A Break from the Past: ESRI's 2006 Demographic Updates

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J-9579

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Contents **Page**

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Population change is constant—from the slow attrition in declining neighborhoods to the rapid expansion of burgeoning suburbs. The methods of measuring local population change also tend to be constant. New developments in housing are common; new developments in demographic update methodology are rare. In 2006, however, ESRI implemented Address-Based Allocation (ABA), a new technique that measures population change by block group, and introduced a new data source from Hanley Wood Market Intelligence to track residential construction.

New Method: Address-Based Allocation

What's new about Address-Based Allocation is not the input data but how the data is deployed to measure demographic change by block group. ESRI has been modeling the change in households from two primary sources, the InfoBase® database from Acxiom Corporation and residential delivery statistics from the U.S. Postal Service (USPS), in addition to several ancillary sources. USPS publishes monthly counts of residential deliveries for every postal carrier route. This is the most comprehensive, current information available for small, subcounty geographic areas. The InfoBase database includes more than 111 million records, the largest collection of U.S. consumer data available in one source.

Neither source provides data directly for block groups. The key to using either delivery statistics reported by postal carrier routes or address list counts is the transformation of the data to block groups. Addresses must be geocoded correctly to the block group, which requires complete street address information and an accurate geocoding database. Converting delivery statistics from carrier routes to block groups is more complex. Carrier routes are defined to deliver the mail while block groups are constructed to collect and report census data. Comparing two areas that are defined for wholly different purposes reveals a number of correspondence issues. Carrier routes change frequently and commonly overlap multiple block groups. Some carrier routes encompass disjointed areas that can be distant from each other, but block groups are rarely divided into multiple polygons. The overlaps require an effective method of allocating the postal delivery counts across multiple block groups.

A few different techniques are used to distribute delivery statistics among component block groups. One way is to create a correspondence between carrier routes and block groups using boundary files. Changes in postal carrier routes can be tracked through quarterly updates of carrier route boundaries, and delivery statistics can be assigned to block groups with Census 2000 block data. A variation of this approach also employs boundary files but assumes a uniform distribution of households within the area. Another option uses commercial correspondence files such as the block/ZIP+4 file sold by Tele Atlas and the ZIP+4 carrier route correspondence available from USPS.

The best options rely on Census 2000 blocks to apportion delivery statistics to block groups; however, these techniques require a housing base that existed in 2000 and minimal changes in the carrier routes to apportion delivery statistics effectively. If an area was developed after 2000, these techniques cannot pick up the change. Using standard geodemographic tools, it is possible to estimate the change in households from carrier route delivery statistics and apply that change to any block group(s) in the area with an existing housing base. But the estimated change is simply being redistributed from one summary area to another. These limitations required a more robust technique that could identify change since 2000 and the location of current households.

ESRI has developed another way to link a carrier route to the correct block group(s)—using the *actual* locations of mail deliveries. ABA uses the addresses from the Acxiom® household database to apportion delivery statistics. These addresses are geocoded with carrier route and block group codes, using an enhanced geocoding technique and database, and serve as the foundation for the conversion. This approach is unbounded by geographic borders, arbitrary assumptions about the distribution of households or postal deliveries, or preexisting housing.

The effectiveness of ABA relies on the precision of block group assignments to addresses in the InfoBase data. ESRI improved the geocoding accuracy of the InfoBase file with the new Dynamap®/Address Points database from Tele Atlas, which provides coordinates that are accurate *to the building.* It offers a new development in large-scale geographic databases where addresses are represented as points rather than approximations estimated from address ranges or street segments. The database currently covers the most densely populated areas in the United States, with continuously increasing geographic coverage. Geocoding was accomplished using ESRI® ArcGIS® 9.2 with the new Address Points database. Addresses that fall outside of the coverage were geocoded with the conventional approach, based on address ranges.

ABA results were tested extensively. The tests include benchmarking against Census 2000 data. Manual reviews confirm the capability of the method to identify areas with high growth. The allocation method reveals sprawls and new developments across the country since Census 2000. Assessments based on other data sources verify the efficacy and precision of ABA. For the small portion of block groups where InfoBase addresses are not available, delivery statistics are allocated from a correspondence file. The correspondence between census block groups and postal carrier routes is developed using quarterly updated data from Tele Atlas.

New Data from Hanley Wood Market Intelligence

Post office delivery counts or address counts provide less coverage in rural areas. Sparsely populated areas tend to have post office box ZIP Codes because there are few rural addressing systems and little comparability to urban, street delivery. The same problems characterize rural addresses in the Acxiom database. To track new housing developments, especially in areas that were previously unpopulated, ESRI licensed a new data source from Hanley Wood Market Intelligence that provides information about new and planned residential construction in 75 of the top U.S. housing markets.

The new residential construction database from Hanley Wood Market Intelligence adds a unique component to ESRI's strategy for demographic forecasts. This database identifies individual construction projects, for instance, a complex of single-family homes or townhomes or a condominium building, with its exact location in latitude and longitude.

J-9579

It also pinpoints conversions of apartments into condominiums. The construction information includes

- Total number of units planned
- Inventory of units under construction, sold, and/or closed
- Type of housing such as detached homes, townhomes, or condominiums
- Target market types such as families, seniors, or empty nesters

The use of this type of information in demographic forecasts has traditionally been confined to small-scale implementation such as producing forecasts for a specific county. ESRI partnered with Hanley Wood Market Intelligence to introduce this information in a large-scale forecasting effort. The new construction database complements and corroborates the postal delivery statistics. More important, it tabulates planned construction to be completed in the upcoming years. This information is incorporated in ESRI's five-year projections. Tracking residential development since 2000 with enhanced tools for demographic and spatial analysis informs the 2011 forecasts more accurately than past trends.

A revised housing unit methodology applies the change in households estimated from address counts, delivery counts, and new housing construction to update household population by block group. The best techniques are derived from a combination of models and data sources. The integration of demographic and spatial analysis and the addition of the Hanley Wood® data on residential development represent the difference from past methods.

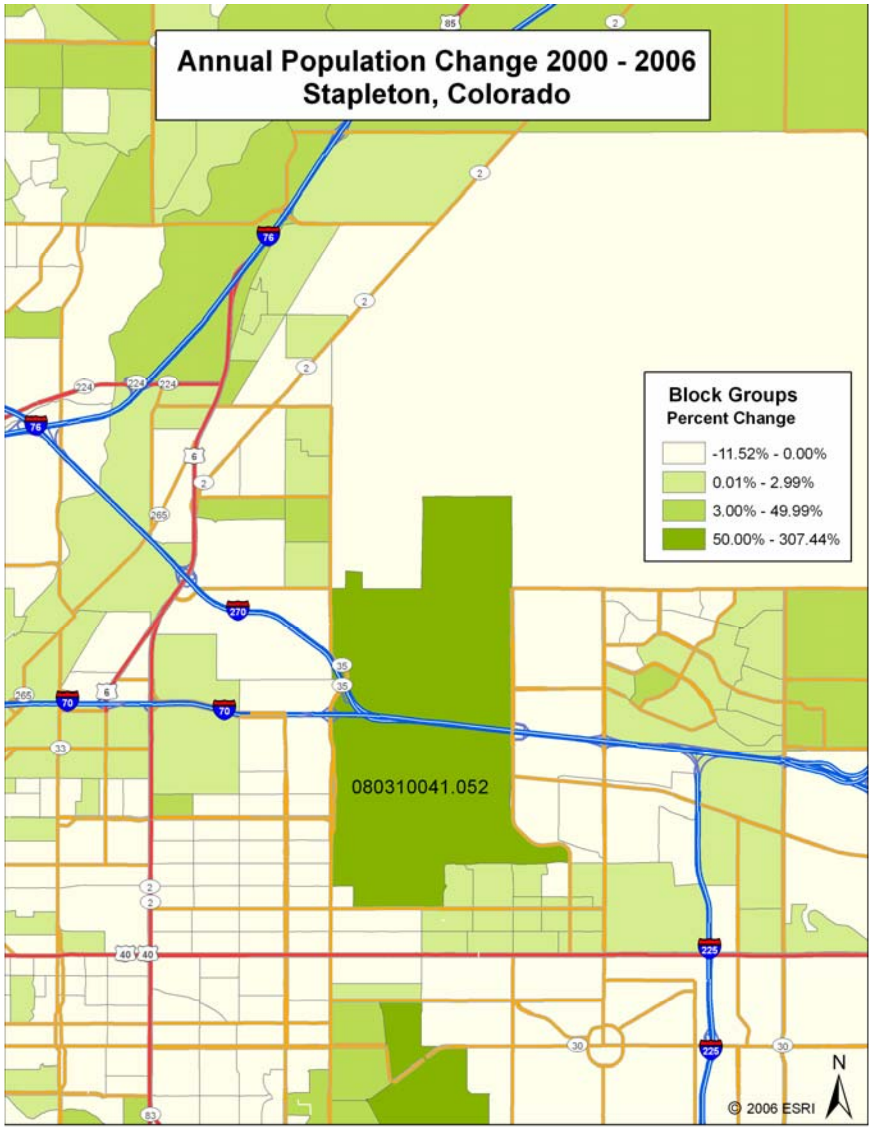
Examples

A couple of examples best illustrate the effects of Address-Based Allocation and the use of Hanley Wood data. The first example shows the community of Stapleton, just east of Denver, Colorado. Previously the site of Denver Stapleton Airport, this community is now the largest urban development in the United States. The 4,700-acre site was opened for redevelopment after the airport closed in 1995. In 2000, it was still unpopulated—no people, no homes. Earlier methods could not automatically pick up the development of Stapleton. In 2006, the updates show the effects of ABA and Hanley Wood data.

Block Group 080310041.052	**2000**	**2006**	**2011**
Population	0	6,500	8,183
Households	0	1,939	2,431
Housing Units	0	2,071	2,638

2006/2011 Updates for Block Group 080310041.052, Representing Stapleton, Colorado

J-9579

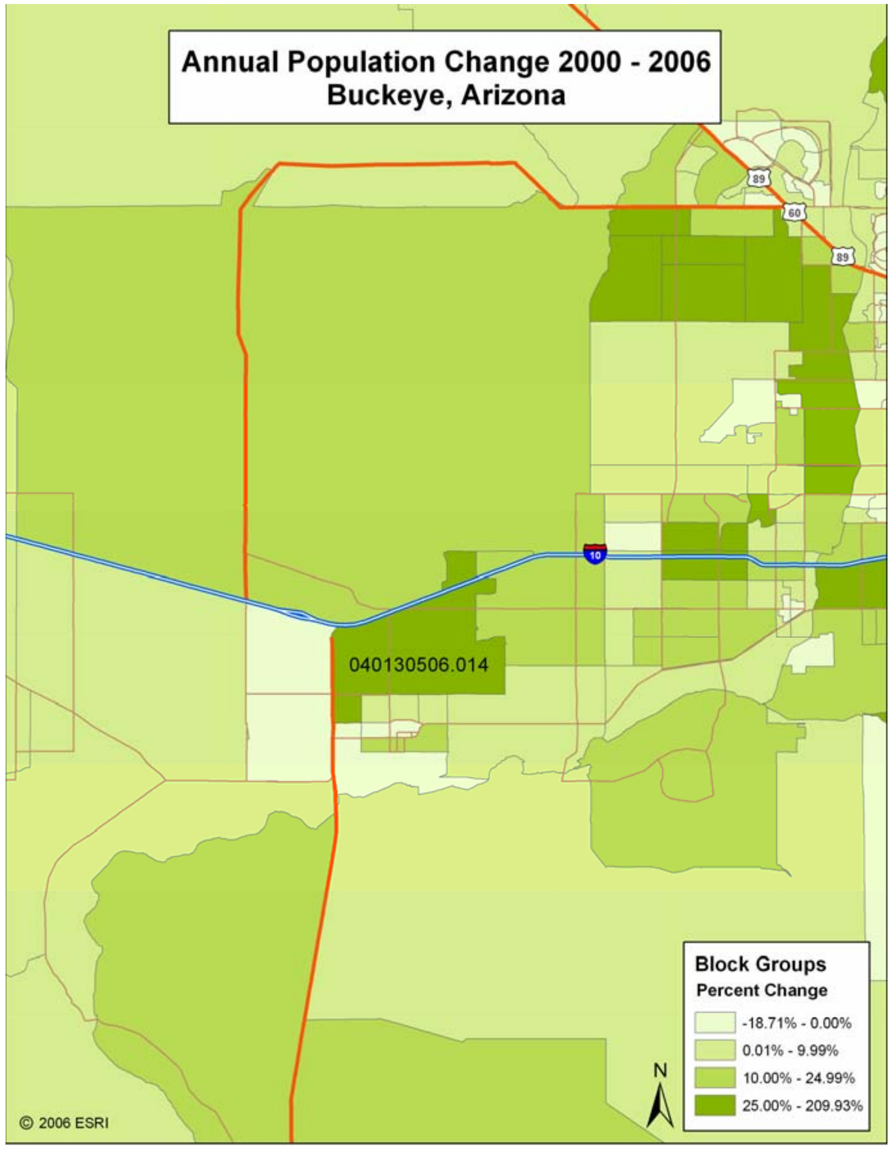


The second example illustrates changes in the community of Buckeye, Arizona, in Maricopa County. Originally settled in 1888, this town has become home to two new Del Webb retirement communities, Sun City Grand (now sold out) and Sun City Festival. Previous methods picked up 33 percent of the growth in the developing block group after 2000. ABA accounts for approximately 75 percent of the new growth. Adding the information from the Hanley Wood database completes the picture.

Block Group 040130506.014	**2000**	**2006**	**2011**
Population	1,997	9,720	18,030
Households	693	3,444	6,400
Housing Units	760	3,786	6,967

2006/2011 Updates for Block Group 040130506.014, Part of Buckeye, Arizona

J-9579



These maps display the annual population changes between 2000 and 2006 for the target block groups in Stapleton and Buckeye along with surrounding neighborhoods. The growth in these developing areas stands out from surrounding block groups—and highlights the enhanced capability of ESRI's geodemographic forecasting to pinpoint local change.