SPATIAL CLASSIFICATION OF LAND PARCELS IN LAND ADMINISTRATION SYSTEMS

Halil Ibrahim INAN[1], Arif Cagdas AYDINOGLU[2], Tahsin YOMRALIOGLU[3]

ABSTRACT

Types of land parcels in Land Administration Systems (LAS) are mostly classified differently in different countries or in different regions of the same country. Different classification systems may be caused by the related legal framework, the parties involved in the process or even different customs. However, they are mainly caused by the fact that there is no standardization for such a classification. Standardization of classes of land parcel type may be possible and may increase its multipurpose use. In fact, in Turkey, it is strongly needed to separate land use/cover classes and annexes of the land parcel in the classification of land parcel types. However, this will not be a complete resolution in terms of multipurpose use within spatial data infrastructures (SDI). In this study, a new style of spatial classification is proposed. The proposed solution requires further development of land administration systems towards the basic building block of SDI. The solution proposes to store different land use/cover classes with permanent boundaries within land parcels with their own geometries which are topologically dependent on the land parcel. The solution is especially functional for agricultural policy implementation in rural areas and has the potential to be effective also for other multi-purposes such as the production of precise descriptive statistical data, planning, land development, construction of engineering structures and other land management activities.

Key word: Land administration, land management, land parcel type, land use/cover, classification, standardization.

1. INTRODUCTION

Land Parcels which is accepted as the basic spatial unit for Land Administration Systems (LAS) (Dale and McLaughlin, 1988 and 1999), in the majority of cases, cannot easily be used for other applications or especially SDIs as the basic spatial unit. There may be several reasons responsible for this. Yet, one of the most important reasons among these is the so-called idea that land parcel boundaries represent only legal situation and cannot appropriately be used for other purposes. In accordance with that idea, types of land parcels are classified differently in different countries or even in different regions of the same country. More interestingly, this type of classification is done by mixing/piling/considering both the type of land use (arable land, grass land, olive, none productive etc.) and the annexes (3 storey house, pool, garage, etc) existing in a land parcel. This may be caused by the facts that land parcels in LAS is only subject to homogenous rights (UN-ECE, 2004) and there is no need to register different objects in a land parcel in a robust way which makes possible to reach information on each object in a land parcel.

For a possible multipurpose use of land parcel information in LAS, especially for the establishment of SDI, considering land parcel conventionally as the only basic spatial unit may hinder proper classification of land parcel types and separation of annexes from the classification. If it is strongly needed, traditional classification of land parcels may be preserved in LAS, yet some advancement is needed for the multipurpose use of spatial data in LAS. In this context, establishing a new classification method by defining appropriate spatial land cover/use classes (sub-parcels) within land parcels may be a good solution.

2. LAND PARCEL AND ITS MULTIPURPOSE USE

Land parcel is the most important spatial component of a LAS. It may be defined as a single closed area (or volume) that is determined geographically by its boundaries, contains land under homogeneous property rights and is held in one ownership.

[1] **Dr. Halil Ibrahim INAN,** hibrahim77@hotmail.com
Institution, www.ktu.edu.tr
Tel.: +90 462 3773653, Gsm.: +90 536 3039398, Fax: +90 462 3280918.
KTU, Muhendislik Fak., Harita Muh. Bol., 61080 Trabzon, Turkey.
[2] **Dr. Arif Cagdas AYDINOGLU,** arifcagdas@gmail.com
Institution, www.itu.edu.tr
Tel.: +90 212 2853782.
ITU, Ayazaga Kampusu, 34469 Istanbul, Turkey.
[3] **Prof. Dr. Tahsin YOMRALIOGLU,** tahsin@itu.edu.tr
Institution, www.itu.edu.tr
Tel.: +90 212 2853782.
ITU, Ayazaga Kampusu, 34469 Istanbul, Turkey.

With homogeneous property right, all types of property rights apply to all shareholders proportionate to their share (oll shares in a land parcel forms one single ownership). So, determination or registration of different rights specific to one share holder is not required to secure the right. This may be interpreted that, in LAS, there is no need for the identification of different objects or land use types in a land parcel for the management of property rights. Yet, it may be required for other purposes within or outside LAS.

In reality a land parcel is a volume of space (a 3D object) subject to different rights on, above and below the surface (Figure 1). However, in the majority of cases, it is spatially represented by its surface area as a polygon feature in LAS. Only when it is strongly required (for the management of urban land) and technically possible it is represented as a 3D space as a volume feature.

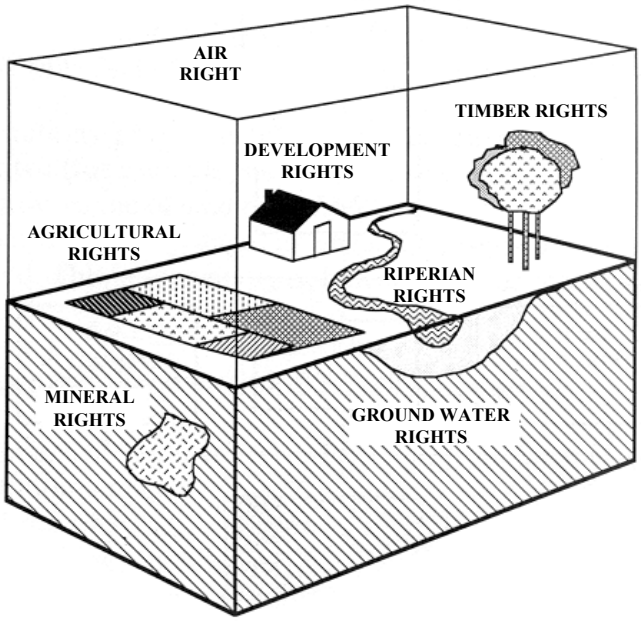

Figure 1. The Land Parcel (Dale and McLaughlin, 1988)

In the last decade, during the implementation of agricultural policy in the European Union (EU), the possibility of use of land parcels (cadastral parcels) in LAS was raised in the majority of the countries in the EU. However, together with many other reasons, the so-called different philosophy or complexity of LAS prevented the use of land parcel data for the implementation of agricultural policy (see Milenov and Kay, 2006; Zielinski and Sagris, 2008). Similarly, land parcel as the basic spatial unit of LAS cannot also be used as the basic spatial unit for the implementation of the initiative Infrastructure for Spatial Information in Europe (INSPIRE), rather it is included as an independent (not integrated) spatial unit specific to LAS.

LAS may be regarded as complex systems with many different aspects (technical, legal, social, economical, administrative etc.). However, there is no need to mix up all aspects together; rather, every aspect should be threaded separately when needed. For example, technically, the basic spatial unit (land parcel) of LAS can be threaded differently for different purposes. Beyond that, representation of land parcels, its boundaries, land use/cover types and annexes should technically be represented, stored and managed in a simplified way, rather than managing a land parcel as one single complex object. Any possible simplification will increase the use of spatial data for other purposes inside or outside LAS.

3. CLASSIFICATION OF LAND PARCEL

3.1. Traditional Classification

Land parcels in LAS are traditionally classified for the specific needs within LAS. In some cases, even a real classification method is not applied, only types of land parcels are determined with mixing up main land use type and annexes in a land parcel (as in Turkey). This type of classification makes impossible to distinguish different types of land parcels. For example, in a study conducted in Macka county of Trabzon Province in Turkey by Uzun and Inan (2007), about 1400 different types of land parcels out of 30000 land parcels is determined. With that study, it is also determined that many types of land parcels are very similar, but classified differently due to the lack of standardization in classification.

3.2. Classification for Multipurpose Use

In this study, the classification of land parcels is focused. In this context, it is a fact that certain standardization is required in order to increase the multipurpose use of land parcel data. However, an overnight dramatic advancement in the classification of land parcel should not be expected because LAS is a living system which has long been affected by the type of administration, social life and also traditions. Therefore, a gradual advancement in the classification of land parcels in LAS should be expected, and measures should be done accordingly. In this context, two stages of advancement are approved in this study. One is the standardization on the classification of land parcel types and the other is the standardization on the classification of land parcel spatially by defining spatial sub-parcels with different land use/cover type in land parcels.

2.1.1. Classification of Land Parcel Type

Land Parcel Type may traditionally be determined as a combination of all different land use/cover types and, in some cases, also some annexes (natural or manmade features except for land use/cover) in land parcel. For this study, however, it is defined as a single dominant or generalized land use/cover type of a land parcel. If it is strongly required, it may also be very well defined combination of multiple land use/cover.

As the first stage of standardization on the classification of land parcels;

- defining standardized domains for the determination of land parcel types,
- developing methods for the registration of annexes in land parcels as independent objects from land parcel types will be a vise/practical solution to the problem.

However, this will not be a complete solution in terms of multipurpose use within spatial data infrastructures (SDI) because this first stage will only make the differentiation of main/basic land parcel type of land parcels and their annexes. This first stage of standardization may contribute to the multipurpose use of land parcel data in some extent. This may be regarded as an interim solution. So, a robust solution is still required.

2.1.2. Spatial Classification of Land Parcel

It is a fact that land parcels may include one or several land use/cover types. The determination and registration of every single land use/cover type in land parcels may not be technically possible. Yet, a standardized method for the classification of basic land use/cover classes in land parcels and their registration may be possible. For such a classification, the classes should be meaningful in terms of the possibility of their registration and their maintenance/update.

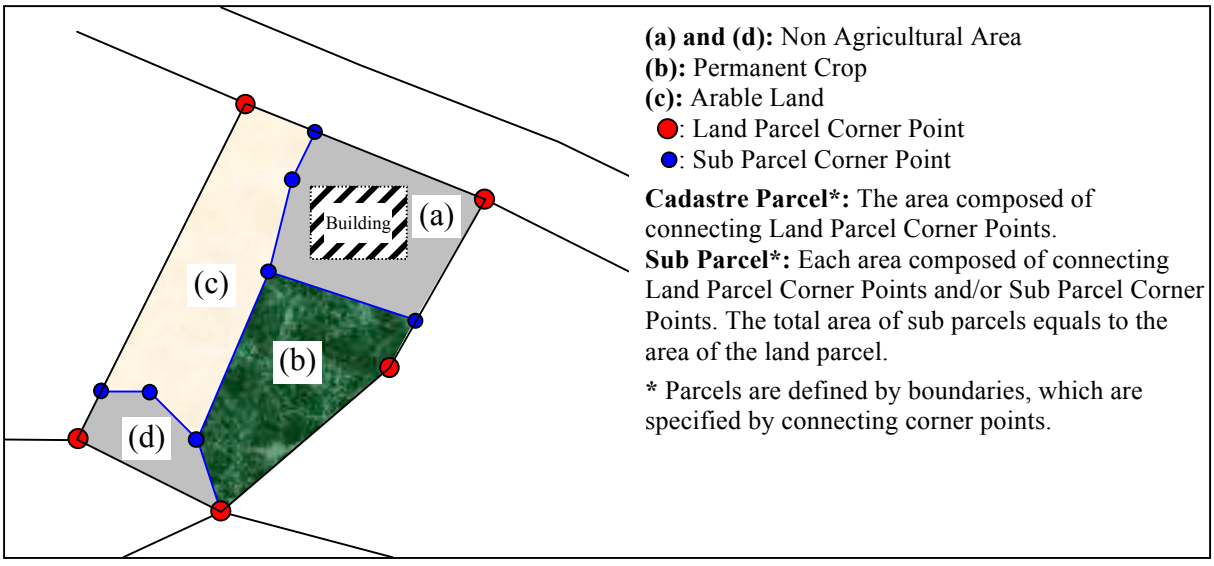

Figure 2. Land Parcel (Cadastre Parcel) and Sub-Parcel Data Model

In this study, each standardized class of different land use/cover types in land parcels is called as Sub-Parcel (see Figure 1). So, Sub-Parcel is defined as a basic subdivision of a land parcel in LAS. The term sub-parcel is used in previous literature for the implementation of agricultural policy with a slightly different meaning (see Perez, 2003). Similarly, this concept was presented as a general classification of land parcels by Inan et al. (2008). That classification included only three basic classes – Cultivated, Planted and NonAgricultural.

In the classification of sub parcel types, special attention is given to the permanence of boundaries considering the previously defined basic rule of the possibility of their registration and their maintenance/update. In fact, relatively few changes in the boundaries of the seven main sub-parcel types (see Table 1) are expected. Sub-Parcel data model and spatial representation (geometry and topology) of sub-parcel boundaries is defined in Figure 2, the data model is also shown in Figure 3 as UML class diagram. Establishment of such boundaries may be done during cadastral surveys or it may be done later in time using ortho photography/imagery by the responsible authorities.

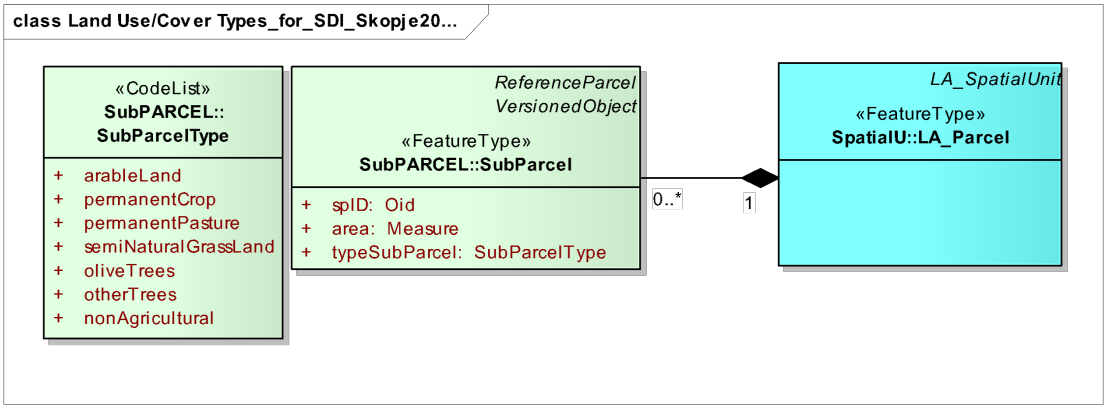

Figure 3. UML diagram of Sub-Parcel Data Model

The sub-parcel model provides the functionality to register some important land use/cover classes as independent objects in relation (topologically) with the land parcel where they coincide. These independent objects as the basic land use/cover classes may be used for different purposes inside or outside the scope of LAS. They can especially be used for SDIs as important spatial environmental information on land use/cover. These independent objects may be used directly for large scale applications (1:1000 – 1:10000) and may be generalised for other small scale applications.

As for the topological structure of sub-parcels, they must be inside land parcels, they cannot overlap, and there must be no gaps between them. Registered buildings and other main annexes must be inside nonagricultural sub-parcels. Sub-parcel corner points can not cause any splits along the edges of land parcels.

In this study, seven types of sub-parcels are classified only for rural areas and especially for the application of agricultural policy. Names of main sub-parcel types and their description are presented in Table 1.

Table 1. Main land use types for sub parcels

Main Types	**Descriptin of the Type**
Arable Land	Includes agricultural areas cultivated with yearly crops. Types of agricultural products within these areas are quite varying. Vegetable gardens and set-aside areas (fallow land) are also included in this type of agricultural land. Permanent greenhouses may be classified as a separated main type.
Permanent Crop	Includes agricultural areas planted with some kind of agricultural permanent crops except for threes (e.g. Vineyards)
Permanent Pasture	Grazing land in private or public ownership whose land cover has not changed over years.
Semi Natural Grass Land	Grazing land in private ownership whose land cover is changeable over years.
Olive Trees	Olive Groves
Other Trees	Fruit Orchards, and Forests
Non Agricultural	The areas not subject to any agricultural production. Urban land, rocky areas, areas with brushwood, roods are some examples.

4. DISCUSSION and CONCLUSIONS

Sub-parcel data model proposed with this study provides a spatial classification of land use/cover within land parcels, and clearly distinguishes annexes as different types of objects which should be registered independently from land use/cover classes. The application of sub-parcel data model is proposed with this study, especially, in order to increase the potential multipurpose use of land parcel data of LAS in different areas of application. The

proposed model adds power to land parcel data in terms of spatial representation of different objects within the boundaries of a land parcel and removes the notion that land parcel data represents only legal situation. In fact, sub-parcels are beyond the legal situation, they represent different main land use/cover types within land parcels which, in legal terms, are homogeneously shared by shareholders.
Currently the sub-parcel data model is especially functional for agricultural policy implementation in rural areas and has the potential to be effective also for other multi-purposes such as the production of precise descriptive statistical data, planning, land development, construction of engineering structures and other land management activities.

The implementation of proposed sub-parcel data model may not easily be possible in current conventional LAS. So, at the first stage, standardization of land parcel types may be an interim solution. This will help the distinction of annexes and initiation of standardization initiative for the classification of land parcels. At, the second stage, application of sub-parcel model requires both the advancement of LASs and other systems (SDIs) needing information from LAS. So, instant implementation will not be possible. Instead, pilot applications should be carried out in order to discover the applicability of the proposed data model, which gives the chance to further develop to proposed model before a fully fledged implementation.

The registration and/or update of sub-parcels may be either within LAS or in another system which properly communicate with LAS. In either case, the capacity (technical, staff, managerial etc.) of responsible authority should be increased by collaborating with main potential user organizations.

Seven sub-parcel types as the basic land use/cover classes which are determined in this study are specific to rural areas and agricultural policy implementation. Therefore, for the implementation of the presented data model further study is required for the refinement of the classes to cover urban areas and other areas of application.

With this proposed method, contribution to the multipurpose use of LAS data is aimed.
National or international initiatives for the modernization and standardization in the area of LAS and also initiatives for integrating separate data infrastructures may be used as good opportunities to implement this spatial classification method.

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6. BIOGRAPHICAL NOTES OF THE AUTHORS

Halil Ibrahim INAN worked and completed his MSc (in 2004) and PhD study (in 2010) at the Department of Geomatics Engineering Karadeniz Technical University, Trabzon, Turkey, and recently moved to the same department at Erciyes University, Kayseri, Turkey. His research interests are agricultural policy, land administration, SDI and GIS.

Arif Cagdas AYDINOGLU works at the Department of Geomatics Engineering of Istanbul Technical University (ITU), Turkey. He completed his MSc study in 2003 and his Phd study in 2009. His research interests are GIS, GDI, and Semantic Interoperability of geo-data.

Tahsin YOMRALIOGLU works as a professor at the Department of Geomatics Engineering of Istanbul Technical University (ITU), Turkey. He completed his Phd study in 1994. His research interests are GIS, GDI, land administration and land management.