Evaluation of Mail Surveys to Identify and Inventory Agricultural Conservation Practices for the Bay Model

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Agriculture Workgroup Meeting

September 20, 2017

Evaluation of Mail Surveys

Previous Work

- Presented at March 2017 Ag Workgroup Meeting

- Used to evaluate mail surveys that include follow-up verification

- Verification using a stratified random sample of the returned surveys

- Key components
  - Measures of accuracy and completeness (PC, HR, FAR)
  - Estimate state and county BMP acreage with confidence intervals (GLM)

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

Jon Harcum

Steve Dressing

Tetra Tech, Inc.

Agriculture Workgroup Meeting
March 16, 2017

Agriculture Workgroup Face-to-Face Quarterly Meeting
March 16, 2017 from 10:00 AM - 3:00 PM

Alternative BMP Survey Methods Statistical Report
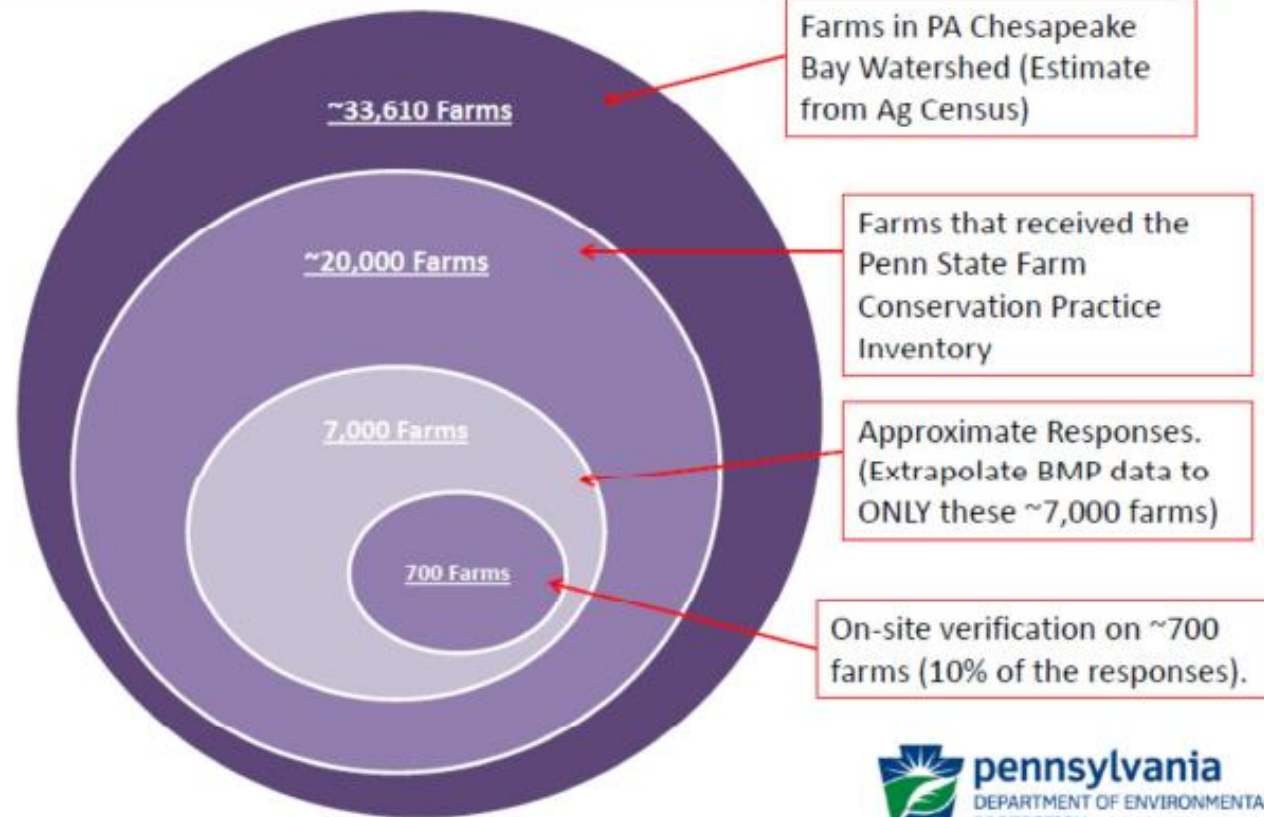Alternative BMP Survey Methods Statistical Report: Presentation

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

Conservation Practice Inventory

~33,610 Farms

~20,000 Farms

7,000 Farms

700 Farms

Farms in PA Chesapeake Bay Watershed (Estimate from Ag Census)

Farms that received the Penn State Farm Conservation Practice Inventory

Approximate Responses. (Extrapolate BMP data to ONLY these ~7,000 farms)

On-site verification on ~700 farms (10% of the responses).

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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

Estimate state and county BMP acreage

Percent Correct		Hit Rate		False Alarm Rate	
	0.85		0.77		0.13

Goal: State and county level estimates of total acreage with confidence intervals
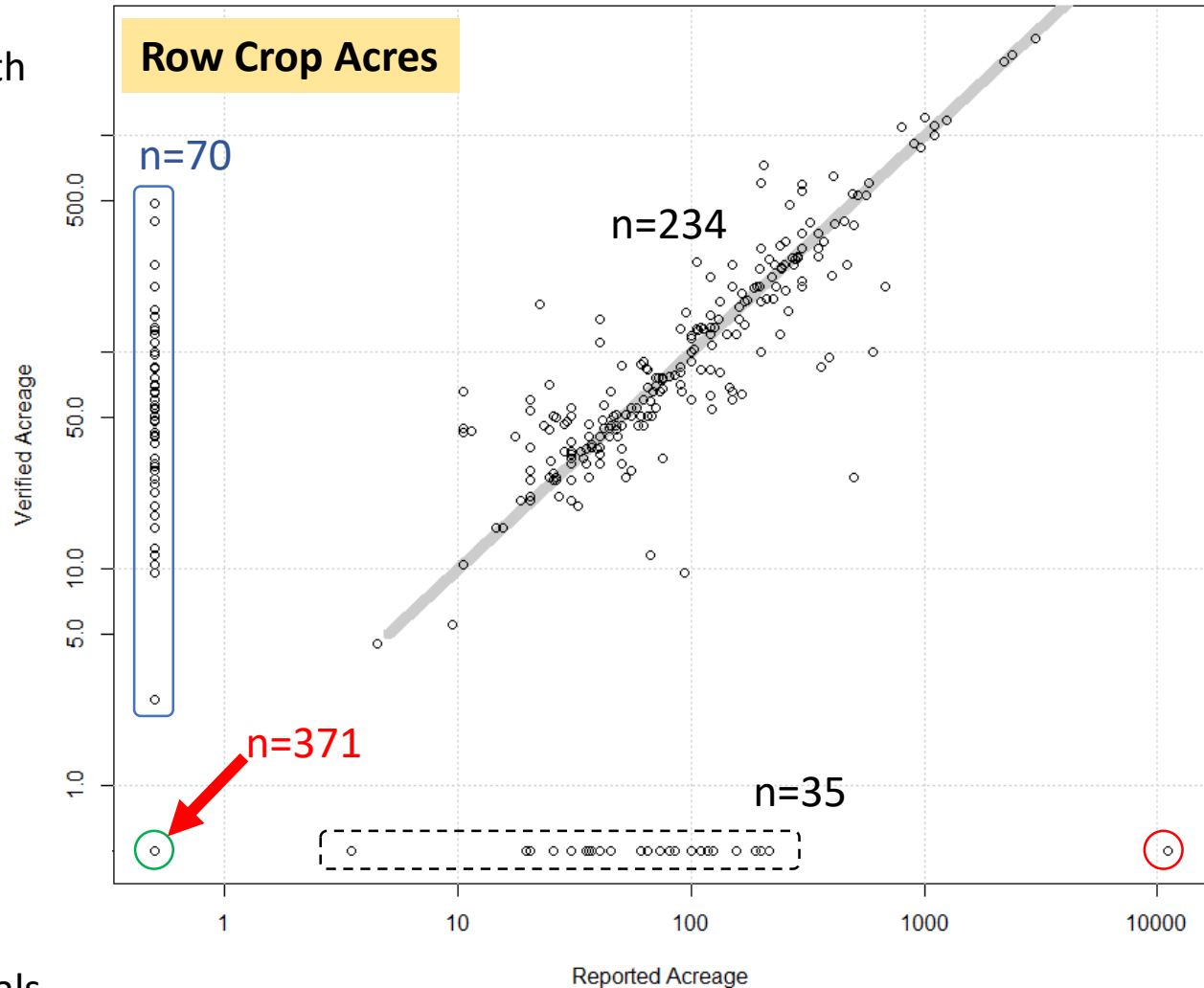
Challenges:

- 0-report/0-verification
- 0-report/>0-verification
- Outliers
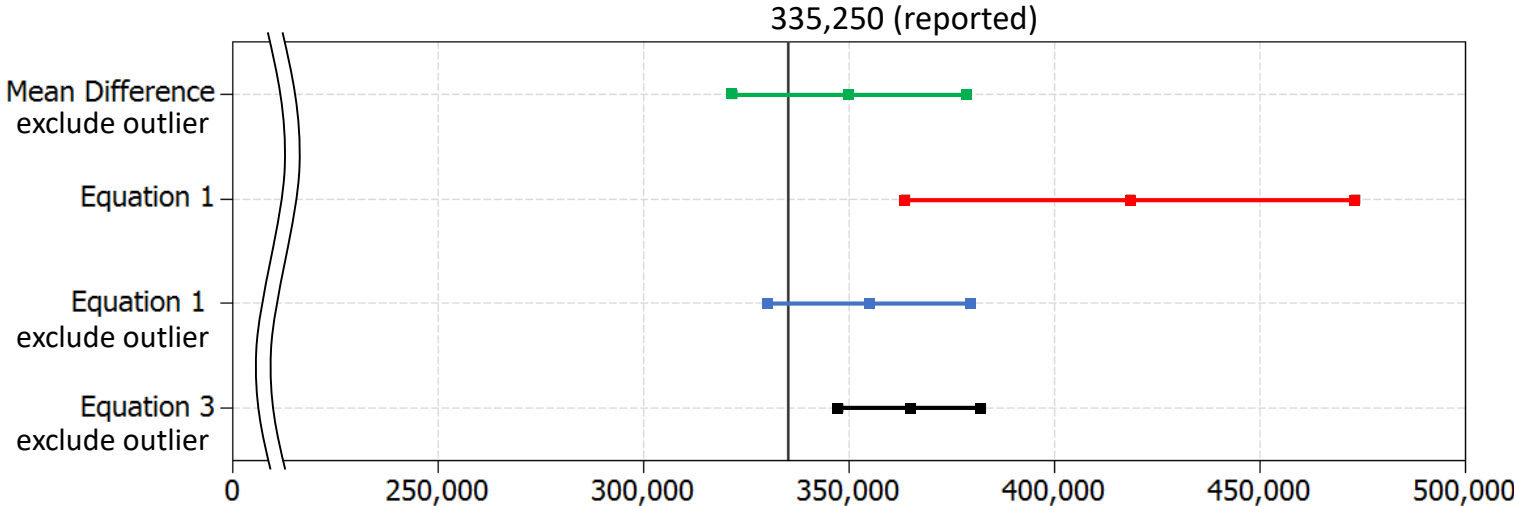- Post Stratification

Method:

- Survey/GLM
  - Strata=County
  - Finite Population

Value:

- Complex survey sampling strategies
- Smaller Standard Errors
- Smaller Confidence Intervals

Row Crop Acres

n=70

n=234

n=371

n=35

Verified Acreage

Reported Acreage

Statewide Estimates

Hypothetical County Data Set

| County	Returned Surveys	Surveys with Zero Reported Acreage	Surveys with Non-zero Reported Acreage	Total Reported Acreage
Adams	210	153	57	9,513
Bedford	191	153	38	2,072
Berks	96	38	58	3,952
Blair	124	86	38	5,228
…	…	…	…	…
Union	143	76	67	6,700
Wayne	29	19	10	125
York	344	229	115	30,003
Total	**6,782**	**4,213**	**2,569**	**335,250**

A Elk and Jefferson, Sullivan, and Wyoming counties were assumed to be aggregated with Clearfield, Columbia, and Luzerne counties, respectively.

Data Requirement for Strata = County
- At least two samples/county

Input County Data Set
- # of Returned Surveys
- # 0 Reported Acreage
- # >0 Reported Acreage
- Total Reported Acreage
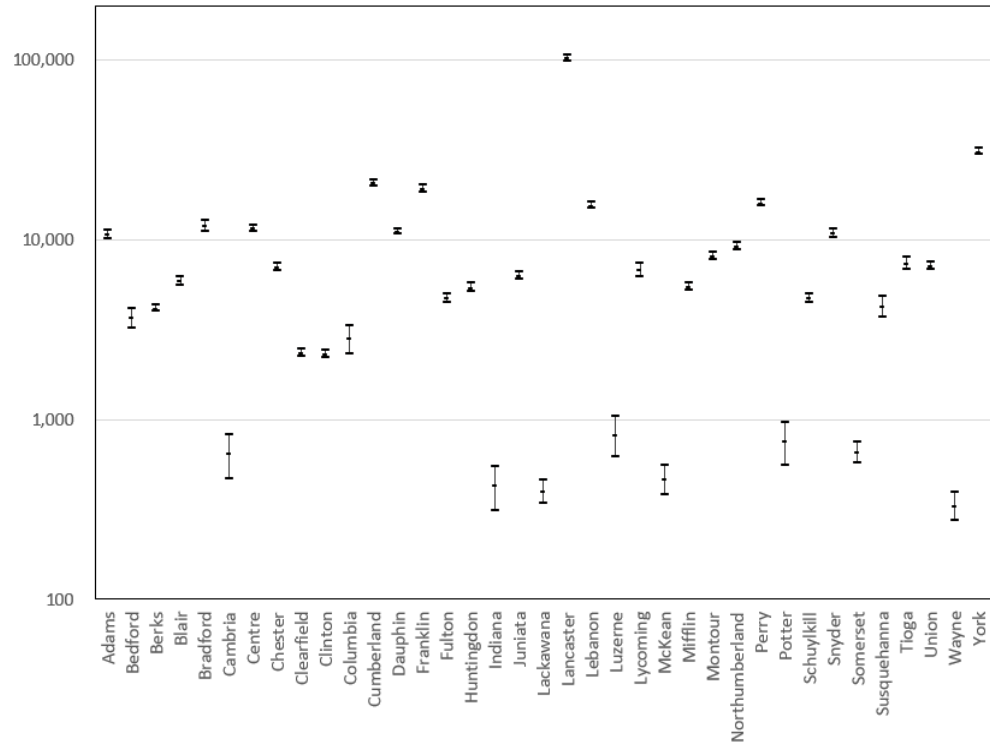
Current Work

- Solicit input/discussion on preliminary report
  - Requirements for Percent Correct (PC), Hit Rate (HR), and False Alarm Rate (FAR)
  - Minimum number of independent verifications per County (minimum has to be 2 per county)
  - Verification only applicable to Operations that returned survey
  - Directed verification to identify outliers

- Develop tool for performing calculations
- Update preliminary report