

Century-long history of rural community landslide risk reduction

Jan Klimeš^{a,*}, Hana Müllerová^b, Jiří Woitsch^c, Michal Bíl^d, Barbora Krížová^b

^a Czech Academy of Sciences, Institute of Rock Structure and Mechanics, V Holešovičkách 41, 182 09, Prague, Czech Republic

^b Czech Academy of Sciences, Institute of State and Law, Národní 18, 116 00, Prague, Czech Republic

^c Czech Academy of Sciences, Institute of Ethnology, Na Florenci 3, 110 00, Prague, Czech Republic

^d Faculty of Science, Palacký University Olomouc, Department of Geography, 17. Listopadu 12, Olomouc, 771 46, Czech Republic

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ABSTRACT

The study documents the more than century-long history of community-based landslide risk reduction of a small rural community in the village of Maršov, the Outer Western Carpathians, Czech Republic. The village is characterized by a high landslide hazard shown by repeated, rainfall-triggered, landslides, which have been inventoried and described using the available historical documents and field investigation. Although the occurring landslides are rather shallow (from 2 m to 10 m) and small (up to 37,000 m²), two of them seriously impacted the life of the community. Available historical data were used to describe direct as well as indirect damage caused by the landslides and the community's response to their occurrences. The first documented landslide (1911) caused no direct damage, but it alarmed the community and played an important role in the initiation of extensive land drainage works. Destruction of one third of the houses in the village by the 1967 landslide was swiftly resolved by relocation of the landslide affected families to the nearby town. This measure accelerated the decline and marginalization of the community, which became an important part of the local oral history that is still vivid 50 years after the event. We suggest that this fresh local memory of the catastrophic event contributed along with other factors (e.g. lack of funds, lack of interest of Maršov inhabitants in the site development) to adopting a largely restrictive territorial plan (in 2017), which if respected would effectively limit possible future landslide related damage.

1. Introduction

Landslides adversely influence social and economic development in many regions (Schuster and Highland [1]) throughout their histories (e.g. Salvati et al. [2]). However, the attention of researchers has not been spread equally among these regions. The issue has been extensively studied particularly in areas with a frequent occurrence of landslides, where land-use management has not been well established (Dowling and Santi [3]) or land development regulations have been difficult to enforce (Carey [4]; Vilímek et al. [5]). On the contrary, in regions with low risk and a long history of application of land-development regulations, and where natural disasters are not frequent or they rarely claim casualties, investigation of landslide impacts on the affected communities and their response to these disasters, has not been a major focus of research (e.g. Czech Republic - Klimeš et al. [6]; Germany - Klose et al. [7]). In the case of the Czech Republic, this research deficit exists despite the fact that at least 274 houses in 35 settlements have been destroyed and nine people have died due to landslides since the end of the 19th century. Just

between 2010 and 2018 two people died, 13 were injured and 66 were forced to temporarily leave their houses due to landslides, which also caused derailment of five local trains. Available records also show that several potentially damaging events were avoided only by chance (Klimeš et al. [6]).

At the same time, landslides in the Czech Republic also strongly impact the social and cultural life of communities, which are in some cases affected for centuries by landslide reactivations (Bíl et al. [8]). We can find both negative and positive examples of such impacts. Cases of forced relocation of the population, property losses or the violent nature of some landslides have deeply disrupted the affected communities as well as individuals, even causing mental problems. On the other hand, examples of positive community reaction may include enhanced community solidarity during disaster relief, construction of a chapel to thank the God for saving houses and lives (Raška [9]) or a memorial of the tragedy (Věchetová [10]). Both, the above-mentioned research gap and the serious effects of landslides on communities make a strong argument for investigating the complex interplays between society and landslides

* Corresponding author.

E-mail address: klimes@irms.cas.cz (J. Klimeš).

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also in “low risk countries” (Gibson et al. [11]).

Moreover, coping with the negative effects of landslides at the community level has also re-emerged (cf. Maskrey [12]) as an important scientific (Sassa [13]) and political issue internationally (Petley [14]). This has resulted from the assumed failure of the previously applied top-down risk reduction approach (Raška [9]) indicated by a rising number of landslide-related fatalities (Petley [14,15]), and by increasing occurrences of fatal landslides triggered by human activities as a results of e.g. construction, illegal mining and hill cutting (Froude and Petley [16]). This enlivened international attention presents another stimulus for studying approaches to landslide risk reduction (LRR) in various social, legal and economic environments.

Various case studies have documented that LRR measures may bring significant social and economic benefits if they are well-designed and involve the community in all of their steps (Hostettler et al. [17]; Maes et al. [18]; Klimeš et al. [19]). These case studies stress the importance of the dynamic nature of any effective LRR strategy, which should not be considered as a static, technical solution, but more a process in which communities are able to adapt the changing social and natural conditions. The legislation and processes of land-use planning are considered one of the most important tools for minimizing future disasters (Schuster and Highland [1]; Müllerová et al. [20]). Nevertheless, their practical application and enforcement tend to be weakened by their dependence on local (c.f. community) personal and material capacities, which are often limited (Maskrey [12]). Moreover, several cases from the Czech Republic (Raška [9]) show that community-based LRR always includes traditional as well as newly-established practices and the response of communities strongly depends on their economic situation, competencies largely granted by the valid legislation or outside solidarity during emergencies, as well as the individual actions of affected land-owners. Raška's study also points out the process of individualization, which may strongly alternate the role of communities in future LRR efforts. However, there is a general lack of community-scale studies focusing on the long-term history of LRRs in specific social (e.g. political, legal) and environmental settings (see Raška [9]).

Our study helps bridge the described gap by examining more than a century long history of a small rural community (Maršov, Fig. 1), whose development was seriously affected by repeated landslide occurrences among which stand out the 1911 and 1967 landslides. We use mainly these two events to document the complex interaction of natural and

social environments exploring the landslide damage recorded in archive sources or from local oral histories. Description of the community's role in landslide emergency responses and procedures of territorial planning is provided to evaluate its influence on the long-term LRR success. Geological conditions favourable to landslide reactivations (e.g. Krejčí et al. [21]), historical contexts, as well as the legislation valid at the time, are described as important drivers of the community's actions.

2. Study area description

The village of Maršov is located in highly landslide-prone hilly land of the Outer Western Carpathians (Krejčí et al. [21]). The region is characterized by wide and gently inclined (up to 7°) ridges dissected by deep and widely-opened valleys often following tectonic fragmentation of the bedrock (Demek and Mackovčín [22]). Local differences in relief are up to 80 m over a distance of approximately 400 m. The highest elevation of the ridge above the village is 390 m above sea level (m a.s.l.) and the local stream leaves the village at 274 m a.s.l. (Fig. 1). Slopes around the village incline between 5° and 13° near the ridges and steepen to more than 17° near the streams along which steep (22°) erosional slopes have developed. Valley heads and slope foots are covered by thick colluvial sediments. The area is built up by allochthonous nappe (Rača Unit of Magura Group) of flysch rocks (calcareous claystones and sandstones) of the Eocene and Oligocene age (Zlín Formation). These marine, highly weathering-prone sediments were thrust over the edge of the West European Plate during the Paleogene and Early Neogene (Pícha et al. [23]).

Landslides in the Czech Republic are usually triggered by extreme precipitation related to large-scale climatic variability (Raška et al. [24]) as well as regional weather conditions affecting the Outer Western Carpathians (Krejčí et al. [20]; Bíl and Müller [25]; Pánek et al. [26]; Bíl et al. [27]). Few relevant rainfall thresholds have been calculated for the study area. Landslides during the 2006 landslide event occurred when 150 mm of water (from both rainfall and snow thawing) was released over a period of 10 days (Bíl and Müller [25]). Moreover, Bíl et al. [27] calculated a threshold for Napajedla station (20 km away from Maršov), which specifies triggering rainfall or water released from snow thawing. The lowest “safe” rainfall value (when no landslides were detected) was determined as 67 mm of water released to the soil over 10 days (Bíl et al. [27]).

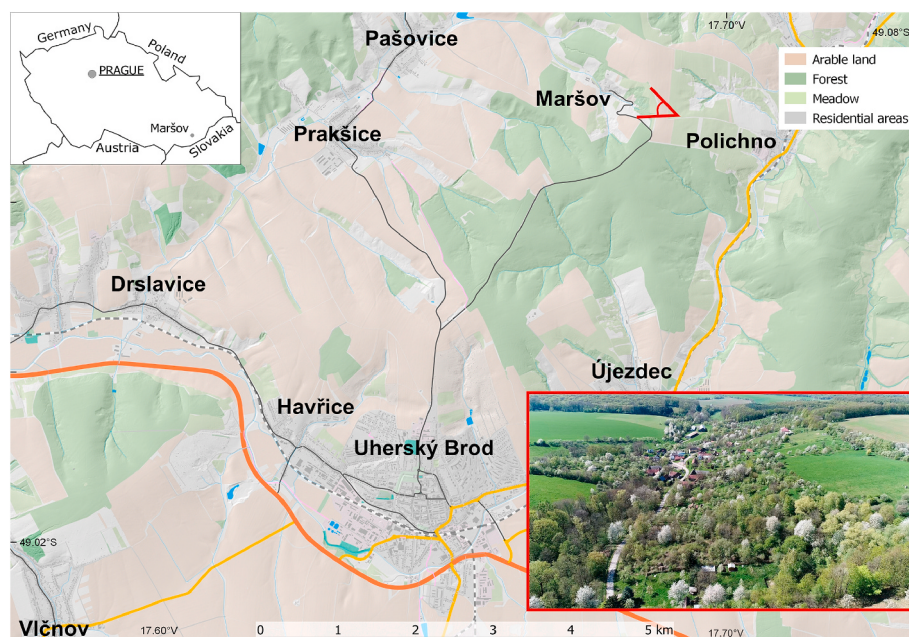


Fig. 1. Location of the study area with the aerial view of the Maršov village to the NW.

According to reliable written accounts (summarized in Jančár [28]), the village was established at the end of the 16th century (the first written record is from 1611) during the time of the agrarian expansion, demographic growth and colonization. Its location in a remote valley is related to the effort to use as much area as possible for agricultural production, which was rather typical in Central Europe at this time (Pánek and Tůma [29]). Maršov largely shared the same history as the surrounding villages, although some sources suggest that its remote location spared the village from the looting that accompanied several wars in the 17th and the beginning of the 18th century. On the other hand, the isolated location of the village, which was connected with neighbouring villages only by poor roads, considerably limited its development.

Throughout history, Maršov has been a small agricultural village where local farmers owned only small areas of land, part of which was only useable as orchards and gardens and was not suitable for intensive cultivation also due to the occurrence of landslides (see below). The number of houses and inhabitants increased very slowly during the early modern period (Jančár [28]), and during the course of the second half of 19th and 20th century (Fig. 2) Maršov witnessed a demographic decline and stagnation in building development. The latter may be seen by the large similarity of land parcels and the distribution of buildings in 1828 compared to recent cadastral maps (Fig. 3). The demographic decline was caused by economic decay (e.g. the total abandonment of viticulture after 1890 as a result of *Plasmopara viticola* epidemics) and the general process of urbanization and depopulation of rural regions in Central Europe (Pánek and Tůma [29]; Fialová et al. [30]). However, in the case of Maršov, especially after 1911, the main limitation to the development of the village were most probably the landslides.

3. Methods

The aim of the following methods was to characterize the environmental, historical and legal conditions enabling us to study and evaluate LRR of Maršov since the turn of the 20th century, when the village and community were affected by the first documented historical landslide. The amount of detail of the historical description depends on available documentary data as well as the complexity and variability of the studied conditions.

3.1. Geomorphological mapping

Landslides were mapped in a field in 2018 and were compared with the mapping results of the 2005 field campaign available in the web database of the Czech Geological Survey [32]. The 2018 field mapping was done with the aid of the detailed digital elevation model (DEM) derived from LiDAR measurements performed in January and February 2018 collecting 3 points/m². The prepared DEM has a ground resolution of 1 m. We also used the publicly available 5G DMR (5th Generation of the Digital Elevation Model [31]) with a resolution of 2 m obtained in

2013. Both models were used as hillsides and slope maps to identify landslide related morphological features. Qualitative interviews of three local inhabitants (for more details see 3.3 Historical documentary data section) also provided valuable information with respect to the identification and historical occurrences or movements of the landslides. Features like opened cracks, fresh-looking scarps without vegetation cover, well pronounced accumulation toes, tilted trees and fresh-looking partial landslides were considered as indicators of recent landslide movements and these landslides were assigned as “active” (cf. McCalpin [33]; Wiczorek [34]; Fig. 4). Other landslides without such features, but still with well-developed morphology, were described as “temporarily inactive”, while landforms obscured by vegetation growth, agricultural practices or denudation were assigned as “old landslides”.

3.2. Legal framework

We researched the legislation (e.g. laws, decrees and ordinances) valid in three, broadly defined time periods from which the first two are linked to historical occurrences of major landslides (cf. before 1911, around 1967 and recent - 2018). Other available legal documents related to landslide prevention and mitigation were also used. The legislation of the Habsburg Monarchy until 1918 can be found at the website of the National Library of Austria [35] and partly also in the Virtual Library of Laws, Masaryk University, Brno [36]. The legislation valid for the territory of what is today the Czech Republic in individual historical periods from 1918 as well as the legislation currently in force is available from various Czech commercial legislative databases [37, 38]. On the other hand, the historical regulations of lower levels of administration including individual decisions (e.g. territorial decisions or building permits) are usually not available, since it was not prescribed to be published. Therefore, secondary sources were used to substitute these shortcomings when necessary. Historical territorial plans of the study area would have been a highly useful source of information for our research. However, it has never been obligatory for municipalities in the Czech territory to elaborate territorial plans and according to our knowledge, Maršov had none during its autonomous existence until 1976 (Fig. 5), when it was attached to the city of Uherský Brod and since then, it has been covered by its territorial plans.

3.3. Historical documentary data

Historical landslide occurrences were reconstructed based on interpretation of available historical aerial and field photographs (Table 1), unpublished reports, and a historical landslide inventory [32]. The major historical events were summarized on Fig. 5 where the empty boxes with question marks indicate periods with known massive landslide occurrences in the close vicinity of the study area, but with no information about the landslides from the village. The hatching indicates periods with unknown exact dates of the described events which occurred between two consecutive aerial photographs available.

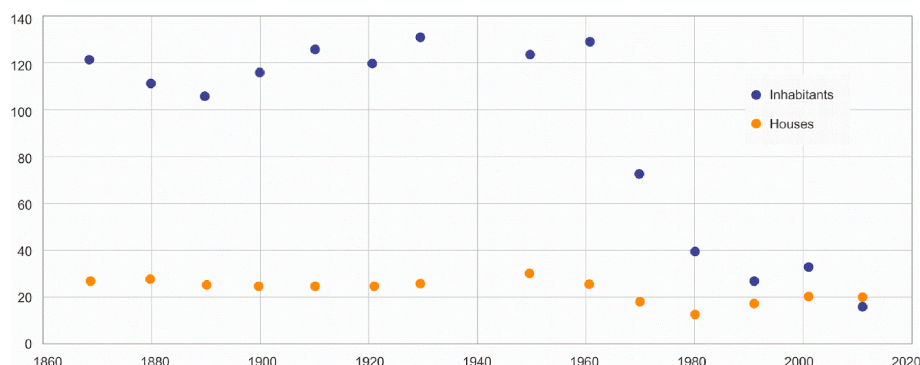


Fig. 2. Number of inhabitants and houses in the Maršov, 1869–2011.

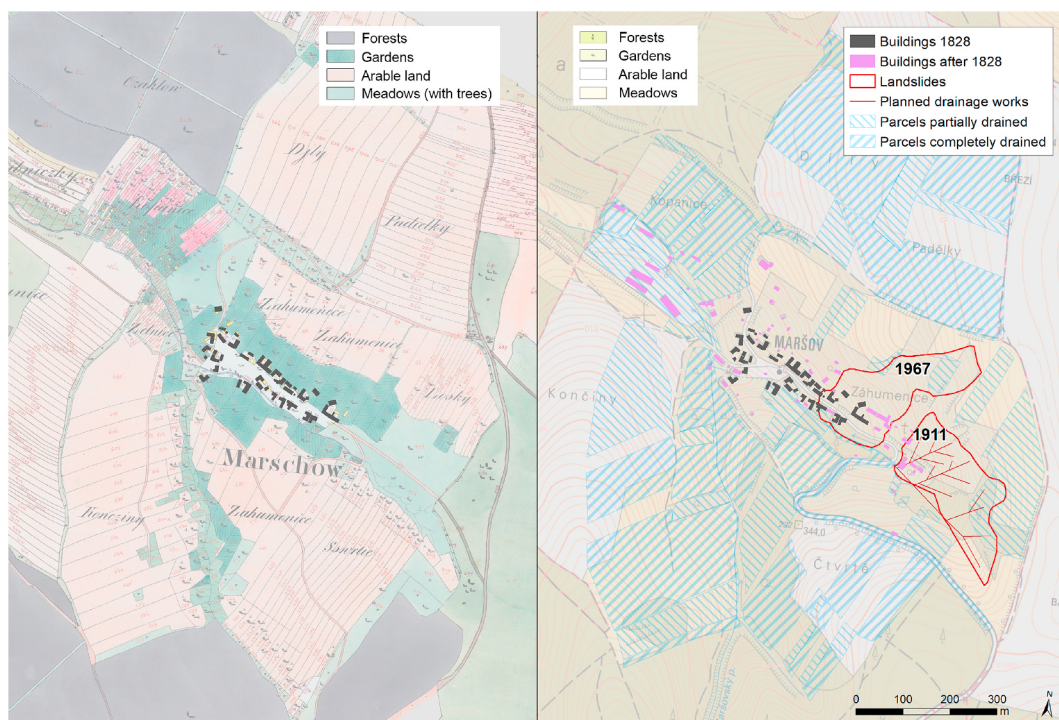


Fig. 3. Cadastral maps from 1828 (left) and present day with 1:10,000 topographic map (contour interval is 2 m [31]) in the background (right). It shows the distribution of land parcels and buildings in Maršov with respect to the 1911 and 1967 landslides.



Fig. 4. Recent morphology of the central transport part (left) and side limit in the scarp area (right) of the major landslide from 1967 (for location of the photos from March 2018 see Fig. 6).

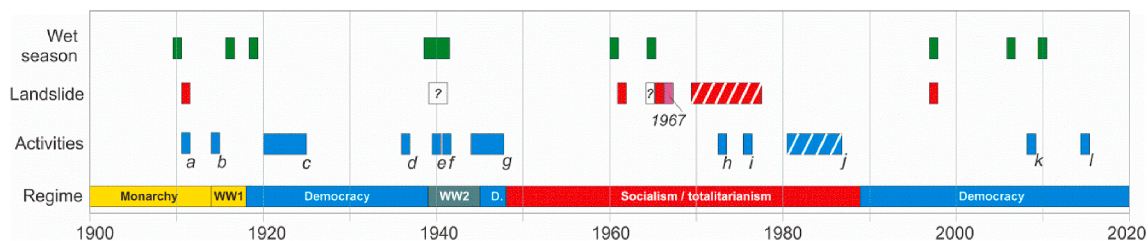


Fig. 5. Chronology of important events related to the community's response to the landslide hazard in Maršov; a) 11 May 1911 – expert report; b) April 1914 – establishment of the Water Cooperative; c) drainage works; d) 1936 – drainage no longer maintained; e) 1940 – stream treatment; f) 1941 – last written record of the Water Cooperative; g) electrification; h) 1973 – the local cooperative farm merged with a farm in Uherský Brod; i) 1 August 1976 Maršov became part of Uherský Brod; j) 1980s a local grocery shop closed, bus connections were cancelled; k) 1 April 2009 – the Centre of Environmental Education opened; l) 6 November 2015 – educational trail opened around Maršov.

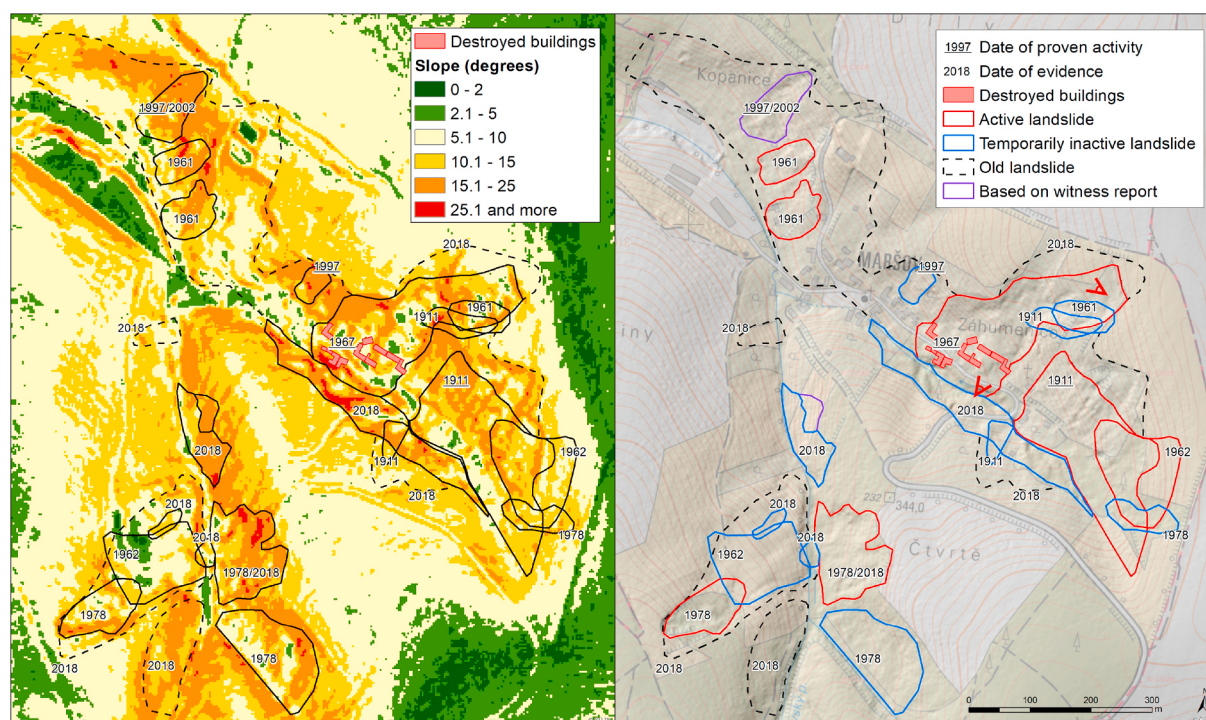


Fig. 6. Historical landslide inventory map of the Maršov village on top of slope map based on the 5G DMR (left) and 1:10,000 topographic map (contour interval is 2 m [31], right). It shows years of landslide occurrence or their identification by the available historical data (e.g. aerial photographs, geological reports) as well as houses destroyed during the catastrophic 1967 landslide. Legend of the topographic background map is in Fig. 3.

Table 1

List of available photographs and topographic data used in the study (¹ – Military Geographical and Hydrometeorological Office, Ministry of Defense of the Czech Republic).

Type	Dates	Source
Field photographs	1967, 2018	the Quido Záruba's Photo Archive [43], own field work
Aerial photographs	1961, 1971, 1978, 1986	VGHMÚř Dobruška, © MO ČR ¹ , 1:25,000 scale
Historical maps	1st (1764–1768), 2nd (1836–1852), 3rd (1876–1878) military mapping	[39,40]
LiDAR data	2013, 2018	[31], own data acquisition

Oral testimonies of local inhabitants were collected during field investigation related to the preparation of short videos about Maršov in 2018. The videos were recorded as part of a project documenting life in communities affected with landslides in the Czech Republic. The original video recordings (10 h) include among others semi-biographic qualitative interviews with six former and current residents of the village, which were analysed with the permission of their authors. The historical development of Maršov and different local and regional/state responses to landslide occurrences in the 20th century were reconstructed using a variety of archive materials including historical maps (Table 1). The most relevant spatial data were provided by cadastral maps preserved from the 1820s onwards ([39], [40]; see also Semotanová [41]; Roubík [42]). Unfortunately, the archive of Maršov (materials from 1700 to 1945) and the archive of the local committee in Maršov (materials from 1945 to 1976) have been preserved only to a small extent; however, important information was found in village bookkeeping and official correspondence (State district archives Uherské Hradiště, fund Archive of Maršov village, 1700–1945 - SOKA UH AO Maršov; State district archives Uherské Hradiště, fund Local national committee, 1945–1976 - SOKA UH MNV Maršov). The wider

contexts of the landslide mitigations of 1911 and 1967 were also explained based on archival sources of regional and state governing bodies preserved in the State District Archives in Uherské Hradiště (SOKA UH AO Maršov, SOKA UH MNV Maršov, State district archives Uherské Hradiště, fund Agricultural cooperative Maršov, 1957–1973 - SOKA UH JZD Maršov; State district archives Uherské Hradiště, fund District national committee, 1945–1990 - SOKA UH ONV Uherské Hradiště) and the Moravian Provincial Archives in Brno Presidium of Moravian regional stadtholderate, (MZA Brno Moravské místodržitelství – presidium). Valuable data (e.g. written memoirs) and photographs from private collections were also studied.

3.4. Local oral history

The “story” of landslides in Maršov is followed retrospectively from the perspective of the collective memory of the community, which is shared inter- and intra-personally and may vary over time and, therefore, may be highly to extremely subjective (Halbwachs [44]; Assmann [45]; Beiner [46]). From the point of view of the current theories of collective memory research using oral history, this memory reproduced in individual narratives can partly speak of real historical events (historical “truth”), in our case about landslides. At the same time, it provides essential information about many levels of community views and attitudes (Perks and Thomson [47]; Gubrium and Holstein [48]; Thompson [49]). We reconstructed the collective memory of the Maršov community from personal interviews, which should be often considered as important oral testimonies, and written testimonies, which were compiled by the locals during the investigation of the landslide in 1967 or later and were kept in family collections as personal memoirs. The available literature (Jančár [28, 50]) partly based on oral-history methods and the municipal chronicle (Village chronicle of Maršov in SOKA UH AO Maršov) has been taken into account as well. Although the chronicle is an official document, it is characterized by a very subjective colouring of information close to the collective memory of the community. In total, more than dozen oral or written testimonies about the

history of the village and landslides were collected. The questionnaires or semi-structured interviews were not used for data collection because they are not suitable for the applied qualitative oral history method of the research.

4. Results

4.1. Landslide occurrences and village development 1910–1967

4.1.1. The 1910–1911 landslide

The first documented landslide to affect the village of Maršov, was officially mapped and documented by a forestry engineer only thanks to the political intervention of a local member of Parliament in May 1911 (Fig. 2). The reliable landslide map and description (MZA Brno Moravské místodržitelství – presidium) allowed us to precisely locate the landslide (Fig. 4). It was probably a shallow landslide, which most likely developed during the winter of 1910–1911 or during the spring of 1911, due to extreme rainfall which occurred in this part of the Outer Western Carpathians in the year before (Dobrovolný et al. [51]). Other authors also mentioned a number of landslides in the wider area of Maršov within the Czech Outer Western Carpathians during early 1911 (e.g., Špůrek [52]; Bíl et al. [8]).

Another two temporarily stable landslides were also identified in 1911 along with the general conclusion that the steep slopes around the village are highly susceptible to landslides. Since the landslide did not affect or threaten any buildings, it was recommended to perform basic and the most affordable land drainage measures (the proposed drainage scheme is shown in Fig. 3), to prevent slope erosion by the stream and to forest the affected area. The available information suggests that the last two recommendations were fulfilled, as most of the landslide is covered by a broadleaf forest or orchard and the influence of the stream at its toe is negligible. On the other hand, we found no evidence that the suggested drainage works were ever performed within the area affected by the 1911 landslide.

4.1.2. The community's LRR effort following the 1911 event

The majority of landowners from Maršov established a Water Cooperative three years after the 1911 landslide (SOKA UH AO Maršov), stating that its main aim is “land and landslide drainage” (Fig. 5). To a certain extent, this represents an attempt of long-term LRR, considering the recommendation of the May 1911 landslide report. At that time, establishing water cooperatives in municipalities was quite common, having been based on Act No. 116 of 30th June 1884 on improving agriculture with hydraulic constructions [53], which also introduced a framework for financial subsidies for the works. However, we found that any real activity of the Maršov Water Cooperative was delayed due to the World War I and following revisions of laws adapted to the needs of new Czechoslovak republic (established in 1918), which neither changed the main conditions of building the hydraulic constructions nor the financial subsidies for them. Therefore, the cooperative resumed its function in the early 1920s and finished the drainage works in 1925. However, as mentioned above, the drainage was not applied to the 1911 landslide and had only a very limited extent on the SW-facing slope above the village, where the 1967 landslide occurred (Fig. 3). The costs of the works were shared by the landowners, the village and the Ministry of Agriculture; subsidies from the regional government are also documented (SOKA UH AO Maršov, SOKA UH, Village chronicle Maršov).

The above-described history of landslide occurrence, community response and assumed mitigation works reflect the then legal environment. Before 1911, land development was regulated by the Building Order of the Margraviate of Moravia No. 64/1894 [54], whose specific spatial planning rule covered mitigating fire and flood hazards but completely omitted landslides. This was probably due to the absence of systematic records about landslide occurrences, while flood limits were well known even at that time. The law only stated that issuing building permits was not allowed for sites endangered by landslides and rockfalls.

This monarchist legal background was largely absorbed by the early legal system of the democratic republic of Czechoslovakia.

4.2. Catastrophic landslide reactivation in 1967 and relief effort

4.2.1. The village history 1925–1967

After completion of the land drainage project in 1925, the Maršov Water Cooperative got into serious economic problems putting Maršov into debt as well, which consequently limited its further development (e.g. construction of water pipelines, electrification, and maintenance of roads). From 1936, the Water Cooperative existed only formally, performing no activities (SOKA UH AO Maršov). Therefore, we can conclude that the maintenance of the built drainage was not performed for longer than 10 years after its construction. After the World War II, the difficult economic situation of the village continued and any available resources were spent on more appealing and important projects of that period (e.g. electrification, road construction and cooperative farm foundation, SOKA UH AO Maršov, SOKA UH MNV Maršov, SOKA UH JZD Maršov), which probably, along with the weakening of the historical memory of the 1911 landslide (cf. Fanta et al. [55]), resulted in overlooking of any landslide mitigation activities.

4.2.2. The 1967 landslide

The first relevant information about the occurrence of landslides after the 1911 event comes from interpretation of an aerial photograph from 1961 (Table 1, Fig. 6) and was confirmed by the local inhabitants (Pašek [56]). The three landslides did not cause any damage, but from August 1966 begun to develop another landslide reactivating the area previously affected by the 1911 and the temporarily inactive 1961 landslides (Fig. 6, Pašek [56]). The progressive nature of its failure with acceleration in March 1967 is well demonstrated by the chronology of demolition notices issued for nine houses (Fig. 7). Precipitation records from neighbouring stations do not show any intensive, extreme rainfall but prolonged continuous rainfall from April to June 1965 (Bíl et al. [27]). A yearlong lag-time before the onset of landslide movement has been previously observed also in similar geological settings in the village of Halenkovice (Bíl et al. [57]), situated 20 km to the NW of the study area. The sliding surface of the 1967 landslide developed on the base of weathered colluvium at depths of about 2 m in the source area increasing up to 10 m at its toe (Fig. 8), which was formed by the steep erosional slope of the local stream. Secondary sliding damaged the main road crossing the landslide accumulation. Failure to maintain the drainage system in the 1920s was mentioned as a factor responsible for the landslide occurrence in the geological report (Pašek [56]) as well as in oral testimonies. Nevertheless, the historical records proved that the drainage did not cover the land parcels affected by the 1967 landslide (Fig. 3) and also no reports were found, which would confirm the presence of damaged drainage pipes within the landslide material.

4.2.3. Emergency response and recovery effort following the 1967 landslide

The first institutions involved in the response to the developing disaster in 1967 were the local Maršov administration (Maršov Municipal National Committee) and an insurance company, which was alerted of the event at the beginning of 1967 (Fig. 7) (SOKA UH MNV Maršov, SOKA UH ONV Uherské Hradiště). The response and recovery were organized by the superordinate administrative unit (District National Committee) through two special *ad hoc* commissions which were successively created specifically to solve the consequences of the Maršov landslide disaster. The commissions were endowed with broad competences in various fields (e.g. to order demolitions of houses, to ensure reconstruction of infrastructure, or to arrange new dwellings for the victims). They applied the then building rules (Act No. 87/1958, the Building Order and its implementing decree No. 144/1959) to justify the house demolitions, which were prescribed to be performed whenever there was a danger the building would fall and cause further damage or injury. The legislation stressed the necessity to respond quickly to such

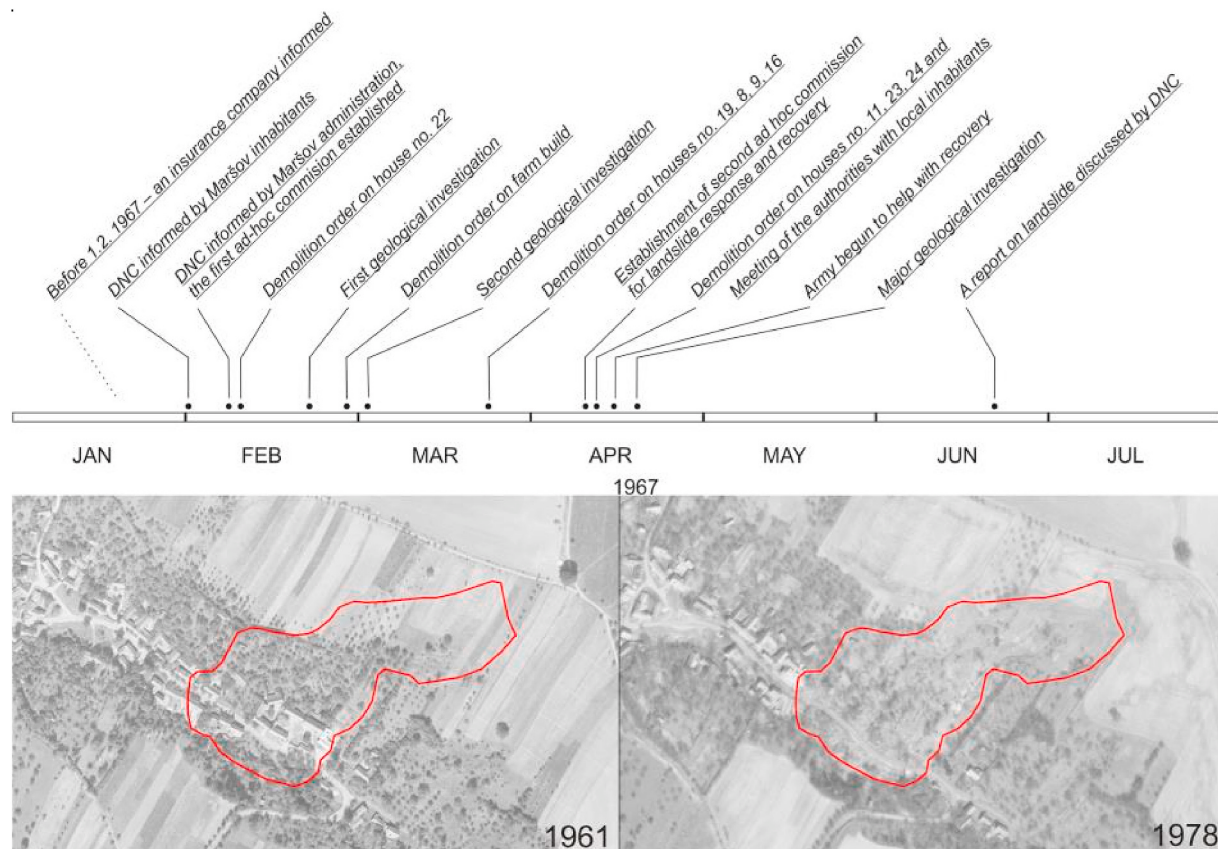


Fig. 7. Important events of the recovery effort after the 1967 landslide in Maršov (DNC - District National Committee) with damage demonstrated in 1961 and 1978 aerial photographs with outlined the 1967 landslide.



Fig. 8. The main scarp (left) and accumulation (right) of the 1967 landslide taken during geological field works in 1967 (photographs from the Quido Záruba's Photo Archive [43]).

emergency situations. The commissions ordered and also used rapid geological evaluations (Fig. 7); the first of which substantially influenced the commissions' decisions. It concluded that it was impossible to stop the landslide movement due to its size, degree of displacement and the extreme costs related to any technical solutions. Therefore, the landslide mitigation measures were in fact limited to banning any new buildings on the affected land and enabling its use for agriculture, and the implementation of drainage and slope grading. We were not able to verify whether the measures were performed as had been planned.

At the beginning of April 1967, the *ad hoc* commission set up a recovery plan suggesting the relocation of the families who lost their houses to the nearby (5 km) town of Uherský Brod (Fig. 1) where they were offered building land parcels for free. This measure was modified

according to an initiative of the affected inhabitants who suggested to build an entirely new street instead where all of the relocated families would settle together. Moreover, each family was assigned with a “patron” usually represented by a company (i.e. a socialist/national enterprise) employing some of their family member. The patrons were responsible for temporary housing of “their” families and for the provision of help during the construction of the new houses (SOKA UH MNV Maršov, SOKA UH ONV Uherské Hradiště).

The relief and recovery measures fully followed the then legal and political environment derived from the 1960 constitution codifying the leading role of the Communist party of Czechoslovakia in the whole society. The National Committees that worked as executive bodies of the Communist Party at various levels of government established permanent

commissions that enjoyed a superior position over the general administrative offices themselves, based on the Act No. 65/1960, on National Committees. The National Committees were also empowered to create *ad hoc* commissions to resolve any problems which fell within the territorial scope of the respective administration (municipal or district). The members of these *ad hoc* commissions were appointed in collaboration with the respective board of the Communist Party. The commissions were not limited by law in terms of the determination of particular competences, steps and instruments they might use to solve the problems; this almost unlimited power corresponded to the totalitarian (communist) type of government (Čechák [58]). We also noticed that the main aim of the territorial plans differed from the current one. Their objective was to facilitate the fulfilment of pre-planned economical aims, while considerations of natural hazards were defined only in a very general and vague way. Nevertheless, the land development law (territorial planning rules in the Territorial Planning Act No. 84/1958 and its implementing decrees) embraced the regulation of the prevention of landslide damage. Yet, we could not find any particular reflections of such prevention in planning at Maršov, because no territorial plans existed of the study area.

4.3. Site development and landslide occurrence after the 1967 event and the slow decline of the village and community

This landslide disaster seriously affected the population of the village, which decreased by the end of 1967 by 80% and in 1976 only 40% of the pre-landslide population remained. This demographic trend illustrates a strong marginalization of the village, which consequently lost its administrative independence, regular bus connection with the neighbouring town of Uherský Brod in 1976, as well as the only grocery store (Fig. 5). Worsening of social and economic conditions was initiated by the “forced” relocation of the families directly affected by the landslide and was later deepened by the “voluntary” migration of families, which were not directly affected by the landslide, but suffered from the social and economic decline and decided to move away. This trend is also documented by the merging of the local cooperative farm with the one of the nearby town of Uherský Brod, which also assumed the role of the village administration (Fig. 5). The trend in marginalization persisted for almost two decades after the landslide and can be considered as indirect damage related to the 1967 event. However, unlike the directly affected families, who lost their homes, families affected only indirectly did not obtain any compensation, and no special care was paid to them (SOKA UH MNV Maršov, SOKA UH JZD Maršov, SOKA UH ONV Uherské Hradiště).

Nevertheless, the low population (the village had only 17 permanent inhabitants in 2011, Fig. 2), remote location accentuated with weak internet connection and poor mobile network coverage as well as the surrounding beautiful landscape, has lately made the site attractive for second housing. Some of the re-settlers are members or descendants of the families relocated in 1967. The recreational value of the village has been recently reflected in policies of the local administration, which has developed an educational centre and cycling as well as educational trails around the village (Fig. 5).

The collected landslide information shows that several smaller landslides occurred between 1967 and 1978, and the local inhabitants also witnessed creep activity in many sites, observing cracks in their houses and topographic changes on the slopes. Only two shallow landslides occurred in 1997 during the extreme flood and landslide event affecting the entire eastern part of the Czech Republic (Krejčí et al. [20]). Nevertheless, the most recent mapping showed that almost all of the entire slopes around the village show evidence of old landslides (Fig. 6), making the area highly susceptible to future landslide occurrence.

4.4. Reflection of the 1967 landslide in recent land-development regulations

The unfavourable geological conditions for village development have been respected so far by local inhabitants and the authorities who have limited granting any building permits concerning the parcels affected by the 1967 landslide to only temporal dwellings for recreational purposes. In addition, they have not allowed any new housing constructions within the whole territory of Maršov, thereby limiting the development only to reconstruction of the houses that survived the 1967 event and to recreational premises. Moreover, the local territorial plan in force [59] does not take into account the construction of any new technical infrastructure (e.g. water/gas pipes, sewerage, roads) with the aim to keep the locality mainly for recreation and tourism. The local administration (i.e. the municipality of Uherský Brod) also does not plan or support any future increase of the permanent population of Maršov.

It should be mentioned, however, that such a generally restrictive approach to building activities on landslide sites is not required by the legislation in force. The current legislation includes landslide prevention within the territorial planning procedure (Building Act No. 183/2006, on town and country planning and on the building code). It contains no specific rules for the evaluation of landslides in relation to constructions, nor a general ban on allowing constructions on landslide sites as was included in the monarchist Building Order law of 1894. Instead, each building planned on a landslide affected site has to be assessed individually during the relevant planning or permitting process. If an already existing building is seriously damaged by a landslide, it may only be ordered to be demolished if it endangers life, health or the property of others (Building Act 2006). However, if the property owner makes use of all consecutive legal instruments pertaining to him or her within the chain of the relevant legal processes in order to resist the demolition order (i.e. appeal, administrative suit and cessation complaint), it may take many months or even several years before the decision would be executed. Any immediate response to a landslide (or other natural disaster), which may interfere with the constitutionally guaranteed rights of citizens, is only possible when the state of emergency is proclaimed for a limited period of time at least at a regional level (Act No. 240/2000, Emergency Act). The proclaimed state of emergency allows the responsible authority to order and immediately execute urgent measures (e.g. evacuation, demolition, restricting the area) to further minimize damage and losses.

4.5. Reflection of the 1911 and 1967 landslides in local oral history

Using the available sources (SOKA UH, Village chronicle Maršov, written and oral testimonies, interviews), we reconstructed stories of the collective memory of the Maršov community about the 1911 and 1967 landslides. The following main narratives related to the landslide occurrences in Maršov were identified: (a) In 1911, a large landslide occurred in the village, which severely damaged it, even relocation of the village was proposed but was refused by the Mayor who had just built a new, unharmed house, (b) the landslide was stabilized by extensive drainage, (c) due to the lack of care of the drainage during the totalitarian period after 1948, it failed, causing a large landslide in 1967, (d) the community has never recovered from this disaster.

5. Discussion

5.1. Contextualizing landslide risk reduction in Maršov and its community

Despite the fact that the 1911 landslide did not affect built-up areas, it was perceived as an exceptional event by the local inhabitants. Moreover, the expert investigation identified older landslides and assigned high landslide susceptibility to all slopes within the village. This probably motivated the community to swift initiation of the Water

Cooperative (Fig. 5) aiming to provide drainage of the agricultural land surrounding the village. Nevertheless, the community response was delayed by six years due to the World War I and transition from a monarchist to democratic legal system. The drainage works did not cover the land parcels affected by the 1911 landslide (see Fig. 3). The main financial and logistic responsibilities for the works were covered by landowners and the village inhabitants, while the state provided financial support only during the construction phase. Landowners and the village inhabitants were later not able to cover the maintenance costs and in the first half of the 1930s (in the times of the Great Depression) the Water Cooperative terminated its activities. We can conclude that in our opinion, the landslide risk reduction effort during this transitional period (although a fallacious one) was marked with only very limited state intervention (e.g. a geological landslide investigation was only performed thanks to strong community intervention) and strong engagement of individual landowners, village officials and the community, while respecting the individual rights of citizens.

The large number of houses destroyed by the 1967 landslide (one third of the village) required substantial aid from outside the affected community. Communist legislation valid at the time allowed fast relief action leading to the relocation of the affected families. The socialistic administration needed only 60 days to both demolish the damaged houses and relocate their inhabitants (Fig. 7). All of the recovery efforts involved massive state intervention represented by the engagement of local and regional economic, administrative as well as political bodies. The army and patron companies were deployed to assist in the technical and financial aspects of the recovery works while the *ad hoc* commissions and respective boards of the Communist Party represented state administration with necessary authority to make quick decisions. It is important to note that the decisions of the *ad hoc* commissions were largely based on detailed and qualified geological reports of leading landslide experts, which perfectly agrees with findings describing the relationship between knowledge and society in the state-socialistic regime in Czechoslovakia in the 2nd half of the 20th century (Spurný [60]; Spurný et al. [61]; Sommer et al. [62]; Sommer [63]). Despite the overwhelming involvement of the state and its institutions in the landslide recovery process, individual community members actively influenced it (e.g. selection of the construction site for new houses). The involvement of family patrons may be seen as external solidarity with the affected community, but actually it was part of the organized state response also noted in Raška [9], who reported collective help of administrative bodies and national companies after flood events. On the other hand, the closeness and remoteness of the village and its community where some families have lived for centuries (Jančár [28]) contributed to a higher degree of social cohesion across the village and the emergence of a strong identity, which, for example, persisted among the inhabitants relocated after the 1967 landslide as shown in e.g. personal interviews.

From our point of view, the documented landslide recovery effort of the communist regime was quick and effective due to the fact that the totalitarian administration tended to control almost all aspects of the lives of the inhabitants and applied interventions to personal rights of individuals, which are inadmissible from the point of view of a constitutional democracy. Moreover, the laws commanded the *ad hoc* commissions to proceed in an “unbureaucratic and operative” way, which was enabled by rules that allowed certain decisions to be given only orally and to be executed immediately (Vedral [64]). There was also no judicial review of administrative decisions in place at the time. An unexpected parallel may be found with committee that operated in Peru after the catastrophic 1970 Ancash earthquake, i.e. in a location geographically distant but at that time politically close. Committee with even greater authorities than the described Czech *ad hoc* commissions was formed by Peruvian government (e.g. Committee for the Reconstruction and Rehabilitation of the Affected Zone – CRYZA, Oliver-Smith [65]). It had an absolute authority (e.g. managing activities of all other ministries and state agencies) over emergency response and long-term

reconstruction of the affected area. At that time, Peru was ruled by the left-wing Military Junta, which did not entirely respect private ownership and the CRYZA was heavily criticized over its actions by the local inhabitants. Nevertheless, its achievement in long-term reconstruction was remarkable especially considering the extreme magnitude of the earthquake damage (Oliver-Smith [65]).

Maršov has not experienced any serious landslide since 1967, but the legal conditions changed significantly after the breakdown of the communist system in 1989. The democratic legal regulations emphasize protection of private property and the human rights of individual citizens strictly limiting direct state intervention. Any measures that infringe the rights of inhabitants may only be based on law and must be set through a respective legal procedure with corresponding remedies (administrative or judicial, or both), which makes it a lengthy process. Moreover, in the current non-centralized market economy, there are no patrons, and no administrative bodies are obliged to immediately arrange new housing for anybody, including the victims of natural disasters. This means that under the legislation in force, any measures adopted outside a state of emergency would probably be extremely inflexible and any remedies would rely on the activity of the affected persons and local administrations. On the other hand, examples of the application of a state of emergency in cases of flooding (e.g. the Decision of the Chairman of the Regional Council of the South Moravian Region No. 2/2014/R of 7 September 2014 on a state of emergency due to floods that enabled *inter alia* the evacuation of inhabitants, demolition of buildings as well as declaration of no admission areas), show that the state may take quick and effective decisions to minimize disaster damage.

This new social and legal environment has probably affected also the community, whose actions after 1911 and 1967 landslides show high social cohesion (e.g. establishment of the Water Cooperative after the 1911 landslide, initiative of the relocated inhabitants after the 1967 landslide to settle in a single street), but the marginalization of the village after the 1967 event caused inequality within the community. No help was provided to those who were not directly affected by the landslide, while the subsequent marginalization affected their well-being, eventually resulting in their decision to move away. This indicates enhanced further individualization of the community. Its cohesion with respect to the LRR is further challenged by new landowners (e.g. holidaymakers) who lack personal or family experience with the landslide disaster and, unlike the original inhabitants, have only a limited ability to see the signs of ongoing deformations on slopes in or around their property. This creates a very complex social setting, further stressing the local nature of landslide disasters – the community response may largely depend on who would be directly affected by the hypothetical landslide.

5.2. Territorial planning as an effective tool for long-term LRR?

The communist centralized territorial planning based on the Territorial Planning Act limited prevention of landslide damage to general and vague provisions. The highly centralized institutional approach was efficient in standard expert reporting, but failed in terms of implementing expert recommendations for territorial planning (Raška [9]). From today's perspective, the territorial planning processes in the socialist era must have been distorted by a lack of any public participation in the decision-making process as well as by the lack of territorial self-governance elements: one of the basic principles of the socialist law was the declared “unity of the public and the individual interest” (Vedral [64]). This means that a top-down approach was exclusively applied in the planning process, which tended to marginalize the local specifics including landslides, even if reported by experts.

Unlike the vague socialist way of considering local environmental conditions in territorial planning, the current democratic laws regulating land development (Building Act No. 183/2006, and its implementing decrees, especially decree No. 500/2006) explicitly mention

the landslide hazard among factors that must be taken into account during preparation of any territorial planning documents.¹ However, there are more than 60 such factors (enumerated in decree No. 500/2006) that must be considered, which makes the process rather intricate, and more or less dependent on the personal capacities and qualification of the relevant bodies and involved private contractors (Müllerová et al. [20]). Moreover, issuing a building permit for a landslide site is not generally banned as such, and preventing landslide damage by refraining from building activities seems to be more of an exception to the rule in the practices of the Czech administrative authorities. The authorities usually tend to not ban constructions on landslides but instead define technical measures to reduce the landslide hazard allowing the planned development to go ahead (Müllerová et al. [20]). This approach partly contradicts general advice of landslide researchers who prefer avoiding damages by limiting constructions on hazardous sites (Schuster and Highland [1]), which proved to reduce risk in urban regions (Kim and Rowe [66]). At the same time, it fulfils, at least partly, demand of the land-owners for development of their properties. Such a complex situation calls for preparation and application of methods, which would identify effective and locally acceptable LRR measures (e.g. Maes et al. [18]) even in “low risk countries” (i.e. Czech Republic). Despite the described tendencies in territorial planning practise, the Maršov territorial plan does not suggest further constructions or even allotment gardens on the landslide-prone slopes or elsewhere within the village territory [59].

5.3. Oral history of the landslide occurrences and historical “truth”

A comparison of the oral histories related to the occurrence of landslides and the community’s response with the available geological information and credible official historical sources shows that the narratives anchored in the collective memory of the community largely do not correspond to the acquired evidence. The historical map of the 1911 landslide and the cadastral maps (Fig. 3) clearly show that the built-up part of the village was not affected during the event. It disproves the oral history about serious landslide-related damage to the village (narrative (a)). Therefore, no direct damage justifies the discussions about the relocation of the village. On the other hand, we have no further information to assess the event from the point of view of indirect damage possibly including also anxiety of the community. Therefore, we may only speculate that the unexpected or unusually large landslide in combination with the conclusion of the official report stating that all the slopes within the village are highly susceptible to landslides, may have provoked discussion about the relocation of the entire village to a safer place. Nevertheless, historical evidence suggests that the landslide event resulted in an intention to stabilize the surrounding slopes by drainage, although there is no available evidence to testify that it was done. The data show that the drainage that was finally completed did not cover the 1911 landslide (as fixed in narrative (b)) and had very limited extent over the area of the 1967 landslide; thereby it may have had no effect on the landslide mitigation. We also collected strong evidence that the maintenance of the drainage was interrupted before World War II; long before the communist take-over (Fig. 5), which was accused of neglecting the maintenance of the drainage (narrative (c)). This narrative may be more a reflection of the community’s attitudes, where criticism of the communist regime plays an important role. The community’s perception that the village has never fully recovered from the 1967 event (narrative (d)) was largely confirmed by the described indirect damage, which resulted in a demographic and economic decline of the village (section 4.2). Nevertheless, there is certain evidence of a positive trend, which shows that the isolation and certain under-

development of the village makes it attractive for recreational use or even permanent housing these days.

The comparison of the oral history of the community with independent external sources also illustrates the partial validity of the community’s narratives, especially with respect to landslides that directly affected their or related properties. This agrees with a number of works, which show that oral histories correctly provide information about the occurrence of landslides even after several centuries, but usually without providing further reliable details about the event (Benko [68], Schuster and Pringle [69]). Understanding the possible sources of inaccuracies and subjectivity in community histories (e.g. animosity to certain political regimes) is important for proper use of this information especially in areas without more objective expert or data-driven evidence about historical landslides (e.g. Klimeš et al. [19]).

5.4. Possible effects of oral history on decisions of the local administration

It is also necessary to carefully consider the attitude of the local administration to the future development of the community, which is a very important factor in LRR. So far, the local administration has seriously restricted development in Maršov. It contrasts with other documented cases (e.g. the village of Poláky, Raška [19]) where the release of a construction ban less than 10 years after the last landslide occurrence in the 1980s, resulted in the development of allotment gardens, where later (in 2015) five recreational huts were seriously damaged by shallow landslides. These losses could have been avoided if the land-use respected the limitations of a high landslide hazard area (Müllerová et al. [20]). The hitherto proper consideration of the high landslide hazard by the Maršov administration office may be partly due not to highly responsible planning but the very restricted funds for development from the municipality and also lack of interest of the Maršov inhabitants in further village development since they prefer to maintain its serene nature. Other factors contributing to the proper territorial planning are the oral history of the landslide event (Jančár [28]) that has been refreshed by the repeated occurrences of landslide and ground movements witnessed by the inhabitants (Fig. 5), as well as indirect damage (e.g. economic and demographic decline of the village) caused by the 1967 landslide, which was observed for over two decades after the event and became part of the community oral history. Annual pilgrimages renewed in 2008 (Jančár [28]) may have also contributed to maintaining the local memory in a similar way as described in Fanta et al. [55] in the case of flooding. As a result, the community’s memory of the catastrophic landslide of 1967 has been preserved for much longer than it has been documented in the majority of cases of flood events (Fanta et al. [55]).

6. Conclusions

The described example of the village of Maršov documents more than the century-long involvement of the local community in landslide risk reduction, beginning during the monarchist, continuing throughout democratic and totalitarian regimes, and finally ending in the recent democratic legal system. It illustrates the role of the community in landslide mitigation and emergency recovery throughout the observed period. It was only due to the activity of the community that a landslide perceived as highly dangerous was investigated by external expert several months after its occurrence in 1911. Implementation of the suggested measures (cf. land drainage, stabilizing slopes and enhancing agricultural land value) was postponed for six years due to external factors related to the beginning of the World War I and subsequent transition of the Czech lands to the democratic Czechoslovak Republic. Later, in 1967 the community played an active role in emergency activities in response to a catastrophic landslide, which destroyed one third of the village houses. Forced relocation of the affected inhabitants, following a consistent top-down approach under the totalitarian communistic legislation was made more acceptable as the relocated

¹ Considering the implementing decree No. 500/2006, Mateos et al. [67] are not accurate when regarding the Czech Republic among states whose legislation does not take account of the landslide threat during spatial planning.

families suggested the formation of a single new street for themselves. They were provided with significant support (e.g. free construction land parcels, help of assigned “patrons”), while families who remained in the village witnessed its marginalization (e.g. further demographic decline, reduction of services) and eventually decided to move to the same town as the disaster victims, but without obtaining any support. Although this probably had an adverse effect on community cohesion, blaming the landslide for the long-term decline of the village, kept the catastrophic event fresh in the local memory for a protracted period of time. We suggest that some 50 years later, during recent planning of the site development, the lively memory of the catastrophic landslide of 1967 contributed, along with other factors (e.g. lack of funds for development projects, lack of interest of Maršov inhabitants in the site development), to the land-use plan, which restricts housing and infrastructure development while supports touristic and recreational use of the area. We also suggest that such landslide risk reduction management results at least partly from the experiences of the community of high landslide hazard and risk.

A detailed comparison of the local oral history with more objective historical data illustrates significant limitations of the local history/narratives with respect to more detailed landslide descriptions (e.g. initiation conditions and occurrence factors). Nevertheless, detailed research at more sites is needed to fully explain the suggested role of communities and their oral history in long-term consideration of catastrophic landslides and their impacts on landslide risk reduction. Further research is also required to better understand possible future challenges for the community's role in reducing the future landslide risk especially with respect to continuous individualization within the community.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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