

# SAFE AND SUSTAINABLE MOUNTAINEERING INFRASTRUCTURE A COLLABORATIVE PROJECT OF THE CROATIAN MOUNTAINEERING ASSOCIATION AND THE CROATIAN MINISTRY OF TOURISM AND SPORT

**Author(s):** Alan Čaplar\*; Hrvoje Gold\*\*; Mladen Vrabec\*\*\* Croatian Mountaineering Association  
\*General Secretary, \*\*Head of the Commission for Mountaineering Trails, \*\*\*Secretary for  
mountaineering infrastructure and project implementation

**Keywords:** Mountaineering infrastructure, Mountaineering trail maintenance, Governmental support,  
Mountaineering trails data base

**Abstract (summary):** The mountaineering infrastructure in Croatia encompasses a network of over 6,500 kilometres of marked trails and 160 mountain lodges, houses, and shelters. These are maintained by the Hrvatski planinarski savez, HPS (Croatian Mountaineering Association, CMA) and its more than 340 member associations.

To enhance the quality of these trails and facilities, which form part of the public tourist infrastructure, the CMA proposed a project to the Croatian Ministry of Tourism and Sport (the Ministry) in 2022. This project aimed to arrange and upgrade the registered mountaineering infrastructure in Croatia. Based on the data from the data base of mountaineering trails and facilities, the Ministry expressed the need for investment in their reconstruction and maintenance. The Ministry gave its consent and approved support to this initiative.

This initiative ensures direct state-level funding for the reconstruction and maintenance of mountaineering trails and facilities. Recognizing the necessity for stable and ongoing investment in mountaineering infrastructure, a model for long-term cooperation between the Ministry and CMA was established, leading to the creation of relevant agreements and contracts.

The groundwork for these agreements was laid by numerous CMA activities over the years. Decades ago, comprehensive registers of mountaineering trails, transversals, waymarkers, and facilities were established, which have been regularly updated with numerous valuable data on the layout and condition of the infrastructure and their maintainers. The implementation of CMA's infrastructure projects is guided by a series of programmatic and analytical documents, adopted by the CMA's administrative bodies over the years. In addition to these project funds, CMA annually, invests significant resources in maintaining this infrastructure.

After completing two cycles of the collaborative project, a third cycle is being prepared, with implementation scheduled for 2025.

This paper describes the organization, preparation, and execution of the project, particularly focusing on the renovation and arrangement of mountaineering trails infrastructure.

## **Croatian Mountaineering Association**

The Croatian Mountaineering Association, CMA (Hrvatski planinarski savez, HPS) is the umbrella organization and the sole national sports association for mountaineering in the Republic of Croatia (CMA, 2011). It brings together member associations, societies and clubs, with the status of legal entity; takes care of mountaineering trails and facilities; publishes the magazine Croatian Mountaineer

(Hrvatski planinar), first issue was out in 1898, and other mountaineering literature; organizes, registers, and certifies general and specialized schools and courses; establishes standards for mountaineering activities; represents and stand for the common interests of mountaineering organizations before state and public institutions. Additionally, it coordinates and promotes the work of mountaineers, waymarkers, mountain guides, alpinists, speleologists, and mountain nature wardens.

CMA is affiliated with the Croatian Olympic Committee (Hrvatski olimpijski odbor, HOO), the International Climbing and Mountaineering Federation (UIAA), the European Union of Mountaineering Associations (EUMA), the European Ramblers' Association (ERA), and the Balkan Mountaineering Union (BMU).

CMA is both the traditional and legal successor of the Croatian Mountain Society, founded in 1874, so this year marks 150 years of organized mountaineering in Croatia.

The seat of CMA is in Zagreb, where the office, the editorial board of the magazine and the headquarters of specialized CMA commissions are located. These commissions include those for mountaineering trails, mountaineering facilities, guides, alpinism, speleology, mountaineering skiing, mountain nature protection, education, promotion and publishing, awards, history of mountaineering, as well as statutory and normative activities.

In 2024, over 340 mountaineering associations as societies and clubs are members of CMA.

### **Mountaineering Infrastructure**

Mountaineering infrastructure in Croatian mountains consists of trails, transversals, facilities (lodges, houses, shelters), and other objects designed to meet the needs of mountaineers while they are in the mountains (CMA, 2011). Currently, Croatia has over 1,600 registered mountaineering trails, totalling more than 6,500 kilometres in length. In addition, there are 160 mountain facilities, including 44 lodges, 74 houses, and 42 shelters.

Every trail and facility have peculiarities related to its location, construction, management and other features, which make it ungrateful and very difficult, sometimes even impossible, to give general evaluations and conclusions about them. However, it can be said that an essential characteristic of all forms of mountain infrastructure is the need for continuous management and maintenance, because all man-made structures are exposed to deterioration in unfavourable mountain conditions. In addition to winter weather conditions, their distance from urban centres and roads and other communal infrastructure is also a big challenge. On the other hand, it is impossible to imagine what mountaineering and hiking would look like if there were no infrastructure in the mountains.

With this in mind, anyone who moves in the mountains should respect the efforts and work of all those countless enthusiasts who take care of the mountain infrastructure. These are mostly mountaineers and builders of mountaineering facilities, but also numerous other mountaineers and individuals who participated in or contributed to the development of the mountain infrastructure in any way through their engagement or funds. This work often remains hidden from the public eye, although the existence and functioning of mountain infrastructure are undoubtedly important matters of public interest.

Besides registered mountaineers, many recreational visitors who are not members of mountaineering organizations also visit the mountains, so the care of mountaineering infrastructure is of broad significance.

For this reason, in advocating for the interests of mountaineering organizations and their members, CMA consistently emphasizes that mountaineering infrastructure is essential public infrastructure. Furthermore, since many mountainous areas are protected as national parks and nature parks (such as Northern Velebit, Paklenica, Risnjak, Velebit, Učka, Dinara, Biokovo, Papuk, Medvednica, and Žumberak - Samobor hills), mountaineering trails and facilities also serve as vital visitor infrastructure for these parks.

In the CMA, care of mountaineering trail maintenance falls under the Commission for Mountaineering Trails.

### **Commission for Mountaineering Trails**

The Commission for Mountaineering Trails (CMT) of the CMA is an expert, advisory, and coordinating body that encourages, directs and improves the marking activity of the mountaineering associations (CMT, 2021). CMT takes comprehensive care of the development, marking, and maintenance of mountaineering trails in Croatia's mountains, organizes training courses, specialised, e.g. for supplementary education and renewal of the waymarking knowledge, workshops, e.g. for collection and processing of GNSS tracks, and maintains a data base of mountaineering trails, transversals, and trail markers. Actively collaborating with mountaineering associations and waymarkers, the CMT supports their efforts in trail maintenance, signalling, and the equipping of control points on transversals.

CMT takes care and issues well-deserved awards to those who have completed the visit of the following transversals: Hrvatska planinarska obilaznica (Croatian Mountaineering Transversal), Velebitski planinarski put (Velebit Mountaineering Trail) and Planinarska obilaznica Dinara (Dinara Mountaineering Transversal), opened in September of this year on the occasion of CMA's 150 anniversary, with aims to promote and enhance the tourism value of Croatia's highest peak (Mount Dinara, Sinjal, 1831 m.a.s.l.) and the newly established Dinara Nature Park.

CMT's work is organized into specialized working groups, including groups for mountaineering trails, with subgroup for secured trail sections, transversals, waymarkers, education and norms, and informatics.

CMT coordinates the work of mountaineering associations through the commissioners of mountaineering regions. Mountaineering regions consist of 20 regions that span Croatia's mountains and hills (see Figure 1.a). Commissioner duties are to encourage mountaineering associations and waymarkers to maintain the trails for which they are responsible, compare lists and data in the CMA's data base of trails, transversals and waymarkers, with the actual situation in the field, participate in the preparation and implementation of courses, seminars and other forms of waymarkers training.

### **Mountaineering Trails**

Mountaineering trails are established and maintained by mountaineering associations that are members of CMA, following specific standards and procedures outlined in documents such as the Book

of Signalling Standards on Mountaineering Trails (see Figure 1.b), Maintenance and Establishment of Mountaineering Trails, and other related publications published on the CMT web site (CMT, 2021).

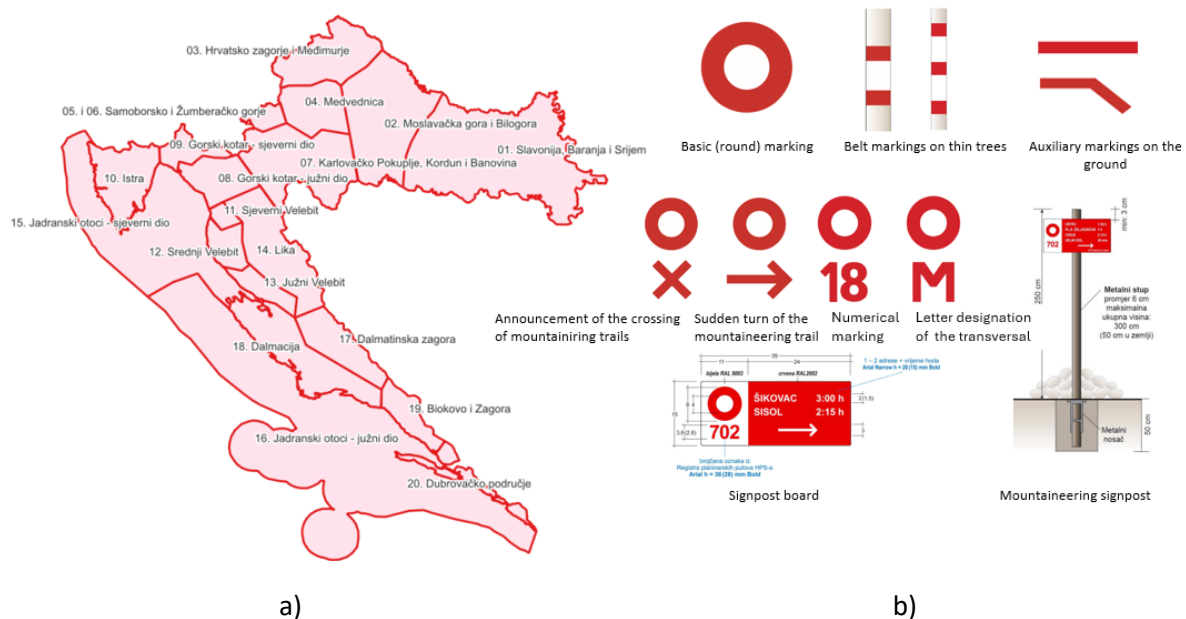


Figure 1. Mountaineering regions and signalling in Croatia: a) mountaineering regions, b) signalling standard (Copyright CMA)

The organization and marking system in Croatia are also presented in the European Ramblers Association's publication *Waymarking in Europe* published by ERA and EUMA (ERA, 2022).

The care for the maintenance of mountaineering trails, that are under the responsibility of the mountaineering association, is primarily led by the trained waymarking leaders and waymarkers, members of the waymarking section of the mountaineering associations, with support of other volunteers from the association.

For the purposes of administering and monitoring the state of trails, transversals and waymarkers, CMT has been developing and maintaining a computer database since 2005. In 2013, this database became publicly available online as the Register of Mountaineering Trails, Transversals and Waymarkers with Accompanying Contents (*Registar planinarskih putova, obilaznica i markacista s pratećim sadržajima*) (see Figure 2) (CMT, 2013). Data from the Register are available free of charge for personal and non-commercial use.

For a visualization of data from the Register, a publicly accessible Interactive Mountaineering Map of Croatia (CMA, 2018) has been developed, showing the spatial and attribute data recorded in the Register on a selected cartographic background (see Figure 3). In addition to Register data, the map can display mountaineering facilities, prominent peaks, protected areas, and other CMA data.

The spatial and attribute data on mountaineering trails from the Register, along with data from the CMA database on mountaineering facilities, have been transferred to the EUMA European Map of Trails, Mountain Huts, and Rock Climbing Areas (EUMA, 2022) and the application *Safe Trails* (Sigurne staze), a publicly accessible, routable interactive map produced by the cartographic department of the Croatian Mountain Rescue Service, CMRS (Hrvatska gorska služba spašavanja, HGSS) (CMRS, 2024).



Figure 2. User interface of the Register of mountaineering trails, transversals and waymarkers with accompanying contents (Copyright CMA)

### The Project: Safe and Sustainable Mountaineering Infrastructure

To improve the state of the mountaineering infrastructure as an important part of public tourist infrastructure and considering the need to ensure the highest possible safety for mountaineers and visitors in mountainous areas, the CMA and the Croatian Ministry of Tourism and Sport, CMST (Ministarstvo turizma i sporta) prepared a project that enables investments in the renovation and maintenance of registered mountaineering infrastructure.

In 2022, CMA and CMST signed the Agreement on long-term cooperation for the development and maintenance of mountaineering infrastructure for tourism purposes, along with the Contract for the implementation of the project for the arrangement and equipping of mountaineering infrastructure called Safe and Sustainable Mountaineering Infrastructure which secures the necessary funds for the care of mountaineering trails and facilities by mountaineering associations (CMA, 2022).

This marks a significant achievement at the national level, providing direct funding from public sources, which mountaineering associations, and the CMA have been seeking for years. The need for such public investment is quite logical, as mountaineering infrastructure no longer serves only mountaineers, but increasingly caters to other visitors who do not concern themselves with the accessibility and safety of trails and the comfort of facilities in mountainous areas but expect that mountaineers to continue to maintain them.

Numerous activities preceded the signing of the Agreement and the Contract without which there would be no foundation for this type of support. It should be kept in mind that several decades ago the CMA established and has since regularly updated the Register of Mountaineering Trails, Transversals and Waymarkers which contain valuable data about the layout and state of mountaineering infrastructure.

The programmatic basis for the implementation of CMA activities related to the arrangement of mountaineering infrastructure is also supported by numerous programmatic and analytical documents adopted by decisions of the Assembly and the Executive Board of CMA in previous years (CMA, 2011): the Strategy for the Development of Croatian Mountaineering (2015), the Work Program of the Croatian Mountaineering Association (2019), a Comparative Analysis of the Development of Mountaineering Infrastructure (2020), the Book of Signalling Standards on Mountaineering Trails (2020), the analysis titled Status, Challenges, and Perspectives of Managing Mountaineering Houses, Shelters, and other Facilities in Croatian Mountains (2021) and the Operational Program for Managing Mountaineering Infrastructure (2022).



Figure 3. Trails and control points of the Dinara Mountaineering Transversal shown on Interactive Mountaineering Map of Croatia (Copyright CMA)

The need for organized and sustainable management of mountaineering infrastructure has been expressed in the National Development Strategy of the Republic of Croatia until 2030 (Nacionalna razvojna strategija Republike Hrvatske do 2030. godine) (CP, 2021), which particularly emphasizes the importance of promoting a healthy and active lifestyle for citizens through sports and recreation. In this context, the necessity of promoting and investing in mountaineering infrastructure is explicitly stated. In the Strategy for the Development of Sustainable Tourism until 2030 (Strategija razvoja održivog turizma do 2030. godine) (CP, 2022) the implementation of activities related to the arrangement of mountaineering infrastructure is aimed at achieving the following strategic goals: year-round and regionally balanced tourism, tourism that preserves the environment, space, and climate, competitive and innovative tourism, and resilient tourism.

The main activities of the Safe and Sustainable Mountaineering Infrastructure project are as follows: renovation, arrangement, and equipping of registered mountaineering trails and transversals, updating and improving the functionality of the Register, collecting and delivering data on public tourism infrastructure related with the public tourism infrastructure regulations, training for waymarkers and other volunteers working on mountaineering infrastructure, providing expert, organizational, and administrative support for managing mountaineering infrastructure, and, in terms of mountaineering facilities and destinations, arranging and equipping these facilities, particularly with



water supply containers, sanitary facilities, monitoring stations for meteorological and biological phenomena, fire surveillance systems in mountain lodges, and viewpoints equipment.

The project is yearly implemented through the following phases: CMA publishes a call for expressions of needs for the improvement of mountaineering infrastructure, accompanied by relevant forms and guidelines; mountaineering associations express their needs to CMA by submitting forms and accompanying documentation; CMA approves these requests and arranges the procurement of materials for justified activities, informs associations about this, and signs contracts with them for regarding the use of funding for arranging infrastructure; CMA organizes and manages the procurement of all approved materials, tools, and equipment, signing contracts with suppliers; CMA informs mountaineering associations about where and how to collect materials, tools, and equipment; associations then retrieve the requested and approved materials, tools, and equipment and carry out maintenance work on trails and facilities; upon CMA's request, the associations report on the status of trail and facility improvements using designated forms; CMA signs contracts with the field workers and deposits the calculated compensation for their fieldwork into their accounts; CMA reports the results to CMTS, mountaineering associations, and the public.

For activities aimed at improving mountaineering infrastructure, CMTS allocated and transferred to the CMA account €428,694 in the first (2022-2023) (Čaplar, 2023) and €398,200 in the second (2023-2024) (Čaplar, 2024) cycle, in total €826,894. These funds come from dedicated state budget resources, specifically allocated within CMTS to support the restoration and maintenance of registered mountaineering infrastructure used for tourism purposes. In addition to these project funds, CMA also invested significant resources of its own, as it does each year.

In the projections for the state budget for 2025, funds for these purposes have also been planned. In agreement with CMTS, a call for the third cycle of 2024-2025 has recently been closed, allowing mountaineering associations to express their further needs (CMA, 2024). An additional €400,000 is planned for the arrangement of infrastructure in 2025.

## **Project Results**

In the first two cycles of the Safe and Sustainable Mountaineering Infrastructure project, a total of 574 registered mountaineering trails were arranged, with a total length of 2,620 kilometres, equating to over 900 hours of walking. For the renovation of markings and improving the accessibility of trails, more than 15,500 individual items of materials (paint cans), supplies (brushes), and tools (scissors, saws, machetes, shovels, axes, etc.) were procured. Suppliers delivered to the mountaineering associations over 800 signpost poles and around 1,500 standardized signposts tables. The costs for materials, supplies, tools, and fieldwork related to the arrangement of paths totalled €367,000 (see Table 1).

One of the project outcomes is the new online version of the Register expanded with functionalities needed to support project management through recording the expressed needs of mountaineering associations for trail restoration, as well as tracking and reporting on completed work and engaged waymarkers (see Figure 4).

To enhance the implementation of activities, CMA has employed project financed position of secretary for mountaineering infrastructure and project implementation responsible for coordinating with CMTS

representatives, relevant CMA commissions, regional mountaineering commissioners, mountaineering association representatives, suppliers, contractors, and other project stakeholders.

Project generates some additional benefits regarding trail management, trail network extension and field data collection.

Data	1. cycle 2022-2023	2. cycle 2023-2024	Total
The need for the arrangement and renovation of trails expressed by mountaineering societies	75	61	136
Submitted number of registered trails	382	192	574
Total length of trails (km)	> 1,707	> 913	2,620
Total walking time (hours)	~ 607	~ 332	~ 939
Requested pieces of materials, tools and accessories	10,053	5,492	15,545
Signpost tables	909	564	1,473
Signpost poles	550	265	815
Costs of materials, accessories and tools (EUR)	13,7000	115,000	252,000
Costs of field work on trails arrangement (EUR)	75,000	40,000	115,000

Table 1. Results of the project in the renovation of mountaineering trails (Copyright CMA)

To balance the involvement of associations and waymarkers, a sustainable model for trail management, that includes publicly accessible e-lists of trails designated for cession and those slated for takeover as well as procedures for transferring maintenance responsibilities, has been established.

Poveznica	Udruga	Materijal od HPSa?	Dvostruko financiranje?	Prijavljeno? (udruga)	Plan: odobren (KzPP)	Plan: priznato? (ured)	Obnovljeno? (udruga)	Obnova: odobreno (KzPP)	Obnova: priznato? (ured)
	PD Čičarija	✓	✗	✓	✓	✓	✓	✓	✓
	PD Yeti	✓	✗	✓	✓	✓	✓	✓	✓
	HPD Martinsžak	✓	✗	✓	✓	✓	✓	✓	✓

Figure 4. Screen of the application for project management when checking the completed obligations of mountaineering associations (Copyright CMA)

Notably, renewed cross-border trails between Croatia and Slovenia are now accessible following the abolition of the Schengen border regime. This activity was carried out in cooperation with the Alpine Association of Slovenia (Planinska zveza Slovenije, PZS).

To assist with the renovation of mountaineering signposts in the field, a mobile application has been developed. This application allows users to view the locations for signposts placements on a



cartographic background when planning fieldwork. In the field, waymarkers can enter data about the signposts and upload photos of the set-up signposts, while information about coordinates and the time of set-up is recorded directly through the application (see Figure 5). If there is access to a public data transmission network, the data can be sent to the geoinformation system in real-time or later when the network becomes available. Additionally, a mobile application for crowdsourced data collection has been developed to gather information on reduced accessibility or damage to trails caused by obstacles or adverse weather conditions. Both applications have been developed in collaboration with the state-owned commercial company Croatian Forests (Hrvatske šume).

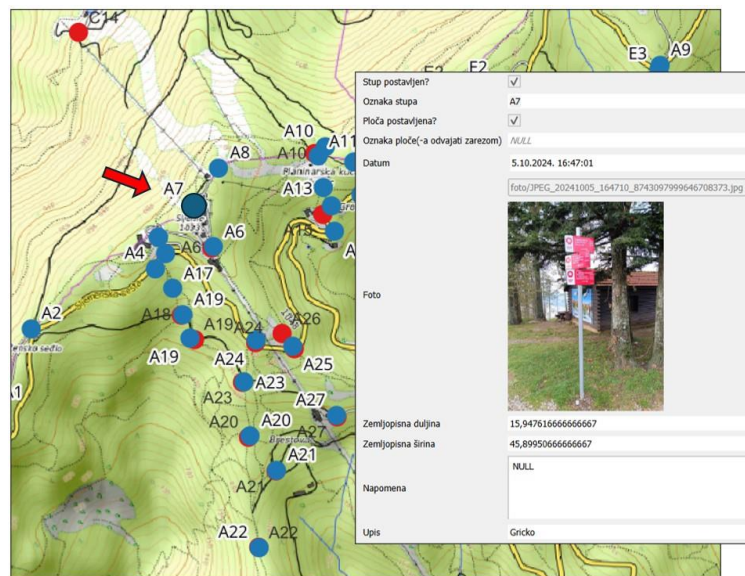


Figure 5. Currently set-up (in blue) and planned locations (in red) of mountaineering signposts at the central part of mountain Medvednica collected by mobile application and shown on screen of the geoinformation system (Copyright CMA)

As with any undertaking, there were difficulties in the implementation of the project. Adverse weather conditions (prolonged winter conditions in the higher mountains, rain, strong winds, stormy weather) posed a particular challenge during many activities. Furthermore, many mountaineering trails were damaged during the storms that occurred in the summer of last year during the second cycle of the project, necessitating a renewed effort to maintain already established trails.

It should be noted that, using funds obtained through the contract between the CMA and CMTS, as well as its own funds, CMA procured the necessary materials, timber, tools, and equipment for the renovation of 21 mountaineering facilities, this included 9 mountain huts, 7 mountain houses, and 5 mountain lodges.

## Conclusion

Through the collaborative efforts in establishing the Safe and Sustainable Mountaineering Infrastructure project, the Croatian Mountaineering Association and the Croatian Ministry of Tourism and Sports have created a foundation for more long-term financing for the renovation and maintenance of mountaineering trails and facilities from public sources.

In the two completed cycles of the project, over 40 percent of mountaineering trails have been restored. With continued support for public financing of trail maintenance, the entire network of trails could be renovated within the next three years.

Projects like this give results primarily through the valuable and important volunteer engagement of waymarkers and mountaineering community aiming to raise the level of safety of movement and comfort of stay in the mountains for mountaineers and visitors from Croatia and abroad.

#### Literature:

Croatian Mountaineering Association, CMA (2011) *Web portal*, Available at: <https://www.hps.hr> (Accessed: 15 October 2024)

Croatian Mountaineering Association, CMA (2018) *Interactive Mountaineering Map of Croatia*, Available at: <https://www.hps.hr/karta> (Accessed: 15 October 2024)

Croatian Mountaineering Association, CMA (2022) *The Ministry of Tourism and Sport and Croatian Mountaineering Association concluded an Agreement on long-term cooperation on the development and maintenance of mountaineering infrastructure in the function of tourism – 15-12-2022*, Available at: <https://www.hps.hr/vijesti/18341/ministarstvo-turizma-i-sporta-i-hps-sklopili-sporazum-o-dugorocnoj-suradnji-na-razvoju-i-odrzavanju-planinarske-infrastrukture-u-funkciji-turizma/> (Accessed: 15 October 2024)

Croatian Mountaineering Association, CMA (2024) *Call for expressions of need for the arrangement of mountaineering infrastructure – 21-08-2024*, Available at: <https://www.hps.hr/vijesti/24919/poziv-na-iskazivanje-potreba-za-uredjenje-planinarske-infrastrukture> (Accessed: 15 October 2024)

Commission for Mountaineering Trails, CMT (2013) *The Register of Mountaineering Trails, Transversals and Waymarkers*, Available at: <https://info.hps.hr/putovi> (Accessed: 15 October 2024)

Commission for Mountaineering Trails, CMT (2021) *Web site*, Available at: <https://www.hps.hr/planinarski-putovi> (Accessed: 15 October 2024)

Croatian Mountain Rescue Service, CMRS (2024) *Safe Trails*, Available at: <https://sigurnestaze.hr> (Accessed: 15 October 2024)

Croatian Parliament, CP (2021) *National Development Strategy of the Republic of Croatia until 2030, Official Journal*, 13/2021, (230) Available at: [https://narodne-novine.nn.hr/clanci/sluzbeni/2021\\_02\\_13\\_230.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2021_02_13_230.html) (Accessed: 15 October 2024)

Croatian Parliament, CP (2022) *Strategy for the Development of Sustainable Tourism until 2030, Official Journal*, 2/2023, (18) Available at: [https://narodne-novine.nn.hr/clanci/sluzbeni/full/2023\\_01\\_2\\_18.html](https://narodne-novine.nn.hr/clanci/sluzbeni/full/2023_01_2_18.html) (Accessed: 15 October 2024)

Čaplar, A. (2023) Investments in mountaineering infrastructure, *Hrvatski planinar*, 115(9), pp368-373. (in Croatian)

Čaplar, A. (2024) New investments in mountaineering infrastructure, *Hrvatski planinar*, 116(9), pp 375-379. (in Croatian)

European Mountaineering Association, EUMA (2022) European Map of Trails, Mountain Huts, and Rock Climbing Areas, Available at: <https://www.european-mountaineers.eu/map> (Accessed: 15 October 2024)

European Ramblers Association, ERA (2022) *Waymarking in Europe*, Available at: <https://www.era-ewv-ferp.org/waymarking-brochure> (Accessed: 15 October 2024)

**Contact details:** Hrvoje Gold, Head of the Commission for Mountaineering Trails of the Croatian Mountaineering Association, <https://www.hps.hr>, [putovi@hps.hr](mailto:putovi@hps.hr)