

Mapping the Third Republic

A Geographic Information System of France (1870–1940)

Victor Gay¹

¹TSE, IAST, UT1

Historical Methods

A Journal of Quantitative and Interdisciplinary History



The TRF-GIS

- The TRF-GIS ecosystem: a database and a data paper.
- Why an ecosystem?
- Methods and content.
- FAIR data in practice.

The TRF-GIS Ecosystem

A Database and a Data Paper

The TRF-GIS Ecosystem: A Database

- The TRF-GIS: a GIS for Third-Republic France.

The TRF-GIS Ecosystem: A Database

- The TRF-GIS: a GIS for Third-Republic France.
- Annual nomenclatures and shapefiles (1870–1940):
 - General administrative constituencies: départements, arrondissements, cantons, communes.
 - Special administrative constituencies: military, judicial, penitentiary, electoral, academic, labor inspections, ecclesiastical.

The TRF-GIS Ecosystem: A Database

- The TRF-GIS: a GIS for Third-Republic France.
- Annual nomenclatures and shapefiles (1870–1940):
 - General administrative constituencies: départements, arrondissements, cantons, communes.
 - Special administrative constituencies: military, judicial, penitentiary, electoral, academic, labor inspections, ecclesiastical.
- 16 datasets:
 - 901 nomenclatures, 830 shapefiles.
 - Reproduction material: source code, source data, archival material.

The TRF-GIS Ecosystem: A Database

- The TRF-GIS: a GIS for Third-Republic France.
- Annual nomenclatures and shapefiles (1870–1940):
 - General administrative constituencies: départements, arrondissements, cantons, communes.
 - Special administrative constituencies: military, judicial, penitentiary, electoral, academic, labor inspections, ecclesiastical.
- 16 datasets:
 - 901 nomenclatures, 830 shapefiles.
 - Reproduction material: source code, source data, archival material.
- Accessible at <https://dataverse.harvard.edu/dataverse/TRF-GIS>.

The TRF-GIS Ecosystem: A Data Paper

- “Mapping the Third Republic. A Geographic Information System of France (1870–1940).” August 2021. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*.

The TRF-GIS Ecosystem: A Data Paper

- “Mapping the Third Republic. A Geographic Information System of France (1870–1940).” August 2021. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*.
- Content:
 - Elements of context.
 - Detailed description of historical and technical methods.
 - Detailed description of data files.
 - Advice on usage.

The TRF-GIS Ecosystem: A Data Paper

- “Mapping the Third Republic. A Geographic Information System of France (1870–1940).” August 2021. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*.
- Content:
 - Elements of context.
 - Detailed description of historical and technical methods.
 - Detailed description of data files.
 - Advice on usage.
- Accessible at <https://doi.org/10.1080/01615440.2021.1937421>.

Why an Ecosystem?

Why an Ecosystem?

- A response to the reproducibility crisis in the (social) sciences. [Wilkinson et al. \(2016\)](#) [Christensen and Miguel \(2018\)](#)
- The Third Republic:
 - Unprecedented production of administrative statistics. [Desrosières \(1993\)](#)
 - Administrations operating at heterogeneous levels of aggregation.
 - Context of profound socio-economic changes.
- Revival of quantitative research in history. [Ruggles \(2021\)](#)

Why an Ecosystem?

- France lags behind other countries (NHGIS, CAMPOP).
 - A few départements and cantons shapefiles, but not FAIR.
[LARHRA \(2011\)](#)
 - No common frame of reference (nomenclatures), no documentation.
 - Waste of time, little interoperability, reduced credibility.

Why an Ecosystem?

- A few exceptions:
 - cassini.ehess for general administrative constituencies.
[Motte et al. \(2003\)](#) [Motte and Vouloir \(2007\)](#)
 - HGIS for transportation infrastructures.
[Thévenin et al. \(2013\)](#) [Mimeur et al. \(2018\)](#)
 - HGIS for communes (ANR-COMMUNES). [Litvine et al. \(2022\)](#)

⇒ The TRF-GIS = documented and reproducible frame of reference.

Why an Ecosystem?

- Data + data paper necessary and go hand in hand.
- Complete documentation of the production process.

Why an Ecosystem?

- Data + data paper necessary and go hand in hand.
 - Complete documentation of the production process.
 - Response to the lack of value given to data production.
 - Little incentives for research evaluations.
 - Little credit to data producers.
- ⇒ A citable data paper can align incentives.
- Bet on creation of public good with positive externalities.

Methods and Content

Methods and Content

- General methodology.
- Limitations.
- Institutional details.
- Data records.
- Technical validation.

General methodology

General Methodology

- TRF-GIS infrastructure builds on three elements:
 - ① INSEE's *Code Officiel Géographique* (COG) nomenclatures of communes (2005, 2011).

General Methodology

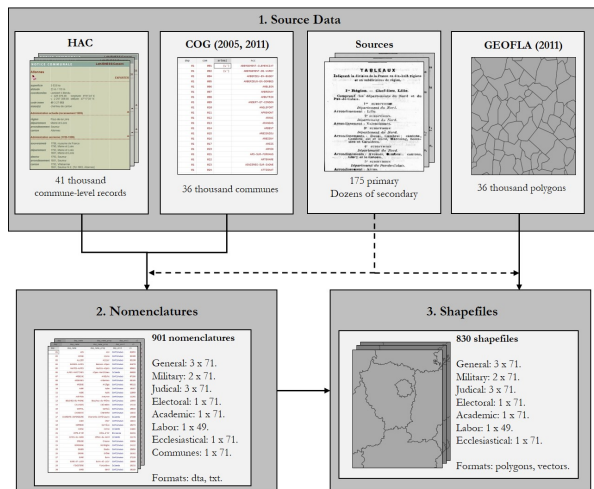
- TRF-GIS infrastructure builds on three elements:
 - ① INSEE's *Code Officiel Géographique* (COG) nomenclatures of communes (2005, 2011).
 - ② The *Histoire Administrative des Communes* (HAC) database (cassini.ehess). [Motte et al. \(2003\)](#) [Motte and Vouloir \(2007\)](#)

General Methodology

- TRF-GIS infrastructure builds on three elements:
 - 1 INSEE's *Code Officiel Géographique* (COG) nomenclatures of communes (2005, 2011).
 - 2 The *Histoire Administrative des Communes* (HAC) database (cassini.ehess). [Motte et al. \(2003\)](#) [Motte and Vouloir \(2007\)](#)
 - 3 IGN's *GEOFLA Communes 2011 France Métropolitaine* shapefile (RGF93 Lambert-93 projection, 1:25,000).

General Methodology

Construction logic of the TRF-GIS



TRF-GIS Shapefiles

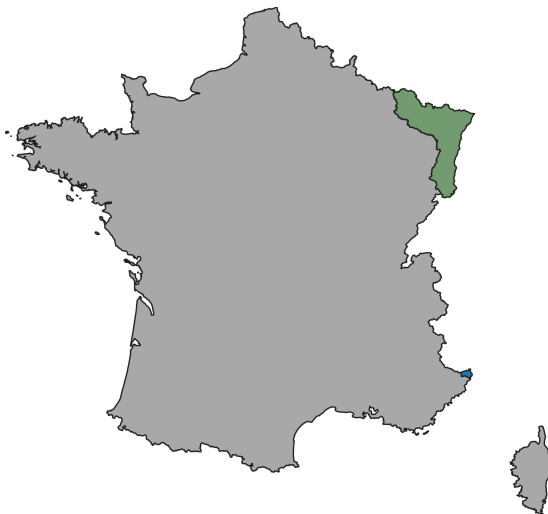
- GEOFLA 2011 as underlying frame except for:
 - Alsace-Lorraine (1871–1918).
 - La Brigue and Tende (1870–1940).

TRF-GIS Shapefiles

- GEOFLA 2011 as underlying frame except for:
 - Alsace-Lorraine (1871–1918).
 - La Brigue and Tende (1870–1940).
- Of the 36,568 communes of 2011:
 - 36,566 represented for 1870 and 1919–1940.
 - 34,932 represented for 1871–1918.

TRF-GIS Shapefiles

Missing territories compared to IGN's GEOFLA 2011



TRF-GIS Shapefiles

- Assign to each commune a general administrative constituency following HAC.
- HAC 2005 geography → 2011 COG → GEOFLA 2011.

TRF-GIS Shapefiles

- Assign to each commune a general administrative constituency following HAC.
- HAC 2005 geography → 2011 COG → GEOFLA 2011.
- Issue: communes created after 1870.
 - 737 communes in 2011 created after 1870.
 - Assign constituencies of parent commune.

TRF-GIS Shapefiles

- Assign to each commune a general administrative constituency following HAC.
- HAC 2005 geography → 2011 COG → GEOFLA 2011.
- Issue: communes created after 1870.
 - 737 communes in 2011 created after 1870.
 - Assign constituencies of parent commune.
- Dissolve commune-level polygons into general constituencies.
- Basis for special administrative constituencies.

TRF-GIS Nomenclatures

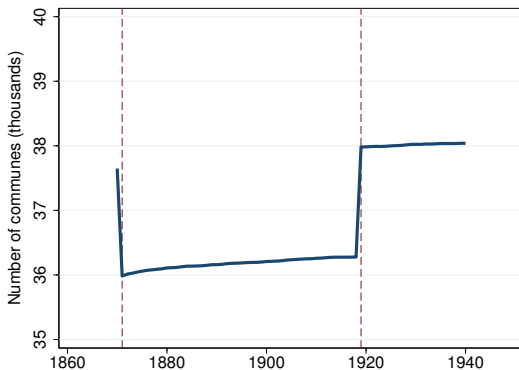
- General constituencies: toponyms and codification from HAC.
- Special constituencies: archival sources.

TRF-GIS Nomenclatures

- General constituencies: toponyms and codification from HAC.
- Special constituencies: archival sources.
- Commune-level nomenclatures: only contemporaneous communes.
 - Minimum: 35,974 communes in 1871.
 - Maximum: 38,038 communes in 1939–1940.

TRF-GIS Nomenclatures

Number of communes in commune nomenclatures



Municipal Arrondissements (Paris, Lyon, Marseilles)

- Different treatment of 45 municipal arrondissements of PLM:
 - GEOFLA: independent elements (36,610 entities; 36,568 communes).
 - COG and HAC: no differentiation (PLM = 3 entities).

Municipal Arrondissements (Paris, Lyon, Marseilles)

- Different treatment of 45 municipal arrondissements of PLM:
 - GEOFLA: independent elements (36,610 entities; 36,568 communes).
 - COG and HAC: no differentiation (PLM = 3 entities).
- TRF-GIS:
 - Distinguishes 20 arrondissements of Paris (stable since 1859).
 - Lyon and Marseilles unique entities (changes since 1870).

Limitations

Shapefiles Limitation 1

- Delineations of communes in 2011 geography.
 - GEOFLA 2011 earliest IGN shapefile accessible open license.
 - Commune boundaries: ANR Communes (2019–2022).
[Litvine et al. \(2022\)](#)

Shapefiles Limitation 1

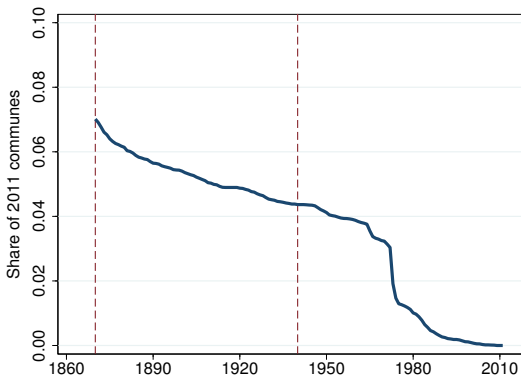
- Delineations of communes in 2011 geography.
 - GEOFLA 2011 earliest IGN shapefile accessible open license.
 - Commune boundaries: ANR Communes (2019–2022).
[Litvine et al. \(2022\)](#)
- Not a dramatic issue.
 - Limited changes in commune boundaries: less than 7%.
 - Constituencies defined at higher levels of aggregation.

Shapefiles Limitation 1

- Delineations of communes in 2011 geography.
 - GEOFLA 2011 earliest IGN shapefile accessible open license.
 - Commune boundaries: ANR Communes (2019–2022).
[Litvine et al. \(2022\)](#)
 - Not a dramatic issue.
 - Limited changes in commune boundaries: less than 7%.
 - Constituencies defined at higher levels of aggregation.
- ⇒ Usage for national / regional extents.

Shapefiles Limitation 1

Share of 2011 communes with modifications

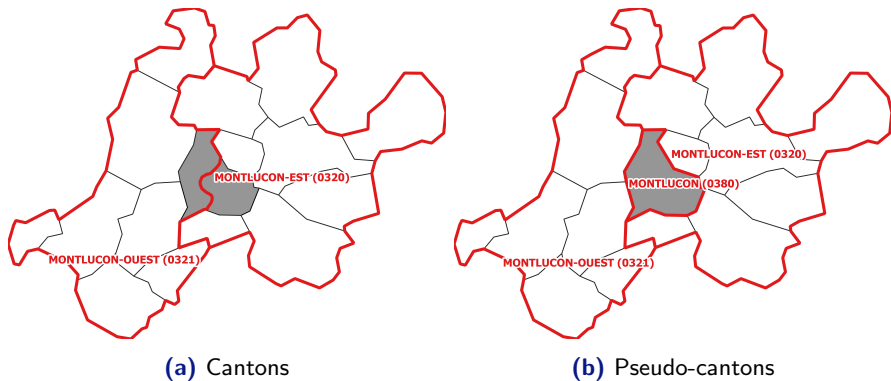


Shapefiles Limitation 2

- Constituencies defined across commune boundaries (e.g., cantons).
 - No issue for nomenclatures.
 - Shapefiles: communes as base units.
 - Follow INSEE and IGN methodology: pseudo-constituencies.
 - Cross-walks documented in the database.

Shapefiles Limitation 2

Cantons and pseudo-cantons of Montluçon (1870–1940)



Institutional Details

General Administrative Constituencies

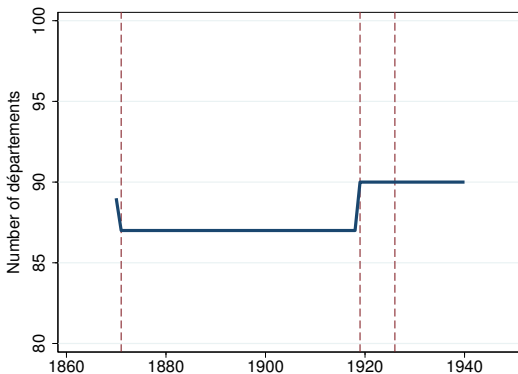
- Annexation (1871) and recovery of Alsace-Lorraine (1919):
 - 1,694 communes (Bas-Rhin, most Haut-Rhin, parts Moselle, Meurthe, Vosges).
 - Reconfiguration:
 - Haut-Rhin → Belfort
 - Meurthe and Moselle → Meurthe-et-Moselle.
 - Changes in arrondissements and cantons 1871–1873.
 - Recovery:
 - Belfort and Meurthe-et-Moselle unchanged.
 - Former Haut-Rhin, Bas-Rhin, Moselle: recover pre-war structure.
 - Keep changes under German rule.

General Administrative Constituencies

- Annexation (1871) and recovery of Alsace-Lorraine (1919):
 - 1,694 communes (Bas-Rhin, most Haut-Rhin, parts Moselle, Meurthe, Vosges).
 - Reconfiguration:
 - Haut-Rhin → Belfort
 - Meurthe and Moselle → Meurthe-et-Moselle.
 - Changes in arrondissements and cantons 1871–1873.
 - Recovery:
 - Belfort and Meurthe-et-Moselle unchanged.
 - Former Haut-Rhin, Bas-Rhin, Moselle: recover pre-war structure.
 - Keep changes under German rule.
- Arrondissement reform of 1926: 106 suppressions, 4 re-established by 1940.

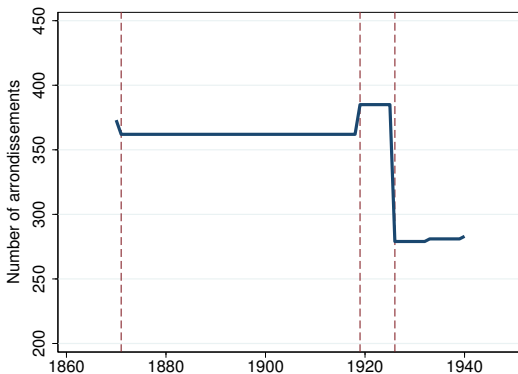
General Administrative Constituencies

Number of départements



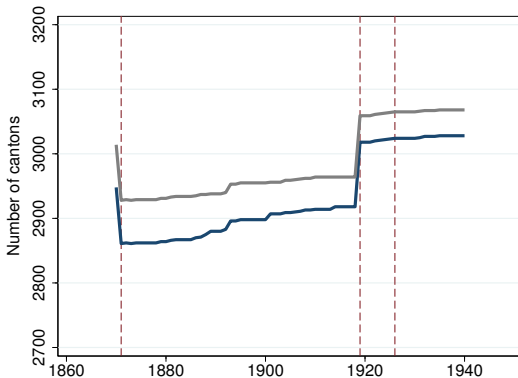
General Administrative Constituencies

Number of arrondissements



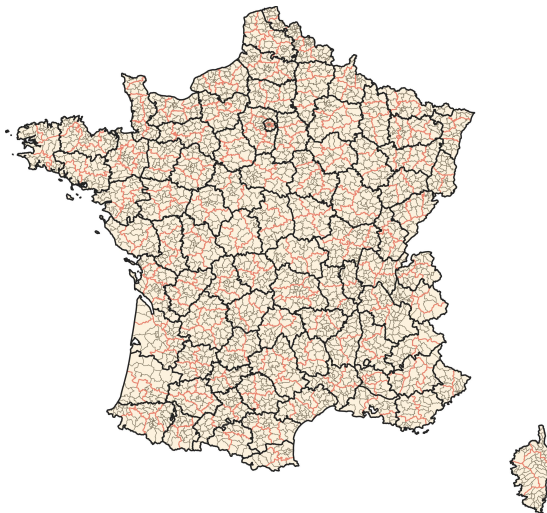
General Administrative Constituencies

Number of cantons and pseudo-cantons



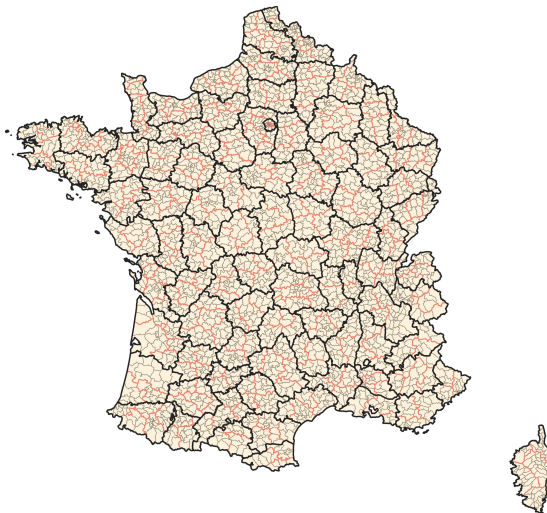
General Administrative Constituencies

General administrative constituencies in 1870



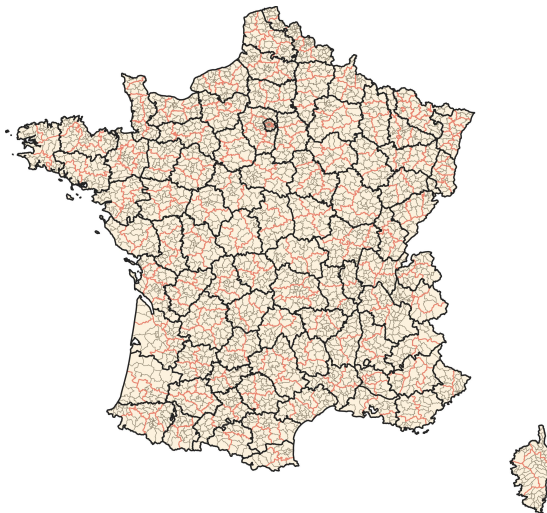
General Administrative Constituencies

General administrative constituencies in 1871



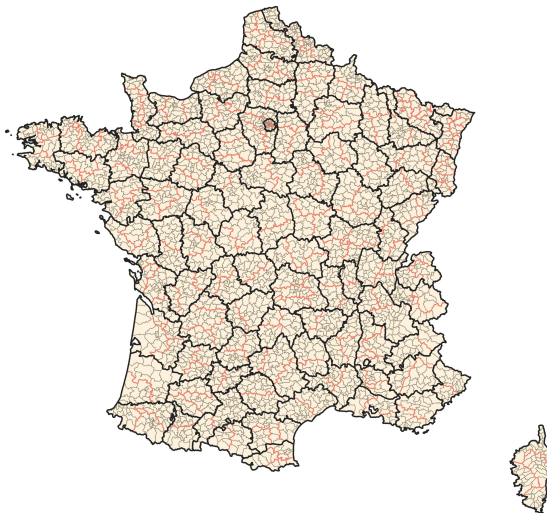
General Administrative Constituencies

General administrative constituencies in 1919



General Administrative Constituencies

General administrative constituencies in 1926



Military Constituencies

- 1870–1873:
 - Army corps subdivided into military divisions.
 - Follow départements.

Military Constituencies

- 1870–1873:
 - Army corps subdivided into military divisions.
 - Follow départements.
- 1874–1940:
 - Military regions subdivided into subdivisions of military regions.
 - Follow arrondissements and cantons (except PLM).
 - After 1920s: nesting subdivisions into départements.

Military Constituencies

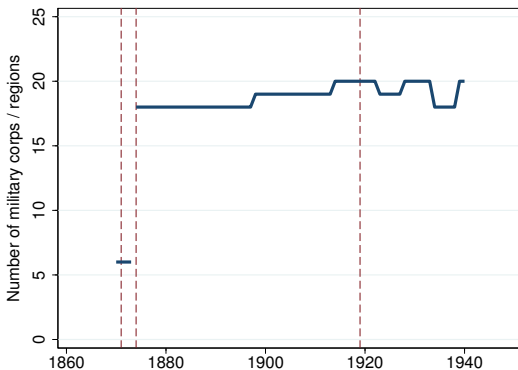
- Construction for 1870–1873:
 - Match with département nomenclatures and shapefiles.

Military Constituencies

- Construction for 1870–1873:
 - Match with département nomenclatures and shapefiles.
- Construction for 1874–1940:
 - Match cantons 1874 nomenclature to each military constituency.
 - Update annually with changes in cantons and (35) military reforms.
 - Necessary creation of pseudo-military constituencies.

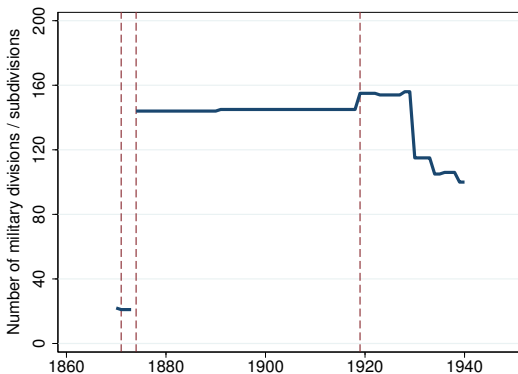
Military Constituencies

Number of military corps / regions



Military Constituencies

Number of military divisions and subdivisions



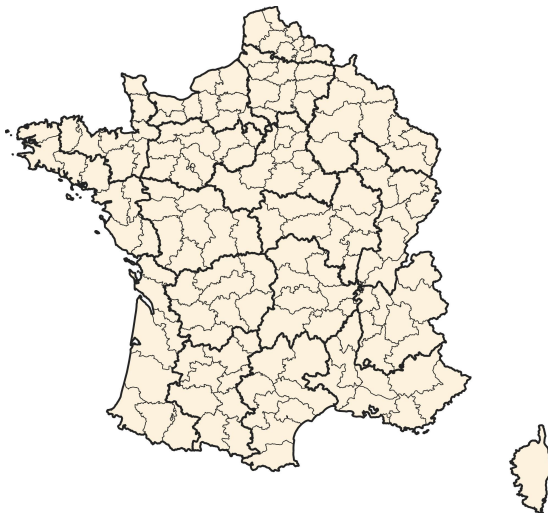
Military Constituencies

Military constituencies in 1870



Military Constituencies

Military constituencies in 1874



Military Constituencies

Military constituencies in 1919



Military Constituencies

Military constituencies in 1940



Judicial and Penitentiary Constituencies

- Five nested levels:
 - 1 Justices de paix (and tribunaux de simple police): cantons.
 - 2 Tribunaux de première instance (and tribunaux correctionnels):
 - 1870–1926: arrondissement based.
 - Reform 1926: suppression of 228 courts.
 - Reform 1929: all but 6 courts reinstated.
 - 3 Cours d'assise: département based.
 - 4 Cours d'appel: groups of départements.
 - 5 Unique Cour de Cassation.

Judicial and Penitentiary Constituencies

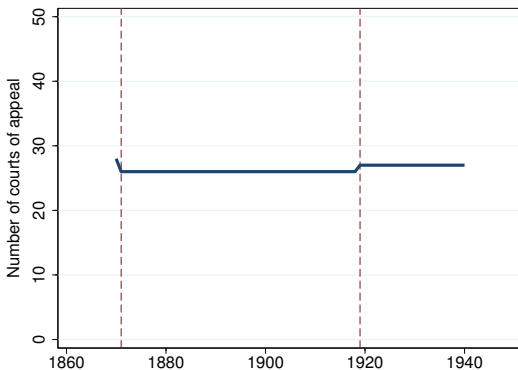
- Five nested levels:
 - 1 Justices de paix (and tribunaux de simple police): cantons.
 - 2 Tribunaux de première instance (and tribunaux correctionnels):
 - 1870–1926: arrondissement based.
 - Reform 1926: suppression of 228 courts.
 - Reform 1929: all but 6 courts reinstated.
 - 3 Cours d'assise: département based.
 - 4 Cours d'appel: groups of départements.
 - 5 Unique Cour de Cassation.
- Penitentiary constituencies: groups of départements.

Judicial and Penitentiary Constituencies

- Five nested levels:
 - ① Justices de paix (and tribunaux de simple police): cantons.
 - ② Tribunaux de première instance (and tribunaux correctionnels):
 - 1870–1926: arrondissement based.
 - Reform 1926: suppression of 228 courts.
 - Reform 1929: all but 6 courts reinstated.
 - ③ Cours d'assise: département based.
 - ④ Cours d'appel: groups of départements.
 - ⑤ Unique Cour de Cassation.
- Penitentiary constituencies: groups of départements.
- Same method: match with general constituencies and update annually with reforms.

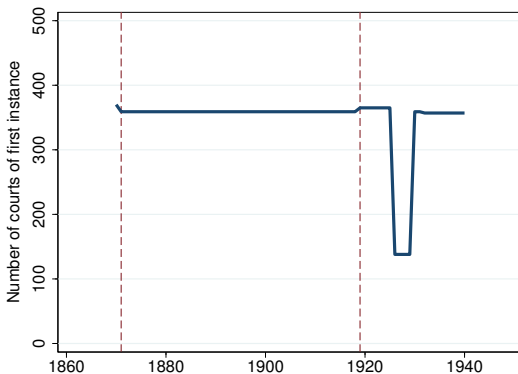
Judicial Constituencies

Number of courts of appeal



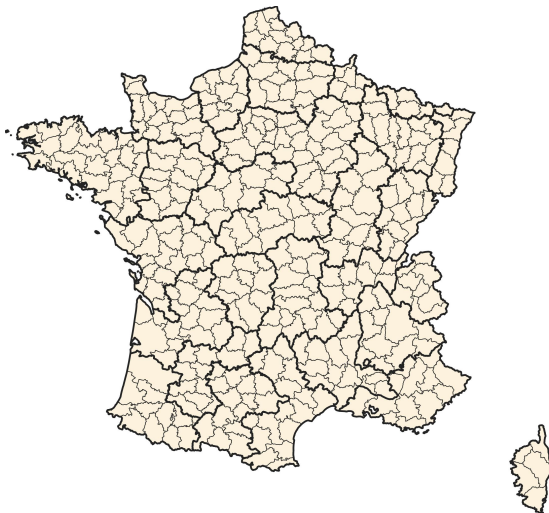
Judicial Constituencies

Number of courts of first instance



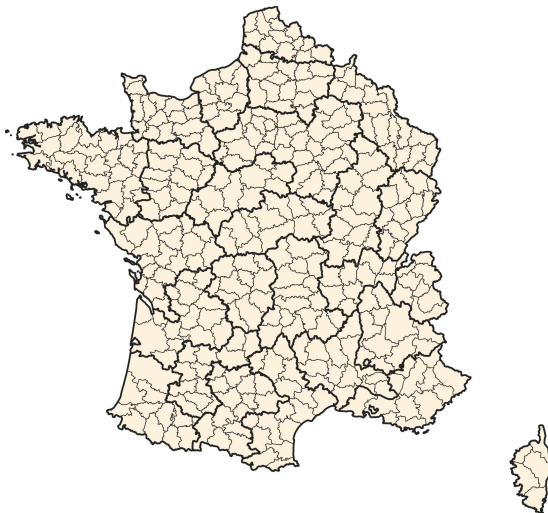
Judicial Constituencies

Judicial constituencies in 1870



Judicial Constituencies

Judicial constituencies in 1871



Judicial Constituencies

Judicial constituencies in 1926



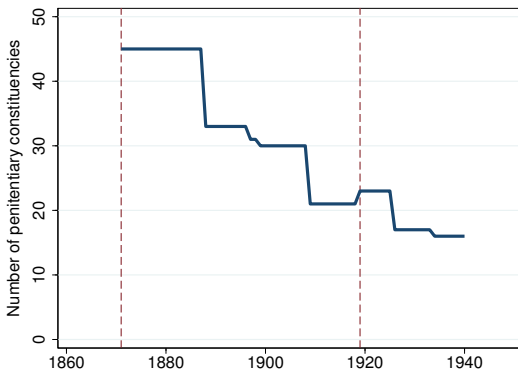
Judicial Constituencies

Judicial constituencies in 1940



Penitentiary Constituencies

Number of penitentiary constituencies



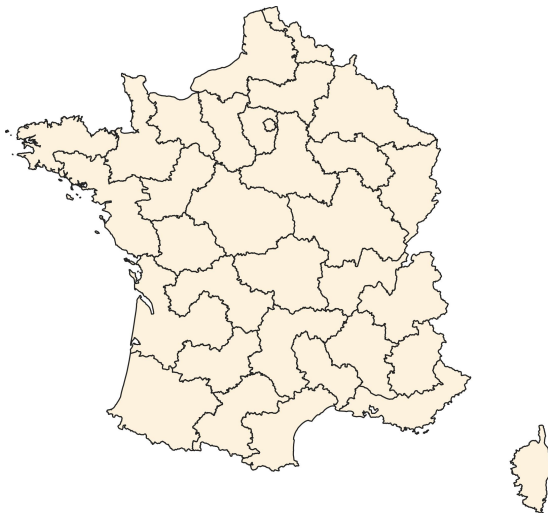
Penitentiary Constituencies

Penitentiary constituencies in 1871



Penitentiary Constituencies

Penitentiary constituencies in 1888



Penitentiary Constituencies

Penitentiary constituencies in 1909



Penitentiary Constituencies

Penitentiary constituencies in 1940



Electoral Constituencies

- Electoral system:
 - Single-member district (one député per circonscription).
 - Except elections 1871, 1885, 1919, 1924 (block-list).

Electoral Constituencies

- Electoral system:
 - Single-member district (one député per circonscription).
 - Except elections 1871, 1885, 1919, 1924 (block-list).
- Electoral geography:
 - Generally follows arrondissements.
 - Major redistricting, after electoral system change:
 - Basis for Third-Republic: 1875.
 - Redistricting of 1889 based on 1875.
 - Redistricting of 1927 based on pre-1926 reform arrondissements.
 - General principles:
 - One député per arrondissement.
 - Each 100k inhabitants entitled one additional député.
 - Modification if number of députés change due to population.

Electoral Constituencies

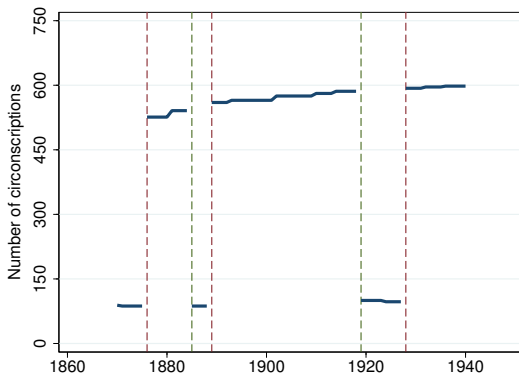
- Electoral system:
 - Single-member district (one député per circonscription).
 - Except elections 1871, 1885, 1919, 1924 (block-list).
- Electoral geography:
 - Generally follows arrondissements.
 - Major redistricting, after electoral system change:
 - Basis for Third-Republic: 1875.
 - Redistricting of 1889 based on 1875.
 - Redistricting of 1927 based on pre-1926 reform arrondissements.
 - General principles:
 - One député per arrondissement.
 - Each 100k inhabitants entitled one additional député.
 - Modification if number of députés change due to population.
 - Block-list elections: generally follow départements.

Electoral Constituencies

- Match Gaudillère's (1995) *Atlas Historique des Circonscriptions Electorales Françaises* with TRF-GIS canton-level annual nomenclatures.
- Verify Gaudillère with (13) redistricting reforms.
- Expand configurations from one election to the next, taking territorial changes into account.
- Creation of pseudo-constituencies when needed for shapefiles.

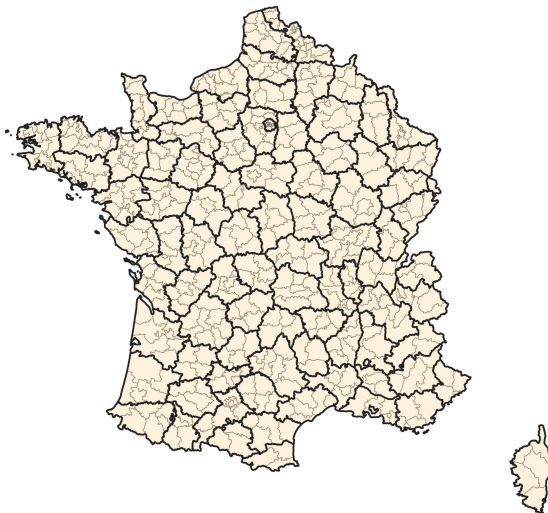
Electoral Constituencies

Number of electoral constituencies



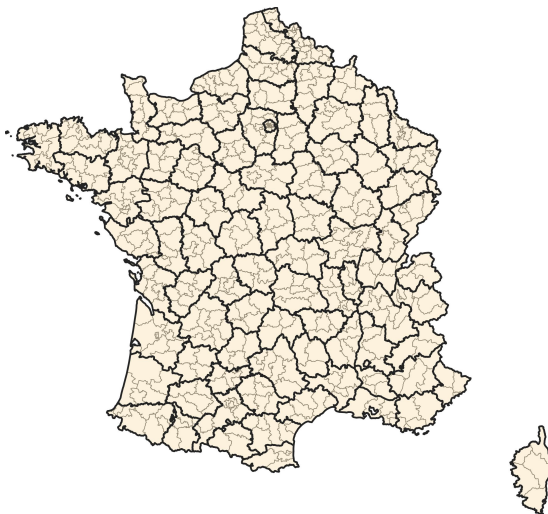
Electoral Constituencies

Electoral constituencies in 1876



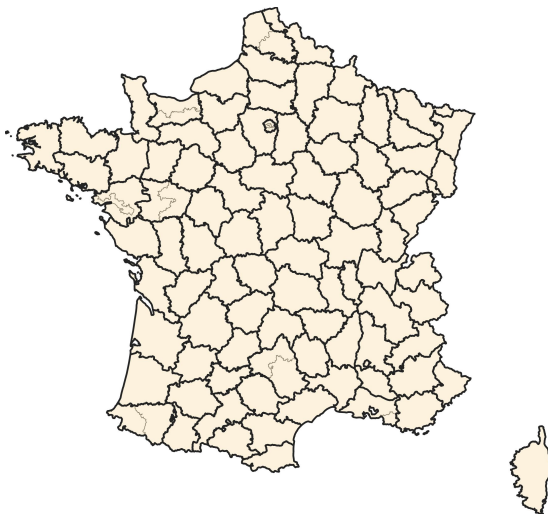
Electoral Constituencies

Electoral constituencies in 1889



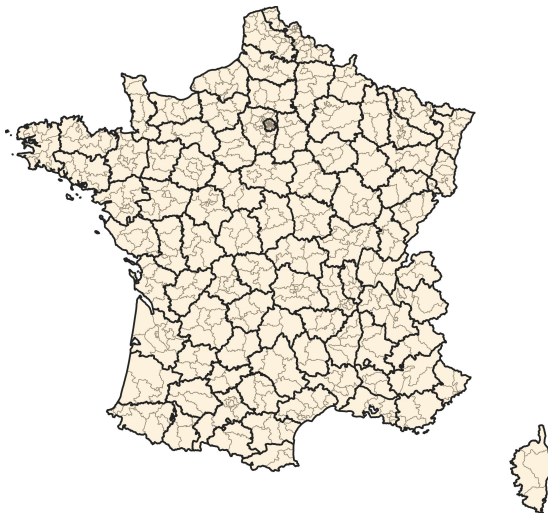
Electoral Constituencies

Electoral constituencies in 1919



Electoral Constituencies

Electoral constituencies in 1928



Other Special Constituencies

- Academic constituencies (academies).
- Labor inspection constituencies (1892–1940).
- Ecclesiastical constituencies (dioceses).

Data Records

Départements

- Nomenclatures:
 - Identifier (Meurthe 1870 is 99 as in CRH database).
 - Name (capitalized, proper).
 - Indicator for enclaves or islands.
 - Prefecture INSEE identifier.
 - Prefecture name (capitalized, proper).
 - Indicator for prefecture current commune.
 - Prefecture coordinates (Lambert-93).
- Shapefiles: same variables.

Arrondissements

- Nomenclatures:
 - Identifier (COG 2011, ascending order if disappeared).
 - Name (contemporaneous toponymy).
 - Subprefecture INSEE identifier.
 - Subprefecture name (contemporaneous toponymy).
 - Indicator for subprefecture common to multiple arrondissements.
 - Indicator for subprefecture located outside arrondissement.
 - Indicator for subprefecture current commune.
 - Subprefecture coordinates (Lambert-93).
- Shapefiles: same variables.

Cantons

- Nomenclatures
 - Identifier (COG 2011, COG 1954 if disappeared, ascending order).
 - Name (contemporaneous toponymy).
 - Canton communal composition (follows INSEE's COG conventions).
 - Bureau centralisateur INSEE identifier.
 - Bureau centralisateur name (contemporaneous toponymy).
 - Indicator for bureau centralisateur common to multiple cantons.
 - Indicator for bureau centralisateur current commune.
 - Bureau centralisateur coordinates (Lambert-93).
- Shapefiles: same variables but
 - Pseudo-cantons assigned codes > 80 (INSEE's COG conventions).
 - Pseudo-canton name: aggregating commune.
 - Cross-walks available.

Cantons

- Nomenclatures
 - Identifier (COG 2011, COG 1954 if disappeared, ascending order).
 - Name (contemporaneous toponymy).
 - Canton communal composition (follows INSEE's COG conventions).
 - Bureau centralisateur INSEE identifier.
 - Bureau centralisateur name (contemporaneous toponymy).
 - Indicator for bureau centralisateur common to multiple cantons.
 - Indicator for bureau centralisateur current commune.
 - Bureau centralisateur coordinates (Lambert-93).
- Shapefiles: same variables but
 - Pseudo-cantons assigned codes > 80 (INSEE's COG conventions).
 - Pseudo-canton name: aggregating commune.
 - Cross-walks available.
- Same logic for special constituencies.

Annual Commune-Level Nomenclatures

- 69 variables.
- Commune identifiers: INSEE (post-1946), HAC.
- Contemporaneous toponymy.
- Constituencies (or pseudo) belonged to.
- Indicators for constituencies chef-lieu.
- Total population (from HAC) with interpolation flags.
- Indicator for sieges of commercial and labor courts.
- Paris: both city and arrondissements.

Technical Validation

Technical Validation: TRF-GIS Nomenclatures

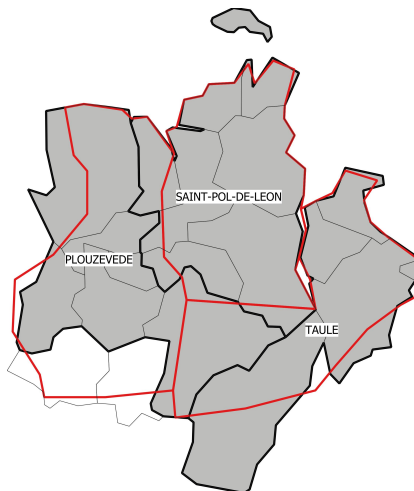
- Information from secondary sources verified against primary administrative sources (175).
- Main primary sources: *JO*, *BL*, *Code Pénitentiaire*, *Bulletin Administratif de l'Instruction Publique*, *Acta Apostolicae Sedis*.
- Also verified against statistical publications of relevant administrations (*Compte Rendu sur le Recrutement de l'Armée*, *Compte Général de l'Administration de la Justice...*, *Statistique Pénitentiaire*, *Tableau des Elections à la Chambre des Députés*).
- 231 errors in HAC corrected.

Technical Validation: TRF-GIS Shapefiles

- GEOFLA vs BD CARTO: freely accessible, light manipulation, but less precise (still, fine for regional extent).
- GEOFLA vs ADMIN-EXPRESS: older geography available.
- Advantages over manual vectorization of georeference maps:
 - Historical maps with national extents not precise at boundaries (and unknown projections).
 - Historical maps not produced annually.
 - Little maps for special constituencies.
 - Manual vectorization time consuming and error prone.
- Positive comparison with existing shapefiles (LARHRA: cantons 1884 and 1925).

Technical Validation: TRF-GIS Shapefiles

Comparison TRF-GIS and LARHRA cantons 1884



Thick red lines: LARHRA; thick black lines: TRF-GIS; thin black lines: GEOFLA 2011. No territorial changes to communes

FAIR Data in Practice

FAIR Data in Practice

- FAIR data: findable, accessible, interoperable, reusable.
[Wilkinson et al. \(2016\)](#)
- Many elements managed by repository.
- Harvard Dataverse: 13k files, 6 BG.

FAIR Data in Practice

- FAIR data: findable, accessible, interoperable, reusable.
[Wilkinson et al. \(2016\)](#)
- Many elements managed by repository.
- Harvard Dataverse: 13k files, 6 BG.
- Some FAIR elements of the TRF-GIS:
 - Rich metadata (DDI, Dublin Core, DataCite).
 - Controlled vocabulary for keywords (LCSH).
 - PID for each data file (DOI).
 - Open and persistent formats (.csv, .txt, .dta, shapefiles).
 - Compatibility with current standards (INSEE COG, IGN GEOFLA).
 - Appropriate licensing (CC-BY 4.0).
 - Versioning.