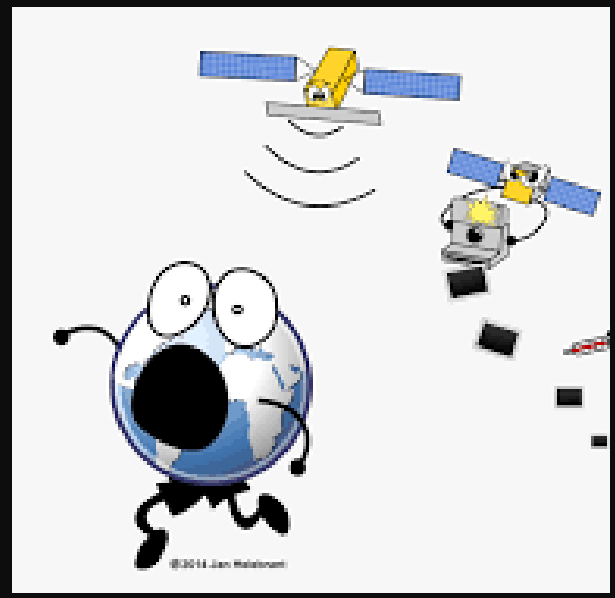
April 21, 2020

Rapid Review: Remote Sensing for BMP Verification

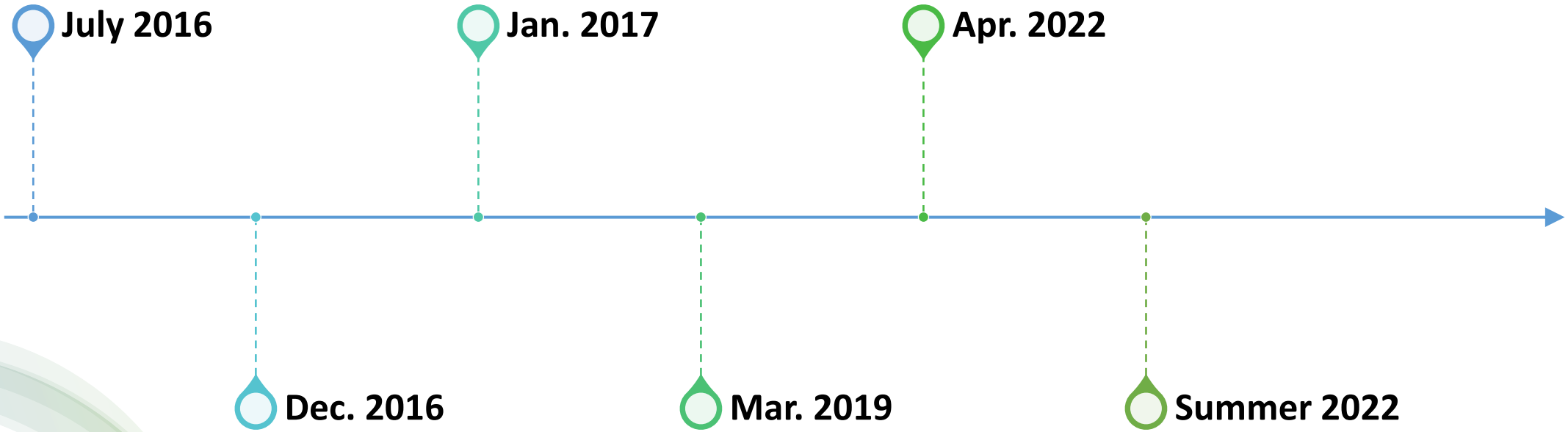
Alternative Methods of BMP Verification

- Producer Inventory Surveys
- Transect Surveys
- Remote Sensing

- Need CBP Approval
  - Methods
  - Statistical Thresholds for Ground-Truthing



Timeline: AgWG Remote Sensing Discussions



July 2016: Pilot Project Introduction

DECISION:

- AgWG agreed to move forward with PA Agricultural Remote Sensing Pilot Project's data collected for the **Potomac River Basin**.
- EPA will provide statistical support to examine the validity of methodology & verification of a subset of project data.
- EPA will provide additional tech support to PA DEP to analyze data in terms of how it will be submitted for historical calibration in Phase 6 model.
- https://www.chesapeakebay.net/what/event/agriculture_workgroup_conference_call_july_2016

December 2016: Pilot Project Assessment

Tetra Tech assessment of PA remote sensing pilot project

- degree to which practices tracked in pilot project match CBP BMPs
- degree to which methods used in the pilot project met CBP verification requirements
- accuracy of remote sensing method as measured with field verification data

The remote sensing pilot was a “Proof of Concept” project

- No determination if meet USDA NRCS Standards & Specifications
- All but two practices (heavy use area protection and vegetative barrier) included in the pilot project could be translated directly to CBP BMPs or RIs.
- # of soil conservation and water quality plans cannot be determined from the data provided.
- Most successful in detecting the following practices: contour orchard and other perennial crops, diversion, riparian forest buffer, prescribed grazing, terrace, and trails & walkways

- https://www.chesapeakebay.net/what/event/agriculture_workgroup_december_face_to_face_meeting1

CBP BMP Verification Guidance: Remote Sensing

- "statistically designed and recognized remote sensing surveys with supporting field-level scale ground-truthing verification."
- "non-annual frequency of statistical remote sensing surveys implemented by trained and certified agency [or NGO] personnel, for all or a sufficient statistical percentage of operations during BMP life span."
- Remote sensing pilot project established prior to completion of CBP verification guidance
  - remote sensing pilot project did not reflect all aspects of the verification guidance document related to visual indicators (VIs) for resource improvement practices (RIs).

December 2016: Pilot Project Assessment

DECISION:

- AgWG approved of PA-NRCS remote sensing methodology as a proof-of-concept
- Tasked AgWG with defining minimum observation level & acceptable levels of metrics for use in future reporting BMP reporting
- Recommended methodology be aligned with a CBP verification protocol

Jan 2017: Defining Statistical Thresholds

Tetra Tech Lit Review + Evaluation of strengths & weaknesses

Recommendation

Step #1:

- Sample size is at least 20
- False Alarm Ratio (FAR) is at or *below* threshold value
  - (upper confidence limit value is recommended)
  - Post Agreement Rate (PAG)=1-FAR
- Hit Rate (HR) is at or *above* the threshold value
  - (lower confidence limit value is recommended)

Step #2 If above conditions met:

- Correct BMP estimate for bias using the ratio of PAG/HR:
  - (Lower confidence limit value is recommended)

Jan 2017: Defining Statistical Thresholds

DECISION:

- AgWG approved a proposed methodology for setting statistical confidence standards for BMPs submitted remote sensing: use of a two-step process

  Step 1:

  - **Sample size greater than or equal to 20**
  - **False Hit Rate (FAR) threshold of 0.2 or below** (upper 90% confidence limit value)
  - **Hit Rate (HR) threshold of 0.7 or greater** (lower 90% confidence limit value)

  Step 2:

  - If above conditions met, correct for bias in the BMP quantity
    - Post-Agreement Rate (PAG)/Hit Rate (HR) (lower 90% confidence limit value).
  - Recommendation will remain in place until modified by the AgWG based upon additional data

- https://www.chesapeakebay.net/what/event/proposed_agriculture_workgroup_interim_face_to_face_meeting_january_2017

March 2019: Assessing Cover Crop Performance

Assessing Cover Crop Performance with Satellite Imagery (USGS & NASA)

- Imagery analysis tool designed by the NASA DEVELOP program
- Analysis of winter cover crop performance for fields annually enrolled in the Maryland cover crop cost share program.
- Combined farm-program data records with satellite remote sensing & on-farm sampling

- https://www.chesapeakebay.net/what/event/agriculture_workgroup_conference_call_march_2019

- Update Summer 2022 (MD & DE fields)

Reference

- The False Alarm Ratio (FAR) is the fraction of remotely-detected BMPs that were not confirmed via farm visits.
  - FAR is also known as the commission error or error of inclusion.
  - The Post Agreement Rate (PAG) is equal to 1-FAR and is also known as the user's accuracy.

- The Hit Rate (HR) is the fraction of remotely-detected BMPs that were confirmed or found through farm visits.
  - HR ranges from 0 to 1, with a value of 1 indicating all BMPs were found.
  - HR is also known as producer's accuracy.