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Original scientific article**Sanja Smiljanic**
Snežana Đurđić**GEOINFORMATION NETWORK FOR THE PURPOSE
OF THE NATURE PROTECTION**

Abstract: A recent global advance in moving from paper to digital data has created undreamed opportunities of access to data, communication of information and for informed decision-making at all levels of society. This so called open access to information presents new challenges for those acquiring, handling, storage and providing access to electronic data and information. Different organizations collect massive amounts of information related to the environment, particularly at regional and local level. However, the data are often of poor quality, inconsistent standards, stored in non-interoperable information systems and not accessible to the public. These obstacles prevent from dealing efficiently with the complex and interconnected issues which are occurring during management process of protected areas and the nature conservation. In this paper it will be presented one of solutions for these obstacles in the sense of geoinformation network for the nature protection which bringing together the different stakeholders in the process of protected areas management.

Key words: nature protection, data, GIS, Web.

Извод: Савремени глобални напредак у смислу преласка са аналогних на дигиталне податке створио је до сада незамисливе могућности приступа подацима, размене информација и на тај начин и ефикасније доношење одлука на свим нивоима друштва. Овакав отворени приступ информацијама ствара нове изазове за оне који се баве прикупљањем, обрадом, чувањем и заштитом приступа електронским подацима и информацијама. Различите организације прикупљају неограничене количине података о животној средини, посебно на регионалном и локалном нивоу. Међутим, ти подаци су често слабог квалитета, нису одговарајућих стандарда, сачувани су у некомпатибилним информационим системима и нису доступни широј јавности. Ови проблеми отежавају ефикасно решавање сложених и међусобно повезаних питања која се јављају у процесу управљања заштитом природе и заштићеним природним добрима. У овом раду биће приказано једно од решења ових проблема у виду геоинформационе мреже за заштиту природе која окупља све заинтересоване стране у процесу управљања заштићеним природним добрима.

Кључне речи: заштита природе, подаци, ГИС, Web.

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Introduction

In the nature protection methodology and practice often is obvious incompliance between ecological, scientific, managerial, planning, utilitarian and developmental necessities of certain space and inherent social organization. Problem becomes more complex and multilayer as far as for the nature protection issues are interested numerous professional and economical organizations, groups and individuals, whose interests are derived from different scientific, educational, economic and technical background.

Much of these problems occur due to lack of accurate, timely and reliably information. Information is necessary for the facilitation of protected nature assets identification, designation, monitor and management. The largest number of this information is of geographical nature, considering that they include data about where the things are (natural resources, habitats, species and facilities locations) and how they relate to each other (spatially and through time).

Appropriate approach for the geographic information management represents Geographic Information Systems (GIS), i.e. combination of hardware, software, techniques and organizational processes that enables efficient collection, display, integration, analysis, usage and dissemination of geo-data. Although the main sources of geographic information are still paper maps, photographs, books and other analog reports, they are also enough available in the digital format (vector and raster layers of digital maps, geospatial data base, digital photographs, video, sound and text) which belongs to different organizations. In most occasions potential informational users don't have any apprehension about quality and quantity of digital data and their owners.

This problem maybe simply solved by forming Serbian Geoinformation Infrastructure (GII), which will with time allocate in the global network. GII represent cooperation of organizations and individuals, information technology usage as to facilitate retrieval and exchange of geographic information, appreciation mutually adopted standards, development of general thematic data and legal regulations establishment whereby ensure data flow between different organizations (Smiljanić et al, 2007).

Geoinformation network for the purpose of nature protection may represent one part of such national GII, and considering that its forming is less demanding it can be some kind of GII prototype.

Technical aspect of geoinformation network for the purpose of nature protection development

The basic conditions that have to be fulfilled during geoinformation network development can be resumed from basic conditions of INSPIRE (INfrastructure for SPatial InfoRmation in Europe) initiative (2007), and they are:

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- information is collected only once and they are maintained on the adequate level,
- information is combined from all available sources, as among many users and applications,
- information is shared through all levels, from local to international,
- information and terms of their usage are easily available,
- easy usage in the different environments (multilingual, semantic, symbolic etc.),
- insurance of high quality services to users,
- services provide based on legal regulations,
- fast responses on the users requirements,
- security and access rights management,
- provide thematic services to users.

Geoinformation network for the purpose of nature protection is composed from: network services for the access to existing data sources, metadata¹ frameworks, service catalogues and generic application.

GIS specification under other information systems is included in the spatial orientation and connection of its composing attributes which have to be coherent with the accompanying content that is unique part of spatially – descriptive data holiness. The rough division of data which have to be component of GIS for the nature protection can be accomplished at:

- spatially – graphically illustrated data which are related to the geographic location, shape, proportion, dissemination of some element and similarly in the 2D or 3D display by maps, plans, models, pictures, simulations, remote images etc,
- descriptive – alphanumeric data which are composing parts of adequate and validation databases (Djurdjic, Smiljanic, 2002).

Recommended database structure by Nature-GIS project² consists of seven data types:

- basic maps – referent layers that provide base for the other layers and are often essential to large number of users,
- administrative maps – layers that represent boundaries of administrative jurisdictions (on the different levels), boundaries of areas that are managed by different agencies and institutions,

¹ Metadata serve for the data description and they represent data about data, like: geographic area covered, data accuracy, rules for the data acquiring, positional accuracy, means of encoding, datum and projection. The metadata purpose is to locate appropriate data, evaluate whether the databases meet one's requirements, extract the relevant data and actually make full use of the data in an application (Smiljanić et al, 2007).

² Information Society Technologies project of the European Commission which started at 2002, with the idea of GIS usage popularization in the nature protection.

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- utility and infrastructure maps – layers with anthropogenic objects,
- planning and management in the occurrence of natural and anthropogenic actions provoke hazards – layers that are necessary for the hazard management and for the planning adequate and forehanded responses in such situations,
- natural resources and landscape characteristics – layers that display and characterize land, air, water and biotic features and areas. They include species, habitats, ecosystems and nature protected assets,
- data about ownerships or about tutor status and supervisors under protected natural assets,
- data about tourism, recreational and economical potentials of nature assets that are of protection concern.

Setting up of such network can be accomplished through next two steps:

- formation of thematic network for the nature protection community as to maintain nature protected assets management by usage of unified servers available on the several levels and
- setting up thematic portal for the nature protection on the Internet as to inform publicity.

For the *thematic network* setting up of key importance are concepts of interoperability, standard based foundation and Web services.

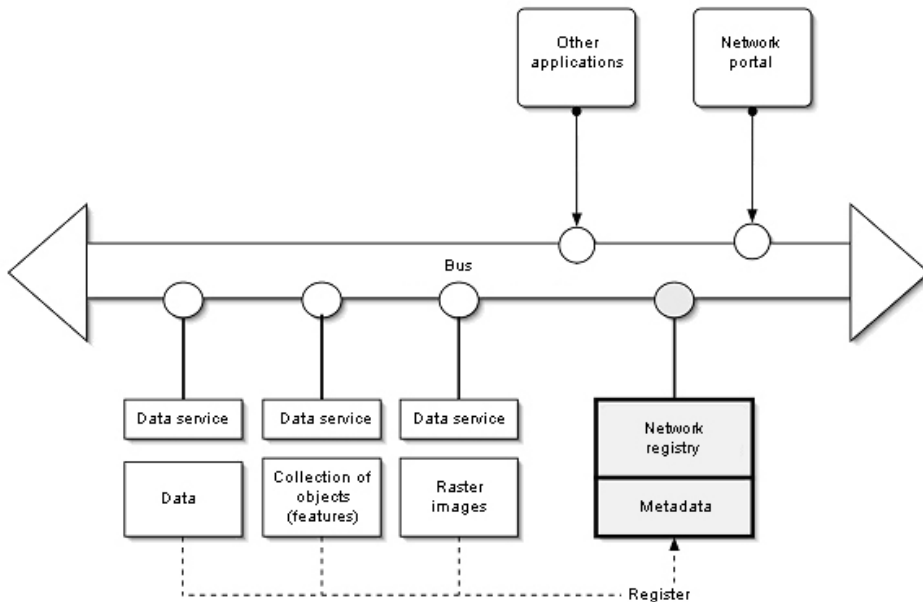


Figure 1. – Functional interoperability

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Interoperability can be defined as ability of one application, or server or client, detect possibilities of other application, to understand it and to use it dynamically from application side (Figure 1). In the future it will be possible to connect few online services in the dynamic “chain of services” (The Nature-GIS Newsletter, 2003). Interoperability can be observed as defining of common language for all processes whereby the communication between them will exist.

Interoperability is possible only if geoinformation network development will be based on internationally accepted standards. In the field of geographic information, International Organization for Standards – ISO TC211 (www.isotc211.org) deal with standardization in the field of digital geographic information, while OpenGIS Consortium (www.opengis.org) is focused on the standardization of interfaces for the access and detection of geospatial data on the Internet. Some of the specifications that can be interesting and taken into consideration during such network development are: OGC Web Map Service (WMS), OGC Web Feature Server (WFS), Geographic Markup Language (GML), Styled Layer Document (SLD), OGC Web Map Context Documents, ISO19115 Data Metadata and ISO19119 Service Metadata.

Web services can be viewed as software applications identified by Universal Resource Identifier (URI), whose interfaces and connections are possible to define, specify and discover by XML (Extensible Markup Language) and that uphold direct connections with other software applications by using messages based on XML via Internet protocols (Smits, 2002). Web services are based on publish-find-bind model (Figure 2) which defines connections between: service provider that publishes services, users that search service and service register that match request with existing services.

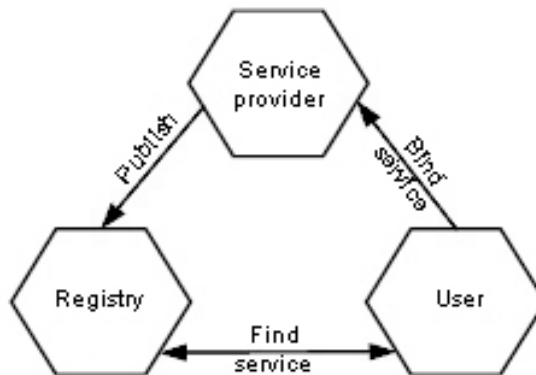


Figure 2. – Diagram publish-find-bind model

Web services enable gathering of all data providers as their service would be represented on the single, unique, well defined set of interfaces, which enable easier data exchange. Also using of commonly adopted standards

enables easy integration in the global information flows (integration with e-government, e-business, e-security, etc.). In that way, any organization can be a network member, since when once publish its data according to defined standards it is registered within network register and it can be used as data source. Web Feature Server also allows remotely data updating, what means that some bigger institution can operate as condensing data center from smaller ones, and yet to allow these smaller information sources to maintain their data themselves, providing better data accuracy and up to date.

From the previously illustrated it is possible to conclude that *thematic portal* of such network don't keep and maintain data, yet they are distributed on the many servers that are serviced by organizations responsible for data, with respect to one of the basic INSPIRE principles: "data should be collected only once and maintained at the level where this can be done most effectively" (www.inspire.jrc.it).

Portal can be also viewed as instrument by whose assistance it is easy to find and acquire the data and information about nature protection, apropos as connection with different functions such as: publishing and enabling data and metadata access, geographic information viewing and analyze. Network portal also has to be placed where users can share and exchange their experiences and to help each other.

Thematic portal components may be as follows: client that serves for service and data discover, and for content publishing; catalog; Web application with generic GIS functions; news related to nature protection; frequently asked questions (common questions with short and clear answers); data model in UML (Unified Modeling Language) and GML (Geographic Markup Language), with user instructions; links; discussion forum; tools...

Thematic portal, even in its prototype faze, has to animate and promote network information community creation, connecting many participants and users in the nature protection field. Open architecture and adopted interoperability standards would guarantee data access and exchange through many different GIS software applications or viewers, generating, for example, important time saving in data format and projection conversions. Also, additional benefits would be recognized in the ability to search and visualize huge amount of data and information gathered on the different locations and with different map techniques, since all of them would be harmonized and gathered in common catalog which will be continuously automatically updated.

Data and information that are kept for usage in the local databases often can be used in external applications once they were published for the first time. The catalog represents a mean by which descriptions of existing nature protection data are published in the standard way to permit search from multiple servers. Catalogs represent systems for the detection and access to raster, vector and spreadsheet geospatial information via metadata search.

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Moreover, catalog include references and/or data access, ordering mechanisms, map graphics for data browsing and other detailed use information that are provided by metadata. This metadata can have three roles: documenting the location of the information, documenting the content and information structures and providing the end-user with detailed information about appropriate data usage (Douglas, 2004).

Insurance of map or graphical view on the geospatial data through online map interface is from primary importance. This can satisfy many novice user necessities and those who only inspect data without fully data assuming. Although this isn't the replacement for the direct data access, it satisfies broader public necessities for the nature protection information.

Once when data are located and evaluated, using catalog and online map techniques, users or application software often request access to detailed geospatial data. Access include ordering, packing and delivery (offline or online) of certain data (coordinate and attributes, in dependence of data format). Finally, the data and information about nature protection attained in such way the user can utilize in a way which is most appropriate to him.

Conclusion

Geoinformation network for the purpose of nature protection enable the users to easily discover, visualize, exchange and to download geographic information and nature protection data. However, GIS technology potential in our country isn't fully inquest yet, so it is necessary to take more investments in the education, standardization, legislative regulations and in technology improvement. In that way we would be able to create thematic network of nature protection institutions and to promote GIS usage in the practice of nature protection itself. Moreover, although we cross into developed PC networks era, practice that we have from past inhibit us to find and use digital geographic information.

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Сања Смиљанић

Снежана Ђурђић

ГЕОИНФОРМАЦИОНА МРЕЖА ЗА ПОТРЕБЕ ЗАШТИТЕ ПРИРОДЕ

Резиме

У методологији и пракси заштите природе често је изражено несагласје између еколошких, научних, управљачких, планерских, утилитарних и развојних потреба одређеног простора. Овај проблем би се решио на лак начин стварањем геоинформационе мреже. Геоинформациона мрежа за потребе заштите природе омогућава корисницима да на лак начин открију, прикажу, размене и преузму географске информације и податке у вези са заштитом природе. Међутим, потенцијал ГИС технологије код нас, још увек није добро истражен, па су неопходна додатна улагања у образовање, примену стандарда, дефинисање законских прописа и у саму технологију како би се створила тематска мрежа организација које се баве заштитом природе и промовисало коришћење ГИС-а у заштити природе.