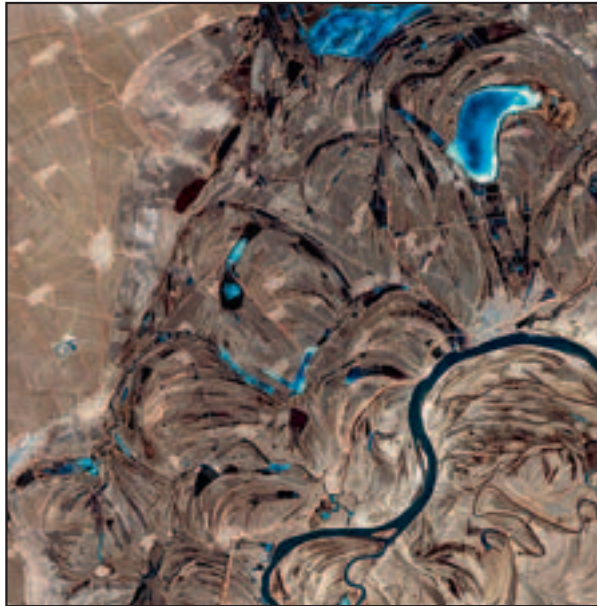


SOCIAL MEMORY AND GEOGRAPHICAL MEMORY OF NATURAL DISASTERS

DRUŽBENOGEOGRAFSKI SPOMIN IN NARAVNOGEOGRAFSKI ŠPOMIN NA NARAVNE NESREČE

Blaž Komac



As on a palimpsest, the traces of the river's relocation on the plain close to Harbin in the Chinese province of Heilongjiang intertwine with the effects of human activity evident in this satellite photograph in the distribution of fields and the settlement and traffic network (© NASA/Goddard Space Flight Center, Japan's Earth Remote Sensing Data Analysis Center, April 1. 2002).

Na ravnici pod Harbinom v kitajski provinci Heilongjiang se sledovi premeščanja reke kot na palimpsestu prepletajo z učinki delovanja človeka, ki so na satelitskem posnetku vidni v poljski razdelitvi ter naselbinskem in prometnem omrežju (© NASA/Goddard Space Flight Center, Japan's Earth Remote Sensing Data Analysis Center, 1. 4. 2002).

Social Memory and Geographical Memory of Natural Disasters

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ABSTRACT: The article offers a geographical perception of the relationship between social (anthropogenic) and geographical processes including their effects that becomes clearly evident in the case of natural disasters. In modern times, geographical processes are often overlooked as participants in the formation of landscapes. The article considers them from the viewpoint of their visibility in the social sphere, that is, from the viewpoint of the social memory of natural disasters as preserved in oral, written, and architectural accounts as well as other results of human actions in nature. We compare the social memory of natural disasters with the so-called »geographical memory« reflected in the impacts of geographical processes that are visible in the landscape, for example, in features of the relief. The geographical perception of the social and natural elements of the landscape or the imprint of social and geographical processes on the landscape, which can be viewed as a palimpsest, depends on the place and time of observation and on the size and frequency of events. Using selected examples we showed that a quantitative definition is possible of the impact of individual factors on the development of the landscape, which is important for the assessment of geographical processes and for decision-making related to the extent, rationality, and necessity of human interventions in nature. In this framework we also confirmed the importance of the geographical information systems for geography.

KEY WORDS: geography, geography of natural disasters, geographical theory, historical geography, virtual geography, social memory of natural disasters, geographical memory of natural disasters, human intervention in nature, palimpsest, geographical information systems, environment, landscape

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1 Introduction

Human interventions in nature change the natural balance. A few decades ago we disregarded the question of how much human interventions influence nature but today there is no longer any doubt that the intensity of human interventions is at least comparable to the intensity of natural processes, if not greater: »Regardless of the fact that man himself is a component part of nature, human society has the function of the principal and conscious motive power in the transformation of nature ...« (Vrišer 1998, 9). Human influence changes the natural environment in order to become a geographical environment that is »a natural environment with anthropogenic elements« (Vrišer 1998, 9), which we can say is already true of the entire earth. It is important to realize that: »... the natural environment is not only changing its **relative** role in social and economic development but also changing in itself at an increasing rate in an **absolute** way, and that this is influenced by society ...« (Ilešič 1962, 289).

Geography deals specifically with the changing relationship between society and nature that results in spatial effects. Geographical studies therefore also include the question of whether human interventions are part of nature or not. Setting aside the biological aspect, man belongs to nature according to his works or the impact they have on the geographical environment. Functionally, man belongs to nature, living and working within it and using the resources he acquires or finds in nature or the geographical environment. Here the processing, transformation, and use of the resources become more important than their origin.

The human or social perception of nature is based on experience acquired when we come in contact with nature. Natural disasters are one example of when geographical processes come in contact with society and at the same time are an example of a contact in which society plays an active role.

This article discusses the influence of social and geographical processes or elements of the landscape on its development. We identify the relationship between the impacts of social and geographical processes on the landscape and how this relationship changes in the course of time.



MATIJA ŽORN

Figure 1: The impact on the landscape left by several centuries of mining lead-zinc ore in Rabelj/Cave del Predil (white spot on the left) is comparable to the landslide in Stovžje where more than a million cubic meters of material moved in seconds (white spot on the right).

Contemporary geographical phenomena are linked to phenomena in the past (centuries or millennia ago). There is much evidence that phenomena in a landscape are often more closely linked to processes in the distant past than to recent processes. Using the examples of natural disasters and other geographical processes, we prove that the impact of past landscape conditions or processes is often more important for the present situation than the influence of current processes.

In the article we illuminate the observation that past processes are of fundamental importance for understanding current conditions from the viewpoint of social memory and the so-called »geographical memory.« It is necessary to maintain the memory or an awareness of the importance of past processes or phenomena for the present situation in order to understand the current landscape. This kind of assessment of social and geographical processes and phenomena makes it easier for us to understand the current situation in the landscape and anticipate its future development (Marrs 2008).

This is very important from the viewpoint of preserving geographical diversity of phenomena and processes in the constantly changing landscape (Gustavsson, Lennartsson, and Emanuelsson 2007). Because geographical or landscape diversity is often more the consequence of conditions in the past than of current conditions, the question of the significance, intensity, and necessity of human interventions in nature is of decisive importance for understanding the reality of the landscape and its future development. Here Geographical information systems play an important role.

2 Perception of nature and natural disasters

Before the age of enlightenment, a theocentric relationship of man to nature prevailed. Then man's perception of nature relativized and became anthropocentric and subsequently objectivized in modern times (Lewis 1998). The final consequence of this is evident in the denial of nature and possibility of patenting living beings, possible by the evolution of genetics. The reason for this lies in the fact that »*the type of perception of nature ... that we create*« originates in »*how we communicate with the physical environment and fellow humans*« (Hallpike 1979; quoted from Rifkin 2001, 239).

The transition of thought is the consequence of technological development and social changes related mostly to the increasing population and industrialization linked to urbanization. The social changes or the transition from the dominant influence of local factors to the dominant influence of global factors in the last century has caused major changes in the landscape. This was a shift from land (agriculture was the main activity) to man (social activities take the lead), a shift from object to subject or the dominance of a subjective perception of the landscape. The relationship that existed until recently between urban and rural areas has been destroyed as well (Kladnik and Ravbar 2003). The exponential growth usually characteristic of socially influenced factors is neither continuous nor even but rather demonstrates characteristic qualitative jumps (Antrop 2005), and therefore changes in the real landscape are even »*more rapid than changes in the imagined*« (Urbanc 2008, 329).

Nature and natural resources have become the *object* of social interest, research and work, and human society acts as if it were outside nature or above it. Short-term and unsustainable activities also derive from such a perception. The activities of man are not sustainable because (among other reasons) they are not based on long-term assumptions and because the dominant desires are the desire for change (rather than the desire for adjustment), the desire for profit and growth (rather than the desire for moderate use of natural resources), and the desire for comfort (rather than the desire for sustainability) (Komac and Zorn 2007).

The desire to eradicate the impacts of natural processes where these processes are the principal element of the landscape is one of the consequences of the objectivized perception of nature. As a result, man causes long-term changes in the natural system that he can neither perceive nor monitor at first, let alone measure or predict. In the future, however, the changed natural processes can have a negative impact on society: man has a short-term impact on nature while nature in turn has a long-term impact on man in a number of ways. It usually takes a long time for human interventions to cause changes in a landscape, and it is therefore often difficult to determine a direct causal connection between the interventions and the consequential natural processes.

This is the basis of the important fact that natural disasters are often not just the consequence of current anthropogenic interventions or current natural processes but are rather »... *a delayed echo of the weakened natural balance from previous phases of landscape transformation ... Now the inherited labile bal-*

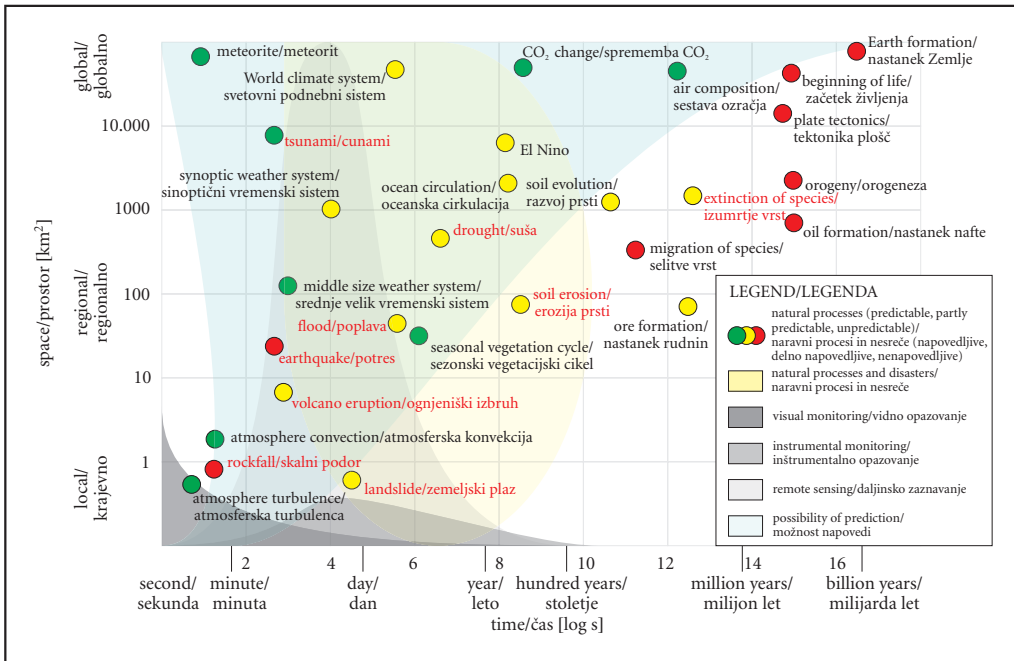


Figure 2: Natural phenomena in a time-space coordinate system.

ance has unexpectedly collapsed ... This ... is simply the consequence of the intertwinement of processes with very diverse development periods» (Radinja 1971).

3 Natural disasters and memory

»Studying natural disasters is a very complex investigation of the smallest morphogenetic processes and everything we have learned about the simultaneous impacts of climate change and human interventions in nature« (Šifer 1975, 1). We must draw conclusions about the future development of the landscape from the relief, sedimentological, pedological, biogeographical, historical, and other evidence about processes in the past and on the basis of analyzing the current situation. These conclusions must be based on the most important processes of the studied landscape. A geographer is particularly interested in examples of the spatial and time distribution of processes and phenomena and in this framework determines their intensity and frequency. Here we it is worth remembering that the term landscape »does not refer only to physical reality, especially the environment, but also to the organization and perception of the social, cultural, philosophical, political, and economic elements of human existence. Thus, the landscape is a mental construction as well, a symbol, an open book ... « (Urbanc 2008, 321).

Some previous phenomena or traces of processes have left imprints on the landscape, and older layers in most cases are less distinct or less visible than younger layers. The landscape therefore resembles a palimpsest (Vervloet 1986; Urbanc 2002; Urbanc et al. 2004; Komac 2006, 137). A palimpsest is parchment from which the original text has been removed to be reused to write new text, but traces of the old text are still visible under the newer, more distinct writing. The distinguishability of individual landscape elements depends on the intensity of the processes and phenomena, on the amount of time that has passed since they occurred, and also on the ability of the system to preserve forms. On the Kras plateau, Western Slovenia, for example, »... there is a variety of (relief) forms that were formed at quite different times, but due to karst evolution, they coexist in today's relief ... « (Mihevc 2007, 35).

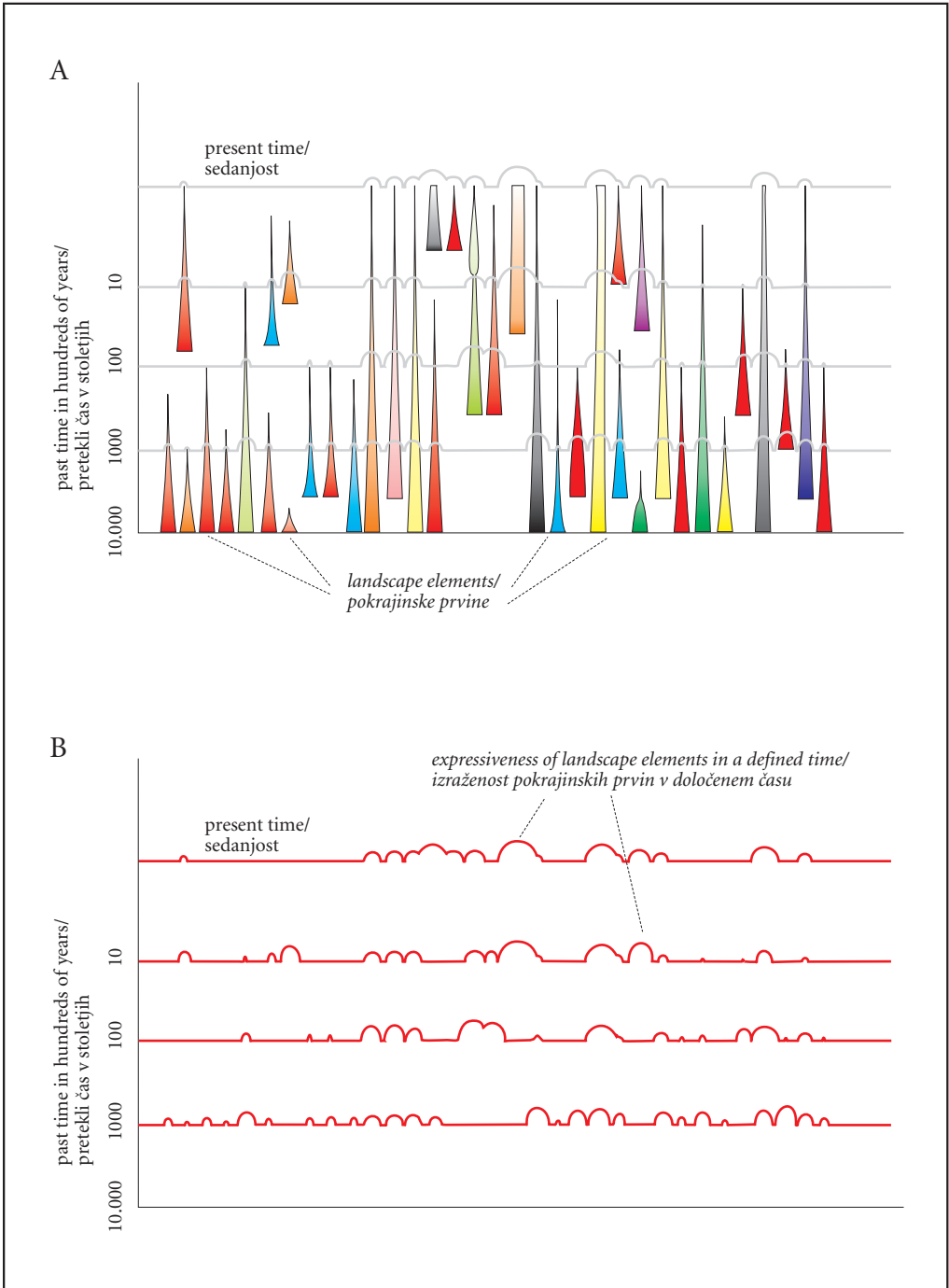


Figure 3: The landscape as a palimpsest: certain landscape elements depicted with vertical cones of different colours last longer, others last only a short time. The present landscape marked by the upper line features only a few landscape elements. In the past, other elements stood out and the appearance of the landscape was different – A. The presence of individual landscape elements in a specific period can be illustrated by lines – B (see Urbanc et al. 2004, 119).

Considering that the landscape contains traces of younger processes as well as very important traces of older processes, we can metaphorically say that the landscape has a memory. On one hand, geographical processes form this memory through constant activity and responses to changing conditions, and on the other, it is marked by all of man's activities in the landscape.

In this article we refer to the entire physical, mental, and spiritual relationship between man and nature as »landscape memory,« which we divide into »social memory« and »geographical memory.«

Man is clearly part of the landscape, and we can therefore speak of a special type of relationship between the anthropogenic and natural landscape elements that finds expression on the material or physical, mental, and spiritual levels. This relationship is described, for example, by Vernadsky's (Oldfield and Shaw 2005)

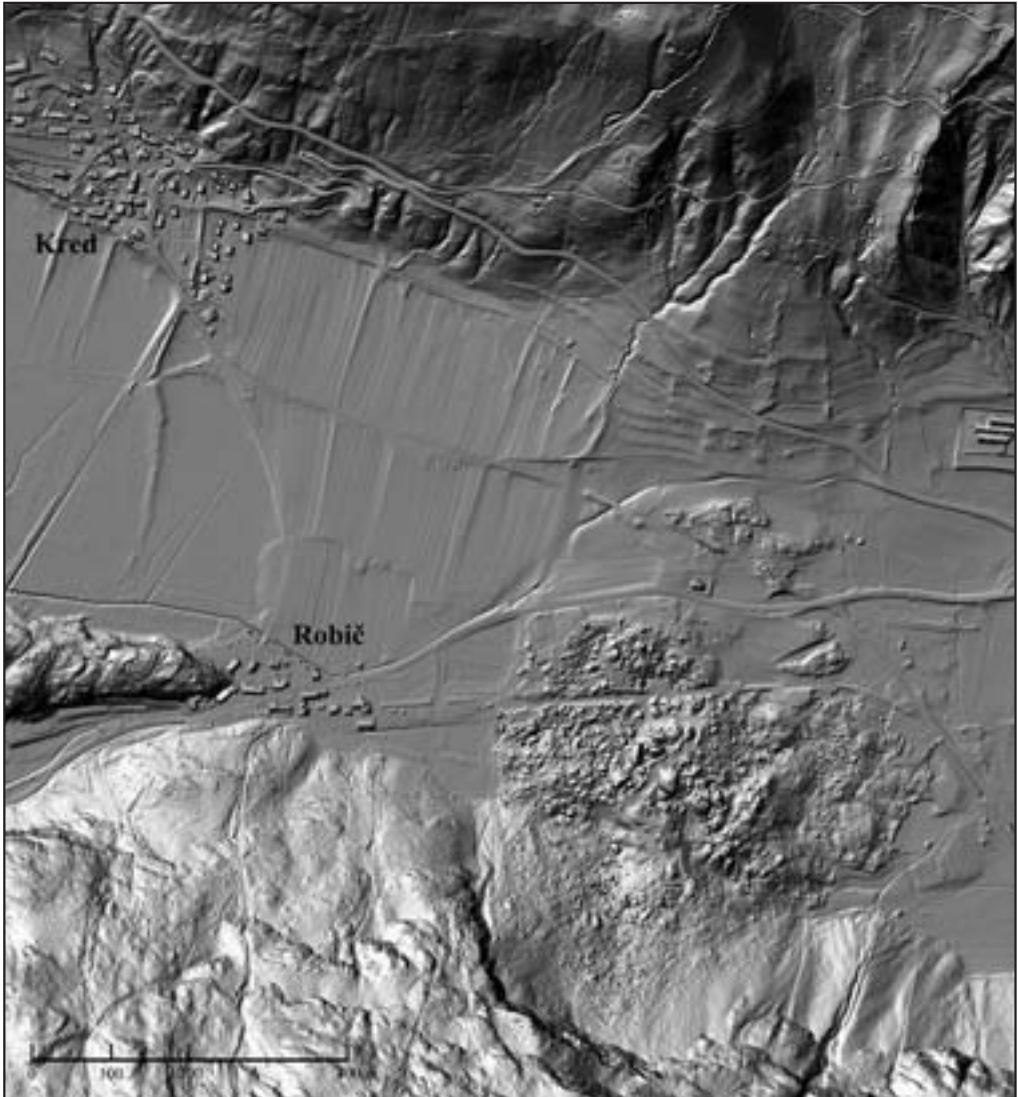


Figure 4: This figure, processed using LIDAR technology (Kokalj, Oštir, and Zakšek 2008), presents the universally interesting valley divide near Robič where traces of various processes of different ages remain imprinted on the landscape like a palimpsest: prehistoric rockfall material, a system of field division, a road, a building, observation trenches from World War I in the rockfall material, the right-of-way for a railway that was never built, and a modern sand quarry in the middle.

or de Chardin's (Jäger 2008) term »noosphere« (compare Rupnik 1995, 36). In short, people tend to »imprint their thinking and values« on the landscape (Urbanc 2008, 321).

The new perception (but not properties, reality) of landscape »as an unfinished piece of art that keeps changing its shape and appearing in new contexts« (Rifkin 2001, 219) enabled the development of cybernetics and the information sciences in which information is the important element rather than the phenomena, processes, or cause-effect relationships *per se*. The consequence of this is that reality »no longer has the firm objective meaning« (Rupnik 1995, 81) that it had for mankind in the past. Thus, for example, cultural heritage would be »the consequence of constant changes and can often be preserved only by interpretation« or by the »simulation of authenticity« (Luthar and Luthar 2008, 263). The properties of a landscape such as heritage, for example, are therefore not fixed and unchangeable since »individual elements constantly change, because of which we can only capture the 'identity' of an area if we capture the changes« (Luthar and Luthar 2008, 268).

Thus we no longer experience nature as a limitation but as a process about which we can collect knowledge or information (Batty and Cole 1997). The result is that the deterministic perception of nature has been replaced by a probabilistic perception, and reality has been replaced by a model.

Therefore, we have to note, that natural processes continue to take place in the anthropogenic landscape in spite of human interventions and stressing human perception of them (Ilešič 1962; Ilešič 1964). This fact is often forgotten in planning of human activities and future regional development. Due to this misunderstanding of reality (processes in the landscape) human interventions in the landscape or parts of landscape where natural processes prevail in the long run (for example flood plains) and result in frequent »contacts« between natural processes and society that we call natural disasters.

3.1 Natural disasters and social memory

The memory of natural disasters, like social memory, remains preserved in the social sphere for a certain period of time. In spite of the frequency of some natural processes and numerous possibilities for providing information and keeping data, people soon forget even extreme events unless they are recorded in newspapers, yearbooks, popular publications, chronicles, information panels at the site itself, or on websites (see Majes 2008) or kept vivid through socially active preservation of memory such as education and various kinds of public events. Social memory is highly subjective, which is not a problem only in individual response to natural disasters, but also the problem of society. By subjectivity we mean especially the influence of mind image and 'social memory' on individual and social response to natural disasters and other events. The response is therefore usually not based on objective realities, or knowledge (Natek et al. 2000; Natek 2002; Polič and Repovš 2002; Natek 2007).

Today's society characteristically has (for example) a »short (weather) memory when it seems to us that lately everything has been rapidly (abnormally) changing while conditions in the past were much more stable. To a large degree this is not true, as records in various chronicles and reconstructions of past weather conditions have proven« (Ogrin 2009).

From this viewpoint, promptly documenting the impacts of natural processes on the landscape is of major importance because within a few decades all the evidence proving their actual extent could be lost and human society would therefore be unable to adapt to the natural processes. In many places this has already happened. The literature provides us with many cases when the memory has been preserved for centuries or only lasted for a few decades (see Komac and Zorn 2002; Zorn and Komac 2002; Zorn and Komac 2004, 77–78; Komac and Zorn 2005; Smrekar 2006; Komac and Zorn 2008; Horvat, Jeršič and Papež 2008). The unregistered (unwritten) social memory is very short term and depends primarily on the intensity of a specific natural phenomena and its frequency. The memory curve decreases at an exponential rate: only half of the population remembers the most intensive and extensive natural processes after ten years, and only a tenth after forty years (Horvat, Jeršič and Papež 2008). Here, an important issue opens regarding the renewal of memory by education.

Another type of memory that is longer-lasting than social memory in the strict sense of the word, is related to natural disasters: this memory is preserved in the adjustments to natural conditions, such as land use, location of settlements, traditional methods of construction, course of the traffic communications, cultural terraces (Ažman Momirski and Kladnik 2009). Highly subjective social memory is reflected in the landscape by the adjustments to a wide variety of natural conditions, including natural disasters (Ilešič 1964; Natek 2002; Natek 2007; Komac, Natek and Zorn 2008).

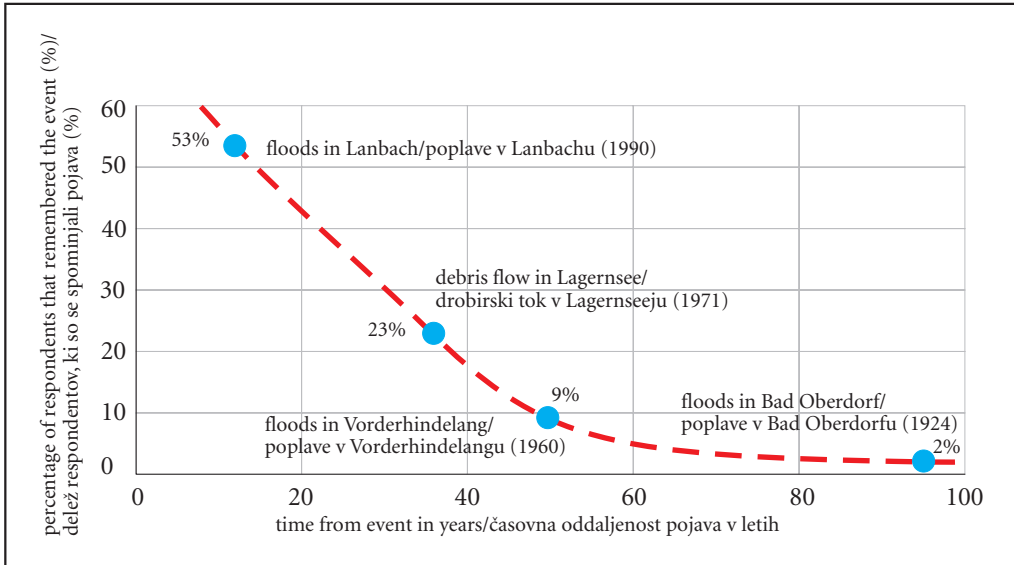


Figure 5: Memory curve showing the half-life of social memory of natural processes (Horvat, Jeršič, and Papež 2008, 207).

This aspect of geographical memory is very important because it directly links natural and social memory, of which we write in the following chapters. Unfortunately it is not taken into account in ‘scientific-supported’ spatial planning any more and may thus be lost for ever.

3.2 Natural disasters and geographical memory

It takes a long time for most natural processes, some of which man influences, to cause changes in the landscape, but sometimes their impacts are immediately visible since they affect people and their works, homes, and transportation routes. In some landscapes natural disasters occur more frequently than elsewhere, because regions differ widely in risk, types of natural disasters and their effects on landscape and society (Melik 1957, 248; Natek 1989, 64; Natek 1990, 9). In certain places they are a »*characteristic landscape feature*« (Radinja 1983, 68), and in other places they are a geographical variable.

Landscapes where natural disasters are a constant can be named after the processes that created them: flood landscapes (Radinja et al. 1976), rockfall landscapes (see Zorn 2002), major or minor landslide landscapes (Komac and Zorn 2009), and landslide-prone landscapes (Zorn 2002; Natek 1989, 66; Natek 1990, 9).

The »memory« of natural disasters remains more or less preserved in nature. Their traces can be called »geographical memory« in which the traces of certain processes such as rockfalls are more obvious in the landscape and much more lasting than the traces of other processes such as floods.

Slope processes are a constant in Slovenia's alpine landscapes. The impacts of some slope processes are so »imprinted« in the landscape that they are visible after tens of thousands of years (for example, the Pleistocene landslide near Selo in the Vipava Valley or the Kuntri rockfall in the Soča River valley; see Komac and Zorn 2007) while others, on the other hand, are less distinct.

In Slovenia's Alps, the last climax of geomorphic activity occurred in the period of warming climate at the end of the Pleistocene when huge amounts of material created by intensive weathering and locked in the ice until then were deposited in the valleys. Later, the processes became somewhat more intensive during minor coolings of the climate, the last time in the so-called Little Ice Age (Ogrin 2005). Along with the relatively slow climate change, episodic phenomena, especially earthquakes that moved weathered material downslope from higher elevations, also influenced the intensity of geomorphic processes (Natek, Komac and Zorn 2003; Vidrih 2008).



MILAN OROŽEN ADAMIČ

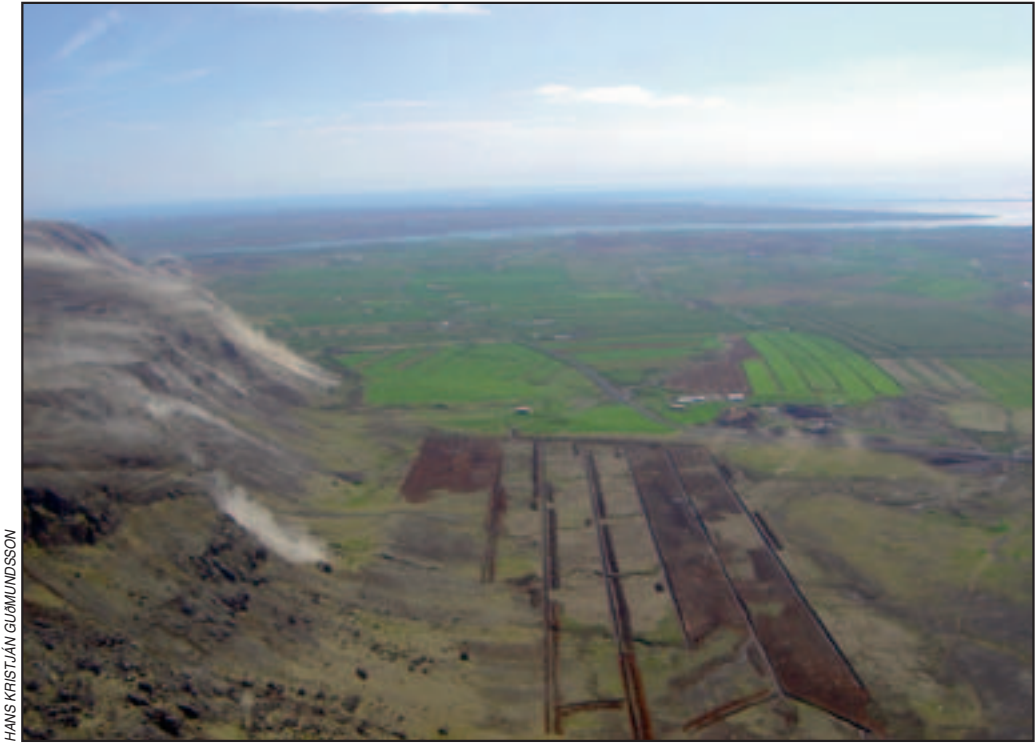
Figure 6: An »image« of a landslide landscape: Haloze hills after a severe storm in 1989.

The appearance of Slovenia's mountainous landscapes, which to a large degree are defined by the very memory of natural processes, corresponds to this type of geomorphic development and is reflected also in geographical terminology.

3.3 Interaction of social and geographical memory

The development of computer technology in the second half of the 20th century contributed greatly to the expression of geographical memory. The use of computers enabled the assessment and quantification of the impacts of geographical processes, their influence on society, and the influence of society on the impacts. Geographical information systems help us better understand the constant rapid changes in the landscape since we can employ computer methodologies such as parallel calculation to explain geographical processes.

After historical periods of »oral memory« or oral tradition and later of »written memory« preserved in books, recordings, or videotapes, using computers man is now for the first time able to maintain, merge, process, present, and reproduce, regardless of space, enormous amounts of data on the cultural or liter-



HANS KRISTJÁN GUÐMUNDSSON

Figure 7: Rockfalls triggered on the slopes near Selfoss, 40 kilometers southeast of Reykjavik on May 29, 2008, following a 6.1 magnitude earthquake. The rumbling of falling rocks and the roar of the earthquake were followed by air vibrations that lasted for 20 seconds, probably caused by warm air escaping from the shaken slope detritus.

ary level (social memory) as well as data on phenomena and processes in the landscape (geographical memory).

Geographical information systems allow us to establish a connection between actual space (and time) and by creating a virtual world help us better understand the impact of long-term geographical processes. Thus we can become more aware of the processes that take place in a landscape and more able to act in harmony with them in a sustainable manner.

Awareness of the processes in the landscape depends on their frequency and magnitude, as well as on changing standards of observation. According to some authors, the so-called »geographical scale« is a construct: it was presumably a social agreement subject to variability that hinders an objective consideration of reality (Terkenli 2005). The experience, interpretation, and presentation of a landscape therefore depend on the »observer, from his personal viewpoint and cultural environment« (Urbanc 2008, 322). Thus the assessment of geographical and social memory can only be objective if we can in some way quantify or assess the significance of factors in the landscape if we are unable to establish their magnitude and frequency.

Although social memory is of short duration and geographical memory is hard to convey, we can quantitatively express geographical memory and the relationship between social and geographical factors in the landscape through complex geographical research and the help of geographical information systems. To a certain extent, this was done even before the introduction of geographical information systems (e. g. in the field of relief classification: Hammond 1964; Brabyn 1997; Dikau 1989). In Slovenia, major geographical studies of flood areas (see Komac, Natek, and Zorn 2008) studied not only the geographical aspects of floods (extent of flood area, frequency of floods, adaptation of vegetation and soil to flooding) but also their sociogeographical aspects (damage, human adaptation, conservation of resources).

Several examples demonstrate how important it is to combine both aspects of research and confirm the importance of geographical information systems for a better understanding of the landscape and man's



MIHA PAVSEK

Figure 8: The southern slopes of Mount Krn (2,245 m) tower more than 2,000 meters, the greatest relative height difference in Slovenia. The steep incline is one of the reasons for continuous transformation due to rockfalls, landslides, and gravel flows, which in 1994 and 2001 caused human casualties and material damage.

role in it. One of the better known methods of demonstrating the importance of man's influences on the current landscape is the »ecological footprint,« which expresses the proportion of human influence relative to the largest possible or anticipated influence in a specific landscape. It is calculated on the basis of population density, changes in land use, development of infrastructure, and accessibility of settlements (Plut 2002; Rozman 2008; Global Footprint 2009).

Determining the proportion of the net primary production used by man is another way to compare natural and social processes. Before man started to influence the environment, primary net production was $150\text{--}170 \cdot 10^9$ metric tons of organic matter per year, while today man has appropriated almost a quarter of the primary net production, or 40% if we consider just the production of land ecosystems (Plut 1998, 61). In some areas social consumption greatly exceeds natural production (Renfrow 2007; Rifkin 2001, 28). The more efficiently technology exploits and controls the forces of nature, the higher the price in the form of shaken and destroyed ecosystems. Human interventions in nature also reduce biodiversity, as was proven, for example, in the meadows in southern Sweden (Gustavsson, Lennartsson, and Emanuelsson 2007, 54).

This is also confirmed by researches about »landscape relicts« as an element of the real landscape. Ilešič (1964, 294) noted that landscape relicts or so called historicisms that may be also attributed as inherited geographical environment are »... all those landscape features that have become extinct or changed essentially, regardless of whether they are merely scattered blatant exceptions in a landscape that has been already fundamentally transformed by modern processes (e. g., historic remains in modern city centers) or continue to dominate in the landscape (old agrarian structures) ...«.

The contribution of sociogeographical processes to fluvial denudation processes is another interesting issue. In this area as well, studies have uniformly established that the human impact has been far greater in modern times than in past historical periods. In the long run their long-term effect is comparable to effects of natural processes, such as El niño (Beresford-Jones, Lewis and Boreham 2009).

In the case of the Upper Soča Valley we determined that social factors influencing the change of land use have an important impact on erosion: man-induced changes are responsible for about a quarter of the annual erosion in the studied area (Zorn and Komac 2008).

Analyses of the rate of sedimentation in the seas in past geological periods and in modern times have revealed that soil erosion caused by man is ten times greater than natural soil erosion occurring without human influence (Wilkinson 2004). The influence of intensive human activity along the Dnieper River is evident in the sediments deposited in the last few millenniums, especially after 500 B. C. (Kalicki et al. 2007). In Hong Kong the first major changes in sedimentation occurred in the 15th and 16th centuries due to the increasingly intensive agricultural activity of Chinese settlers. The intensity of the processes reduced afforestation in the 19th century, and in the 20th century human influence on the landscape increased steadily, reaching a climax in the last three decades (Owen and Lee 2003). Settlement and agriculture also produced an increase in the rate of erosion in the hinterland of Weeks Bay in southern Alabama in the United States, where the rate of sedimentation has been 0.2–2 mm/year over the last four millennia but is currently 10 mm/year (Haywick 2003). Through changes in land use in the Mississippi River basin that are reflected in the morphology and sediments of the flood plain, man has caused more change in the last two centuries than any other natural change in the last ten thousand years (Figure 9). The natural sedimentation rate on Mississippi River tributaries levelled off at 0.2 mm/year while sedimentation linked to the period of Euro-American agriculture reached between 2 and 10 mm per year in the same river basins (Knox 2006). Similarly, deforestation in the Neolithic (5,500 B. C.) in Poland caused increased soil erosion that resulted in alluvial fans (Zygmunt 2009).

On the Kras plateau in Slovenia, however, erosion and sedimentation levels have been estimated from the observations of the dolines (Mihevc 2000). Thick layers of 1–7 m thick clay with no human evidence were found in the bottom of dolines. On the other hand, two layers which are above clay show traces of human activities. In the lower (0.1–0.5 m thick) part there are pieces of charcoal, which probably reflect burning of the forest, and stones, which were probably excavated by the roots of the falling trees. Dispersed pieces of pottery belong to occasional presence of shepherds in Neolithic. The upper layer (2–3 m thick) is



Figure 9: Sedimentation in the Mississippi River delta bears witness to the intensity of erosion in the river basin (Space Science ... 2009; © Space Science and Engineering Center, Madison, USA).

connected to cleaning of the rocks from the surface and building of dry walls (with density up to 11 km/km²), while the bottom and the slopes of the dolines were more intensively cultivated. The mentioned pressures upon earth probably occurred in Roman times and from 10th to 18th century (Mihevc 2005).

In Slovakia the changes in land use that occurred in the Myjavka hills following colonization in the second half of the 13th century increased erosion. Along the wagon tracks numerous erosion gullies developed that were several hundred meters long and up to fifteen meters deep. The material was deposited on valley floors, raising their bottoms by one meter on average. In the 20th century, the intensity of geomorphic processes decreased due to afforestation (Stankoviansky 2003).

In Brazil, sedimentological and geochemical characteristics of nearshore deposits show that impacts of modern urbanization are severe, especially in terms of erosion/sedimentation. They are comparable to an earlier phase of rapid nearshore sedimentation which appears to be correlated with deforestation during the early stage of European colonization in 17th century (Baptista Neto, Smith and McAllister 1999).

In Sweden, a study of changes in land use proved that historical factors (land use in the 18th century) have a larger impact on the diversity of plant species in the modern landscape than the current processes changing land use. Until two hundred years ago, land use had been stable for more than a thousand years (Gustavsson, Lennartsson, and Emanuelsson 2007, 54), but in spite of everything, the *«clear long link between historic land-use change and current biotopes, and the impact that changes implemented since might then have on future change»* is a surprise (Marrs 2008).

This also applies to other natural systems, such as karst springs. In northern China, the contribution of anthropogenic activities (1.89–2.90 m³/s) is comparable to the contribution of climate change to depletion of Niangziguan Springs (2.30 m³/s) (Hao et al. 2009).

The phenomena described above (we could list several other cases, e. g. Foster et al. 2009; Hesse and Baade 2009; Notebaert et al. 2009; Reiß et al. 2009) all prove in their own way that the palimpsest analogy is appropriate for use in describing landscapes and that we must not ignore the geographical and social memory or traces of past processes when studying the current phenomena and processes (Marrs 2008) that play an important role in the development of human society.

4 Conclusion

For understanding the landscape, the fact that we can predict future events to a certain extent based on knowing the geographical memory and preserving the social memory is very important. Phenomena are the most difficult to predict in the medium time (week, year) and space (from a few km² to a few dozen km²) ranges; it is much easier to predict phenomena (statistically) over wider space and time spans. Our study confirmed the thesis that human activities in the landscape must consider not only the unreliable and incomplete social memory but also the geographical memory. The awareness of the importance of the great technological power of human society *«requires us to move beyond the important but necessarily limited discussions concerned with reducing human impact on ecological systems and engage more purposively with the task of understanding the dynamic relationship between society and nature»* (Oldfield and Shaw 2005, 152). Here geography plays an indispensable role with its comprehensive treatment of landscape memory, which includes the memory left in the landscape by geographical processes as well as social memory.

Due to its objectivized relationship with nature, modern society finds it difficult to read natural processes or to recognize, accept, and transform them into a basis for taking action. This is largely the consequence of the intertwining of the various time and space ranges in which processes in nature occur and the fact that the landscape is a dynamic network of relationships that is constantly adapting, changing, and regenerating. For this reason, it is difficult for us to understand the processes and their impacts on the landscape (Terkenli 2005).

Computer models have improved the situation and become an important tool in geography. Thanks to the geographical information systems and simulations, our ability to react often surpasses our ability to predict. Technological development has brought us to the point where we can do many things; the question is whether we properly understand what we are doing. In spite of the expected mistakes, the modeling of natural and social processes is useful and in many cases even necessary or imperative since *«models are clearly, a good thing and in need of continuous development ... We should not be too disappointed by unsat-*

isfactory results since at this stage models are still developing and unsatisfactory results may indicate which aspects of models are most in need of further development. We should not expect models to reproduce reality. Models are meant to simplify reality and can, at best, only produce ball-park estimates» (Boardman 2006, 77).

The development of computer science has made work in geography significantly easier but at the same time has brought about major changes. We must therefore reconsider the substance of geographical research, that is, the essential importance of knowledge of the actual landscape reality and the past and current phenomena and processes in it. It is impossible to develop or properly use geographical information systems without a good knowledge of conditions in the landscape. Computer modeling is only a tool that helps us understand the processes and phenomena in the real landscape but it cannot replace them.

Geographical information systems facilitate the transformation of landscapes into virtual landscapes (Johnston 1997, 332). We are able to create landscapes inside computers that have no connection with reality, but by using virtualization real landscapes can be subjected to major changes (Batty 1997, 280–281). In this process the boundaries between real and virtual landscapes increasingly disappear (Urbanc 2008). The sciences studying landscapes are also subject to major changes: the danger appears that the object of geographical research will be replaced with its tools. Geography could thus become virtual geography (Batty 1997) and geographical memory could be replaced (only) with computer memory. This would lead to a situation in which the main advantage of computers for geographical research becomes its main weakness (Komac, Natek and Zorn 2008, 44–45) and even take the science away from its basic subject of study. Computer memory can not replace geographical memory, which includes the comprehensive evaluation of the landscape reality and not merely data about it or its simulation that may often be anthropocentric or may even not speak about the real world (Latour 1999, 30).

Research of concrete and real landscapes and their processes therefore remains a fundamental and irreplaceable domain of geography. Ilešič's ascerntainment still seems appropriate and still up-to-date: »... This ever closer interweaving of the natural and social processes and the increasingly active human encroachments on the environment are so strong as to substantially redirect the natural processes themselves, which forces us to redefine the concept of a geographical environment ...« (Ilešič 1962, 287).



ROMEO ČERNUTA

Figure 10: The largest bridge arch in Triglav National Park above the Mangartski potok stream will preserve the social memory of a natural process in 2000 even when the geographical memory imprinted by the impact of the erosion on the slopes and the new debris deposits at the bottom of the valley become overgrown with vegetation.

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Družbenogeografski spomin in naravnogeografski spomin na naravne nesreče

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IZVLEČEK: Članek opisuje geografsko razumevanje razmerja med družbenogeografskimi in naravnogeografskimi procesi in njihovimi učinki, ki se jasno kaže na primeru naravnih nesreč. Naravnogeografski procesi so v sodobni družbi pogosto prezrti kot sooblikovalec pokrajine. V članku jih obravnavamo z vidika vidnosti v družbenogeografski sferi oziroma z vidika družbenega spomina na naravne nesreče, kot je ohranjen v ustnih, pisnih in arhitekturnih virih ter drugih rezultatih človekovega delovanja v pokrajini. Družbenemu spominu na naravne nesreče smo naproti postavili tako imenovani naravnogeografski spomin, ki se odseva v učinkih naravnogeografskih procesov, ki so vidni v pokrajini, na primer v reliefnih oblikah. Geografsko razumevanje družbenih in naravnih sestavin pokrajine oziroma odtisov družbenogeografskih in naravnogeografskih procesov v pokrajini, ki jo lahko razumemo kot palimpsest, je odvisno od kraja in časa opazovanja ter od velikosti in pogostnosti pojavov. Na izbranih primerih smo pokazali, da je možna kvantitativna opredelitev vpliva posameznih dejavnikov na razvoj pokrajine, ki je pomembna za vrednotenje naravnogeografskih procesov ter za odločanje o obsegu, smiselnosti in nujnosti človekovih posegov v prostor. V tem okviru smo opredelili tudi pomen geografskih informacijskih sistemov v geografiji.

KLJUČNE BESEDE: geografija, geografija naravnih nesreč, geografska teorija, historična geografija, virtualna geografija, naravne nesreče, družbenogeografski spomin na naravne nesreče, naravnogeografski spomin na naravne nesreče, posegi v prostor, palimpsest, geografski informacijski sistemi, okolje, pokrajina

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1 Uvod

Človek posega v naravo in tako spreminja naravno ravnovesje. Pred desetletji smo si še zastavljali vprašanje, koliko človekovi posegi vplivajo na naravo, vendar danes ni več dvoma, da je intenzivnost človekovih posegov vsaj primerljiva z intenzivnostjo naravnih procesov, če ne večja od nje: »... *Ne glede na to, da smo tudi ljudje sami sestavni del narave, pa pripada človeški družbi funkcija poglobitnega in zavestnega gibala preobrazbe prirode* ...« (Vrišer 1998, 9). Vplivi človeka spreminjajo naravno okolje, da postane geografsko okolje, to je »... *priravno okolje z antropogenimi elementi* ...« (Vrišer 1998, 9), kar že lahko rečemo za celotno Zemljo. Pri tem je treba opozoriti, da »... *priravno okolje ne spreminja samo svoje relativne vloge v družbenem in gospodarskem razvoju, temveč da se čedalje bolj spreminja tudi samo v sebi, absolutno, in to pod vplivom družbe* ...« (Ilešič 1962, 289).

Geografija se ukvarja ravno s spreminjajočim se razmerjem med družbo in naravo, ki ima prostorske ali pokrajinske učinke. Geografsko raziskovanje zato zadeva tudi vprašanje, ali so človekovi posegi del narave ali ne. Če izvzamemo biološki vidik, človek pripada naravi po delih oziroma učinkih, ki jih imajo njegova dejanja v geografskem okolju. Naravi pripada funkcijsko, v njej prebiva, dela in za to uporablja sredstva, ki jih (pri)dobiva v naravi oziroma geografskem okolju. Pri tem ne gre samo za njihovo proizvodnjo, kot za reprodukcijo in preoblikovanje ter (u)porabo.

Iz tega izhaja, da družbeno razumevanje narave temelji na izkušnjah, ob katerih prihajamo v stik z naravo. Naravne nesreče so eden od primerov, v katerih naravnogeografski procesi pridejo v stik z družbo, obenem pa so tudi primer stika, v katerem ima družba aktivno vlogo.

V članku bomo razpravljali o vplivu družbenogeografskih in naravnogeografskih procesov oziroma prvin pokrajine na njen razvoj. Ugotavljali bomo, kakšno je razmerje med učinki naravnogeografskih in družbenogeografskih procesov na pokrajino in tudi, kako se to razmerje spreminja v času.

Sodobni geografski pojavi so povezani s tistimi v preteklosti (v stoletnem do tisočletnem razdobju). Imamo več dokazov, da so pojavi v pokrajini pogosto celo tesneje povezani s procesi v preteklosti, kot pa z recentnimi procesi. Na primeru naravnih nesreč in nekaterih drugih naravnogeografskih procesov bomo v članku pokazali, da je vpliv preteklih pokrajinskih razmer oziroma procesov za sedanje stanje pogosto pomembnejši, kot pa vpliv sodobnih procesov.

Ugotovitev, da so pretekli procesi temeljnega pomena za razumevanje sodobnih razmer bomo v članku osvetlili z vidika družbenogeografskega spomina in tako imenovanega naravnogeografskega spomina. Ohranjanje spomina oziroma zavedanje o pomenu preteklih procesov oziroma pojavov za sedanje razmere je nujno za razumevanje sodobne pokrajine. S pomočjo takšnega vrednotenja naravnogeografskih in družbenogeografskih procesov in pojavov lahko bolje razumemo sedanje razmere v pokrajini in tudi lažje napovemo njen prihodnji razvoj (Marrs 2008).

To je zelo pomembno z vidika ohranjanja geografske pestrosti pojavov in procesov v stalno spreminjajoči se pokrajini (Gustavsson, Lennartsson in Emanuelsson 2007). Ker je geografska ali pokrajinska pestrost pogosto bolj posledica preteklih kot sodobnih razmer, na razumevanje pokrajinske stvarnosti in njen prihodnji razvoj odločilno vpliva intenzivnost in potrebnost človekovih posegov v naravo. Pri tem imajo pomembno vlogo geografski informacijski sistemi.

Slika 1: Nekajstoletno kopanje svinčovo-cinkove rude v Rablju/Cave del Predil (bela lisa na levi) je po učinkih v pokrajini povsem primerljivo zemeljskemu plazu na Stovžju (bela lisa na desni), ob katerem se je hipoma premaknilo več kot milijon m³ gradiva. Glej angleški del prispevka.

2 Dojemanje narave in naravne nesreče

Če je pred razsvetljenstvom prevladovalo teocentrično razmerje človeka do narave, se je njegovo dojemanje narave potem relativiziralo in postalo antropocentrično, v sodobnosti je postalo še popredmeteno (Lewis 1998). To se v končni posledici kaže v zanikanju narave in možnosti patentiranja živih bitij, kar je omogočil razvoj genetike. Vzrok za to je dejstvo, da »... *vrste predstave o naravi ... ki si jo ustvarimo ...*,« izvirajo iz načina, »... *kako komuniciramo s fizičnim okoljem in soljudmi* ...« (Hallpike 1979; citirano po Rifkin 2001, 239).

Miselni prehod je posledica tehnološkega razvoja in družbenih sprememb, ki so povezane predvsem z naraščanjem števila prebivalstva in industrializacijo v povezavi z urbanizacijo. Zaradi družbenih sprememb

oziroma prehoda od prevladujočega vpliva krajevnih dejavnikov do prevladujočega vpliva globalnih dejavnikov, so v zadnjem stoletju v pokrajini nastale velike spremembe. Šlo je za premik od zemlje (temeljna dejavnost je bila kmetijstvo) do človeka (temeljne so družbene dejavnosti), za premik od objekta k subjektu oziroma k prevladi subjektivnega dojemanja pokrajine. Porušilo se je tudi donedavno razmerje med mestnimi in podeželskimi pokrajinami (Kladnik in Ravbar 2003). Ker je za družbene vplivne dejavnike povečini značilna eksponentna rast, ki pa ni zvezna niti enakomerna, ampak so zanjo značilni kakovostni skoki (Antrop 2005), so spremembe v resnični pokrajini celo »... hitreje kot spremembe v zamišljeni pokrajini ...« (Urbanc 2008, 329).

Narava in naravni viri so postali *predmet* družbenega zanimanja, raziskovanja in dela, pri čemer se družba vede, kakor da je zunaj narave ali nad njo. Kratkoročno in po učinkih tudi nesonaravno delovanje izhaja prav iz takšnega dojemanja. Delovanje človeka ni sonaravno, ker (med drugim) ne temelji na dolgoročnih predpostavkah, ker prevladujejo želja po spremembah (ne pa želja po prilagajanju), želja po dobičku, rasti (ne pa želja po zmerni rabi naravnih virov) in želja po udobju (ne pa želja po vzdržnosti) (Komac in Zorn 2007).

Ena od posledic popredmetenega dojemanja narave je tudi želja po popravljanju učinkov naravnih procesov, kjer so ti procesi pogloblitveni element pokrajine. Tako človek v naravnem sistemu povzroča dolgoročne spremembe, ki jih sprva niti ne more zaznati ali opazovati, še manj pa jih lahko meri ali napove. Spremenjeni naravni procesi pa v prihodnosti negativno vplivajo na družbo: človek kratkoročno vpliva na naravo, narava pa na druge načine in dolgoročno vpliva na človeka. Ker človekovi posegi ponavadi šele čez daljši čas izzovejo spremembe v pokrajini, je pogosto težko ugotoviti neposredno vzročno povezavo med njimi in posledičnimi naravnimi procesi.

Iz tega izhaja pomembno dejstvo, da naravne nesreče marsikdaj niso le posledica sodobnih antropogenih posegov ali sodobnih naravnih procesov, ampak gre pri njih za: »... *zapoznel odmev na razrahljano prirodno ravnotežje iz prejšnjih faz pokrajinske preobrazbe ... V sedanji dobi se je podedovano labilno ravnotežje nepričakovano porušilo ... To ... je pač posledica prepletajočih se procesov z zelo različnimi razvojnimi obdobji ...*« (Radinja 1971).

Slika 2: Naravni pojavi v časovno-prostorskem koordinatnem sistemu.

Glej angleški del prispevka.

3 Naravne nesreče in spomin

»... *Preučevanje naravnih nesreč je zelo kompleksno raziskovanje najmlajših morfogenetskih procesov, vseh spoznanj o istočasnem spreminjanju podnebja ter poseganju človeka v to pokrajino ...*« (Šifrer 1975, 1). Iz reliefnih, sedimentoloških, pedoloških, biogeografskih, historičnih in drugih dokazov o procesih v preteklosti ter na podlagi analize sedanjih razmer moremo sklepati na prihodnji razvoj pokrajine. To sklepanje mora temeljiti na najpomembnejših procesih in pojavih v pokrajini. Geografa posebej zanimajo vzorci prostorske in časovne razporeditve procesov in pojavov, v tem okviru pa opredelitev njihove intenzivnosti in pogostnosti. Pri tem velja spomniti, da se izraz pokrajina »... *ne nanaša zgolj na fizično realnost, zlasti na okolje, ampak tudi na organizacijo in dojanje družbenih, kulturnih, misljenjskih, političnih in gospodarskih prvin človekovega obstoja. Tako je pokrajina tudi miselna inštitucija, simbol, odprta knjiga ...*« (Urbanc 2008, 321).

V pokrajino so vtisnjeni nekateri dosednji pojavi oziroma sledovi procesov, starejši sloji so povečini manj izraziti ali vidni od novejših. Pokrajina ima zato podobo palimpsesta (Vervloet 1986; Urbanc 2002; Urbanc in ostali 2004; Komac 2006, 137). Palimpsest je pergament, s katerega je bilo prvotno besedilo odstranjeno, kasneje pa so ga ponovno uporabili in nanj napisali novejša besedila. Sledovi starega besedila so tako še vidni pod izrazitejšim novejšim tekstom. Izrazitost posameznih pokrajinskih prvin je odvisna od intenzivnosti procesov in pojavov, od časa, ki je pretekel, odkar so se zgodili, pa tudi od sposobnosti sistema za ohranjanje oblik. Tako na primer Kras sestavlja »... *vrsta zelo različnih reliefnih oblik, ki so nastale v različnem času, vendar so se zaradi posebnosti razvoja krasa ohranile in sobivajo v sedanjem reliefu ...*« (Mihevc 2007, 35).

Slika 3: Pokrajina kot palimpsest – nekatere pokrajinske prvine, prikazane z raznobarnimi navpičnimi stožci, trajajo daljši čas, druge pa krajši čas. V sodobni pokrajini, ki jo označuje zgornja črta, so izražene le nekatere pokrajinske prvine. V preteklosti so izstopale druge prvine, zato je bila podoba pokrajine drugačna – A. Izraženost posameznih pokrajinskih prvin v določenem času lahko prikazemo s črtami – B (prim. Urbanc in ostali 2004, 119).

Glej angleški del prispevka.

Glede na to, da so v pokrajini vidni sledovi mlajših procesov, zelo pomembni pa tudi sledovi starejših procesov, lahko v prispodobimo rečemo, da ima pokrajina spomin. Na eni strani ga oblikujejo naravnogeografski procesi z neprestanim delovanjem in odzivanjem na spreminjajoče se okoliščine, na drugi strani pa se vanjo vtiskuje vse, kar v pokrajini naredi človek.

V tem članku smo celoto fizične, duševne in duhovne povezanosti med človekom in naravo izrazili s terminom spomin pokrajine, ki ga zaradi lažjega (ali geografskega) razumevanja stvari delimo na družbenogeografski in naravnogeografski spomin.

Ker je človek bistveni del pokrajine, lahko govorimo o posebni vrsti povezanosti med antropogenimi in naravnimi prvinami pokrajine, ki se izraža na materialni oziroma telesni, duševni in tudi duhovni ravni. To povezanost na primer opisujeta Vernadskyjev (Oldfield in Shaw 2005) oziroma de Chardinov (Jäger 2008) izraz *noosfera* (prim. Rupnik 1995, 36). Ljudje naj bi namreč v pokrajino vtisnili »... svoje mišljenje in vrednote...« (Urbanc 2008, 321).

Takšno novo razumevanje (ne pa lastnosti, resničnosti) pokrajine »... kot nedokončane umetnine, ki ves čas prevzema nove oblike in se pojavlja v novih kontekstih...« (Rifkin 2001, 219) je omogočil razvoj kibernetike in informacijskih znanosti, v katerih je pomembna informacija, ne pa pojavi ali procesi oziroma vzročno-posledična razmerja sama po sebi. Posledica je, da naj resničnost ne bi več imela »... trdnega objektivnega pomena...« (Rupnik 1995, 81), ki ga je za človeštvo imela v preteklosti. Tako naj bi bila na primer tudi kulturna dediščina »... posledica nenehnih sprememb in jo je pogosto mogoče ohraniti le z reinterpretacijo...« oziroma s »... simulacijo avtentičnosti...« (Luthar in Luthar 2008, 263). Lastnosti pokrajine, dediščina na primer, naj potemtakem ne bi bile nekaj trdnega določenega in nespremenljivega, saj se »... posamezni elementi nenehno spreminjajo, zaradi česar lahko 'identiteto' nekega prostora ujamejo le, če ujamejo spremembe...« (Luthar in Luthar 2008, 268).

Ker narave ne doživljamo več kot omejitvev (Batty in Cole 1997), ampak kot proces, o katerem lahko zbiramo znanje ali informacije, je deterministično razumevanje pokrajine zamenjalo probabilistično ali verjetnostno razumevanje; resničnost smo, grobo rečeno, zamenjali z modelom.

Zato moramo pripomniti, da kljub človekovim posegom ali drugačnemu človekovemu dožemanju tako v antropogeni kot v antropogeno preoblikovani pokrajini še vedno potekajo naravni procesi (Ilešič 1962; Ilešič 1964). To dejstvo pogosto zanemarjamo pri načrtovanju človekovih dejavnosti oziroma prihodnjega razvoja pokrajine, zaradi takega pomanjkljivega razumevanja resničnosti (procesov v pokrajini) pa pogosto posegamo v pokrajine ali njihove dele, v katerih na dolgi rok prevladujejo naravni procesi (na primer poplavljalna pokrajina). Posledica so pogosti stiki med naravnimi procesi in družbo, ki jih imenujemo naravne nesreče.

Slika 4: Posnetek, pripravljen s tehnologijo LIDAR (Kokalj, Oštir in Zakšek 2008), prikazuje geografsko zanimivo dolinsko razvodje pri Robiču, kjer so v pokrajini kot na palimpsestu vtisnjeni sledovi različnih in različno starih procesov: predzgodovinsko podorno gradivo, sistem poljske razdelitve, cesta in stavba ter opazovalni rovi iz 1. svetovne vojne na podornem gradivu s traso nesojene železnice in novejšim peskopom sredi njega.

Glej angleški del prispevka.

3.1 Naravne nesreče in družbenogeografski spomin

Spomin na naravne nesreče se za določen čas ohrani v družbeni sferi, torej kot družbenogeografski spomin. Kljub pogostnosti nekaterih naravnih procesov, številnim možnostim obveščanja in hranjenja podatkov, kmalu pozabimo celo ekstremne dogodke, če za to ne poskrbimo z zapisi v časopisih, letopisih, poljudni literaturi, kronikah, informativnih tablah na kraju dogodka ali na spletnih straneh (prim. Majes 2008) oziroma z družbeno aktivnim ohranjanjem spomina, kot so izobraževanje in različne javne prireditve. Družbeni spomin je izrazito subjektiven, kar ni problem samo pri odzivanju posameznika na naravne nesreče, ampak je tudi problem celotne družbe. S subjektivnostjo mislimo predvsem na to, da se posamezniki in družba odzivamo na naravne nesreče in druge dogodke na osnovi te podobe v naših glavah oziroma v 'družbenem spominu' in ne na osnovi objektivnih danosti oziroma spoznanj. Naše ravnanje izhaja iz

podobe, ki jo imamo o resničnosti in ne temelji na resničnosti sami (Natek in ostali 2000; Natek 2002; Polič in Repovš 2002; Natek 2007). Za sodobno družbo je na primer značilen »... *kratek (vremenski) spomin, ko se nam zdi, da se v zadnjih letih vse zelo (nenormalno) spreminja, medtem ko so bile razmere v preteklosti precej bolj stabilne. To seveda v veliki meri ne drži, kar dokazujejo zapisi v raznih kronikah in rekonstrukcije preteklih vremenskih razmer* ...« (Ogrin 2009).

S tega vidika je zelo pomembno sprotno dokumentiranje učinkov naravnih procesov v pokrajini, saj bi sicer že čez desetletja ostali brez dokazov o njihovi resnični razsežnosti, človeška družba pa se ne bi mogla prilagajati naravnim procesom. Marsikje se je to že zgodilo. Iz literature poznamo že več primerov, ko se je spomin ohranil stoletja, pri drugih pa ni ostal živ niti nekaj desetletij (prim. Komac in Zorn 2002; Zorn in Komac 2002; Zorn in Komac 2004, 77–78; Komac in Zorn 2005; Smrekar 2006; Komac in Zorn 2008; Horvat, Jeršič in Papež 2008).

Nezabeležen druženogeografski spomin je zelo kratkotrajen. Odvisen je predvsem od intenzivnosti določenega naravnega pojava in njegove pogostnosti. Krivulja spominjanja upada po eksponentni stopnji: tudi intenzivnih in obsežnih naravnih procesov se čez 10 let spominja polovica prebivalcev, čez 40 let pa le še desetina (Horvat, Jeršič in Papež 2008). Tu se odpira zelo pomembno vprašanje obnavljanja spomina z izobraževanjem.

Z naravnimi nesrečami pa je povezan še en vidik družbenega spomina, ki je dolgotrajnejši od družbenega spomina v ožjem pomenu besede: to so prilagoditve naravnim danostim, kakor se kažejo na primer v rabi tal, poselitvi, tradicionalnem načinu gradnje, poteku prometnic, kulturnih teras (Ažman Momirski in Kladnik 2009). Prek teh pokrajinskih prvin se izrazito subjektivni družbeni spomin v pokrajini izraža v prilagoditvah najrazličnejšim naravnim danostim, vključno z naravnimi nesrečami (Natek 2002; Natek 2007; Komac, Natek in Zorn 2008).

Slika 5: Krivulja spominjanja, ki prikazuje razpolovno dobo družbenega spomina o naravnih procesih (Horvat, Jeršič in Papež 2008, 207). Glej angleški del prispevka.

3.2 Naravne nesreče in naravnogeografski spomin

Naravni procesi, na nekatere vpliva tudi človek, povečini šele po daljšem času povzročijo spremembe v pokrajini, včasih pa so njihovi učinki takoj vidni, saj je prizadet človek, njegovi izdelki, bivališča, transportne poti. Naravne nesreče so v nekaterih pokrajinah pogostejše kot v drugih, saj se pokrajine med seboj razlikujejo po ogroženosti, vrstah naravnih nesreč ter njihovih učinkih na pokrajino in družbo (Melik 1957, 248; Natek 1989, 64; Natek 1990, 9). Ponekod so naravne nesreče celo »... *značilna pokrajinska poteza* ...« (Radinja 1983, 68). Pokrajine, v katerih so naravne nesreče stalnica, lahko imenujemo po procesih, ki so jih povzročili: poplavna pokrajina (Radinja in ostali 1976), podorna pokrajina (prim. Zorn 2002), usadna ali plazovna pokrajina (Komac in Zorn 2009), lahko tudi plazovita pokrajina (Zorn 2002; Natek 1989, 66; Natek 1990, 9).

»Spomin« na naravne nesreče se bolj ali manj dobro ohrani tudi v naravi. Njihove sledove lahko imenujemo naravnogeografski spomin, pri čemer so sledovi nekaterih procesov, kot so skalni podori, v pokrajini očitnejši in dolgotrajnejši kot sledovi drugih procesov, kot so na primer poplave.

Pobočni procesi so stalnica slovenskih alpskih pokrajin. Učinki nekaterih pobočnih procesov so se tako »vtisnili« v pokrajino, da so njihovi učinki vidni še čez desetisočletja (na primer pleistocenski plaz pri Selu v Vipavski dolini ali pa skalni podor Kuntri v dolini Soče; prim. Komac in Zorn 2007), drugi pa so manj izraziti.

V slovenskih Alpah je bil zadnji višek geomorfnega dogajanja ob otoplitvi podnebja koncem pleistocena, ko so se v doline sprostile ogromne količine gradiva, ki je nastal z intenzivnim preperevanjem in ga je dotlej vklepal led. Kasneje so procesi postali nekoliko intenzivnejši še ob manjših ohladitvah podnebja, nazadnje v tako imenovani mali ledeni dobi (Ogrin 2005). Ob razmeroma počasnih spremembah podnebja so na intenzivnost geomorfnih procesov vplivali tudi epizodični pojavi, zlasti potresi, ki so z višjih leg navzdol premaknili preperelo gradivo (Natek, Komac in Zorn 2003; Vidrih 2008).

V skladu s takšnim geomorfnim razvojem je podoba slovenskih vzpetih pokrajin, ki jo v veliki meri določa prav spomin na naravne procese, kar odseva tudi terminologija.

Slika 6: Podoba usadne pokrajine – Haloze po ujmi leta 1989. Glej angleški del prispevka.

Slika 7: Na pobočjih pri Selfossu 40 km jugovzhodno od Reykjavika so se 29. maja 2008 ob potresu z magnitudo 6,1 sprožili skalni podori. Bobnenju padajočih skal in grnjenju potresa so se pridružile 20 sekund trajajoče vibracije zraka, ki so verjetno nastale zaradi uhajanja toplega zraka iz pretresenih pobočnih nanosov.

Glej angleški del prispevka.

3.3 Povezanost družbenogeografskega in naravnogeografskega spomina

Velik prispevek k ubesedenju naravnogeografskega spomina je prinesel razvoj računalništva v 2. polovici 20. stoletja. Uporaba računalniškega spomina je omogočila ovrednotenje in kvantifikacijo učinkov naravnogeografskih procesov, njihovega vpliva na družbo in obratno, vpliva družbe nanje. Z geografskimi informacijskimi sistemi bolje razumemo stalne hitre spremembe v pokrajini, saj računalniški način organiziranja, na primer vzporedno računanje, uporabimo tudi za razlago naravnogeografskih procesov.

S pomočjo računalnikov je človek po zgodovinskih dobach »ustnega spomina« oziroma ustnega izročila in kasneje »pisnega spomina,« ohranjenega v knjigah ter na magnetofonskih in video trakovih, z računalniki prvič sposoben hraniti, združevati, obdelovati in prikazovati ter ne glede na prostor posredovati ogromno količino podatkov kulturne ali besedilne ravni (družbenogeografski spomin) ter podatkov o pojavih in procesih v pokrajini (naravnogeografski spomin).

Geografski informacijski sistemi omogočajo tudi povezavo s konkretnim prostorom (in časom), z ustvarjanjem virtualnega sveta pa tudi boljše razumevanje učinkov geografskih procesov, ki delujejo na dolgi rok. Tako lahko se bolje zavedamo procesov v pokrajini ter delujemo bolj skladno oziroma bolj sonaravno.

Zavedanje o procesih v pokrajini je odvisno tudi njihove pogostnosti in intenzivnosti (Hungar et al. 2008) ter od spremenljivega merila opazovanja. Tako imenovano geografsko merilo je po mnenju nekaterih raziskovalcev konstruirano: šlo naj bi za družbeni dogovor, ki je podvržen spremenljivosti, kar otežuje objektivno obravnavanje stvarnosti (Terkenli 2005). Doživljanje, interpretacija in predstavljanje pokrajine naj bi bili zato odvisni od »... gledalca, od njegovega osebnega pogleda in kulturnega okolja ...« (Urbanc 2008, 322). Zato je vrednotenje naravnogeografskega in družbenogeografskega spomina lahko objektivno le, če lahko geografske procese na nek način kvantificiramo oziroma ocenimo pomen dejavnikov v pokrajini, če že ne moremo ugotoviti njihove intenzivnosti in pogostnosti.

Čeprav je družbenogeografski spomin kratkotrajen, naravnogeografski spomin pa je težko ubesediti, lahko s kompleksnimi geografskimi raziskavami in s pomočjo geografskih informacijskih sistemov kvantitativno izrazimo naravnogeografski spomin ter razmerje med družbenogeografskimi in naravnogeografskimi dejavniki v pokrajini.

To je do neke mere uspelo že pred uveljavitvijo GIS-ov (npr. na področju klasifikacije reliefa Hammond 1964; Brabyn 1997; Dikau 1989). V Sloveniji v veliki geografski raziskavi poplavnih območij (prim. Komac, Natek in Zorn 2008) niso preučevali le naravnogeografskih vidikov poplav (obseg poplavnega območja, pogostnost poplav, prilagoditve rastja in prsti poplavam), temveč tudi njihove družbenogeografske vidike (povzročena škoda, prilagoditve človeka, ohranjeni viri).

V nadaljevanju bomo na nekaj primerih na eni strani pokazali, kako pomembno je povezovati oba vidika preučevanja, na drugi pa potrdili pomen geografskih informacijskih sistemov za boljše razumevanje pokrajine in človekove vloge v njej.

Eden od bolj znanih načinov prikaza pomena človekovih vplivov v sodobni pokrajini so ekološke sledi oziroma ekološki odtis, ki izraža delež človekovega vpliva glede na največji možni oziroma pričakovani vpliv v določeni pokrajini. Izračunan je na podlagi gostote prebivalstva, sprememb rabe tal, razvitosti infrastrukture in dostopnosti naselij (Plut 2002; Rozman 2008; Global footprint 2009).

Primerjavo družbenih in naravnih procesov omogoča tudi ugotavljanje deleža neto primarne proizvodnje, ki jo uporablja človek. Pred vplivi človeka je bila primarna neto proizvodnja $150\text{--}170 \cdot 10^9$ organske snovi na leto, danes si človek prisvaja že približno četrtno primarne neto proizvodnje oziroma 40 %, če upoštevamo le produkcijo kopenskih ekosistemov (Plut 1998, 61). Družbena poraba na nekaterih območjih že močno presega naravno (Renfow 2007; Rifkin 2001, 28). Pri tem je cena v obliki omajanih in uničenih ekosistemov tem višja, kolikor bolj tehnologija učinkovito izkorišča in nadzira sile narave. S posegi človeka se zmanjšuje tudi pestrost rastlinskih vrst, kar so na primer ugotovili za travnike na južnem Švedskem (Gustavsson, Lennartsson in Emanuelsson 2007, 54).

Slika 8: Južna pobočja Krna (2245 m) segajo več kot 2000 m nad dolino Soče, kar je največja relativna višinska razlika v Sloveniji. Velik naklon je eden od razlogov za stalno preoblikovanje s skalnimi podori ter z zemeljskimi plazovi in drobirskimi tokovi, ki so leta 1994 in 2001 prizadeli tudi človeka.

Glej angleški del prispevka.

Zanimivo pa je tudi vprašanje, koliko družbenogeografski procesi prispevajo k rečno-denudacijskim procesom. Raziskave enotno ugotovljajo, da je človekov vpliv v sodobnosti tudi na tem področju veliko večji kot v preteklih zgodovinskih obdobjih. Njihov učinek je dolgoročno primerljiv učinkom naravnih procesov, kot je El niño (Beresford-Jones, Lewis and Boreham 2009).

Na primeru Zgornjega Posočja smo ugotovili, da družbeni dejavniki, ki vplivajo na spremembe rabe tal, pomembno vplivajo na erozijo: od človeka povzročene spremembe obsegajo četrtno povprečne letne erozije na preučevanem območju (Zorn in Komac 2008).

Z analizo hitrosti sedimentacije v morjih v preteklih geoloških obdobjih in v sodobnosti so ugotovili, da človek povzroči desetkrat večjo erozijo prsti kot je naravna erozija prsti, ki poteka brez vpliva človeka (Wilkinson 2004). Vpliv intenzivnega človekovega delovanja je ob Dnjepru viden v sedimentih, ki so se odložili v zadnjem tisočletju, zlasti pa po letu 500 pr. Kr. (Kalicki in ostali 2007). V Hongkongu so prve večje spremembe v sedimentaciji nastale v 15. in 16. stoletju zaradi vedno intenzivnejše kmetijske dejavnosti kitajskih prišlekov. Njeno intenzivnost je zmanjšalo ogozdovanje v 19. stoletju, v 20. stoletju pa je vpliv človeka na pokrajino postajal vedno večji in v zadnjih treh desetletjih dosegel višek (Owen in Lee 2003). Poselitev in kmetijstvo sta vplivala tudi na povečano stopnjo erozije v zaledju zaliva Weeks v južni Alabami v ZDA, kjer je bila stopnja sedimentacije v zadnjih štirih tisočletjih 0,2–2 mm/leto, v sodobnosti pa je 10 mm/leto (Haywick 2003). V porečju Misisipija (slika 9), je človek s spremembami rabe tal v zadnjih dveh stoletjih povzročil večje spremembe, ki se odražajo v morfologiji in sedimentih poplavne ravnice, kot katerekoli naravne spremembe v zadnjih 10.000 letih. Naravna sedimentacija je na pritokih Misisipija 0,2 mm na leto, medtem ko je po prihodu belcev narasla na 2 do 10 mm na leto (Knox 2006). Podobno je izsekavanje gozda v neolitiku (5500 pr. Kr.) na Poljskem vplivalo na povečano erozijo prsti zaradi česar so nastali vršaji (Zygmunt 2009).

Na Krasu so erozijo ocenili na podlagi opazovanja vrtač (Mihevc 2000). V njihovem dnu ležita na 1–7 m debeli ilovnati plasti dve plasti s sledovi človeškega delovanja. V spodnji plasti, ki je debela od 0,1 do 0,5 m, so koščki oglja, ki kažejo na požiganje gozda, in kamni, ki so jih iz prsti izpulile korenine podirajočih posušenih dreves. Zgornja plast meri 2–3 m, njen nastanek pa je povezan s čiščenjem skal s površja in gradnjo suhih zidov (z gostoto do 11 km/km²), medtem ko so bila dna vrtač intenzivneje obdelana. Močnejši pritiski na zemljo so bili v rimskem času, nato pa od 10. do 18. stoletja (Mihevc 2005).

Na Slovaškem so spremembe rabe tal v Myjavskem gričevju ob kolonizaciji v 2. polovici 13. stoletja povečale erozijo. Vzdolž poti so nastali številni nekaj sto metrov dolgi in do 15 m globoki erozijski jarki, gradivo se je odložilo v dnu dolin, ki so se s tem dvignila povprečno za 1 m. V 20. stoletju je intenzivnost geomorfnihih procesov upadla zaradi ogozdovanja (Stankoviansky 2003).

Sedimentološke in geokemične raziskave obalnih sedimentov v Braziliji kažejo, da so vplivi sodobne urbanizacije na erozijo/sedimentacijo zelo močni ter primerljivi s povečano sedimentacijo po izsekavanju gozda v zgodnji fazi evropske kolonizacije v 17. stoletju (Baptista Neto, Smith and McAllister 1999).

Na Švedskem so z raziskavo sprememb rabe tal dokazali, da imajo historični dejavniki (raba tal iz 18. stoletja) večji vpliv na variabilnost rastlinskih vrst v sodobni pokrajini, kot pa sodobni procesi sprememb rabe tal (Gustavsson, Lennartsson in Emanuelsson 2007, 54), vendar kljub vsemu preseneča »... *jasna in dolgotrajna povezava med zgodovinskimi spremembami rabe tal in sodobnimi biotopi ter vpliv, ki ga bodo te spremembe imele na prihodnji razvoj* ...« (Marrs 2008).

To velja tudi za druge naravne sisteme, kot so kraški izviri. V severni Kitajski so ugotovili, da je vpliv človeških dejavnosti (1,89–2,90 m³/s) na upadanje količine vode v izvirih Niangziguan povsem primerljiv z vplivi podnebnih sprememb, ki dosegajo 2.30 m³/s (Hao et al. 2009).

Opisani pojavi (našteli bi lahko še več takih primerov, npr. Foster in ostali 2009; Hesse in Baade 2009; Notebaert in ostali 2009; Reiß in ostali 2009) vsak na svoj način dokazujejo, da je analogija s palimpsestom ustrezna za opis pokrajin in da pri preučevanju sodobnih pojavov in procesov ne smemo zanemariti naravnogeografskega in družbenogeografskega spomina oziroma sledov preteklih procesov (Marrs 2008), ki so zelo pomembni tudi za prihodnji razvoj človeške družbe.

Nenazadnje to potrjujejo tudi raziskave o preostankih preteklosti v pokrajini kot elementu resničnega geografskega okolja. Med t. i. historizme oziroma preostanke preteklosti, ki jih lahko razumemo tudi

kot podedovano geografsko okolje Ilesič (1964, 294) šteje »... vse tiste pokrajinske poteze, ki so ugasnile ali se bistveno spremenile, ne glede na to, ali so te poteze morda samo raztresene, kričče izjeme v pokrajini, ki so jo v bistvu preoblikovali že sodobni procesi (npr. zgodovinski ostanki sredi modernih mest) ali pa v pokrajini še vedno prevladujejo (stare agrarne strukture) ...«.

Slika 9: Sedimentacija v delti Misisipija priča o intenzivnosti erozije v porečju (Space science ... 2009; © Space science and engineering center, Madison, ZDA.).

Glej angleški del prispevka.

4 Sklep

Za razumevanje pokrajine je pomembno, da lahko na podlagi poznavanja naravnogeografskega spomina in ohranjanja družbenogeografskega spomina sklepamo na dogodke v prihodnosti. Najtežje je napovedati pojave v srednjem časovnem (teden, leto) in prostorskem (nekaj km² do nekaj deset km²) merilu, lažje pa jih (statistično) napovemo na širši prostorski in časovni ravni.

V članku smo potrdili ugotovitev, da mora delovanje človeka v pokrajini obravnavati tudi naravnogeografski spomin, ne le nezanesljivega in necelovitega družbenogeografskega spomina. Spoznanje pomena velike tehnološke moči človeške družbe »... bi nas moralo prek sicer pomembnih in nujnih prizadevanj za zmanjšanje človekovega vpliva na ekološke sisteme pripeljati do večjega prizadevanja za boljše razumevanje dinamičnega razmerja med družbo in naravo ...« (Oldfield in Shaw 2005, 152). Pri tem je nezamenljiva vloga geografije, saj celovito obravnava spomin pokrajine, torej tako spomin, ki so ga v pokrajini pustili naravnogeografski procesi, kot tudi družbenogeografski spomin.

Sodobna družba zaradi popredmetenega razmerja do narave naravne procese težko ubesedi v družbeno sfero oziroma jih prepozna, sprejme in pretvori v podlago za ukrepanje. To je posledica prepletanja različnih časovnih in prostorskih ravni na katerih potekajo procesi v pokrajini ter dejstva, da je pokrajina dinamična mreža razmerij, ki se vse čas prilagaja, spreminja in obnavlja. Zaradi tega je oteženo naše razumevanje teh procesov oziroma njihovih učinkov v pokrajini (Terkenli 2005).

To so močno izboljšali računalniški modeli, ki so postali pomembno orodje tudi v geografiji. Sposobnost ukrepanja je po zaslugi geografskih informacijskih sistemov in simulacij pogosto preseгла sposobnost našega predvidevanja. Razvoj tehnologije je privedel do točke, v kateri lahko naredimo veliko stvari, vprašanje pa je, ali jih tudi prav razumemo. Kljub pričakovanim napakam je modeliranje naravnih in družbenih procesov koristno, marsikdaj pa celo potrebno ali nujno, saj so modeli »... 'dobra stvar', ki pa potrebuje stalen razvoj ...«, vendar »... zaradi nezadovoljivih rezultatov ne smemo biti preveč razočarani, saj so modeli še vedno v fazi razvoja in tudi nezadovoljivi rezultati lahko pokažejo, v katero smer mora iti njihov razvoj. Od modelov pa ne smemo pričakovati, da bodo posnemali naravo. Mišljeni so, da stvarnost poenostavijo in lahko v najboljšem primeru proizvedejo le približne ocene ...« (Boardman 2006, 77).

Razvoj računalništva je v geografiji olajšal delo, vendar je tudi povzročil velike spremembe. Zato se moramo znova vprašati o temelju geografskega raziskovanja: to pa je nezamenljiv pomen poznavanja konkretne pokrajinske stvarnosti ter preteklih in sodobnih pojavov in procesov v njej. Brez dobrega poznavanja razmer v pokrajini ne moremo niti narediti niti pravilno uporabljati geografskih informacijskih sistemov. Računalniški spomin je le orodje, ki nam pomaga pri razumevanju procesov in pojavov v realni pokrajini, ne more pa jih nadomestiti.

Geografski informacijski sistemi omogočajo pretvorbo pokrajin v navidezne pokrajine (Johnston 1997, 332). Znotraj računalnikov že lahko ustvarimo cele pokrajine, ki z resničnimi nimajo nobene povezave, pa vendar so resnične pokrajine tudi z virtualizacijo podvržene velikim spremembam (Batty 1997, 280–281). V tem procesu vse bolj izginjajo meje med resničnimi in navideznimi pokrajinami (Urbanc 2008). Velikim spremembam so podvržene tudi vede, ki preučujejo pokrajine: nastopila je nevarnost, da bi predmet geografskega raziskovanja zamenjali z njegovim orodjem. Geografija bi tako postala virtualna geografija (Batty 1997), geografski spomin pa bi zamenjali (le) z računalniškim spominom. To bi vodilo do stanja, ko bi se poglobljena prednost računalnikov pri geografskem raziskovanju izkazala kot največja pomanjkljivost (Komac, Natek in Zorn 2008, 44–45), in vedo celo peljalo stran od njenega temeljnega predmeta preučevanja. Računalniški spomin pač ne more nadomestiti geografskega spomina, ki obsega tudi celovito vrednotenje pokrajinske stvarnosti, ne le podatkov o njej ali njene simulacije, ki je pogosto antropocentrična ali celo ne govori o resničnem svetu (Latour 1999, 30).

Raziskovanje konkretne pokrajinske stvarnosti in procesov v njej torej še vedno ostaja temeljna in nezamenljiva domena geografije. Še vedno se zdi umestna in aktualna Ilešičeva ugotovitev: »... *Ravno to vedno tesneje prepletanje prirodnih in družbenih procesov ter vedno aktivnejši posegi človeka v okolje, ki so tako močni, da bistveno preusmerjajo tudi prirodne procese same, pa nas kar sili, da znova razčistimo pojem tako imenovanega geografskega okolja ...*« (Ilešič 1962, 287).

Slika 10: Največji ločni most v Triglavskem narodnem parku nad dolino Mangartskega potoka bo ohranil družbenogeografski spomin na naravni proces iz leta 2000 tudi potem, ko bo naravnogeografski spomin v obliki učinkov erozije na pobočjih in novega nanosa drobirja v dolinskem dnu že nekoliko zbrisalo rastje.

Glej angleški del prispevka.

5 Literatura

Glej angleški del prispevka.