Evaluation of Self-certified Assessment Inventories to Identify and Inventory Agricultural Conservation Practices for the Bay Model

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Tetra Tech Assessment

An overview of a procedure that could be used to evaluate a self-certified assessment inventory (e.g., mail survey) that includes follow-up verification using a stratified random sample of the returned surveys.

Tetra Tech Assessment

What We Did

- An overview of a procedure that could be used to evaluate a self-certified assessment inventory (e.g., mail survey) that includes follow-up verification using a stratified random sample of the returned surveys.

What We Didn't Do

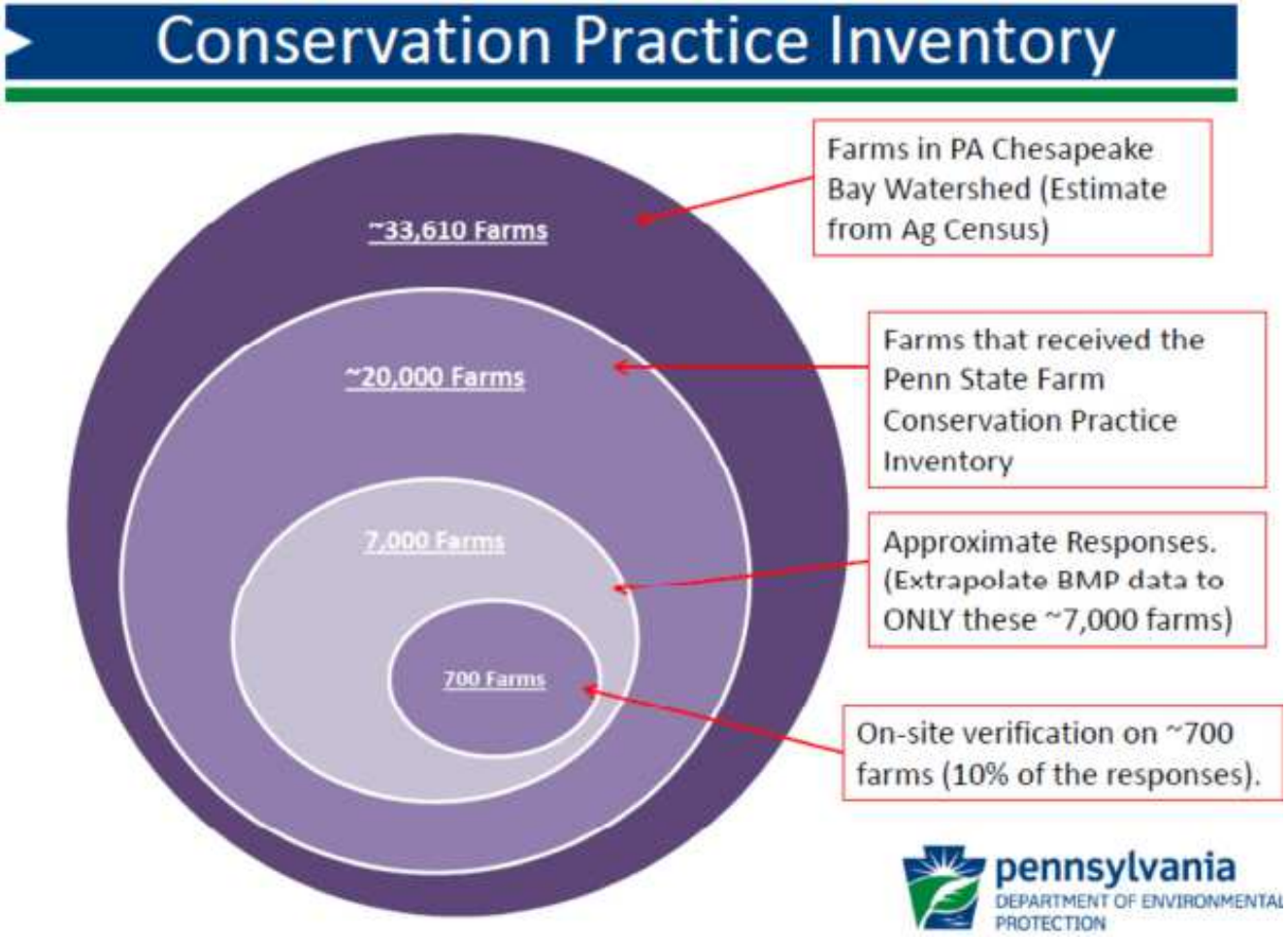
- Did not address selection of an appropriate survey tool (e.g., online versus mail-in), but the method described here can be used to either type of survey.

Example

PSU/DEP Conservation Practice Inventory

Survey Population and Sample Size

- Surveys mailed to 20,0000 farms
- 6,782 surveys returned (34%)
- ~10% post-stratified sampling by county (n=710) for on-site verification



Approaches

- Measures of accuracy and completeness
- Mean Difference to adjust reported acreage
- Apply Survey/General Linear Modeling Tool*

Measures of accuracy and completeness

- Three measures used:
  - Proportion Correct (PC):

$$PC = (a + d)/(a + b + c + d)$$

  - Hit Rate (HR):

$$HR = a/(a + c)$$

  - False Alarm Ratio (FAR):

$$FAR = \frac{b}{a + b}$$

		Field Observed		
		Yes	No	Total
Survey	Yes	a	b	a+b
	No	c	d	c+d
	Tot.	a+c	b+d	n

Metric	Formula
False Alarm Rate (FAR)	b/(a+b)
Hit Rate (HR)	a/(a+c)
Post Agreement Rate (PAG)	a/(a+b)
Frequency Bias (FB)	(a+b)/(a+c)

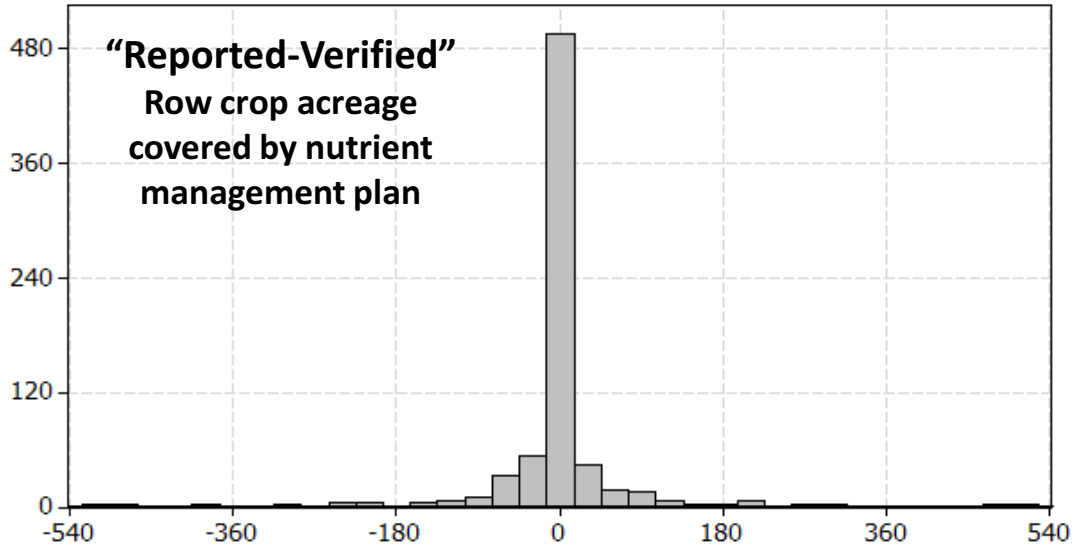
Measures of accuracy and completeness

Practice	Subcategory	Percent Correct	Hit Rate	False Alarm Rate
Nutrient Management Plan Acres	Row Crop Acres	0.85	0.77	0.13
Nutrient Management Plan Acres	Pasture Acres	0.81	0.62	0.19
Nutrient Management Plan Acres	Hay Acres	0.80	0.67	0.24
Nutrient Management Plan Acres	Privately Funded Act 38 Row Crop Acres	0.93	0.26	0.46
Nutrient Management Plan Acres	Privately Funded Act 38 Pasture Acres	0.94	0.14	0.60
Nutrient Management Plan Acres	Privately Funded Act 38 Hay Acres	0.93	0.09	0.69
Nutrient Management Plan Acres	Acres	0.95	0.21	0.68
Nutrient Management Plan Acres	Privately Funded NRCS 590 Pasture Acres	0.97	0.24	0.71
Nutrient Management Plan Acres	Privately Funded NRCS 590 Hay Acres	0.95	0.23	0.75
Nutrient Management Plan Acres	Acres	0.84	0.61	0.39
Nutrient Management Plan Acres	Acres	0.84	0.49	0.40
Nutrient Management Plan Acres	Manure Management Plans on Hay Acres	0.85	0.60	0.43
Nutrient Management Plan Acres	Advanced Nutrient Management	0.83	0.35	0.69
E&S Plans	Row Crop Acres	0.90	0.30	0.46
E&S Plans	Pasture Acres	0.92	0.30	0.48
E&S Plans	Hay Acres	0.93	0.27	0.44
E&S Plans	Barnyard Acres	0.96	0.17	0.73
NRCS Plans (privately funded)	Row Crop Acres	0.81	0.35	0.57
NRCS Plans (privately funded)	Pasture Acres	0.86	0.28	0.58
NRCS Plans (privately funded)	Hay Acres	0.85	0.31	0.58
NRCS Plans (privately funded)	Barnyard Acres	0.94	0.16	0.78
Stream Bank Fencing	Fencing Length (Ft.)	0.88	0.71	0.15
Stream Bank Fencing	Distance from Stream to Fence (Ft.)	0.87	0.74	0.19
Stream Bank Fencing	Public Funded Fencing (Ft.)	0.93	0.69	0.25
Stream Bank Fencing	Privately Funded Fencing (Ft.)	0.87	0.53	0.30
Stream Bank Fencing	Acres of Buffer	0.87	0.70	0.19
Stream Bank Fencing	Acres of Privately Funded Buffer	0.87	0.53	0.34
Riparian Buffers	Buffer Acres	0.71	0.45	0.50
Riparian Buffers	Privately Funded Buffer Acres	0.77	0.29	0.70
Riparian Buffers	Buffer Width	0.71	0.48	0.49

Mean Difference "Reported-Verified"

Mean Diff = -2.197

90%CI = (-6.404 - 2.010)



$$\textbf{Adj. Acreage} = \textbf{Rep. Acreage} - (\textbf{N} * \textbf{Mean Diff})$$

335,250 – (6,782 * -2.197) = 350,150 acres

$$\textbf{90\% CI} = \textbf{Rep. Acreage} - (\textbf{N} * \textbf{90\%CI})$$

335,250 – (6,782* -6.404) = 378,682

335,250 – (6,782* 2.010) = 321,618

Adj. Acreage (90%CI):

350,150 (321,618 - 378,682) acres

Anderson-Darling Normality Test	
A-Squared	114.79
P-Value <	0.005
Mean	-2.197
StDev	68.014
Variance	4625.874
Skewness	-0.2727
Kurtosis	24.2316
N	709
Minimum	-521.000
1st Quartile	0.000
Median	0.000
3rd Quartile	0.000
Maximum	500.000
90% Confidence Interval for Mean	
-6.404	2.010
90% Confidence Interval for Median	
0.000	0.000
90% Confidence Interval for StDev	
65.175	71.133

Survey/General Linear Model

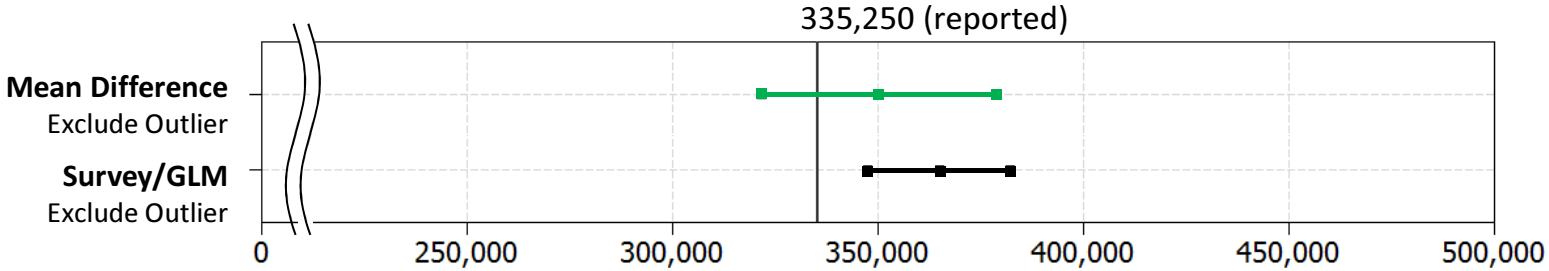
- Objective
  - Estimate State and County total BMP acreage (with confidence intervals)
- Data Characteristics
  - 0-report/0-verification versus 0-report/>0-verification
  - Outliers
- Method—Survey/GLM
  - SAS® or R
  - Post Stratification: County (need at least 2 obs./county)
  - Finite Population
- Advantages
  - Complex survey sampling strategies
  - Smaller Standard Errors → Smaller Confidence Intervals

Survey/General Linear Model

- Approach tested with the row crop acreage covered by nutrient management plan
- Develop model generally using the same best practices that would be used for any regression
  - Model fit
  - Residuals
  - AIC (Akaike Information Criterion)
- For the example row crop data, we found that the most appropriate model:
  - Used a combined model that evaluates 0-reported from >0 reported acreage separately
  - Set y-intercept to 0 for >0 reported acreage

Survey/General Linear Model

- Statewide Estimate Result



- Data Requirements For Application to County Estimates
  - Need at least 2 observations per County
  - Number of Returned Surveys
  - Number of Surveys with 0 Reported Acreage
  - Number of Surveys with >0 Reported Acreage
  - Total Reported Acreage

Summary

- The Survey/GLM procedure could be used to evaluate self-certified assessment inventories
  - Post-stratified random sampling at the county level
  - 10% sampling per county
- Input Data
  - Verification data set
    - County name, reported acreage and verified acreage
    - 2 or more observations per county
  - County- and state-level summary information
    - Number of returned surveys
    - Number of surveys with zero reported acreage
    - Number of surveys with non-zero reported acreage
    - Total reported acreage for each county and the state overall

Summary

- Measures of accuracy and completeness
  - PC, HR, FAR
- Statewide or county acreage estimates

Subcategory	Reported State Acreage	Proportion Correct (PC)	Hit Rate (HR)	False Alarm Ratio (FAR)	Adjusted State Acreage
Row Crops	335,250	85% (83-87%)	77% (73-81%)	13% (10-17%)	364,850 (347,508-382,191)