

Shenandoah River Algae

Development of Field Monitoring Methods

Sandra Mueller
December 2, 2016



Background

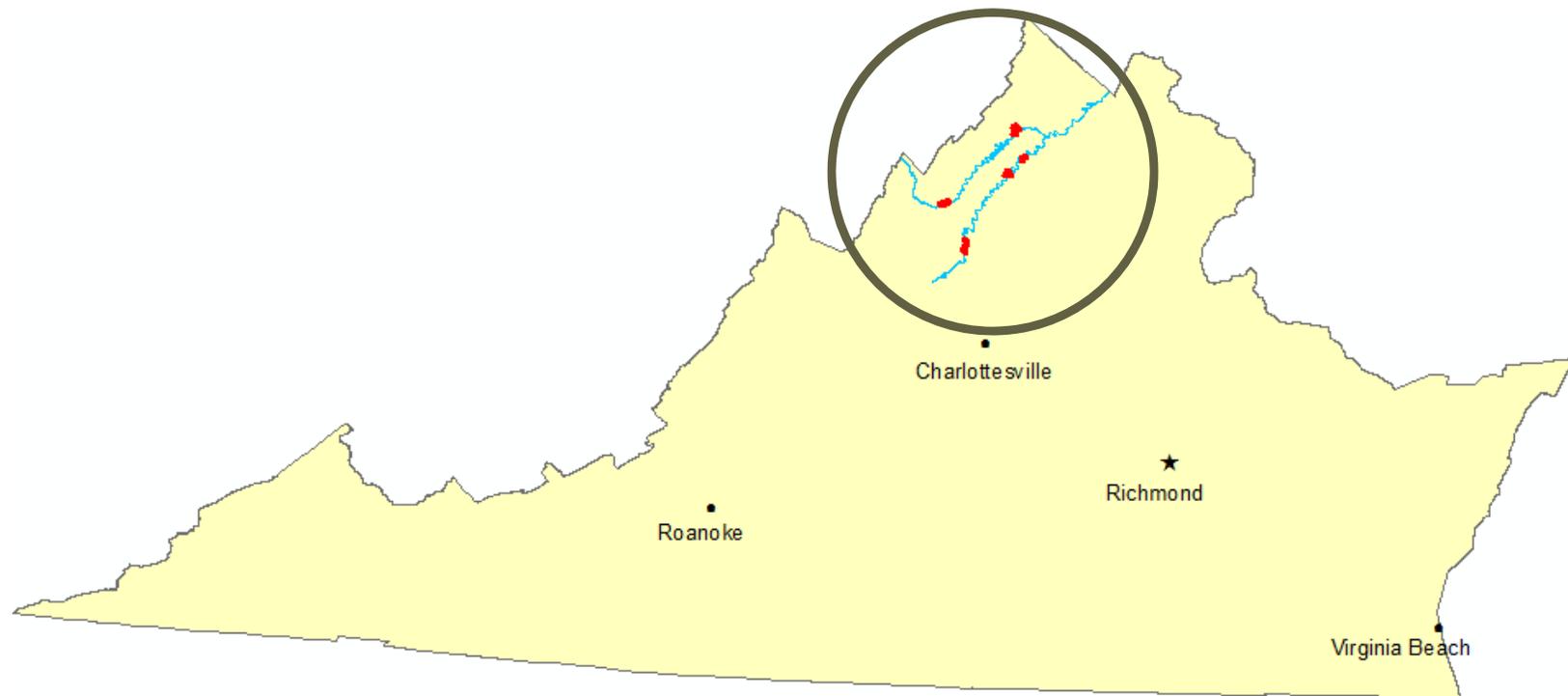
- Every even year, Virginia submits to EPA a report that describes the quality of Virginia's waters.
- This report is known as the **Integrated Water Quality Assessment Report, or IR.**
- DEQ received EPA's approval of the 2014 IR on May 19, 2016.
- Action had been delayed due to citizen concerns about **algae growth** in the Shenandoah River.

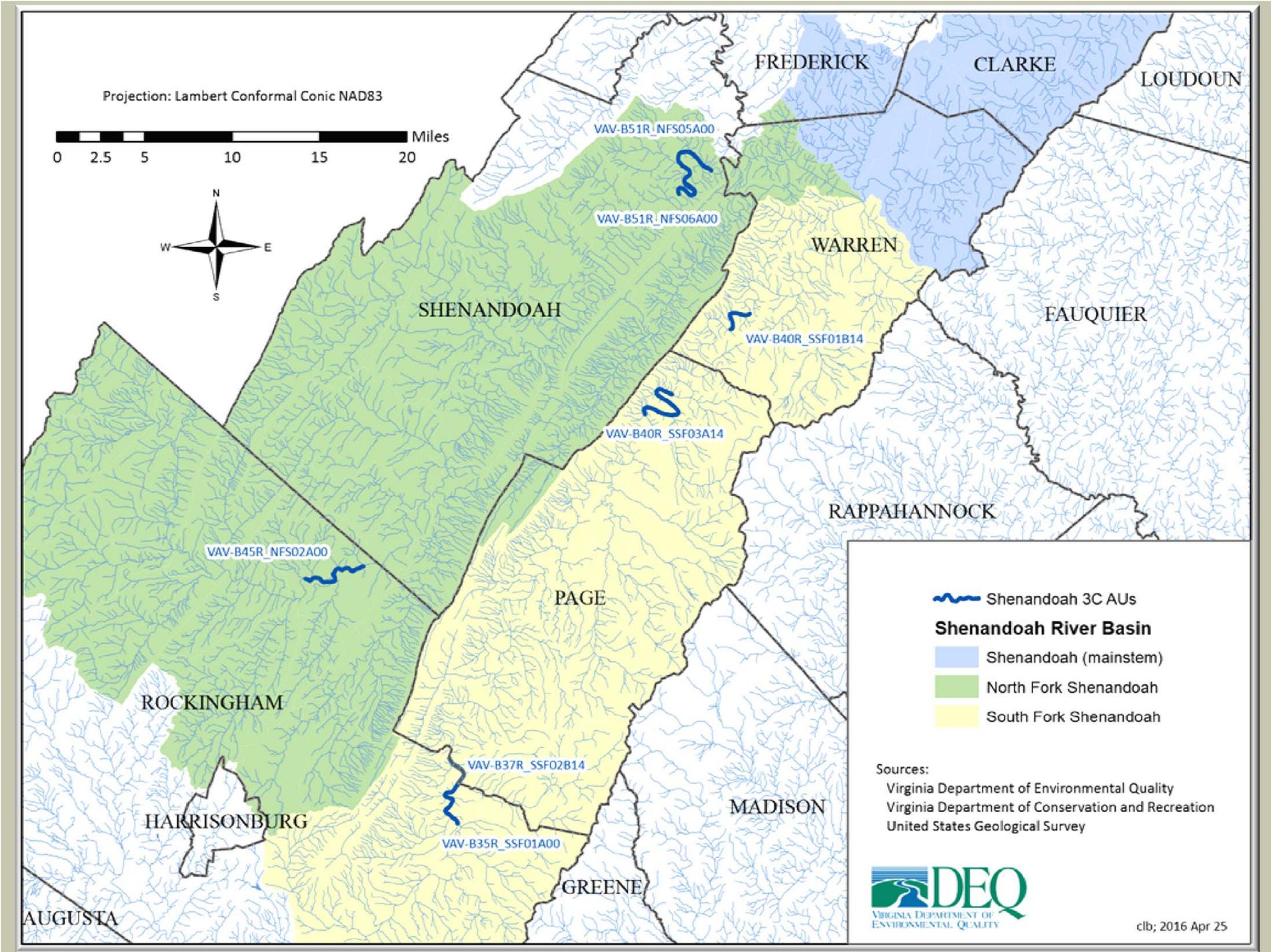




DEQ Action

- listing 5 river segments in the 2014 IR (~25 river miles) as having an **observed effect**, but with insufficient data to determine whether or not the recreation use was supported





EPA – DEQ commitments

- conducting follow-up monitoring during the 2016 and 2017 growing seasons to develop field methods for estimating the percent coverage of river bottom by filamentous algae, and
- developing impairment thresholds to be included in the 2018 IR Guidance, and
- making a recreational use attainment decision in the 2018 IR.

Field Methods Development

- Since June 2016, DEQ has been working with Region 3 partners to develop and test several field methods
- Goal: Develop a field estimation method to quantify the amount of algae present. The method should be: **quantifiable, repeatable, defensible, accurate, objective**, and relatively quick/easy.
- In 2016, field visits at each site, once a week, as conditions permitted
- June to early November



Field Methods Development

- DEQ tested **three** “lateral transect” monitoring methods during the 2016 field season
- All three methods have the following in common:
 - First, the average wetted channel width was estimated using a laser rangefinder
 - Second, the river width was divided into evenly spaced increments
 - Third, biologists used a viewing scope to make a determination of algae in each increment

Field Methods Development - Lateral Transects

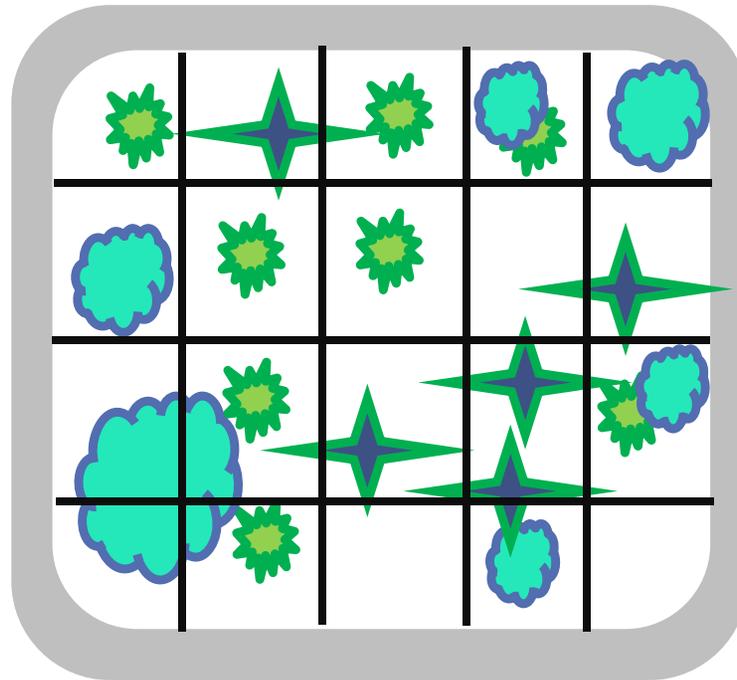
Take 1: Point Method



- Presence/absence noted at each point
- Percent cover calculated by:
- $(\#hits/\#increments) * 100$

Field Methods Development - Lateral Transects

Take 2: Cell Method



Presence/Absence Per Cell

- Filamentous Green Algae = $8/20 = 40\%$
- Other Algae = $9/20 = 45\%$
- Submerged Aquatic Vegetation = $9/20 = 45\%$

Field Methods Development - Lateral Transects

Take 3: Quadrat Method

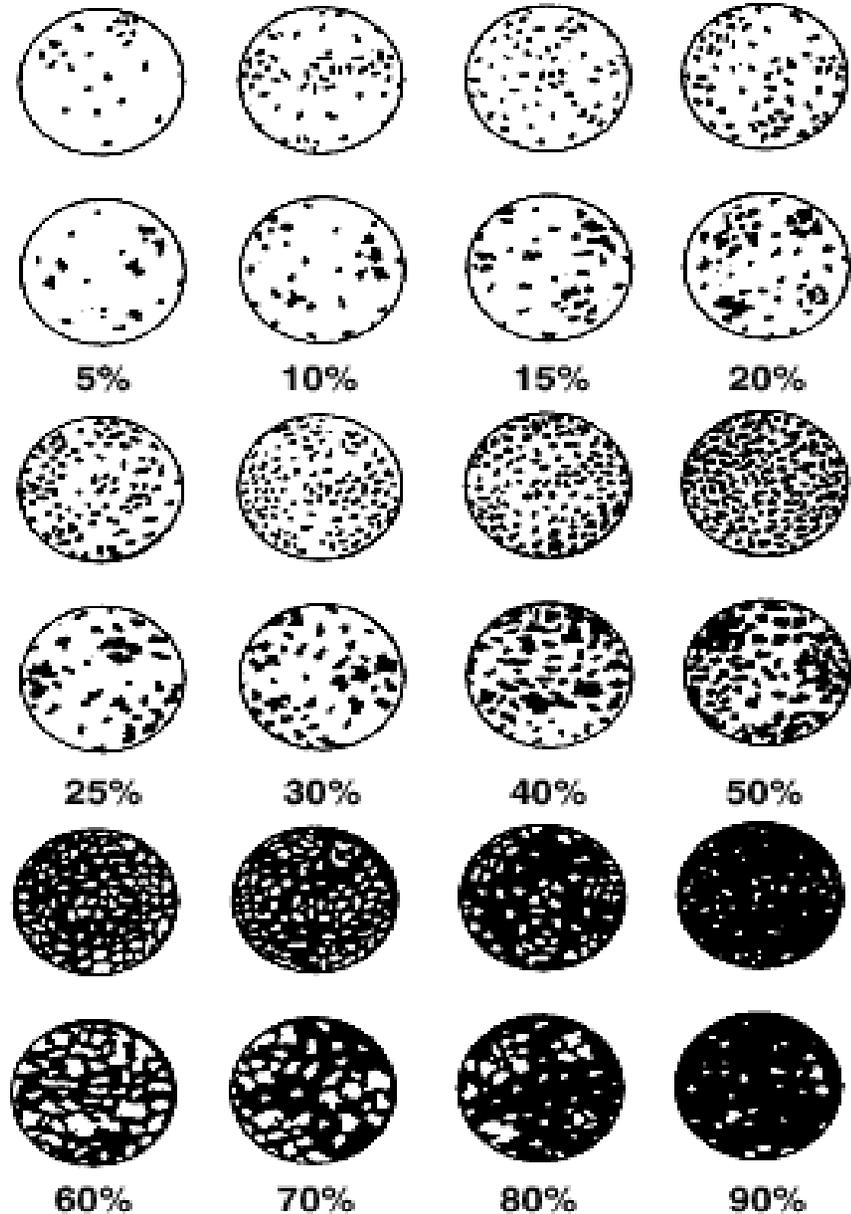


Field Methods Development - Lateral Transects

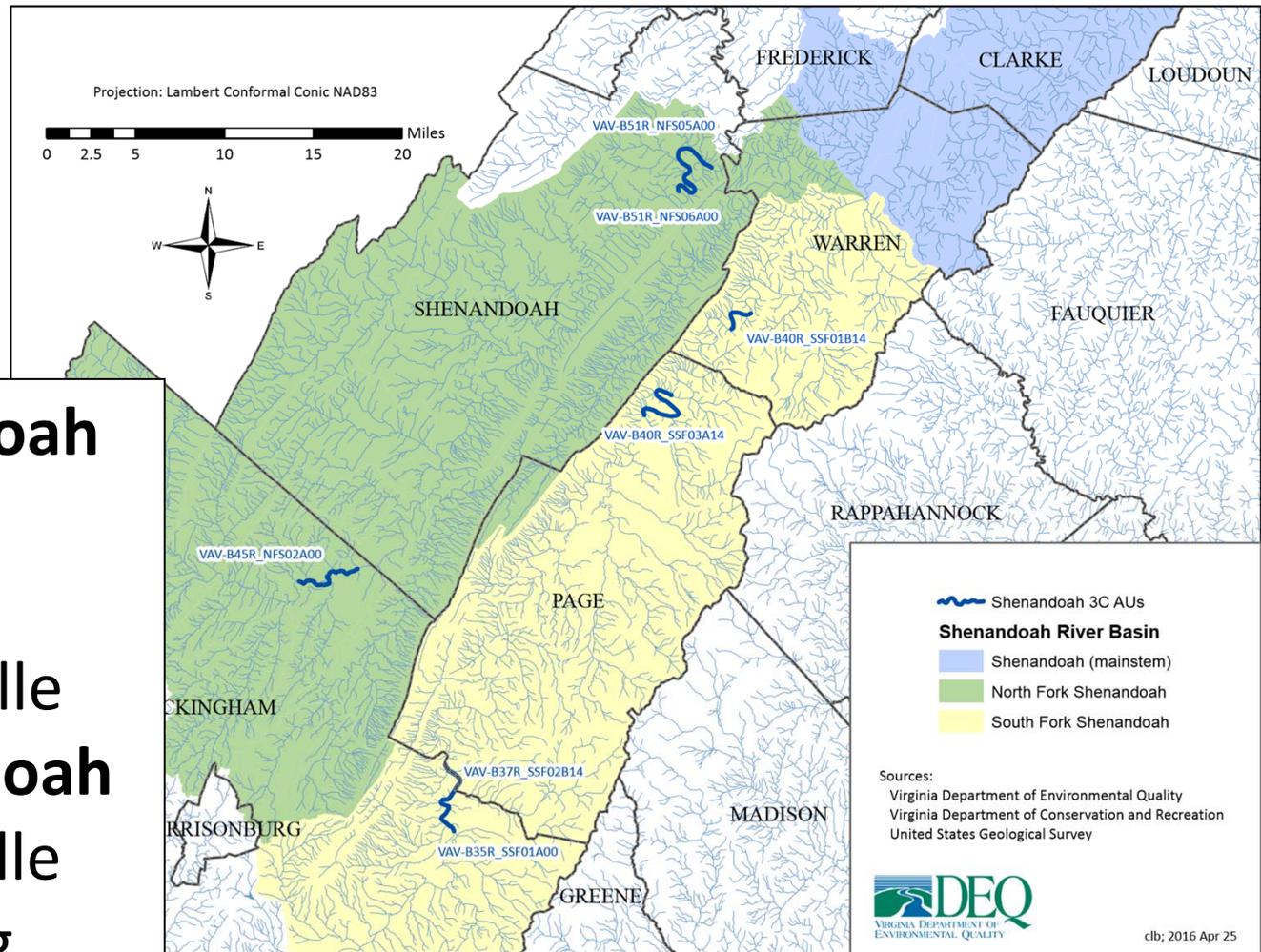
Take 3: Quadrat Method



Quadrat Method: Comparison Chart for Visual Percent Cover Estimation



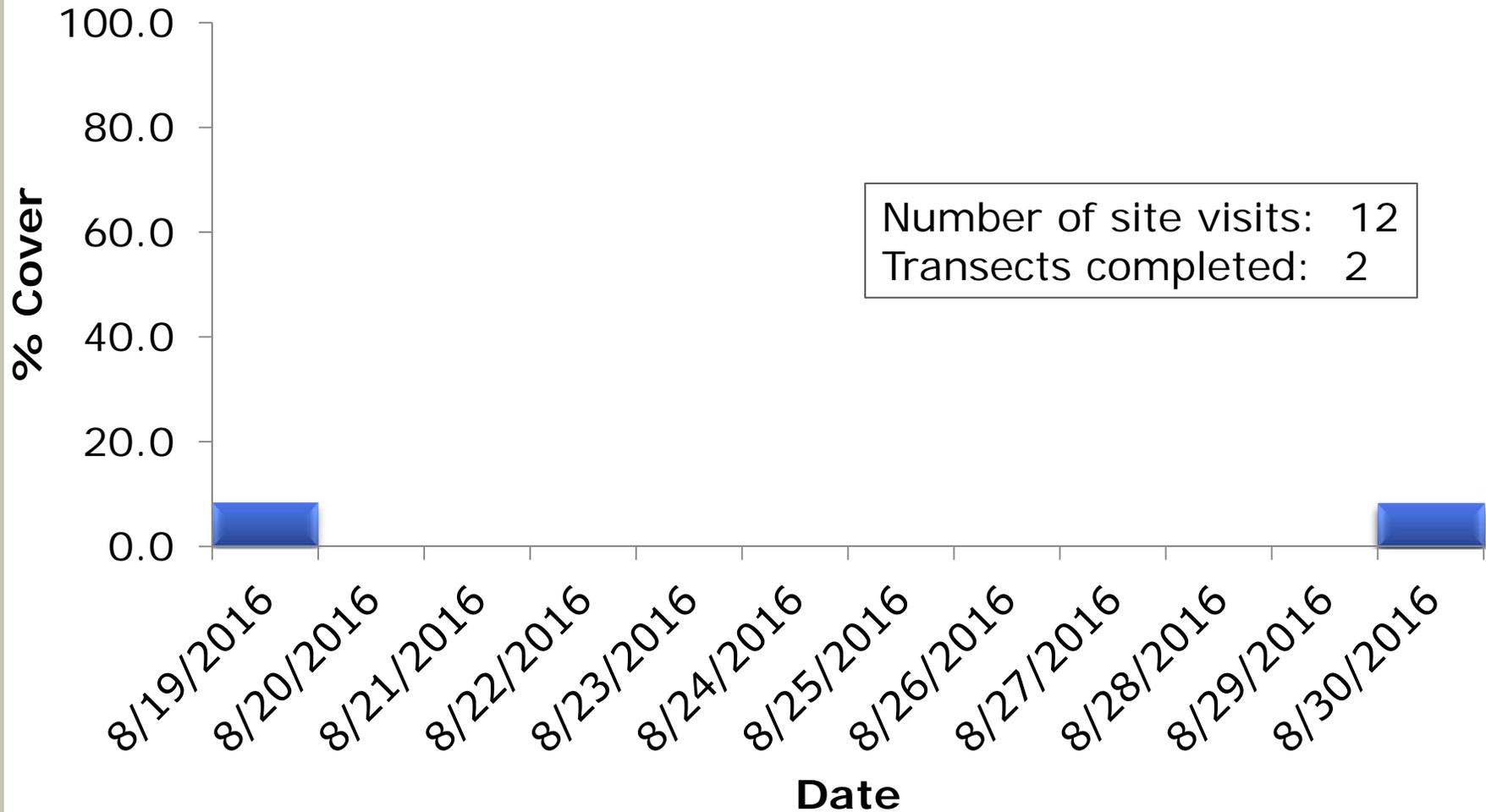
Field Methods Development – Data Review



- **SF Shenandoah**
 - Elkton
 - Rileyville
 - Bentonville
- **NF Shenandoah**
 - Timberville
 - Strasburg

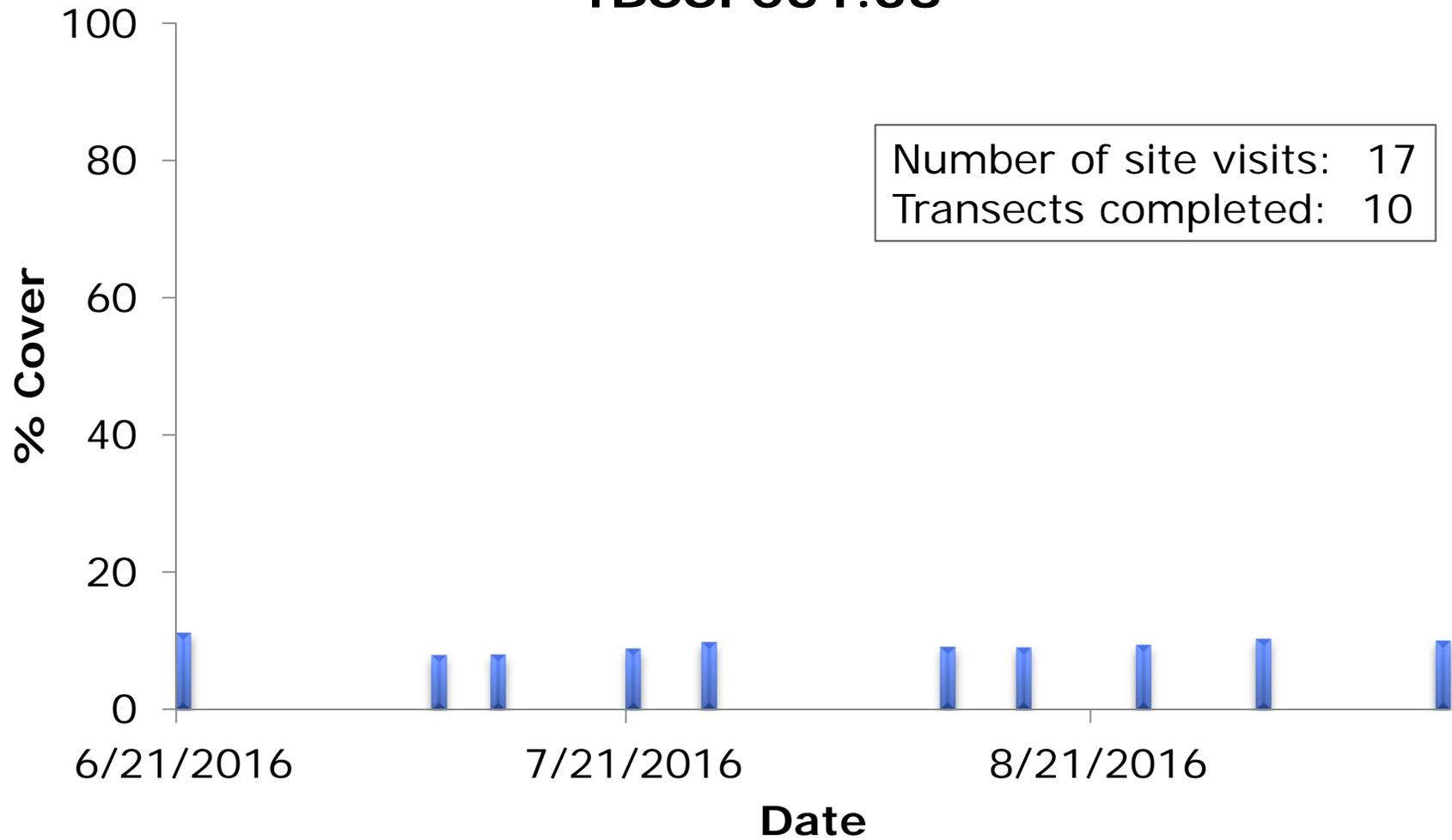
Transect Data: South Fork Shenandoah (Elkton)

1BSSF080.84

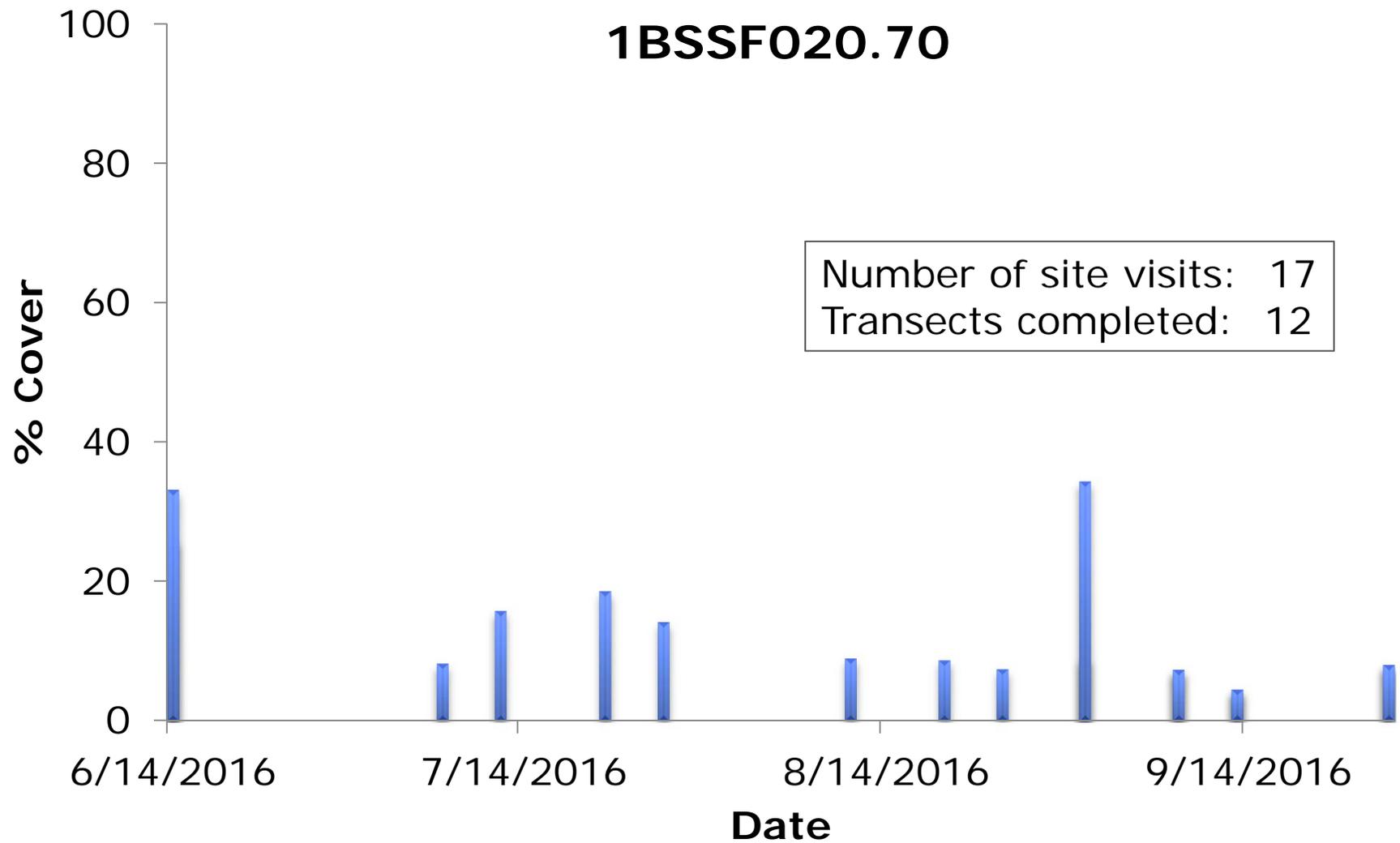


Transect Data: South Fork Shenandoah (Rileyville)

1BSSF031.38



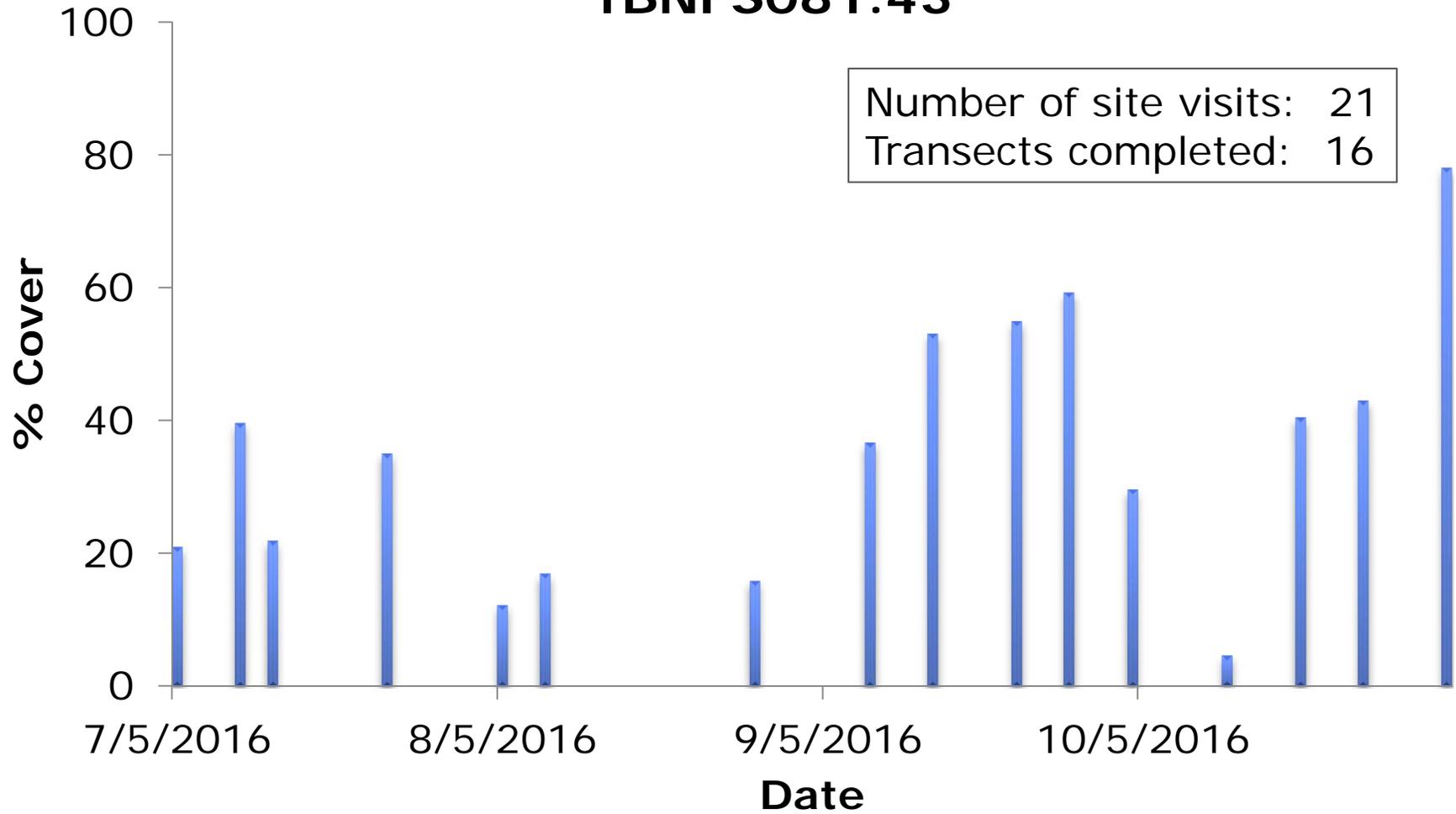
Transect Data: South Fork Shenandoah (Bentonville)



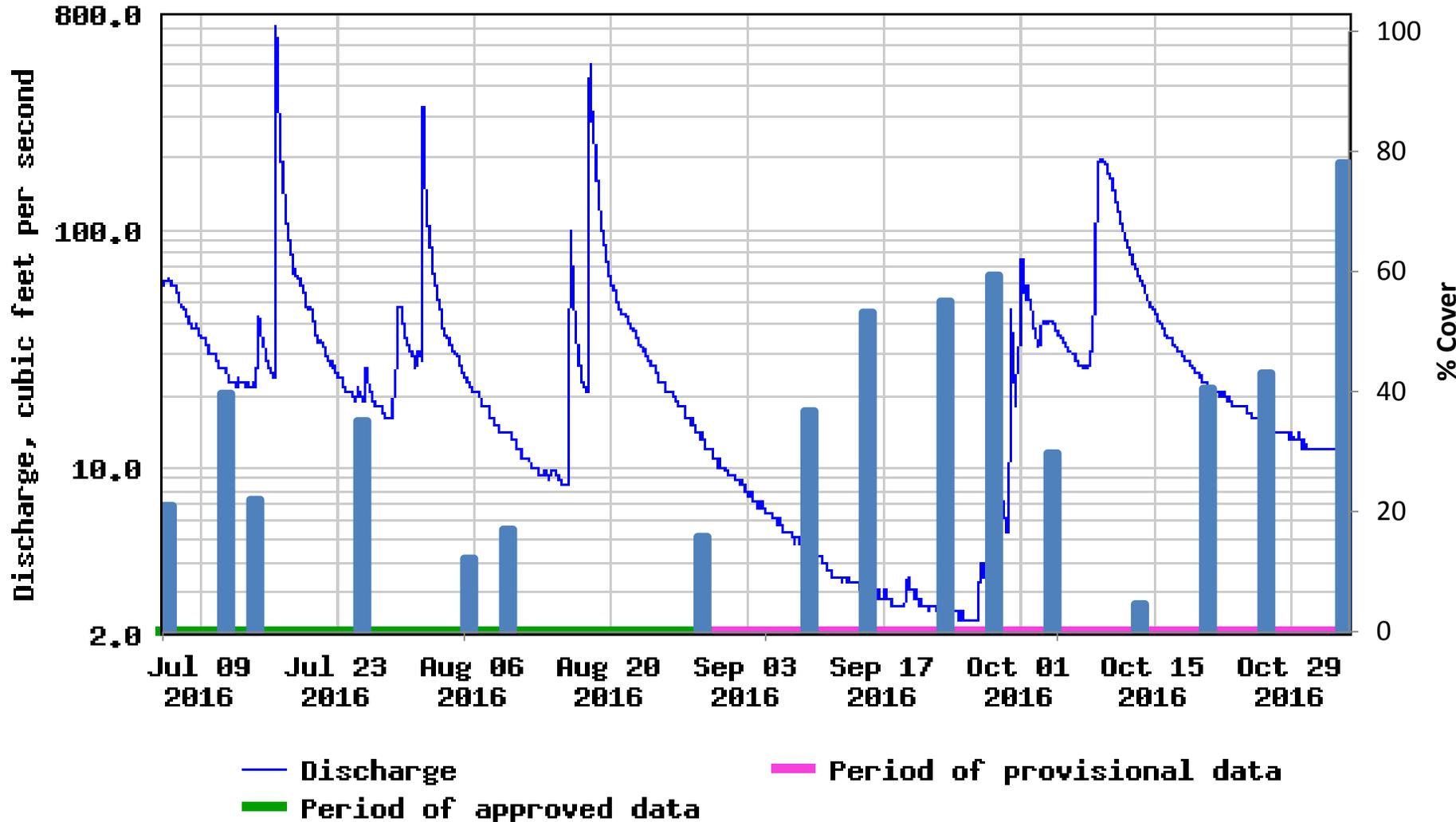
Transect Data: North Fork Shenandoah (Timberville)

1BNFS081.43

Number of site visits: 21
Transects completed: 16



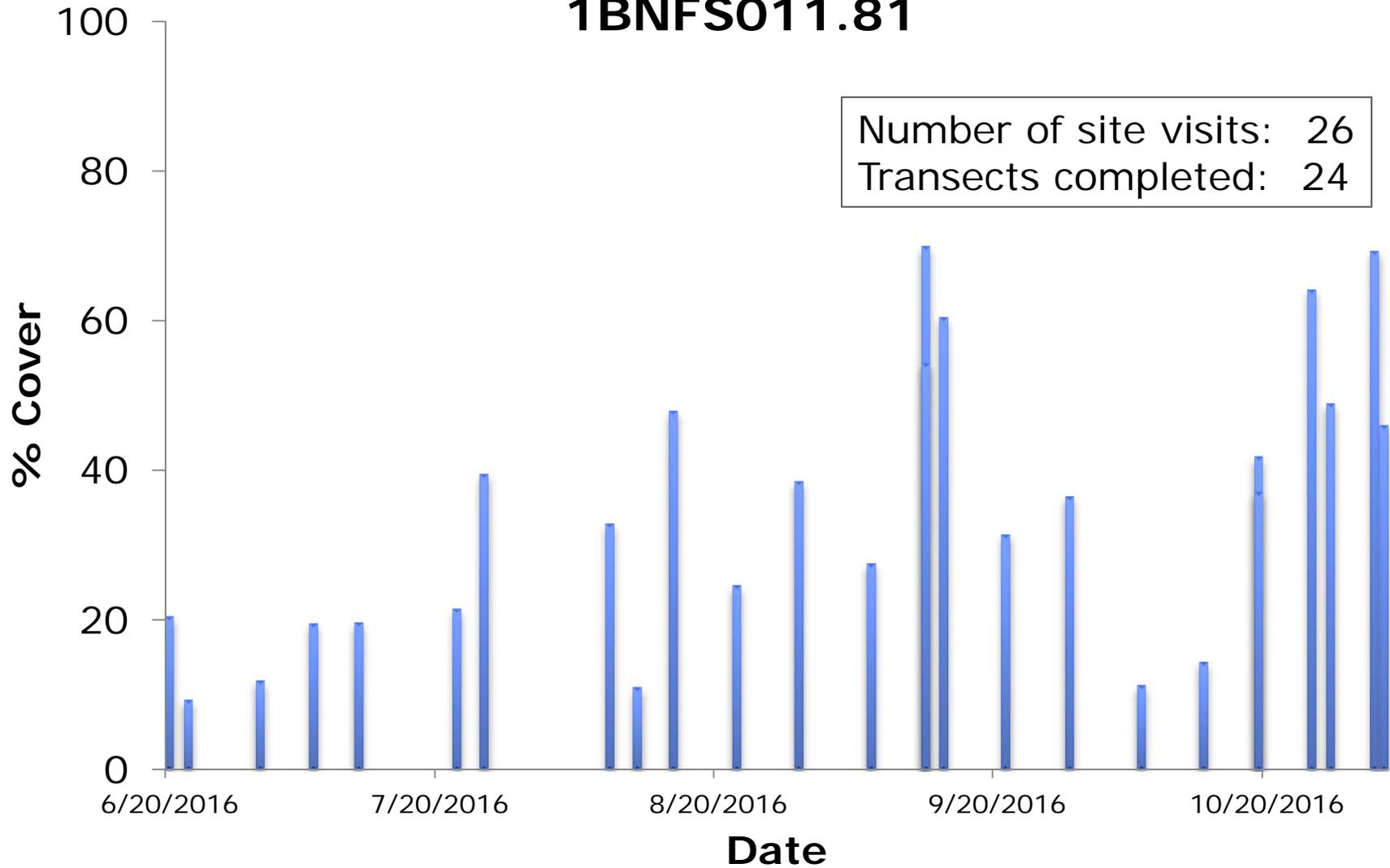
USGS 01632000 N F SHENANDOAH RIVER AT COOTES STORE, VA



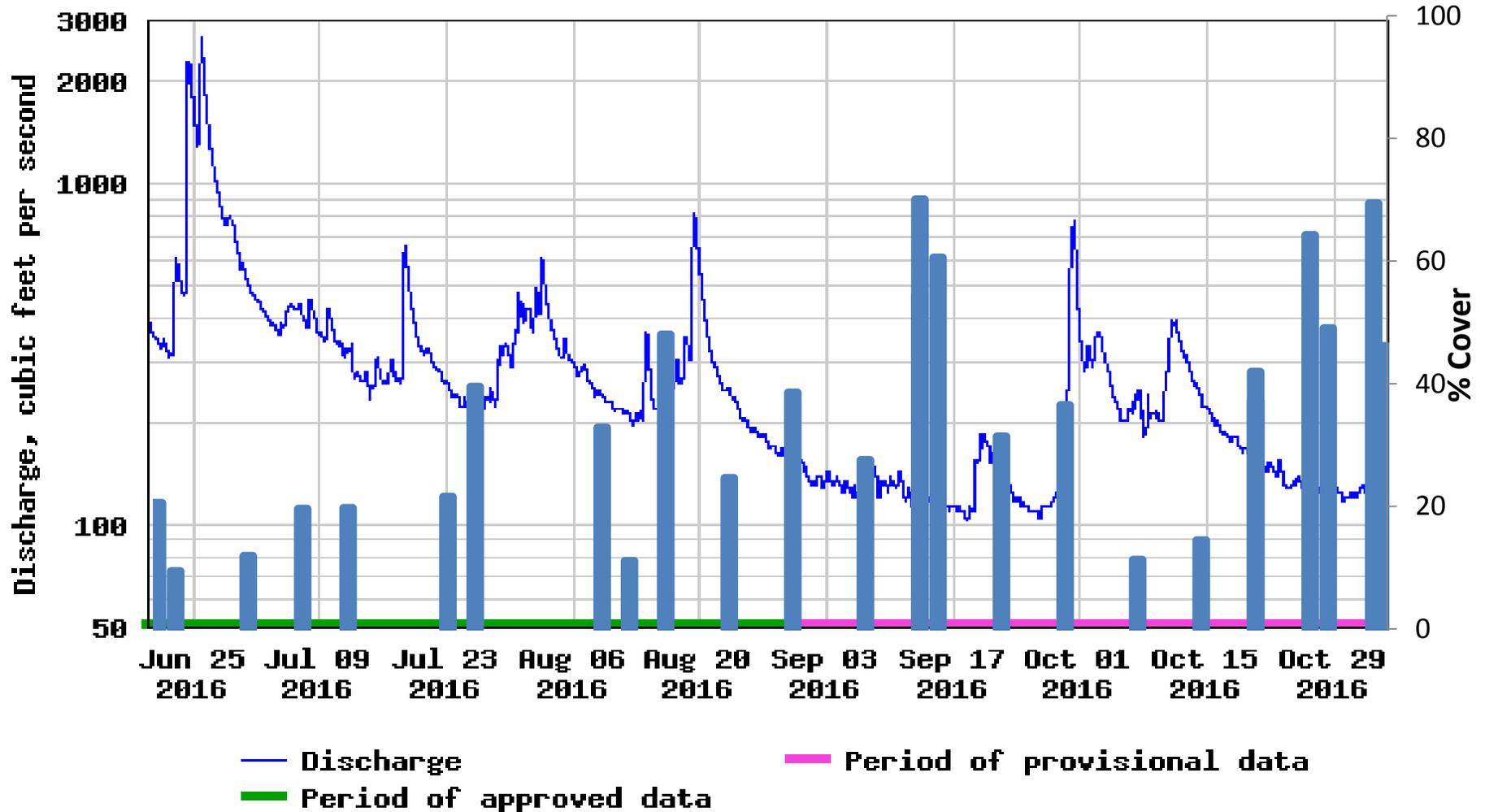
Transect Data: North Fork Shenandoah (Strasburg)

1BNFS011.81

Number of site visits: 26
Transects completed: 24



USGS 01634000 N F SHENANDOAH RIVER NEAR STRASBURG, VA



Field Methods Development: *General Observations and Conclusions from 2016 field season*

- Minimally trained staff can successfully visually estimate percent coverage at or below 10%
- Above 10%, the Quadrat method seems to be the more scientifically sound method for visual estimation of algal percent coverage

Field Methods Development: *General Observations and Conclusions from 2016 field season*

- However, given the potential for bias/error, and because impairment listing decisions are being considered, staff began looking for methods to **objectively and consistently** determine numeric algae densities.
- Montana DEQ: Estimation of algal density using **Benthic chlorophyll-a (Chl-a)** and **Ash Free Dry Mass (AFDM)** measurements



**Benthic Chlorophyll-a (Chl-a)
and Ash Free Dry Mass (AFDM)
collection using a Surber device**





Analytical Data Summary

- **15** Chl-a and AFDM data points collected this field season, only **5** results received to date
- Preliminary results - we are on the right track
 - good correlation between % cover estimates from the Quadrat method and lab analyses (AFDM and Chl-a)
- Must collect more data at a wide range of % cover, and complete regression analysis to find if correlations are statistically significant
 - Montana DEQ has a robust data set that shows strong relationships between algae %cover and both Chl-a and AFDM. **Does VA data corroborate this strong correlation?**

Field Methods Proposal – Three Stages

- **Stage 1:** visual observation for early indications of algae growth.
- **Stage 2:** Lateral transect (Quadrat method) to visually estimate algal percent coverage
- **Stage 3:** Numeric algae densities generated via chlorophyll-a/ ash-free dry mass samples.

Data Gaps and Considerations for 2017

- Collect % cover transect data from a second growing season
- Collect additional Chl-a and AFDM data over a wide range of percent cover to gain more confidence in selection of thresholds
- Resources: very limited personnel resources available to do additional monitoring in 2017

Next Steps:

- Further develop Monitoring Plan to define sample intervals
- Impairment threshold discussion once next season of field data is available
- Fall 2017, public webinar to present updated findings and recommendations to public (prior to publication of 2018 IR Guidance)

For more information:

<http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/ShenandoahAlgae.aspx>

Sandra Mueller

VADEQ, Water Monitoring and Assessment Program Manager

804-698-4324

Sandra.Mueller@deq.virginia.gov