable to search for new or improve existing solutions aimed to increase the quality of logistic terrain assessment, which should consist in more than simply studying the components of the terrain and determining their impact on the operation of subunits and logistic facilities.

Table 2. Selected elements of the assessment of terrain of specific combat environments with regard to the provision of logistic support for troops

	Urbanised area	Coastal area	Forested area	Mountainous terrain
Ability (susceptibility) to deploy subunits and use logistic facilities	based on structures of logistic infrastructure, as well as natural and artificial terrain hideouts. In a situation entailing the risk of potential encirclement, subunits and logistic facilities are deployed in the centre of the formation	most of the logistic capacity needs to be deployed away from the front line of defence, ready to be manoeuvred with the second-strike subunit	forces and means of logistic subunits should be deployed as far as possible on the outskirts of forest complexes, near large clearings, by lakes, etc., so that in case of fire, they can be evacuated from the endangered area	usually, it is necessary to divide the logistic potential into individual directions of tactical operations. When deploying forces, attention should be paid to areas that may be flooded or cut off from protected subunits in case of sudden water surges in rivers and streams
Ensuring good conditions for the operation of logistic facilities	generally well-developed repair, supply, medical and accommodation base. In the event of prolonged combat, it is necessary to take into account an increase in sanitary and hygienic risks and the possibility of fires	significant threat from enemy naval firepower, generally well-developed repair, supply, medical and accommodation base in areas regarded as attractive for tourists	in the event of operations conducted in isolated locations, it is necessary to take into account the need to divide the available logistic potential into individual directions of tactical operations, as well as their proximity to the front line of defence	well-developed base of tourist facilities
Manoeuvring capacity of logistic subunits	reduced manoeuvring capacity may occur temporarily or permanently due to e.g. the width of streets, rubble and barricades. In case of forming troops dealing with the removal of barricades and debris-laden road sections, it is necessary to take into account the need to separate evacuation tractors, which will translate into evacuation possibilities	depends on the development of the road network (its technical condition), especially the number of bridges and culverts, as well as the state of rivers, which can create numerous floodplains in the face of the phenomenon known as the backwater. It is necessary to take into account limited visibility caused by fog, which makes it difficult to orient oneself in the area and thus carry out provide logistic support	depends on the development of the road network and fire lanes, the use of which will be determined by meteorological conditions (intense rain and snow). An additional difficulty may consist of undulating terrain that can significantly reduce the possibility of manoeuvring, loading and evacuation of military equipment, particularly around wetlands	severely limited by the existing road network and its characteristics (road surface, technical condition, load capacity of bridges and culverts, slope, width, curvature, etc.), as well as prevailing weather conditions and other phenomena (avalanches, landslides, floods) that may limit the load capacity of vehicles and necessitate the creation of technical assistance points, which will result in the use of tractors to pull vehicles up hills or the engagement of a larger number of such vehicles to evacuate a single piece of military equipment; "downhill" evacuation requires the involvement of two tractors, which can reduce the evacuation capacity. Consideration should be given to the use of transport animals and porters to deliver materials and means of combat

	Urbanised area	Coastal area	Forested area	Mountainous terrain
Layout and development of road network (transport network)	convenient, enabling the multi-variant use of roads, depending on the character of development (layout of roads, quarters, squares, parks, etc.)	a well-developed network of lateral routes and poorly developed axial routes	a poorly developed road network, often difficult to cross by both wheeled and tracked vehicles	a poorly developed road network, often difficult to cross by both wheeled and tracked vehicles. In many cases, the lack of lateral routes allows, for example, the manoeuvring of supplies between subunits
Method of preparing motor vehicles for off-road driving	no additional preparation is required	no additional preparation is required	no additional preparation is required	drivers must be trained in mountain driving, fitting of snow chains
Possibility of extracting water	generally high; it is necessary to identify all sources of water and expect that the water supply network may need to be repaired, bearing in mind the need to supply water not only to the fighting troops but also to the civilian population remaining in the city	generally high	generally high	severely limited (sometimes impossible) use of tube wells; the need to use existing water intakes or water supply. Water occurring in the environment should be consumed after treatment and monitoring of its suitability for consumption due to the possibility of contamination
Method of organising the delivery of supplies to fighting subunits and evacuation of the wounded and sick, as well as damaged military equipment	limited in the event of fires and collapses of urban structures hampering or preventing the delivery of supplies to the fighting subunits and the evacuation of the wounded and sick, as well as damaged military equipment. Increased demand for small arms ammunition, grenades, smoke agents and high-trajectory anti-tank ammunition is to be expected	In most cases, similar to conventional conditions; however, an increased need for ammunition for long-range means of warfare is to be expected. Engineer barrages and barriers will be widely used by the fighting troops, resulting in a large increase in the transport of engineer-sapper means	delivery and evacuations via roads and lanes with frequent use of porters and stretcher-bearers; high consumption of explosives, grenades and small arms ammunition	limited possibilities of carrying out the evacuation of the injured and the damaged military equipment, highly dependent on the slope angles, the development of the road network and its characteristics (width, curvature, etc.), as well as prevailing weather conditions. Increased demand for engine fuels and lubricants, artillery and anti-aircraft ammunition, explosives and smoke agents. The calorie content of meals must also be increased due to the higher energy requirements of soldiers and the prevailing weather conditions

	Urbanised area	Coastal area	Forested area	Mountainous terrain
Possibility of exploiting local resources	generally high	available to obtain only from the logistic infrastructure located in urban and built-up areas, as well as tourist facilities	severely limited. Available to obtain only from the logistic infrastructure located in urban and built-up areas, as well as tourist facilities	severely limited; available to obtain only from few objects of logistic infrastructure located in urban and built-up areas, as well as tourist facilities
Method and extent of defence and protection of subunits and logistic facilities, etc.	limited field of fire and observation, favourable conditions for protection and camouflage. It is recommended to deploy logistic facilities in fire-resistant objects including exits that prevent possible blockage with debris	due to the possibility of employment of a large number of reconnaissance subunits and airborne landing troops, subunits and logistic facilities should be located in close proximity to general military subunits	the terrain on the one hand favours camouflage, but on the other facilitates diversion and infiltration by enemy subunits	the terrain favours diversionary activities, limited field of fire and observation
Other	the presence of a large number of civilians and objects protected by international law that may significantly limit military operations is to be expected	It is necessary to take into account additional difficulties resulting from the large scale of organised defence and high intensity of defensive combat in the landing area	logistic subunits should avoid stationing in large forest complexes and using roads running through them. In the case of wetlands, increased activity of insects that may transmit infectious diseases is to be expected in non-winter periods, which will require intensified supervision of the observance of hygiene and living conditions in the area of operations	the necessity to use one road (or one-way roads) to deliver materials and means of combat, as well as execute medical and technical evacuation. It is necessary to prepare "passing places" on roads and place tractors on hills. Subunits should be equipped with special gear for carrying out tasks in the mountains (goggles, skis, ropes, etc.)

Source: Own study based on [Cf. 5; 8; 19; 26].

The commonly used, generally accepted and recommended method of Observation and Fields of Fire, Cover and Concealment, Obstacles, Key Terrain, Avenues of Approach can and should be applied only as a starting (guiding) point for further considerations relating to the influence of terrain, weather and climatic conditions on the achievement of the assumed goal – consisting in the provision of logistic support for troops – as its scope does not cover all issues concerning the presented topic.

Since the scope and method of providing logistic support for fighting troops are always different, it is necessary to analyse a wide set of determinants. The conclusions resulting from this process should be reflected in the established logistic support plans in a synthetic form.

The authors of this article are fully aware that they have not exhausted the subject of the influence of selected aspects of logistic terrain assessment on the provision of logistic support for troops during tactical operations. Some of the issues have been merely hinted at in this particular publication. The authors will be grateful for any critical comments on the paper and request that they be sent electronically.

Acknowledgement

The work was developed as part of research project No. 168/WZA/83/DS.

Conflict of interests

All authors declared no conflict of interests.


Author contributions

All authors contributed to the interpretation of results and writing of the paper. All authors read and approved the final manuscript.

Ethical statement

The research complies with all national and international ethical requirements.

ORCID

Grzegorz Stankiewicz  <https://orcid.org/0000-0003-0975-0222>

Sławomir Hajt  <https://orcid.org/0000-0003-3516-7743>

References

1. Modrzejewski Z. *Wybrane aspekty prowadzenia działań rozpoznawczych w terenie górzystym*. Zeszyty Naukowe AON. 2014;95(2):191-207.
2. NO-06-A015:2012. *Teren. Zasady klasyfikacji. Ocena terenu na szczeblu operacyjnym*. Warszawa: Wojskowe Centrum Normalizacji, Jakości i Kodyfikacji; 2012.
3. Sun Tzu. *Sztuka wojny*. K.A.M. (transl.). Warszawa: Wydawnictwo Przedświt; 1994.
4. von Clausewitz K. *O wojnie*. Ks. 6, 7 i 8. Vol 2. Koc L, Schoener F (transl.). Warszawa: Wydawnictwo Ministerstwa Obrony Narodowej; 1958.
5. Kowalski K, Hajt S, Stankiewicz G, Szukalski M. *Logistyka wojskowa w działaniach taktycznych*. Wrocław: Wydawnictwo Wyższej Szkoły Oficerskiej Wojsk Lądowych imienia generała Tadeusza Kościuszki; 2014.
6. *Praca w terenie na szczeblu taktycznym*. Warszawa: AON. Wydział Wojsk Lądowych. Katedra Sztuki Operacyjnej i Taktyki Wojsk Lądowych; 2004.

7. *Słownik tematyczny terminów, wyrażań i zwrotów stosowanych w prognozach meteorologicznych*. Zawiślak T (ed.). Warszawa: Instytut Meteorologii i Gospodarki Wodnej; 2010.
8. *Regulamin działań taktycznych pododdziałów wojsk pancernych i zmechanizowanych (pluton – kompania – batalion)*. Warszawa: Dowództwo Wojsk Lądowych; 2009.
9. *Dane Głównego Urzędu Statystycznego*, [online]. Available at: <https://bdl.stat.gov.pl/bdl/dane/podgrup/temat> [Accessed: 26 January 2022].
10. *Mokradła Polski*, [online]. Available at: <http://www.gis-mokradla.info/html/index.php?page=mokradla> [Accessed: 26 January 2022].
11. *Pas gór*, [online]. Available at: <http://geografia24.pl/pas-gor/> [Accessed: 26 January 2022].
12. *Pas pobrażęży*, [online]. Available at: <http://geografia24.pl/pas-pobrazezy/> [Accessed: 26 January 2022].
13. Jałowiec T. *Efektywność logistyczna w siłach zbrojnych*. Warszawa: ASzWoj; 2017.
14. *Leksykon obronności. Polska i Europa*. Huzarski M, Wołęjszo J (sci. eds.). Warszawa: Bellona; 2014.
15. Reczkowski R. *Użycie artylerii w obronie wybrzeża*. Przegląd Wojsk Lądowych. 2011;045(3):14-9.
16. Sobolewski G. *Działania opóźniające w terenie lesisto-jeziornym*. Przegląd Wojsk Lądowych. 2004; 537(3):53-6.
17. *Słownik terminów z zakresu bezpieczeństwa narodowego*. Łepkowski W (ed.). Vol 4. Warszawa: Wydawnictwo Akademii Obrony Narodowej; 2010.
18. *Jezioro przybrzeżne*, [online]. Available at: https://pl.wikipedia.org/wiki/Jezioro_przybrze%C5%BCne [Accessed: 18 January 2021].
19. Elak L. *Działania taktyczne w specyficznych środowiska walki* [wykład]. AON; April 2015.
20. Iwiński D, Barczak Ł. *Użycie artylerii do zwalczania desantów morskich*. Przegląd Wojsk Lądowych. 2008;018(12):17-20.
21. Wrzosek M. *Wojskowo-geograficzna ocena środowiska jako element operacyjnej oceny rozpoznawczej*. In: *Studia operacyjne rejonu operacyjnego. Materiały z sympozjum naukowego*. Polak A (ed.). Warszawa: Akademia Obrony Narodowej – Wydział Wydawniczy; 2007, p. 58-73.
22. *Góry*, [online]. Encyklopedia PWN. Available at: <https://encyklopedia.pwn.pl/haslo/gory;3907237.html> [Accessed: 18 January 2021].
23. Decyzja Nr 435/MON Ministra Obrony Narodowej z dnia 24 grudnia 2013 r. w sprawie określenia funkcji gestorów i centralnych organów logistycznych sprzętu wojskowego w resorcie obrony narodowej (Dz. Urz. MON z dnia 24 grudnia 2013 r., poz. 390).
24. *Doktryna logistyczna Wojsk Lądowych (DD/4.2)*. Warszawa: Sztab Generalny Wojska Polskiego. Dowództwo Wojsk Lądowych; 2007.
25. *System logistyczny Sił Zbrojnych Rzeczypospolitej Polskiej. Raport 2019*. Jałowiec T, Mitkow S, Radomycki A, Smal T, et al. (sci. eds.). Warszawa: Wydawnictwo Akademii Sztuki Wojennej; 2019.
26. Nowak E, Szeląg K. *Zabezpieczenie logistyczne brygady zmechanizowanej i w obronie i natarciu*. Warszawa: Akademia Obrony Narodowej. Wydział Wojsk Lądowych. Katedra Logistyki Wojsk Lądowych; 1998.
27. Smyk S. *Zabezpieczenie logistyczne batalionu w działaniach taktycznych*. Warszawa: Akademia Obrony Narodowej; 2004.
28. *Poradnik logistyczny do ćwiczeń i treningów sztabowych. Związek taktyczny, oddział, pododdział*. Kaźmierczak M (ed.). Warszawa: Akademia Sztuki Wojennej; 2016.
29. Stankiewicz G, Koziej R. *Analiza doświadczeń z wojny radziecko-afgańskiej (1978-1989) w zakresie zabezpieczenia logistycznego*. Zeszyty Naukowe WSOWL. 2007;145(3):151-7.
30. Brzeziński M. *Logistyka wojskowa*. Warszawa: Bellona; 2005.
31. Kowalkowski S. *Zabezpieczenie inżynieryjne obrony w terenie lesisto-jeziornym*. Przegląd Wojsk Lądowych. 2004;538(4):11-6.
32. *Podręcznik oficera sztabu*. Kręcikij J, Wołęjszo J, Prusiński N (eds.). Warszawa: Wydawnictwo Akademii Obrony Narodowej; 2009.

33. *Podręcznik dowódcy batalionu*. Praca zbiorowa. Kręcikij J, Wołęjszo J (eds.). Vol. 2. Warszawa: Akademia Obrony Narodowej; 2007.
34. Stanecki J. *Topografia w zabezpieczeniu logistycznym*. Przegląd Wojsk Lądowych. 2000;489(3):36-9.

Biographical note

Grzegorz Stankiewicz – COL (ret.), DSc Eng., a graduate of the Higher Officer School of Mechanised Infantry in Wrocław, the University of Wrocław and the National Defence University of Warsaw, as well as a number of domestic and foreign logistic qualification, improvement and specialist courses. He conducts scientific activity in the field of military logistics theory, organisation of logistic support during tactical operations, army logistic security management, information systems in logistics and logistic infrastructure. He has participated in many research projects and is the author or co-author of dozens of articles and publications. He has been repeatedly awarded by his superiors for his teaching, journalistic and military activities.

Sławomir Hajt – LTC, MSc Eng., a senior lecturer in the Department of Logistics. He specialises in issues concerning logistic support of tactical operations. He is the author and co-author of several dozen publications.

Wpływ wybranych aspektów logistycznej oceny terenu na osiągnięcie celu zabezpieczenia logistycznego wojsk w działaniach taktycznych

STRESZCZENIE

Celem przygotowanego materiału jest ukazanie wybranych aspektów logistycznej oceny terenu w kontekście osiągnięcia celu zabezpieczenia logistycznego wojsk w działaniach taktycznych. Opracowanie artykułu zostało poprzedzone szeregiem wieloaspektowych analiz literatury fachowej oraz periodyków traktujących zarówno o wojskowej analizie terenu, jak i specyficznych środowiskach walki, a także determinantach zabezpieczenia logistycznego, co w konsekwencji umożliwiło dokonanie syntezy oraz sformułowanie wniosków.

SŁOWA KLUCZOWE

logistyka, zabezpieczenie logistyczne, ocena terenu, warunki terenowe, warunki atmosferyczne

How to cite this paper

Stankiewicz G, Hajt S. *Influence of selected aspects of logistic terrain assessment on the provision of logistic support for troops during tactical operations*. Scientific Journal of the Military University of Land Forces. 2022;54;3(205):356-74. DOI: 10.5604/01.3001.0016.0036.



This work is licensed under the Creative Commons Attribution International License (CC BY).
<http://creativecommons.org/licenses/by/4.0/>