

# LAND REGISTERS AS A SOURCE OF STUDYING LONG-TERM LAND-USE CHANGES

Matej Gabrovec, Ivan Bičik, Blaž Komac



Land pattern with very narrow plots is clearly visible on the section of the 1823 Franciscan cadastral map of the municipality of Žerovnica in Slovenia.

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## Land registers as a source of studying long-term land-use changes

**ABSTRACT:** Land registers, or cadasters, contain information on land use because this is vital for land assessment and taxation. Some European countries produced land registers covering their entire territories as early as the nineteenth century. In the first half of the nineteenth century, the Habsburg Monarchy produced the Franciscan Cadaster, also known as the Stable Cadaster, which shows the traditional preindustrial cultural landscape and makes it possible to analyze land-use changes or the transformation of the traditional cultural landscape. This special issue is the result of collaboration between Slovenian and Czech geographers, and it features six articles covering land-use changes from the perspective of natural geography, political geography, ecosystems, farms, and metrics. The articles, which explore the processes of changes at the national and regional levels, are based on the textual part of the Franciscan Cadaster, and the local studies are based on the cartographic part of the cadaster.

**KEY WORDS:** geography, agrarian geography, historical geography, land-use changes, Franciscan cadaster, Europe

## Zemljiški kataster kot vir proučevanja dolgoročnih sprememb rabe zemljišč

**POVZETEK:** Zemljiški kataster vsebuje podatek o rabi zemljišč, ker je ta podatek pomemben za njihovo vrednotenje in obdavčitev. Nekatere evropske države so že v 19. stoletju izdelale kataster za območje celotne države. Habsburška monarhija je v prvi polovici 19. stoletja izdelala tako imenovani franciscejski ali stabilen kataster. Kataster prikazuje tradicionalno, predindustrijsko kulturno pokrajino in omogoča analize spremembe rabe zemljišč oziroma preobrazbo tradicionalne kulturne pokrajine. Posebna številka je rezultat sodelovanja med slovenskimi in češkimi geografi, obsega šest prispevkov, ki obravnavajo spremembe rabe zemljišč z naravno- ter političnogeografskega, ekosistemskega, kmetijskogospodarskega in metričnega vidika. Članki, ki obravnavajo procese sprememb na državni ali regionalni ravni, temeljijo na pisnem delu, krajevne študije pa na kartografskem delu franciscejskega katastra.

**KLJUČNE BESEDE:** geografija, agrarna geografija, historična geografija, spremembe rabe zemljišč, franciscejski kataster, Evropa

### **Matej Gabrovec, Blaž Komac**

Research Center of the Slovenian Academy of Sciences and Arts, Anton Melik Geographical Institute

[matej@zrc-sazu.si](mailto:matej@zrc-sazu.si), [blaz@zrc-sazu.si](mailto:blaz@zrc-sazu.si)

### **Ivan Bičik**

Charles University in Prague, Faculty of Science, Department of Social Geography and Regional Development

[bicik@natur.cuni.cz](mailto:bicik@natur.cuni.cz)

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# 1 Introduction

This special issue of *Acta geographica Slovenica* features articles dealing with land-use changes. The series of articles presented continues the long-standing tradition of exploring land-use changes in Slovenian geography (Ilešič 1950; Medved 1970; Gabrovec and Kladnik 1997; Gabrovec and Kumer 2019), and the collaboration with fellow researchers from the Czech Republic (Bičík, Jeleček and Štěpánek 2001; Bičík et al. 2015) extends this research into other parts of central Europe. The six articles featured in this special issue are presented in greater detail in Section 3 of this article but here it is sufficient to say that land-use changes are discussed from the perspective of natural geography, political geography, ecosystems, farms, and metrics.

Land use is an important human footprint (Komac 2009) in a landscape, and landscape changes reveal a great deal about the geographical processes shaping it (Šmid Hribar et al. 2017; Špulerová et al. 2017; Geršič Gabrovec and Zwitter 2018). Just as territoriality is the primary expression of social power, land-use changes are an important aspect of the historical relationships between society and space. Land-use changes in Europe reflect a combination of traces of feudal, industrial, and postindustrial processes, including settlement, whereas elsewhere the influences of precolonial land use on later processes can be observed. For example, the earliest European settlers in the Americas had a clear preference for sites with a long history of Native American occupation located on productive wide floodplains (Coughlan and Nelson 2018).

Surprisingly, even in today's technology- and information-based society, agriculture remains the most important factor in land-use change on Earth, considering that approximately a third of its surface is used for growing crops or grazing. Agricultural land transformation has been especially rapid in the past three hundred years (Ramankutty et al. 2006).

Various types of sources are available for determining land use and its changes. Remote sensing has been at the forefront in recent decades, and various textual and cartographic historical sources are available for older periods. Land registers, or cadasters, are key among these and their introduction is connected with the economic transformation mentioned above. Land registers usually entail parcel-based information systems featuring information on land use and the related rights and restrictions (Foški et al. 2018). They include a textual part and a graphic section or cadastral maps, which show the relative and absolute locations of parcels in a specific area (usually a cadastral district). Maps are produced at a scale of one to several hundred up to one to several tens of thousands. Historically, there were two reasons for maintaining records on land use: fiscal and legal. Income and the related taxation depend on land use, which is hence the key piece of information of any land register. The land register itself is a useful tool for recognizing and controlling land rights, such as ownership (Lisec and Navratil 2014).

The applicability of land-register data to analyses conducted at the regional level depends on the method of publishing these data and varies by country and historical period. If land use is marked on cadastral maps in different colors, scanning and georeferencing these maps makes it possible to include land-use data in geographical information systems and analyze land-use changes (Petek and Urbanc 2004; Yang et al. 2014). The publication of summary tables on land use at the municipal level by year allows comparative studies of long-term land-use changes (Bičík, Jeleček and Štěpánek 2001; Petek and Urbanc 2004; Bičík et al. 2015; Gabrovec and Kumer 2019).

## 2 Brief historical overview

Landed properties were represented on a map to a limited extent in ancient Mesopotamia. The Royal Registry of ancient Egypt was created in about 3000 BC (Kain and Baigent 1992), and in China the taxation system based on land survey records was established in AD 700. The Romans carried out a land survey in AD 300, and they held regular and detailed censuses, such as Emperor Vespasian's AD 77 survey map in Campania (Larsson 1996; Kain and Baigent 1992). Since the Classical period, accurate cadastral records have been an important tool for proving ownership of land, which in turn earned people substantial privileges such as citizenship (Manville 1990); this predominated until the twentieth century (Heater 1990; Vilfan 1996).

The demise of the Roman Empire also saw the end of property registration. Land registers at the level of regions and countries began to be reestablished in Europe during the sixteenth century. European countries that stand out in terms of either an early introduction of the land register or its quality, which makes

it possible to study land use at least from the nineteenth century onward, are presented below. The Netherlands was among the first to introduce a land register, and its introduction was connected with collecting taxes for the maintenance of dikes in the polders and acquiring new land. On 1:3,000 to 1:5,000 cadastral maps from the first third of the sixteenth century showing the area north of the town of Alkmaar, different colors were also used to indicate land use (Kain and Baigent 1992). A land register covering the entire national territory was produced in the first half of the nineteenth century, featuring 1:1,250 to 1:5,000 maps and providing information on the owner, land use, quality, and yield for each parcel (Kain and Baigent 1992).

A very long tradition of property taxation and assessment is typical of Sweden (Mansberger 2015). The Swedish land survey was established in 1628 under King Gustavus Adolphus. The 1636 instructions gave surveyors a detailed color scheme in order to standardize presentation on the maps: »Cultivated fields were to be colored gray, meadows green, mosses yellow, fences black, lakes light blue, rivers dark blue, boundaries red, forests dark green, and stony slopes white« (Kain and Baigent 1992, 54). The maps were produced at a scale of 1:5,000 and 1:3,333. The forests and wasteland around the villages were not included, and therefore a large part of the national territory was not surveyed (Kain and Baigent 1992). At the time it was created, the Swedish land register was the most extensive cartographic work in Europe. Unlike modern aerial photos, the cadastral maps it contained make it possible to analyze land-use changes over a period of three hundred years. Cousins (2001) conducted such an analysis on a 2.2 × 2.8 km area in Nynäs south of Stockholm.

In France, discussions on designing a land register began as early as the end of the eighteenth century and systematic work began in 1807 after the relevant law was adopted. Work was completed in 1850. Cadastral maps used various scales, ranging from 1:500 to 1:5,000, and the textual part of the land register also contained summary tables on land use in individual municipalities. The land register has been used as a source for several studies of changes in land use as well as visible aspects of the rural landscape (Clout and Sutton 1969). Perpilou was the first researcher in France to base his analyses of land-use changes on cadastral maps, such as the one presented in his study of the Limousin region, which he conducted based on summary tables on land use in nine hundred municipalities (Perpilou 1959). Juillard and Angrand (1961) produced maps of nineteenth- and twentieth-century land use in eastern France based on the textual part of the land register. A comprehensive volume about land-use changes in nineteenth-century France was authored by Clout (1983). Gabet (1965) used the cadastral maps for geomorphological research – specifically, for measuring cliff retreats.

In Denmark, many of the attributes and history of the Napoleonic land registers can be observed. The Danish land register was established in 1844. Its text and maps have been updated continually ever since. The first Danish land register was created in 1688 but it contained no maps. The land was surveyed at a scale of 1:4,000 in the last two decades of the eighteenth century. Each map included a village and the associated cultivated areas. The land register is still used to collect land taxes, but to a much smaller extent because the property tax has been based on the market value of the individual properties since 1903 (Enemark 1992; 1994).

In Norway, the most extensive body of historical maps is made up of the cadastral maps designed after the 1857 Land Consolidation Act, which brought about an extensive reorganization of agricultural areas. These 1:2,000 maps make it possible to analyze changes in the cultural landscape (Domaas 2007; Hamre, Domaas and Austad 2007).

Unlike France and the Scandinavian countries, during the nineteenth century Germany was not yet united, but consisted of many smaller states. Land-register development varied by state and was influenced by French, Dutch, and Scandinavian models (Kain and Baigent 1992). Based on the cartographic and textual parts of the Bavarian land register, which has been kept continually since the mid-nineteenth century, Bender et al. (2005) analyzed cultural landscape changes and used them to produce a scenario of future development.

The Milan land register is the predecessor of the Habsburg land register. Lombardy and the Duchy of Milan were part of the Habsburg Monarchy at that time, and the survey there was carried out from 1720 to 1723, with maps produced at a scale of 1:2,000. During the 1750s, the Theresian Cadaster was designed in the monarchy, followed by the Josephinian Cadaster between 1785 and 1788. It was completed in four years; however, the surveys were conducted hurriedly with the main objective of determining the areas of land parcels, and no or only limited graphical documentation was provided (Lisec and Navratil 2014). The Josephinian Cadaster provided the basis for the Franciscean Cadaster, which is examined by the articles featured in this special issue and presented below.

### 3 Articles

What all the articles in this special issue have in common is the Franciscan Cadaster, often also referred to as the Stable Cadaster. It was created in the Habsburg hereditary lands between 1818 and 1828 following the reforms introduced by Emperor Francis I and it succeeded the Josephinian Cadaster. This cadaster is the key data source for the territory of the former Habsburg Monarchy. It was produced in the first half of the nineteenth century for the Austrian part of the empire, which included what is now Austria, Czechia, and Slovenia, and parts of what is now Italy, Croatia, Poland, Ukraine, and Romania, and in the second half of the nineteenth century for the Hungarian part, which included what is now Hungary and Croatia, and parts of Romania, Serbia, and Slovenia (Lisec and Ferlan 2017). The importance of this cadaster as the source for studying the nineteenth-century cultural landscape and its later transformations is demonstrated by Petek and Urbanc (2004), and Bičič et al. (2015), and an overview of literature on land-use changes based on this source was prepared by Gabrovec and Kumer (2019).

The first article in this special issue of *Acta geographica Slovenica*, titled »Long-term land-use changes: A comparison between Czechia and Slovenia« (Bičič, Gabrovec and Kupková 2019), is the first comparative study of land-use changes in two central European countries over a period of two centuries using uniform quantitative methods. The driving forces of land-use change have been comparable in both countries. However, the Czech cultural landscape was more significantly transformed due to nationalization and collectivization, whereas in Slovenia fragmented private property contributed to preserving nineteenth-century cultural landscape elements. The article helps better understand past, present and future land-use changes in central Europe.

The second article, titled »Long-term land-use / land-cover changes in Czech border regions« (Bičič, Kupková and Boudný 2019), discusses the long-term impact of borders and border regimes on land use. The authors used the Czech–German and Czech–Austrian border to present land-use changes in nine thousand territorial units between 1845 and 2012, and they also conducted a pilot study of a locality in the eastern part of the Krkonoše Mountains. They established a significant increase in forests and grasslands accompanied by an extreme decrease in arable land in the second half of the twentieth century, driven by the political changes after 1945 and 1989. After 1990, the landscape changes in the Czech Republic were greater than those in Austria and Germany.

The article »Land-use changes in Slovenian terraced landscapes« (Kladnik et al. 2019) presents long-term land-use changes in eight areas of various Slovenian landscapes. It offers a comparison of changes on terraced and non-terraced land from the early nineteenth century to the present and a typological classification of land-use change; specifically, extensification, afforestation, grass overgrowth, intensification, and urbanization. It demonstrates large differences in influencing factors and the rate of land-use change between terraced and non-terraced land, which reflect both economic growth and the general economic and political-administrative situation in Slovenian regions.

In the article »Assessment of land-use changes and their impacts on ecosystem services in two Slovenian rural landscapes« (Ribeiro and Šmid Hribar 2019), the authors use two pilot areas to explore the links between land use, landscape changes, and ecosystem services. They state that, from the perspective of ecosystem services, intensification and overgrowth should be restricted. The paper presents an approach that can be used as a support tool for decision-making in managing and governing landscapes.

The article »Monitoring land-use change using selected indices« (Foški and Zavodnik Lamovšek 2019) presents various land-use change indices developed by the authors or derived from landscape metrics. They were calculated for five selected sites in agricultural land (i.e., fields) for the time when the Franciscan Cadaster was introduced and for 2015. It was found that the numerical values mostly reflect the visually detected land-use changes well and show land-use fragmentation. The indices could be used as an objective approach in systems monitoring land-use change.

### 4 Conclusion

National authorities introduce land registers to assess and tax property. Information on land use, which is an important cultural landscape element, is an integral part of these registers. Except for rare previous examples in smaller areas, European countries began introducing land registers at the national level during

the eighteenth century, but it was not until the nineteenth century that the first countries began introducing land registers with appertaining maps for their entire national territory. The Habsburg Monarchy stands out among these for having produced the high-quality Franciscan Cadaster, or Stable Cadaster, for the Austrian part of the monarchy in the first half of the nineteenth century. This cadaster thus shows the cultural landscape at a preindustrial stage, which is why it can also be described as a traditional cultural landscape. The central topic covered in this issue is land-use change or the transformation of the traditional cultural landscape, with all articles using the Franciscan Cadaster as their primary data source. Cases are presented from Slovenia and Czechia. The authors used data from both the textual and cartographic parts of the cadaster. The textual part was used in articles dealing with the national and regional levels, and the cartographic part was used in case studies at the level of individual municipalities. All the articles deal with the countryside, which predominated in the nineteenth century. Agricultural land use is thus at the forefront of the studies presented, with authors interested not only in the changes in the area and share of individual land-use types, but also the fragmentation of land use and its connection with other factors, such as relief characteristics, cultivated terraces, and state borders. Land use is connected with the ecosystem services and the level of biodiversity in individual landscapes, both of which can increase or decrease with changes in land use.

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