The Comprehensive Cadastre Supports Recovery from Disaster

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SUMMARY

Disasters happen. They can be presumed, but not prognosticated. And the effects of disasters in most cases cause heavy changes to the existing situation of land, nature, environment and living space. They provoke as well the need to restore destroyed infrastructures. In most cases this restoration must be conform to the legal situation. If it is not known any more what was the legal situation before the disaster, recovery will be difficult and delayed. You cannot restore buildings without knowing the legal situation of property, you cannot develop land when you don't know how the physical planning was foreseen. You cannot restore infrastructures when the information about the type, nature and position is missing or destroyed.
These questions became urgent in every case we know. So the recovery from earthquakes in Haiti, Christchurch, Iran, the Tsunami in Thailand and Indonesia and Japan, was hampered by lack of information about how was the legal situation before the disaster.
If this information about the legal situation existing in the disaster area is available, restoration can start as soon as the victims are accommodated and the appreciation of the situation is made.
The tool to support an immediate recovery is the comprehensive cadastre as it was stipulated by FIG under the title cadastre 2014 and further developed by the FIG task force on the Spatially Enabled Society.
The paper shows what a Comprehensive Cadastre is and how it can be established. Based on the example of the Cadastre of Public-law Restrictions on landownership (PLR-cadastre) as it is now under construction in Switzerland, a characteristic and a roadmap is presented and the expected contribution of the Comprehensive Cadastre to disaster recovery is illustrated.

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1 DISASTERS HAPPEN

Disasters can be presumed, but not prognosticated. The damage they cause is tremendous and recovery is hampered by lack of knowledge about the situation before. Recovery can only be tackled efficiently, when the information about the legal situation of the land is known and reconstruction work can be carried out in a rightful manner.

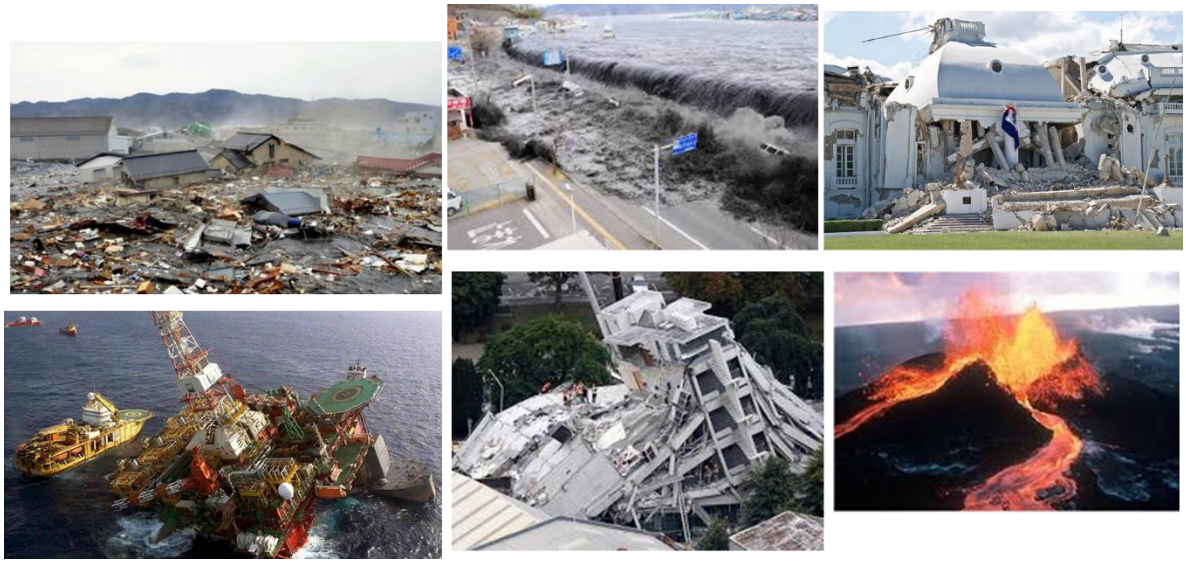

Figure 1 Disasters create tremendous damage

Often the information about the legal situation was not available before or was lost during the disaster. After the Haiti earthquake 2010 the prominent Swiss economist Dr. Beat Kappeler stated: *Without the property right and its guaranty, the reconstruction will not be successful*. And not only the existing situation concerning private rights to land and soil, but all the public-law arrangements effective in the affected area, which exist in every country of the world, should be known.

Normally a huge effort is needed to get the information in hand to enable efficient recovery procedures.

So, a very useful prevention from disaster is the setup of a Comprehensive Cadastre as quick as possible.

With such a tool, recovery will be much easier and efficient.

2 WHAT IS A COMPREHENSIVE CADASTRE?

The first cadasters date back to roman times to recover state owned lands that had been appropriated by private individuals, and thereby recover income from such holdings. These purposes remained unchanged for a long time until the issues of overcrowding and environment protection became obvious mainly after World War II. Emission cadasters, pipeline cadasters and multi-purpose cadastre arose, in many cases as parallel facilities to the property cadastre.

In view of the developments taking place in the field of cadastre, FIG Commission 7 launched in 1994 a working group with the following terms of reference:

'Study cadastral reform procedures as applied in developed countries, take into consideration automation of the cadastre and the role of the cadastre as part of a larger land information system, evaluate trends in this field and produce a vision of where cadastral systems will be in the next 20 years, show the means by which these changes will be achieved and describe the technology to be used in implementing these changes'.

The result of the work was published 1998 under the title CADASTRE 2014 - A Vision for a Future Cadastre System by the chair Jürg Kaufmann and the secretary Daniel Steudler with the Working Group 1 of FIG Commission 7.

CADASTRE 2014 after the publication was translated in about 30 languages[1] and influenced the thinking about cadastral systems.

The brochure Cadastre 2014 launched six statements showing the developments expected in the next 20 years:

The six statements of Cadastre 2014

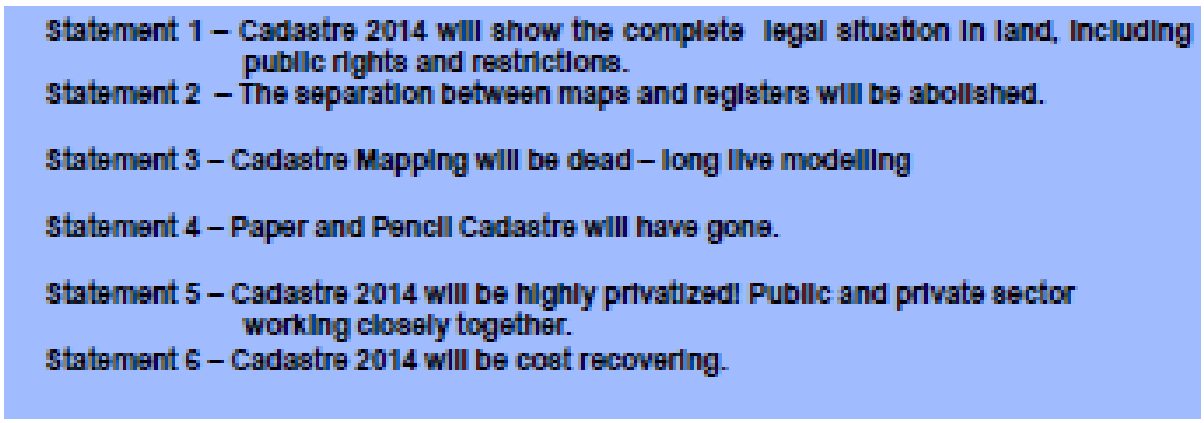

Figure 2 The six statements of CADASTRE 2014

[1] www.fig.net > publications

Statement 1 describes the idea of a Comprehensive Cadastre being a further development of the traditional cadastre to an infrastructure documenting not only the land property rights but also all the rights restrictions and responsibilities imposed on land by official or traditional whether written or unwritten regulations.

The Comprehensive Cadastre must cover a wider field than the traditional cadastre has since its introduction. The circumstances of the resource land have changed significantly since its inception.

During the development of the legal systems, the private laws were dominant. The constitutions of most countries defined the rights of the citizens, one of which is the guarantee to own property. Civil codes have reinforced this guarantee and defined clear procedures and institutions to protect the rights of citizens against alienation.

The growing world population and the development of new technologies lead to an intensified use of natural resources including land. To protect the natural resources from being totally consumed, damaged, or destroyed, the absolute right to use the natural resources was restricted in the name of the social necessity.

Especially after World War II, the number of new public laws grew significantly. Public law regulation of land use planning, environment protection, noise protection, construction laws, protection against danger caused by natural phenomena, etc. arose.

While these definitions under public law have an impact on the property rights of the landowner, they are not part of the official register. Despite the boundary definition process of the rights and restrictions defined under public law follows democratic legal rules, there is no boundary verification, no title verification, and no registration of the right in an official legal register.

Aside from land objects from private and public law, we can find a third category of legal land objects, namely areas where traditional rights, e.g. tribal land use rights exist. They can overlap other legal land objects, such as private property rights and public rights and restrictions, and concessions for the exploitation of natural resources. A feasible documentation of these traditional, customary rights, creating legal security, is often absent.

The Comprehensive Cadastre must correct this situation, which is becoming more and more precarious. It must document, in a safe manner, all legal aspects of land.

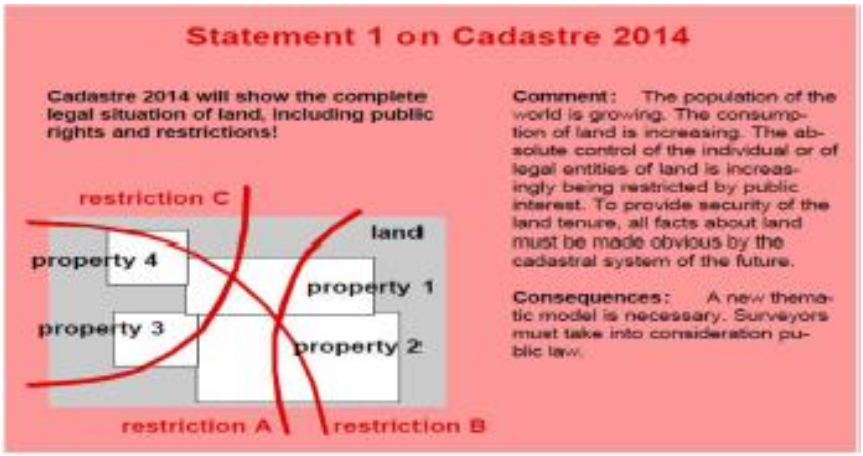

Figure 3 The Comprehensive Cadastre is a reliable documentation of the legal situation

3 STRUCTURE OF THE COMPREHENSIVE CADASTRE

The structure of the Comprehensive Cadastre is to follow the principle of legal independence stipulated by CADASTRE 2014.

The principle stipulates that:

• *legal land objects, being subject to the same law and underlying a unique adjudication procedure, have to be arranged in one individual data layer; and*

• *for every adjudicative process defined by a certain law, a special data layer for the legal land objects underlying this process has to be created.*

The Comprehensive Cadastre is therefore based on a data model, organized according to the legislation for the different legal land objects in a particular country or district.

Figure 4 The principle of legal independence

While the traditional cadastre consists in general of one information layer representing the information about boundaries between different properties, in the Comprehensive Cadastre are added information layers representing the boundaries between land objects defined by different legal topics, which exist in a jurisdiction.

Daniel Steudler and Abbas Rajabifard designate this principle in the FIG Publication No 58 Spatially Enabled Society[2] as institutional independence. With this term, they indicate that this structure is suitable to assign the responsibility for the data layers to the authority charged with the enforcement of a certain Act.

4 PRECONDITIONS FOR THE COMPREHENSIVE CADASTRE

A further principle stipulated in Cadastre 2014:

To make sure that legally independent organized land objects can be combined, compared, and brought into relation to each other, it is necessary that they will be localized in a common reference system. The combination and comparison of the thus located land objects can be realized by the method of polygon overlaying. This method was published in already in 1973 by Kaufmann and Bigler [1973][3].

The Comprehensive Cadastre will only function in an efficient manner when the relations between land objects can be derived from their location. This avoids links between land objects in different information layers. According to experience in many cases, traditional and distorted maps are anyway to be replaced by data sets located in a common reference system in order to enable modern geographic information systems be able to render the expected services.

[2] Spatially Enabled Society FIG Publication Nr. 58
[3] Kaufmann & Bigler: New Techniques in Land Consolidation

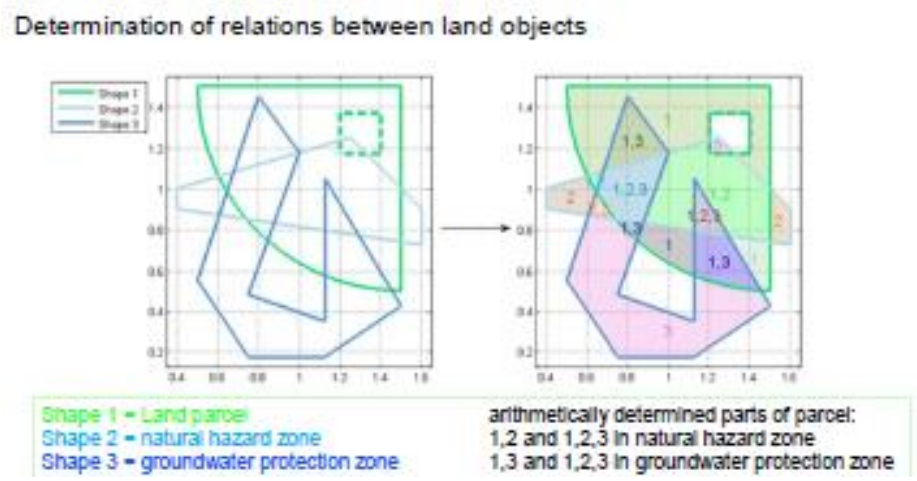

Figure 5 Arithmetic determination of relation between objects

5 STEPS TO IMPLEMENT A COMPREHENSIVE CADASTRE SUCCESSFULLY

5.1 Introduce the possibility for the Comprehensive Cadastre in your legal framework

It is wise to fix the principle of a Comprehensive Cadastre before starting with the setup. Switzerland decided to introduce the cadastre of Public Law restrictions on Landownership, which can be considered as a first step of the Comprehensive Cadastre. A short article was introduced in Switzerland's Federal Act of 5 October 2007 on Geoinformation (Geoinformation Act) http://www.admin.ch/ch/e/rs/c510_62.html:

Cadastre of Public-law Restrictions on landownership

Art. 16 Subject matter and form

1 The Cadastre of public-law restrictions shall contain public-law restrictions on landownership rights which, in accordance with the provisions of the Civil Code are not part of the Land Register.

2 The Federal Council determines which official geodata under federal legislation are entered in the Cadastre of public-law restrictions.

3 The cantons may define additional official geodata of proprietary nature that must be recorded in the Cadastre of public-law restrictions.

4 The Cadastre of public-law restrictions shall be made available in electronic form either online or by any other method.

5 The Federal Council shall determine the minimum requirements with regard to the organization, management, data harmonization, methods and processes for the Cadastre of public-law restrictions.

In the Principality of Liechtenstein the legal base was laid in the Law on the official surveying as follows:

Documentation of the public-law restriction of the landownership

Art. 57 Basic principle

1) The public-law restrictions with geometric characteristic as, in particular land use and development plans, protection zones or building lines, are represented in specific information layers.

2) The government determines the spheres, were information layers are defined.

5.2 Develop an enactment on the Comprehensive Cadastre

Because the rules for the Comprehensive Cadastre are the same as those for the traditional cadastre a regulation can be kept short. In Switzerland we developed an Ordinance on the Cadastre of Public-law Restrictions on Landownership (PLR-Cadastre) with 33 articles regulating the details.

Section 1:	General provisions
Section 2:	Content and Information
Section 3:	Inclusion into the Cadastre
Section 4:	Forms of Access
Section 5:	Authentification
Section 6:	Function as official gazette
Section 7:	Organization
Section 8:	Financing
Section 9:	Participation
Section 10:	Final Provisions

Figure 6 The content of the Swiss Ordinance on the PLR-Cadastre

5.3 Introduce data and representation modeling as mandatory

One important aspect for the successful implementation is the provision to use data modelling for the description of all data topics of the Comprehensive Cadastre and representation models to define how these data are to be represented on maps or other documents.

Switzerland regulated this in the framework of the Federal Act of 5 October 2007 on Geoinformation. As modeling standard we use INTERLIS 2. Please consult www.interlis.ch for details.

5.4 Determine a responsible authority for the Comprehensive Cadastre

In every country a responsible authority must be designated to organize the Comprehensive Cadastre. To allocate this task to the authority already taking care of the traditional property cadaster seems to be appropriate and advantageous.

5.5 Scan your legal framework including traditional rules

A first task of the responsible authority is the scanning of the existing legal framework and also all existing unwritten traditional legal arrangements. As soon as a law or a regulation contains arrangements concerning maps, sketches, schemes, boundaries, building lines, etc., it is to be supposed that the respective land objects are candidates for inclusion in the Comprehensive Cadastre.

5.6 Identify the stakeholders

A further result of this scan shows the institutions responsible for the enforcement of the law. These institutions are the stakeholders to be involved in the implementation of the Comprehensive Cadastre. The further steps will be undertaken together with these stakeholders.

5.7 Create data models for all legal topics included into the Comprehensive Cadastre

It is important to describe all data of the Comprehensive Cadastre in a precise and easy to interpret manner in cooperation with the respective stakeholders. The modeling paradigm was launched by statement 3 of Cadastre 2014.

A tool for data modeling is determined in the ISO/TC211 – Geographic information/Geomatics Standards. The ISO 19152 standard published in 2012 deals with the Land Administration Domain Model (LADM). The standard describes the data model with Entity-Relationship-Diagrams but does not offer automatic model and data checking possibilities. Switzerland uses since 1993 the standardized data description language INTERLIS, which allows computer-assisted model and data checking. Recently the developers of the LADM from The Netherlands and Swiss data modelling specialists undertook an initiative to combine these modeling approaches by description of the LADM in INTERLIS 2 to profit from automatic checking facilities.

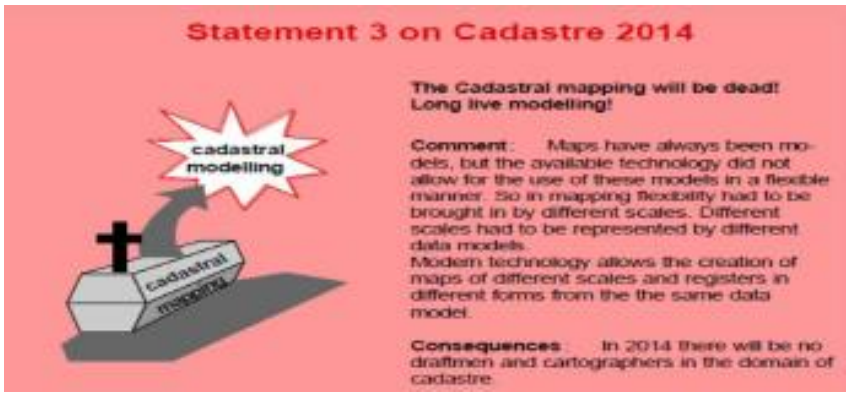

Figure 7 Data modeling

Switzerland has developed data models for all data topics to be included in the Swiss PLR-Cadastre. The models are public and can be found on http://models.geo.admin.ch/

5.8 Identify the procedures for the definition of legal arrangements

Similar to the traditional cadastre the effective procedures are to be learned and pursued by to make sure the Comprehensive Cadastre works correctly. Sometimes these procedures are complicated and in many cases not handled correctly. It is worthwhile to analyze the procedures carefully and to take the opportunity to simplify them, if this is possible.

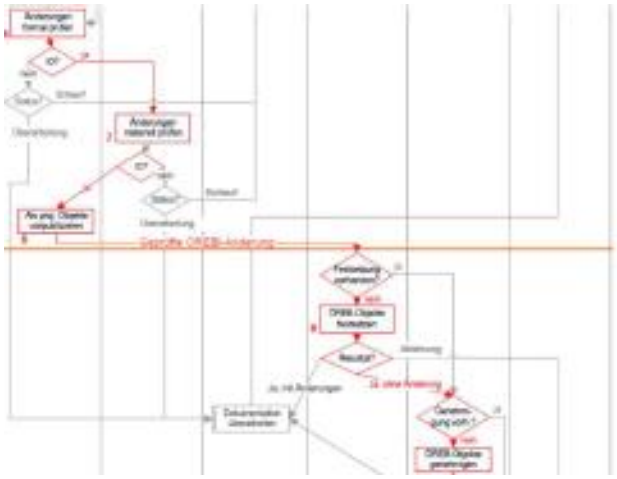

Figure 8 Definition procedures for legal arrangements

5.9 Develop a feasible IT-Infrastructure

A Comprehensive Cadastre is unthinkable without the help of IT. In a modern environment it makes sense to base the Comprehensive Cadastre on internet-technology.

In Switzerland's PLR-Cadastre a modern solution GeoApp replacing WebGIS by Web-Application was chosen to realize an integration platform organizing the access to the different information systems of the stakeholders by governing the directories, controlling the access rights, integrate data from different sources, and managing the rules to be applied. Figure 10 shows the possible web-application GeoApp used for the Swiss PLR-Cadastre. Further information can be found under www.fig.net/pub/fig2014/papers/ss31/SS31_luethy_7031.pdf

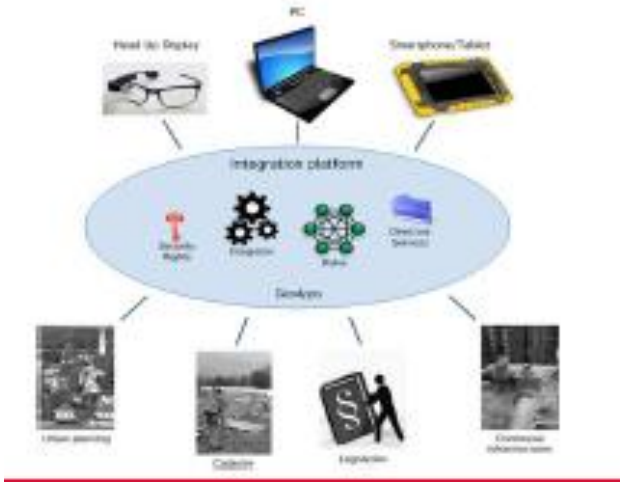

Figure 9 Modern web based approach in Switzerland

5.10 Summary

1. Introduce the possibility for the CC in your legal framework
2. Develop a short enactment on the CC
3. Introduce data and representation modeling as mandatory
4. Determine a responsible authority for the CC
5. Scan your legal framework including traditional rules
6. Identify the stakeholders
7. Create data models for all legal topics included into the CC
8. Identify the procedures for the definition of legal arrangements
9. Develop a feasible IT-Infrastructure

Figure 10 Nine Steps to achieve the Comprehensive Cadastre

6 THE COMPREHENSIVE CADASTRE SUPPORTS DISASTER RECOVERY

The Comprehensive Cadastre serves to many purposes as:

- Base for the economic development;
- Regularization of informal legal conditions;
- Poverty reduction;
- Prevention from land grabbing;
- Land consolidation;
- Better Spatial Planning;
- Implementation of Spatially Enabled Societies (SES).

Besides these purposes it is an essential tool to create favorable conditions for disaster recovery as well. To dispose of a systematic documentation of the legal situation of land, soil and water helps the countries affected by disasters to start with recovery as soon as possible. It is a wise decision to implement a Comprehensive Cadastre before the next disaster takes place.

Our friends from New Zealand have understood the importance of disposing of reliable cadastral information. With their vision cadastre 2034 they have initiated an upgrade of the traditional into a Comprehensive Cadastre. We wish them that they have not to use this instrument in connection with a disaster.

Figure 11 The vision Cadastre 2034 aims at the Comprehensive Cadastre in NZ

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BIOGRAPHICAL NOTES

Jürg Kaufmann, born 1942 and graduated from the Swiss Federal Institute of Technology in Zurich, founded 1988 his own company KAUFMANN CONSULTING, working in the field of cadastre and geomatics on national and international level. Among many involvements for the Swiss Development Agencies, the UN, the Worldbank, and for the federal and cantonal governments he was a member of the management board for the Swiss cadastral surveying system reform and the legislation team for the Swiss Law on Geoinformation.

From 2003 until 2010 he acted as a president of geosuisse, the professional Association for Geomatics and Landmanagement and he became a honorary member.

Jürg Kaufmann is also a honorary member of FIG and was chairing the FIG-Commission 7 working group on 'Cadastre 2014'.

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