The Population Puzzle

Putting the Pieces Together

Bonneville
POWER ADMINISTRATION

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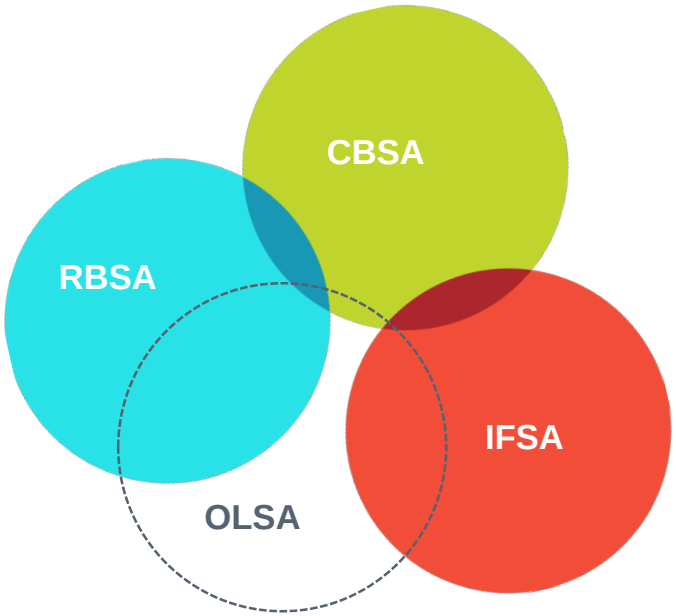
Creating a Complete Regional Picture



We need primary data on buildings, installed equipment, characteristics and energy consumption

NEEA gathers extensive building characteristics data through regular, regionally-focused building stock assessments

OLSA to supplement the existing assessments, focusing on untouched outdoor lighting segments

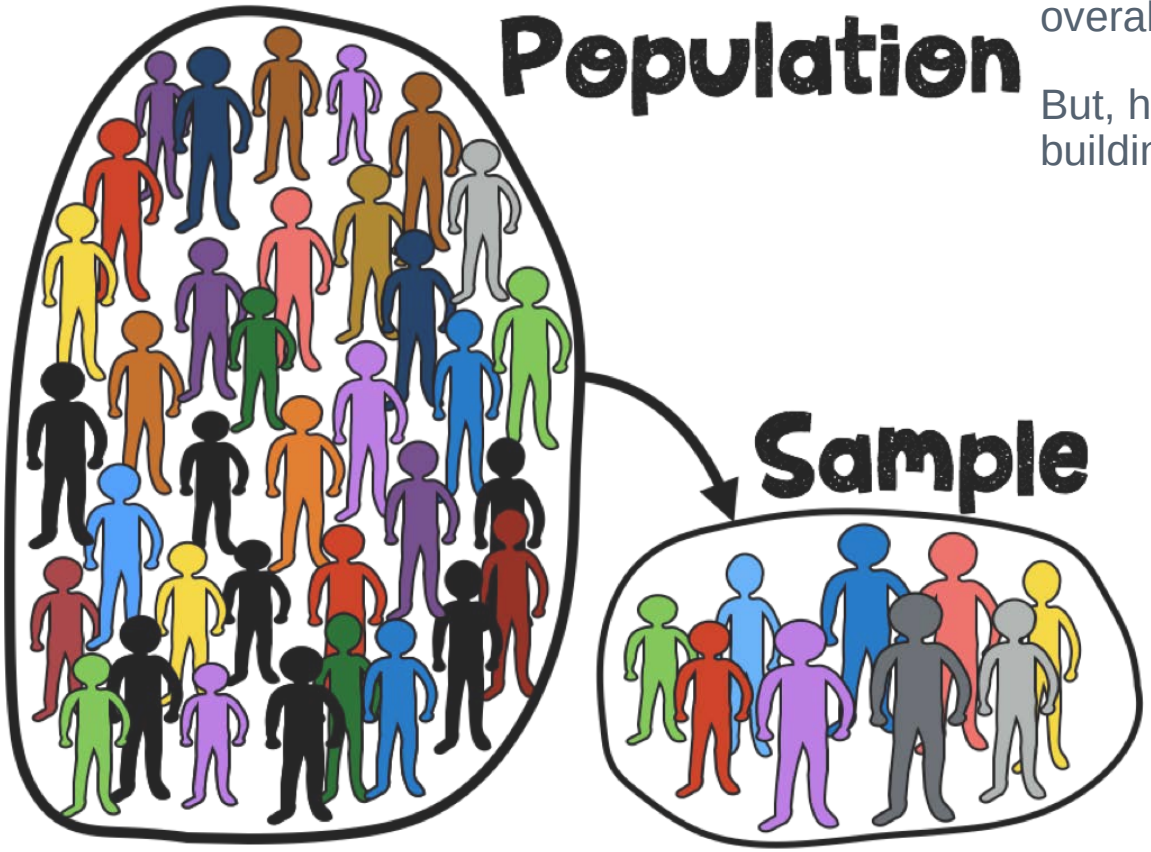
These studies are both in progress; concurrent, but coordinated

The Non-Utility Conundrum

Regional energy and efficiency organizations

- No utility CIS or metering data
- No comprehensive regional utility shape file source

In Search of a Population Frame



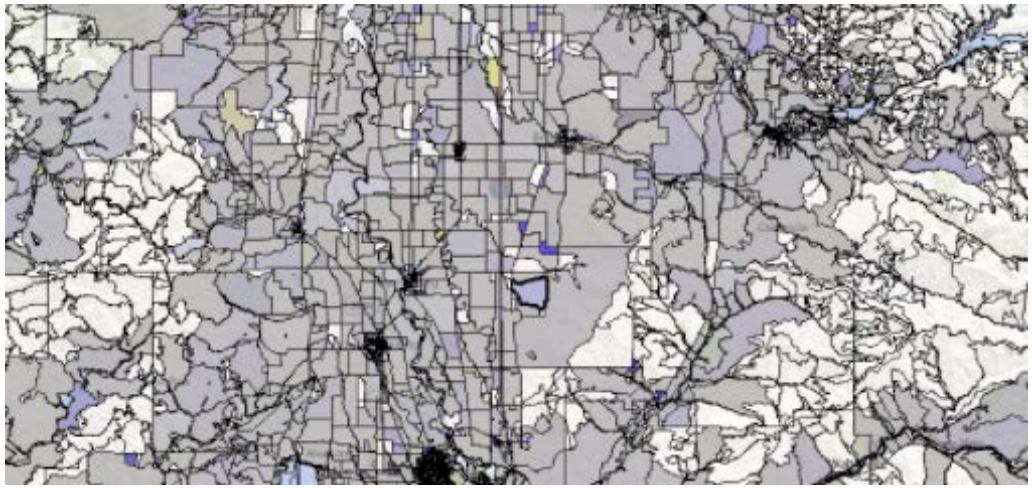
Both the CBSA and OLSA require a sample selected systematically that can support weighting and extrapolation.

The quality and completeness of the population frame from which the sample is selected often determines the overall reliability of the results.

But, how to identify every commercial building or outdoor light fixture?

Geographic Sampling and Census Blocks

NEEA and BPA used a two-stage geographic sample that involves subdividing the region into geographic areas from which to sample.

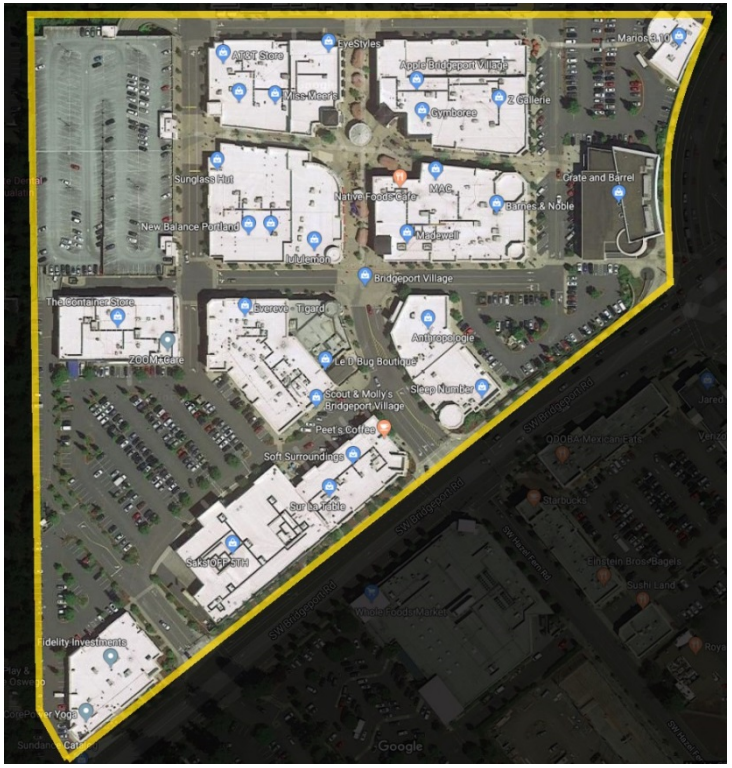


Census blocks are:

1. **Mutually exclusive**.
2. **Comprehensive and exhaustive**.
3. **Delineated** using visible and non-visible boundaries
4. **Do not factor in population**, making them suitable for broad research applications.
5. **Reasonably sized**..

The Virtual Catalogs

Both studies sought to create “virtual” catalogs to support sampling

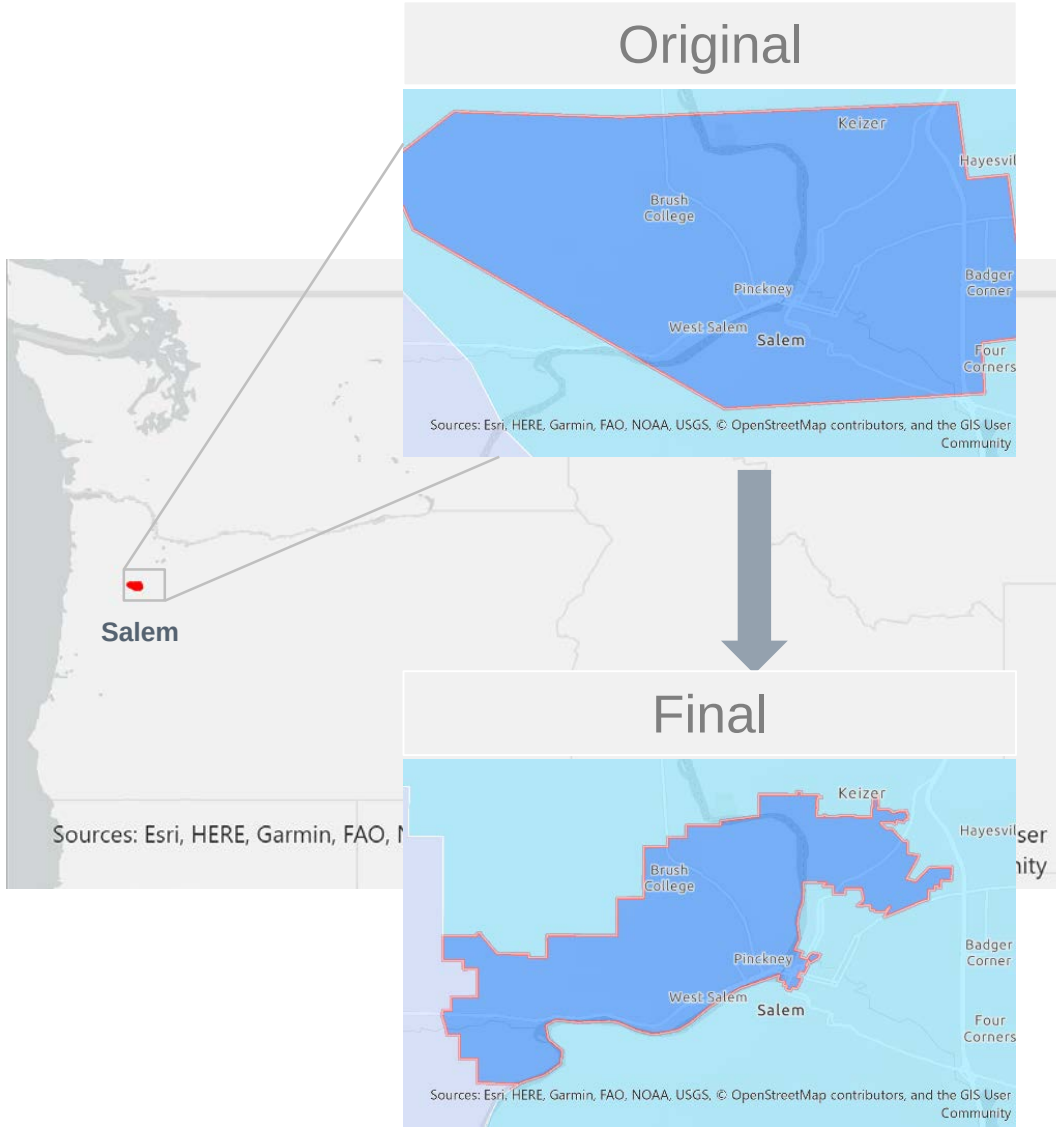


Commercial Building Stock Assessment

Utility shapefiles, virtual cataloging, and manual review

First: Utility Shapefile Improvements

- Purchased files were marginally accurate
- Worth reaching out to each utility for more specific maps



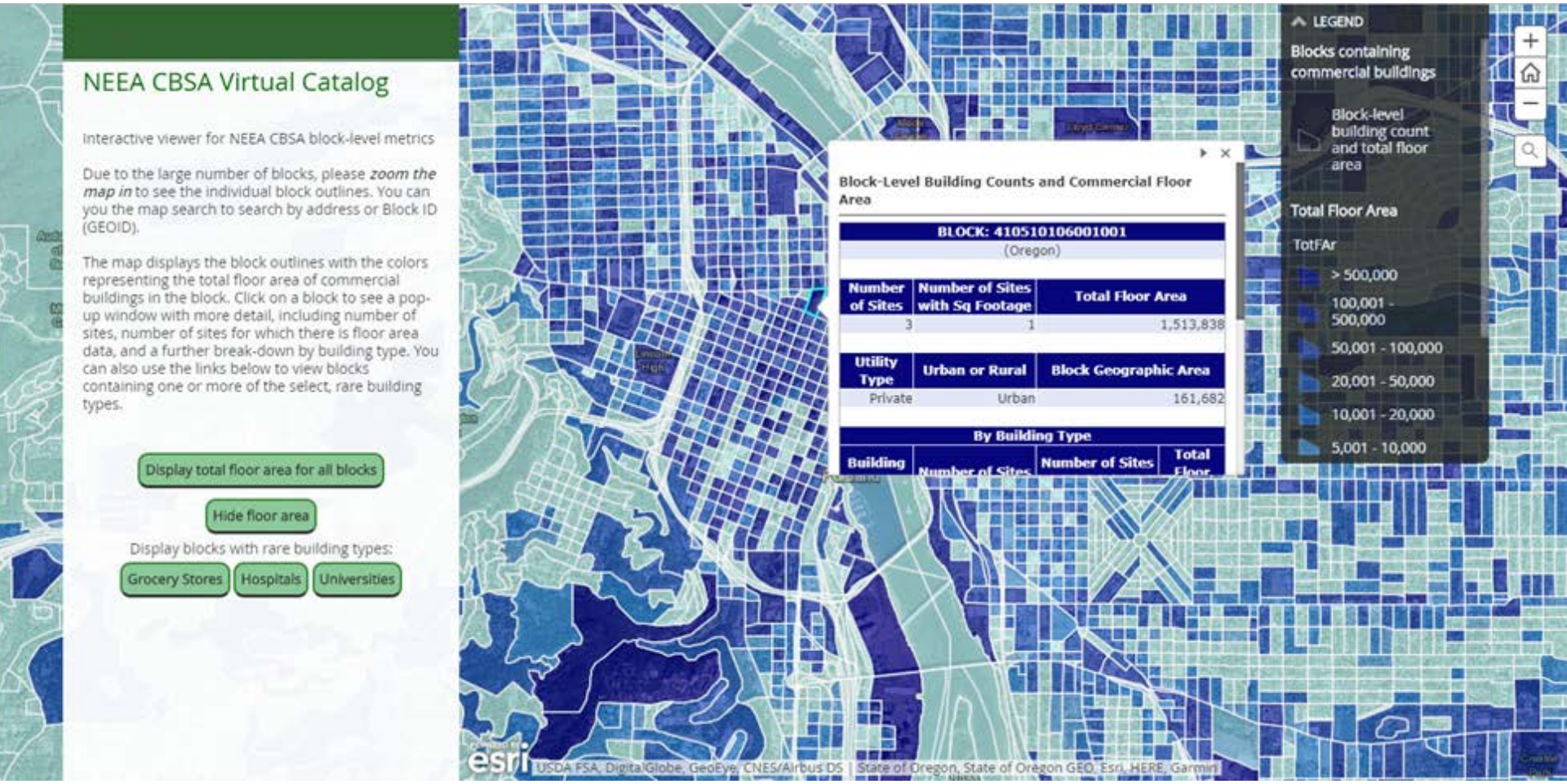
Next: Virtual Catalog Inputs and Objectives

Data sources included:

1) SMR commercial property list with estimated square footages
2) Google Places
3) Electric utility boundaries
4) Census blocks

Characteristic	Detail needed
Dominant use type	One of 12 building types
Total floor area	Square footage ideally allocated to different use types.
Utility assignment	Electric and natural gas utility. Assignment to public or private utility is based on electric utility assignment.
Contact information	Person best able to authorize participation in the study.

Virtual Catalog



Virtual Catalog: Results

Census-block level summaries of site count, floor area, utility type, and building type

Block-Level Building Counts and Commercial Floor Area

BLOCK: 530630145002030 (Washington)		
Number of Sites	**Number of Sites with Sq Footage**	**Total Floor Area**
10	9	105,608

Utility Type	Urban or Rural	Block Geographic Area
Private	Urban	704,647

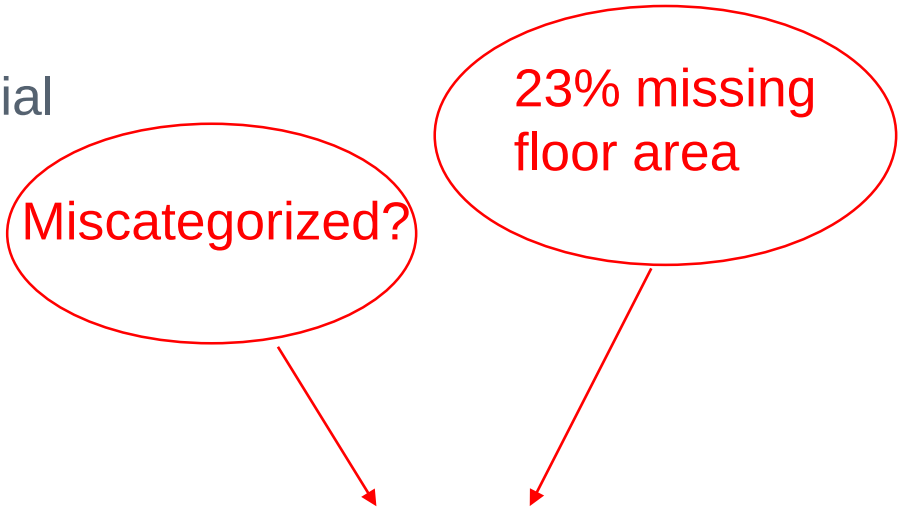
Building Type	Number of Sites	Number of Sites with Sq Footage	Total Floor Area
Assembly	0	0	0
Dry Goods Retail	2	1	19,237
Grocery	0	0	0
Hospital	0	0	0
Hotel/Motel	0	0	0
Office	4	4	18,766
Other	1	1	1,770
Other Health	0	0	0
Restaurant	0	0	0
School	0	0	0
University	0	0	0
Warehouse	2	2	42,135

Virtual Catalog: Questions

Summary estimates of commercial building sites by state….

A population frame?

Stratification by type and size



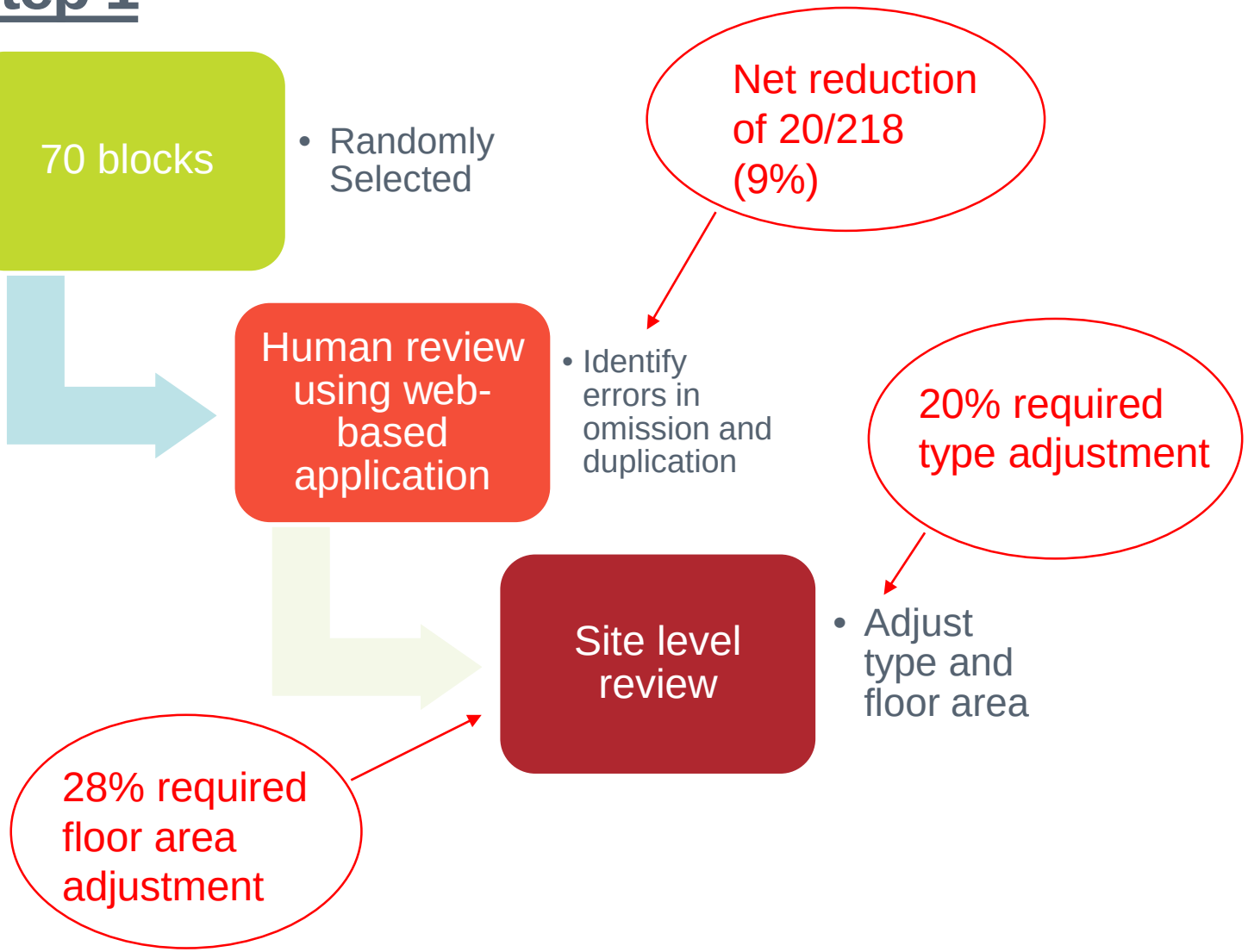
Region	Total Blocks	% of Total Blocks	Total #Sites	% of Total Sites
ID/MT	19,270	26%	62,145	24%
OR	23,880	32%	82,527	32%
WA	30,999	42%	116,907	45%
Total	**74,149**	**100%**	**261,579**	**100%**

Next step: Manual Review

Proceeded with planned manual review

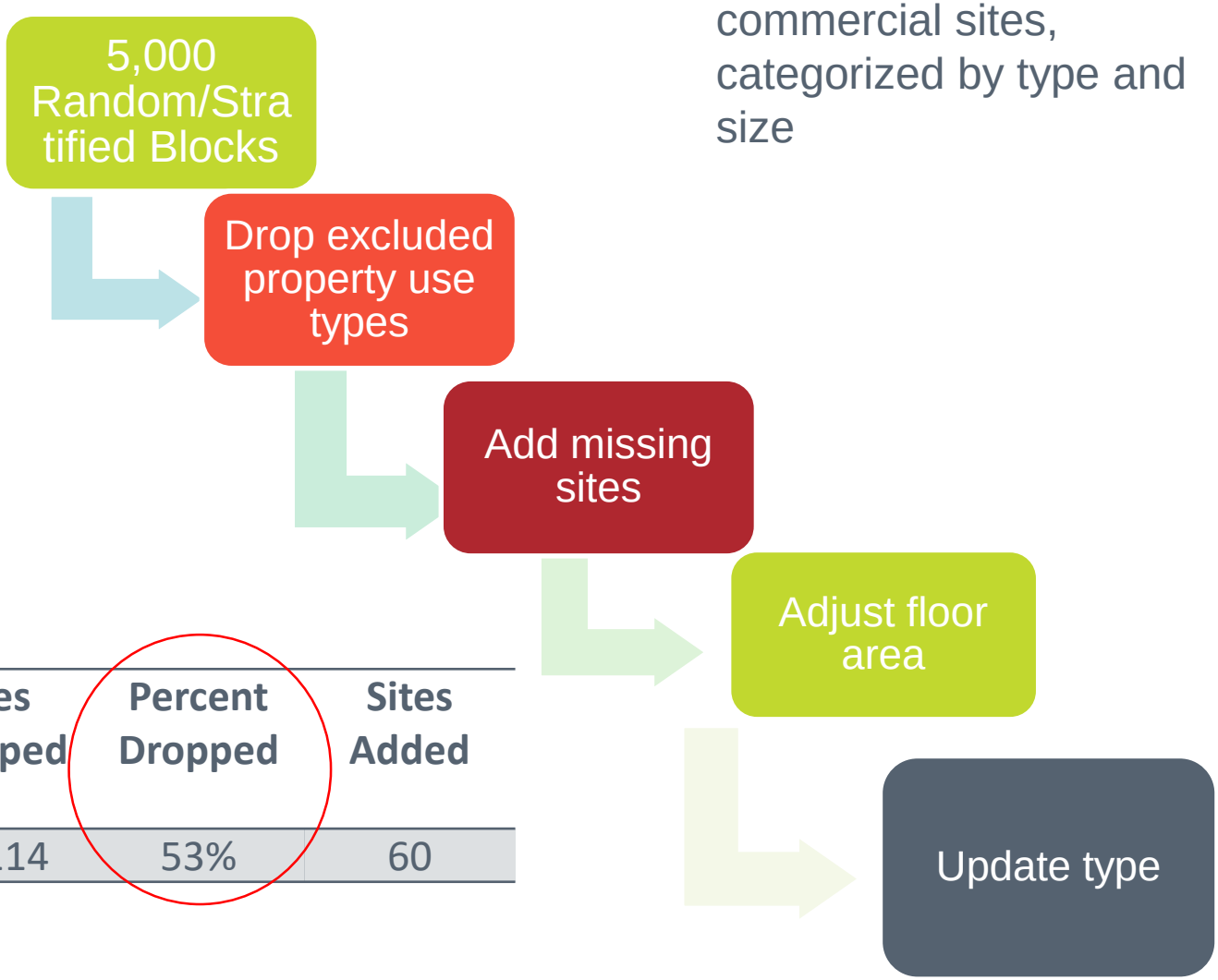
This ultimately expanded…

Two-step Manual Review: Step 1



Two-step Manual Review: Step 2

Resulted in a final sample frame of 26,000 commercial sites, categorized by type and size



Total Sites from Raw Data	Sites Dropped	Percent Dropped	Sites Added
56,412	30,114	53%	60

Outdoor Lighting Stock Assessment

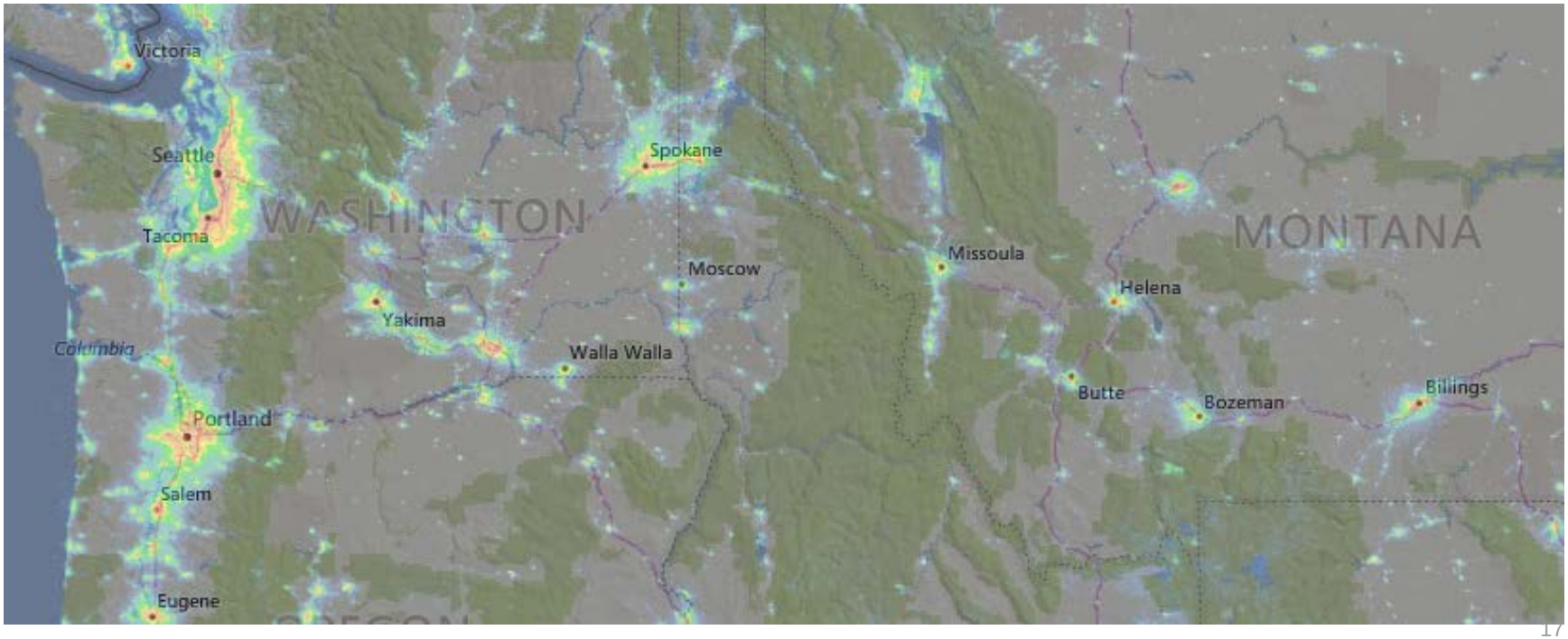
Luminosity, web-based cataloging, fixture counts

Satellite Luminosity Data

How to find outdoor lighting?

Using satellite luminosity data, the OLSA team:

- Overlaid census blocks
- Calculated luminous “flux”, the average luminosity in an area multiplied by the size of the area
- Drew a sample of blocks with the greatest flux, and thus most likely to contain OLSA lighting.

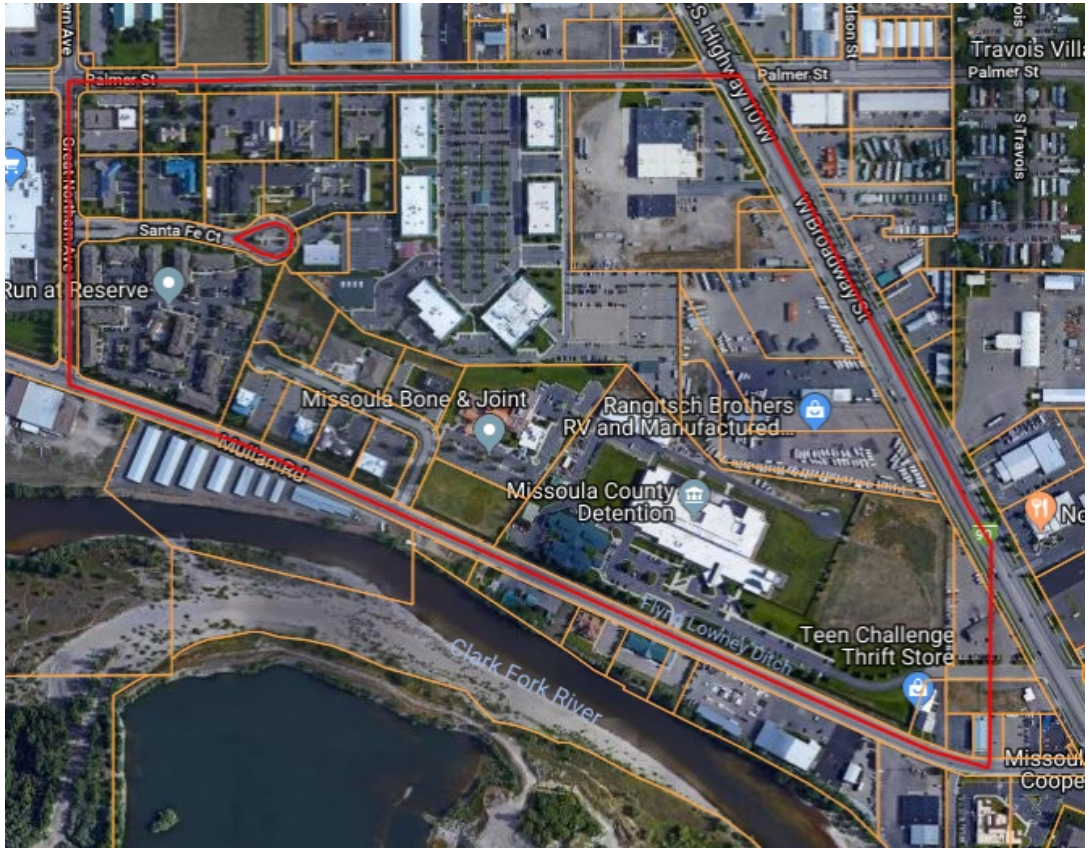


Web-based Cataloging

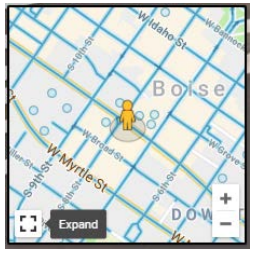
The team sampled 2,300 blocks across the luminous flux strata and manually cataloged 601 for the pilot looking for any form of OLSA lighting.

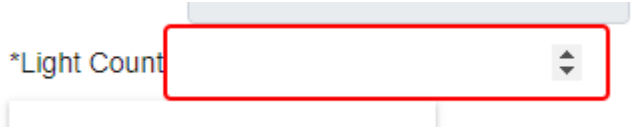
If there was evidence of OLSA lighting, the team drew site boundaries, collected relevant data.

Block Type	*Count of Block*	*Sum of Streetlight Count*
No OLSA	86	
Other OLSA	284	6043
Streetlights Only	231	2420
Grand Total	601	8463



Counting Streetlights





1. Search each named road within the sampled census block for streetlights.
2. Using street view “walk” each street.
3. Place markers at the location of each streetlight’s base.
4. Where street view was not available aerial view enabled the team to look for the shadows from streetlight poles.
5. Only count streetlights with a pole or structure inside the sampled census block.
6. Secondary data collected on technology mix was applied to the streetlight population.

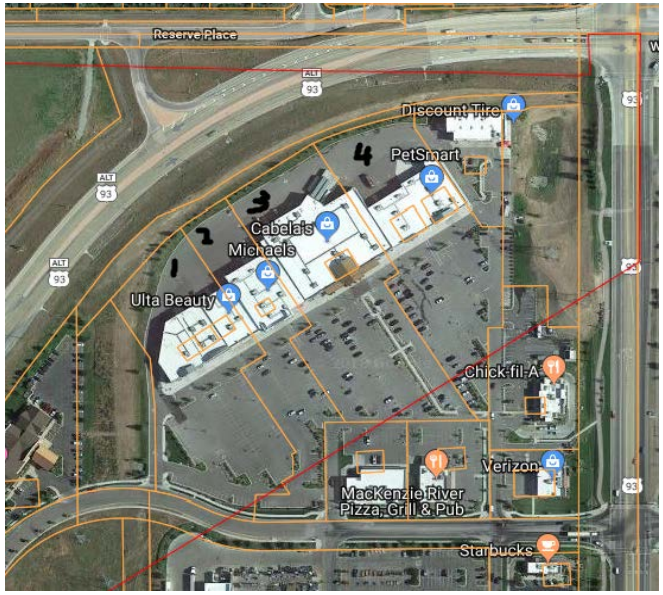
Lessons Learned

What to keep in mind when creating a virtual catalog

Manual Review

CBSA manually reviewed a sample of 5,000 census blocks to refine the information in the catalog

OLSA manually cataloged all selected census blocks



1. Algorithms and automation are not a substitute for the human eye
2. Exceptions are prevalent and best identified by manual review
3. Manual review must be systematic and trackable
4. Effective manual review requires a team of well-trained reviewers
5. Training materials should be tested across multiple reviewers and refined until results are consistent
6. Custom GIS tools must include flexible and sophisticated tools to assist in manual checks

Lessons Learned

We think this is the future…. The cost of primary data collection makes it imperative to figure these tools out.

Open source code – get a little help from your friends

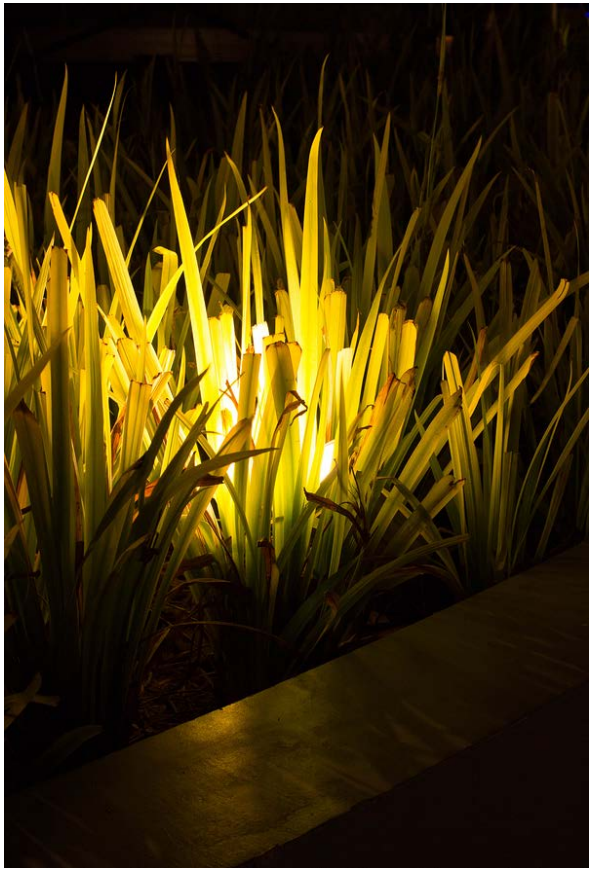
Mapping data – even Google isn't perfect

Rules – love them and hate them

Setting time limits – avoid the rabbit hole

Streetlight counts – take time to make time

Residual error – fine tuning required



Comments or Questions?

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