



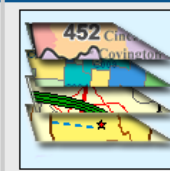
Everything You Wanted To Know About Zip Code Use in Public Health and Were Afraid To Ask



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ZIP Code Maps


Carrier Route Maps


Custom Maps


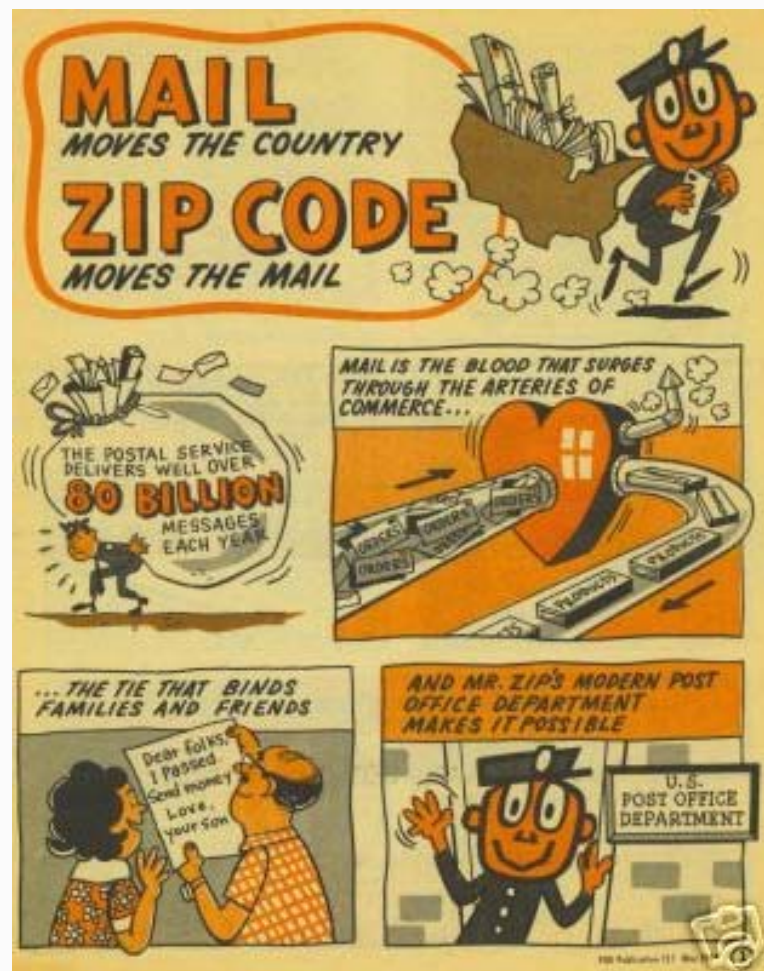
Reports & Data

ZIP	PO_NAME	STAT
9950	ANCHORAGE	AK
9950	ANCHORAGE	AK
9950	ANCHORAGE	AK
9950	ANCHORAGE	AK
9950	ANCHORAGE	AK
9950	FORT RERAF	AK
9950	FUMERDORF	AK
Geoset	IORAGE	AK

GIS Data


Address Lists

CR_ID	PO_NAME	ST	Dist (mi)
12524B005			9.96
12524B000			9.30
12524B000			2.24
12524			17.80
12524			9.97
12524			13.70
12524C004	FISHKILL		13.75
12524C005	FISHKILL	NY	16.84



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WREN 2010



Overview

- Summarize ZIP code use in public health
- Define ZIP codes and outline challenges
- Illustrate data variability by provider
- Outline Census relationship to ZIP codes
- Offer some solutions

Maybe.



ZIP code use in public health

- Between 1989-2008, 579 articles indexed in PubMed and Social Sciences Citation Index by “zip code” (Grubesic 2008)
- Why are ZIP codes used in public health?
 - Sub-county, often small geographic level
 - Easily understood by stakeholders
 - Generally available boundaries and population summaries
 - Ostensibly, representative of human activity locations
 - Some health outcome data only available at ZIP code level
 - Hospital discharge and ER visits in CA collect ZIP only
 - Other data providers aggregate on purpose
 - When geocoding, can match to ZIP code in absence of accurate or complete address (point matches to ZIP center)
 - Offer more stable statistical estimates compared to census tracts
 - Offer confidentiality protection when mapped
 - Protect personal privacy
 - Allow more detailed maps



What's the deal with ZIP codes?

- US Postal Service **delivery routes**
 - 5-digit ZIP “birthday” – July 1, 1963
 - 9-digit ZIP (a.k.a ZIP+4) “birthday” – 1983
- Linear features, associated with roads and addresses
- Not discretely bounded geographic areas, not polygons
- Geographic extent approximated by mail delivery addresses and postal carrier routes
- **Boundaries not known**





What's the deal with ZIP codes? II

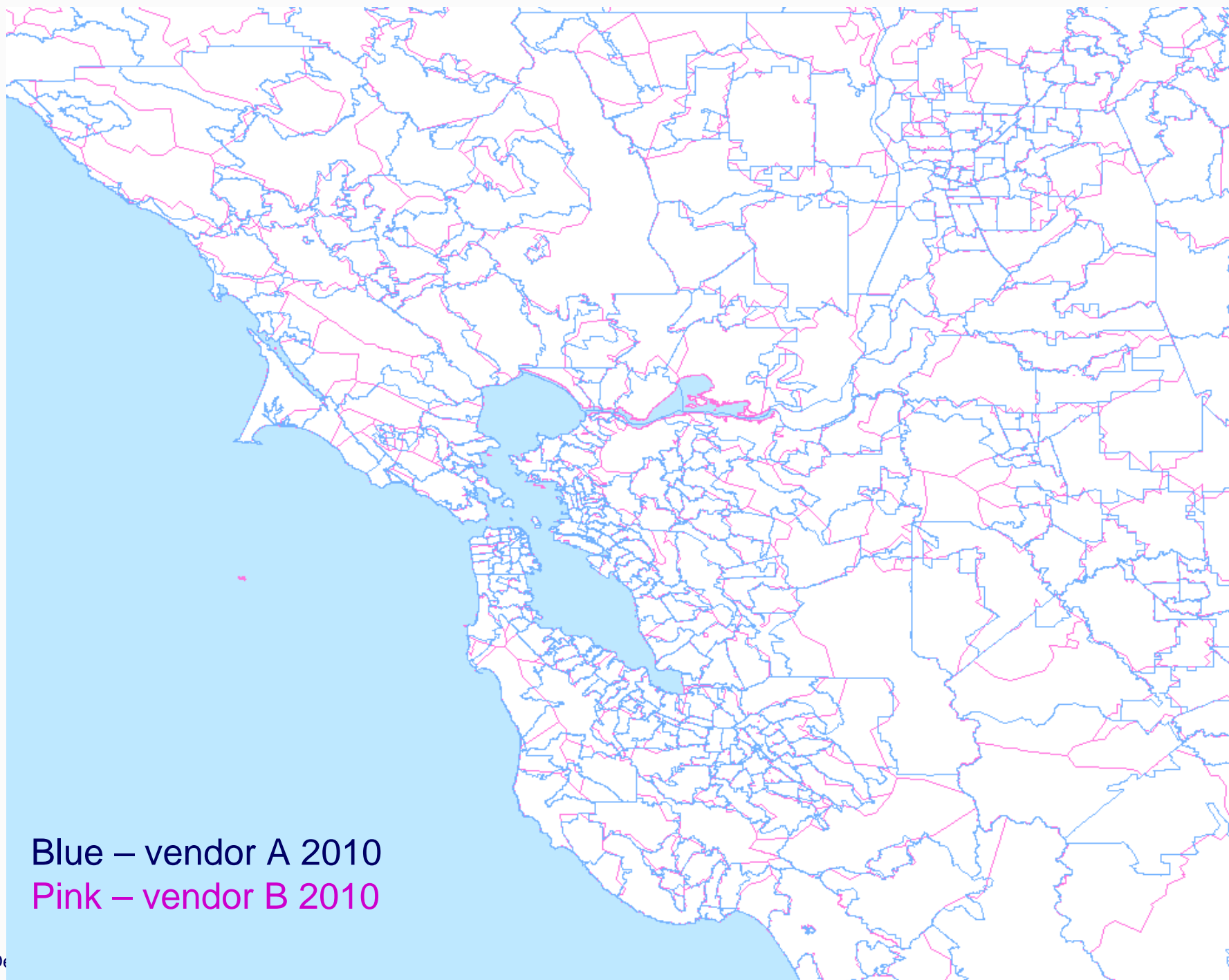
- No mail delivery point or address range – no ZIP code
- No assigned ZIP codes in some unpopulated areas
- Little correspondence between where people live and where they get mail
 - Residence vs Mailing address
 - POBox ZIP codes in urban areas
 - People may get their mail at POB near work
 - Commercial zone, no residences, different demographics
 - “Real address” POB
 - POBox ZIP codes in rural areas
 - No mail delivery to residences
 - People have to travel distances to collect mail
 - ZIP code not a good indicator of residence location

What's the deal with ZIP codes? III

- ZIP codes change to
 - Reflect population growth
 - Accommodate mail volume to commercial enterprises
 - Fulfill other USPS business functions
- ZIP codes have different sizes
 - Area (in CA, <0.5 to >300 square miles)
 - Population (in CA, <100 to >100,000 people)
- Difficult to estimate population counts or demographic characteristics
 - Requires temporal and spatial match to Census
 - Requires population projections for post-Censal years
- Difficult to represent cartographically
 - Gaps in unpopulated areas without ZIP code assignments
- Polygon boundary representations and population estimates vary by vendor



ZIP code boundaries by vendor



ZIP code boundaries by vendor

Green — vendor A 2008
Blue — vendor A 2010
Pink — vendor B 2010



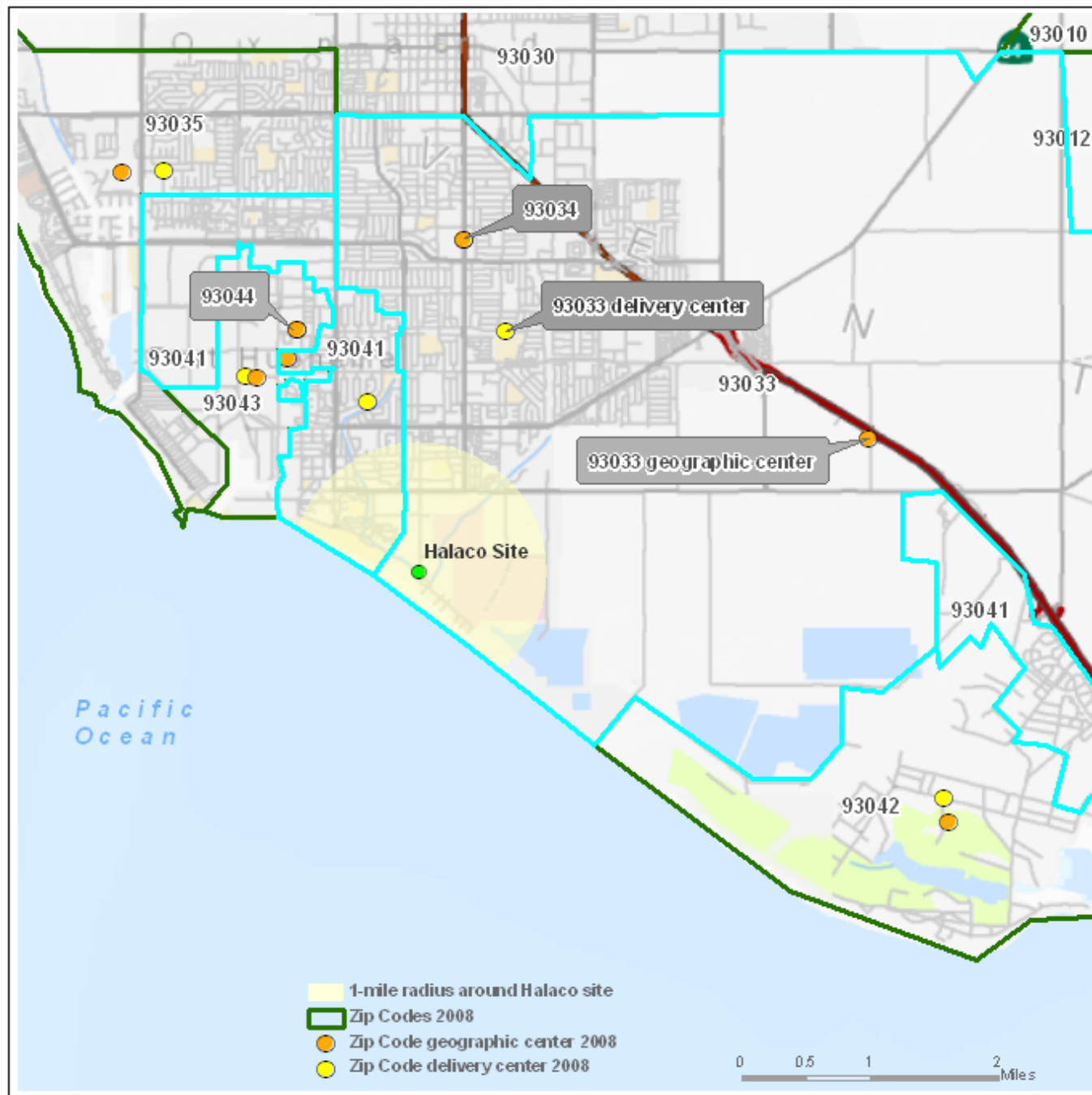


More definitions

- Centroid
 - Geometric – i.e. land-based (polygon point of balance)
 - Population – i.e. adjusted for population concentration
 - Deliverable address concentration or census block population allocation
 - Residence or mail delivery?
 - Implications for geocoding
- Demographic estimates (population counts, age, race/ethnicity, etc)
 - Census-based (at least for starters)
 - List definition
 - Demographics relate to persons and households receiving mail at addresses with common zip code, regardless of where they live
 - Spatial definition
 - Demographics relate to persons and households living in land area approximated by zip code, regardless of where they get mail



ZIP code centroids: geographic vs. population





So? Census makes ZIP code data!

- 1990 and 1999 ZIP code products
- For 1990 Census, data available in STF3B
- Byproducts of internal Census operations
- Available only for city-style addresses (exclude rural)
- Latitude/Longitude imputed, not claimed accurate
- 2000 Census ZIP product
- ZIP Code Tabulation Areas (33,178 ZCTAs)
- Based on allocation of whole census blocks
- Do not have to be contiguous
 - Water features and unpopulated areas may have own ZCTAs
 - ZCTAs containing water features are split and duplicated
- Updates reflect ZIP code change through Oct. 2002 only
- ZCTAs and ZIP code sharing the same 5-digit code do not necessarily cover the same area

ZIP vs ZCTA



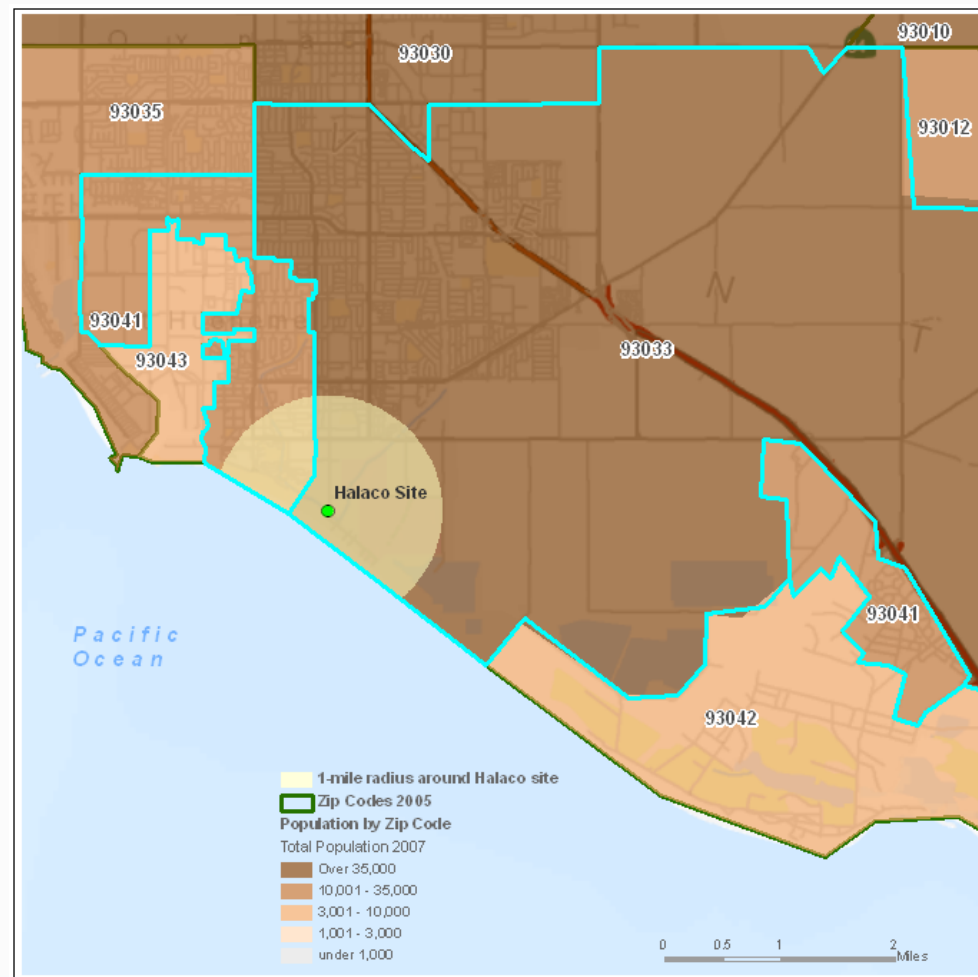
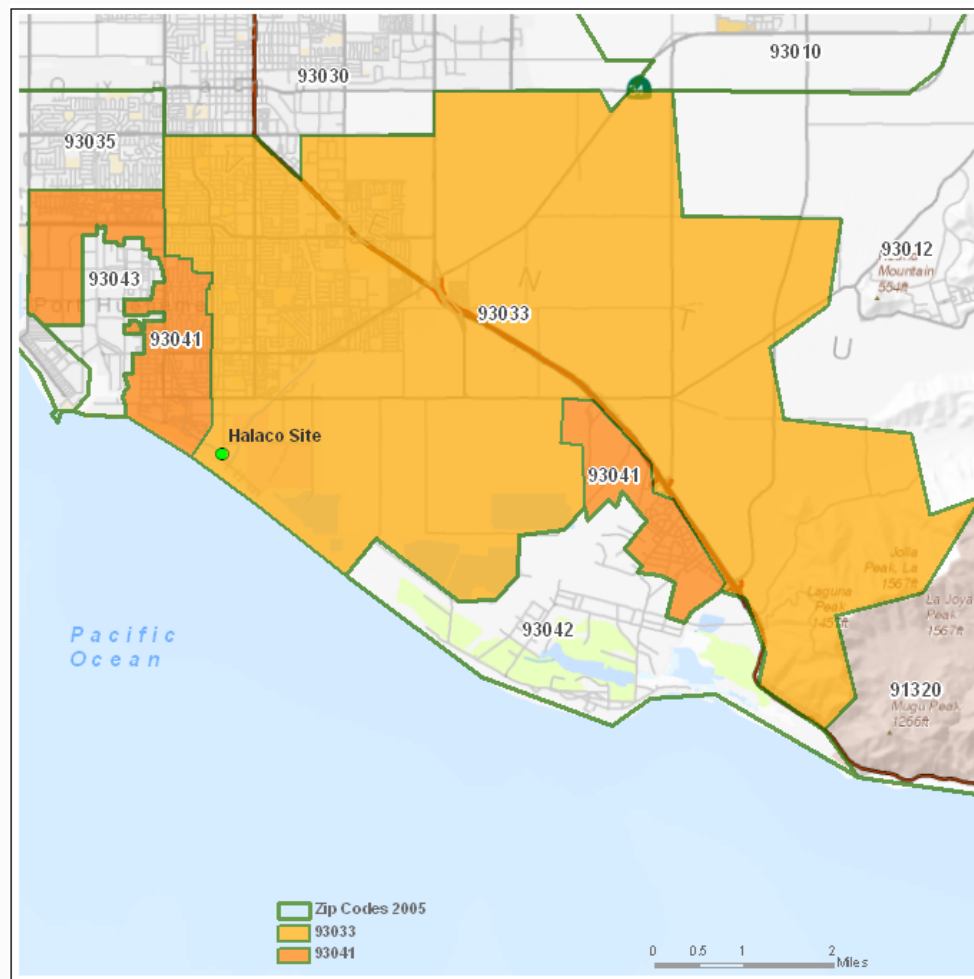
From Grubestic 2006



ZIP code population and demographic estimates: Claritas example

- Each update starts with the decennial Census
- USPS deliverable address counts – “Housing Unit method”
- ZIP code population estimates
 - Aggregations of prepared block group and block group parts estimates (from Census geography population estimates and projections)
 - Estimates based on spatial ZIP code definition
 - Block group to ZIP code correspondence
 - If block group centroid falls within ZIP boundary, it's allocated to that ZIP
 - For block groups allocated to multiple ZIPs, percent inclusion factor is based on 2000 census block population counts
- No population estimates for rural POBox ZIP codes
- Counts of deliverable addresses provided to assess discrepancies
- Who determines ZIP code boundaries at Claritas?
 - Purchased from GDT/TeleAtlas

ZIP population use in epi studies





ZIP code challenges in a nutshell

- Technically non-existent boundaries
- Methodology of estimating those boundaries largely unknown
 - Trusted to commercial vendors
- Vendor product variability
- Changing “boundaries” (frequency and spatial extent)
- Centroid location (geometric or population)
- Methodology of estimating population (denominator data)
- Large variability across different areas in
 - Size
 - Populations



Solutions?

- Avoid using ZIP codes whenever possible
- Be aware of ZIP code limitations and provide caveats to readers or viewers
- Know where ZIP code boundaries come from
 - Read vendor documentation
- Limit spatial and temporal mismatch
 - Use the same vendor for boundaries and population estimates
 - Use current boundaries and population estimates
- Avoid using geographic centroids
- If using ZCTAs
 - Do not combine with other ZIP boundaries
 - Make sure to dissolve split polygons
- Downscale ZIP codes to street networks (Matisziw 2008)
- Collect and geocode address-level data
- Use geo-imputation (Henry 2008)
 - ... or other statistical methodology



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