2005 Nairobi Land Use Memo

Abstract
Over the past year the Spatial Information Design Lab has been working with the Earth Institute to create a GIS database of Nairobi, Kenya. While the city of Nairobi already has some GIS databases, these databases are difficult for urban planners, policy analysts, and community stakeholders to obtain. This project set out to create a freely available dataset that will allow those interested in Nairobi's future to use GIS to make informed decisions. Obtaining this type of data in many developing countries is extremely difficult and its provision there will likely have an effect on planning and data policies within the city itself. The first experiment of this its use will be for a transportation modeling project for the City of Nairobi.

The land use file was created by manually digitizing a map which was prepared jointly by the Japan International Cooperation Agency (JICA) and the Government of the Republic of Kenya under the Japanese Government Technical Cooperation Program. The map was published and printed by survey of KENYA 1000 in March 2005 and is copyright protected by the Government of Kenya. The creation of this basemap took place over the course of several months in 2003: aerial photography was taken in February 2003 at a scale of 1:15,000; photogrammetric work was completed in August 2003; field identification was completed in November 2003. The land use file was created with the intention of providing a freely accessible, generalized representation of Nairobi's land-use patterns; it should be noted that the JICA map used to generate the land use file obviously possesses a greater degree of accuracy and detail than the land use file itself.

The Process
The creation of the land use shapefile involved the digitization of the original JICA map. First, polygons representing the various land uses denoted on the original map were drawn and assigned a land use category. Depending on the amount of information provided by the original map, a more specific description and/or official name was added to the polygon in the attribute table. The number of buildings contained within the polygon was then counted, either individually or by determining building density (per acre). If a particular polygon was too big to count all the buildings it contained, a building density count was completed instead; this involved moving a box that represented an acre to the polygon, counting the buildings inside it, and entering this number in the "buildings per acre" field. Because lot lines and parcel boundaries are not always clearly indicated on the original map, polygons were created using these boundaries as only a loose guide.

Explanation of Land Use Categories

Commercial
Polygons were categorized as commercial only if they were labeled with a name or category that suggested retail, sales, services, business, or company. Note that towers, plazas, or other

office buildings were not categorized as commercial, but rather as mixed CI (commercial-institutional). Commercial uses include (but are not limited to) the following:
bank, bakery, bar, casino, cinema, club, funeral home, guest house, hostel, hotel, market, media, petrol station, restaurant, supermarket, shops, shopping centre, travel agency.

Industrial
Polygons were categorized as industrial if they contained features such as factories, warehouses, quarries, or the production of raw materials. Industrial uses include (but are not limited to) the following: brewery, construction, crematorium, dairy farm, dump, factory, feed farm, greenhouse, industrial bakery, mills, mortuary, oil depot, oil tank, oil refinery, pig farm, plant nursery, quarry, ranch, slaughterhouse, tannery, timber yard, warehouse.

Institutional
Polygons were categorized as institutional if they contained structures that could be considered institutional in nature. Other land uses that are within institution's lots were considered part of the institution (i.e. a car park within university grounds is considered part of the university and therefore classified as institutional). Institutional uses include (but are not limited to) the following: animal hospital, church, clinic, college, community centre, consulate, diplomatic residence, dispensary, embassy, fire station, garrison, government offices, health centre, hospital, institute, kindergarten, library, mausoleum, monument, mosque, museum, NGO, nursery, nursing home, orphanage, paramilitary training school, police booth, police depot, police post, police station, post office, prison, public hall, school, sewage pond, sewage treatment plant, shrine, synagogue, temple, training centre, university, utilities, youth centre.

Mixed CI (mixed commercial-institutional)
Polygons were categorized as mixed CI if they were permanent buildings that were larger than those in residential sections, did not have front and back yards, were relatively densely clustered, did not resemble residential estates or slum, and did not have any labels suggesting industrial uses. Additionally, structures that were labeled "[x] House" and appeared to be multi-story office buildings were categorized as mixed CI. Mixed CI uses include (but are not limited to) the following: arcade, high rise building, office building, plaza.

Mixed RC (mixed residential-commercial)
Polygons were categorized as mixed RC if they contained a mix of residential and commercial uses (see residential and commercial).

No_structures
Polygons were categorized as no structures if they contained no permanent buildings and were shaded white on the original map signifying they were in some way developed. It should be noted that the distinction between 'no structures" and "open space" was largely subjective. Polygons were labeled "no structures" if the base map and/or GoogleEarth indicated the presence of a vacant lot in the middle of developed land; polygons were labeled "open space" the base map and/or GoogleEarth indicated that land was more removed from human activity or development.

Recreational
Polygons were categorized as recreational if they contained labels that clearly indicated recreational uses. Recreational uses include (but are not limited to) the following: arena, campgrounds, country club, golf course, horse complex, playing field, pool, racing track, sports club, sports complex, stadium, tennis courts, volleyball court, water park.

Residential
Polygons were categorized as residential if it contained mostly permanent buildings, the boundaries of property were clearly marked as an estate or housing complex or each parcel appeared to have what looked like a front yard and back yard. Additionally, GoogleEarth indicated that residential areas contain more trees and green space than mixed CI or industrial areas. Residential uses include (but are not limited to) the following: apartments, estates, flats, staff quarters, student housing, and villas.

Res_slum (Residential Slum)
Polygons were categorized as res_slum if they contained small, mostly temporary buildings that are randomly distributed in high density clusters. It should be noted that the distinction between res_slum and residential areas was highly subjective. Generally speaking, polygons were labeled res_slum when both GoogleEarth and the base map indicated that the area possessed all of the above characteristics. It should also be noted that in some cases the JICA maps labeled these areas as slums on the map and that is the reason we included it here. It was hard to categorize slum so this label was only used when it was clear that this was the type of land use.

Open space
Polygons were categorized as open space if they were shaded green on the original map and were not adjacent to structures with which it could be directly associated (see note under "no_structures"). Open space uses include (but are not limited to) the following: cemetery, coffee plantation, cultivated, forest, garden, national park, nature preserve, park, sisal plantation, zoo.

Transportation
Polygons were categorized as transportation only if they were clearly labeled as having purely transportation-related uses. Transportation uses include (but are not limited to) the following: airport, bus depot, bus garage, bus station, bus stop, bus terminus, car park, rail station, rail depot, railway lines, road, traffic circle.

Water
Polygons were categorized as water if they were shaded blue on the base map. Rivers are represented as long thin polygons that generally followed the riverbank as shown on the base map. The various distinctions between certain types of water features (i.e. stream/river, pond/pool/lake) were largely subjective since the information contained in the base map was frequently vague. Water features include (but are not limited to) the following: canal, culvert

(no consistently digitized), dam, irrigation canal, lake, pond, pool, river, seasonal swamp, stream, swamp, water hole, water reservoir, water tank, well.

Unknown
Polygons were categorized as unknown whenever it was impossible to determine the exact land use from the base map, GoogleEarth, and other research methods. Building count was still recorded in polygons labeled unknown.