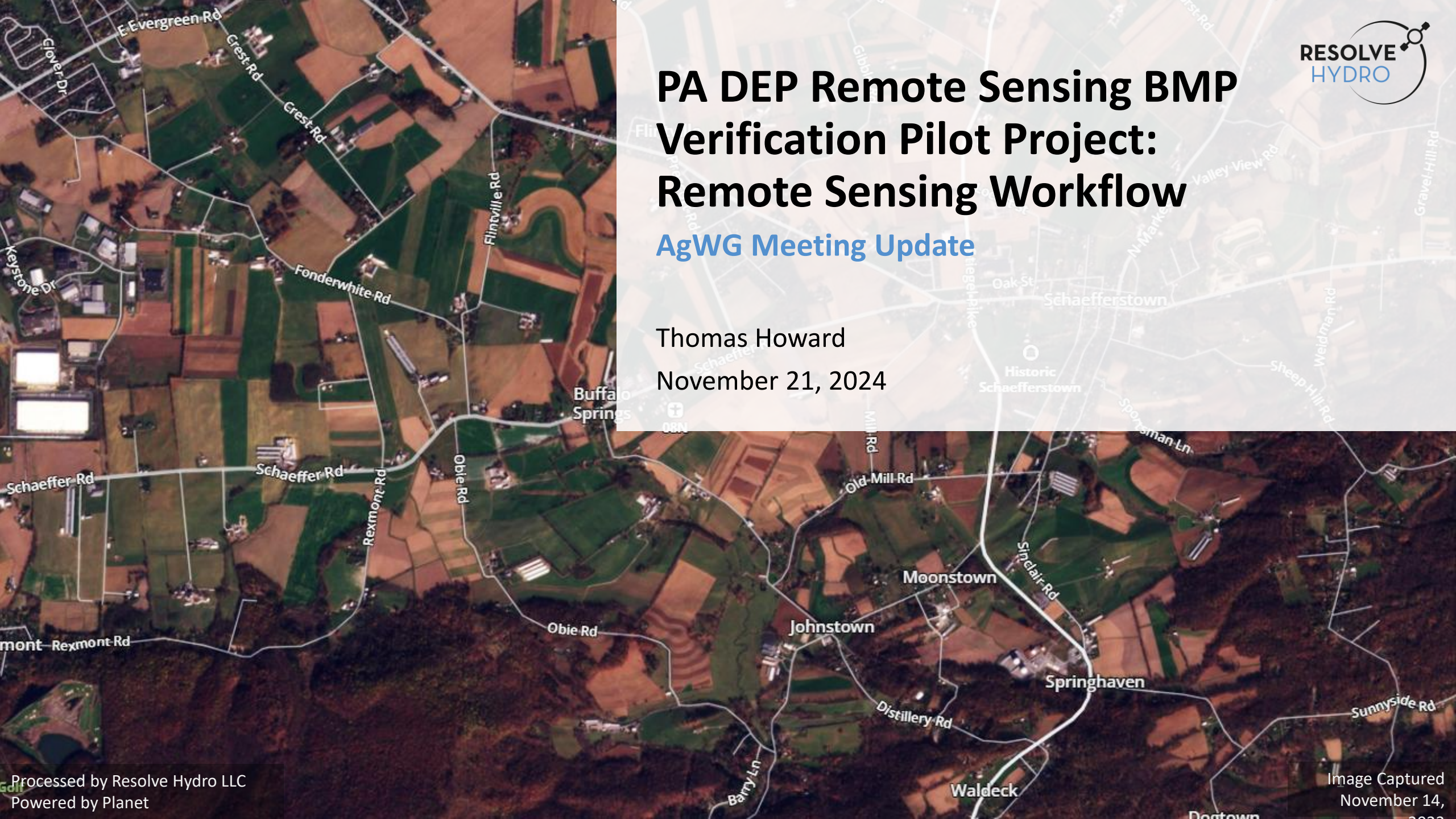
PA DEP Remote Sensing BMP Verification Pilot Project: Remote Sensing Workflow

AgWG Meeting Update

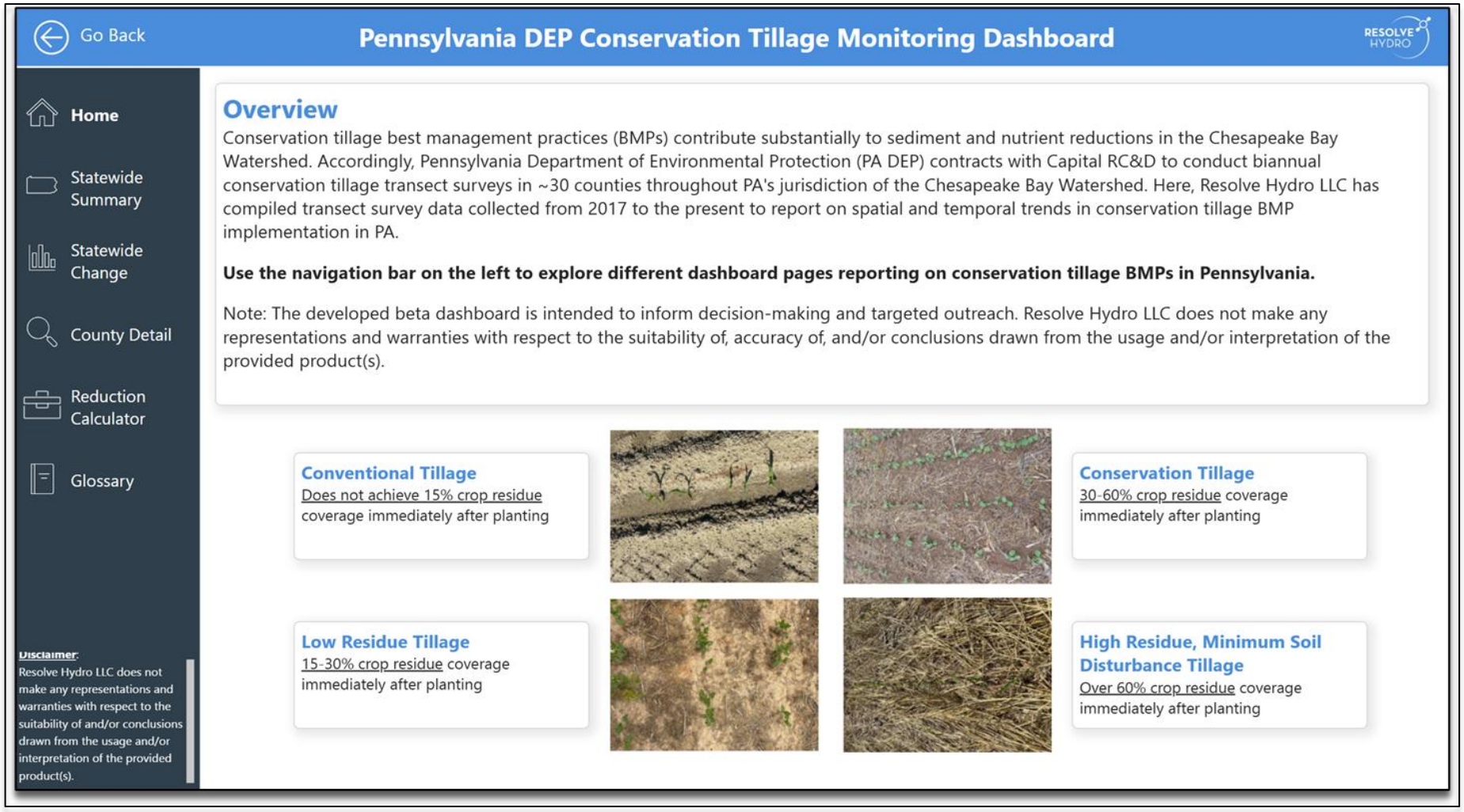
Thomas Howard

November 21, 2024



Preliminary Conservation Tillage Monitoring Dashboard

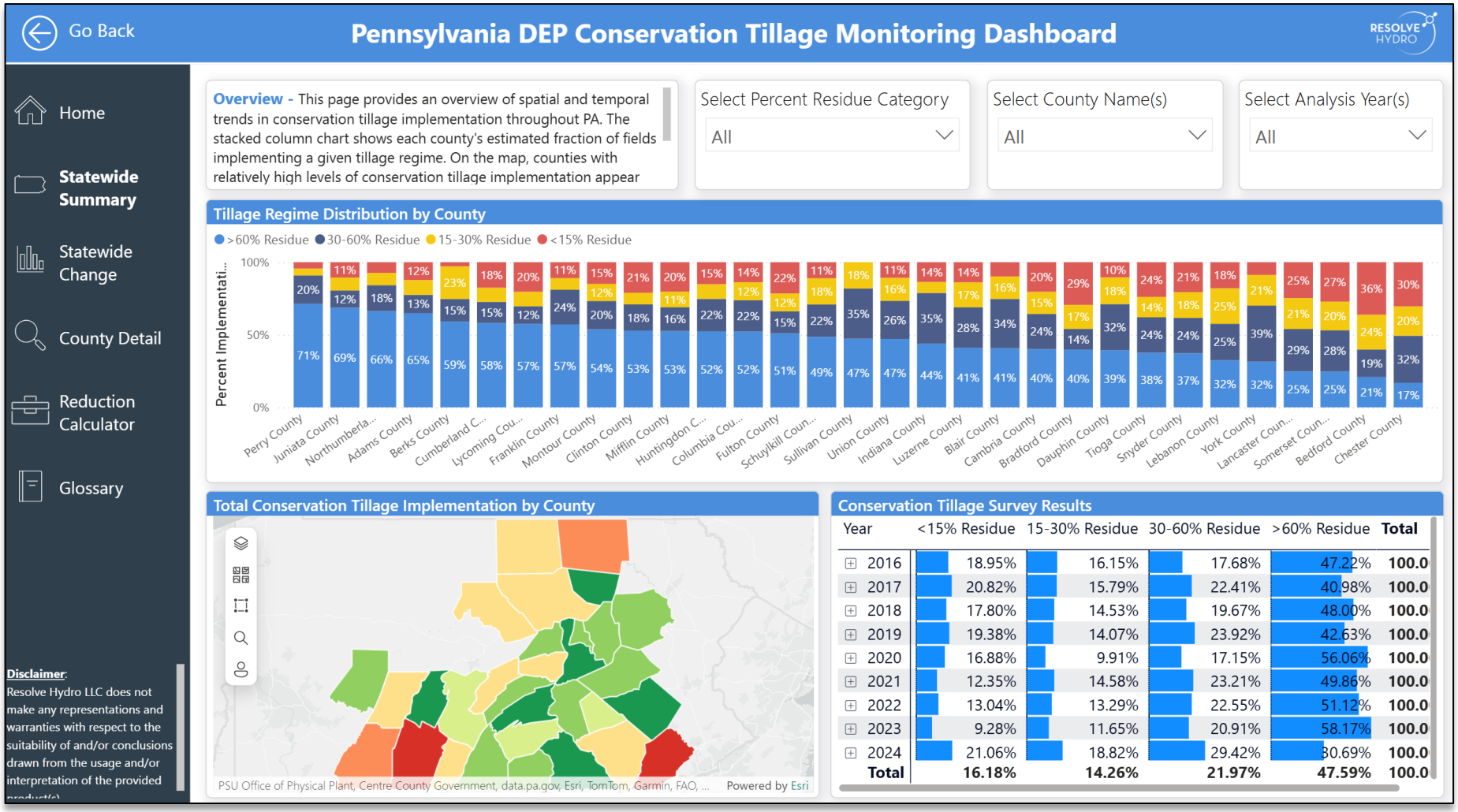
The developed dashboard aggregates prior conservation tillage surveys to both support RS model development and inform future decision-making



Dashboard homepage

Preliminary Conservation Tillage Monitoring Dashboard

The developed dashboard aggregates prior conservation tillage surveys to both support RS model development and inform future decision-making



Statewide data inventory showing distribution of tillage regimes in each county

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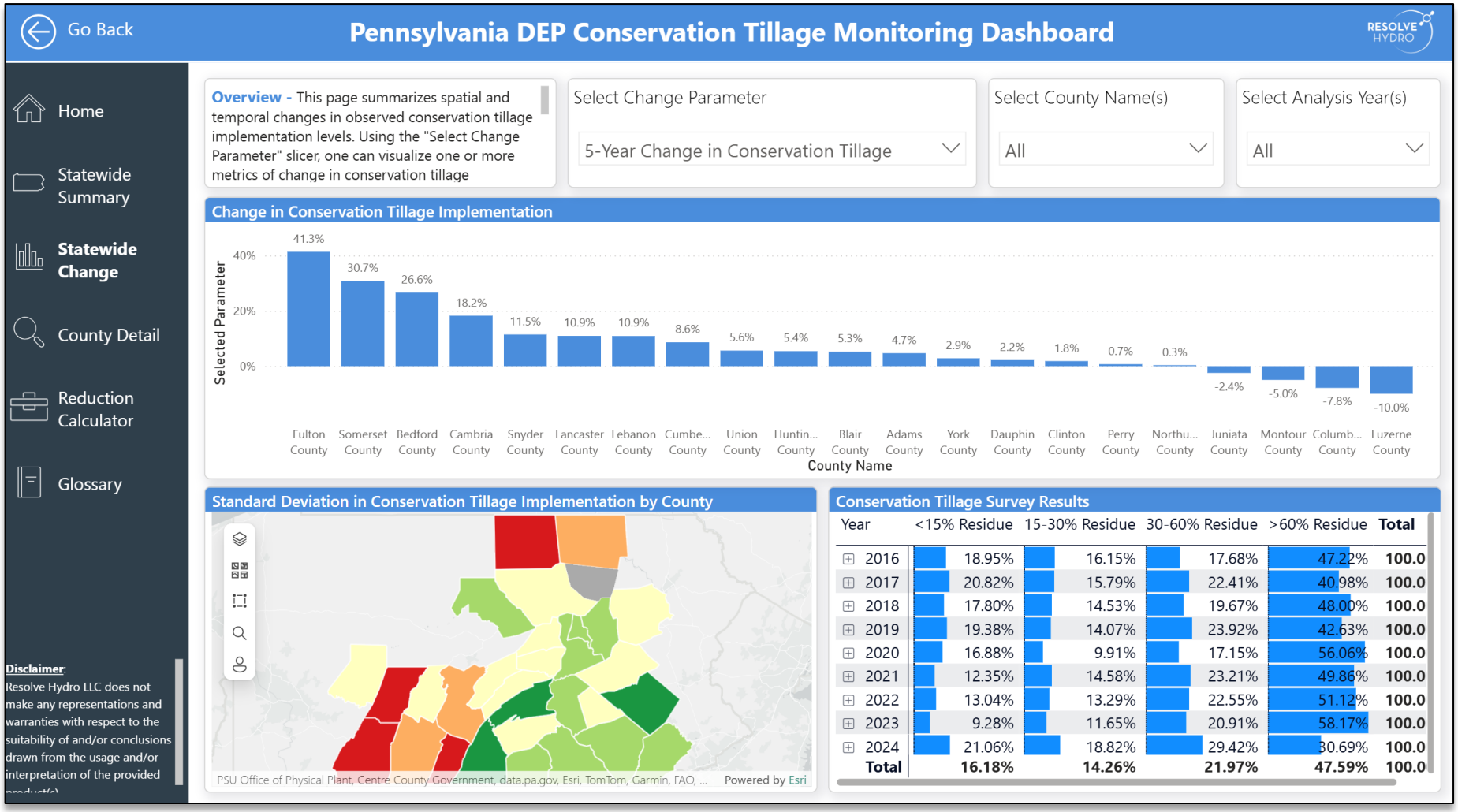

5-Year Change in Reduced Tillage Implementation

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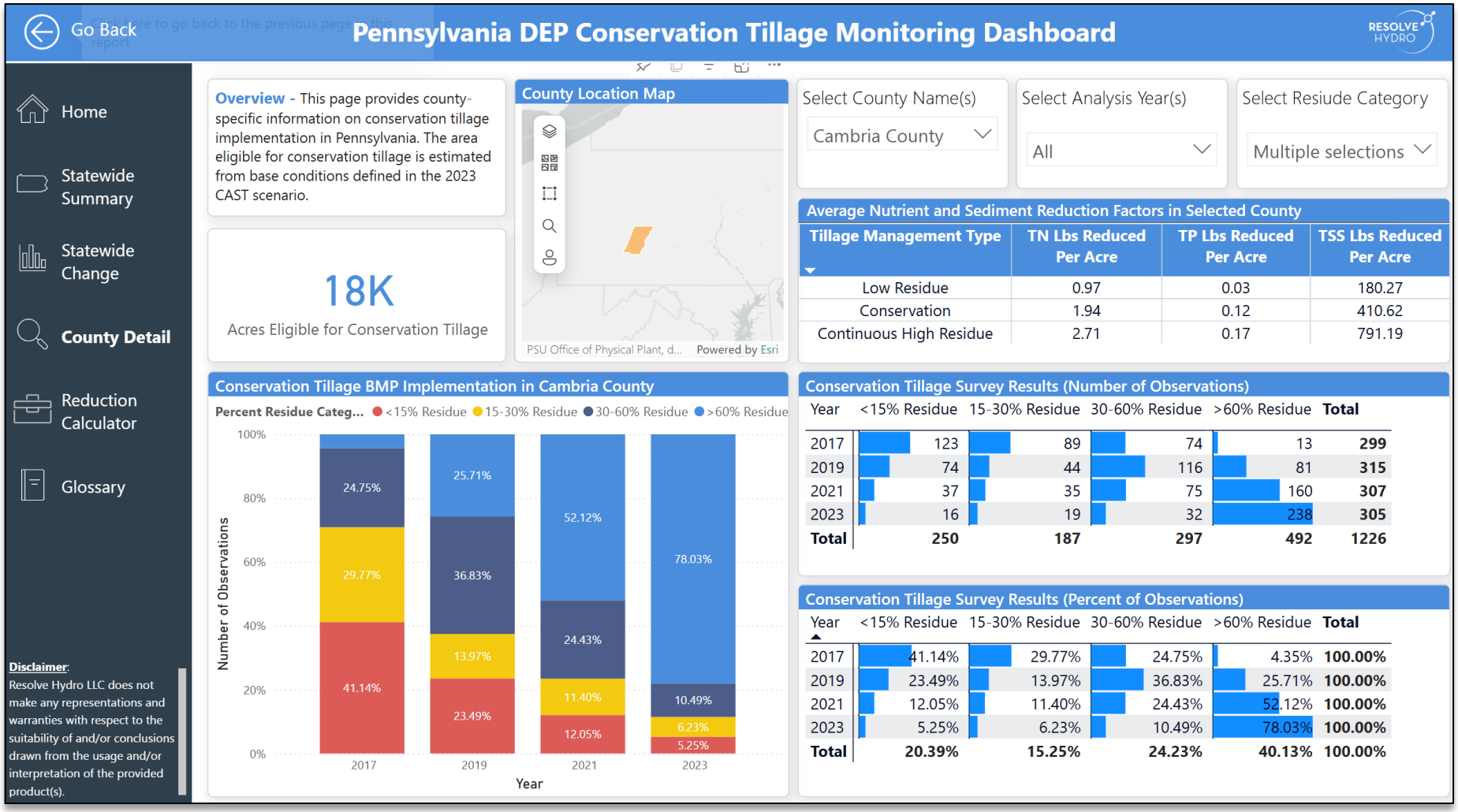

County-specific detail page

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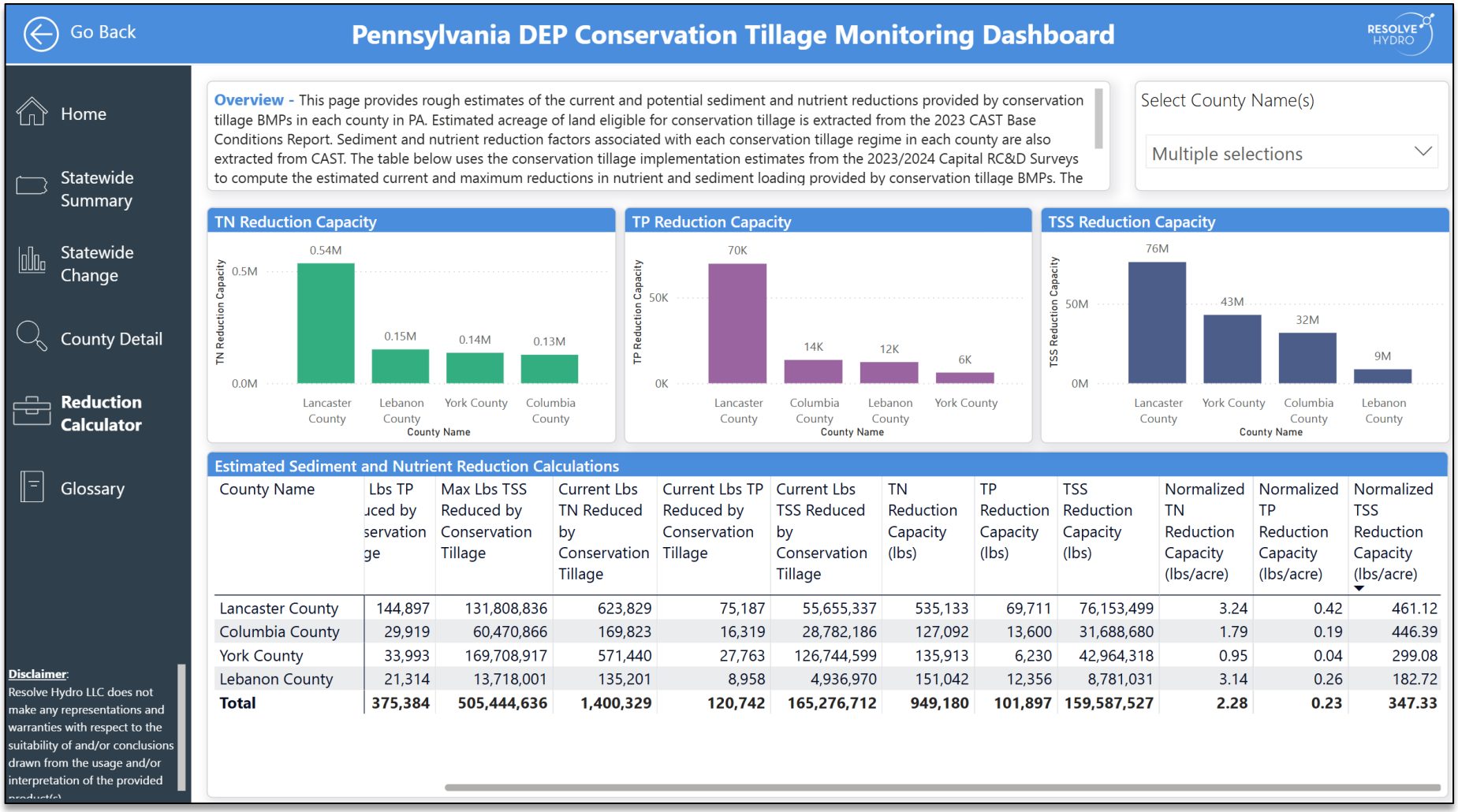
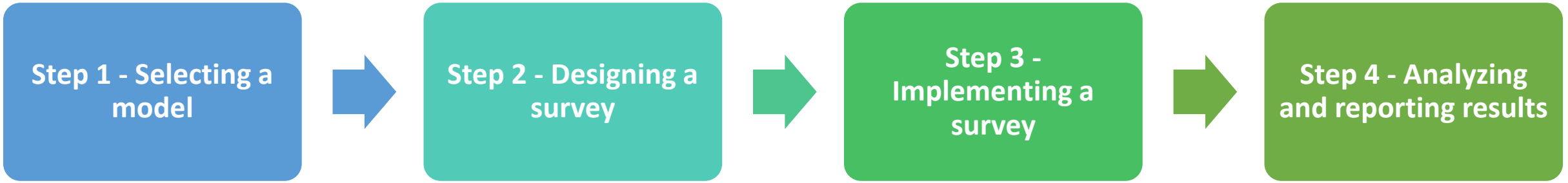


County Name	Lbs TP ...uced by ...servation ...ge	Max Lbs TSS Reduced by Conservation Tillage	Current Lbs TN Reduced by Conservation Tillage	Current Lbs TP Reduced by Conservation Tillage	Current Lbs TSS Reduced by Conservation Tillage	TN Reduction Capacity (lbs)	TP Reduction Capacity (lbs)	TSS Reduction Capacity (lbs)	Normalized TN Reduction Capacity (lbs/acre)	Normalized TP Reduction Capacity (lbs/acre)	Normalized TSS Reduction Capacity (lbs/acre)
Lancaster County	144,897	131,808,836	623,829	75,187	55,655,337	535,133	69,711	76,153,499	3.24	0.42	461.12
Columbia County	29,919	60,470,866	169,823	16,319	28,782,186	127,092	13,600	31,688,680	1.79	0.19	446.39
York County	33,993	169,708,917	571,440	27,763	126,744,599	135,913	6,230	42,964,318	0.95	0.04	299.08
Lebanon County	21,314	13,718,001	135,201	8,958	4,936,970	151,042	12,356	8,781,031	3.14	0.26	182.72
Total	**375,384**	**505,444,636**	**1,400,329**	**120,742**	**165,276,712**	**949,180**	**101,897**	**159,587,527**	**2.28**	**0.23**	**347.33**

Estimated "reduction capacity" for each county

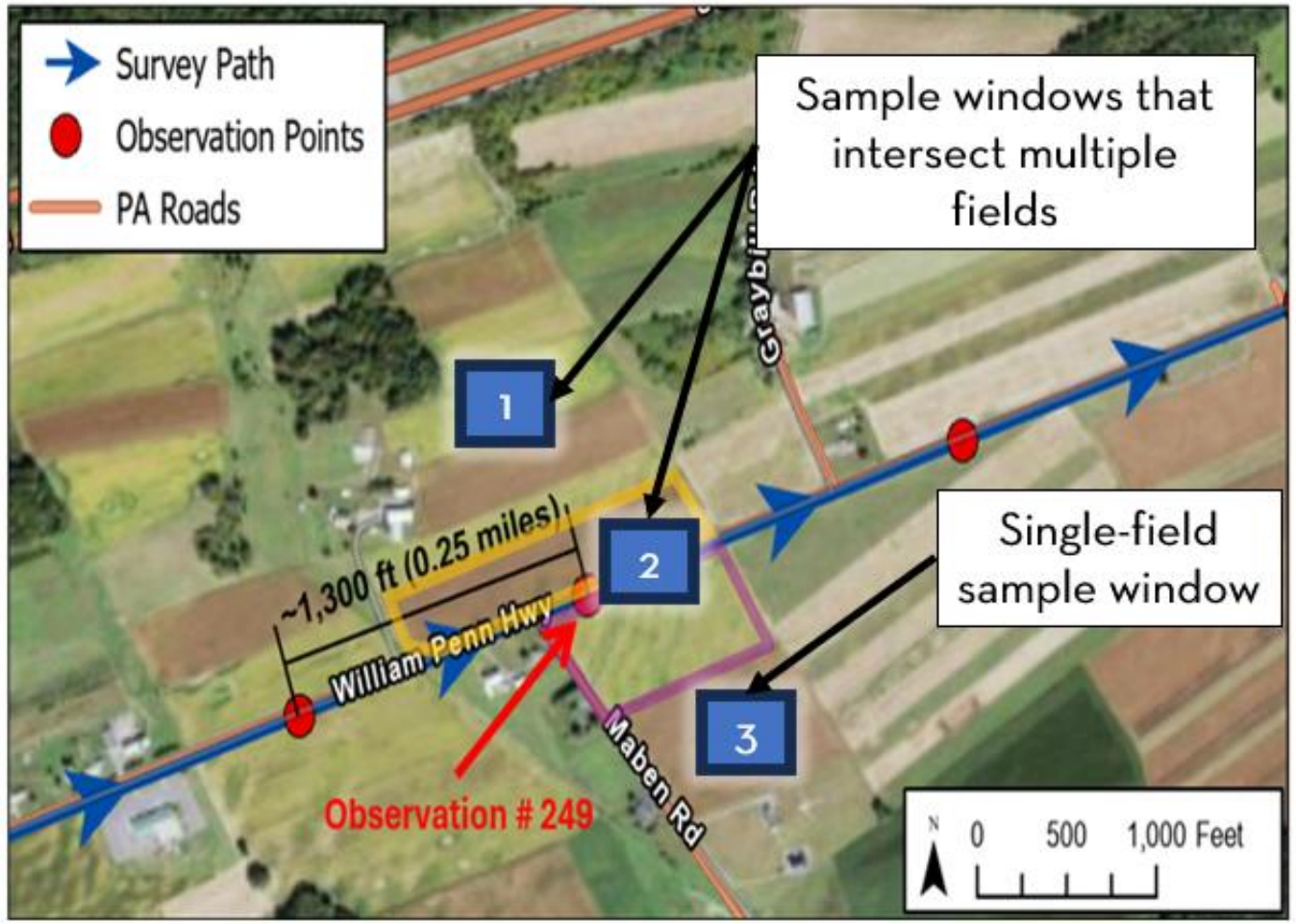
Methodology Outline

We propose four main sections in the RS methodology



The developed methodology (to be presented to the AgWG in 2025) will detail guidelines and requirements for implementing and verifying a remote sensing-based conservation tillage BMP survey

Sampling approach – what is our base unit and how does that impact aggregation?



Examples of single-field and multi-field sampling windows that may be created via random sampling

The random sampling approach may create sampling windows that cross multiple field boundaries. How do we aggregate this data to develop the best estimates of county-wide conservation tillage implementation?

Sampling approaches

How does the selected method impact verification? Relate to model training? Align with CBP reporting standards? Impact sampling design?

Method 1 (by field)

- Identify *j* sub-fields within a sample window
- Aggregate reflectance data per sub-field (we will have 1 **R** per sub-field)
- Apply model to aggregated data (i.e., to each **R**)
- Compute county tillage percentages $\frac{\sum \text{subfields of class i}}{\sum \text{subfields}}$

Method 2 (by field)

- Identify *j* sub-fields within a sample window
- Apply model to every (eligible) pixel in window (i.e., predict tillage classification for each pixel)
- Average the estimated classification throughout the entire window to compute 1 estimate per sub-field
- Compute county tillage percentages $\frac{\sum \text{subfields of class i}}{\sum \text{subfields}}$

Method 3 (by window)

- Apply model to every (eligible) pixel in window (i.e., predict tillage classification for each pixel)
- Average the estimated classification throughout the entire window to compute 1 estimate per window
- Compute county tillage percentages $\frac{\sum \text{windows of class i}}{\sum \text{windows}}$

Method 4 (by window)

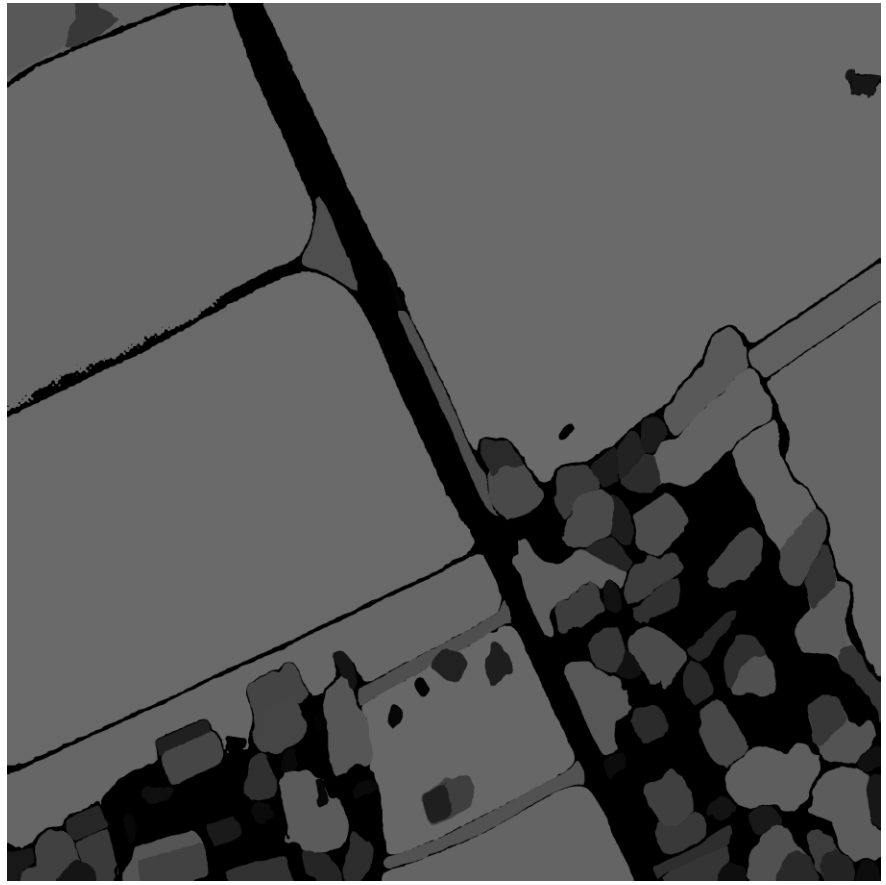
- Aggregate reflectance data per window (we will have 1 **R** per window)
- Apply model to aggregated data (i.e., to each **R**)
- Compute county tillage percentages $\frac{\sum \text{windows of class i}}{\sum \text{windows}}$

Method 5 (by area)

- Apply model to every (eligible) pixel in window (i.e., predict tillage classification for each pixel)
- Compute county tillage percentages $\frac{\sum \text{pixels of class i}}{\sum pixels}$

Countywide Field Segmentation Using Computer Vision

Segmentation will be used to assign field observations to discrete locations in space



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PAC Meeting Update

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October 2, 2024