

Procedures used for back-classification of existing land use shapefiles using ancillary data (DOQQs, impervious surface, and planimetric data)

10/3/02 (from research log)

Added Vint Hill and UOSA WWTPs to ArcMap project "LandUse6.mxd."

Created a new ArcMap project to georeference scanned map, called "ImageReferencing.mxd" (saved from original LandUse1.mxd). Files md01 (1989) and md03 (1979) will be used for research. Georeferencing begins by selecting the target, then selecting the reference. Began with the two central intersections of I-66, then worked around from the northern basin border, counterclockwise around the boundary. Used Occws83.shp (original shapefile from nvpcd) as the template. Used 180 source/reference pairs to georeference the border of the 1989 image (md01.tiff). Total RMS error was 69.815. According to notes, there are two options to save the rectified image. 1. Update georeferencing: attaches a World file; 2) Rectify: warps the image. I used the update georeferencing command and saved the project, then removed the tiff image from the project and re-added it to the project to confirm the geo-referencing worked. Tiff image appeared to work ok. I also used the other suggestion with the "rectify" command, which does not create a .TWF file, making the file more portable to other applications.

11/13-15/02

Continued working to create proper 1995 and 2000 land use shapefiles. Used available 1994 DOQQs to verify conflicts. Created a new layer called "construction1995" to accommodate disturbance/land conversion between 1995 and 2000 land use polygons due principally to missed by mismatch of dates. Completed 1995 and 2000 shapefile sets for Cub Run. Began new layers for ca1990. Continued working on new 1990 shapefiles for Cub Run. Details, as follows (excerpted from ASPRS paper draft).

“The land use data used in this study is composed of three data sets representing land use for the Cub Run watershed for the years 1990, 1995, and 2000. The 1990 land use mapping is derived from historic Northern Virginia Regional Commission (NVRC) base mapping dated December, 1989. This hard copy 107cm x 152cm map, shown digitally photographed and georeferenced in figure 2, was assembled by NVRC from local land use maps, Master Plans, infrared photography (April, 1974), field surveys, and information from the Virginia Department of Forestry, and local Soil & Water Conservation Districts. The NVRC has used a consistent set of land use classifications for planning purposes since 1979 (8 urban, 5 agricultural, 1 forest/idle). For the purpose of this study, institutional, commercial, and industrial land use classifications were combined, since they were assigned equal impervious surface area. Similarly, estate residential and low density residential land use classifications were combined.

Consequently, the following three residential land use categories, similar to a Anderson (Anderson et al., 1976) Level III classification, were used in this study; 1) low density residential land use (identified by NVRC as housing at a density of 0-5 dwelling units per hectare), 2) medium density residential land use (identified by NVRC as housing at a density of 5-20 dwelling units per hectare), and 3) townhouse-garden apartment land use (identified by NVRC to characterize a variety of high density multi-family dwellings). Crawford-Tilley et al. (1996) used a residential density of 3 houses per hectare as a threshold for classification of land use as urbanized. Modified NVRC land uses used in this study, including two new categories (major roads and construction/disturbed land), are presented in figure 3 (plates a-c). Digitization of the 1990 land use from the georeferenced 1989 base map is described in the data preparation section.

The 1995 land use data was supplied by NVRC as pre-delineated land use polygon ArcView©GIS3.3 shapefiles having the following metadata. Land use delineations were derived by NVRC staff from color infrared aerial photography at a nominal scale of 1:40,000, taken during leaf off conditions, with airborne photo centers and ground points identified by differential GPS during flight. The resulting digital orthophotography was produced at map scale of 1:12,000 (1"=1,000'), 25 microns scan resolution (1000dpi), at a ground resolution of 1m. The 2000 land use data was derived similarly, but from airborne true color photography at 0.6m (2 foot) resolution. Land use polygon shapefiles provided by NVRC to this study were projected using the State Plane Coordinate System (Virginia North, meters) cast upon a datum of NAD1983."

"To produce a set of 1990 land use polygons for comparative analysis, the existing 1989 base map (90cm x 152cm) was digitally photographed, then georeferenced within ESRI® ArcMap™8.2 using over 200 control points representing matching watershed boundaries and road intersections. Exact registration with 1995 and 2000 land use polygons was not critical, since initial 1990 land use polygons were derived by duplicating existing 1995 polygons. The georeferenced 1989 base map was used as a backdrop for on-screen verification of all back-classifications from the 1995 data. The 1995 and 2000 land use categories were cross-checked one by one in order to eliminate obvious errors or

inconsistencies that may be present between the two datasets. DOQQs of the same era, available from the Virginia Economic Development Partnership (VEDP), as well as matching Digital Raster Graphs (DRGs) of USGS 7.5-minute topographic maps were used for verification before making major changes in land use polygons. One 25-hectare site classified as institutional in the 1995 dataset was converted to a forested tract based on this comparison. Also, the industrial classification used to delineate the forested buffer south of Dulles International Airport (located in the northern section of Cub Run watershed) was reduced in the 1995 dataset to conform more closely to the 2000 dataset. It was also noted during the verification process that forest buffer delineation of the 2000 dataset was more accurate than the 1995 dataset, which resulted in minor polygon boundary inconsistency. This inconsistency occurred mainly among the scattered, intricate riparian and urban-fringe areas of the watershed.

Significant disturbed areas showing up on the RESAC (Regional Earth Science Applications Center) impervious surface data for a matching time period appeared to have been missed in the NVRC land use mapping. Conceivably, disturbed areas were not picked up by the NVRC land use polygons, either because the land disturbance took place after NVRC field mapping was completed or because there was an omission in the NVRC mapping. In either case, RESAC impervious cover estimates were used judiciously as a further cross-check of all land use polygons to identify obvious areas of imperviousness such as major industrial expansions and new construction sites. These areas of disturbance were subsequently added as polygons to the 1990, 1995, and 2000 datasets as a new land use classification, and concurrently deleted from the agriculture/forested/idle land use category. This method was deemed acceptable based upon the intent of the study, which was to compare photo-interpreted impervious surface estimates with improved synoptic estimates of imperviousness using satellite imagery. An additional land use category called major roads was added to the 1990, 1995, and 2000 data sets. This land use category was used to delineate several major highways located within the study area. Planimetric road centerline data from Virginia Department of Transportation (VDOT) was buffered by 15m to approximate a nominal 100-ft

highway right-of-way. Visual registration of the resulting major road polygon with the RESAC impervious cover estimates was deemed acceptable for use in this study.”

11/18/02 - 11/19/02

Worked on finishing 1990 shapefiles. Spoke with Normand Goulet from NVRC, who was surprised to find that all 1989 residential land use mapping was not delineated as on-the-ground land use, rather as zoning areas. Received description of limitations and procedures used to produce RESAC IS data from Claire Jantz, with promise of more coming, see note below from Claire.

"In terms of the historic layers, I do not think they will be much help to you. The impervious values in 1986, 1990, and 1996 were derived from the 2000 data. We were able to capture the presence or absence of impervious surfaces in the historic TM scenes, but were not able to do full scale continuous classifications. We used the binary maps of urban extent for 1986, 1990, and 1996 as masks on the 2000 impervious surface data to create the time series. This method assumes that the impervious values in 2000 remain constant through time even though the extent of development has changed (i.e. intensification is not taken into account). It will also not capture transitional events. I am not sure about how the 2000 data will handle this--hopefully Drew will have something to say about that."

11/20/02

Produced polygon to grid conversions needed for Cub Run analysis (ASPRS paper). Assigned LULC class numbers and impervious values, as follows:

0. Roads (547ha)	100% impervious
1. Construction	100%
2. Industrial-commercial	87%
3. Institutional	87%
4. Townhouse-garden	82%
5. Med-dens-residential	41%
6. Low-dens residential-estate	12%
7. Golf course	0%
8. Agriculture/forest/idle	0%