

CREATING LAND VALUE MAPS VIA REMOTE SENSING AND GIS TECHNICS

Recep Nişancı¹, Tahsin Yomralıoğlu¹

¹Department of Geodesy & Photogrammetry Engineering,
Karadeniz Technical University, Trabzon, Turkey
rnisanci@ktu.edu.tr, tahsin@ktu.edu.tr

Determining of land values and using that figures in taxation process is one of the most economic resources for the developed countries. Because land valuations are not based on scientific criteria in Turkey, applications related to land values (property taxing, land expropriation, zoning, trial, etc.) have different issues and considerable economics wastes. So, respect to legal regulations, land value maps should be created to use in taxing. Proximity and variety of lands to technical infrastructure and social facilities effect land values either in positive and negative ways. As a result, land location values are determined. In this study, mainly using IKONOS satellite images it is aimed to produce fast, up-to-dated and dynamic land valuation maps for land taxation purposes. The factors which can effect land values related to their locations (main road, public and commercial areas, urban attraction centre, etc.) were specified. In ArcInfo/GRID module, necessary analyses were done and nominal values based on a pixel were calculated by using GIS. After this process, raster based value map were done. Consequently, vector based cadastral map was overlapped on this raster based land valuation map and thus, cadastral property values were determined on a parcel base.

1. INTRODUCTION

Determination of land value is one of the most important problems of land applications in Turkey. There are needs for land value knowledge in a various area, like land taxation, land readjustment, land registry (title deed transaction) processes, trial, insurance and land nationalization. Land taxation is a local authority's income which comprises buildings, lands and real properties and realized by municipalities [Uzun, 2000]. Land valuation problems in the point of view of taxation which has approximately 18 millions taxpayer are discussion matters [Gökbel, 2002]. Since 1985 that "Minimum declaration principle" comes into force, in the application, unit value of lands is specified via minimum unit value of street based land taxation value by local land valuation commission. However, if land unit value specified as street based, position rants can not be understood. In some regions, different sides of the street are in different municipality regions. So, a side of a street could have nine times more value from the other side [www.olayhaber].

As in various areas, developing computer technology has effected to the map producer and users. Developing of map supported applications has increased the needs of digital map. As a result, Geographical Information Systems (GIS) are increasing decision capabilities of research, planning and managements, getting time and speed, spatial and table information of similar/different geographical entities are queried and analyzed together and offered to the users has come out. Because data acquiring one of the important steps of GIS is %50-80 of total cost, applicator have intended to use remote sensing techniques which is developing and increasing resolution recently. Having to high differentiation power of high resolution, studies can be possible based on settlement areas [Nişancı, 2002].

2. DETERMINING OF LAND VALUES

Real estate valuation/appraisal is objective and impartially determining of a real estate value process by evaluation of factors like quality, utility, environment, using conditions [Güngör, 1999]. Determining of definite value is difficult in the application. Owing to lack of real estate valuation policy based on objective element, acquiring of the data directly related to valuation is very difficult in Turkey [Yomralioğlu, 1997b]. In addition to this, a real estate's conjectural market value can be affected from national or international conditions. The factors like demographical changes, commercial and industrial tendencies, financial policies of government, inflation, high interest, credit conditions effect the value of real estate directly [Güngör, 1999]. Because this change affects all real estates with same proportion, values rise or increase with same proportion. So, for some works like taxation of the real estates where is in wide areas, land readjustments, land consolidation, nationalization applications, a special method respects value differences dispersion between different real estates should be preferred. The most important process for using such system, determining of the weighted factors effect real estate values. Thus, the value specified for a unit area can be reflected to all real estates with same proportions. This method is named as "nominal land valuation method". Respect to this method, nominal values of real estates can be calculated in a parametric way instead of definite value. Objective and subjective criteria selected for this aim are evaluated one by one. Then, doing in a unit area or volume, these evaluations are reflected to all real estates.

3. NOMINAL ASSET LAND VALUATION APPROACH

In various land valuation processes, market value approach is the fundamental. However, units specified by valuation method used in the application can be change depending on the nation's economic structure. Whereas, characteristics owned by real estates can not generally be different. Because these changes in market conditions cause price speculations, controlling unit values of real estates are very difficult. As a matter of fact, such problems can be seen in valuation processes done for real estate taxation. Generally, real estate values which have same region or street are same. Whereas, each real estate can has positive or negative characteristics in economic perspective from neighbor real estates. This reality point out that each land parcel has different value.

For this reason, by evaluating in a region is existing properties, value dispersion between these properties under consideration should be determined. In this value dispersion process, base unit may be the real-property value or parametric values obtained by grading effective factors on property. In this aim, minimum and maximum points are determined by formulizing value criteria taken into consideration, and a value coefficient representing each property is calculated. This value coefficient shows property situations between each other in respect of the value, and these values are easily converted to real-value when needed [Yomralioğlu, 1992].

4. THE FACTORS AFFECTING LAND VALUES

In general, a subdivision's value is directly related to the features that this subdivision has by means of its position, and this is measured by the parcel's economical value [Yomralioğlu, 1997a]. A value changes according to factors that land has in its nature (internal factors) and factors that isn't related to land (external factors). The factors existing in the nature of the land are the shape of the land and the structure of the soil. External factors, that is, land-free factors are surrounding area of the parcel, proximity to various sources, easiness of arrival, and making use of public services sufficiently [Dale, 1988]. The factors having the parcels in general in an order;

- using objective of the property (housing, commercial etc.),
- the features of the property place (environmental features, legal features, individual features of the owner),

- location of the property (proximity to public services, shopping malls, educational areas, recreational areas, nasty and hazardous areas, noisy areas and tourist areas etc.).
- position of the property (topographical structure, ground structure, shape and dimensions of the parcel, frontal use and view etc.).

These factors are changeable according to the valuation aim and experience of the valuing-expert [Nişancı, 2002].

5. PRODUCING LAND VALUATION MAPS BY GIS

Producing land-valuation maps is anticipated only for taxation purposes in accordance with the law of real-property taxation. Yıldız's opinion, he stated in an article also including land-valuation maps in 1973, that "land-valuation processes haven't been started yet and these maps will not be prepared for a while" keeps its currency at present although it has passed approximately 30 years since then [Yıldız, 1973]. Producing land-valuation maps requires analyzing altogether some spatial factors effecting land-value. Advanced GIS spatial data analyze capabilities, raster and vector data processing support by developing GIS software facilitate considerably producing land-valuation maps via GIS. In this study, by using IKONOS images as base maps, it was produced pixel base land-valuation maps that will be used as a transition form to provide real-value via GIS techniques. Followed processing steps (Figure 1) to realize this study are as follows;

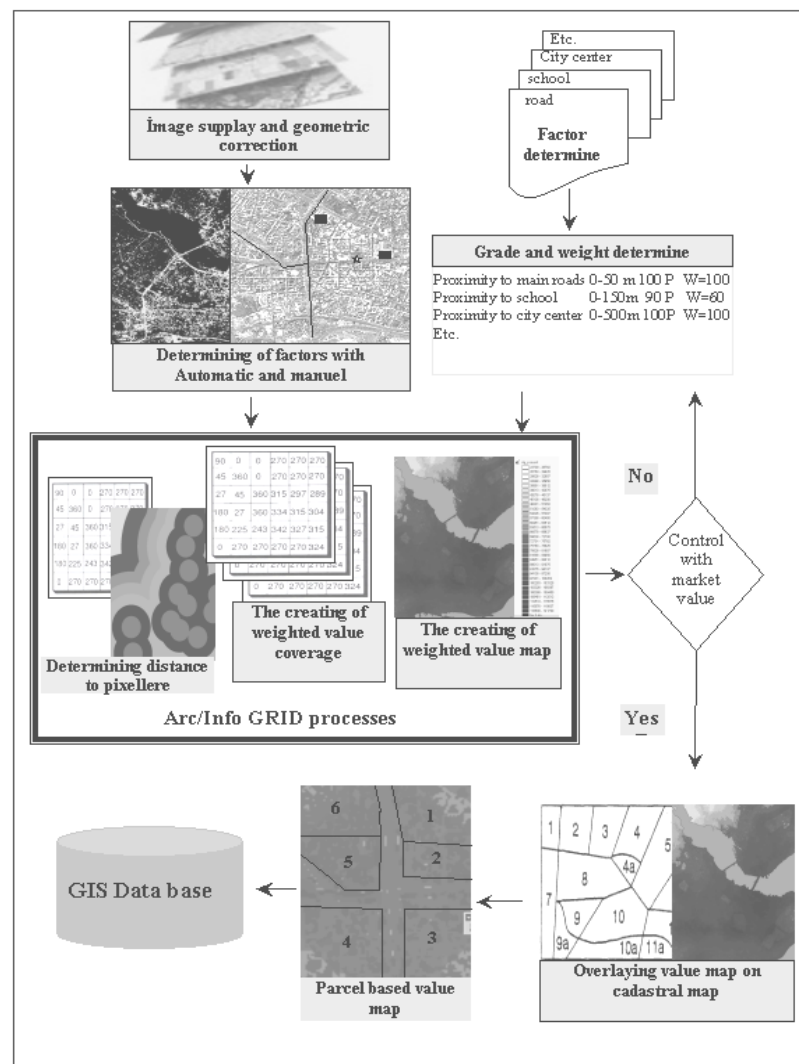


Figure 1:
Outline of creating
Land value map

First step: IKONOS image corrected geometrically and converted to UTM coordinate system of the city Istanbul, an historical peninsula, as a training area, sea-water, housing areas, main routes and green fields which are main land classes were gathered. The other factors (urban centers, attraction centers, etc.) effect real estate's value have specified on the image manually.

Second step: The distance from each pixel to a selected factor is appointed via essential command in Arc/Info GRID module. This process is repeated for all factors (Figure 2a and Figure 2b).

Third step: The pixels appointed its distance are pointed respect distance from factors via classification done in beginning (For example, pixels which has 0-250m distance from urban center have 100 point, 250-500m 95 point).



Figure 2a.



Figure 2b.

Figure 2a : Respect main road route, Figure 2b: Respect attraction centers (greated condition of pilot area)

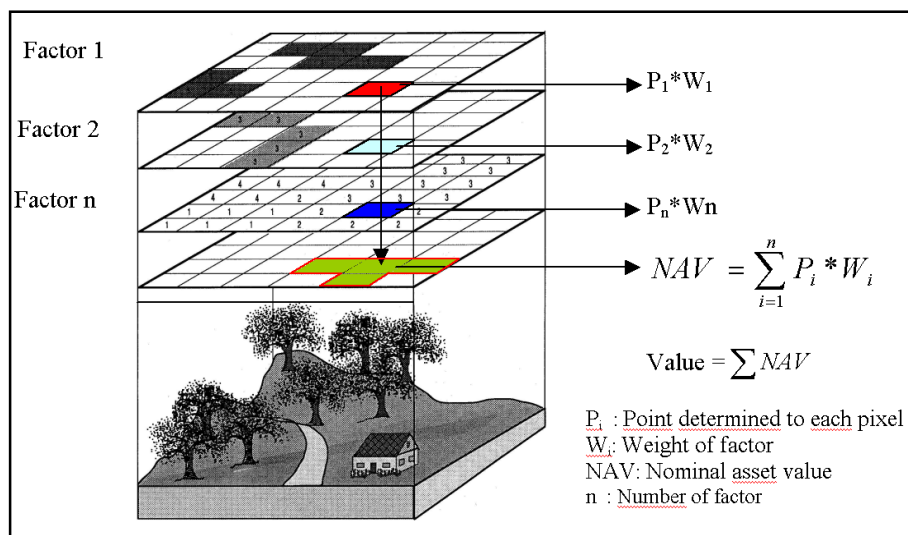


Figure 3: Calculated of Nominal asset value for parcel base

Fourth step: Multiplying point maps get for each factor with specified weights ($F_i \cdot W_i$), weighted values of factors which effect value are specified (Figure 3).

Fifth step: By adding up provided weighted-value layers, pixel-based proportional value maps are produced. Not having a mathematical unit, produced value maps can be converted to desired unit (TL, \$) easily.

Sixth step: By comparing provided proportional value-maps with real-values, accuracy of the constituted base maps should be tested. At first, it should be examined whether the factors affecting the value are determined properly or not. In the event that any defect is not encountered, by changing factors' weights, it should be reproduce value maps and tested.

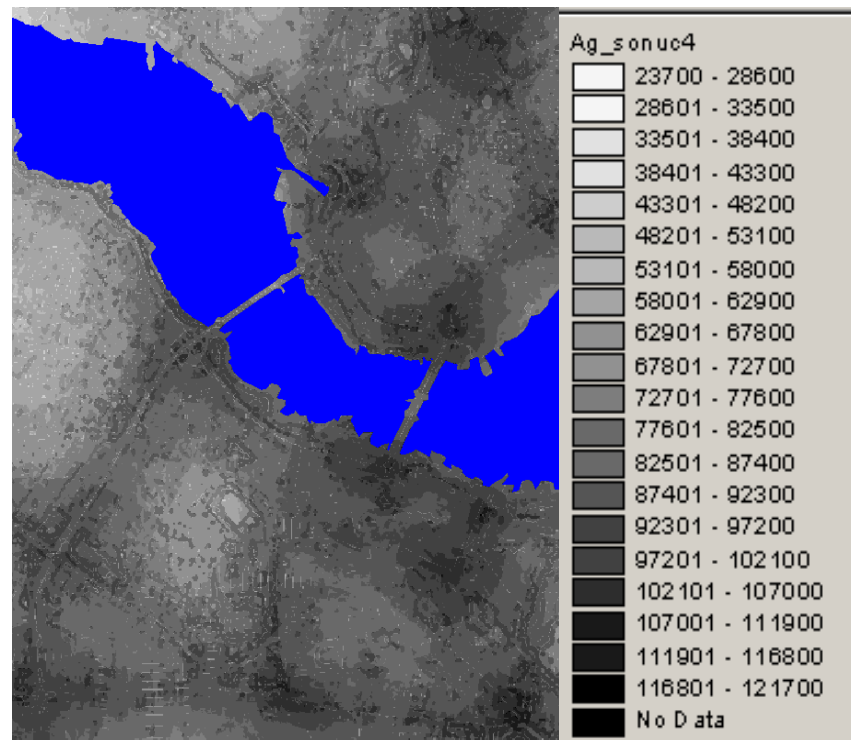


Figure 4: Nominal asset value of pixel base

6. CONCLUSION

Producing land-valuation maps is an important task for the countries. Especially developed countries buying-selling property and rental revenue are being kept under control continuously by official foundations. However, in such countries as Turkey which is developing and legislative applications cannot be controlled thoroughly, it is hard to inspect financial registration related to economical income. Especially, in a bargaining that happens only between buyers and sellers in accordance with the law, it seems quite hard to determine the real-value of the property. Overcoming this kind of difficulties is possible just by providing the parameters through which approximate value of the property under consideration can be determined. Land-value maps will assist in urban planning, guiding urban development by local governors and planners, determining conjectural prior cost prices for some application projects, and especially collecting fair tax by real property taxation applications.

REFERENCES

- Dale, P. F., and J.D. McLaughlin, "Land Information Management", Oxford University Press, New York, USA (1988).
- Gökbel, D., "Emlak Vergisinde Vergilendirilecek Matrahın Belirlenmesi", www.eso-es.net/kurumsal/yazi.asp?68 (2002).
- Güngör, E., "Gayrimenkul Değerlemesi ve Türkiye’de Sermaye Piyasalarında Gayrimenkul Ekspertiz Şirketlerine Yönelik Düzenlemeler Yapılmasına İlişkin Öneriler", T.C. Başbakanlık Sermaye Piyasası Kurulu Kurumlar Yatırımcılar Dairesi, Expert Thesis, Ankara (1999).
- Nişancı, R., Yomralıoğlu, T., "Uydu Görüntüleri ve Coğrafi Bilgi Sistemleri Teknikleri ile Taşınmaz Değer Haritalarının Oluşturulması (İstanbul-Haliç Örneği)", 8. ESRI & Erdas Users conferences, Ankara (2002).
- Uzun, B., "Çevre Yolu-Mülkiyet İlişkilerinin İmar Hakları Açısından İncelenmesi ve Arazi Düzenlemesi Yaklaşımıyla Bir Model Önerisi", PhD Thesis, Karadeniz Technical University Graduate school of Natural and Applied Sciences, Trabzon (2000).
- Yıldız, N., "Türkiye’de Arsa Politikası", Harita ve Kadastro Mühendisliği Dergisi, Vol. 29, Ankara (1973).
- Yomralıoğlu, T., "Determination of Land Parcel Values in Land Reallocation Using GIS", International Congress on Agrarian Reform and Rural Development, Ankara (1992).
- Yomralıoğlu, T., "Taşınmazların Değerlendirilmesi ve Kat Mülkiyeti Mevzuatı", Kentsel Alan Düzenlemelerinde İmar Planı Uygulama Teknikleri, Jeodezi ve Fotogrametri Derneği, Vol. 1, Trabzon (1997a).
- Yomralıoğlu, T., "Eşdeğer İlkesine Dayalı Arsa ve arazi Düzenlemesi Modeli", Kentsel Alan Düzenlemelerinde İmar Planı Uygulama Teknikleri, Jeodezi ve Fotogrametri Derneği, Vol. 1, Trabzon (1997b).
- [www.olayhaber.com/2002/01/27/anasayfa/01emlak vergisi.htm](http://www.olayhaber.com/2002/01/27/anasayfa/01emlak%20vergisi.htm)