Automating Tabulation and Reporting of ACS Data for Emergency Management

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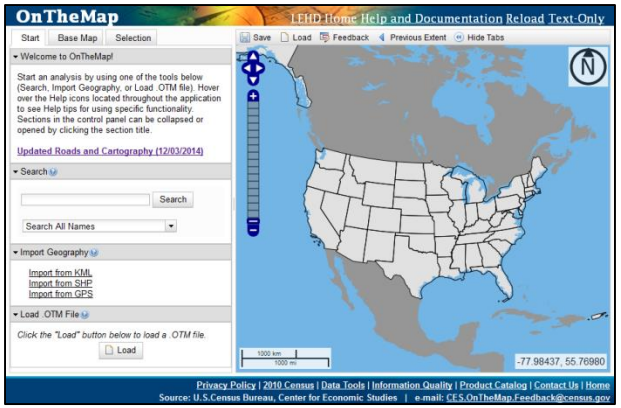
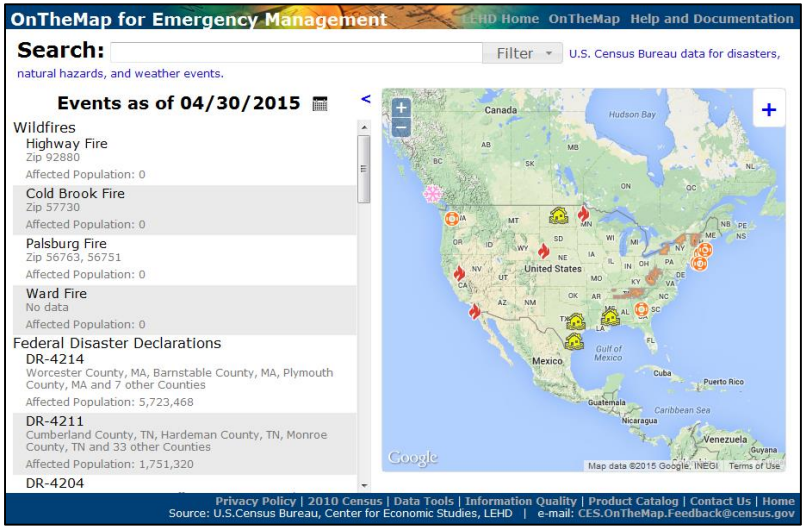
Background

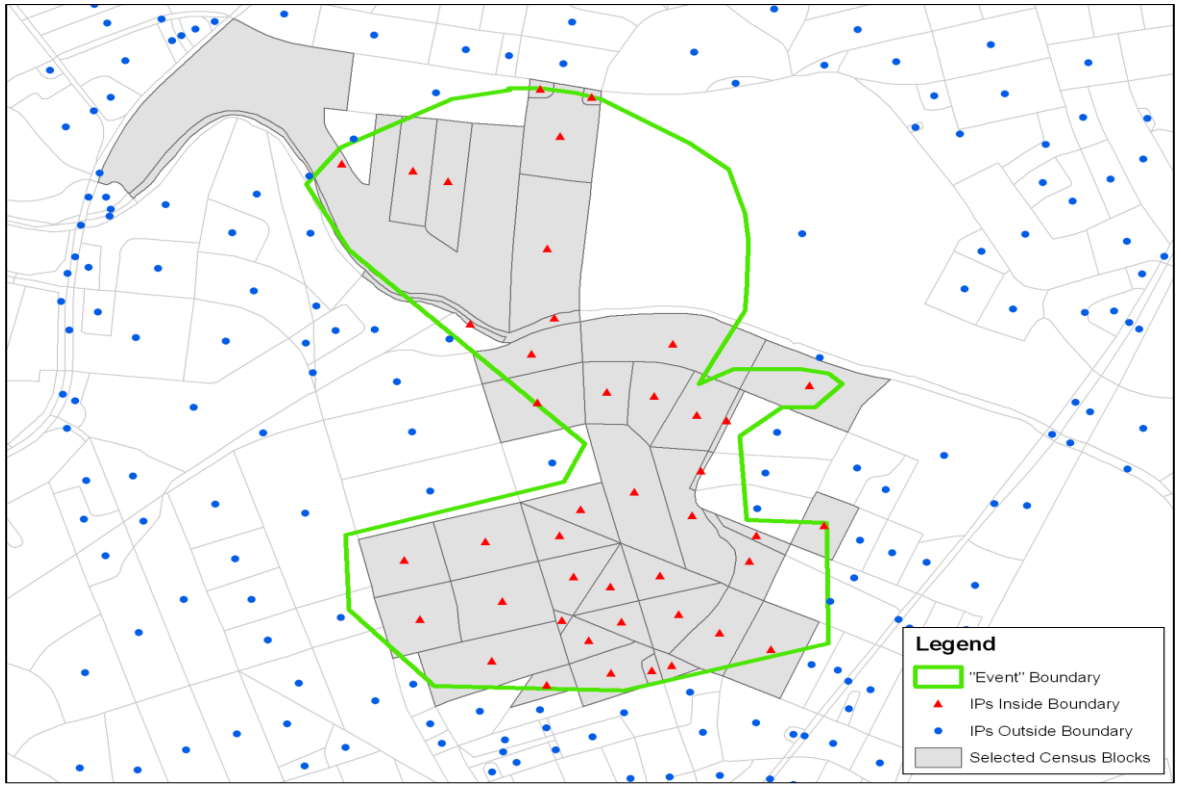
- LEHD & OnTheMap
  - lehd.ces.census.gov
  - onthemap.ces.census.gov
- OnTheMap for Emergency Management
  - onthemap.ces.census.gov/em.html
- Adding ACS…





Geographic Selection in OnTheMap for Emergency Management

- Block-based, which allows for reasonable approximation for many emergency events
- No method is perfect, and none will meet all users' requirements.



Differences for Adding ACS

- Larger geographical units (blockgroup for 5-year estimates)
- Margins of error are proportionally larger for smaller geographies

Differences to Challenges

- The differences lead us to our two core challenge questions:
  1. How can we “best approximate” arbitrary boundaries with blockgroups?
  2. How can we minimize the derived margin of error?

Geographic Approximation

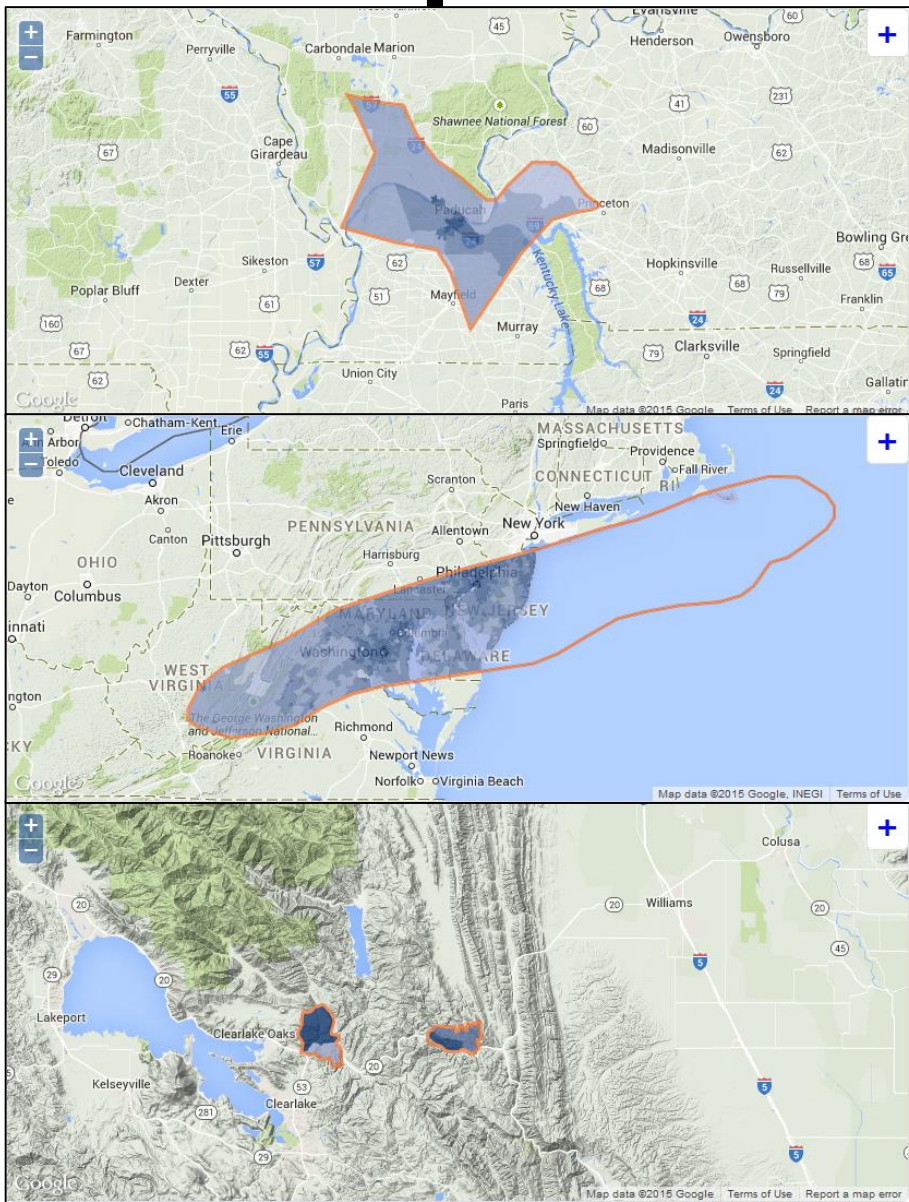
- Many possibilities:
  - Inclusive?
  - Exclusive?
  - Minimize areal difference?
  - Data-driven?
- In this presentation we'll see three. In practice we settled on one.

Approximation Methods

- Minimum: Take blockgroups that are **entirely inside** the event boundary.
- Maximum: Take blockgroups that **intersect** the event boundary.
- **Middle**: Take blockgroups that have at least one block with an internal point in the event boundary.

Approximation Examples

- Flood (3/25/2015)
  IL & TN
- Snow (3/5/2015)
  WV to MA
- Fire (8/14/2015)
  CA



Approximation Outcomes

Approximation of Flood Boundary from 3/25/2015			
Selection Method	**Minimum**	**Middle (IPs)**	**Maximum**
Blockgroup Count	96	155	158
Land Area [sq. mi.]	922	3,001	3,089
ACS Pop Estimate	114,173	181,573	185,981

Approximation of Snow Boundary from 3/5/2015			
Selection Method	**Minimum**	**Middle (IPs)**	**Maximum**
Blockgroup Count	11,922	12,272	12,296
Land Area [sq. mi.]	28,344	34,274	34,435
ACS Pop Estimate	17,444,239	18,013,344	18,047,590

Approximation of Fire Boundary from 8/14/2012			
Selection Method	**Minimum**	**Middle (IPs)**	**Maximum**
Blockgroup Count	0	3	4
Land Area [sq. mi.]	0	469	477
ACS Pop Estimate	0	1,997	4,359

Derived MOE Minimization

- $SE(A + B + \cdots) = \sqrt{SE(A)^2 + SE(B)^2 + \cdots}$
- All things being equal, we prefer larger geographies.
- So, replace blockgroups with the largest areas: Currently limited to the **State-County-Census Tract-Census Blockgroup** hierarchy.
- Additionally, at each geographic level, use only one structural zero (the one with the highest MOE).

MOE Min Outcomes

MOE Minimization for Flood Boundary from 3/25/2015		
	All Blockgroups	Combined Areas
Total Pop Estimate	181,573	181,573
Derived MOE	3,381	1,647

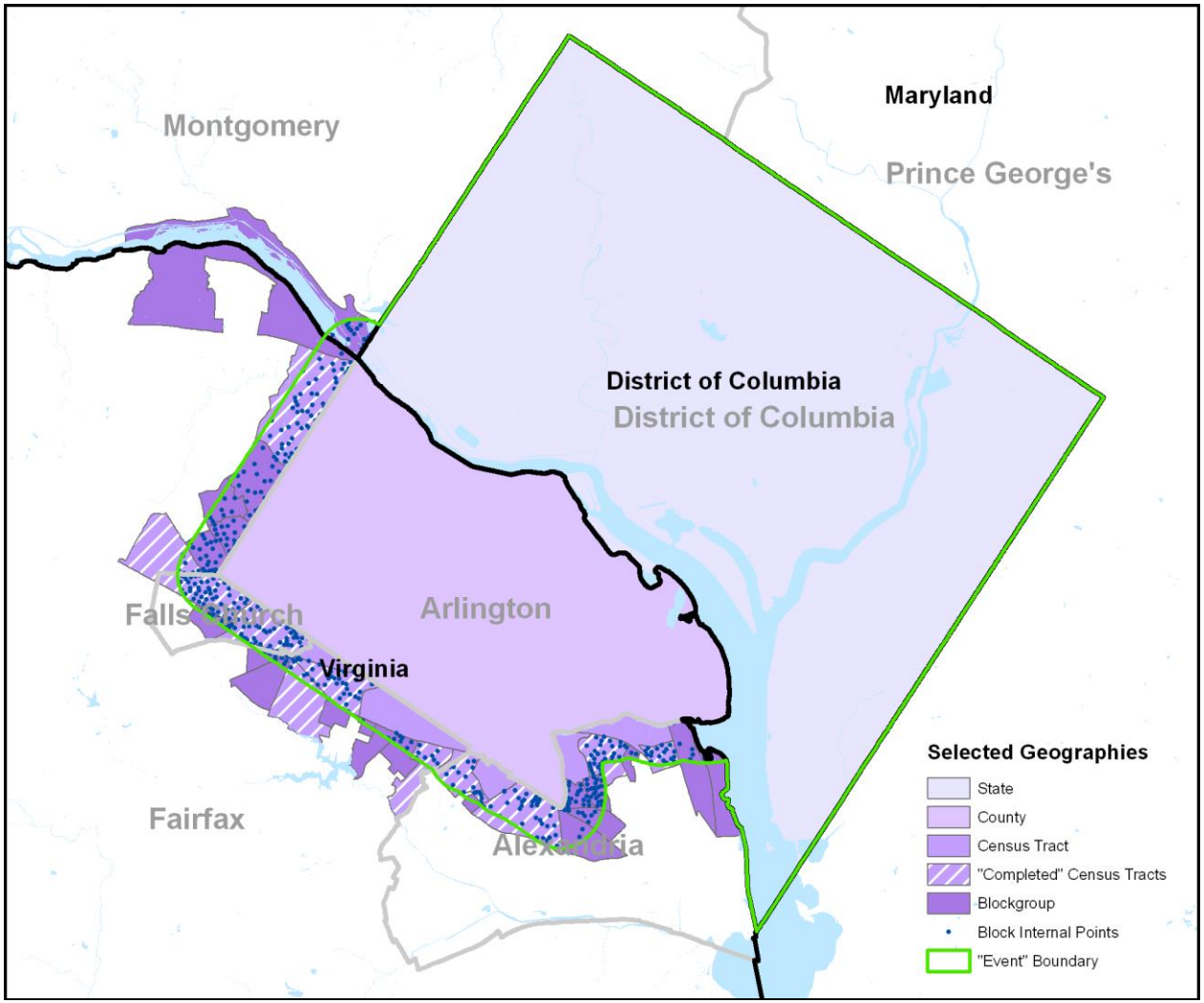
MOE Minimization for Snow Boundary from 3/5/2015		
	All Blockgroups	Combined Areas
Total Pop Estimate	1,8013,344	1,8013,344
Derived MOE	38,248	10,291

MOE Minimization for Fire Boundary from 8/14/2012		
	All Blockgroups	Combined Areas
Total Pop Estimate	1,997	1,997
Derived MOE	422	422

One Version of the Algorithm

1. **Select all states** that are wholly within the event boundary.
2. **Select all counties** that are wholly within the event boundary minus the states selected in #1.
3. **Select all census tracts** that are wholly within the event boundary minus the states selected in #1 minus the counties selected in #2.
4. **Select all blockgroups** that have at least one constituent census block with an IP inside the remainder of the boundary (event boundary minus the states selected in #1 minus the counties selected in #2 minus the census tracts selected in #3).
5. Check whether, through the addition of blockgroups, a whole tract, county, or state has been created from its parts. If so, then **substitute the larger area for its parts**.

Algorithm Example



Finally…

- This has been implemented for some ACS variables in one application with one method.
- Other methods for other purposes are possible (e.g. substituting places).
- Could be scaled to all ACS datasets and included with other applications/tools.

Thank You

- Matthew.Graham@census.gov
- http://onthemap.ces.census.gov/em.html
- http://lehd.ces.census.gov/
- Thanks to Jody Hoon-Starr for helping to prepare the ACS data extracts.