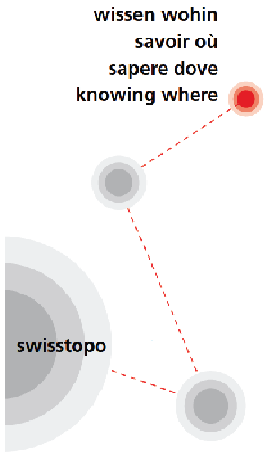
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Landestopografie swisstopo
Geodäsie und Eidgenössische Vermessungsdirektion

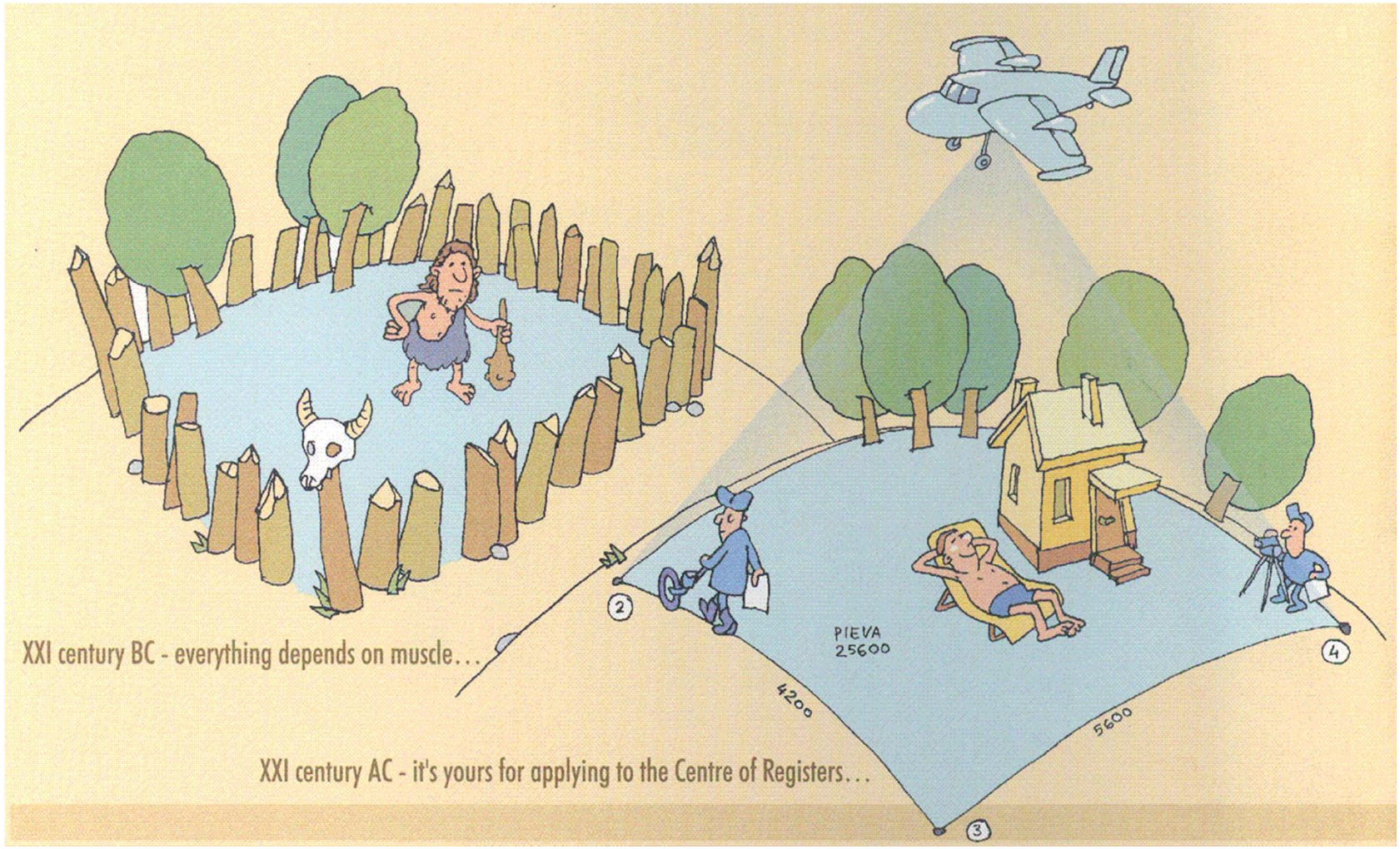


The Multi-Dimensions in Cadastre

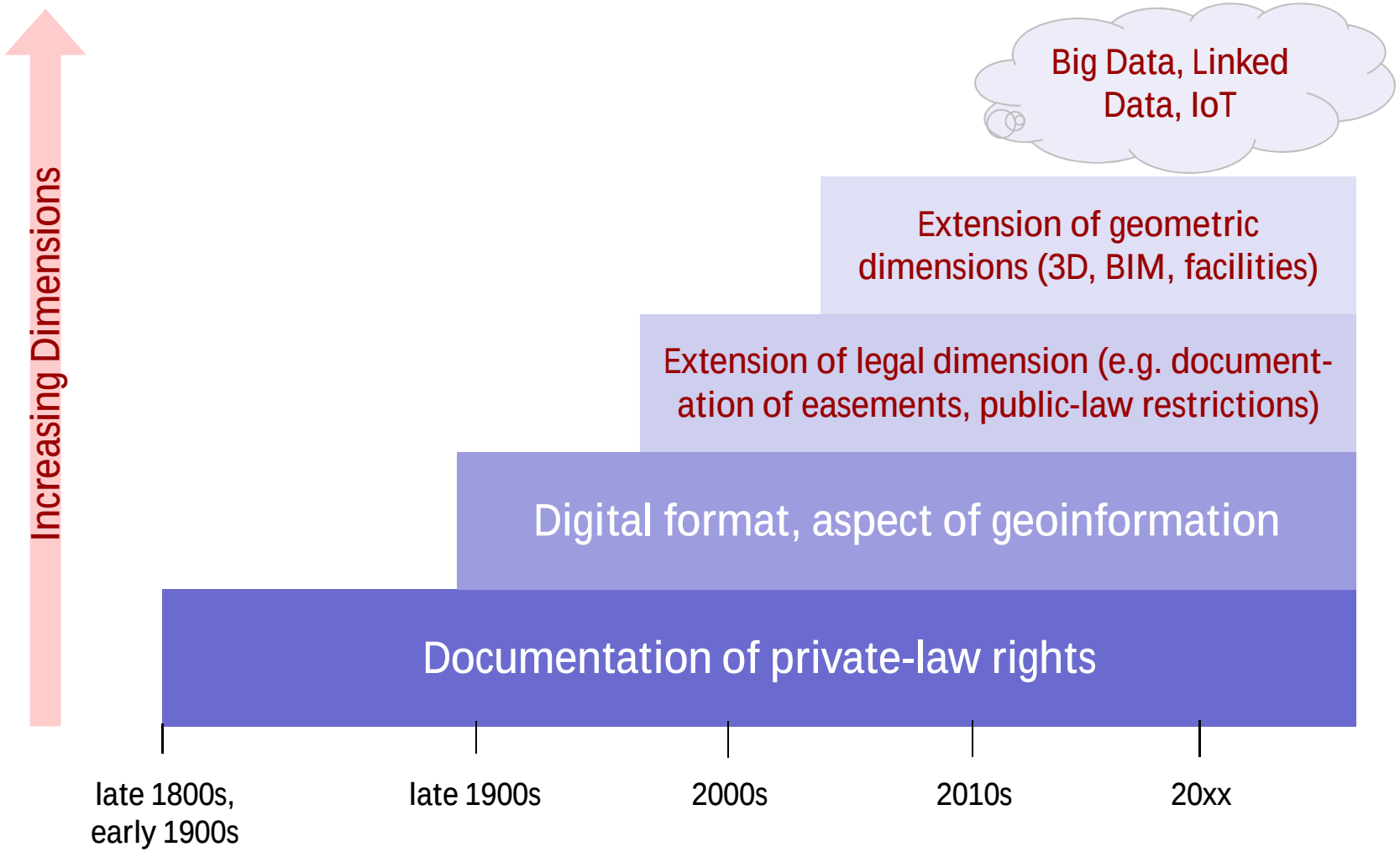
FIG-Commission 7 – Annual Meeting 2018
Bergen, Norway, 26 Sep. 2018

Dr. Daniel Steudler
Scientific Associate

Documentation of Landownership



Multi-Dimensions of Cadastral Systems



Going digital

Legal basis

Swiss Civil Code, 1912

- **Security of ownership**, efficient land market, and mortgaging of real estates

Ordinance on Cadastral Surveying, 1993

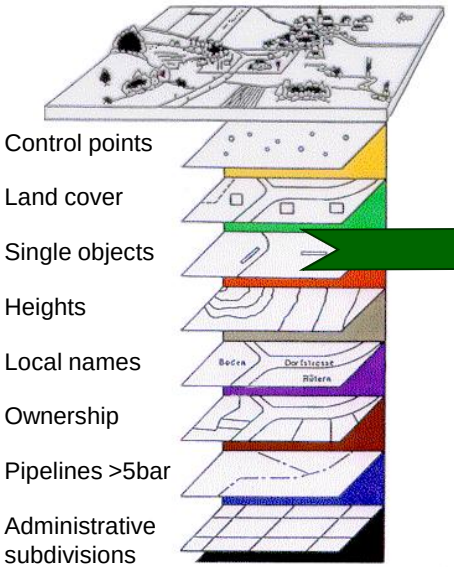
- **Digital format** of cadastral surveying, extension of purpose beyond land registry to information systems

Act on Geoinformation, 2008

- A **uniform legal basis** for **all land information** based on the various federal decrees (incl. cadastral surveying)
- A legal basis for the introduction of a **cadastre for public legal restrictions on landownership rights (PLR-Cadastre)**

Core Data Model of Swiss Cadastral Surveying

Digital data description AV93 (introduced in 1993)



Control points

Land cover

Single objects

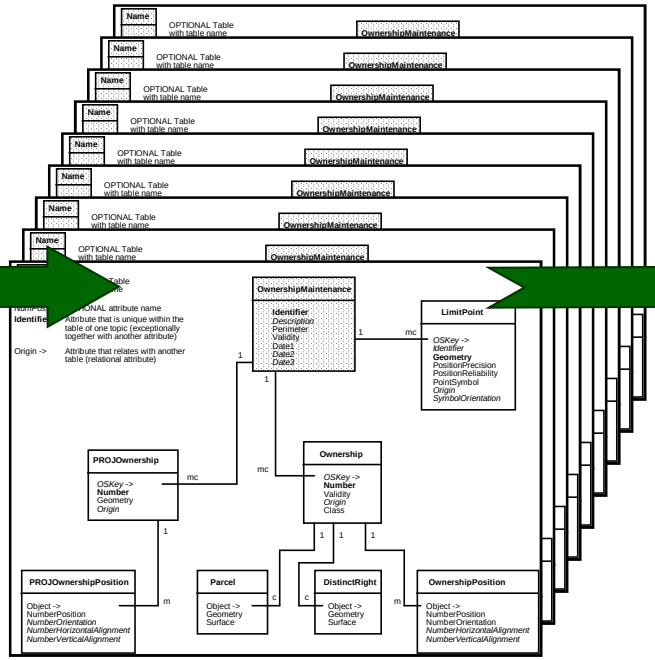
Heights

Local names

Ownership

Pipelines >5bar

Administrative subdivisions




```
TRANSFER Data_Catalogue;
MODEL Basic_Data_Set
 DOMAIN
  LKoord = COORD2  480000.000   70000.000
                    840000.000  300000.000;
  HKoord = COORD3  480000.000   70000.000      0.000
                   840000.000  300000.000   5000.000;
  Height = DIM1  0.000  5000.000;
  Precision = [0 .. 300];
  Reliability = (yes, no);
  LetterOrientation = GRADS  0.0  400.0;
  Status = (planned, valid);

TOPIC Control_Points =
.........
END Control_Points;

TOPIC Land_Cover =
.........
END Land_Cover;

TOPIC Ownership =
  MAIN
    mentation = (border_stone, plastic_peg, cross,
                 not_monumented);
  OwnershipType = (parcel, distinct_right,
                   construction_right, water_source_
                   right);
TABLE LimitPoint =
   OSKey: OPTIONAL -> OwnershipMaintenance;
   Identifier:  OPTIONAL TEXT*12;
   Geometry:  LKoord;
   PositionPrecision:  Precision;
   PositionReliability:  Reliability;
   Origin:  OPTIONAL TEXT*30;
   SymbolOrientation:  OPTIONAL LetterOrientation;
   !! Default: 0.0
   IDENT
   Geometry;
 END LimitPoint;
END Ownership.
END Basic_Data_Set.
```

8 Information Layers

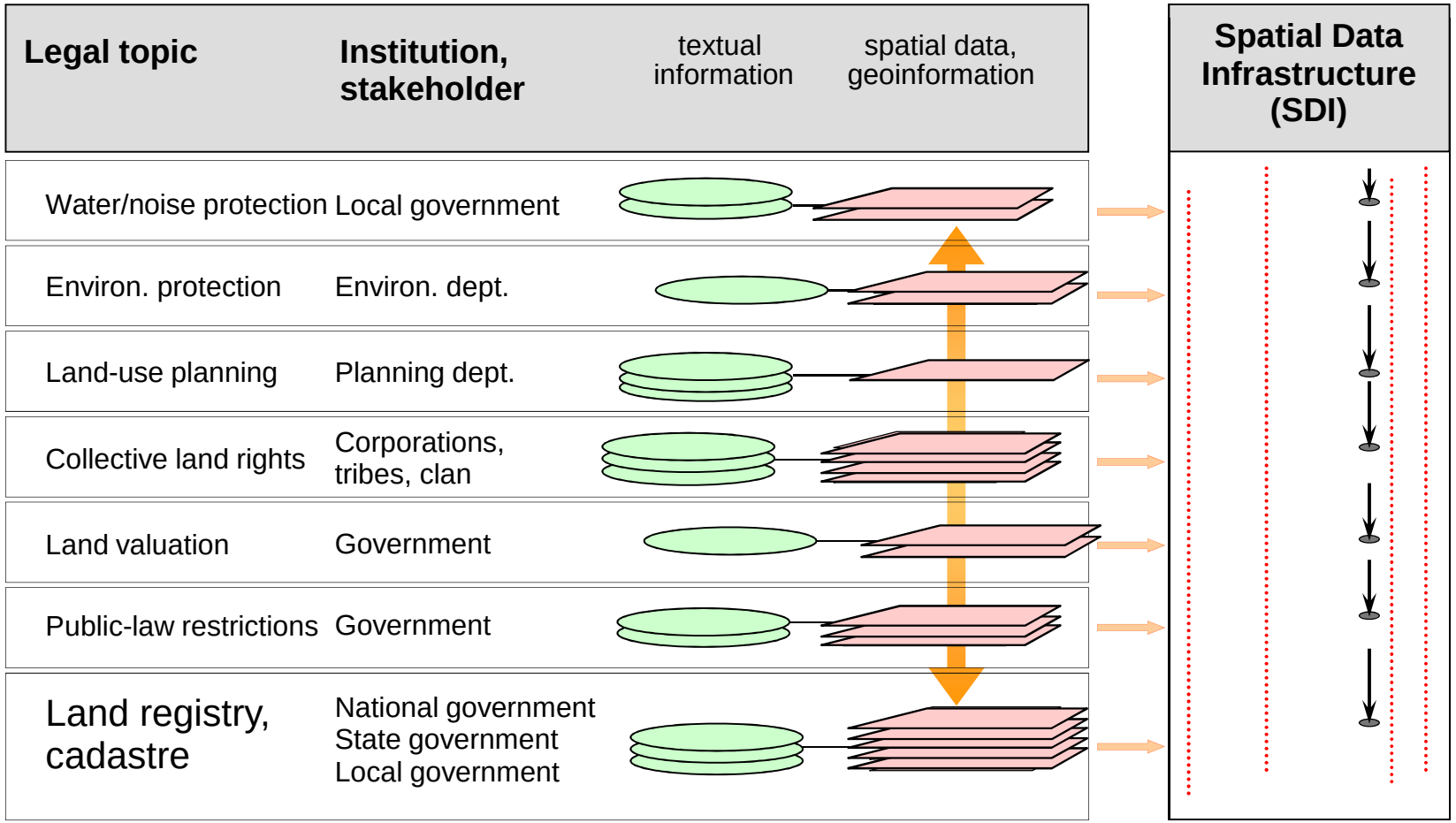
(Possibility to manage the layers separately)

Data Model (UML)

(8 Entity-Relationship-Diagrams)

Data Description Language INTERLIS

Common Data Integration Concept



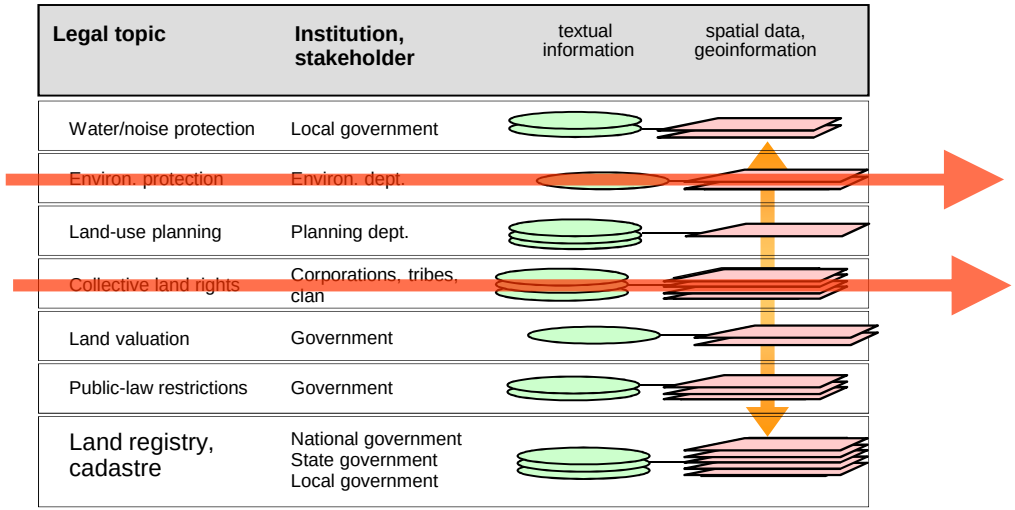
Four basic principles for a common data integration concept:

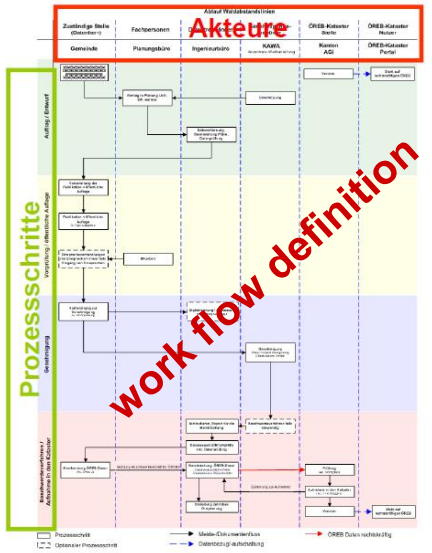
1) to respect the legal / institutional independence of stakeholders
2) to use a standardized data modelling concept
3) to use a common geodetic reference framework
4) no logic relations between objects in different topic except through geographic location

Independent information layers

Advantages:

- stakeholders can look after their own data sets, they only have to respect the defined basic principles
- the fear of stakeholders – losing control over their data – can be overcome

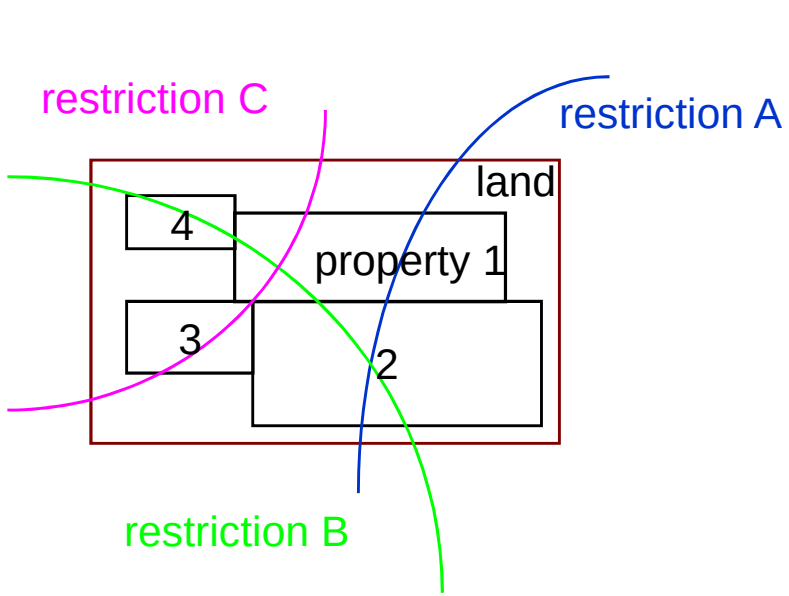




- work flow and data flow can be clearly defined and managed for each stakeholder independent from the others

Extension of legal dimensions

Statement 1 on Cadastre 2014

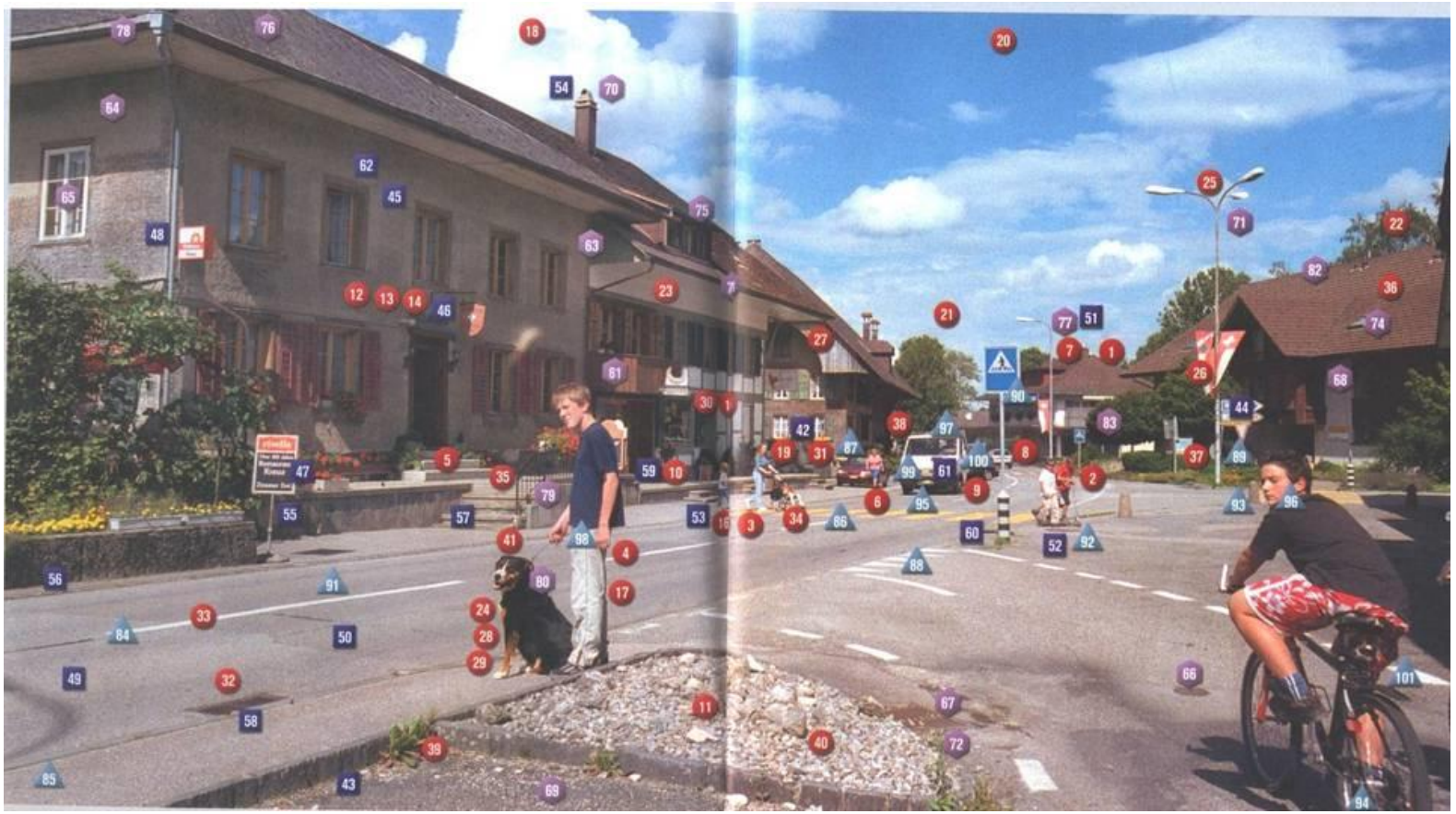


Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions!

(Kaufmann and Steudler, 1998)

Flood of restrictions

Ortstermin in Ursenbach BE, Freitag, 20. August 2004 : 101 Gesetze, Verordnungen und Vorschriften müssen allein in dieser Alltagszene beachtet werden (aus FACTS, 2.9.04)



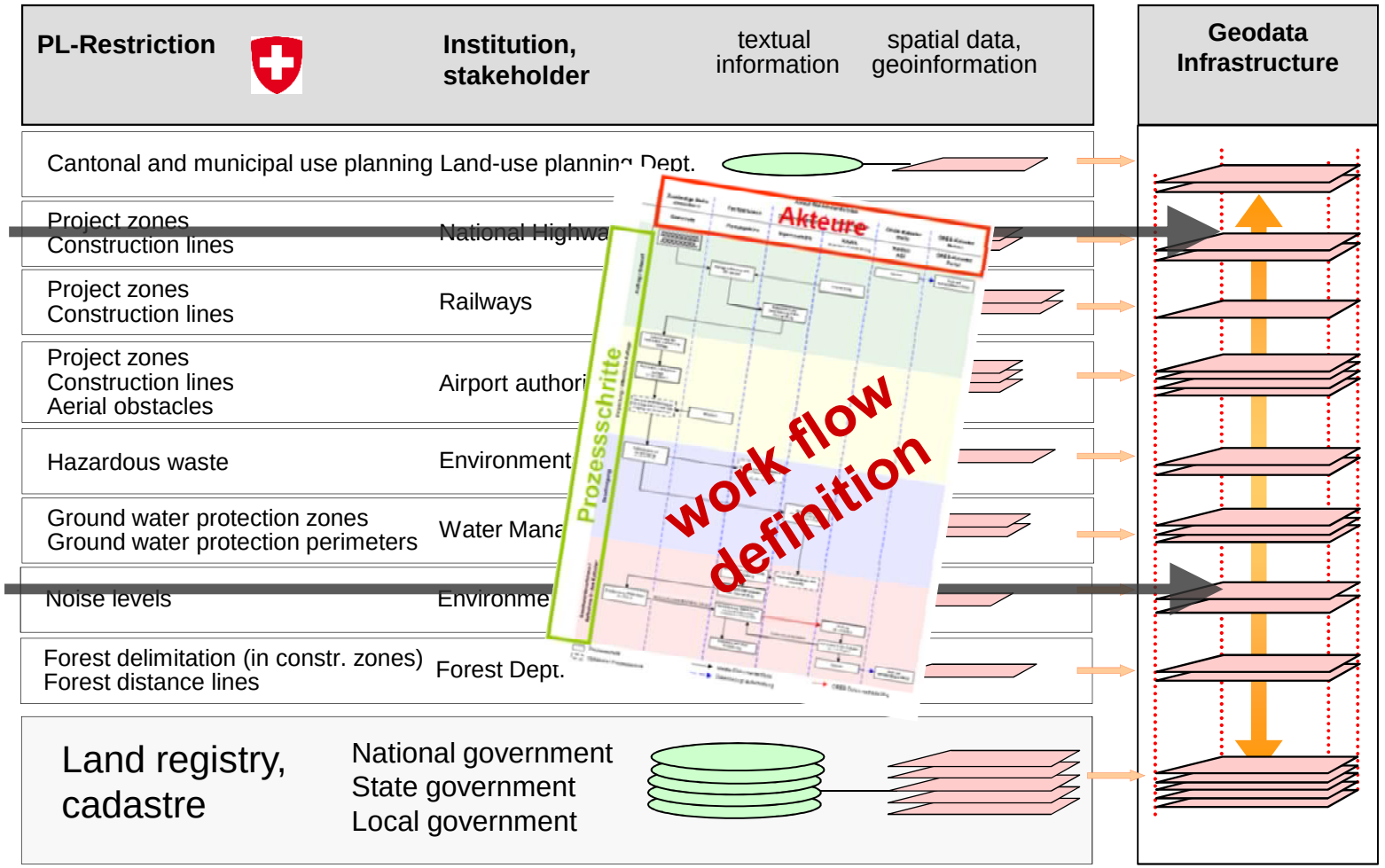
Landownership: the macro-economic dimension

The Swiss cadastral system secures real estate values in the order of CHF 2,000 billion, of which approx. CHF 900 billion of mortgages are given out (more than CHF 100,000 per population).

The documentation of PLRs potentially can improve transparency and security of landownership; if the effect is only 0.1%, it would correspond to CHF 900 million.

17 Public-law restrictions in Swiss cadastre

(full coverage by 2020)

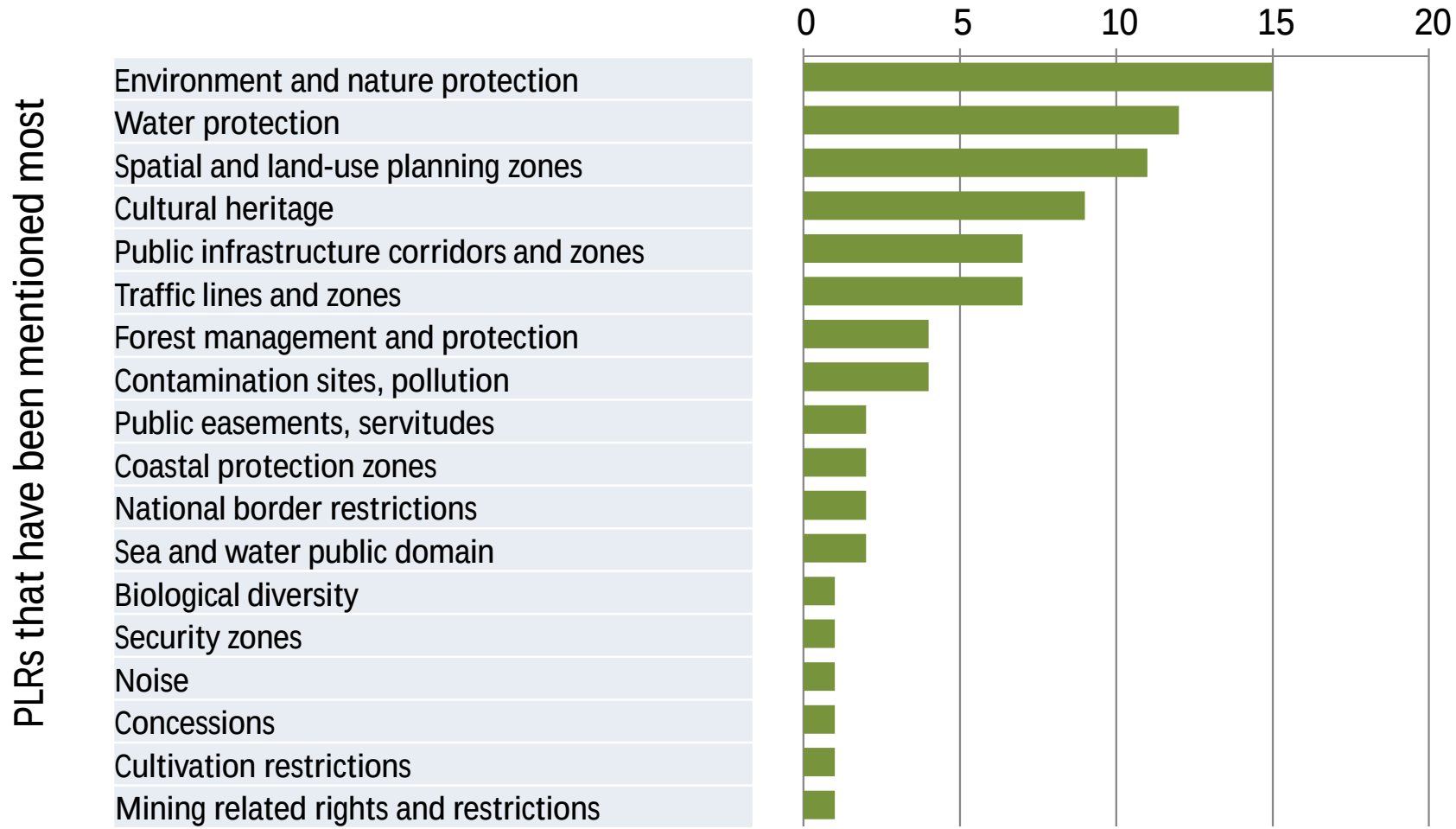


CLRKEN – Questionnaire in 2015

- **Public-Law Restrictions (PLRs) and Status in Europe (Nov. 2015):**
  - **Types of documented PLRs**
  - **How many different PLRs?**
  - **Integration in cadastral system?**
  - **Coverage**

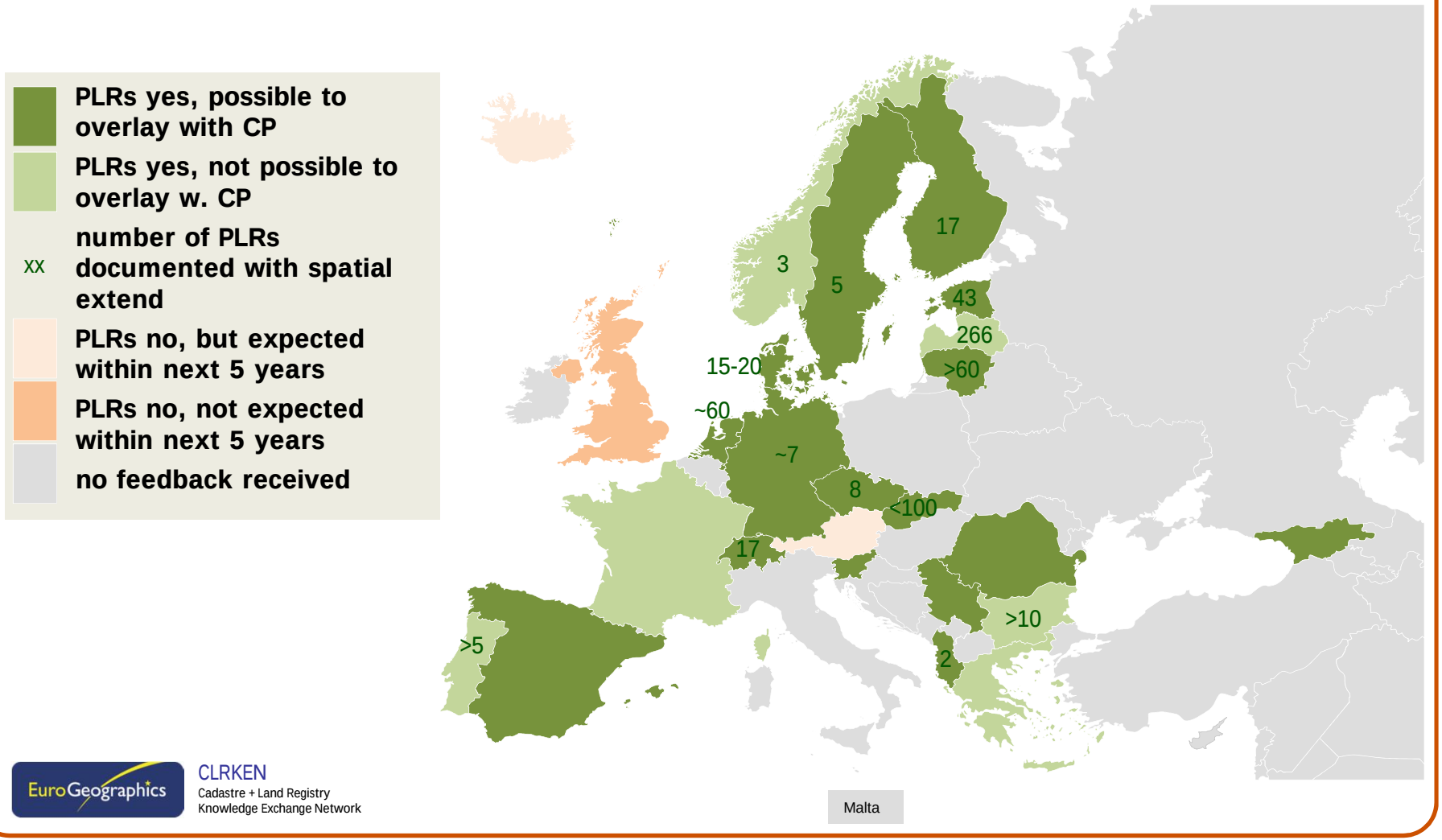
- **Responses from 25 countries**

Types of documented PLRs in 22 countries



Status of PLR Documentation in Europe

Documentation of PLRs and possibility to overlay
with cadastral landownership parcels



EuroGeographics

CLRKEN
Cadastre + Land Registry
Knowledge Exchange Network

Extension of geometric dimensions

Our world is evolving, it gets more and more complex…

The needs become more demanding…

New surveying techniques become available…

So far – in the cadastral context – we maintain and present our data in 2D only!

Dense urban context

Across the street from
the World Bank building
in Washington DC

«There is Chaos in the Underground»

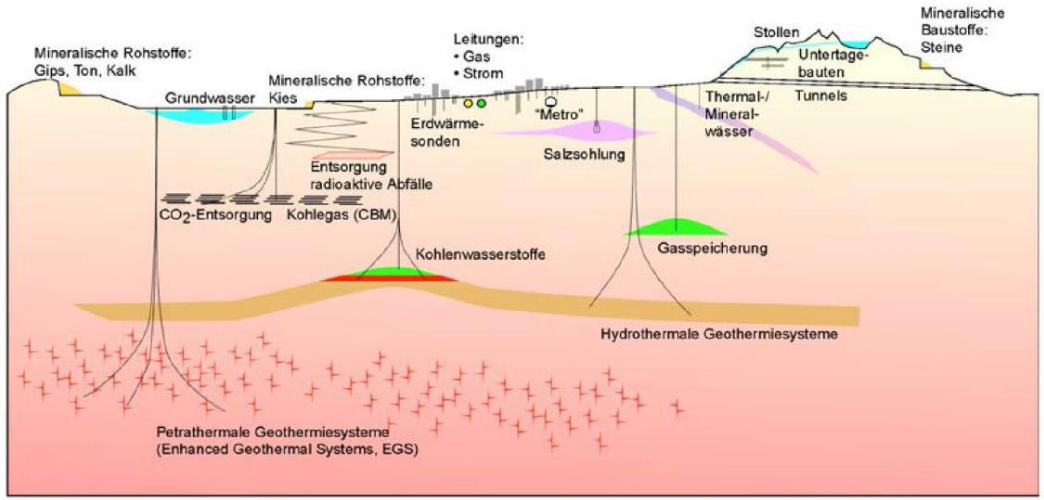
- Postulate by Member of Parliament in 2011: Gov. is requested to explain:

  (i) how the use of the underground is legally regulated; and

  (ii) what opportunities and concepts exist for the better regulation and sustainable use of the underground.

- Report from the Federal Office for Spatial Development (ARE) in 2014 with the recommendation

  … to investigate how the extension of official cadastral surveying and the cadastre of PLRs into the underground as well as the harmonization of the cadastre of underground utilities can help to satisfy the requirements for the 3rd dimension.



Digital Transformation

Discussion Paper 2017 – Paths to Digitisation

- identifies four elements of megatrends that may affect the cadastre
- call on the profession to keep eyes open

Four opportunities for the future of the cadastre

1

Data: the basis of the digital revolution

RECOMMENDATION 1

Data science is a new area that will supplement the field of geodata as we know it today. It is therefore essential that Swiss universities introduce studies for geodata scientists.

2

Meta platforms for a high level of market dominance

RECOMMENDATION 2

In the future, people will access public services via apps. Requests will be carried out through application algorithms. Public administrations will have to operate meta-platforms for the future provision of their services. In addition, they can manage their official data and algorithms in the form of (geo)services available to other meta-platforms operated by other third parties (public or private). An example might be BIM (Building Information Modelling).

Four opportunities for the future of the cadastre

3

Revolutionising registers through the use of Blockchains

RECOMMENDATION 3

Blockchain technology is moving in the direction of distributed ledgers, i.e. distributed, transparent and high-security registers. This development will have a particularly strong impact on the public sector, which will have to react swiftly and offer such services as quickly as possible, especially in the context of the land register.

4

Towards an administration and governance of variable geometry

RECOMMENDATION 4

The "Smart Cities" concept will affect the structure of public administrations. Smart Cities will sit across different territories (municipality, canton or region, e.g. Greater Geneva) and will be digital rather than bureaucratic. Administrations therefore have to create smart data that form the digital building blocks for Smart Cities.

EU Ministerial Declaration on eGovernment, signed in Tallinn on 6 Oct. 2017

- signed by 28 EU countries (incl. GB) + IS, FL, NO, CH
- … the overall vision remains to strive to be open, efficient and inclusive, providing borderless, interoperable, personalized, user-friendly, end-to end digital public services to all citizens and businesses – at all levels of public administration.
- Policy action lines:
  1) Digital-by-default, inclusiveness and accessibility
  2) Once only
  3) Trustworthiness and Security
  4) Openness and transparency
  5) Interoperability by default
  6) Horizontal enabling policy steps

Evolving Dimensions of the Cadastre

Description	Aim, Purpose	Effect
Traditional cadastre	documentation of land-ownership rights	legal, social, and economic security
Digital format	maintain data digitally	interoperability, basis for Spatial Data Infrastructures
Extension of legal dimensions	documentation of public-law restrictions	more transparency in legal terms, more transparent land market
Extension of geo-metric dimensions	document 3D owner-ship situations	enable planning and coord-ination above and under-ground
Digital trans-formation	Linked Data, Internet of Things, Big Data	to support E-Government, to connect with Smart Cities and BIM