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LITHUANIAN SPATIAL INFORMATION PORTAL

Директива INSPIRE (OL 2007 L 108, с. 1) стала стимулом для литовських державних та приватних організацій. Вона допомогла правильно організувати і стандартизувати геопросторові дані та забезпечити надійний доступ до них насамперед для литовських користувачів. У статті описуються принципи організації даних та онлайнові сервіси, які надає наш геопортал. Доступ до даних забезпечується через портал доступу до геопросторових даних – LEI-portal. Набори геопросторових даних узгоджені з вимогами, зазначеними у Додатках до Директиви INSPIRE (географічні назви, адміністративний поділ, адреси, кадастрові ділянки, транспортні мережі, гідрографія, заповідні території, рельєф, ґрунтово-рослинний покрив, ортофотоплани і геологічні дані). Ці набори доповнює широке коло тем природничого, соціального та економічного спрямування. Список наборів даних у рамках цих тем оновлюється щороку відповідно до постанови Уряду Литовської Республіки. Адміністратор порталу пропонує необхідні інструменти для постачальників даних, допомагаючи їм розмістити свої дані на порталі та надаючи їм допомогу в трансформуванні цих даних способом, який забезпечує досягнення їх повної сумісності з технічними характеристиками INSPIRE.

Директива INSPIRE (OL 2007 L 108, с. 1) стала стимулом для литовских государственных и частных организаций. Она помогла правильно организовать и стандартизировать геопространственные данные и обеспечить надежный доступ к ним прежде всего для литовских пользователей. В статье описываются принципы организации данных и онлайновые сервисы, которые предоставляет наш геопортал. Доступ к данным обеспечивается через портал доступа к геопространственным данным – LEI-portal. Наборы геопространственных данных согласованы с требованиями, указанными в Приложении к Директиве INSPIRE (географические названия, административное деление, адреса, кадастровые участки, транспортные сети, гидрография, заповедные территории, рельеф, почвенно-растительный покров, ортофотопланы и геологические данные). Кроме того, перечисленные выше данные дополняет широкий набор тем естественно-научного, социального и экономического содержания. Список наборов пространственных данных в рамках этих тем обновляется ежегодно в соответствии с постановлением Правительства Литовской Республики. Администратор портала предлагает необходимые инструменты для поставщиков данных, помогая им разместить свои данные на портале и оказывая помощь по трансформированию этих наборов способом, который обеспечивает достижение полной их совместимости с техническими характеристиками INSPIRE.

Lithuanian spatial information portal (the LEI-portal) is the most important component of the infrastructure – a state information system for the online exchange of information. By using the LEI-portal you can access spatial data sets and their *metadata* (standardised information about data sets). The LEI-portal services concerning spatial data and GIS web solutions have been made available free of charge to government institutions and other providers of free

public services. Due to the LEI-portal services and tools, which are accessible to every user, geographical information use and transparency is increasing in the country, and better reasoned decisions can be made in various activity fields.

This paper introduces the LEI-portal services and the project **"Lithuanian spatial information infrastructure development by implementing priority tools of the INSPIRE directive"** funded by EU structural support funds between 2012 and 2014. The project is being implemented under the implementation tool "Interoperability" by Information Society For All, the economic growth programme (project No VP2-3.1-IVPK-06-V-02-002).

The partner of the project is the National Land Service under the ministry of Agriculture and the State Enterprise National Centre of Remote Sensing and Geoinformatics GIS-Centrers.

Project objectives:
• to implement Directive 2007/2/EC of the Europe Parliament and of the Council of 14 March 2007 by establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), and the requirements on interoperability of spatial data set out in the implementing documents of the Directive;
• to ensure provision of the best quality Lithuanian spatial data to Lithuanian and EU users that is adequate to the data themes referred to in Annex I and II *(Geographical names, Administrative units, Addresses, Cadastral parcels, Transport networks, Hydrography, Protected sites, Elevation, Land cover, Orthoimagery)*;
• to expand the network of data providers and e-services, and increase the efficiency of national spatial data usage.

The expected outcome of the project is that organisations' geographical information collection, maintenance and delivery costs will be reduced, citizens' access to sensitive and detailed geographic information will be improved, and document coordination processes will become simpler. The socio-economic benefit to the country will be on average six million LTL per year from the implementation of the project.

The LEI-portal consists of two parts: content pages where login can be performed directly from www.geoportal.lt, and the map browser (www.geoportal.lt/map). The portal pages contain methodical and training materials, documents, news, support texts and a dictionary of geographical terms. The thematic domains have been designed for particular categories of geographical information users: cartographers, georeferential data users, and surveyors. The portal pages also provide spatial data sets, and offer the possibility to order and download them, review your order list, receive information on concluded contracts and data updates. In the My Portal area, a user can check their account information, the rights granted, saved setting of search performed, reports and other account-related information.

Map browser is the environment used for work with maps and the most popular portal system. Here you can not only view data, but also search for data sets and places on maps based on place-name, use the-

matic catalogues of spatial data services where services are grouped according to their popular fields of application. The map browser has measurement, comparison, embedded map link creation, and various statistics calculation tools; you can develop, save and print your maps in your chosen format, as well as downloading these maps and spatial data. For your convenience, we are developing new tools which will facilitate use of data without any special software.

The LEI-portal e-services are various ways to use Lithuanian geographical information. The simplest are **spatial data services:** single actions with particular spatial data sets that are supplied by different data providers:
• to search data sets based on keywords and other criteria, and find and review their metadata;
• to review spatial data using the map browser;
• to order and download data sets or selected parts of them;
• to transform data set, i.e. alter its system of coordinates or file format.

These standard operations are also known as the LEI-portal **network services.**
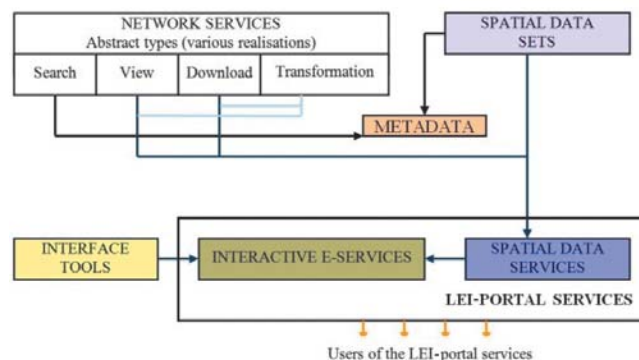

Fig. 1. Types of LEI-portal services

Search and review functions are available to any user of geoportal.lt. If you want to order and download data, registration and consultation of Terms of Use is required. Registration on portal and almost all spatial data services is free of charge! When ordering a service, verification of users' identity may be requested, usually when a user wants to download state-relevant data.

Interactive LEI-portal services are more complex and comprise various operations using spatial data, and have individual user interfaces. For example, land reform and land management project plans provision service.

State Key Data and Maps
Official large-scale maps are some of the most important national documents. They display which natural and anthropogenic features are located within the country's territory: elevation points above the Earth's surface, bodies of water, forests, roads, buildings and communication sites. The spatial data used to develop this map is referred to as georeferential data.

The most important source of georeferential data are **orthophoto maps,** compiled using aerophotos which are linked to geographic coordinates and created on a regular basis for all or any territories. The main orthophoto map of Lithuania ORT10LT is created based on not less than a 1:10 000 scale of precision. Orthophoto maps of densely built-up areas are of better resolution which complies to scale precision requirements at scale 1:5 000 (ORT5LT) and 1:2 000 (ORT2LT). These maps also include easily identifiable small objects, including trees, small structures and cars. Orthophoto maps are used to compile georeferential data which can be displayed in different ways, as well as split in different layers and change individual objects.

Georeferential data is supplied through the LEI-portal free of charge by the National Land Service under the Ministry of Agriculture. It is updated by the SE GIS-Centras on a regular basis. You can order and download all data, or only the data that has been updated. The most recent data is being submitted for review as a web map service (WMS) at any time:

• georeferenced public datasets (GRPK) are official sets of relatively invariant simple objects (axial lines, borders and points). It is updated on a regular basis using outdoor measurement data, and information received from other institutions and users about inconsistencies or changes observed;

• national georeferential data set GDR10LT at scale 1:10 000 is updated monthly based on the updated GRPK data set. The GDR10LT data set consists of 12 spatial data themes: roads and streets; railways; buildings and constructions; land cover; geodetic points; trunk pipelines; electricity networks; air navigation barriers, quartal forest lines; natural and cultural heritage sites; administrative boundaries and place-names;

• georeferential data sets at other scale. Georeferential data sets at small-scale GDR50LT (1:50 000), GDR250LT (1:250 000) and GDR1kLT (1:1 000 000) are used usually in cartography and developed when generalising information of GDR10LT. The information from large-scale georeferential data sets (1:5 000, 1:2 000, 1:1 000) is used to adjust GRPK, and GDR10LT data are developed for residential areas for territory planning purposes.

At the LEI-portal, we offer to users the **main map** prepared by professional cartographers and adapted to use with thirteen different scales. This map is updated on a regular basis using orthophoto map information. If linear elements and records of the main map are also visible on the orthophoto map background, this map is called a hybrid background map. Background maps used by the map browser can be partially transparent, and so they can easily be used with other data that is being reviewed. The map can be printed in a format of your choice at a higher than screen resolution. We guarantee the quality of background maps and that they are continuously being improved.

Diversity of spatial data

The LEI-portal does not provide georeferential data. Thematic data sets are also provided by institutions that implement national politics in different fields, municipal institutions, educational and training institutions, public organisations, and business entities. In spring 2014, 28 organisations provided 255 spatial data sets through the LEI-portal. We are striving to facilitate access through the portal to all official national and municipal data sets and more information collected by competent organisations. The volume of large-scale data that is provided by the municipalities keeps increasing. A data set can be developed without special GIS software. For example, staff of Lithuanian tourist information centres simply enters data on places of interest to sightseers in the portal's map browser. In this way, collected data sets are developed by different data providers.

Spatial data service is the LEI-portal service that helps to find, review or download particular data sets. Using the map browser, registered users can choose public or booked services from a thematic catalogue where review services are grouped based on popular areas of use: georeferential data; data for surveyors and land use planners; municipal data; and data from the national atlas of Lithuanian.

Metadata is brief, essential pieces of information about each data set or service which is provided to all users free of charge. This information is necessary to evaluate whether data sets have been obtained from reliable sources and are suitable for their intended use; it is possible to check the date of data set development and update, terms of use, to obtain administrator and distributor contact data. The coverage of data set in map and map fragment of review service is visible in document of metadata.

The main the LEI-portal **data providers** are government institutions: National Land Service that provides a biggest volume of data sets, including national georeferential data and the most important data on land; the Lithuanian Geological Survey, the State Service for Protected Areas, the State Forest Survey Service, the Lithuanian Department of Statistics, the State Enterprise Centre of Registers, the Department of Cultural Heritage, the municipal administrations and other services.

Large-scale engineer network data and small-scale maps of national atlas of Lithuania with various themes, georeferential data which is updated on regular bases and historical cartographic material, precise facts and statistical summaries on maps that are readily made available on the portal. The diversity of the data which is accessible on the LEI-portal is constantly increasing, allowing users to perform a comprehensive analysis of Lithuania's territory. We invite municipal administrations, education and training organizations to share the valuable data that they have collected so far. Users of geoportal.lt received almost a million e-services during 2013.

Interactive services

The LEI-portal does not only offer spatial data services. Specialists from SE GIS-Centras have created many complex GIS web solutions for people and organisations. These are interactive e-services with

individual map browser environments and tools which are tailored for specific challenges. They are constantly improved and adapted to the needs of users!

Historical cartographic material

The LEI-portal solution that is used to create, maintain and use a cartographic heritage archive is tailored for two interactive services: submission of project plans of geodetic and cartographic materials fund (GKMF) and land reform land management.

The geodetic and cartographic materials fund consists of topographic map sheets from various different years. They are provided in digital format, linked to coordinates and described using metadata. GKMF is regularly expanded to systematically collect and manage national geodetic and cartographic material. Today users have access to almost 7,000 sheets of previously compiled maps. The GKMF-material is used to carry out geodetic and mapping works of national significance. This allows historical analysis of the evolution of particular territories. More information on GKMF is available at the thematic domain (www.geoportal.lt/gkmf).

The system of land reform land management project plans is operated in a very similar way, but has a simpler environment. Today users can view and download 9,500 project plans. There is a plan to collect other types of geodetic, cartographic graphic material relating to land management.

You can use cartographic material at geoportal.lt: perform document search based on specified criteria (document coordinate system, creation date, scale, the territory being represented, the document type and file format desired). You can view or download the outcome to your computer in a graphic format of your choice (SID, TIF or PDF).

LEI-portal services for land accounting and maintenance

After the tax on abandoned land was raised in 2013, we have developed e-service which allows people, who have noticed inaccuracies on map of abandoned land, or know that the situation in the territory has changed, to mark the error on a map and to communicate it through the Internet. We have registered more than 7,500 notices about inaccuracies since May 2013. Information is automatically transferred to the State Enterprise of the State Land Fund, the administrator of data relating to abandoned lands. The service is available on www.geoportal.lt/az.

The map is easy to use. Using the system for abandoned land registration errors, you can view data about abandoned land on the main or orthophoto map background on geoportal.lt, and find abandoned land using different criteria.

The e-service of the **Vacant State Land Fund** (www.geoportal.lt/lzf) allows land use planning specialists and others to work with information about vacant state property in rural areas: to collect, find and analyse data based on different criteria, e.g., what kinds of property and in what proportion the vacant state land fund is formed from.

Our users

On geoportal.lt users cooperate, share their experiences, and create value to spatial data.

Non-registered users can receive the general portal's services just by visiting its pages. They can use any portal information that is available to public: training and information material; search and metadata system; main maps in a map browser; land information system and cartographic material funds services; measurement, map exportation, and map link creation tools. The portal information for non-commercial purposes can be used virtually without limits, although if this information is published in other places, identification of the source is required. Please read the portal's terms of use and copyright information, which you will find on the main page of the portal.

Additionally, **registered users** can use all public spatial data services directly in the map browser, order spatial data sets and conclude use contracts when use is limited. They can save settings of performed searches, compile maps, enter their spatial data directly into the portal, and mark errors in data. The assigned rights and user profile information is also visible to registered users. Registration is required to provide the LEI-portal with metadata and data sets, and to receive special services and have the right to enter information. Registration is free of charge to all users.

The LEI-portal data providers are portal users who share the data that they maintain, receive reports about data usage, sell and pay data on the portal. Data providers automatically receive data errors that have been registered by users. The data provider agrees with the LEI-portal administrator regarding terms and conditions for the provision of data and signs a data provision contract which obliges both parties to ensure better data accessibility.

The LEI-portal is available to everybody. Of course, its development was primarily intended to increase the efficiency of spatial data use in institutions and business entities. Five years later, it is safe to say that this goal has been achieved. Up to 30 % of the portal users are institutional staff who manage their work faster and solve problems better, because so much information about territories is now available at a single click. The LEI-portal services save hundreds of hours of civil servants' working time each year.

Almost half of LEI-portal users are from the business sector: mostly geodesists, surveyors, designers and other GIS-specialists. We are inviting more business representatives who are able to create added value geographic information products and distribute them through the LEI-portal.

Users from education and training institutions create new information and knowledge from incoming data that they can spread further. Students are highly active LEI-portal users, since they are of a generation which is well aware of the importance of open information. They use the data and study material which has been published in the portal in Lithuanian.

LEI-portal development: Implementation of the INSPIRE directive

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 (OL 2007 L 108, p. 1)
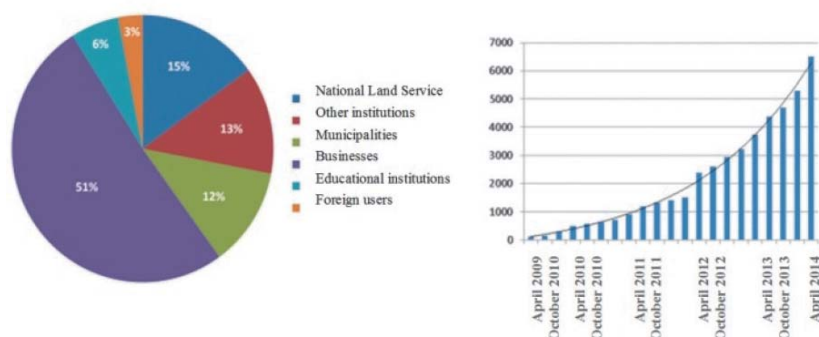
Fig. 2. www.geoportal.lt users structure and dynamics

establishing an Infrastructure for Spatial Information in Europe entered into force on 15 May 2007. The aim of the Directive is to enable Member States to use mutually compatible spatial data about the environment obtained from primary sources. Common Implementing Rules of the Directive are adopted and Member States should ensure that the spatial data infrastructures are compatible to these rules. The Directive will be implemented in stages until 2019. Further information on the INSPIRE directive is available at http://inspire.jrc.ec.europa.eu.

The INSPIRE directive is an incentive for Lithuanian organisations, particularly state institutions, to properly organise, standardise and provide collected spatial data in the best possible way, not only to European Union institutions, but, first of all, to Lithuanian users. One or a few spatial data sets must be consistent to the themes indicated in the Annexes to the INSPIRE directive: the themes in Annexes I and II, which are essential for management: (geographical names, administrative units, addresses, cadastral parcels, transport networks, hydrography, protected sites, elevation, land cover, orthoimagery, and geology,) and the broad range of themes covered in Annex III, including natural, social and economic aspects. The list of spatial data sets, which fall under these themes is reviewed and updated every year according to a resolution of the Lithuanian government, requiring these data administrators to provide data through the LEI-portal.

The LEI-portal is a technological platform that is used to implement INSPIRE requirements in stages in Lithuania. The search, view, download and transformation services that fulfil interoperability requirements laid down in the Implementation Rules will be provided, and performance, capacity and availability of all spatial data services will increase after the completion of the project that is carried out from 2012 to 2014. At the LEI-portal, we offer tools to all data providers, helping them to provide their data on the LEI-portal in accordance with the INSPIRE-directive's requirements, and we help them to transform data sets in a manner that is compatible with the INSPIRE-data specifications. We provide consultations and methodical assistance to all data providers.

• How to identify which data sets should be submitted to INSPIRE?

Data sets from primary sources that best meet the themes set out in INSPIRE-are selected. At least one or more data sets should meet one theme.

• Is it necessary to submit a data set indicated in the government resolution if it does not meet the INSPIRE-data specifications?

Yes. Data sets that have not been recently created or transformed may not comply with appropriate INSPIRE-data specifications. It is more important that data is described using metadata and is available online.

The INSPIRE-directive implementation in Lithuania is presented at the LEI-portal's thematic domain INSPIRE. Here you can find information about the provision of spatial data sets and their metadata, and the values of monitoring indicators.

LEI-portal development: the GIS cloud and other new services
Online management of spatial data

We will introduce a new e-service based on cloud computing technology later. Users of the service entitled Online Management of Spatial Data will be able to maintain their spatial data and maps on the LEI-portal. This will not require any additional GIS software. Users will use cloud computing based system to enter, revise and publish new spatial data or to integrate existing date, as well as to create public or user-specific maps. The mobile service will allow them not only to review data sets and maps, but also to edit and fill them in using GPS equipment. In this way, they can mark territory problems or planned works, show land boundaries and collect data on community-related objects and incidents.

The option to collect spatial data online is very important to those who are inexperienced geographic information users: scientists, SME specialists, employees of public institutions and members of community organisations. Each new set of qualitative spatial data which we share with others on the LEI-portal is another step towards a better understanding of the environmental, social and information surrounding.

Verification of measurement data conformity to GRPK data

When using this service on the LEI-portal, surveyors will be able to upload available measurement data and use appropriate tools to identify whether this data corresponds with data from the official georeferenced public dataset (GRPK) of e.g. roads, streets, railways, rivers, small rivers, axis lines of drainage ditches, boundaries of lakes and ponds. Users will also be able to receive conclusions regarding conformity online, thus saving both the surveyor and client's time.

Provision of consent to construct transport communications, networks and buildings on state-owned land

The public e-service is available to users or legal persons who seek to obtain permission to construct transport communications, or engineering networks and buildings that are necessary for their existence on

state-owned land not divided into separate parcels. Applicants will not have to go to local land planning department and waste their time standing in lines; the new service will allow them to submit applications on the LEI-portal. They will be able to create a new scheme in the same place. An application will be automatically registered and sent to the local land planning department for evaluation. Applicants will be able to see their application's submission and evaluation state and will be notified when the decision is made. This helps to save time for both applicants and local land planning department specialists.

Analysis and evaluation of land fund

The e-service used to execute analysis and evaluation of land funds will allow people to use data from the LEI-portal to evaluate the characteristics of their selected territory. Each user will be able to indicate land boundaries (by uploading data or to drawing on the map browser directly); choose indicators and spatial data sets; execute analyses; and receive statistical reports with schemes. When planning, for example, to rent a parcel of land, a summary of information will be provided, including details of land use, dominant soils, land productivity, restrictions stipulated in the special terms of land use and abandoned land.

LEI-portal for municipalities

About one sixth of LEI-portal users are employees of municipal bodies and businesses. Administrations of Lithuanian municipalities collect a lot of precise and valuable information about sites in their territory, including engineering networks, drainage systems, green plantations, containers for secondary raw material, outdoor advertising, as well as other sites and their locations. People use this information every day; it is shared between specialists of municipalities, businesses. Municipalities use the LEI-portal services because the tools for geographical information processing which are available online are provided free of charge and without any conditions.

Municipality map

All the municipalities in the country can use online maps on the LEI-portal which was compiled by the SE GIS-Centras. The interactive map displays spatial data provided on the LEI-portal. The map is adopted for the particular needs of each individual: to display selected data sets, create additional tools that are used to work with these data, and symbols. It is possible to search for place names and routes, to prepare and print a map with settings of the user's choice, and download collected data in a desirable format. Even those municipalities that already have online maps can always supplement them by using the LEI-portal's professional mapping solutions and other new tools which are constantly developed.

The online map of municipality is interactive and easy to use, as well as free of charge to all users; it can be used at any time and is accessible from any place with Internet access. The map is easy to add to Internet-pages and always includes the most recent data.

Municipal data registration

Municipal topographic plans and digital spatial data sets are included in the list of themes that were approved by a resolution of the Government of the Republic of Lithuania and which data shall be provided through the LEI-portal for the INSPIRE directive. Detailed geographic information about communication infrastructure (power transmission; telecommunication lines; water pipelines; oil, gas, heat and wastewater pipelines; and transport infrastructure) is of particular importance.

This data is used by municipal administrations, as well as by businesses that conduct geodetic measurements, territory planning and construction design, operate utility networks. It is also used by real estate and construction companies; investors; and land owners and buyers. It is therefore our goal to make all collected information about communication available in one place and to effectively provide it online. Municipal spatial data sets can be combined into a single state-wide and single-technology-based spatial data system. The LEI-portal already has all the means to attain this aim. It's up to municipalities to decide which data sets they want to provide, although their decision does not alter their ability to use the LEI-portal services designated for them.

Municipal thematic domain

The thematic domain of geoportal.lt is intended for the use of municipalities. Here they can check the list of spatial data sets from all municipalities, their metadata and maps. Furthermore, relevant methodical material, and detailed instructions about how to provide data through the LEI-portal are also provided.

LEI-portal for other information systems

The LEI-portal is an open system that is designed for a whole country rather than a particular organisation. Most of the e-services and technological solutions available on geoportal.lt are successfully used by other organisations that want to save time and money. The LEI-portal's **spatial data services** are easy to integrate into other information systems and use in other applications.

The most popular service in the LEI-portal is the main multi-scale map which is used for internal purposes of organisations, and is displayed as background in other systems. Few other main map variants are supported and are tailored to client needs in this way. This is the only digital map that is constantly updated bases from official data. We provide this continuously improved map and adapted spatial data services free of charge to other organisations and their information systems to use for non-commercial purposes. All you need to do is apply to SE GIS-Centras and sign a bilateral e-service provision contract. The spatial data services for commercial purposes are provided for by a small set-up and annual support fee; a sum much lower than the costs incurred by companies which develop and administer these services in-house.

All information about the Earth…

We seek to provide on the LEI-portal not only the data that is handled by different institutions: parcels of land, areas where they are not formed, abandoned land, special terms of land use, drainage systems, types of soil, etc., but also as many public and administrative services related to land as possible. Therefore, we create "standard" components that are available to different e-service providers: spatial data review and comparison, editing and analysis, searches based on selected criteria, statistics calculation and online data uploading.

The land information system services are provided only through the LEI-portal map browser (www.geoportal.lt/zis). SE GIS-Centras and SE State Land Fund share resources and expertise to successfully develop together new geographic information technology solutions and tools which have been made available to all LEI-portal users.

Map browser is a right tool for you?

Many companies and institutions have important spatial data but use it only for simple operations: to enter, edit and submit for online review. To date, a substantial amount of money has been spent on various semi-professional GIS solutions whose outcomes are online maps of poor quality, indifferent users, and systems that are difficult to develop and support. We offer simple and effective means based on modern LEI-portal technology. Adapted map browser solutions are successfully used by tourist information centres in Lithuanian cities and districts (tourism map of Lithuania), the Lithuanian Consumer Institute (interactive map of organic farms) and other organisations to save money on software, data storage and system support, and provide users with more valuable information.

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3. *Directive* 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) // EUR-Lex Official Journal of the EU. – 2007, Vol. 50. – http://eur-lex.europa.eu/JOHtml.do?uri= OJ:L:2007:108:SOM:EN:HTML.

4. *The* LEI portal services are available at www.geoportal.lt.

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