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Changing Boundaries

Harmonizing Territorial Data for Comparative Subnational Research

2026

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Abstract

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Changing Boundaries: Harmonizing Territorial Data for Comparative Subnational Research*

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May 18, 2026

Abstract

Comparative subnational research typically assumes stable territorial units. Yet municipal boundaries change frequently across Europe, posing overlooked threats to longitudinal comparability and inference in comparative research. We document 2,070 municipal territorial changes across 35 European countries between 2014 and 2024, using harmonized geospatial boundary data systematically validated against legislative records. We extend existing typologies of municipal spatial change, showing that mergers dominate territorial restructuring, while several other forms of territorial change remain largely overlooked. We then introduce LoQoG Dataspace, an open-access longitudinal spatial harmonization infrastructure that enables consistent alignment of subnational data across changing administrative boundaries. Together with a methodological framework for analyzing territorial change across contexts and over time, LoQoG Dataspace supports rigorous comparative empirical research.

Keywords: municipal spatial change; border change; European municipalities; geospatial approach
JEL: R58, R12, C8

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1 Introduction

A growing number of actors–from scholars to businesses, policymakers, and citizens–rely on subnational data to better understand socioeconomic and political phenomena (OECD, 2024; UN Statistics Commission, 2020). In academia, the emphasis on causal identification (Imbens, 2024) has further intensified demand for high-quality data beyond country-level indicators, making comparative subnational research a standard design in political science and beyond (Giraudy et al., 2019). Our analysis of Web of Science data illustrates this trend: the number of publications referencing municipalities in their title or abstract increased from roughly 1,000 annually in 2000 to nearly 12,000 in 2025.

However, the expanding use of subnational data also raises important conceptual and methodological challenges. Subnational political units such as municipalities are not fixed territorial entities: their boundaries, names, and official identifiers change over time. Yet many researchers implicitly treat these units as temporally stable–an assumption that often does not hold in practice. For example, when the Italian municipality Faedo merged with San Michele all'Adige in 2020, the resulting municipality retained San Michele all'Adige's identifier, producing an apparent population increase of more than 20 percent despite no underlying demographic shock (see Appendix A for extensive illustrations).[1]

This issue is particularly salient in Europe, where repeated boundary reorganizations have substantially altered both the number and spatial configuration of municipalities – the most common subnational political units. Municipalities have undergone a wide range of territorial changes driven by mergers, splits, and other forms of reorganization (Goerlich and Ruiz, 2018; Swianiewicz, 2020, 2021), resulting in the elimination of municipalities, changes to their spatial form, and the creation of new municipalities. (Council of Europe, 2017; Klausen, 2026).

Changes in the boundaries of subnational administrative units alter the geographic basis of statistical indicators. Consequently, panel datasets may combine observations referring to different territorial entities over time, a discrepancy that is often unaccounted for in empirical research. As a result, comparative studies may unknowingly combine observations from substantively different territorial units, generating several threats to inference. First, boundary

[1] Conversely, when Misiliscemi was created from part of Trapani in 2021, Trapani's population appeared to decline sharply.

changes generate *measurement error*, as variables may be measured for different underlying populations or territories. Because territorial reforms are often driven by political, fiscal, or demographic pressures, this error is unlikely to be random and may bias empirical estimates. Second, boundary changes can produce *misattributed effects*, when observed changes reflect territorial restructuring rather than the underlying causal processes. Third, they undermine *comparability over time*, as municipalities before and after reforms may represent substantively different entities. For example, in France Beaumont-les-Nonains existed as an independent municipality in 2014, merged into Les Hauts-Talican in 2019 (which retained its identifier), and was re-established in 2024 with its original boundaries and identifier. As a result, observations for the same nominal unit may refer to different underlying territories over time.

Researchers often attempt to address these problems by restricting analyses to territorially stable municipalities or to periods without boundary changes (Agasisti and Porcelli, 2023; Dahlberg and Johansson, 1998; Roesel, 2017; Schmutz and Verdugo, 2023). While such strategies improve panel consistency, they may also introduce *selection bias* by systematically excluding municipalities most affected by administrative reforms.

Beyond their implications for inference, municipal boundary reforms are also politically consequential processes in their own right. Despite their prevalence, systematic knowledge about the scale and patterns of municipal boundary changes remains limited. This gap is consequential because such reforms are rarely purely technical adjustments; rather, they are embedded in broader political and policy processes, including efforts to strengthen administrative capacity, address fiscal pressures, or improve local service provision. Understanding territorial boundary changes is therefore essential both for the accurate interpretation of longitudinal data and for the analysis of the political and institutional dynamics of subnational governance.

At its core, these challenges reflect the temporal inconsistency of subnational political units. In this article, we introduce LoQoG Dataspace (Local Quality of Government Dataspace), an open-access infrastructure for documenting and harmonizing municipal boundary changes across 35 European countries between 2014 and 2024,[2] thereby enabling researchers to identify and account for inconsistencies in longitudinal and cross-national municipal data. The platform is accompanied by online tools that help researchers improve the validity of comparative

[2]Including the EU, EFTA and the constituent units of the UK.

subnational analyses.

Our approach combines the analysis of official geospatial boundary data with systematic verification of detected changes using legislative acts governing boundary reform. By comparing municipal polygons across years and validating detected changes against relevant legislation, we construct a comprehensive dataset of European municipalities that supports the creation of geographically consistent longitudinal data, reduces measurement error arising from territorial change, and facilitates more credible comparative and causal research designs. This paper makes four contributions. First, it provides a methodological framework for identifying and analyzing territorial unit changes in longitudinal and comparative research. Second, it introduces a public data infrastructure that enables the construction of geographically consistent subnational panel data and supports more rigorous empirical analysis. Third, it documents 2,070 municipal boundary changes across 35 European countries between 2014 and 2024, showing that mergers constitute the dominant form of territorial restructuring. Fourth, it extends the typology of territorial unit changes developed by Goerlich and Ruiz (2018) by incorporating a broader range of spatial alterations. As such, this framework enables researchers to track municipalities consistently over time, construct comparable longitudinal subnational data, and study the causes and consequences of territorial reform.

2 Literature Review

Municipalities change through both geographical modifications to territorial boundaries and non-geographical changes to legal identifiers such as names or registry codes (Goerlich and Ruiz, 2018; Kociuba and Kociuba, 2023). Existing research, however, typically examines only one dimension or form of change within individual-country contexts (Blesse and Baskaran, 2016; Heinisch et al., 2018; Strebel, 2018). Most studies focus on mergers (Allers and Geertsema, 2016; Blom-Hansen et al., 2016; Hansen et al., 2014; Harjunen et al., 2021; Moisio and Uusitalo, 2013; Solvang et al., 2025) or splits (Bačlija Brajnik and Lavtar, 2021; Brink, 2004; Erlingsson et al., 2024; Lysek, 2021; Swianiewicz et al., 2024), while broader analyses of municipal boundary change remain rare (Dobos, 2021; Klausen, 2026; Swianiewicz, 2020, 2021). Moreover, boundary reforms are usually studied through their causes or consequences rather

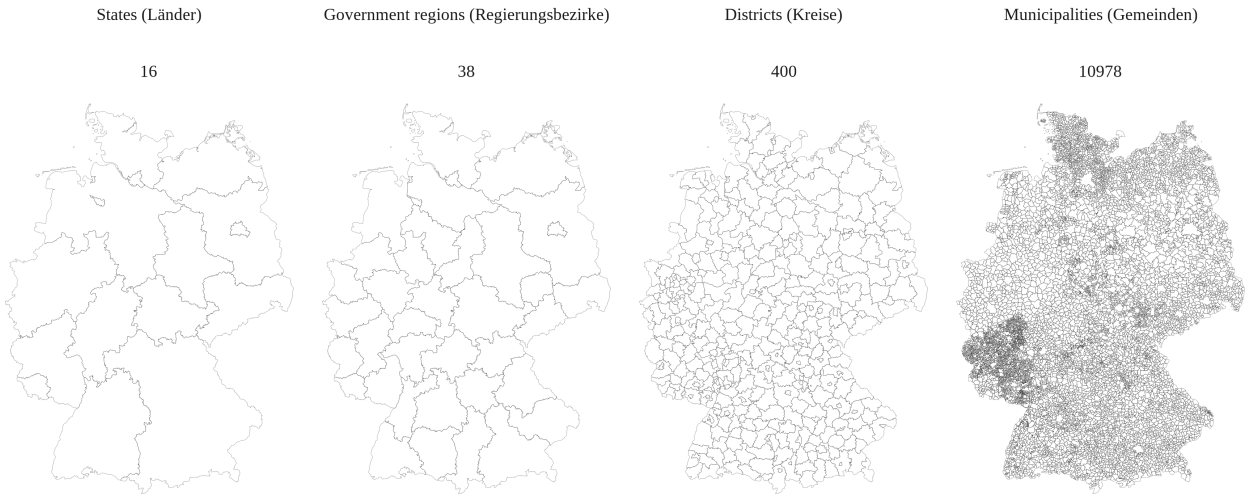
than as a phenomenon requiring systematic conceptualization and measurement (Allers and Geertsema, 2016; Bačlija Brajnik and Lavtar, 2021; Blom-Hansen et al., 2016; Erlingsson et al., 2024; Hansen et al., 2014; Harjunen et al., 2021; Heinisch et al., 2018; Solvang et al., 2025; Strebel, 2018; Swianiewicz, 2020; Swianiewicz et al., 2022, 2024). Existing comparative efforts, most notably Goerlich and Ruiz (2018), provide important foundations for tracking territorial change, but remain geographically and temporally limited (Kociuba and Kociuba, 2023; Pászto et al., 2020). This paper builds on and extends this literature by developing a typology of municipal spatial change and systematically documenting territorial alterations across 35 European countries between 2014 and 2024.

3 Defining the Unit of Analysis

Conceptually, we approach the unit of analysis from the perspective of local self-rule, or local autonomy. We define this as the legally and institutionally grounded capacity of local government units operating within clearly demarcated territories to make binding decisions for local residents and manage resources independently of higher levels of government. The existence of an effective "policy space" (Ladner et al., 2016, 325), in which local governments can design and implement policies, distinguishes local autonomy from mere local administration, where authorities primarily execute policies determined by higher-level governments. Following Lidström (1998), we define a local government as a territorially bounded unit with legislative and executive institutions, authority to make binding decisions for local residents, and a degree of autonomy in managing local affairs and resources.

Although some countries feature multiple tiers of subnational government – as in Germany, where three levels exist (see Figure 1) – we focus on the lowest level within each country's government hierarchy. Across Europe, this level is most commonly referred to as the municipality (Ladner et al., 2016), although country-specific terminology varies (e.g., local authority in the United Kingdom, *commune* in France and Luxembourg, *Gemeinde* in Germany, or *gmina* in Poland). We therefore adopt municipalities as our unit of analysis, as they constitute the primary institutional arena where local autonomy is exercised and decisions with direct implications for local communities are made.

Figure 1: Subnational Territorial Organization in Germany



4 Method

To systematically identify municipal boundary changes across 35 European countries between 2014 and 2024, we combine automated comparisons of geospatial data over time with manual verification against legislative sources. Following Servigne et al. (2000), we use geometric properties of polygons and computational geometry algorithms (e.g. checks for closure, intersections, and uniqueness) to detect potential boundary changes between t and $t+1$. We then verify these changes against legal records to ensure that they correspond to formally adopted administrative reforms. Appendix B provides a detailed description of the methodology.

We begin by acquiring geospatial boundary files for consecutive years (t to $t+1$, $t+1$ to $t+2$, etc.) from official sources, including national government agencies, public geoportals, and Eurostat. The data, obtained in different formats (Shapefile, GeoJSON, GML), were harmonized by converting them to GeoPackage format, reprojecting to a common coordinate reference system (EPSG:3035), and encoding in UTF-8. We then applied custom algorithms to compare polygons across years and detect spatial changes, including the disappearance of

existing polygons, the emergence of new polygons without linkage to prior units, and changes in the size or configuration of existing polygons.

We subsequently verified each detected spatial change against official legal documentation retrieved from national legal databases and government sources and, where necessary, through correspondence with the relevant authorities (e.g., National Institute of Statistics and Economic Studies (INSEE) and data.gouv.fr in France). This step not only confirmed the validity of observed outcomes but also allowed us to identify the underlying territorial alterations–such as mergers, splits, and dissolutions–that generated these outcomes.

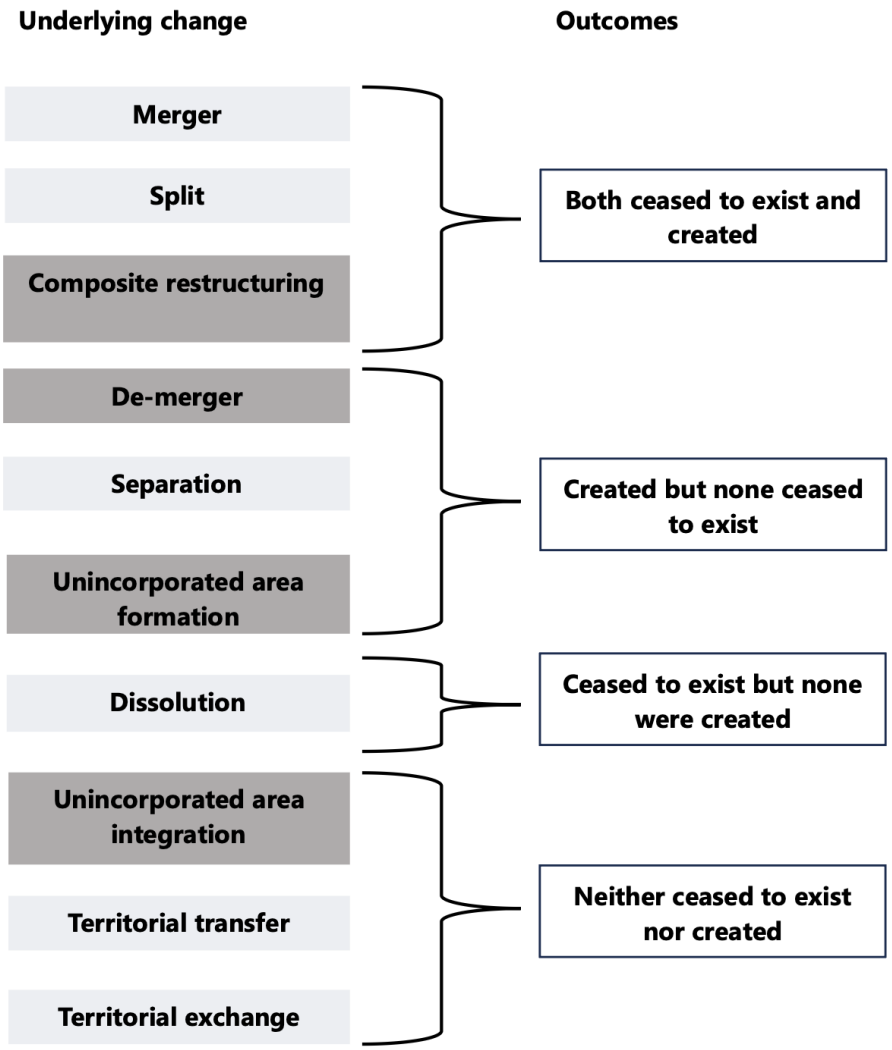
Finally, we constructed a master database documenting the annual status of each municipality: remained unchanged, dissolved, newly created, or reconfigured. Each unit is assigned a unique internal identifier (LoQoG ID), enabling consistent linkage over time. Each Case ID is shared by all municipalities involved in a given event of territorial alteration and follows the *country code–change type–case number–pre/post years* structure. For example, *fr-m-34-2015-2016*, indicating France, a merger, case number 34, and the years before and after the change. We link these identifiers to geospatial polygons, allowing users to trace territorial evolution directly within a GIS environment. The resulting dataset provides harmonized local time series, a legally validated record of boundary changes, and geospatial layers suitable for spatial analysis.

5 The LoQoG Typology of Municipal Spatial Changes

We conceptualize municipal spatial change as a transformation between two time points: one preceding a territorial alteration (t) and one following it ($t + 1$). Following Goerlich and Ruiz (2018), we distinguish between observed spatial outcomes and the underlying territorial alterations that generate them. Unlike that article, however, we systematically attribute all observed spatial changes to specific types of territorial alteration, including previously unidentified forms, thereby avoiding residual categories such as "unspecified disappearance" or "unspecified emergence".

Figure 2 presents the LoQoG typology. The outcomes, shown on the right, are the observed changes in spatial status, captured through the geospatial data analysis: whether municipalities

Figure 2: LoQoG Typology of Municipal Spatial Changes



Note: Alterations in dark gray denote types not identified in Goerlich and Ruiz (2018).

cease to exist, are created,[3] both, or neither. These outcomes are the consequences of underlying territorial alterations, shown on the left, such as mergers, splits, separations, or territorial transfers. Alterations highlighted in dark gray denote types not identified in Goerlich and Ruiz (2018).

Table 1 summarizes the ten main categories of municipal boundary change identified in our analysis. Appendix C provides further details, including definitions of type of underlying change and their subtypes, graphical illustrations, legislative references, and country examples

[3]Creation refers to the establishment of a new administrative entity, legally recognized within the administrative system, with a distinct territory, an officially recognized name, and an organizational structure enabling local governance and elections.

for each type of territorial alteration.

While mergers represent the most common form of reform in many countries, other types of change–such as territorial transfers or composite restructuring–also occur in several national contexts. Multiple types of territorial alteration may lead to the same spatial outcome; for example, mergers, splits, and composite restructurings all result in units both ceasing to exist and being created.

In addition, we identify three categories of changes to municipal identifiers that occur without spatial change: name changes, identification code (ID) changes, and simultaneous changes in both name and ID. Although these changes do not alter territorial boundaries, they can affect the analysis of municipal-level data, as identifiers are commonly used to link statistical observations over time (see Appendix D for examples). Spatial and identifier changes do not always coincide. Municipalities may undergo boundary alterations without changes to their identifiers, while in other cases identifiers change despite stable territorial boundaries. In some instances, both types of change occur simultaneously, generating obstacles for robust data analysis.[4]

6 Scope and Patterns of Municipal Boundary Changes

Across the 35 European countries in our dataset, we identify 2,070 territorial changes between 2014 and 2024, revealing substantial cross-national variation in both the scope and form of municipal restructuring. These changes are highly concentrated geographically: a small subset of countries accounts for the overwhelming majority of reforms, with France recording by far the largest number of cases (853 since 2015), followed by Austria (215) and Germany (205), while seven countries experienced no municipal boundary changes during the study period (Figure 3).

The temporal distribution of these territorial changes further underscores their uneven character. Rather than occurring gradually, reforms tend to cluster in specific years, reflecting the implementation of discrete, large-scale reform programs. This pattern is particularly visible

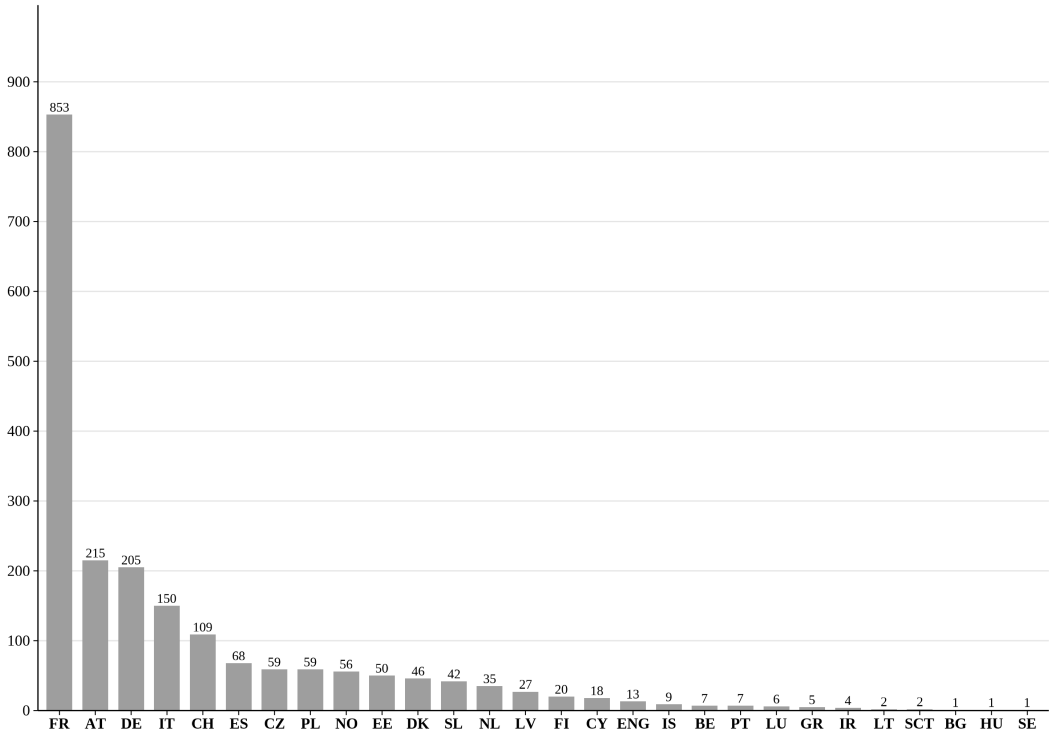
[4]For example, in the case of mergers, four configurations frequently occur: (a) a new name with a new ID, (b) a new name with an inherited ID, (c) an inherited name with a new ID, and (d) an inherited name with an inherited ID. See Appendix D for further detail.

Table 1: Types of Underlying Territorial Alterations

Category	*Explanation*
1. Both ceased to exist and created	
Merger	A new municipality formed through the union of two or more pre-existing municipalities.
Split	The territory of a municipality is divided into two or more newly created municipalities, none of which retains the legal or administrative identity of the original unit.
Composite Restructuring	The simultaneous dissolution, merger or territorial transfers of multiple municipalities, whereby entire or partial territories are reorganized into one or more newly created municipalities.
2. Created but none ceased to exist	
De-Merger	The re-establishment of one or more municipalities previously absorbed in a merger, creating new entities whose territories coincide with their pre-merger boundaries.
Separation	A new municipality is formed through the separation of part of the territory from one or more existing municipalities, all of which continue to exist.
Unincorporated Area Formation	A new municipality is formed from territory that was not previously organized as a municipality.
3. Ceased to exist but none were created	
Dissolution	A municipality ceases to exist as a legal-administrative entity and its territory is redistributed among existing municipalities.
4. Neither ceased to exist nor created	
Unincorporated Area Integration	Previously non-municipal territory is incorporated into one or more existing municipalities.
Territorial Transfer	The transfer of part of a municipality's territory to another municipality without reciprocal exchange.
Territorial Exchange	The mutual exchange of territory between municipalities.

Note: All categories, except dissolution and composite restructuring, include subcategories; territorial transfer and exchange are classified as national or international.

Figure 3: Municipal Spatial Changes by Country, 2015-2024



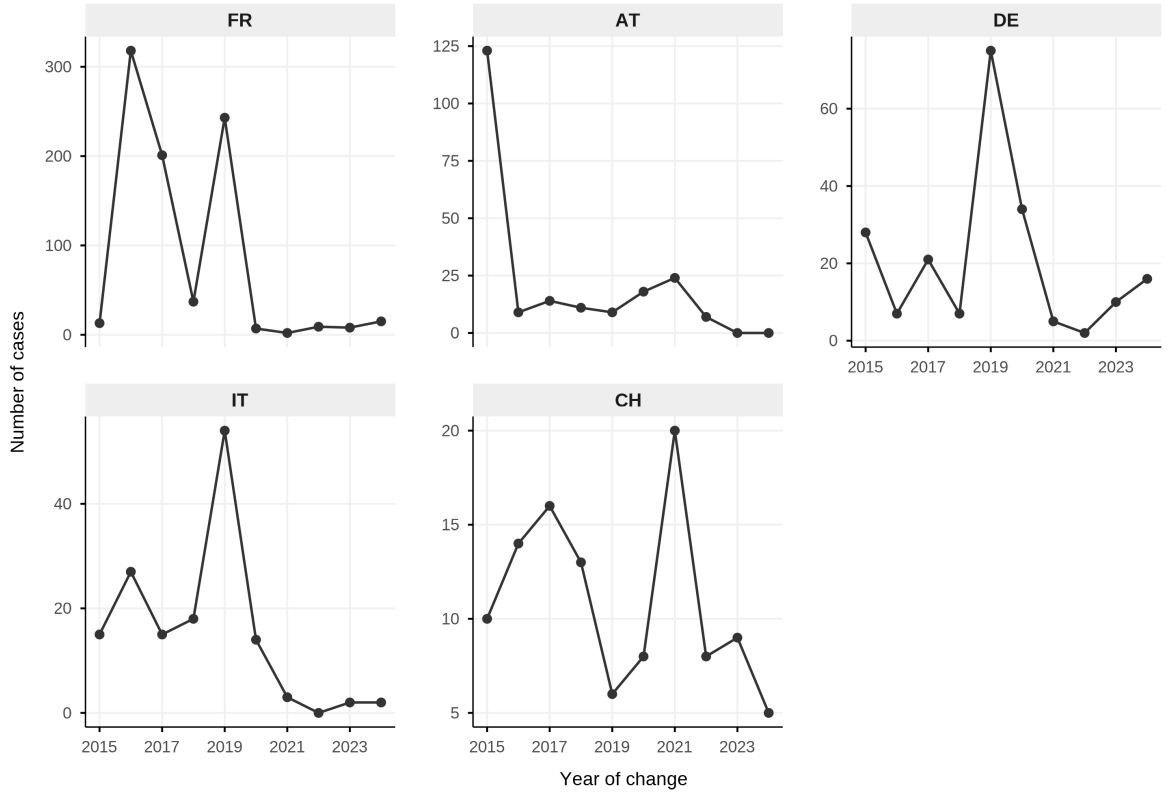
Note: Croatia, Liechtenstein, Malta, Romania, Slovakia, Northern Ireland, and Wales had no changes.

in countries with the highest reform activity (Figure 4).

In terms of their substantive form, territorial changes are dominated by mergers, which account for 78% of all cases (Figure 5). Other types of alterations—such as territorial transfers and exchanges—occur less frequently, while separations, dissolutions, and more complex restructuring processes are rare. This distribution highlights a strong overall tendency toward municipal consolidation, but also indicates that territorial change encompasses a broader range of institutional adjustments beyond merger-driven reforms.

Despite the scale of these territorial changes, their aggregate impact on the overall number of municipalities remains modest. Across all countries, the total number of municipalities declined by approximately 4% over the decade (Figure 6). Appendix E provides additional descriptive statistics, including the number of municipalities by country and year.

Figure 4: Municipal Spatial Changes in the Five Countries with the Highest Number of Changes, 2015–2024



Note: Y-axis scales are adjusted to highlight country-specific temporal trends. FR=France, AT=Austria, DE=Germany, IT=Italy, CH=Switzerland.

Figure 5: Territorial Alterations by Type, 2015–2024

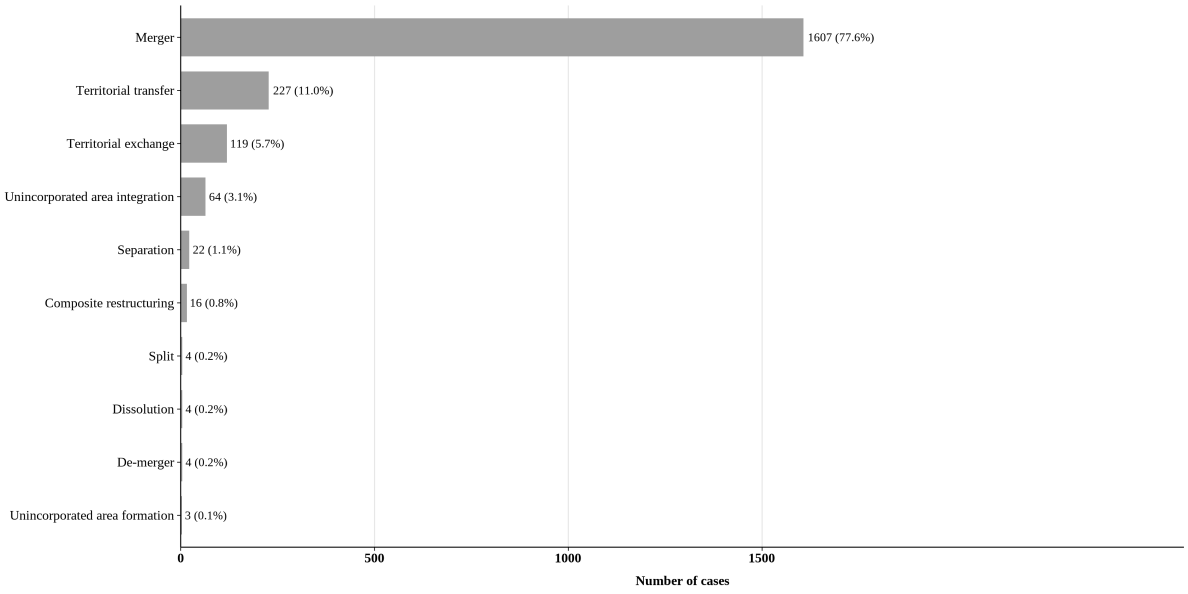
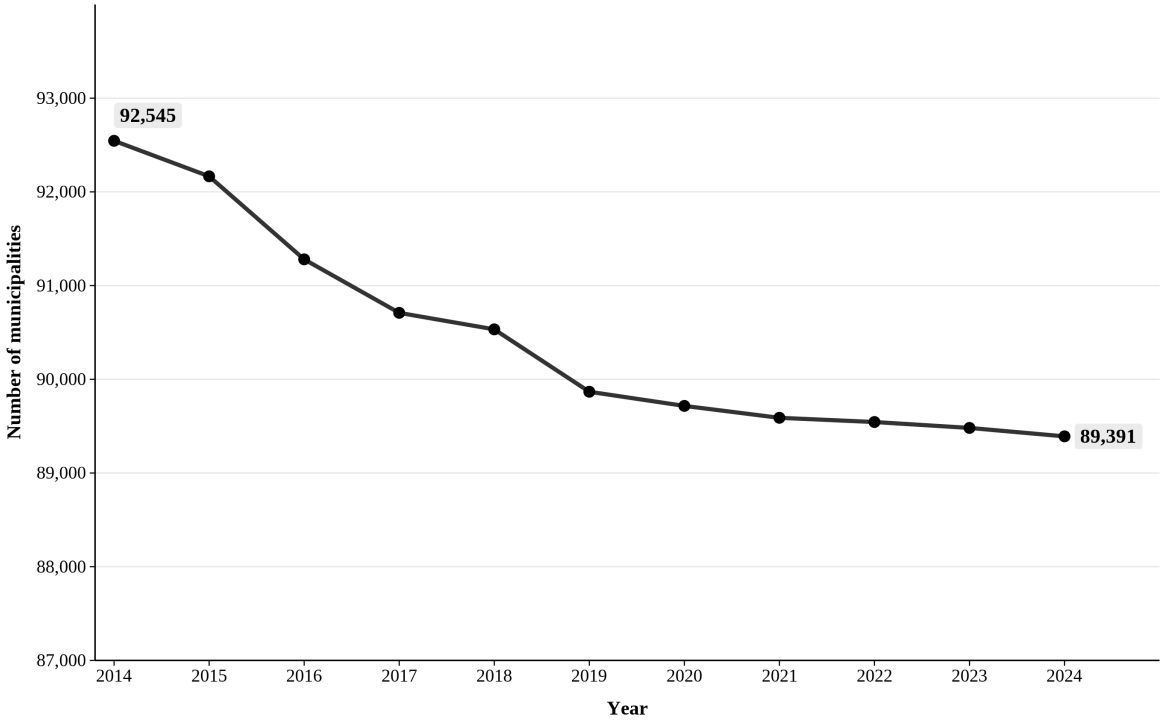


Figure 6: Number of Municipalities across 35 European Countries, 2014–2024



Note: The number of municipalities as of January 1st of each year.

7 Implications for Research

The results demonstrate that municipal boundaries in Europe change more frequently than is often assumed. When such changes are not accounted for, they introduce inconsistencies in longitudinal municipal data, generating measurement error and potentially biasing statistical inference. Indicators derived from shifting territorial units may conflate administrative reorganization with substantive demographic or economic change, thereby complicating both descriptive and causal analysis.

The LoQoG framework addresses this problem by providing i) a methodology for identifying spatial change and ii) a public data infrastructure that accounts for all municipal territorial alterations across 35 European countries between 2014 and 2024. Together, these enable the integration of comparable subnational data and support more rigorous empirical analysis.

The LoQoG methodology relies on longitudinal analysis of geospatial data, combined with systematic verification of detected changes against legislative sources. It explicitly documents boundary discontinuities and links municipalities involved in the same territorial alteration

through shared case identifiers. This produces transparent, consistent, and geographically referenced time-series data and supports the reconstruction of geographically consistent spatial units over time. The underlying approach–automated polygon comparison combined with legal validation–is extendable to other contexts where official geospatial and legislative data are available and can be applied iteratively as new data are released.

The LoQoG data infrastructure provides harmonized information on politically relevant subnational units that already account for territorial change. Each unit is assigned a unique identifier (LoQoG ID, which connects all municipalities involved in a given alteration) and links them to corresponding geospatial data and legislative sources. This structure enables researchers to align statistical indicators with their correct geographic context, thereby reducing measurement error and the risk of biased estimates. In addition, it facilitates the integration of existing, often fragmented subnational datasets into a unified framework, thereby improving cross-national comparability and expands opportunities for causal analysis, including designs that rely on precise spatial or administrative discontinuities.

8 Limitations

This study has several limitations that should be considered when interpreting the results. First, our geo-based approach identifies potential municipal boundary changes through comparisons of geospatial boundary files and subsequently verifies these cases using legislative sources. This approach enables the consistent analysis of boundary changes across a large number of countries, including those where comprehensive legislative documentation is difficult to access. However, because legislative documents are not systematically collected as an independent first step, some legally relevant changes may remain undetected.

Second, the analysis relies on official geospatial boundary files that typically represent administrative divisions as of January 1 of each year. In practice, however, municipal reforms often take effect at other points during the calendar year. For example, a major administrative–territorial reform in Latvia that reduced the number of municipalities from 119 to 42 entered into force on July 1, 2021 (Saemia Press Service, 2020). As a result, annual geospatial files may capture either the pre-reform or post-reform configuration, but not both within the

same year. Similar timing discrepancies occur elsewhere in Europe, including France, where some municipal mergers take effect mid-year rather than on January 1.

Third, differences in the spatial resolution of municipal boundary files across years may generate false positives when detecting potential boundary changes. Apparent changes may therefore reflect technical inconsistencies in geospatial files rather than genuine administrative reforms. To reduce this risk, all detected cases are manually verified against official legal sources.

Finally, the temporal scope of this study is limited to 2014–2024. While this ten-year interval provides sufficient variation to identify multiple forms of territorial alteration and develop a comprehensive typology, reforms occurring outside this period are not captured. Because boundary changes are detected through year-to-year comparisons of spatial data, some reforms may also become observable with a one-year lag.

This temporal limitation also affects the interpretation of certain categories of boundary change, particularly splits. Some cases recorded as splits may instead reflect reversals of mergers that occurred before the observation period. In such cases, municipalities that re-emerge during the study period may appear as newly created units even though they existed prior to earlier consolidation reforms. Although this limitation does not affect the identification of boundary changes themselves, it should be considered when interpreting specific change categories within the typology.

9 Conclusion

Municipalities are often treated as stable units in comparative research, yet our analysis demonstrates that they change more frequently than is commonly assumed. This poses an important challenge for scholars working with subnational data, as changes in municipal boundaries can introduce measurement error, undermine the comparability of longitudinal data, and lead to biased estimates. Here, we develop an approach for identifying and accounting for these inconsistencies in longitudinal and cross-national municipal data.

The paper makes four contributions. First, we provide a methodological framework for analyzing territorial unit changes across contexts and over time. Building on evidence from

more than 2,000 identified municipal boundary changes, we extend the typology of territorial unit changes developed by Goerlich and Ruiz (2018) by introducing four new types of change and eliminating the residual category "unspecified". Second, we provide new empirical evidence on municipal boundary changes across 35 European countries between 2014 and 2024, showing that territorial restructuring is widespread and varies substantially across countries and over time. Third, we introduce the LoQoG dataset, a new research infrastructure that accounts for spatial changes across European municipalities over a ten-year period and enables the integration of comparable subnational data. Fourth, we provide a framework that supports more rigorous longitudinal and comparative empirical analysis by enabling researchers to track municipalities consistently over time and construct geographically consistent municipal-level panel data.

Beyond these contributions, the paper also opens several avenues for future research. Extending the temporal and geographical scope of the dataset would allow scholars to examine longer-term patterns of territorial restructuring and compare administrative reforms across a broader range of institutional contexts. Future work may also combine the geo-based approach developed here with additional administrative, electoral, fiscal, or demographic data to improve the comparability and measurement validity of longitudinal subnational research.

An additional promising direction concerns the political origins of municipal boundary changes. While the LoQoG dataset documents how municipal boundaries change, future research could further distinguish between reforms initiated by higher levels of government and those emerging from local initiatives. Such distinctions may be particularly valuable for empirical research designs, as exogenously imposed reforms may provide opportunities for causal inference, while locally initiated changes may themselves constitute important political outcomes.

More broadly, as the use of subnational data continues to expand across the social sciences, ensuring that geographic units are consistently defined over time will remain a central methodological challenge. By documenting municipal boundary changes and providing tools to track them systematically, the LoQoG framework contributes to more reliable longitudinal and cross-national research using municipal-level data and supports more credible comparative and causal inference.

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Appendix Contents

A Why municipal boundary change matters

A.1 Municipal Boundary Change in Longitudinal Research

In this section, we show the importance of accounting for municipal boundary changes in research with longitudinal data. Although some researchers recognize the issue of boundary changes, they typically adopt one of two strategies to address it. The first strategy is to restrict the sample only to municipalities whose boundaries remain stable over time, thereby excluding units affected by territorial changes. The second strategy is to limit the temporal scope of analysis to periods during which the number and boundaries of municipalities remained constant.

Several studies deliberately selected only the municipalities whose boundaries remained stable during the study period to ensure the consistency of the panel (Agasisti and Porcelli, 2023; Roesel, 2017; Schmutz and Verdugo, 2023). In the case of France, Schmutz and Verdugo (2023) exclude from their sample any municipality that merged with another during the period of analysis. A similar strategy is employed in Italy by (Agasisti and Porcelli, 2023), who omit municipalities that were aggregated or merged, having therefore changed their geographical boundaries. In Sweden, in order to obtain time-consistent municipality definitions (same name and boundaries of the municipality over time), the authors drop municipalities that did not exist throughout the study period and construct a final sample of time-consistent municipalities for research purposes (Islam et al., 2006). In Germany, (Helm and Stuhler, 2024) adopt a more refined approach: rather than removing all municipalities for which boundaries changed or that merged with other municipalities, they exclude only those whose area changed by more than three square kilometers from one year to another.

Many researchers that use data on French municipalities in their studies also explicitly drop six municipalities from the Meuse department known as *villages died for France* (namely Beaumont-en-Verdunois, Bezonvaux, Cumières-le-Mort-Homme, Fleury-devant-Douaumont, Haumont-près-Samogneux, and Louvemont-Côte-du-Poivre), which were destroyed during the First World War. Although these villages have never been rebuilt or repopulated, they still officially exist as municipalities, with names and codes, and are managed by a council appointed by the prefect of Meuse Breuillé and Le Gallo (2017).

The second strategy is to limit the temporal scope of analysis to periods during which the number and boundaries of municipalities remained constant. For example, Dahlberg and Johansson (1998) analyze 265 Swedish municipalities over the period 1974–1987, a span deliberately chosen because it experienced no municipal boundary changes.[5]

Most studies using panel data on municipalities do not provide any explicit explanation regarding the stability of municipal boundaries in their data. For example, (Costa and Veiga, 2021) perform their analysis on a panel comprising all 278 municipalities in mainland Portugal for the years 1997 to 2017. Despite the fact that Portuguese municipalities are generally characterized by a high degree of territorial stability, the paper does not touch on the question of the extent to which municipal boundaries remained stable during this period.

Given the potential for boundary changes to introduce measurement errors and bias in longitudinal analyses, it is crucial that researchers explicitly address the issue of municipal boundary change when using panel data.

The importance of accounting for changes in municipal boundaries can be illustrated by the case of one de-merger in France. For example, if we were to compare electoral outcomes (such as European Union elections) for the municipality (commune in France) of *Beaumont-*

[5] A major amalgamation of Swedish municipalities took place at the end of 1973, which reduced the number of municipalities from 464 to 278.

les-Nonains as part of a potential research study, using its ID [60054], it would be possible to obtain electoral results from the European Union election data for the years 2014, 2019, and 2024 (Table A1).

Table A1: Example of electoral results obtained for selected municipalities, 2014, 2019 and 2024.

Id	Year	Municipality Name	Voting Bureau Code	Registered Voters	Voters
60054	2014	Beaumont-Les-Nonains	0001	283	149
60455	2014	La Neuville-Garnier	0001	224	106
60694	2014	Villotran	0001	227	124
60054	2019	Les Hauts-Talicans	0001	304	148
60054	2019	Les Hauts-Talicans	0002	114	126
60054	2019	Les Hauts-Talicans	0003	125	130
60054	2024	Beaumont-Les-Nonains	0001	319	178
60694	2024	Les Hauts-Talican	0001	248	131
60694	2024	Les Hauts-Talican	0002	226	130

Source: The European Union Election Data in 2014, 2019 and 2024
https://www.data.gouv.fr/

However, if we relied solely on the name of the municipality *Beaumont-les-Nonains* or on a combination of its name and ID, we would retrieve electoral results only for 2014 and 2024, as this name does not appear in the 2019 dataset. If we used only the ID [60054], we would encounter an inconsistency. Thus, in the 2019 data, this ID corresponds to a different municipal name, *Les Hauts-Talicans*. To understand what happened, it is necessary to examine the evolution of the territorial boundaries of the municipality *Beaumont-les-Nonains* (see Figure A1).

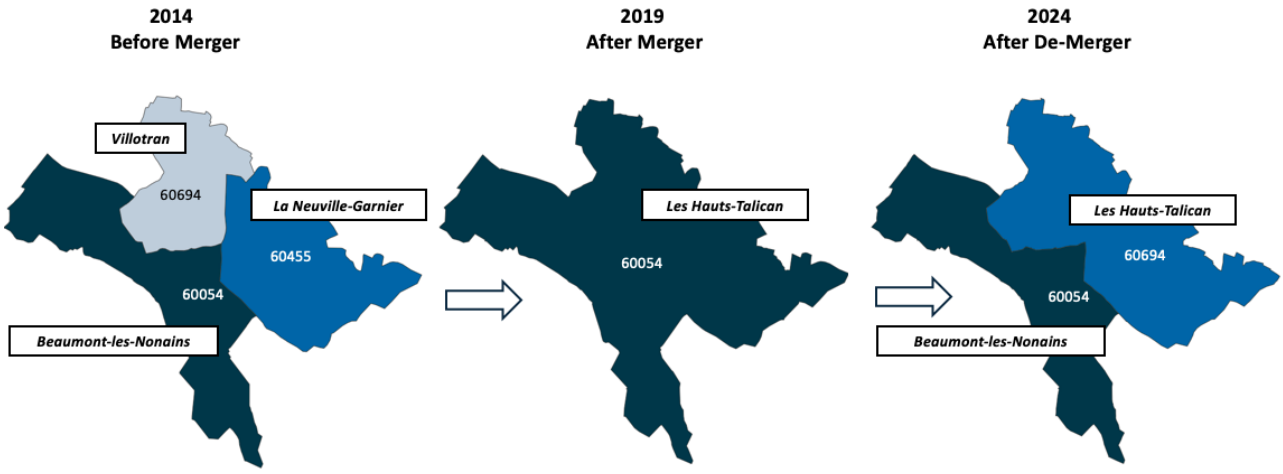


Figure A1: Illustration of boundary changes in selected French municipalities.

As shown in Figure A1, starting in 2019, the municipalities *Beaumont-les-Nonains* [60054], *La Neuville-Garnier* [60455], and *Villotran* [60694] were merged to form a new municipality (commune in France) *Les Hauts-Talican*. The newly created municipality retained the ID of one of the original communes, *Beaumont-les-Nonains* [60054]. As a result, in the 2019 electoral data, the ID [60054] appears, but under a different municipal name.

However, why does ID [60054] once again correspond to *Beaumont-les-Nonains* in the 2024 electoral results? The reason is that, as illustrated in Figure A1 (and confirmed by official legislative sources), starting in 2024, *Beaumont-les-Nonains* was re-established as an independent municipality, with territorial boundaries identical to those prior to the 2019 merger. It reverts to its previous name, *Beaumont-les-Nonains*, and resumes the ID [60054]. The municipality *Les Hauts-Talican*, now consisting only of the former municipalities *Neuville-Garnier* and *Villotran*, conserves the name *Les Hauts-Talican* but adopts a new ID [60694], inherited from *Villotran*.

Thus, in order to track municipal units and accurately interpret what has happened to all municipalities and their corresponding identifiers in electoral (or other) datasets, it is crucial to have information on boundary changes and how these boundaries align with municipal names and IDs.

A.2 A new approach to track municipal boundary changes (LoQoG ID and Case ID)

In the previous section, we demonstrated the importance of accounting for municipal boundary changes for longitudinal research. The main challenge in tracking municipal units lies in the fact that standard municipal IDs used in national statistical data do not reflect changes in municipal boundaries. In this subsection, we demonstrate: (1) the problems that arise when a municipality's ID does not capture boundary changes, using Italian population data as an example; (2) existing attempts to create new municipal IDs that account for boundary changes and thereby enable proper linkage between statistical data and the actual geographic boundaries of municipalities; and (3) the advantages of our approach, which allow users not only to identify when municipal boundaries have changed, through the creation of an auxiliary LoQoG ID that captures boundary modifications, but also to explain why these changes occurred, drawing on the LoQoG Typology of Municipal Changes, and to show which municipalities were involved, through additional Case_ID codes created for each individual change.

Firstly, we use the example of Italian municipal-level population data to illustrate the impact of inherited municipal IDs. Our analysis shows that almost all cases of significant population growth are not attributable to real demographic dynamics. Instead, they result from municipal mergers, in which the newly formed municipalities retained the same name and ID as one of the pre-existing entities. Consequently, the reported population values reflect administrative restructuring rather than actual demographic change.

Table A2 illustrates how population figures are reported in two contrasting situations: Example No. 1 (Merger with the inherited ID) and Example No. 2 (Merger with the new ID). In the first case, the municipality *Faedo* [022080] merged with *San Michele all'Adige* [022167], and the newly formed municipality inherited both the name and the identifier [022167] of *San Michele all'Adige*. As a result, in the official Italian statistics, the new municipality has been treated as a direct continuation of the former *San Michele all'Adige* since 2021. The reported population increase of more than 20% in *San Michele all'Adige* is therefore explained by the merger process rather than by actual demographic change.

In the second example, where the newly created municipality adopts both a new name and a new ID following a merger, as in the case of *Vermezzo con Zelo* [015251], such inconsistencies do not occur. In this situation, the new municipality *Vermezzo con Zelo* [015251] is registered in the statistical system as a distinct municipality, thereby preventing any conflation of records based on inherited names or IDs.

Not only mergers can cause discrepancies in municipal statistical indicators. This problem arises in any situation where changes in municipal boundaries are not reflected in the official

Table A2: Examples of Population Data for Municipalities in Italy

Municipality	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*
Example No. 1 (Merger with the inherited ID)						
Faedo [022080]	642	643	..	..	..	..
San Michele all'Adige [022167]	3 228	3 268	3 956	4 010	4 051	4 103
Example No. 2 (Merger with the new ID)						
Vermezzo [015235]	3 928	..	..	..	..	..
Zelo Surrigone [015246]	1 884	..	..	..	..	..
Vermezzo con Zelo [015251]	..	5 754	5 796	5 831	5 890	5 910
Example No. 3 (Separation)						
Misiliscemi [081025]	..	..	..	8 415	8 523	8 491
Trapani [081021]	66 289	65 841	65 378	56 293	55 816	55 229

Source: ISTAT https://esploradati.istat.it/databrowser/#/en

municipal identifiers and, consequently, in subsequent statistical indicators. This can be observed, for example, in the case of a separation process in Italy (see Table A2). In this case, since 2021, the new municipality *Misiliscemi* [081025] was established through the separation of part of the territory from the municipality *Trapani* [081021], which continues to exist. The municipality *Trapani* retained both its name and ID, while *Misiliscemi* acquired a new name and a new ID. Thus, the nearly 14% decline in the population of the municipality *Trapani* in 2022 is explained not by demographic or other factors, but by the separation of part of its territory into a new municipality, which was not reflected in the municipal identifiers and, consequently, in the statistical data.

A.3 Tracking all meaningful boundary changes over time

The developed geo-based approach, combining algorithmic detection of boundary changes with systematic legal verification, constitutes a replicable methodological framework that extends beyond its current application. This section outlines four pathways for scaling the methodology: temporal extension within the existing country sample, geographical expansion to new countries, vertical application across different levels of government, and integration with statistical data infrastructure.

Temporal Extension: Continuous Monitoring of Municipal Change. A key advantage of the algorithmic approach is its capacity for automation, enabling continuous monitoring of municipal boundary changes as new geospatial data become available. The methodology can be operationalized as a recurring pipeline with the following components:

1. *Automated Data Acquisition.* Official geospatial repositories across the 35 European countries release updated boundary files on regular schedules, typically annually. A systematic

data harvesting protocol can monitor these repositories and retrieve new vintages as they become available.

2. *Change Detection Module.* The core algorithms developed for this study, polygon comparison, intersection analysis, and threshold-based classification, can be packaged as a modular detection system that automatically flags potential changes when new geospatial vintages are acquired.

3. *Verification Queue.* Detected changes are compiled into a verification queue, prioritized by change type and magnitude. This queue feeds into the legal verification workflow, where researchers consult official legislative sources to confirm or reject each flagged change. Over time, country-specific patterns in legislative publication can be documented, accelerating the verification process.

4. *Database Integration.* Confirmed changes are integrated into the master database, updating the LoQoG identifiers and Case IDs accordingly. The historical record is preserved through versioning, ensuring that users can access both current and historical configurations.

Geographical Expansion: Extending Coverage Beyond Europe. The methodological framework is not inherently limited to European municipalities. The same principles, algorithmic detection of polygon changes combined with legal verification, can be applied to local government units in any country where two conditions are met: (1) availability of official geospatial boundary data at the relevant administrative level, and (2) accessibility of legal documentation confirming boundary modifications.

Vertical Extension: Application to Different Tiers of Government. The LoQoG methodology focuses on the lowest tier of local government, the municipality, but the same principles apply to other administrative levels. Regional boundaries, provincial boundaries, and even national boundaries are subject to change over time, and researchers working at these scales face analogous challenges in tracking units consistently across periods.

Integration with Statistical Data Infrastructure. Beyond serving as a research dataset, the LoQoG identifier system offers a potential contribution to how statistical agencies manage and disseminate geographically referenced data. Current practices, wherein municipal identifiers remain unchanged despite boundary modifications, generate inconsistencies that complicate longitudinal analysis and can mislead users who are unaware of underlying territorial changes.

A.4 Use for research

In this section, we outline potential uses of the LoQoG dataset, demonstrating how it can support both validation of existing data and the creation of new geospatial datasets.

1. Validation of existing datasets.

For researchers who already have data at the municipal level, the LoQoG dataset can serve as a reference to validate the geographic consistency of their tracking units. Using our data, one can assess whether the units under study truly maintain a stable geography over the analyzed time period, or whether territorial changes might affect the comparability of results.

2. Population of geospatial units with new data.

For researchers without an existing dataset, LoQoG provides a ready-made framework to attach information of interest to standardized geographic units. By linking data to geocoded municipalities, researchers can ensure consistent spatial units across time, minimizing potential biases arising from changes in boundaries or scales.

B Code-based Change Identification

Geospatial data files were obtained from official repositories of respective country in various formats, including GeoPackage (GPKG), GeoJSON, Shapefile, and GML, among others. To ensure consistency, all files were converted to the GeoPackage format, reprojected to a common coordinate reference system (EPSG:3035). We preferred this CRS because it is an equal-area coordinate reference system which preserves relationships across the whole continent, making it especially suitable for comparing polygon sizes and detecting municipal boundary changes over time. We also standardised our data into uniform encoding UTF-8. During this phase, 11 standardized GeoPackage files were generated for each country with the following standardized attribute fields:

- `mun_id`: local unique identifier of the municipality as provided by the official country source;
- `mun_name`: name of the municipality;
- `shape_area`: area of the municipality;
- `year`: year corresponding to the shapefile data.

To ensure geometric validity, all spatial geometries were validated. Where invalid geometries were detected, a small buffer of 0.01 units was applied to correct topological errors. Our spatial analysis, defined as the examination of patterns, relationships, and processes across geographic space (Goodchild and Haining, 2004; Rey and Franklin, 2022) focused on municipal boundary changes. These changes were assessed through year-to-year comparisons over the 10-year period, thereby enabling a longitudinal understanding of spatial dynamics. Municipal mergers were identified by detecting municipalities that appeared in the geospatial file for year t but were absent in the file for year $t+1$. A reduction in the total number of municipalities between t and $t+1$ served as an initial indicator of potential mergers. To verify these cases, a spatial intersection analysis was performed: each potentially merged municipality was intersected with the new entities in the geospatial file for year $t+1$, and the area of overlap was calculated relative to the municipality's area in year t. Municipal mergers were identified by detecting municipalities present in the geospatial file for year t, but were absent in the file for year $t+1$. A decrease in the total number of municipalities between t and $t+1$ served as an initial indicator of potential mergers. To verify these cases, a spatial intersection analysis was conducted: each potentially merged municipality was intersected with the new entities in geospatial file for year $t+1$, and the area of overlap was calculated relative to the municipality's area in year t, using the following formula:

$$IP = \left(\frac{I}{A_t}\right) \times 100$$

$$VI = IP > 49$$

where IP is the percentage of intersection, I is the area of spatial intersection, and A_t is the area of the original municipality in year t, and VI represents a valid intersection within the threshold of more than 49%. To validate the area of change, we conducted a consistency test based on the assumption that the combined areas of the abolished municipalities should equal the area of the newly created municipality. This assumption, however, did not always hold, as some municipalities involved in mergers were only partially abolished, with portions of their territory incorporated into the new entity. To address this issue, we tested a range of area thresholds, beginning at 90% and gradually decreasing to 50%. At each step, the results were cross-verified against the relevant legislation to identify the saturation point at which all

components of a merger case were accurately captured. Ultimately, a 50% threshold was determined to be the most appropriate. An analogous procedure was applied to establish thresholds for splits and boundary adjustments. Thus, a threshold of $IP > 49\%$ was applied to ensure that a substantial portion of the original municipality was incorporated into a new administrative entity. Recognizing that not all mergers entail complete (i.e., 100%) spatial overlap, supplementary analyses were conducted for France, Italy, Germany, and Austria to determine an appropriate threshold for defining a merger. These comparative assessments corroborated the choice of the 50% threshold, which was subsequently validated against official administrative records. To identify municipal splits, a procedure complementary to the merger analysis was applied. First, municipality IDs absent in the pre-year (t) geospatial file but present in the post-year ($t + 1$) file were identified as potential split outcomes. Additionally, municipalities present in both years' geospatial files were examined, as they might have contributed portions of their territory to the formation of new municipalities. Spatial intersection analyses were conducted between the two years to determine which pre-existing municipalities contributed territory to the newly formed entities. Intersections were filtered to include only those where the area of overlap exceeded 1% but remained below 70% of the original municipality's area. This range was selected to exclude minor boundary modifications (below 1%) and to prevent overlap with the merger classification (above 70%). The following formulas were applied:

$$IP = \left(\frac{I}{A_t}\right) \times 100$$

$$VI = (IP > 1) \ \& \ (IP < 70)$$

where IP is the percentage of intersection, I is the area of spatial intersection, and A_t is the area of the original municipality for year (t), and VI represents a valid intersection range for splits, defined within the threshold of more than 1% and less than 70%, and IP is the percentage of intersection. This method facilitated the identification of cases in which a new municipality emerged from one or more pre-existing municipalities. To ensure completeness, the process was repeated for new municipalities' geospatial file for year $t+1$ that had significant intersections with multiple existing municipalities from year t. Finally, intersection results from both directions (t-to-$t+1$ and $t+1$-to-t) were combined to identify and verify all potential splits. Regarding boundary changes, municipalities present in both geospatial files were analyzed, and intersections below 1% were examined to determine whether boundaries had changed. Municipalities exhibiting changes in area size were deemed as potential cases of boundary change. We further compared the area of each municipality for years t and $t + 1$ to determine the direction of change. Municipalities that lost territory showed a reduction in area size, whereas those that gained territory showed an increase. The following formulas were applied:

$$\textit{diff} = A_{t+1} - A_t$$

$$VI = IP < 1$$

where *diff* is the difference between the area of the municipality for years A_{t+1} and A_t; A_{t+1} is the area of the municipality for year $t + 1$; A_t is the area of the municipality for year t, where t denotes the year; VI represents a valid intersection within the threshold of less than 1%; and IP is the percentage of intersection. Non-geographical changes included modifications to the identifiers and names of municipalities. We compared the names and IDs of municipalities across geospatial files corresponding to different years. Any differences in names were recorded as name changes, while discrepancies in IDs were recorded as ID changes. Furthermore, we

verified whether these differences corresponded to the same administrative unit or to distinct entities.

C Boundary Changes

C.1 Merger

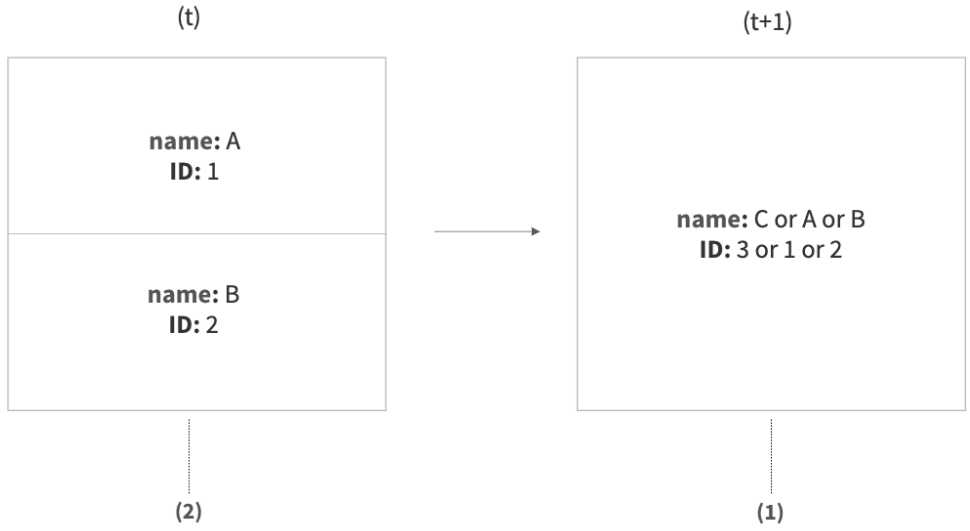
C.1.1 Merger: simple

1. Definition: The creation of a new municipality whose territory results from the union of two pre-existing municipalities.

2. Implications of the change:

   - *year (t)*: municipalities A (ID 1) and B (ID 2) exist as separate administrative entities, each possessing its own name, ID, and territory.
   - *year (t + 1)*: municipalities A and B ceased to exist; municipality D is created, covering the combined territory of A and B. Municipality C either carries forward one predecessor's name/ID or receives a new name/ID.

3. Visual overview[6]



4. Examples:

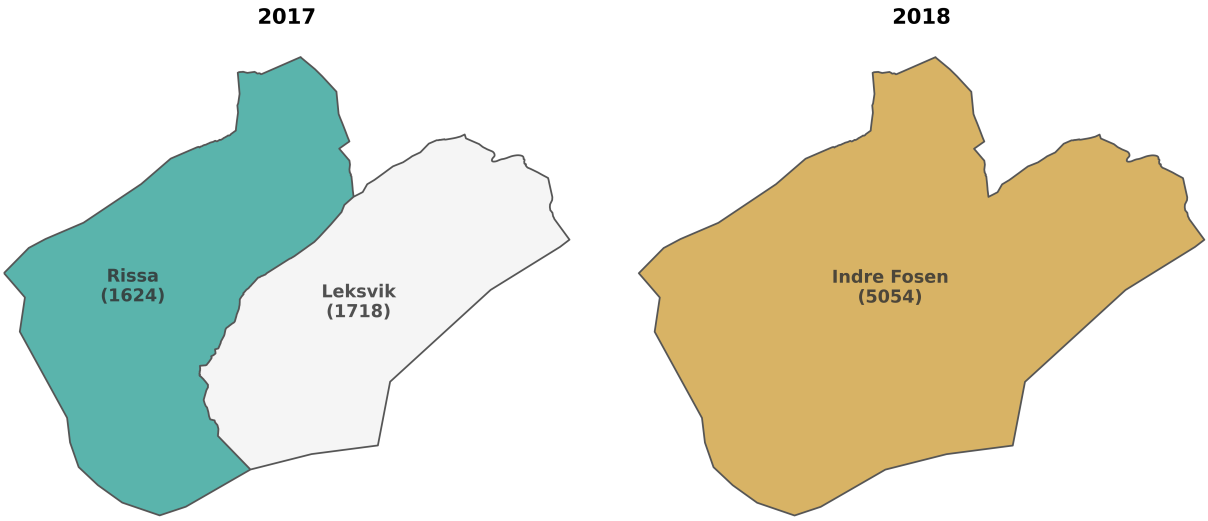
   - New name and inherited ID. The new municipality (Commune in France) Val de Lambronne (ID 11080) was created through the merger of the municipalities Caudeval (ID 11080) and Gueytes-et-LabastIDe (ID 11171). The name Val de Lambronne is new, and the ID was inherited from the municipality of Caudeval (Légifrance, 2015). Case ID: fr-m-34-2015-2016
   - Inherited name and inherited ID. The new municipality (Commune in Luxembourg) Wiltz (ID 0807) was created through the merger of the municipalities Wiltz (ID 0807) and Eschweiler (ID 0803). Both the name and ID were inherited from the former Wiltz municipality (Légilux, 2014). Case ID: lu-m-1-2014-2015
   - Inherited name and new ID. The new municipality (Kommune in Norway) Larvik (ID 0712) was created through the merger of the municipalities Larvik (ID 0709) and

[6]Here and below in Section 3, Visual overview, the number of municipal units involved is indicated in parentheses under each description.

Lardal (ID 0728). The name Larvik is inherited from the former Larvik municipality, and the ID 0712 was new (Lovdata, 2016a). Case ID: no-m-2-2017-2018

- New name and new ID. The new municipality (Kommune in Norway) Indre Fosen (ID 5054) was created through the merger of the municipalities Leksvik (ID 1718) and Rissa (ID 1624). Both the name and the ID are new (Lovdata, 2016b).Case ID: no-m-6-2017-2018

5. Map:



C.2 Merger

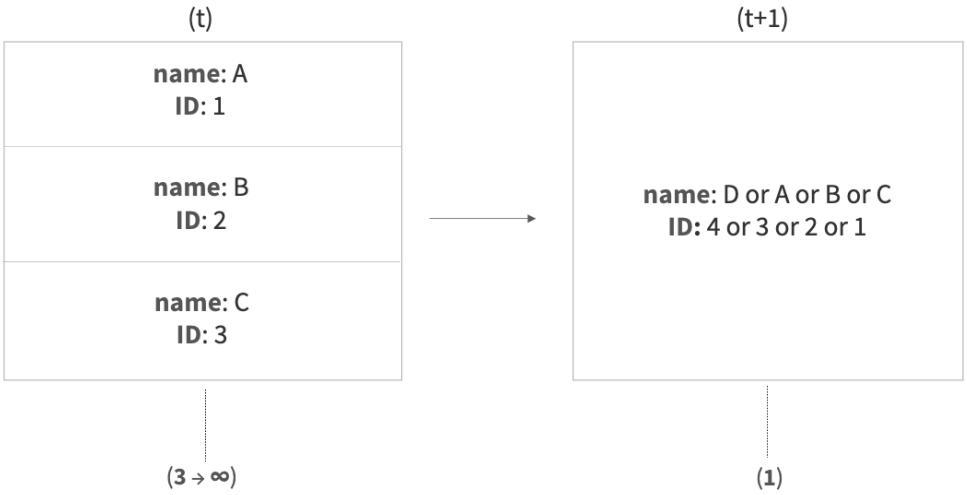
C.2.1 Merger: multiple

1. Definition: The creation of a new municipality whose territory results from the union of more than two pre-existing municipalities.

2. Implications of the change:

   - *year (t)*: municipalities A (ID 1), B (ID 2), and C (ID 3) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: municipalities A, B, and C were dissolved. Municipality D was created, covering the combined territory of Municipalities A, B, and C. Municipality D either carries forward one predecessor's name/ID or receives a new name/ID.

3. Visual overview

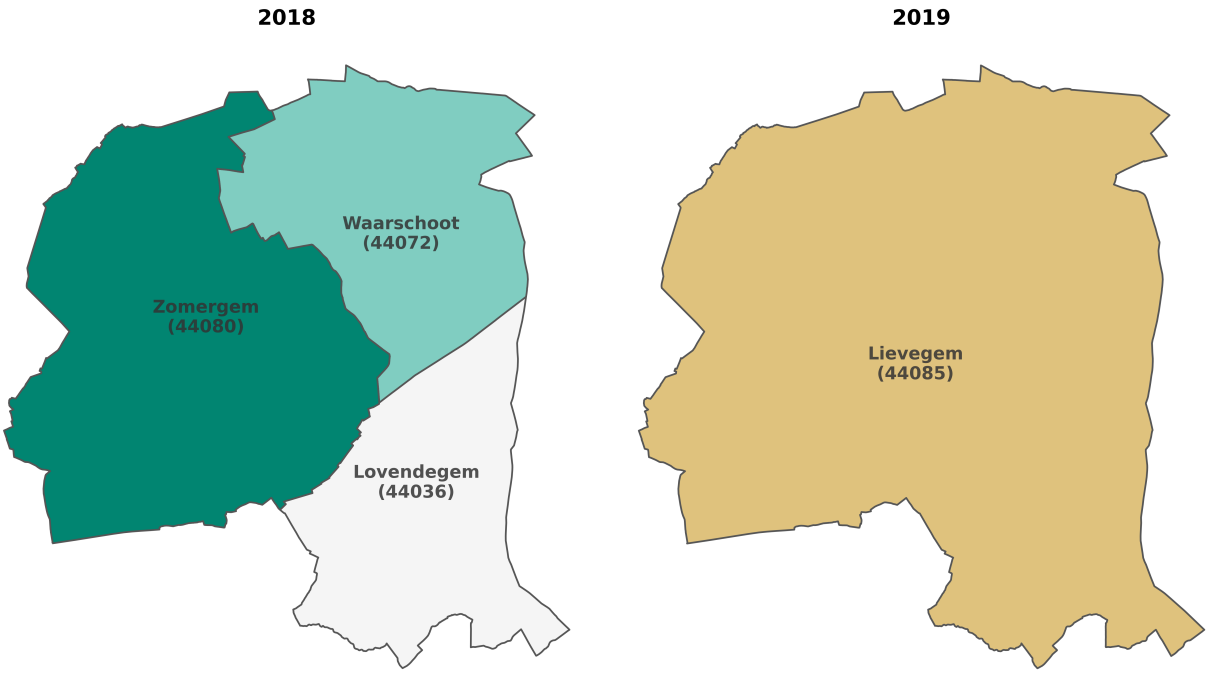


4. Examples:

   - New name and inherited ID. The new municipality (Commune in France) Les Trois Châteaux (ID 39378) was created through the merger of the municipalities L'Aubépin (ID 39023), Chazelles (ID 39135), and Nanc-lès-Saint-Amour (ID 39378). The name is new, while the ID was inherited from Nanc-lès-Saint-Amour (Légifrance, 2016). Case ID: fr-m-430-2016-2017
   - Inherited name and inherited ID. The new municipality (Gemeinde in Germany) Friedland (ID 130715152035) was created through the merger of the municipalities Eichhorst (ID 130715152031), Glienke (ID 130715152040) and Friedland (ID 130715152035). Both the name and ID were inherited from the former Friedland municipality (Regierungsportal Mecklenburg-Vorpommern, 2014). Case ID: de-m-10-2014-2015
   - Inherited name and new ID. The new municipality (Gemeinde in Austria) Bad Mitterndorf (ID 61255) was created through the merger of the municipalities Bad Mitterndorf (ID 61226), Pichl-Kainisch (ID 61233), and Tauplitz (ID 61245). The name was inherited from Bad Mitterndorf, while the ID is new (RIS – Legal Information System Austria, 2013). Case ID: at-m-33-2014-2015

- New name and new ID. The new municipality (Gemeente in Belgium) Lievegem (ID 44085) was created through the merger of the municipalities Waarschoot (ID 44072), Lovendegem (ID 44036), and Zomergem (ID 44080). Both the name and the ID are new (Service public federal Justice, 2018). Case ID: be-m-4-2018-2019

5. Map:



C.3 Split

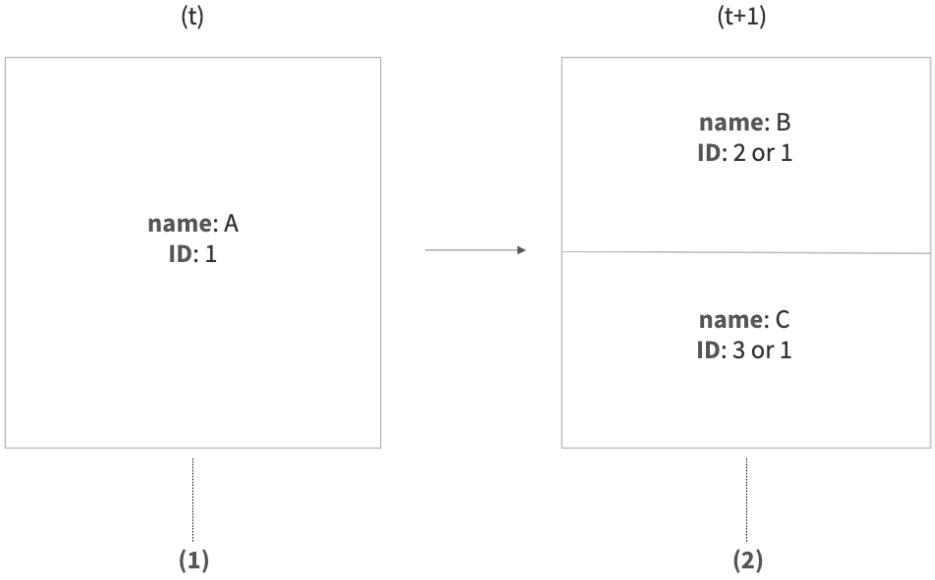
C.3.1 Split: simple

1. Definition: The dissolution of one municipality, whose territory is divided among two newly established municipalities, neither of which retains the legal or administrative aspects of the original entity.

2. Implications of the change:

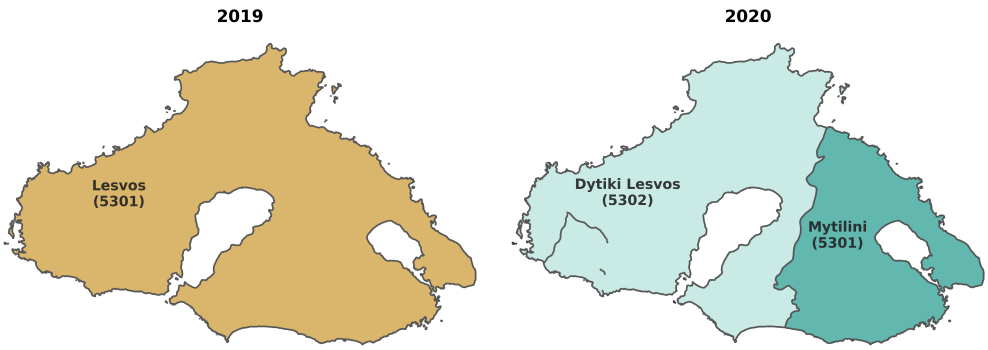
   - *year (t)*: Municipality A (ID 1) exists as a separate entity with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A was dissolved. Municipalities B and C were created, covering the territory of Municipality A. Municipalities B and C have their own names and IDs, or one of them retains Municipality A's ID.

3. Visual overview



4. Example: Since 2020, the municipality (dímos in Greece) of Lesvos (ID 5301) has been dissolved. Two new municipalities were created in its place: Dytiki Lesvos (ID 5302) and Mytilini (ID 5301), covering the entire territory of the former municipality of Lesvos. Dytiki Lesvos received a new ID, while the ID of Mytilini was retained from the former municipality of Lesvos (Government Gazette Greece, 2019; Ministry of Interior, 2019). Case ID: gr-s-4-2019-2020

5. Map:



C.4 Split

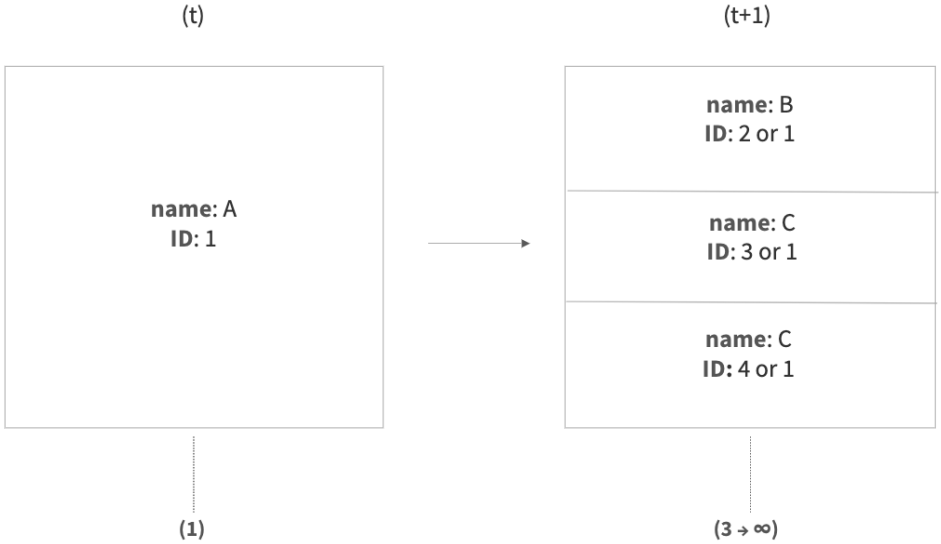
C.4.1 Split: multiple

1. Definition: The dissolution of one municipality, whose territory is divided among more than two newly established municipalities, none of which retains legal or administrative aspects of the original entity.

2. Implications of the change:

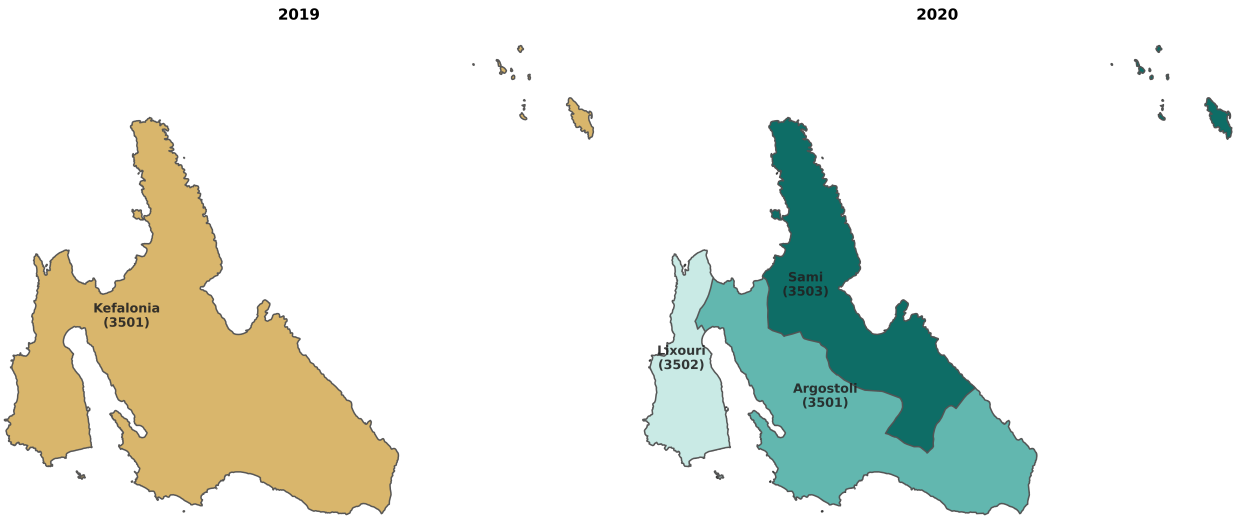
   - *year (t)*: Municipality A (ID 1) exists as a separate entity with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A was dissolved. Municipalities B, C, and D were created, covering the territory of Municipality A. Municipalities B, C, and D have their own names/IDs, or one of them retains Municipality A's ID.

3. Visual overview



4. Example: Since 2020, the municipality (dímos in Greece) of Kefalonia (ID 3501) has been dissolved. Three new municipalities were created in its place: Lixouri (ID 3502), Sami (ID 3503), and Argostoli (ID 3501), covering the entire territory of the former municipality of Kefalonia. Lixouri and Sami received new IDs, while the ID of Argostoli was retained from the former municipality of Kefalonia (Government Gazette Greece, 2019; Ministry of Interior, 2019). Case ID: gr-s-3-2019-2020

5. Map:


2019
Kefalonia
(3501)
2020
Sami
(3503)
Lixouri
(3502)
Argostoli
(3501)

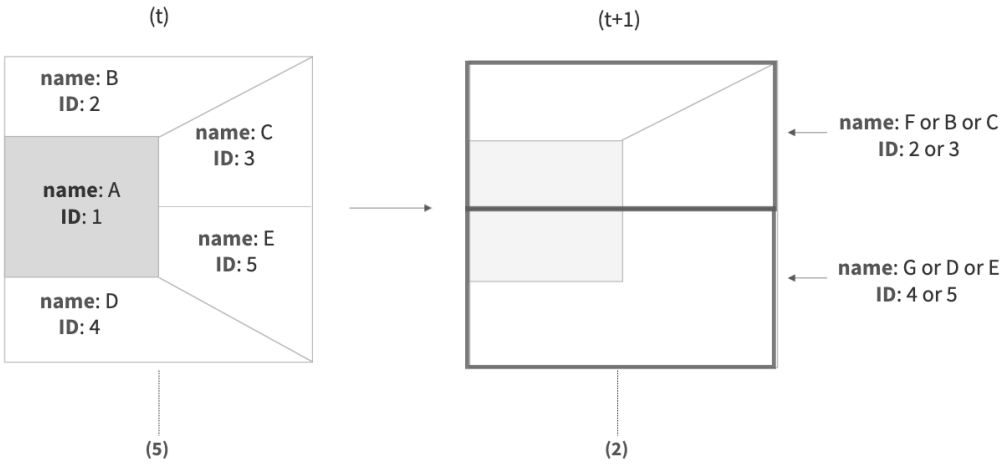
C.5 Composite restructuring

1. Definition: The simultaneous dissolution of one or multiple municipalities and the merger of their entire or partial territories, along with other pre-existing municipalities, into newly created municipalities.

2. Implications of the change:

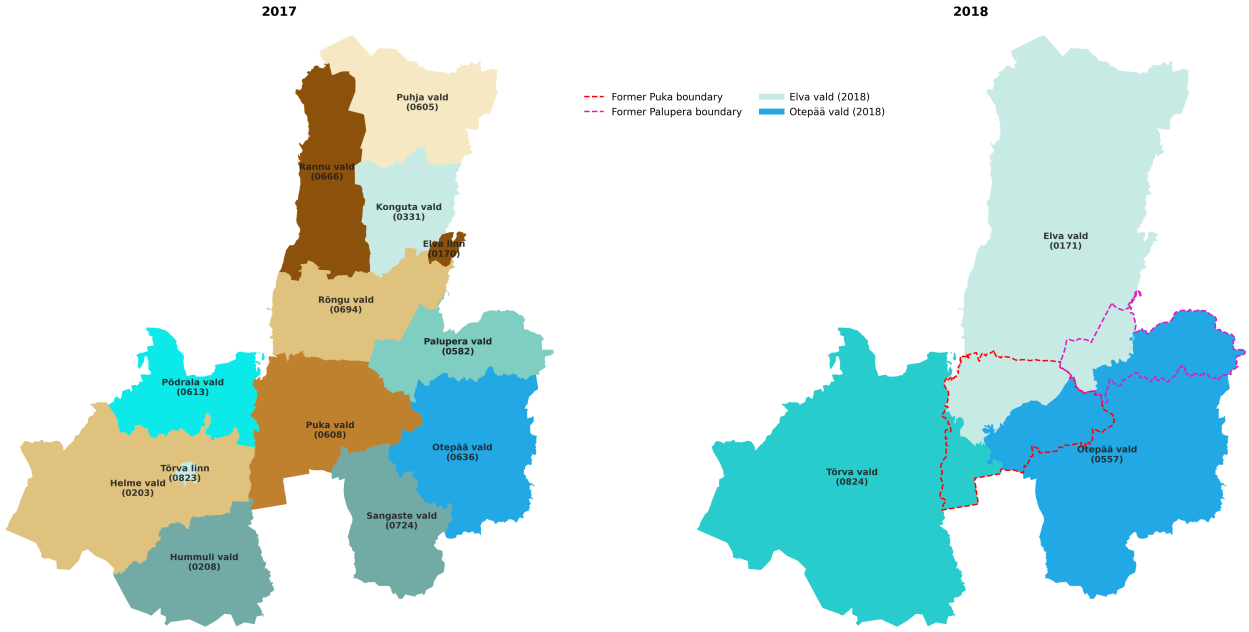
   - *year (t)*: Municipalities A (ID 1), B (ID 2), C (ID 3), D (ID 4), and E (ID 5) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A was dissolved. Part of its territory participated in a merger to create a new Municipality F, while another part participated in a merger to create a new Municipality G. Municipalities B and C were dissolved. Municipality F was created, covering the combined territory of Municipalities B and C, and a part of territory from Municipality A. Municipality F either retains one predecessor's name/od or receives a new name/ID. Municipalities D and E were dissolved. Municipality G was created, covering the combined territory of Municipalities D and E, and another part of territory from Municipality A. Municipality G either retains one predecessor's name/ID or receives a new name/ID.

3. Visual overview



4. Example: Since 2018, the municipality Palupera (vald in Estonia, ID 0582) was dissolved, and its entire territory was divIDed between two newly created municipalities: Elva (ID 0171) and Otepää (ID 0557), each receiving 7 villages. At the same time, the new municipality Elva vald (ID 0171) was created through the merger of the municipalities Elva linn (ID 0170), Konguta vald (ID 0331), Puhja vald (ID 0605), Rannu vald (ID 0666), Rõngu vald (ID 0694), and part of the former Palupera municipality (7 villages) (source). The new municipality Otepää vald (ID 0557) was created through the merger of the municipalities Otepää vald (ID 0636), part of Puka vald (ID 0608), Sangaste vald (ID 0724), and the remaining part of Palupera municipality (7 villages) (Riigi Teataja, 2017a, 2017b, 2017c). Case ID: ee-cr-1-2017-2018

5. Map:



C.6 De-Merger

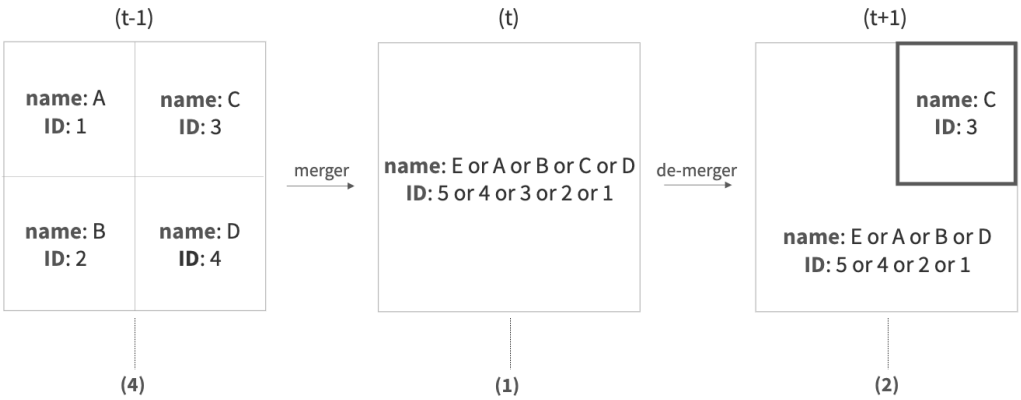
C.6.1 De-Merger: simple

1. Definition: The re-establishment of one municipality that had previously participated in a merger (either simple or multiple) into a new, separate municipality whose territory exactly matches its original boundaries prior to the merger, thereby fully reversing the territorial effects of its inclusion in that merger.

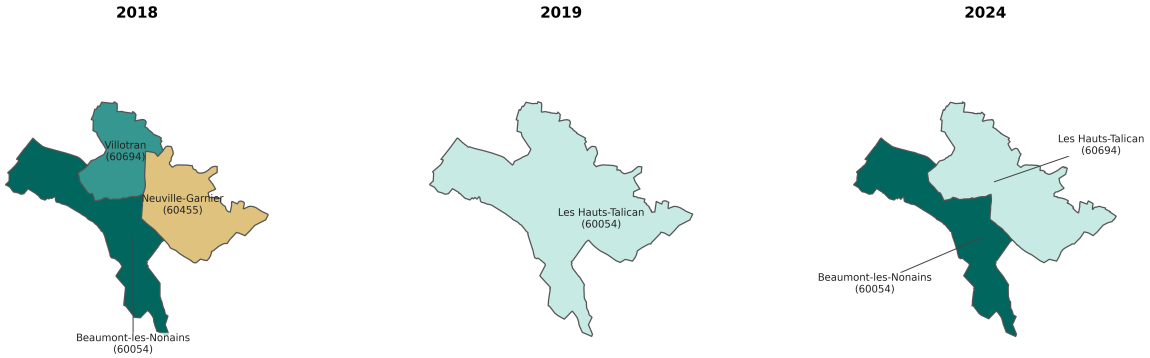
2. Implications of the change:

   - *year (t - 1)*: Municipalities A (ID 1), B (ID 2), C (ID 3), and D (ID 4) exist as separate entities, each with its own name, ID, and territory.
   - *year (t)*: Municipalities A, B, C, and D were dissolved. Municipality E was created, covering the combined territory of Municipalities A, B, C and D. Municipality E either retains one predecessor's name/ID or receives a new name/ID.
   - *year (t + 1)*: Municipality C was re-established as a new, separate municipality whose territory exactly matches its original boundaries prior to the merger (year t - 1). Municipality E, from (year t + 1), combines only territories of Municipalities A, B and D.

3. Visual overview
4. Example: Since 2019, the new municipality (commune in France) Les Hauts-Talican (ID 60054) was formed by the merger of the municipalities Beaumont-les-Nonains (ID 60054), Neuville-Garnier (ID 60455), and Villotran (ID 60694). The name was new, and the ID was inherited from Beaumont-les-Nonains (source). However, since 2024, the municipality Beaumont-les-Nonains is re-established as a new, separate municipality whose territory exactly matches its original boundaries prior to the merger. It reverts to its previous name, Beaumont-les-Nonains, and resumes the ID 60054. The municipality Les Hauts-Talican, now consisting only of the former municipalities Neuville-Garnier and Villotran (from year t + 1), conserves the name Les Hauts-Talican but adopts a new ID, 60694, inherited from Villotran (Légifrance, 2023a). Case ID: fr-dm-1-2023-2024


(t-1)
(t)
(t+1)
name: A
ID: 1
name: C
ID: 3
name: B
ID: 2
name: D
ID: 4
merger
name: E or A or B or C or D
ID: 5 or 4 or 3 or 2 or 1
de-merger
name: C
ID: 3
name: E or A or B or D
ID: 5 or 4 or 2 or 1
(4)
(1)
(2)

5. Map:


2018
2019
2024
Villotran
(60694)
Neuville-Garnier
(60455)
Beaumont-les-Nonains
(60054)
Les Hauts-Talican
(60054)
Les Hauts-Talican
(60694)
Beaumont-les-Nonains
(60054)

C.7 De-Merger

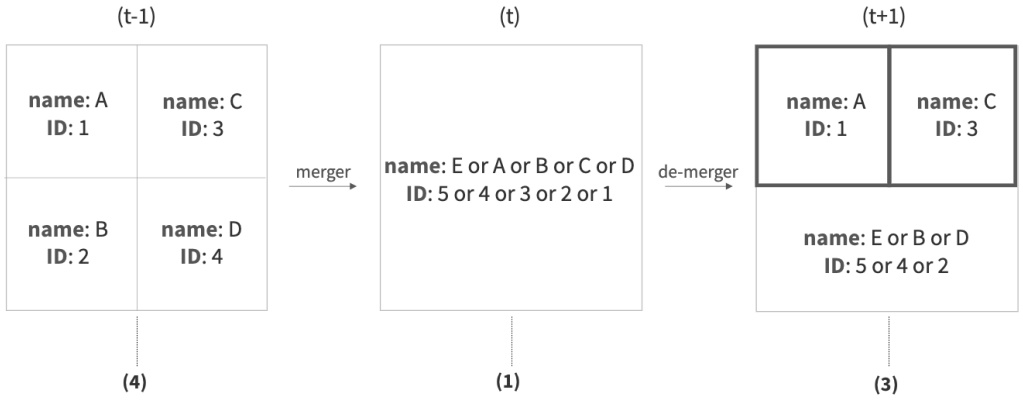
C.7.1 De-Merger: multiple

1. Definition: The re-establishment of more than one municipality that had previously participated in a merger (either simple or multiple) into a new, separate municipalities whose territories exactly match their original boundaries prior to the merger, thereby fully reversing the territorial effects of its inclusion in that merger.

2. Implications of the change:

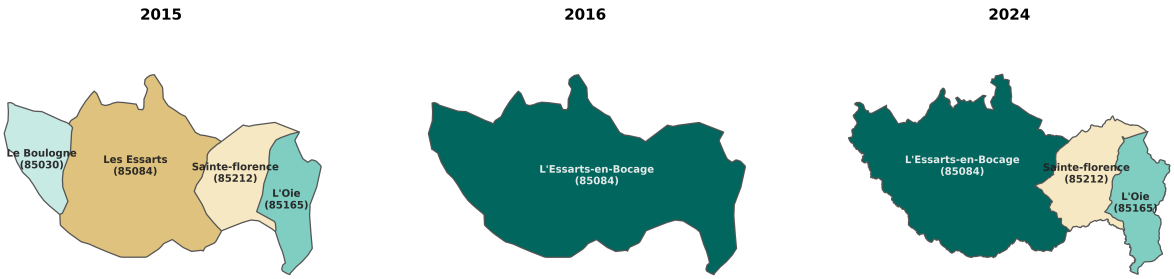
   - *year (t - 1)*: Municipalities A (ID 1), B (ID 2), C (ID 3), and D (ID 4) exist as separate entities, each with its own name, ID, and territory.
   - *year (t)*: Municipalities A, B, C, D were dissolved. Municipality E was created, covering the combined territory of Municipalities A, B, C and D. Municipality E either retains one predecessor's name/od or receives a new name/ID.
   - *year (t + 1)*: Municipalities A and C were re-established as new, separate municipalities whose territory exactly match their original boundaries prior to the merger (year t - 1). Municipality E, from (year t + 1), combines only territories of Municipalities B and D.

3. Visual overview



4. Example: Since 2016, the new municipality (commune in France) L'Essarts-en-Bocage (ID 85084) was formed by the merger of the municipalities Les Essarts (ID 85084), Le Boulogne (ID 85030), L'Oie (ID 85165), and Sainte-Florence (ID 85212). The name was new, and the ID was inherited from Les Essarts (source). However, since 2024, two municipalities — (1) L'Oie (source) and (2) Sainte-Florence (source) — are re-established as new, separate municipalities whose territories exactly match their original boundaries prior to the merger. They revert to their previous names and IDs. The municipality L'Essarts-en-Bocage, now consisting only of the former municipalities Les Essarts and Le Boulogne (from year t + 1), retains the name L'Essarts-en-Bocage and the ID 85084, inherited originally from Les Essarts (Légifrance, 2023b). Case ID: fr-dm-3-2023-2024

5. Map:



C.8 Separation

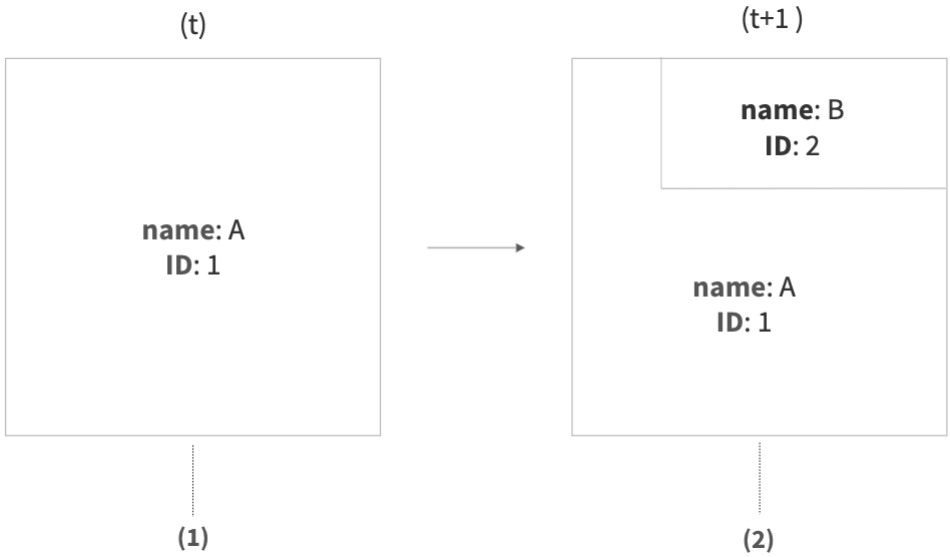
C.8.1 Separation: simple

1. Definition: The creation of a new municipality through the separation of a part of the territory from one municipality, which continues to exist.

2. Implications of the change:

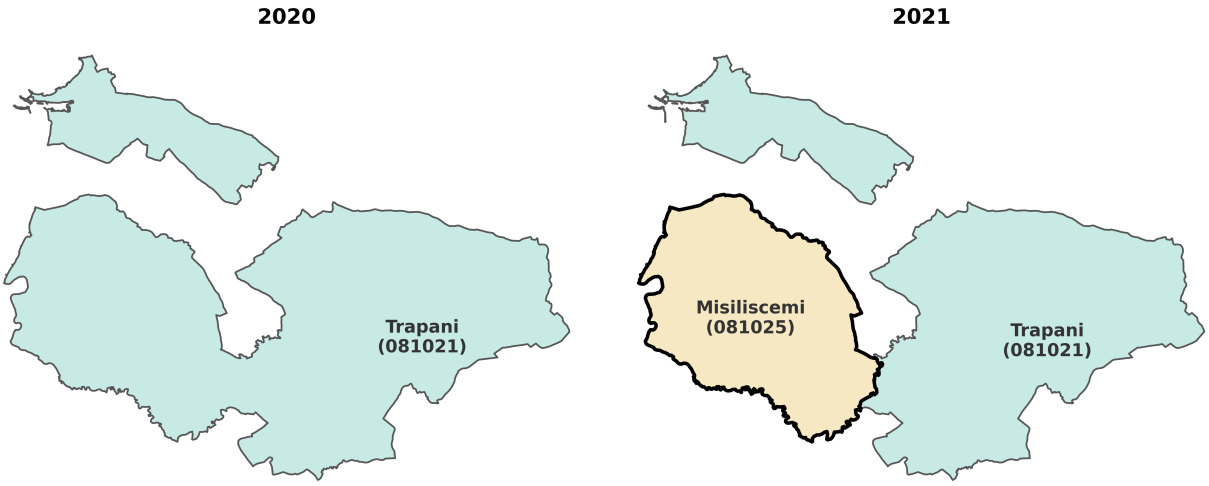
   - *year (t)*: Municipality A (ID 1) exists as a separate entity with its own name, ID, and territory.
   - *year (t + 1)*: Municipality B was created by separating a part of the territory from Municipality A, which continues to exist without changing its own name and ID. Municipality B has its own name and ID.

3. Visual overview



4. Example: Since 2021, the new municipality (comune in Italy) Misiliscemi (ID 081025) was created through the separation of part of the territory from the municipality of Trapani (ID 081021), which continues to exist. While Trapani retained both its name and its municipal ID (081021), its territorial boundaries were reduced. The newly established municipality of Misiliscemi has both a new name and a new municipal ID (081025) (Gazzetta Ufficiale Sicilia, 2021). Case ID: it-se-2-2020-2021

5. Map:


2020
Trapani
(081021)
2021
Misiliscemi
(081025)
Trapani
(081021)

C.9 Separation

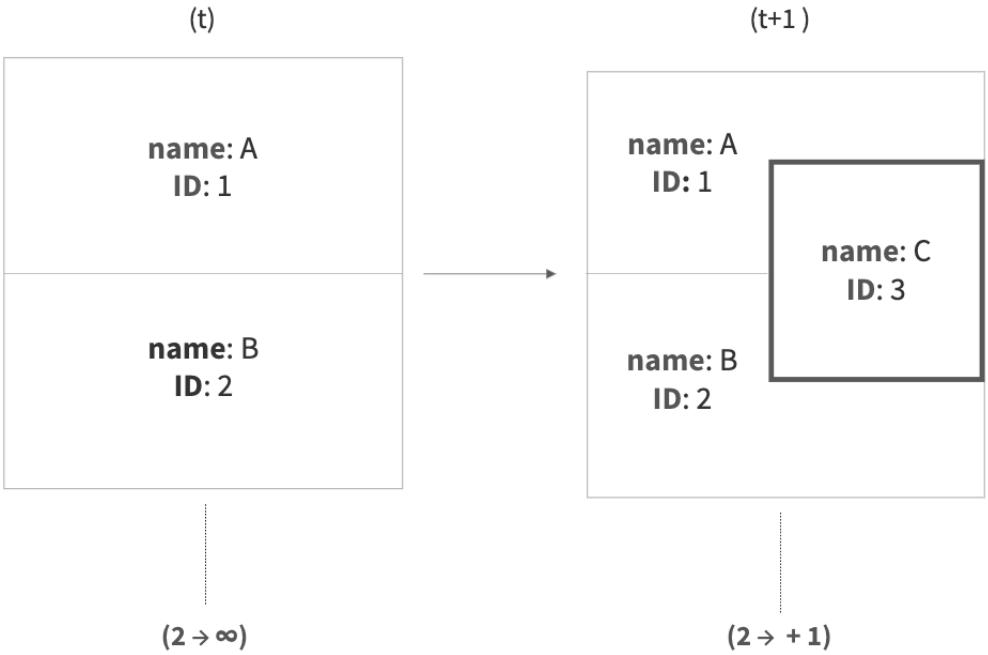
C.9.1 Separation: multiple

1. Definition: The creation of a new municipality through the separation of a part of the territory from more than one municipality, all of which continue to exist.

2. Implications of the change:

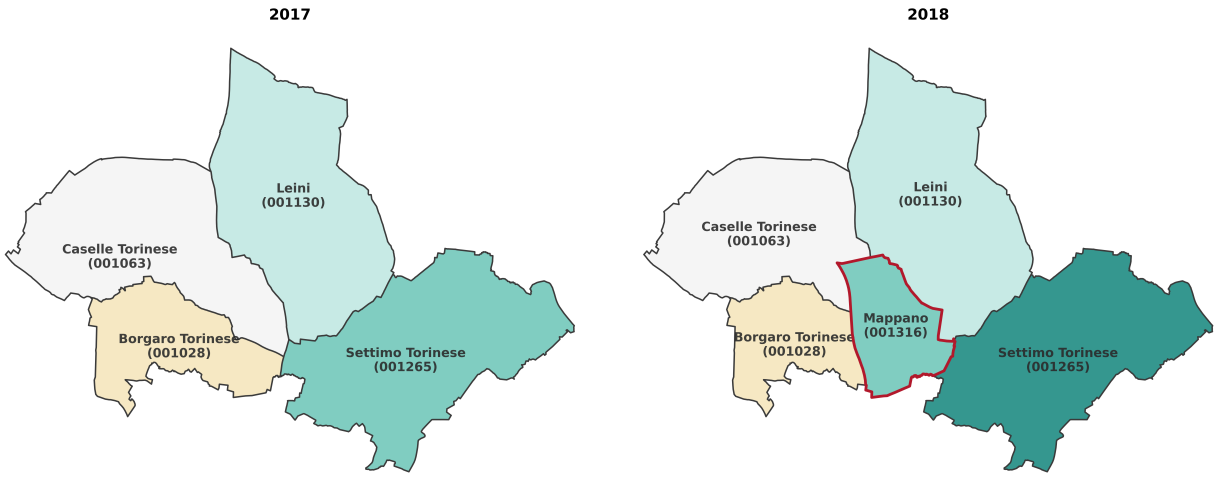
   - *year (t)*: Municipalities A (ID 1) and B (ID 2) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: Municipality C was created by separating a part of the territory from Municipalities A and B, which continue to exist. Municipality C has its own name and ID.

3. Visual overview



4. Example: Since 2018, the new municipality (comune in Italy) Mappano (ID 001316) was created through the separation of parts of the territory from four existing municipalities: Borgaro Torinese (ID 001028), Caselle Torinese (ID 001063), Leini (ID 001130), and Settimo Torinese (ID 001265), all of which continue to exist with their original names and IDs: Borgaro Torinese (ID 001028), Caselle Torinese (ID 001063), Leini (ID 001130), and Settimo Torinese (ID 001265). The municipality Mappano has a new name and a new ID (Bollettino Ufficiale Regione Piemonte, 2013). Case ID: it-se-1-2017-2018

5. Map:



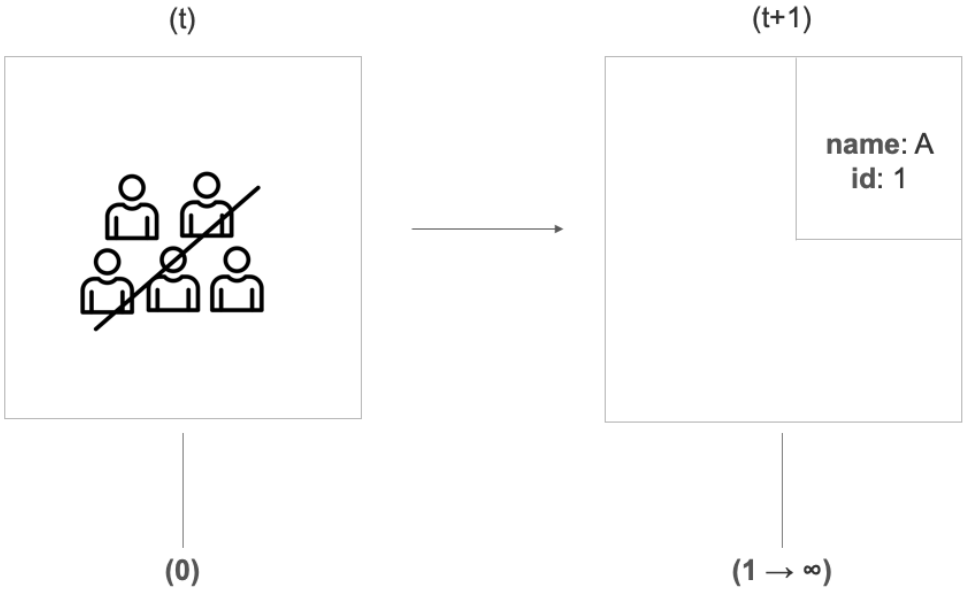
C.10 Unincorporated Area Formation

1. Definition: The creation of one or more new municipalities from territory that was not previously a municipality (unincorporated area).

2. Implications of the change:

   - *year (t)*: No Municipalities existed in this area, it was an unincorporated area (a parcel of land that is not governed by a local general-purpose municipal corporation).
   - *year (t + 1)*: Municipality A (ID 1) was created from territory that was not previously a municipality (unincorporated area). Municipality A has its own name and ID.

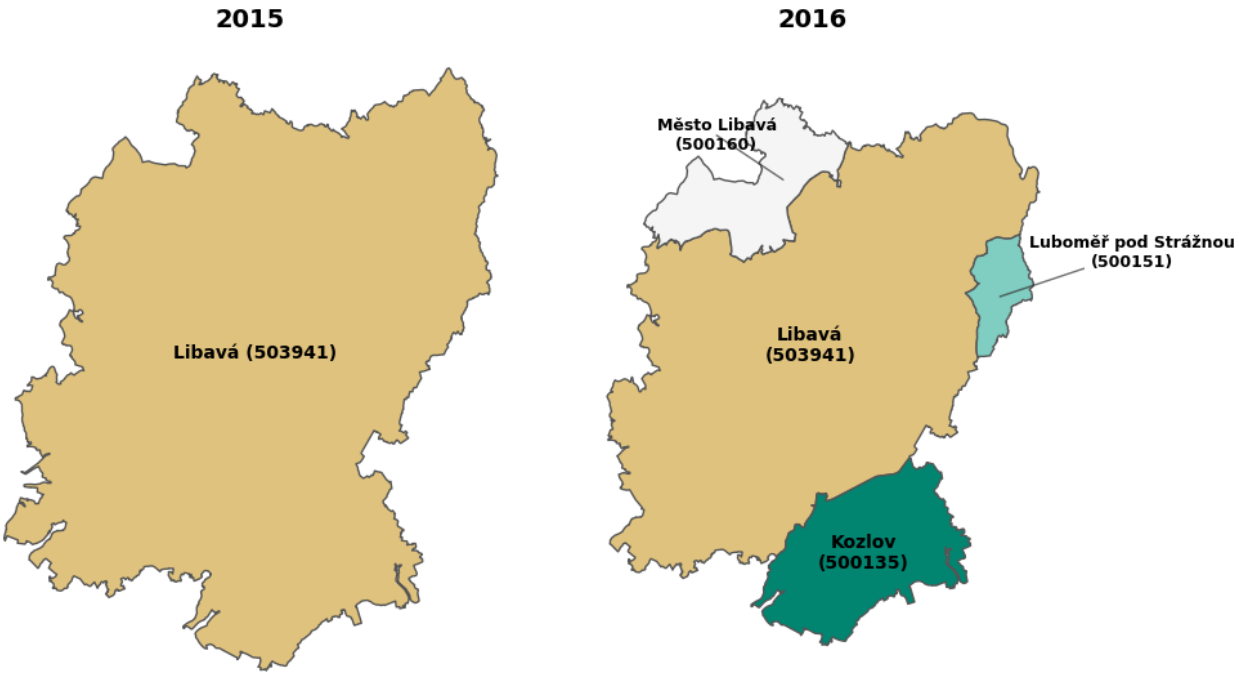
3. Visual overview



4. Example: Since 2016, three entirely new municipalities (obce in the Czech Republic) Město Libavá (ID 500160), Kozlov (ID 500135), and Luboměř pod Strážnou (ID 500151) were created. Before 2016, none of these territories had the status of independent municipalities, they constituted parts of the Libavá military training area (Vojenský újezd Libavá) and therefore lacked ordinary municipal self-government (Sbírka zákonů ČR,

2015). In the Czech Republic, military training areas are not self-governing municipalities but are administered by military offices under the Ministry of Defence and are legally classified as unincorporated areas within the regional framework, lacking standard municipal governance structures. Case ID: cz-uf-1-2015-2016

5. Map:



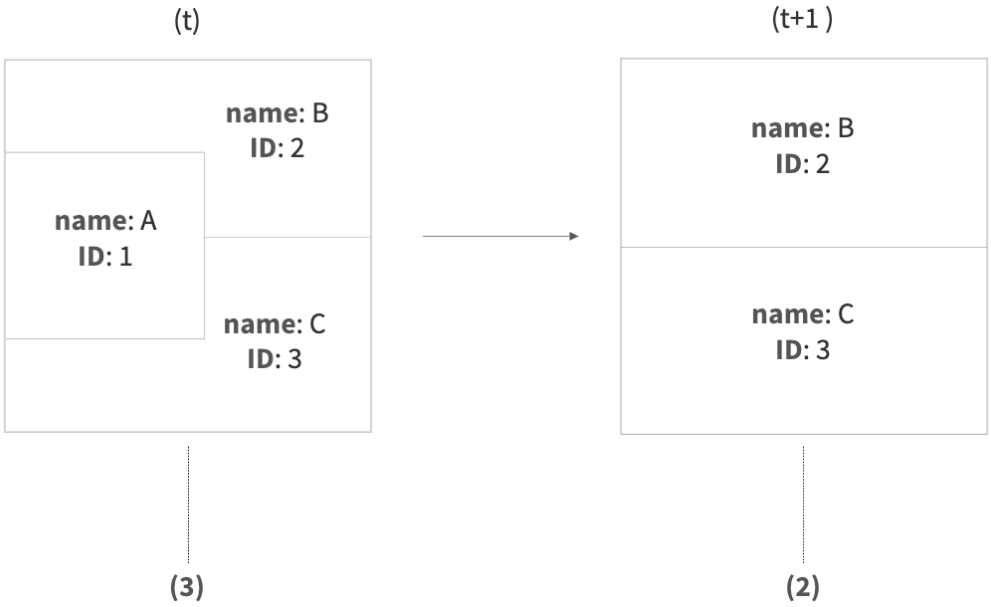
C.11 Dissolution

1. Definition: The dissolution of one municipality and the distribution of its territory among two municipalities, neither of which is newly created. The original municipality ceases to exist as a legal-administrative entity.

2. Implications of the change:

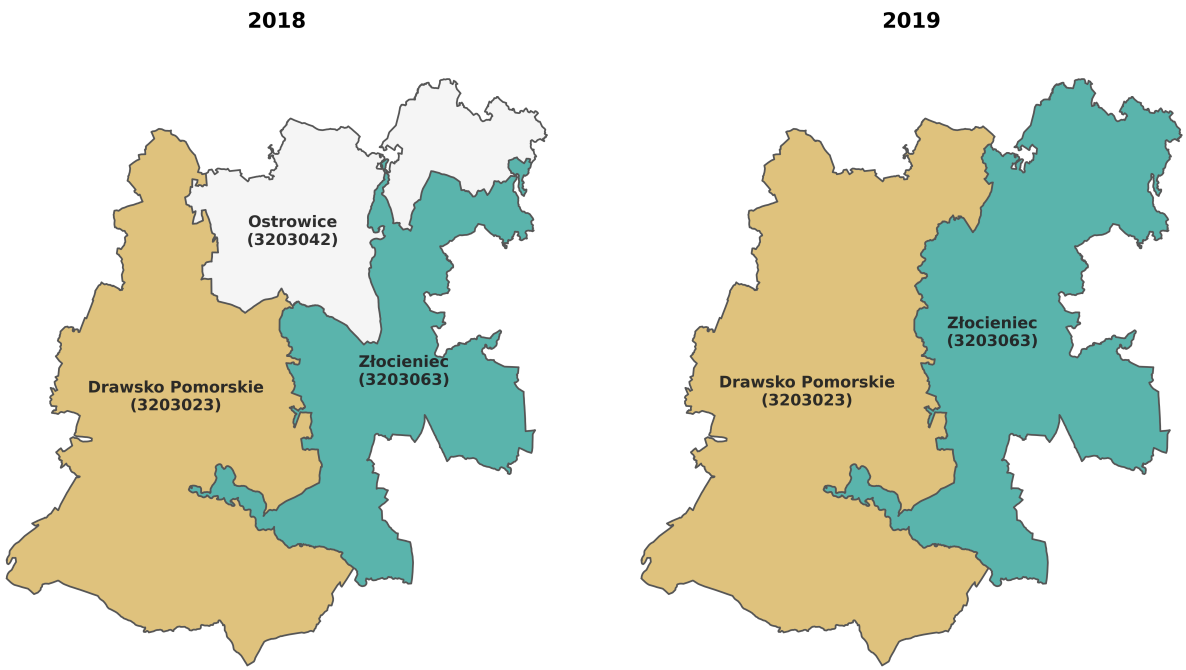
   - *year (t)*: Municipalities A (ID 1), B (ID 2), and C (ID 3) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A was dissolved, and its entire territory was distributed between Municipalities B and C. Municipalities B and C did not change their names or IDs.

3. Visual overview



4. Example: Since 2019, the municipality (gmina in Poland) Ostrowice (ID 3203042) has been dissolved, and its entire territory has been divided between the municipalities Drawsko Pomorskie (ID 3002032) and Złocieniec (ID 3203063). The receiving municipalities, Drawsko Pomorskie (ID 3002032) and Złocieniec (ID 3203063), retained their existing names (Drawsko Pomorskie and Złocieniec) and IDs without any changes (ISAP, 2018). Case ID: pl-d-1-2018-2019

5. Map:



C.12 Unincorporated Area Integration

C.12.1 Unincorporated Area Integration: simple

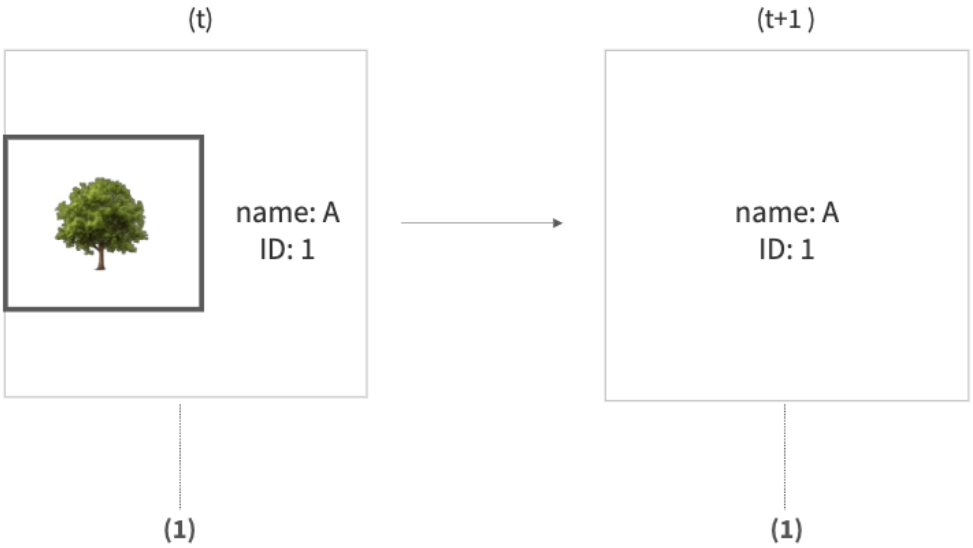
1. Definition: The incorporation of a previously non-municipal territory (unincorporated area, e.g., a national park, forest, or military training areas) into one already existing municipality.

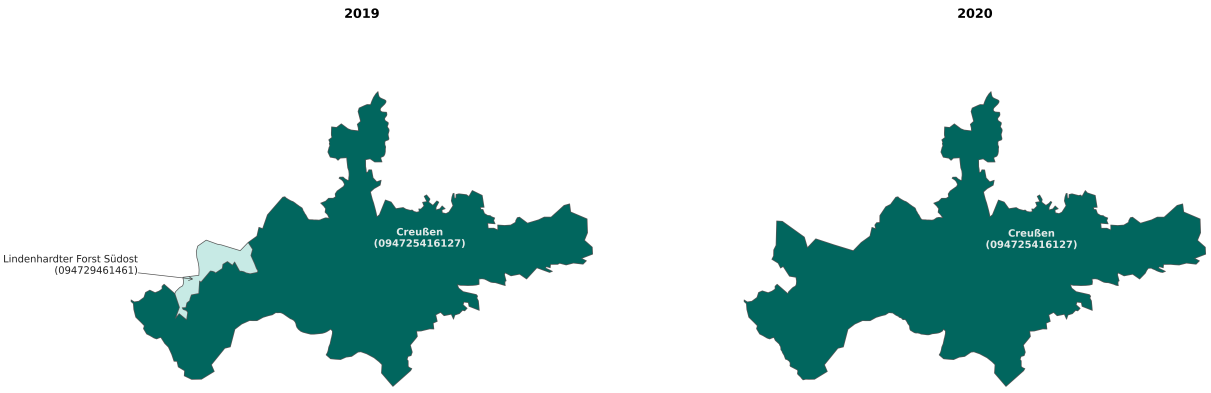
2. Implications of the change:

   - *year (t)*: Municipality A (ID 1) exists as a separate entity with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A incorporated a non-municipal territory (unincorporated area, e.g., a national park, forest, or military training areas) into its own territory. Municipality A did not change its name or ID, however, its territorial extent increased through the incorporation of previously unincorporated areas.

3. Visual overview
4. Example: Since 2020, the municipality (Gemeinde in Germany) Creußen (ID 94725416127) integrated the non-municipal (unincorporated area) territory of Lindenhardter Forst Südost (forest) into its own municipal territory. The municipality Creußen retained both its name (Creußen) and ID (ID 94725416127) (Oberfränkisches Amtsblatt, 2019). Case ID: de-ui-7-2019-2020

5. Map:


(t)
(t+1)
name: A
ID: 1
name: A
ID: 1
(1)
(1)


2019
2020
Creußen
(094725416127)
Lindenhardter Forst Südost
(094729461461)
Creußen
(094725416127)

C.13 Unincorporated Area Integration

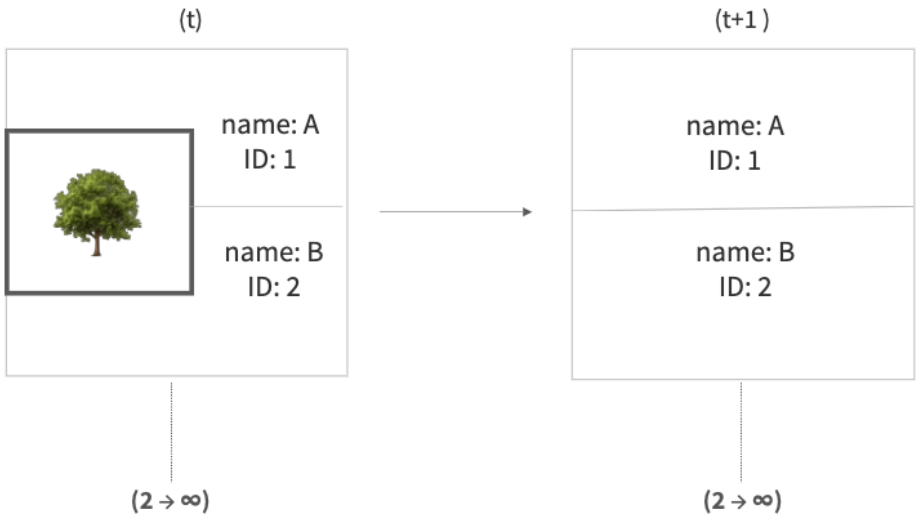
C.13.1 Unincorporated Area Integration: multiple

1. Definition: The incorporation of a previously non-municipal territory (unincorporated area, e.g., a national park, forest, or military training areas) into more than one existing municipalities.

2. Implications of the change:

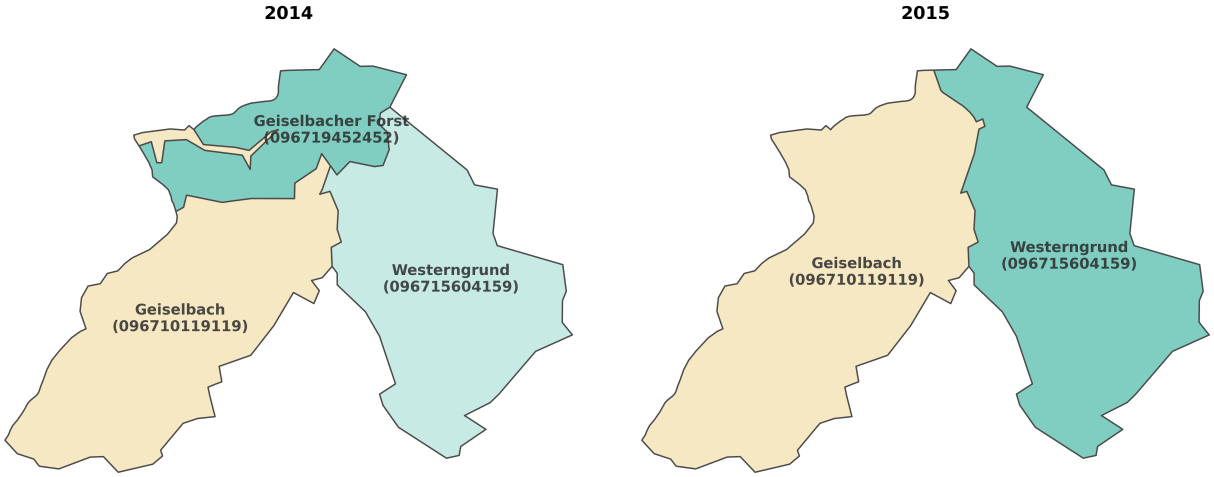
   - *year (t)*: Municipalities A (ID 1) and B (ID 2) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: Municipalities A and B incorporated parts of a non-municipal territory, such as a national park, forest, or uninhabited administrative zone, into their own territories. Municipalities A and B did not change their names or IDs, however, its territorial extent increased through the incorporation of previously unincorporated areas.

3. Visual overview



4. Example: Since 2015, the municipality (Gemeinde in Germany) Westerngrund (ID 096715604159) and Geiselbach (ID 096710119119) integrated the non-municipal territory of Geiselbacher Forst (forest) into its own territories. The municipalities Westerngrund and Geiselbach retained both its name and ID The municipalities Westerngrund and Geiselbach retained both their names and IDs (Amtsblatt der Regierung von Unterfranken, 2014). Case ID: de-ui-1-2014-2015

5. Map:


2014
Geiselbacher Forst
(096719452452)
Westerngrund
(096715604159)
Geiselbach
(096710119119)
2015
Geiselbach
(096710119119)
Westerngrund
(096715604159)

C.14 Territorial transfer

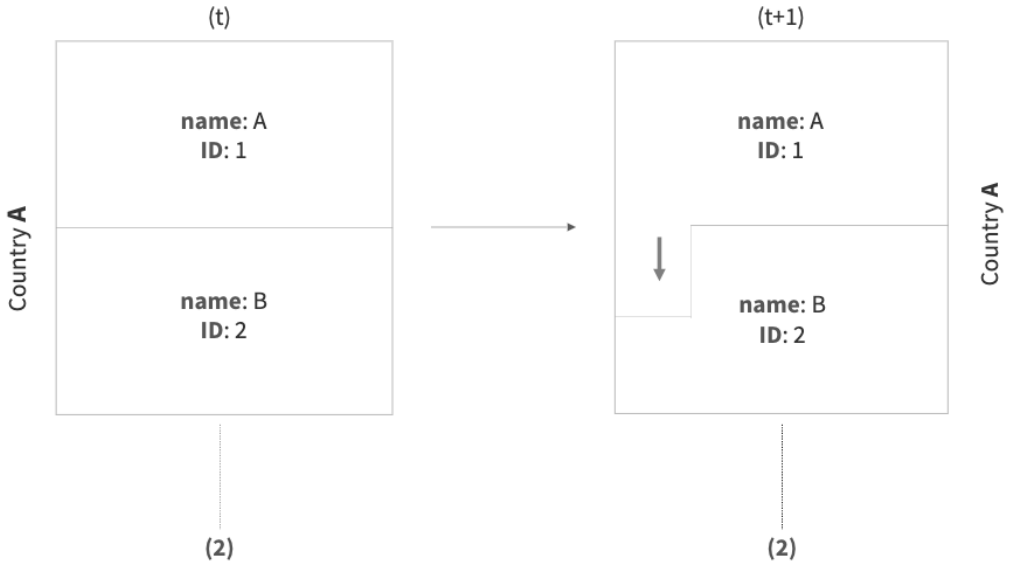
C.14.1 Territorial transfer: national transfer

1. Definition: The transfer of part of the territory of one municipality to another, without receiving territory in return, within the same country.

2. Implications of the change:

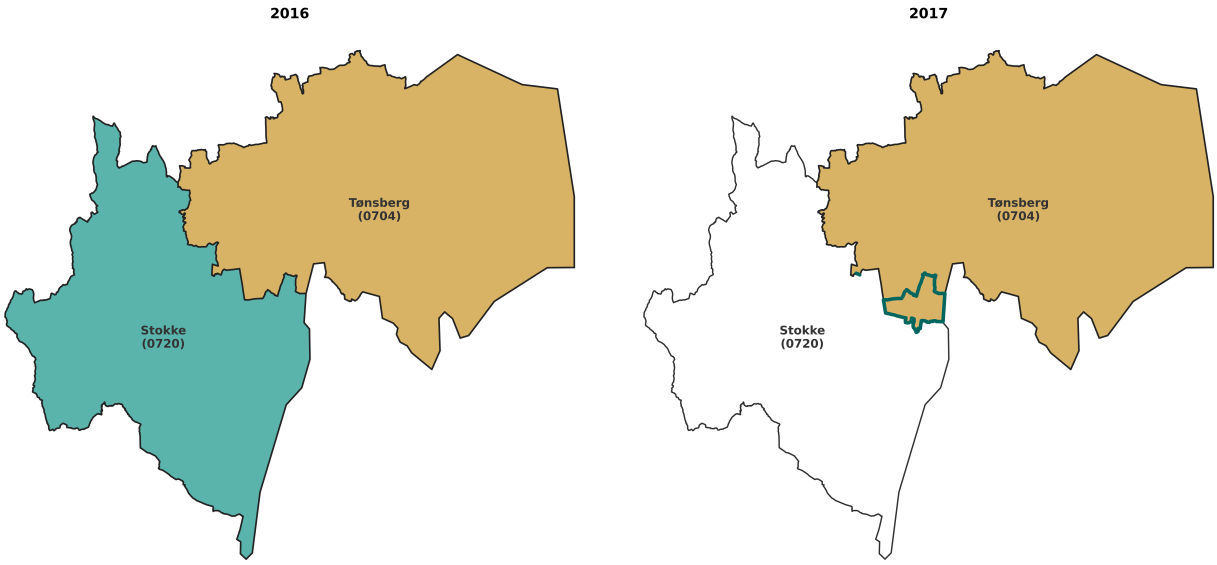
   - *year (t)*: Municipalities A (ID 1) and B (ID 2) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A transferred one part of its territory to Municipality B, without receiving any territory in return, within the same country. Municipality A and B didn't change their names or IDs.

3. Visual overview



4. Example: Since 2017, the municipality (kommune in Norway) of Stokke (ID 5301), located in Vestfold county, transferred one part of its territory to municipality Tønsberg (ID 0704), without receiving territory in return, within the same country (Norway). Municipalities Stokke and Tønsberg retained both its name (Stokke and Tønsberg) and ID (ID 5301 and ID 0704) (Lovdata, 2015). This case involves the transfer of territory in a single direction between two municipalities within the same country (Norway). Case ID: no-tt-1-2016-2017

5. Map:



C.15 Territorial transfer

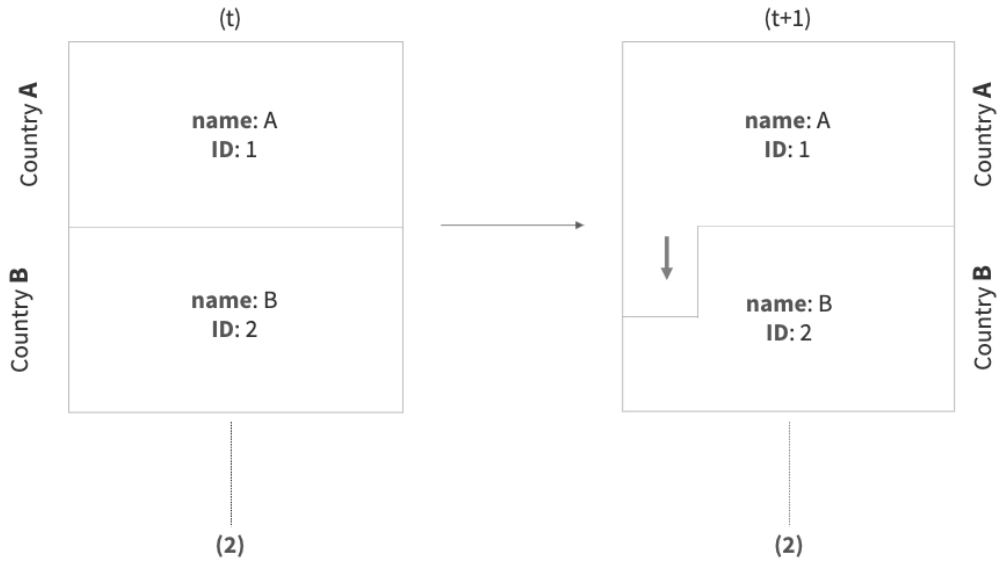
C.15.1 Territorial transfer: international transfer

1. Definition: The transfer of part of the territory of one municipality from one country to another municipality in a neighboring country, without receiving territory in return.

2. Implications of the change:

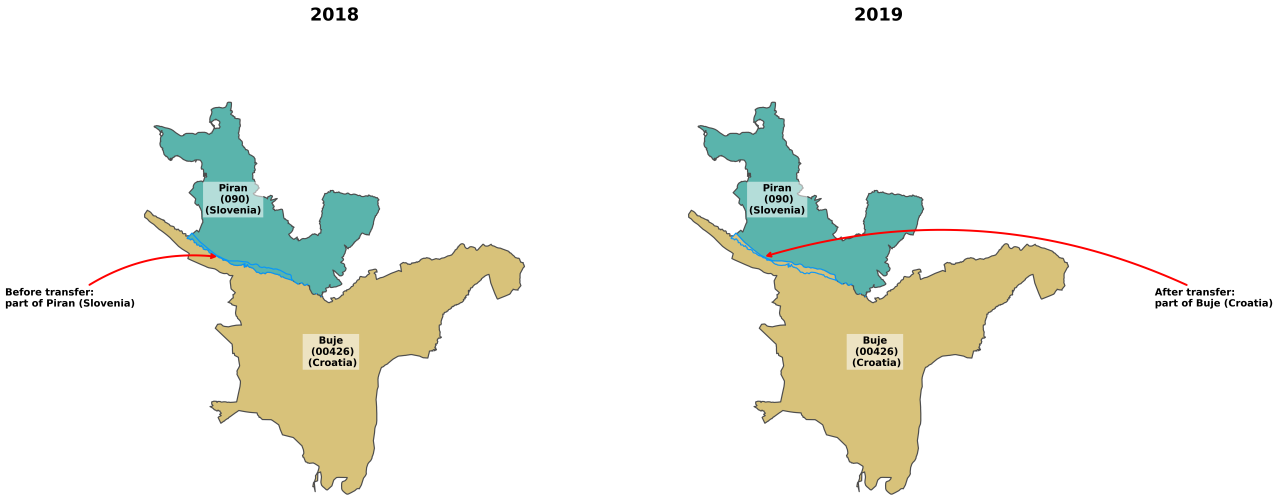
   - *year (t)*: Municipalities A (ID 1) and B (ID 2) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A from one country transferred part of its territory to Municipality B in a neighboring country, without receiving any territory in return. Municipality A and B didn't change their names or IDs.

3. Visual overview



4. Example: Since 2018, the area of the municipality of Piran (ID 090) changed due to a territorial transfer across national borders (Slovenia and Croatia). Parts of the settlements Parecag and Sečovlje (municipality of Buje in Croatia) were eliminated from the national territory of the Republic of Slovenia and incorporated into the national territory of the Republic of Croatia, without any territory being transferred in return (Uradni list Republike Slovenije, 2017). This case represents an international territorial transfer between two countries, formally confirmed by legislation only on the part of Slovenia. Case ID: sl-tt-28-2018-2019

5. Map:



C.16 Territorial exchange

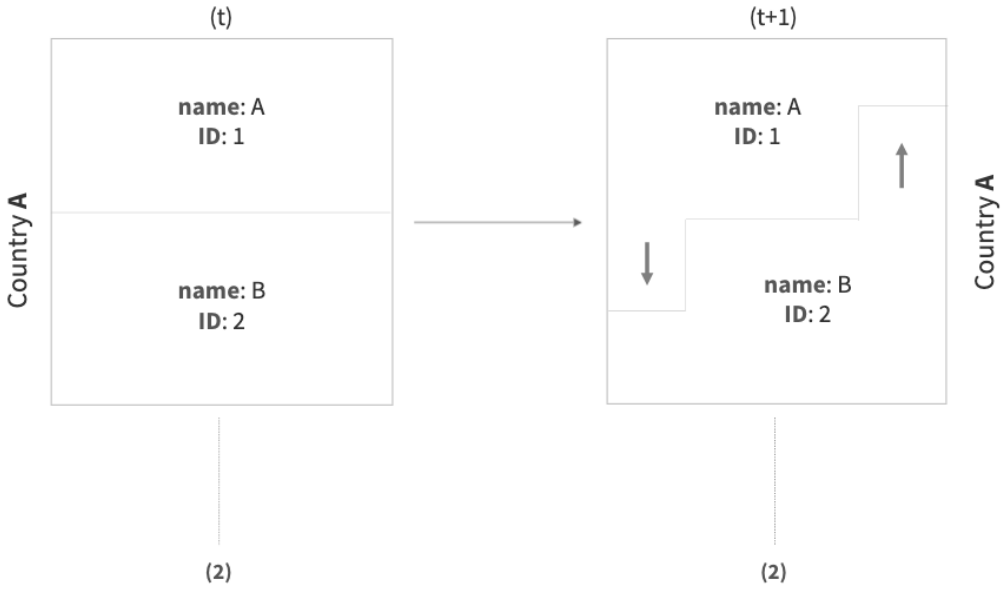
C.16.1 Territorial exchanger: national exchange

1. Definition: The one-time exchange of territories between two municipalities within the same country.

2. Implications of the change:

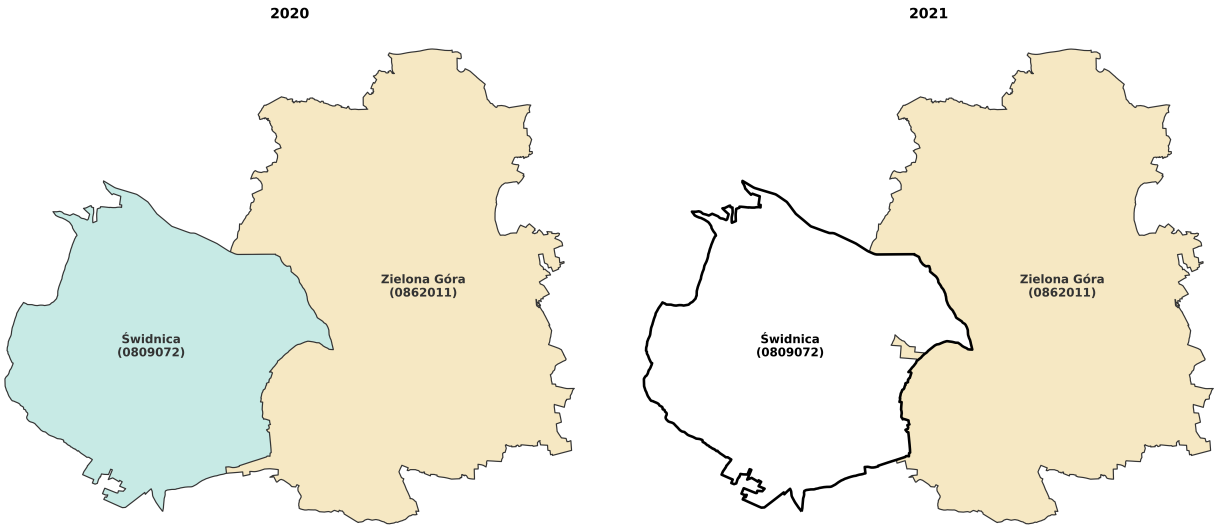
   - *year (t)*: Municipalities A (ID 1) and B (ID 2) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A transferred part of its territory to Municipality B and, at the same time, received part of Municipality B's territory in return, within the same country. Municipality A and B didn't change their names or IDs.

3. Visual overview



4. Example: Since 2021, the municipality (gmina in Poland) Świdnica (ID 0809072), located in the Lower Silesian Voivodeship, transferred one part of its territory to municipality Zielona Góra (ID 0862011),located in the Lubusz Voivodeship, and, at the same time, received part of Municipality Zielona Góra's territory (ID 0862011) in return. Municipalities Świdnica (ID 0809072) and Zielona Góra (ID 0862011) retained both its name (Świdnica and Zielona Góra) and ID (ID 0809072 and ID 0862011) (ISAP, 2020). This case involves the exchange of territory in both directions between two municipalities within the same country (Poland). Case ID: pl-te-32-2020-2021

5. Map:



C.17 Territorial exchange

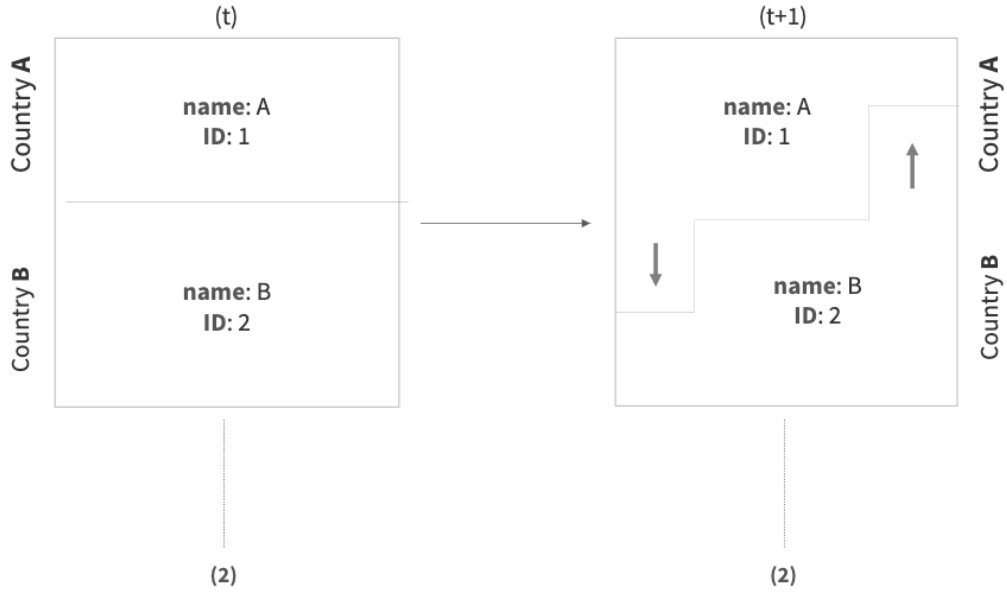
C.17.1 Territorial exchanger: international exchange

1. Definition: The one-time exchange of territories between two municipalities from neighboring countries.

2. Implications of the change:

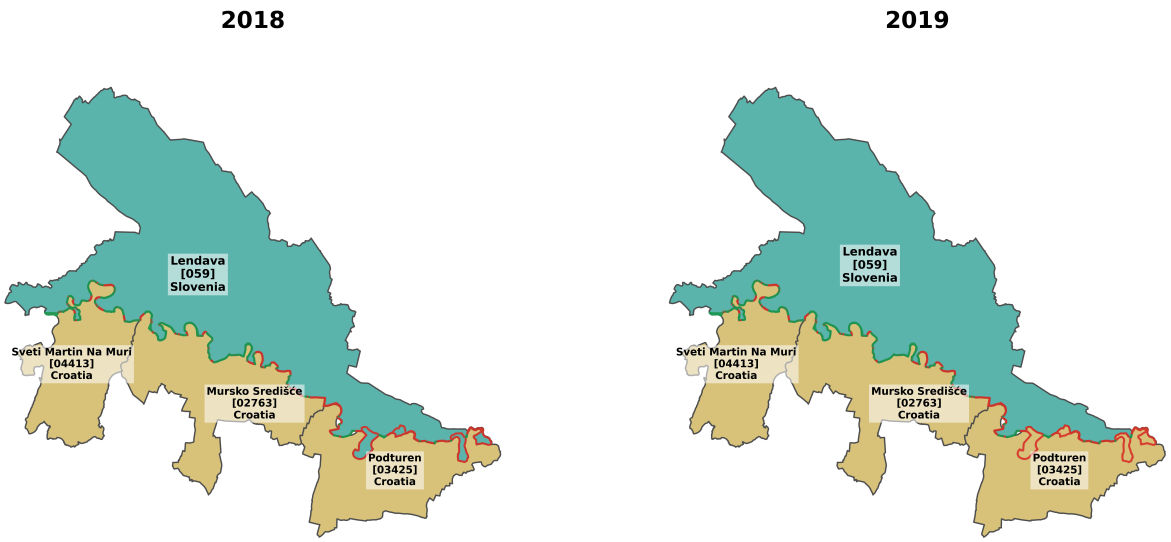
   - *year (t)*: Municipalities A (ID 1) and B (ID 2) exist as separate entities, each with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A from one country transferred part of its territory to Municipality B from a neighboring country and, at the same time, received part of Municipality B's territory in return. Municipality A and B didn't change their names or IDs.

3. Visual overview



4. Example: Since 2018, the municipality of Lendava experienced a reciprocal territorial exchange across national borders. A part of the settlement Pince-Marof was eliminated from the national territory of the Republic of Slovenia and incorporated into the national territory of the Republic of Croatia, while parts of the settlements Pince-Marof and Brezovec were eliminated from the national territory of the Republic of Croatia and incorporated into the national territory of the Republic of Slovenia. The municipality of Lendava retained both its name and ID (Uradni list Republike Slovenije, 2017). This case represents an international territorial exchange between two countries, formally confirmed by legislation only on the part of Slovenia. Case ID: sl-te-25-2018-2019

5. Map:



D Municipality Identifier Changes

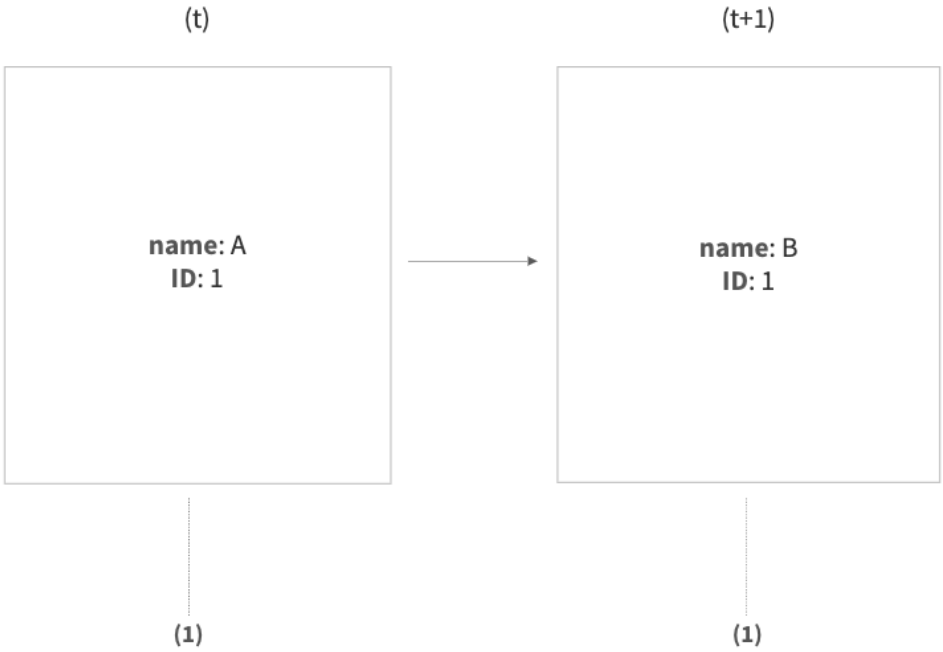
D.1 Change name

1. Definition: The change of a municipality's name, while its boundaries and ID remain unchanged.

2. Implications of the change:

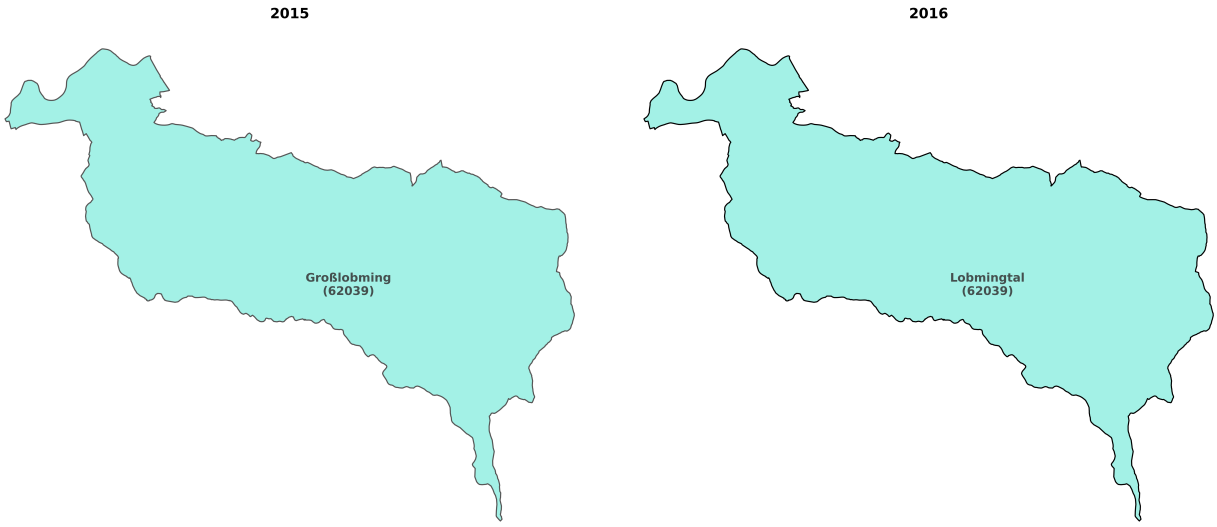
   - *year (t)*: Municipality A (ID 1) exists as a separate entity with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A changed its name from A to B without changing its ID and boundaries.

3. Visual overview



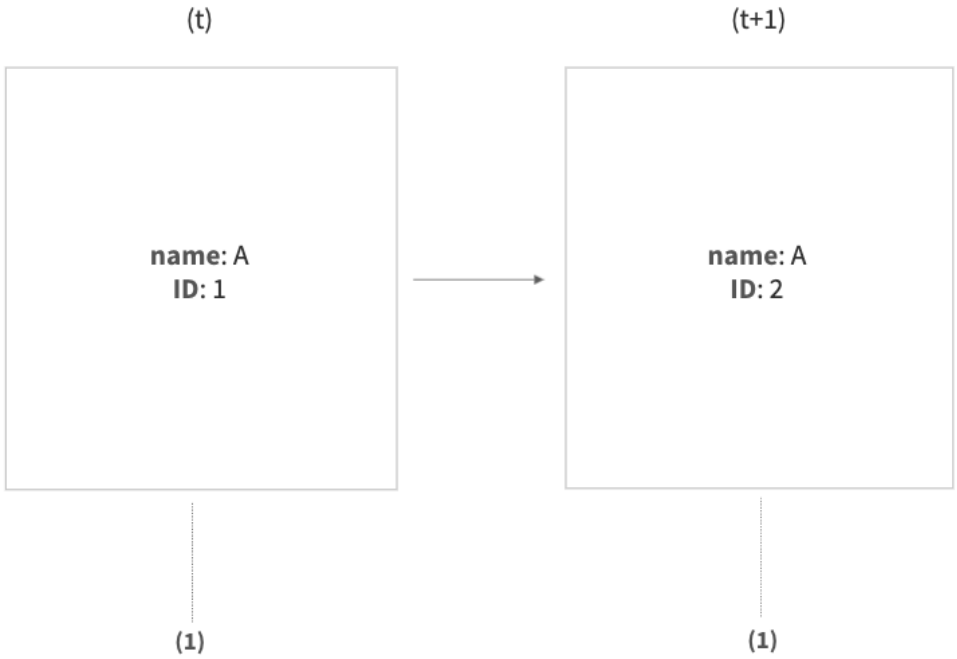
4. Example: Since 2016, after a council decision, the municipality (Gemeinde in Austria) Großlobming (ID 62039) in the Murtal District and the Judenburg judicial district of Styria, Austria, has changed its name from Großlobming to Lobmingtal without changing its ID (ID 62039) (Land Steiermark – Landesentwicklung, 2016). This case represents a change in the municipality name while retaining its municipal ID and unchanged boundaries. Case ID: at-ng-7-2015-2016

5. Map:



D.2 Change ID

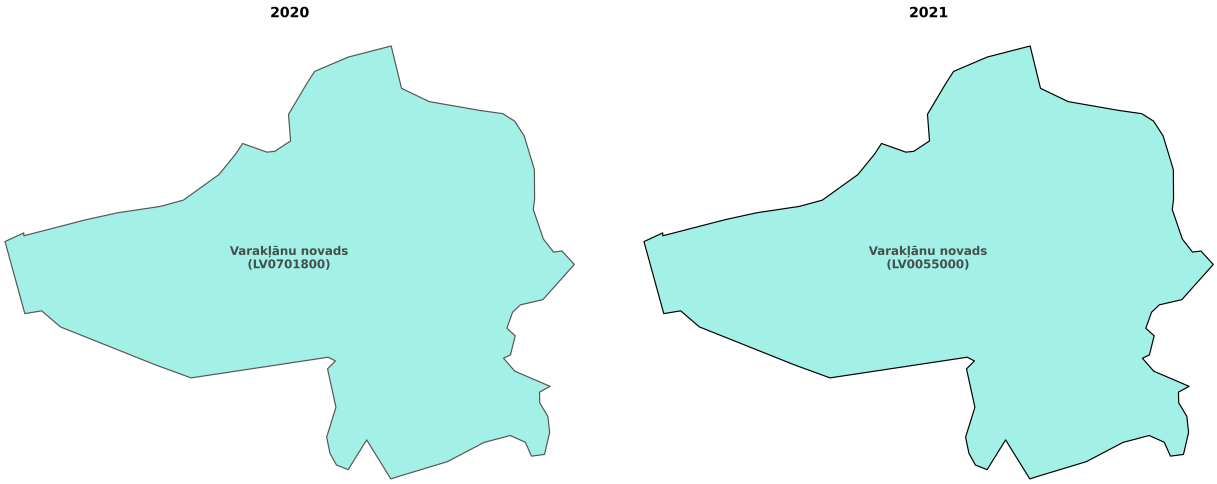
1. Definition: The change of a municipality's ID, while its boundaries and name remained unchanged.
2. Implications of the change:
   - *year (t)*: Municipality A (ID 1) exist as separate entity with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A changed its ID from 1 to 2 without changing its name and boundaries.
3. Visual overview



4. Example: Since 2021, the municipality (novads in Latvia) Varakļānu novads in Latgale, Latvia, the easternmost region of the country, changed its ID from LV0701800 to

LV0055000 without changing its name (Varakļānu novads) (Latvijas atvērto datu portāls, 2016). This case represents a change in the municipality ID while retaining its name and unchanged boundaries. However, furthermore, in 2025 the Varakļānu novads merged into Madonas novads in Vidzeme, Latvia. All settlements, parishes, and municipal infrastructure of Varakļānu novads were included in the merger. The administrative functions and local governance of Varakļānu novads were transferred to the administrative centre of Madonas novads. Case ID: lv-ng-14-2020-2021

5. Map:



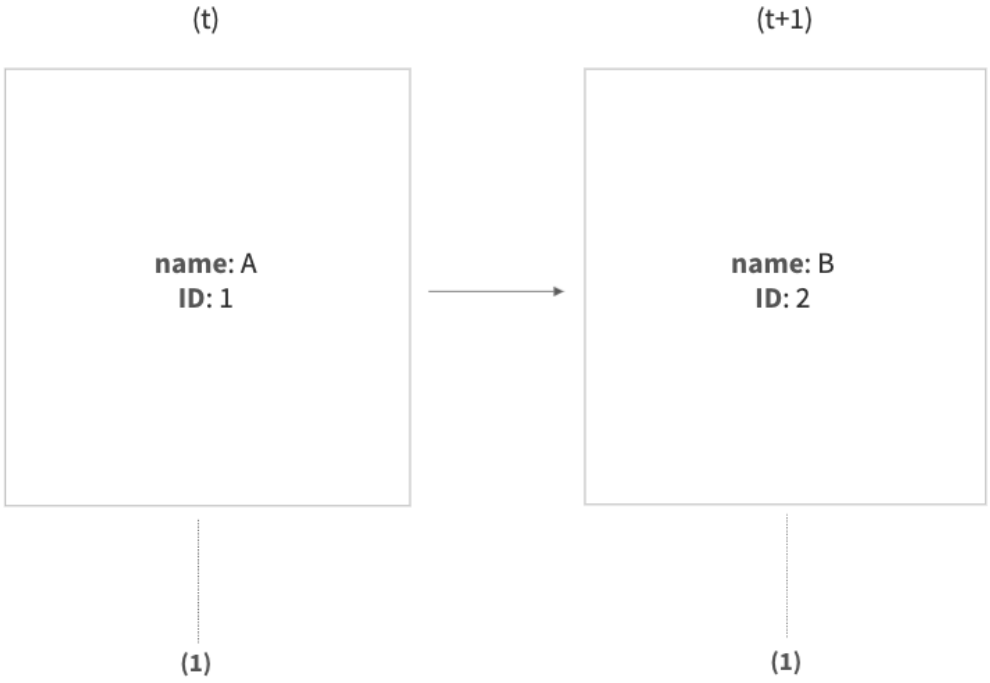
D.3 Change Name & ID

1. Definition: The change of a municipality's name and ID, while its boundaries remained unchanged.

2. Implications of the change:

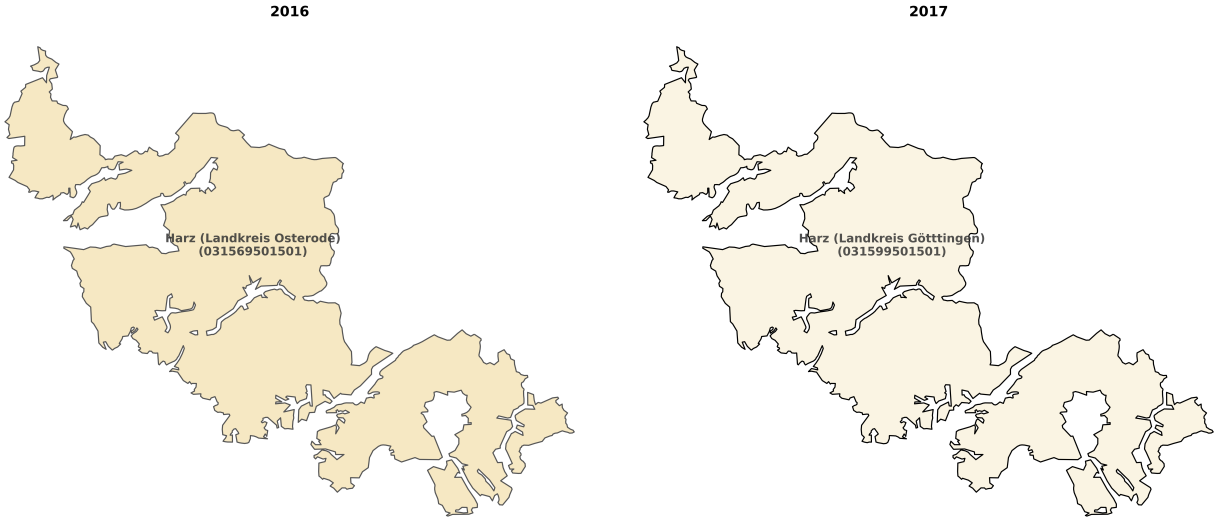
   - *year (t)*: Municipality A (ID 1) exists as a separate entity each with its own name, ID, and territory.
   - *year (t + 1)*: Municipality A changed its name from A to B and its ID from 1 to 2 without changing its name boundaries.

3. Visual overview



4. Example: Since 2017, the municipality (Gemeinde in Germany) Harz (Landkreis Osterode) (ID 31569501501) in Lower Saxony, Germany, changed its name from Harz (Landkreis Osterode) to Harz (Landkreis Götttingen) and ID from 31569501501 to 31599501501 (Statistisches Bundesamt (Destatis, 2016)). The name and municipal ID were updated following the merger of Landkreis Osterode am Harz into Landkreis Göttingen, reflecting the new administrative affiliation. This case represents a change in the municipality name and ID while maintaining the same boundaries. Case ID: de-ng-342-2016-2017

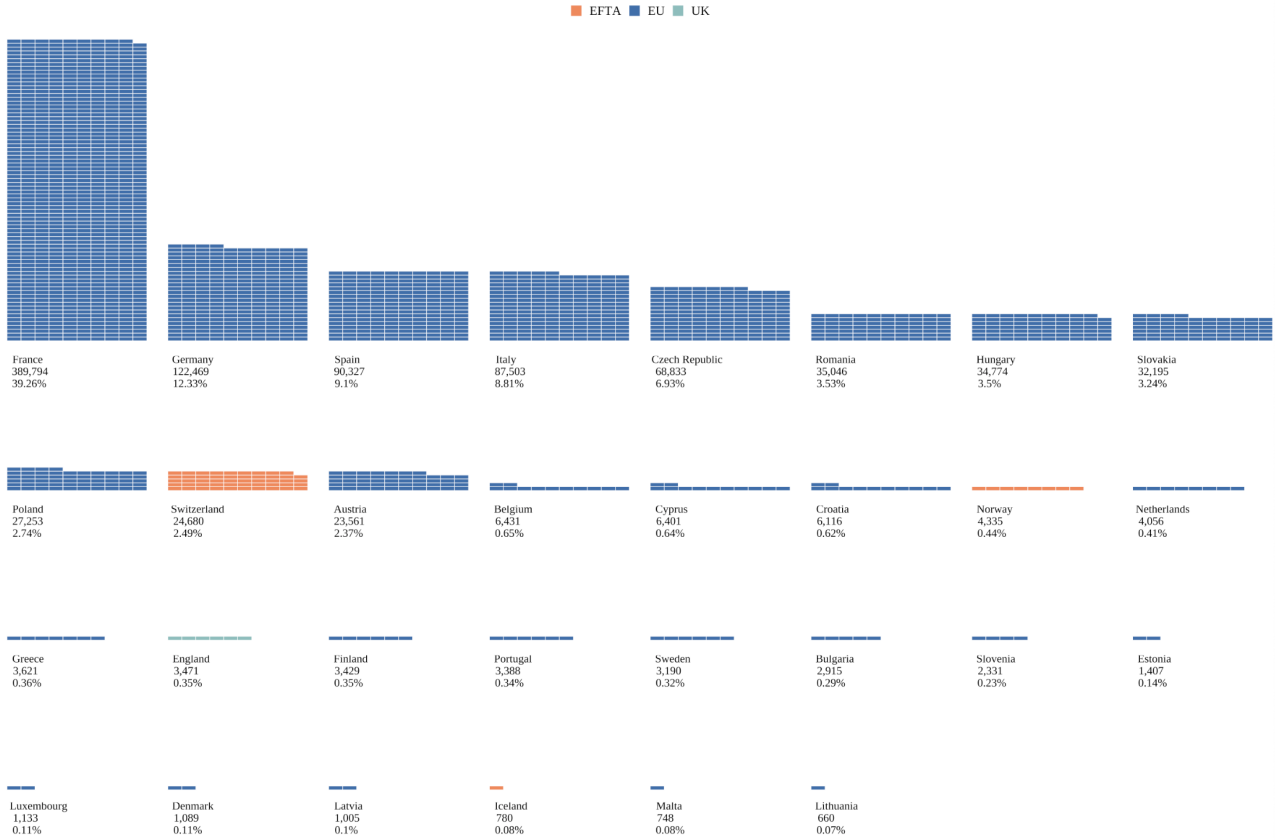
5. Map:


2016
Harz (Landkreis Osterode)
(031569501501)
2017
Harz (Landkreis Göttingen)
(031599501501)

E The Number of Municipalities by Country and Year, 2014-2024

Country	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Austria	2376	2124	2122	2122	2120	2118	2117	2117	2115	2115	2115
Belgium	589	589	589	589	589	581	581	581	581	581	581
Bulgaria	264	265	265	265	265	265	265	265	265	265	265
Croatia	556	556	556	556	556	556	556	556	556	556	556
Cyprus	615	615	615	615	615	615	615	615	615	615	251
Czech Republic	6253	6258	6258	6258	6258	6258	6258	6258	6258	6258	6258
Denmark	99	99	99	99	99	99	99	99	99	99	99
Estonia	215	213	213	213	79	79	79	79	79	79	79
Finland	320	317	313	311	311	311	310	309	309	309	309
France	36687	36663	35890	35421	35362	34978	34973	34970	34960	34950	34940
Germany	11353	11306	11299	11266	11256	11058	11003	10997	10993	10981	10957
Greece	326	326	326	326	326	326	333	333	333	333	333
Hungary	3154	3155	3155	3155	3155	3155	3155	3155	3155	3155	3178
Ireland	31	31	31	31	31	31	31	31	31	31	31
Italy	8071	8048	8003	7983	7960	7926	7904	7904	7904	7901	7899
Latvia	119	119	119	119	119	119	119	43	43	43	43
Lithuania	60	60	60	60	60	60	60	60	60	60	60
Luxembourg	106	105	105	105	102	102	102	102	102	102	100
Malta	68	68	68	68	68	68	68	68	68	68	68
Netherlands	404	394	391	389	381	356	356	353	346	343	343
Poland	2479	2478	2478	2478	2478	2477	2477	2477	2477	2477	2477
Portugal	308	308	308	308	308	308	308	308	308	308	308
Romania	3186	3186	3186	3186	3186	3186	3186	3186	3186	3186	3186
Slovakia	2927	2927	2927	2927	2927	2927	2927	2927	2927	2927	2927
Slovenia	211	212	212	212	212	212	212	212	212	212	212
Spain	8199	8203	8208	8205	8205	8212	8217	8217	8223	8218	8220
Sweden	290	290	290	290	290	290	290	290	290	290	290
Iceland (EFTA)	74	74	74	74	74	72	72	69	69	64	64
Norway (EFTA)	428	428	428	426	422	422	356	356	356	356	357
Switzerland (EFTA)	2397	2369	2312	2272	2239	2229	2219	2189	2161	2149	2144
Liechtenstein (EFTA)	11	11	11	11	11	11	11	11	11	11	11
England (UK)	326	326	326	326	326	317	314	309	309	296	296
Wales (UK)	22	22	22	22	22	22	22	22	22	22	22
Scotland (UK)	32	32	32	32	32	32	32	32	32	32	32
Northern Ireland (UK)	11	11	11	11	11	11	11	11	11	11	11
Total	92567	92188	91302	90731	90455	89789	89638	89511	89466	89403	89022

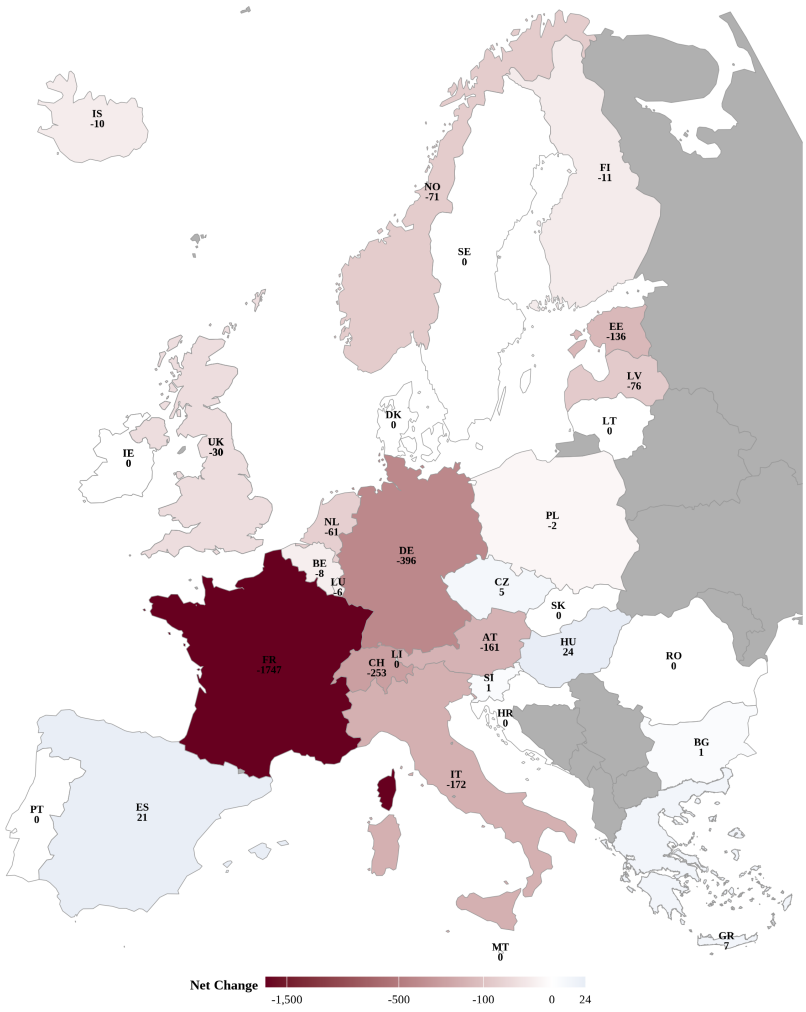
E.1 Cross-country Distribution of Municipalities, 2014-2014



Note: Each square represents 500 municipalities.

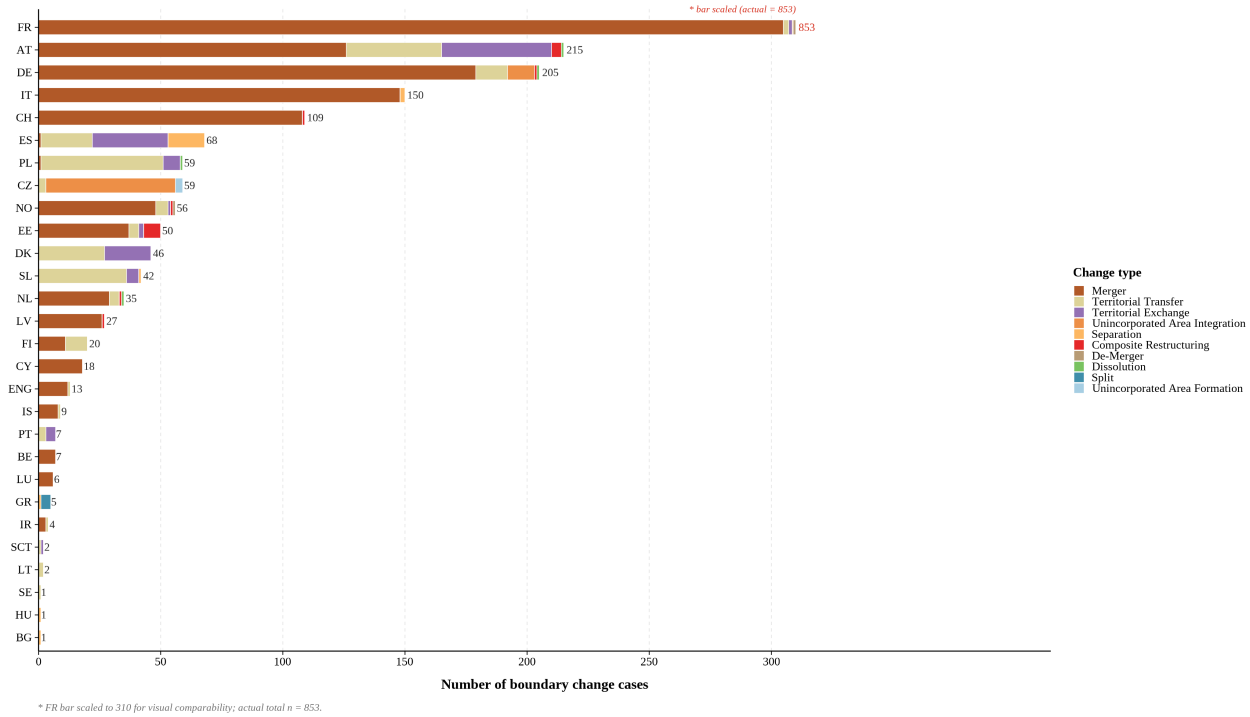
E.2 Net Change in the Number of Municipalities by country and year, 2014-2024

E.3 Municipal Transformation- 2014-2024



Note: Gray areas indicate missing data; colors are scaled using a square-root transformation

E.4 Distribution of Territorial Alterations by Country, 2015-2024



** FR bar scaled to 310 for visual comparability; actual total n = 853.*

E.5 Data Systems

The design of the dataset is founded on the principle of documenting both change and continuity in European municipal boundaries. By capturing every merger, split, transfer, and dissolution alongside corresponding legal identifier changes, the dataset enables researchers to trace the full territorial and administrative evolution of municipalities from 2014 to 2024. This comprehensive record-keeping supports research questions such as: *How have municipal borders in France evolved over the past decade?* or *When and why did a municipality change its name without altering its territory?*

To achieve this, we adopted a modular data architecture composed of three interlocking components, each published in open, non-proprietary formats (e.g., GeoPackage and CSV) to ensure reproducibility and interoperability.

1. **Geographical dataset**
   All municipal polygons are stored in a GeoPackage (`.gpkg`) layer, preserving geodetic accuracy and topological consistency. This format supports high-precision mapping and spatial analysis using standard GIS tools without reliance on proprietary software. Each feature contains:

   - the municipality's official national identifier; and
   - the project's internal identifier.

2. **Municipal border changes dataset (metadata)**
   Every year-to-year administrative or territorial modification is recorded in a longitudinal table structure. This dataset:

   - identifies whether a municipality experienced a territorial or non-territorial change in a given year;
   - classifies the type of event (e.g., merger, split, transfer, dissolution, or renaming);
   - tracks the complete lifespan of both official and internal identifiers; and
   - groups related modifications under a shared `case_id`.

   This structure allows users to determine precisely when a change occurred and to analyse the frequency and nature of municipal transformations over time.

3. **Legal source register**
   A dedicated legal dataset accompanies the spatial and metadata components. It catalogues the legal acts authorising each municipal change and provides:

   - the title of the legal act;
   - the official reference URL; and
   - a persistent link to the downloadable document.

Because every country follows the same three-module schema, integrating additional national case studies is straightforward: new GeoPackage and CSV files can simply be appended to the existing structure. This design ensures scalability and preserves cross-national comparability. As the project expands to include additional European countries, the unified architecture will continue to support seamless longitudinal and comparative analyses of municipal governance and territorial change.

E.6 Demonstration of the data structure

To illustrate the structure and analytical potential of the new datasets, we present a municipal merger recorded in Norway during the 2017–2018 period. The municipality of Indre Fosen (`id 5054`) was established through the merger of the municipalities Leksvik (`id 1718`) and Rissa (`id 1624`). Both the municipality name and the official identifier assigned to the newly created entity were newly introduced. Within the dataset, this administrative change is recorded under the case identifier `no-m-6-2017-2018`.

Year before the change

cname	year	original_code	munqog_code	mun_name	geom
Norway	2017	1624	no-1624	Rissa	here goes the geometry
Norway	2017	1718	no-1718	Leksvik	here goes the geometry

Year after the change

cname	year	original_code	munqog_code	mun_name	geom
Norway	2018	5054	no-5054	Indre Fosen	here goes the geometry

Main Metadata

cname	year	reference_year	original_code	munqog_code	mun_name	geome	original_code_years	munqog_code_years	recorded_change	change_nature	sub_change_nature	case_id	units_involved	change_name_description	change_code_description	shape_area
Norway	2018	2018	5054	no-5054	Indre Fosen	here goes the geometry	4	7	TRUE	merger	simple	no-m-6-2017-2018	2	new_name	new_code	1 131 532
Norway	2017	2018	1624	no-1624	Rissa	here goes the geometry	4	7	TRUE	merger	simple	no-m-6-2017-2018	2	name_will_cease_existance	code_will_cease_existance	121 331
Norway	2017	2017	1718	no-1718	Leksvik	here goes the geometry	4	7	TRUE	merger	simple	no-m-6-2017-2018	2	name_will_cease_existance	code_will_cease_existance	1 010 201

Legal Dataset

year	original_code	munqog_code	case_id	law_name	law_link	law_file_name
2018	5054	no-5054	no-m-6-2017-2018	LAW-2001-06-15-70	View Law	no-m-6-2017-2018.pdf
2017	1624	no-1624	no-m-6-2017-2018	LAW-2001-06-15-70	View Law	no-m-6-2017-2018.pdf
2017	1718	no-1718	no-m-6-2017-2018	LAW-2001-06-15-70	View Law	no-m-6-2017-2018.pdf

E.6.1 Data Access

We will develop an open-access platform through which datasets contributed by individual researchers and public institutions (e.g., government agencies) will be freely distributed. Contributors of datasets integrated into the platform will be recognised as co-authors of the corresponding data products.

The platform will enable researchers to download and integrate a wide range of municipal-level indicators, including procurement data, postal code information, night-time light intensity measures, and counts of public facilities such as hospitals, police stations, and other administrative or service infrastructures.

A key advantage of the platform is its ability to account for temporal changes in municipal boundaries and identifiers. The datasets will allow researchers to identify periods of territorial stability as well as episodes of administrative alteration. By systematically documenting these changes, the platform reduces the risk of inference errors arising from inconsistent spatial units over time and supports robust longitudinal and comparative analyses.

E.7 Local Municipality Naming Conventions by Country

Country	Name of municipality in local language
Estonia	Omavalitsus
Austria	Gemeinden
France	Commune
Italy	Commune
Belgium	Gemeente/commune/gemeinde
Poland	Gminas
Latvia	Novadi and Valstspilsētas
United Kingdom (Northern Ireland)	Local Government Districts
Iceland	Sveitarfel
Luxembourg	Gemengen/Communes/Gemeinden
Lithuania	Savivaldybė
Germany	Gemeinde/Kommune, here: Verwaltungsgebiete (general term, can also apply to Länder or Kreise), also possible: Verwaltungseinheiten, Gemeindeflächen
Croatia	Grada/općine(city and municipality but same status)
Czech republic	Obce
Greece	Dimoi (dími)
Cyprus	Dimoi
Portugal	Municipio
Malta	Local Councils Units
Switzerland and Liechtenstein	Gemeinde (DE)/commune (FR)/Comune(IT)
Sweden	Kommun
Romania	Municipii
Lithuania	Savivaldybės
Bulgaria	Obshtina
Finland	kuntien
Netherlands	Gemeente
United Kingdom (England, Wales, Scottland)	Local Authority Districts
Ireland	Local Authorities
Czech republic	Obce (municipalities)
Spain	Municipio
Slovenia	Občine
Denmark	Kommune
Norway	kommune

Table E3: Municipality names by country

F Legislation References

1. Légifrance (2015). *Arrêté du 12 novembre 2015 portant création de la commune nouvelle de Val de Lambronne*. Available at: https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000031690236 (Accessed 25 January 2026).

2. Légilux (2014). *Loi du 19 décembre 2014 portant fusion des communes d'Eschweiler et de Wiltz*. Available at: https://legilux.public.lu/eli/etat/leg/loi/2014/12/19/n8/jo (Accessed 25 January 2026).

3. Lovdata (2016a). *Vedtak om sammenslåing av Lardal og Larvik kommuner, Vestfold fylke. Iverksetting og unntak fra kommuneloven, valgloven og enkelte særlover*. Available at: https://lovdata.no/dokument/LF/forskrift/2016-02-05-115?q=LARVIK (Accessed 25 January 2026).

4. Lovdata (2016b). *Forskrift om sammenslåing av Rissa kommune i Sør-Trøndelag fylke og Leksvik kommune i Nord-Trøndelag fylke*. Available at: https://lovdata.no/dokument/LF/forskrift/2016-06-17-695?q=LEKSVIK (Accessed 25 January 2026).

5. Légifrance (2016). *Arrêté du 18 mars 2016 portant création de la commune nouvelle de Les Trois Châteaux*. Available at: https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000032895201 (Accessed 25 January 2026).

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