Seneca Lake PURE WATERS Association

2019 Harmful Algal Bloom Results

Presentation by: **Bill Roege**

Final Results
May 11, 2020

Agenda

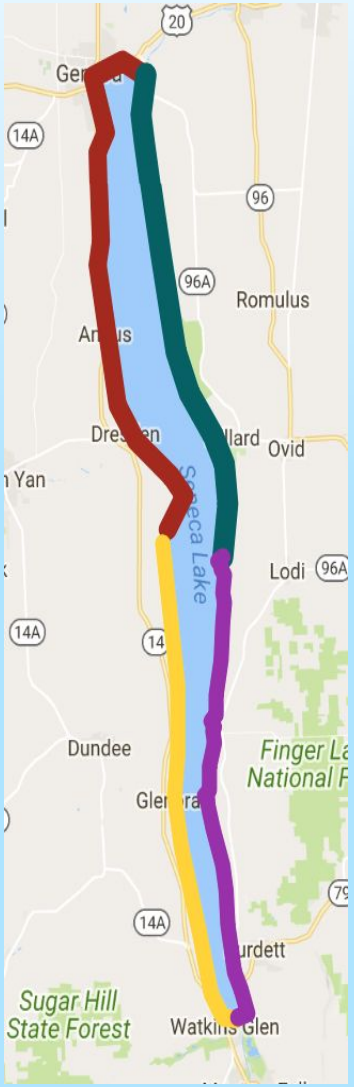
- Program history and statistics
- Cyanobacteria and definitions (toxins)
- Bloom experience this year
- Other lakes this year (tentative)
- Blooms over time
- Dock Monitoring Program
- Next year

Brief Program History

	# Volunteers	% Shoreline	# Reports	# Confirmed	High Toxins
2019	123	80%	149	130	34/40
2018	102	75%	48	39	36/39
2017	80	45%	60	50	22/50
2016	40		12	5	2/5
2015	Hot Line		9	5	1/5
2014	Hot Line		9	0	0/0

2019 Program Statistics

- 85 Zones—covered about 60 miles of shoreline
  - Used the same regional approach—Regional Coordinators
  - Averaged 85% coverage each week
- Differences between this year and last
  - 7-day a week coverage window vice just weekends
  - Focus on likely days
  - More volunteers and back ups in many zones
  - Surveyed into October
  - Encouraged higher sampling for FLI analysis (previously limited to DEC numbers)
  - DEC limits on toxin analysis (40 for HABs program)—special bottles
  - New reporting system, which included location data

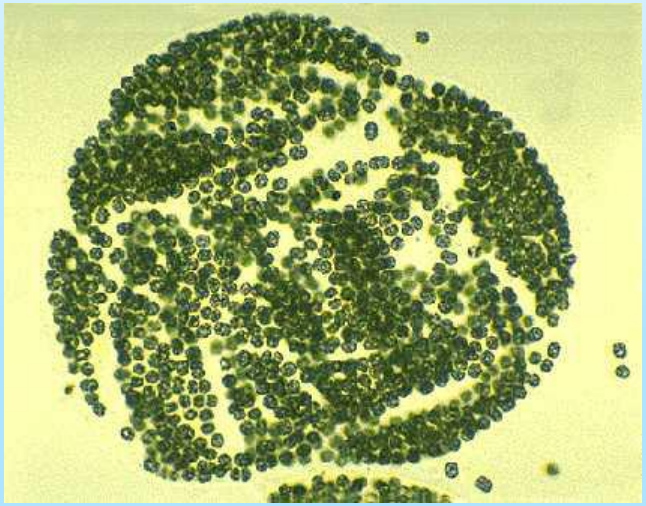


Cyanobacteria

- Primary types of Cyanobacteria in Seneca Lake
  - Microsystis
  - Dolichospermum
  - Pseudanabaena

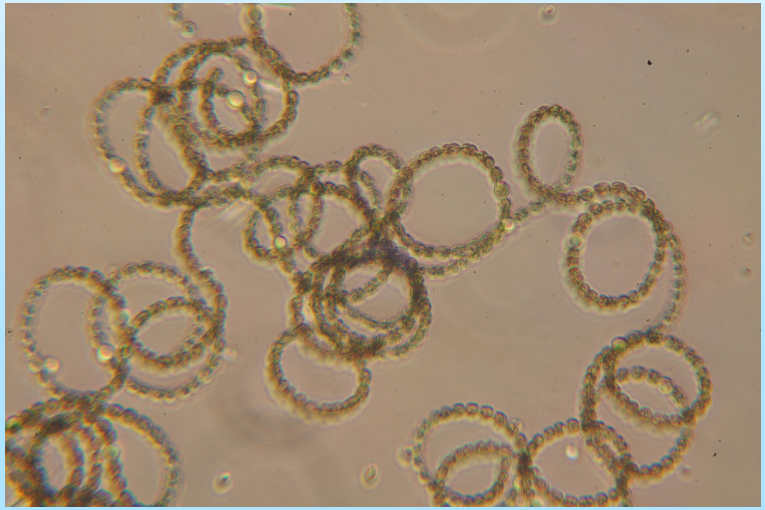
- Bloom: ≥ 25 µg/L of Blue-Green Chlorophyll
- High toxins: ≥ 20 µg/L (any toxin) for shoreline samples
  - Microcystin is the most common toxin and is the primary one tested

Microcystis



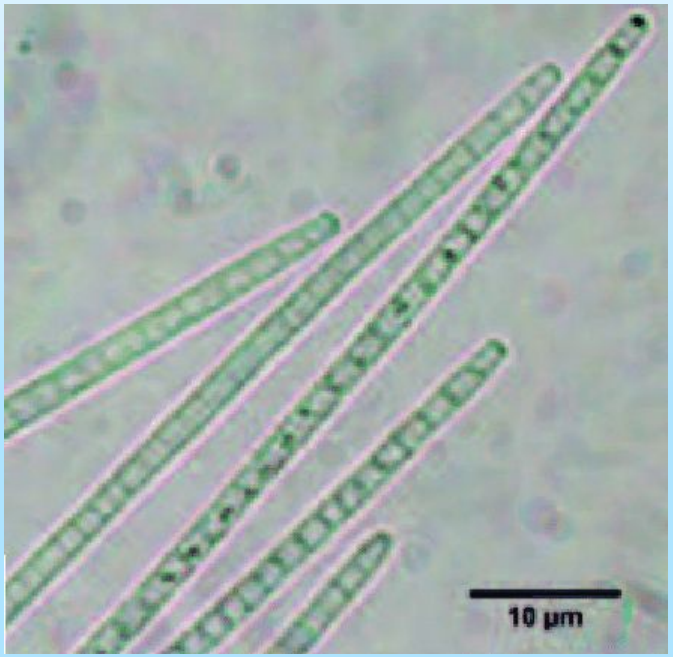
- Very small, but form colonies that are roughly circular
- Growth inhibited at less than 15 deg C
- Fastest growth at 32 deg C
- Most toxic at 20 deg C
- Produce microcystin (liver toxin) and endotoxins
- Love phosphorus
- May be resistant to glyphosates that kill competitors

Dolichospermum (formerly Anabaena)



- Cells form linear strands: straight, coiled or bent
- May appear brown due to gas vacuoles
- Has specialized cells that can convert dissolved nitrogen for cell growth
- Can move up and down in the water column
- Prefer high nitrogen or phosphorus concentration
- Can over winter in sediment
- Can produce toxins, usually when cell wall is breached

Pseudanabaena



- Linear colonies
- Likes 20-30 deg C temperature
- Not buoyant
- Tolerates lower light levels
- Appears to favor higher nitrogen concentrations over phosphorus
- Can be toxic – neuro- and hepatotoxins possible

Definitions

- **No Bloom**—sampled but test is < 25 µg/L or not sampled and photos are not conclusive
- **Suspicious**—not sampled, no photos to evaluate
- **Confirmed/Photo**—not sampled and photographic evidence is conclusive for a bloom
- **Confirmed**—sampled and lab test is ≥ 25 µg/L
- **High toxin**—Confirmed plus sent to UFI and toxin level over limit

2019 Seneca Lake Bloo...

2019 Confirmed and suspicious blooms found on Seneca Lake by Seneca Lake Pure Waters Association Volunteers.

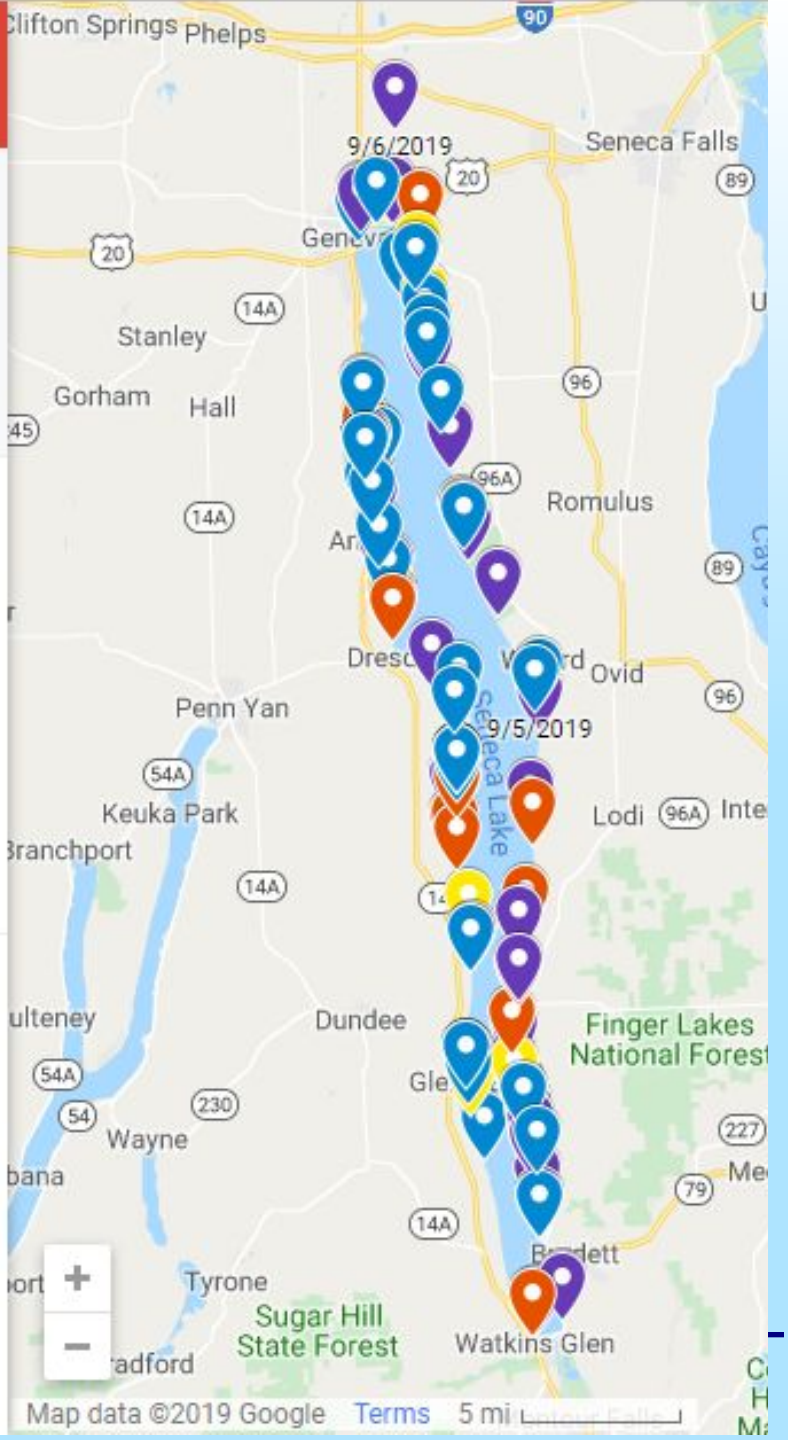
2 views

SHARE EDIT

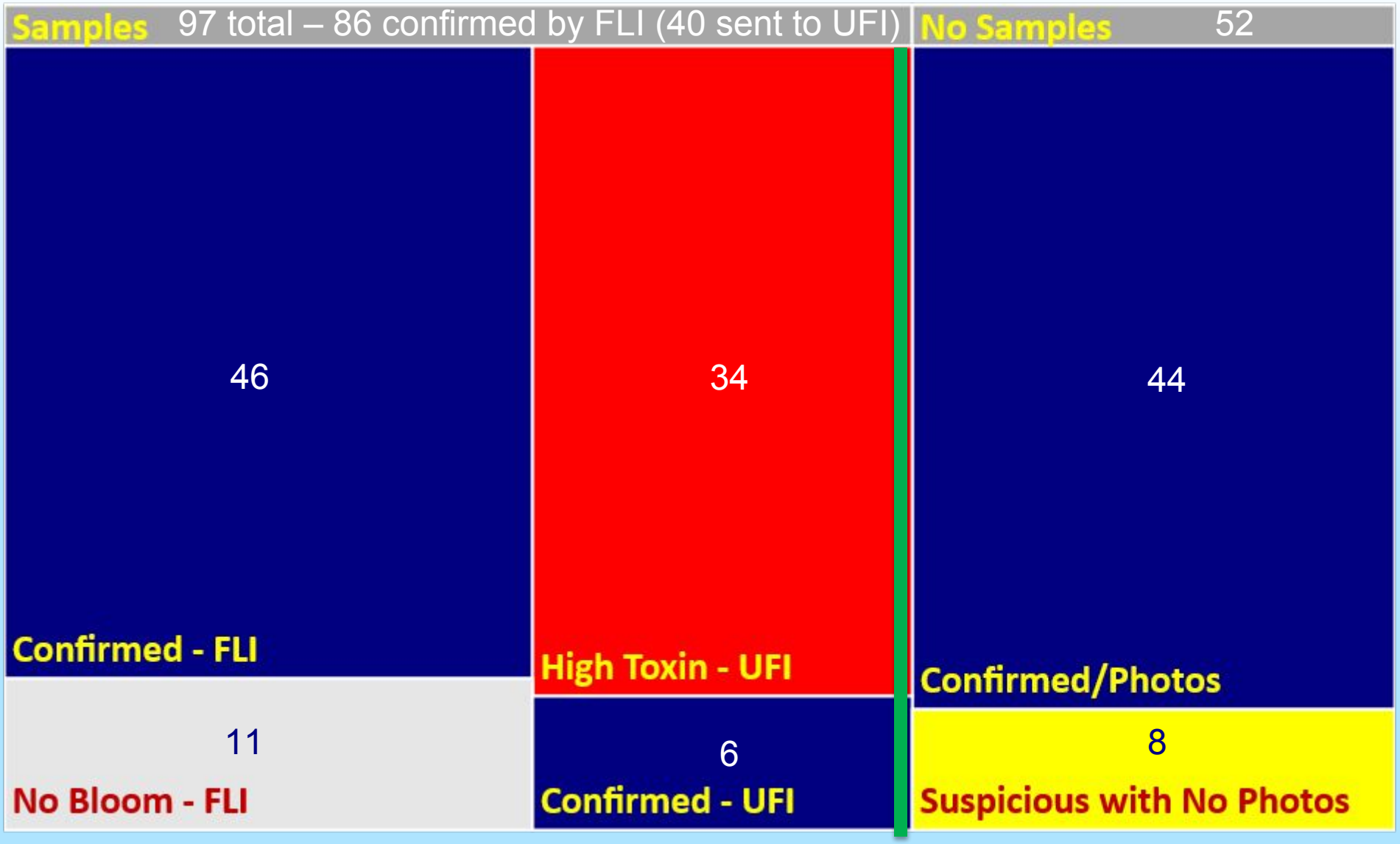
Map Data Master

- Confirmed
- Confirmed/Photo
- Confirmed with High Toxins
- Suspicious

Made with Google My Maps

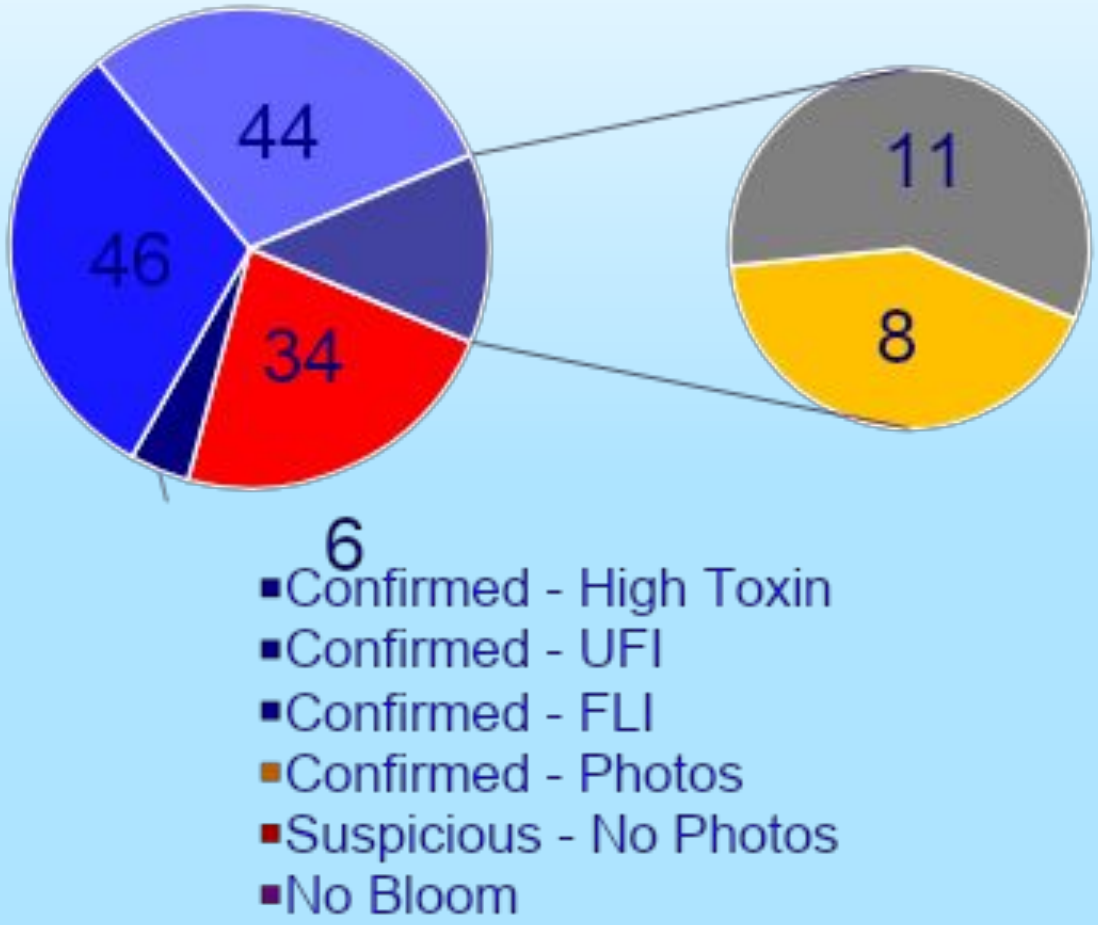


2019 Seneca Lake Bloom Reports



149 total valid bloom reports – 130 confirmed

Seneca Lake 2019 Sampling and Bloom Status



Bloom Summary by Region

Bloom Summary 2019	Northwest	Northeast	Southeast	Southwest	Total
Confirmed with High Toxins	10	7	7	10	34
Confirmed by Lab Results	19	10	16	7	52
Confirmed by Photo	19	13	4	8	44
Total	48	30	27	25	130

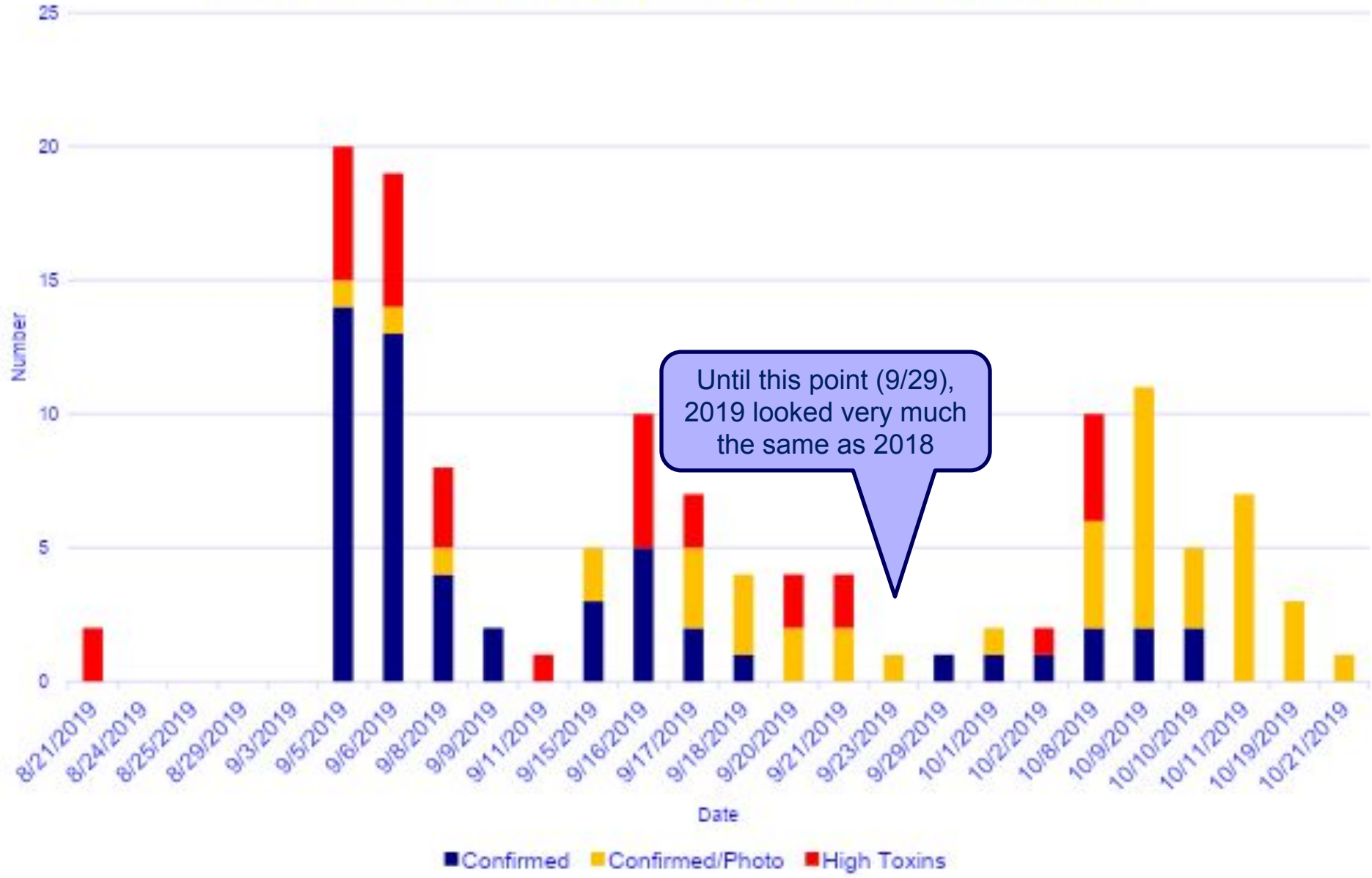
Toxin Samples	40	
High toxins (≥ 20 µg/L)	34	85.0%
Recreational Std (≥ 4 µg/L)	39	97.5%
Drinking Std (≥ 1 µg/L)	40	100.0%

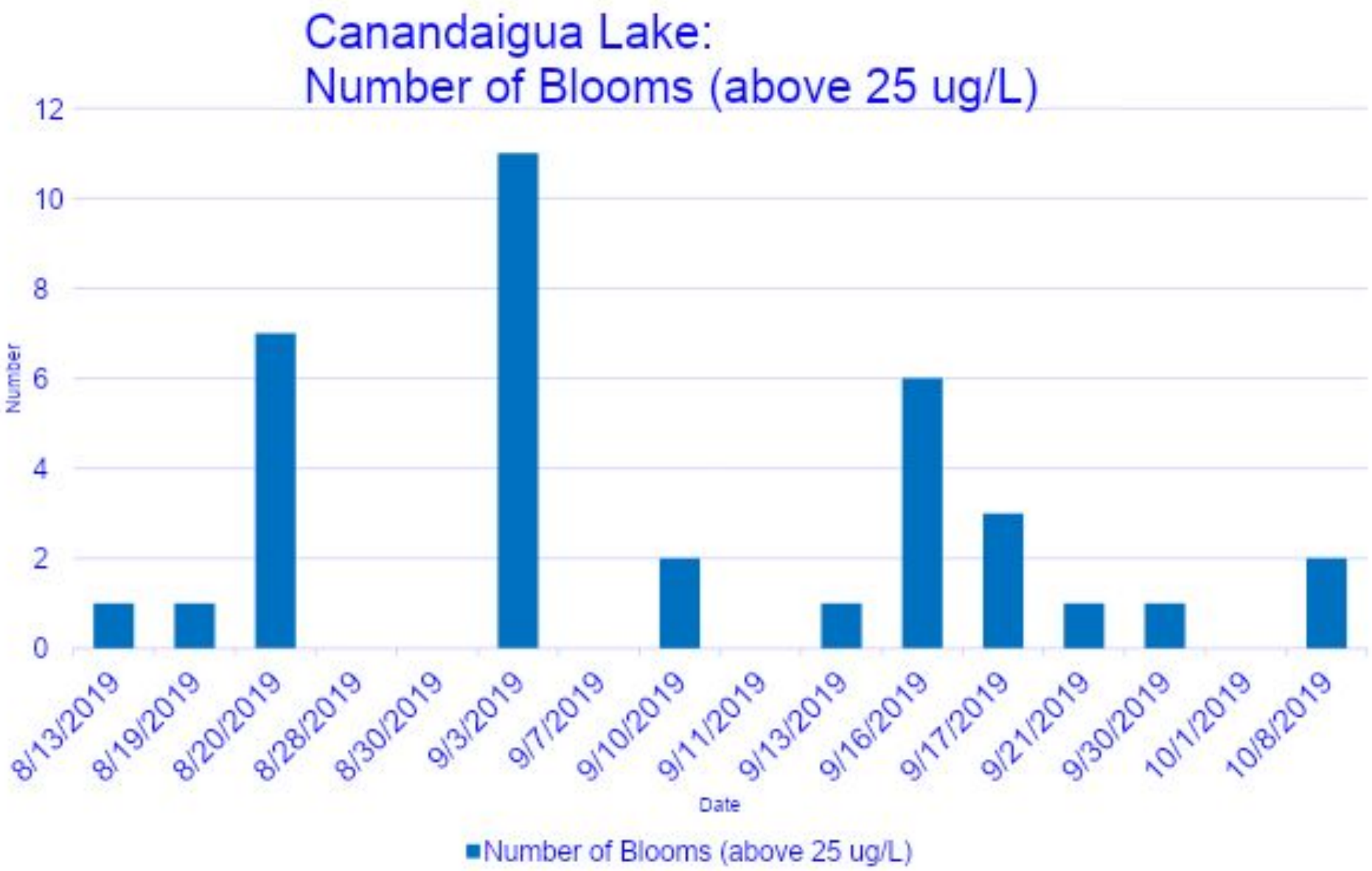
Toxins

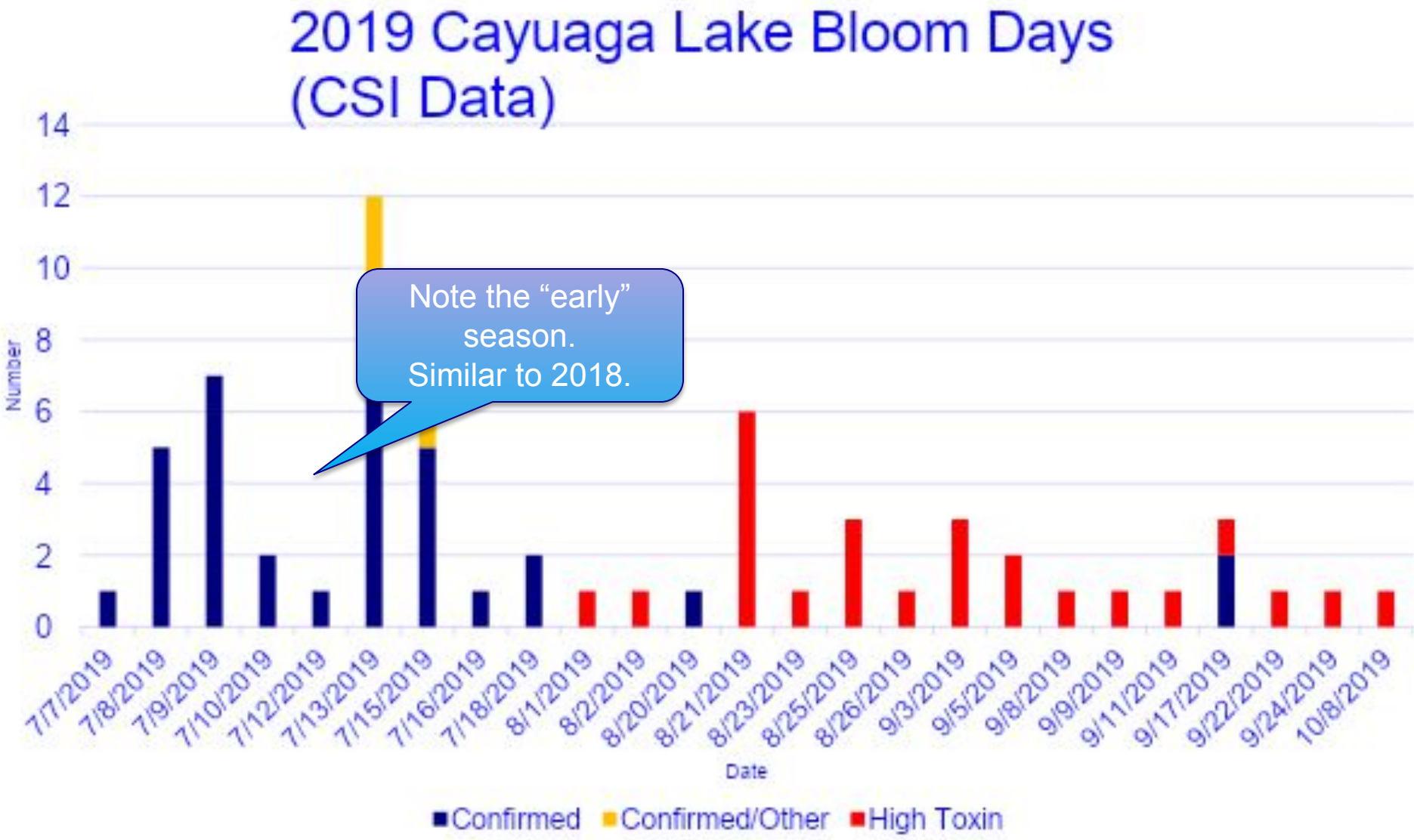
Toxin Samples	Northwest	Northeast	Southeast	Southwest	Total
Less than 4 µg/L	1	0	0	0	1
4 to less than 20 µg/L	0	0	4	1	5
20 to less than 75 µg/L	1	0	4	1	6
Greater than 75 µg/L	10	7	3	8	28
Total	12	7	11	10	40

Toxin Samples - Visual	Microcystis	Dolichospermum
Less than 4 µg/L	0	1
4 to less than 20 µg/L	0	5
20 to less than 75 µg/L	2	4
Greater than 75 µg/L	16	12
Total	18	22

2019 Seneca Lake Confirmed Blooms




Canandaigua Lake:
Number of Blooms (above 25 ug/L)
12
10
8
6
4
2
0
Number
8/13/2019
8/19/2019
8/20/2019
8/28/2019
8/30/2019
9/3/2019
9/7/2019
9/10/2019
9/11/2019
9/13/2019
9/16/2019
9/17/2019
9/21/2019
9/30/2019
10/1/2019
10/8/2019
Date
Number of Blooms (above 25 ug/L)


2019 Cayuaga Lake Bloom Days
(CSI Data)
Note the “early” season.
Similar to 2018.
Number
0
2
4
6
8
10
12
14
7/7/2019
7/8/2019
7/9/2019
7/10/2019
7/12/2019
7/13/2019
7/15/2019
7/16/2019
7/18/2019
8/1/2019
8/2/2019
8/20/2019
8/21/2019
8/23/2019
8/25/2019
8/26/2019
9/3/2019
9/5/2019
9/8/2019
9/9/2019
9/11/2019
9/17/2019
9/22/2019
9/24/2019
10/8/2019
Date
Confirmed
Confirmed/Other
High Toxin

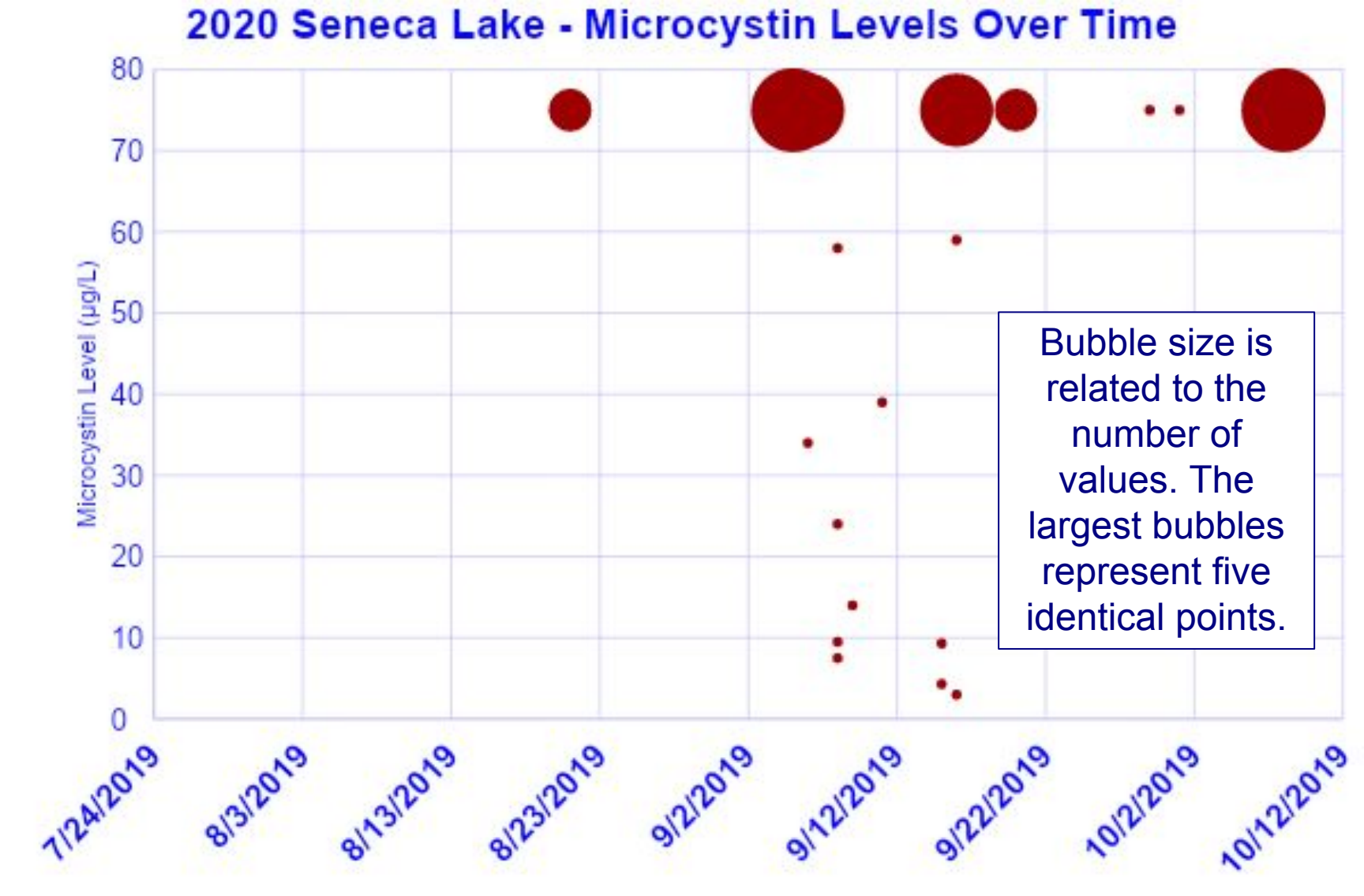
Keuka Lake

- Keuka just started their program this year
- Not too many sightings during the main season
  - Mainly 9/17-9/21
- However, they also have photos and samples of blooms into October
  - October 5, 9, 10, 11,19 and 21!
  - Samples taken on 5th, 9th, 19th and 21st
  - Results appear to confirm blooms

Cyanobacteria Dominance Over Time

August	September 5-17	September 17 and beyond
Microcystis dominant in both samples.	**Dolichospermum** dominant in 50 of 65 samples. 14 of 37 samples on 9/5 and 9/6 were Microcystis dominant. Next Microcystis dominant sample was on 9/17.	**Microcystis** dominant in all 18 samples.
Both high toxins.	20 of 26 samples sent to UFI were high toxin. All 6 of the non-high toxin samples were **Dolichospermum** dominant	Ten of 10 samples sent to UFI were high toxin.
Pseudanabaena present in one sample.	**Pseudanabaena** was 3rd or not seen during this period.	**Pseudanabaena** first beat out Dolicospermum for 2nd place on 9/20. Then it was always second after 9/21 as Dolichospermum phased out.

It appears the main Cyanobacteria types have different life cycles in Seneca Lake


2020 Seneca Lake - Microcystin Levels Over Time
Microcystin Level (µg/L)
80
70
60
50
40
30
20
10
0
7/24/2019
8/3/2019
8/13/2019
8/23/2019
9/2/2019
9/12/2019
9/22/2019
10/2/2019
10/12/2019
Bubble size is related to the number of values. The largest bubbles represent five identical points.

Dominant Species by Region

Cyanobacteria Dominance 2020 in Toxin Samples	Northwest	Northeast	Southeast	Southwest	Total
Microcystis Dominant	8	5	2	3	18
Dolichospermum Dominant	4	2	9	7	22
Total	12	7	11	10	40

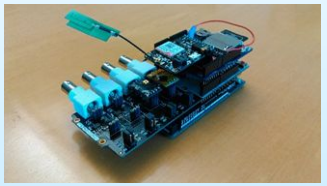
Dock Station Project

- How much do weather and water conditions vary around the lake?
- Do certain local conditions correlate with HAB sightings?
- HABs may be very transient, persistent visual HAB searches might lend a clue (perhaps most promising aspect)
- Weekly near shore water sampling to see if there is variability geographically and over time (compare with mid-lake CSLAP and HWS data)
- Provide funding for lab and research time at FLI and HWS

Equipment

Solar weather station
Base station indoors—internet capable

Time-lapse camera
SD Card, battery operated

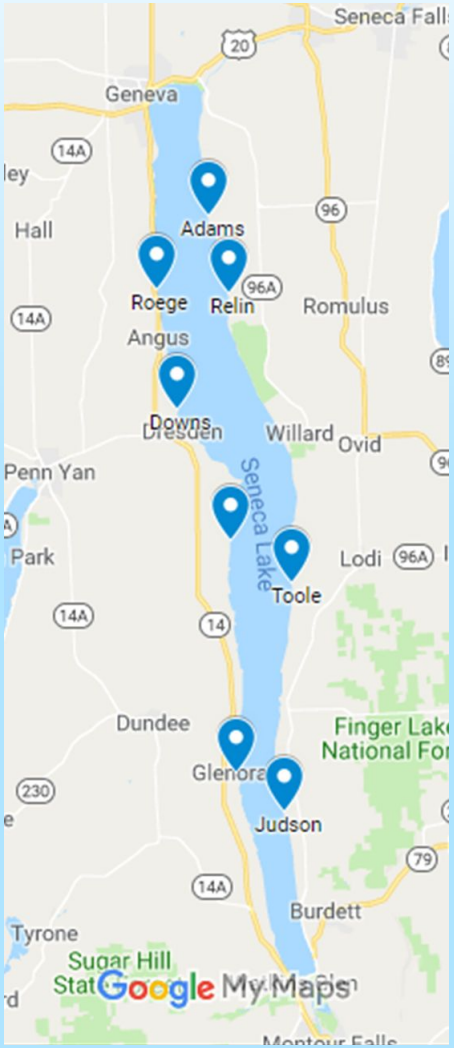


Experimental data logger with
water temperature and dissolved oxygen sensor
Solar powered (not in picture to left)

Water temperature sensor
Special “Bluetooth” data download

Eight Locations Around the Lake

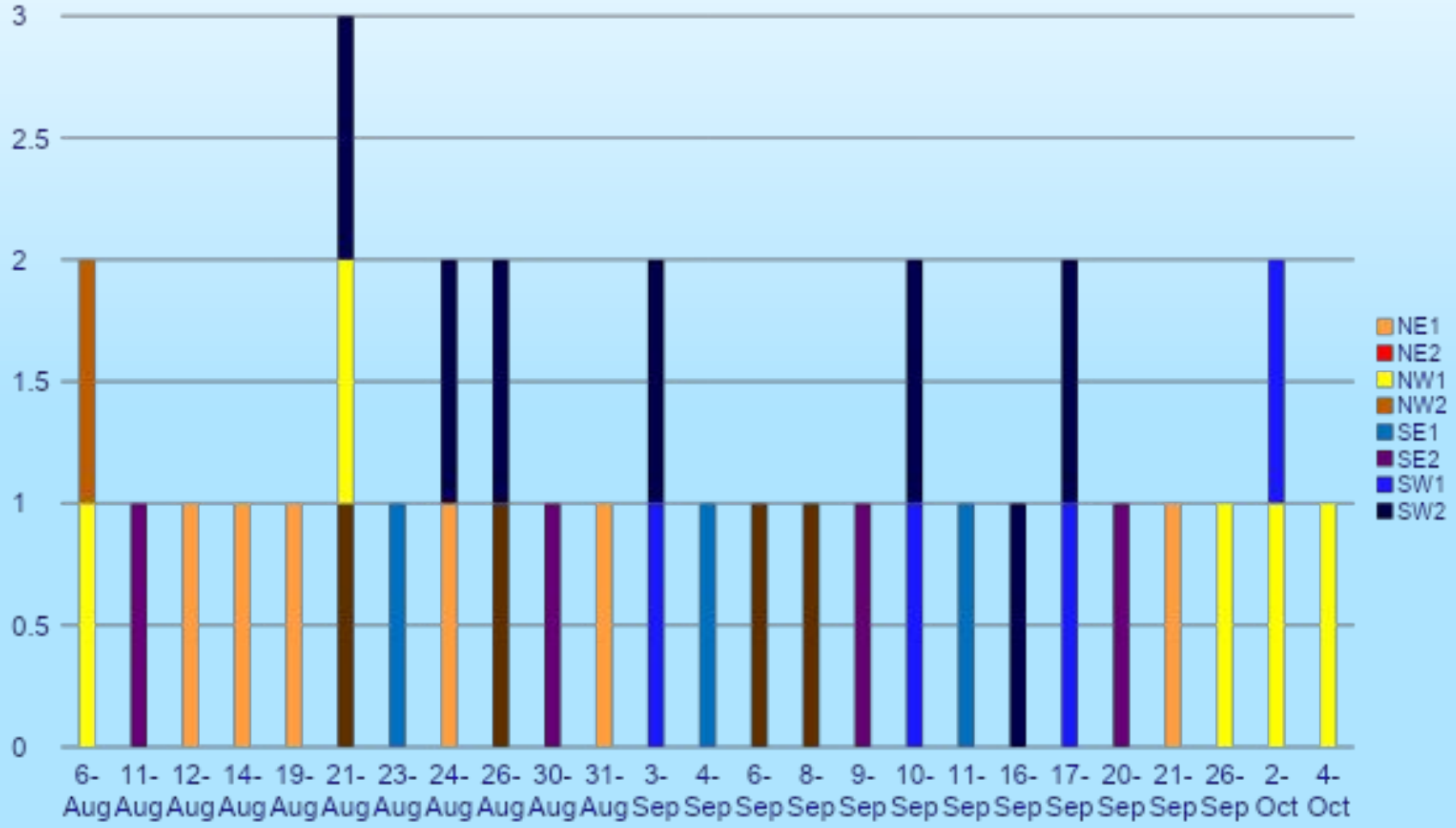
- Dock stations at 8 locations around the lake
- Water sampling at 4 of those locations, one in each quadrant
- One location testing a dissolved oxygen sensor



Bloom Results

- All locations found multiple blooms via the camera
- There were 34 total blooms detected (one camera malfunctioned in mid-August)
- Cameras saw blooms on 12 days in August that volunteers did not report blooms
- Camera saw blooms on 15 days in September and October that the local volunteer did not see them
- Many other days volunteers saw blooms when the camera did not detect them

Dock Blooms


3
2.5
2
1.5
1
0.5
0
6-Aug
11-Aug
12-Aug
14-Aug
19-Aug
21-Aug
23-Aug
24-Aug
26-Aug
30-Aug
31-Aug
3-Sep
4-Sep
6-Sep
8-Sep
9-Sep
10-Sep
11-Sep
16-Sep
17-Sep
20-Sep
21-Sep
26-Sep
2-Oct
4-Oct
NE1
NE2
NW1
NW2
SE1
SE2
SW1
SW2

Hot Spots

- While there could be observations bias, there were “hot spots” at the following locations
  - Near the mouths of Kashong, Keuka Outlet, Big Stream and a small stream south of Long Point
  - Sampson marina

Take Aways

- The vast majority of blooms are highly toxic
- Correlations with weather and water data are ongoing
  - We have a lot more data this year to compare
- Seneca does not seem to have the earlier season some other lakes have
- Blooms are not necessarily concentrated in one part of the lake, although on some days they are sporadic in a certain area
- The October blooms were a surprise
  - Need to investigate potential reasons (e.g., calm and sunny with lots of bacteria still in the water column and temps still around 16 deg C and below)
  - Other lakes have the same experience

Future

- Situation
  - We are able to find a lot of blooms with good certainty and communicate them quickly
  - DEC will not be sponsoring toxin testing
- New Focus Areas—Fill in where we have less knowledge
  - Drinking water focus – need toxin testing (must pay) and a strategy
  - Open water blooms – find a way to get a better handle on them and relationship to shore blooms
  - More shoreline sampling at hot spots?
  - Finding out more about currents (do blooms move with current and winds)
  - Better October bloom coverage (and sampling)
- Research needed on Seneca to help understand our lake
  - Fund a summer intern and research at HWS/FLI

Next Year

- Continue shoreline monitoring program
  - Keep the ArcGIS real-time map and spreadsheet on our website
  - Add more real-time notifications (e.g., Twitter, FB)
  - Volunteers report all NO BLOOM surveys
  - Focus more on drinking water and recreational limits
  - DEC not funding toxin testing, so we have to decide whether to fund testing for regular shoreline samples
- Looking into better mid-lake coverage
  - Now that we are very good at shoreline monitoring, it is time to look further from shore
  - Pilot program being developed

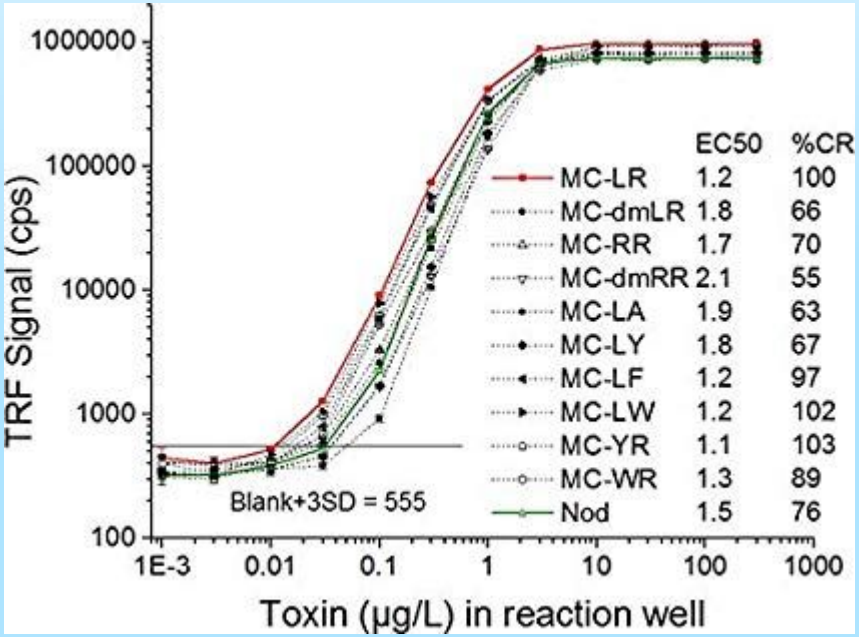
Next Year (cont)

- Continue the dock monitoring program
  - Would like to fund additional research and a summer student
  - Try and fund cellular-enabled cameras and monitor them so we can respond for potential observation and sampling
  - If funding permits, we will continue the weekly water quality sampling effort
- Signs

New Toxin Focus

- Until now, the focus has been on the presence of blooms, but we want to investigate toxins more
  - Answer the question: **“When is it safe to go in the water again?”**
  - Leverage the dock monitoring program and hot spots
  - Multiple toxin tests through the bloom cycle, and after
  - Canandaigua focusing on toxins in “clear” water
- Drinking water focus
  - Try out new toxin field test kits to determine what we might recommend to private households that draw water from or recreate in the lake

“5 Strands” Toxin Test Kit



Three kits are $86 on Amazon

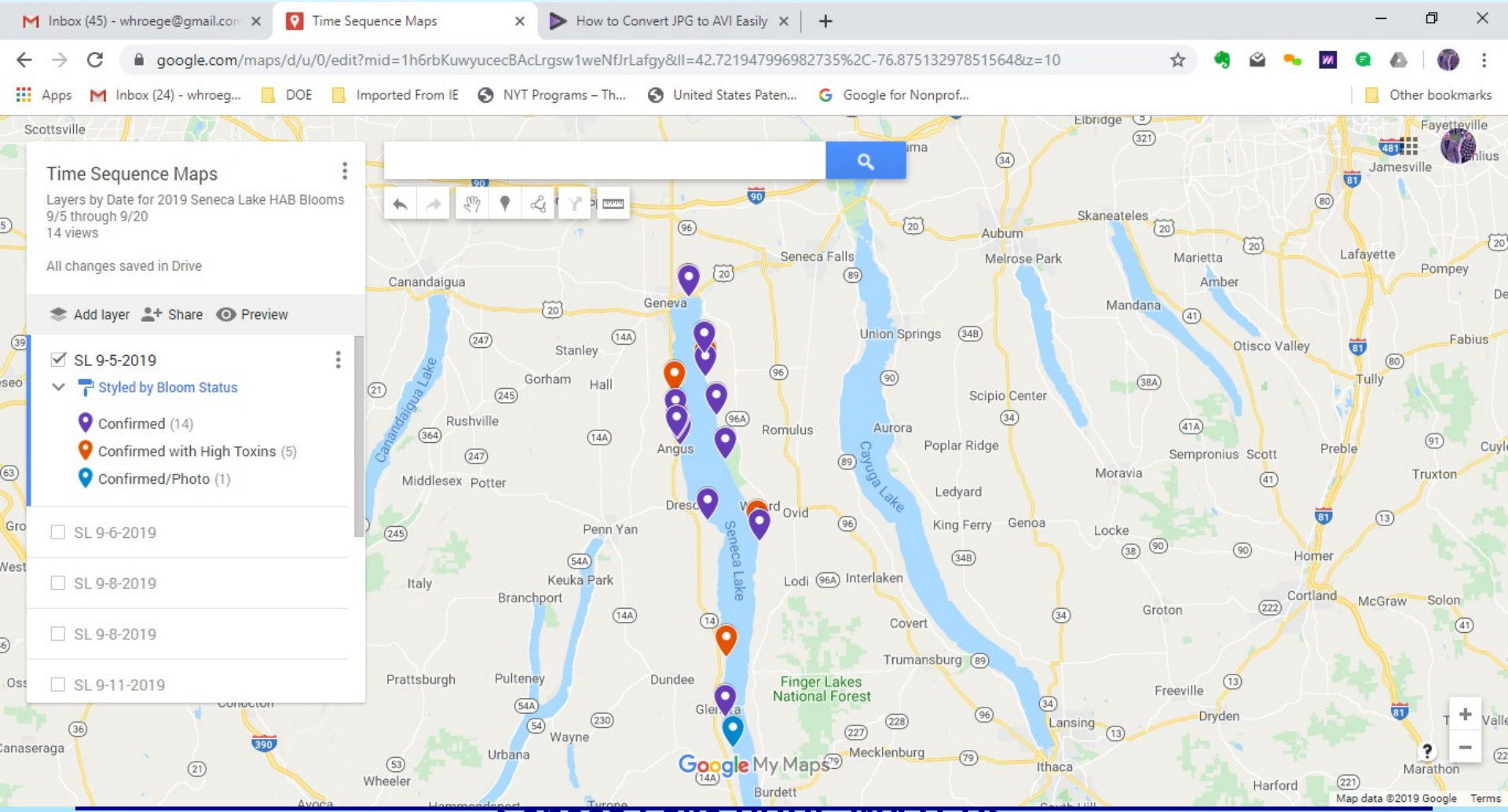
Tests for many Microsystin-based toxins at concentrations down to 0.1 µg/L in 15 minutes

Closing

- Volunteers did a great job
- Hope they come back and new people get involved
- Need volunteers to help manage the program and get the word out
  - Regional Coordinators and assistants
  - Data collection and quality control
  - Communications and education
- Will communicate more results throughout the winter as they emerge

Questions

September 5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Time Sequence Maps
How to Convert JPG to AVI Easily
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Google for Nonprof...
Other bookmarks
Time Sequence Maps
Layers by Date for 2019 Seneca Lake HAB Blooms
9/5 through 9/20
14 views
All changes saved in Drive
Add layer
Share
Preview
SL 9-5-2019
Styled by Bloom Status
Confirmed (14)
Confirmed with High Toxins (5)
Confirmed/Photo (1)
SL 9-6-2019
SL 9-8-2019
SL 9-8-2019
SL 9-11-2019
Scottsville
Canandaigua
Geneva
Seneca Falls
Auburn
Skaneateles
Jamesville
Fayetteville
Marietta
Lafayette
Pompey
Amber
Mandana
Union Springs
Otisco Valley
Fabius
Tully
Stanley
Gorham
Hall
Rushville
Angus
Romulus
Aurora
Scipio Center
Poplar Ridge
Semponius
Scott
Preble
Moravia
Truxton
Ledyard
Middlesex
Potter
Penn Yan
Ovid
King Ferry
Genoa
Locke
Homer
Italy
Keuka Park
Branchport
Lodi
Interlaken
Cortland
McGraw
Solon
Groton
Covert
Trumansburg
Prattsburgh
Pulteney
Dundee
Finger Lakes National Forest
Freeville
Dryden
Lansing
Wayne
Urbana
Mecklenburg
Ithaca
Marathon
Wheeler
Burdett
Harford
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Cayuga Lake
Canandaigua Lake
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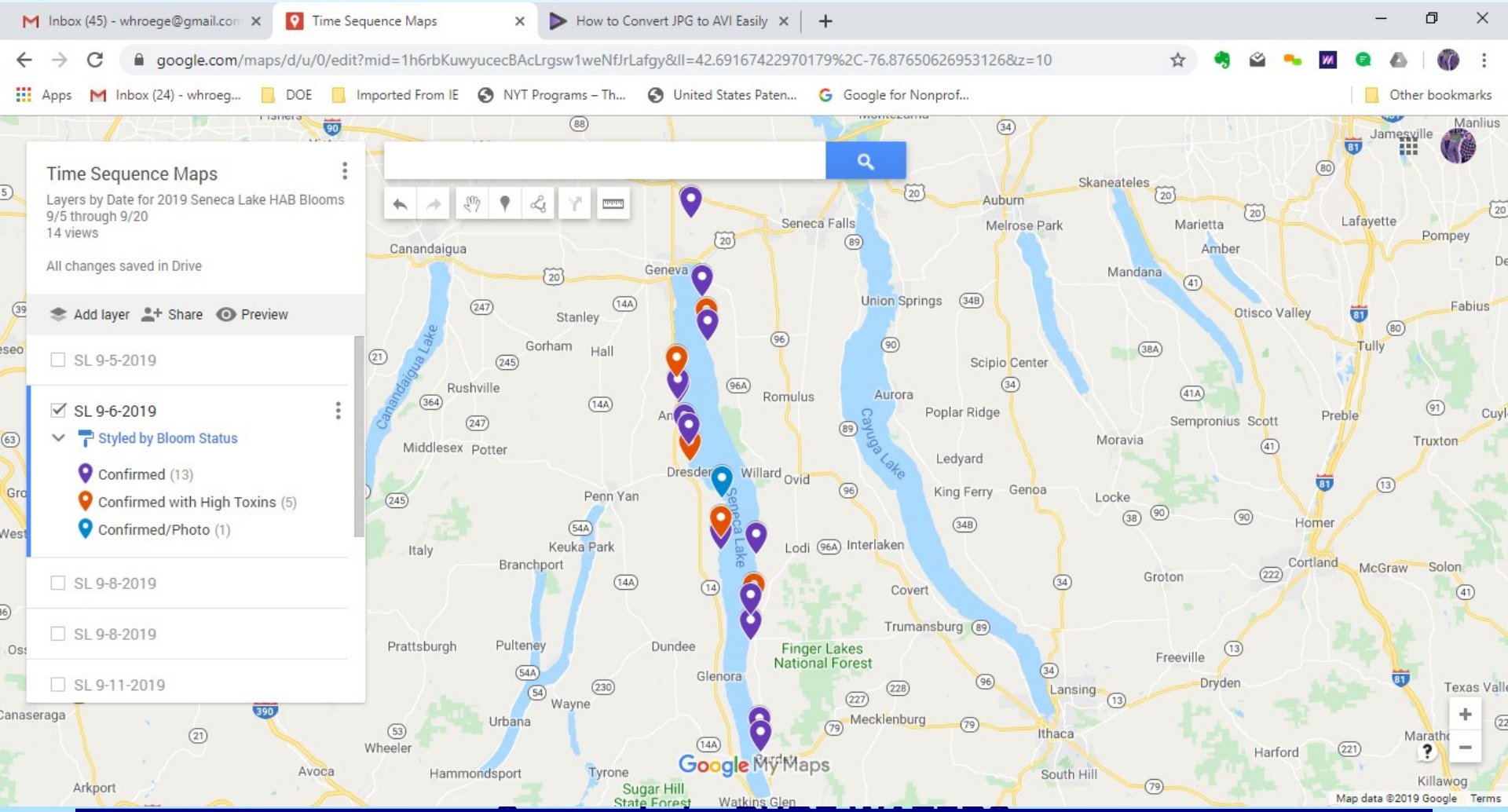
September 6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Seneca Falls
Geneva
Canandaigua
Auburn
Skaneateles
Union Springs
Cayuga Lake
Seneca Lake
Finger Lakes National Forest
Ithaca
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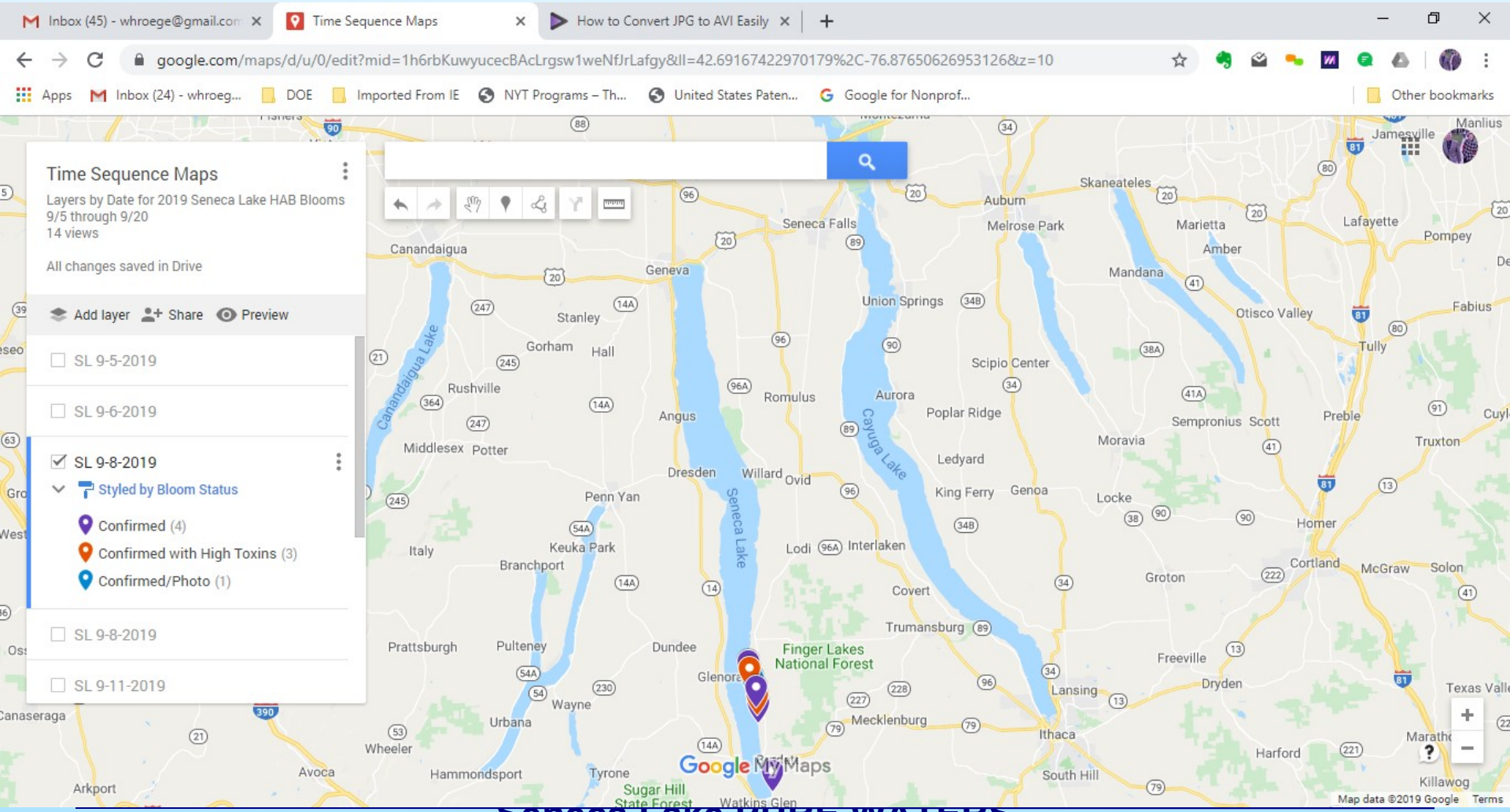
September 8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Confirmed/Photo (1)
SL 9-8-2019
SL 9-11-2019
Seneca Falls
Canandaigua
Geneva
Auburn
Skaneateles
Union Springs
Scipio Center
Romulus
Aurora
Poplar Ridge
Ledyard
Dresden
Willard
Ovid
King Ferry
Genoa
Penn Yan
Keuka Park
Branchport
Italy
Lodi
Interlaken
Covert
Trumansburg
Groton
Finger Lakes National Forest
Dundee
Prattsburgh
Pulteney
Wayne
Urbana
Wheeler
Hammondsport
Tyrone
Sugar Hill State Forest
Watkins Glen
Mecklenburg
Ithaca
Lansing
Freeville
Dryden
Cortland
Homer
Locke
Moravia
Ovid
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Cayuga Lake
Canandaigua Lake
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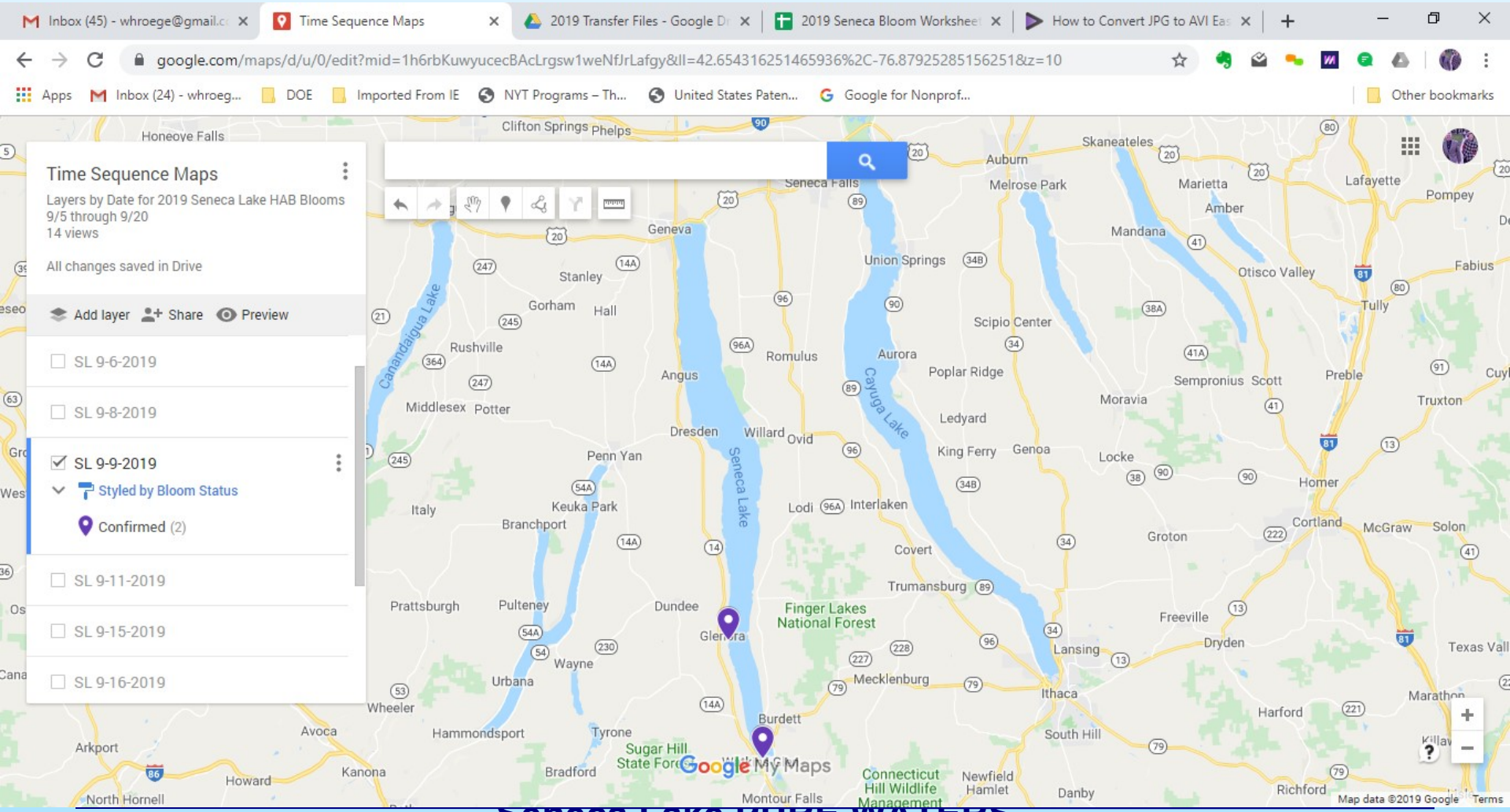
September 9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Confirmed (2)
SL 9-11-2019
SL 9-15-2019
SL 9-16-2019
Seneca Lake
Cayuga Lake
Canandaigua Lake
Finger Lakes National Forest
Connecticut Hill Wildlife Management
Sugar Hill State Forest
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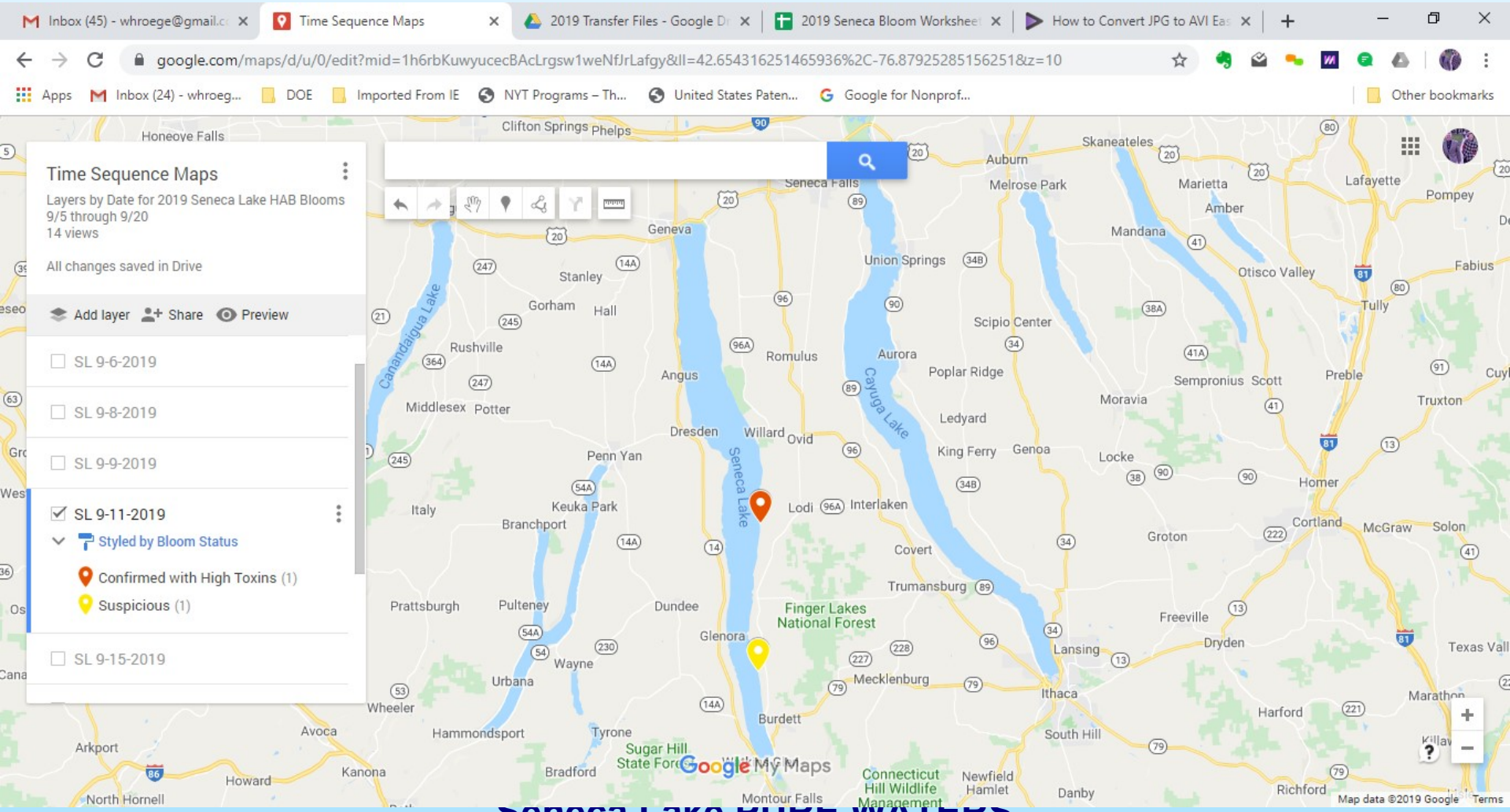
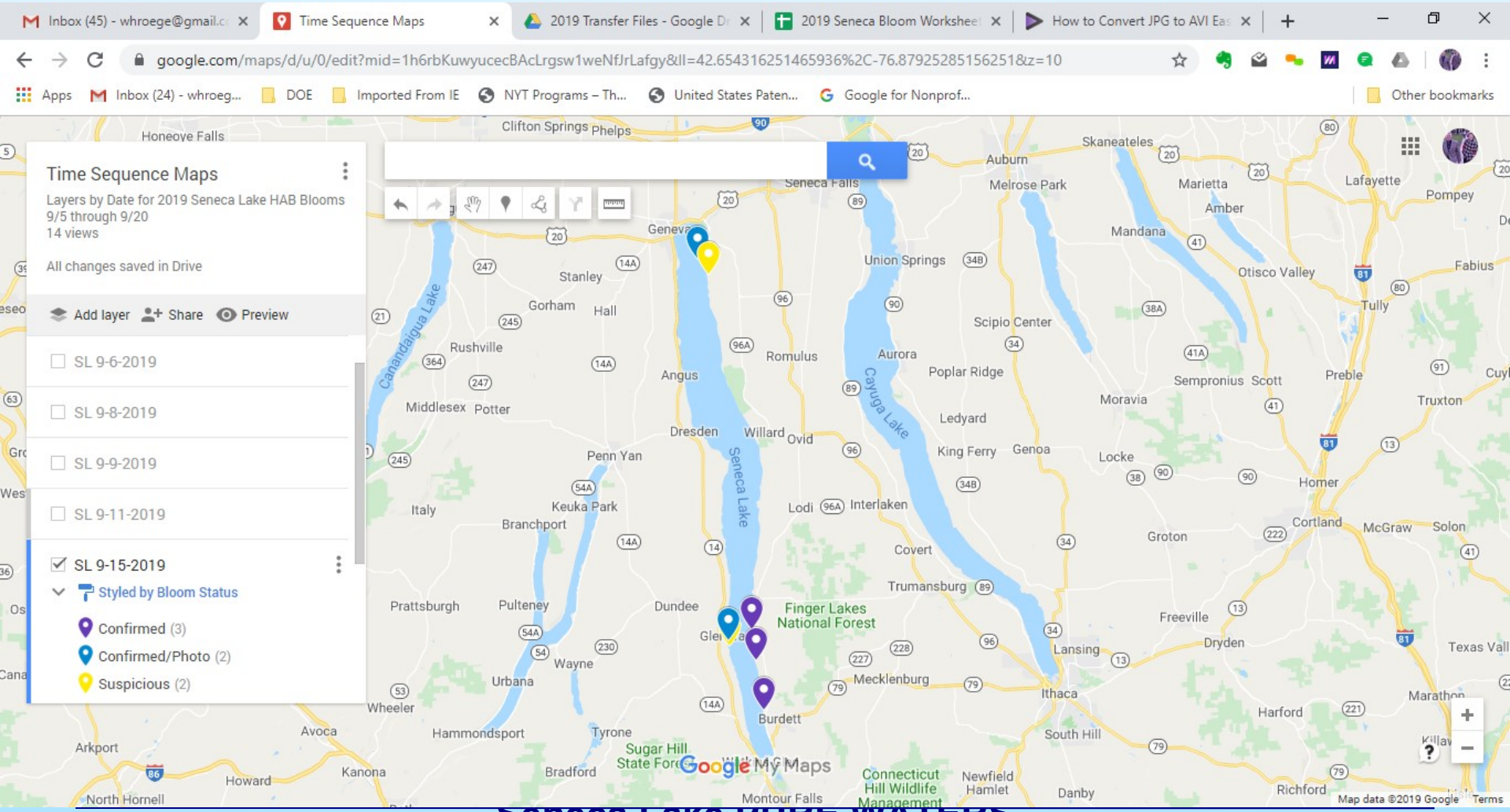
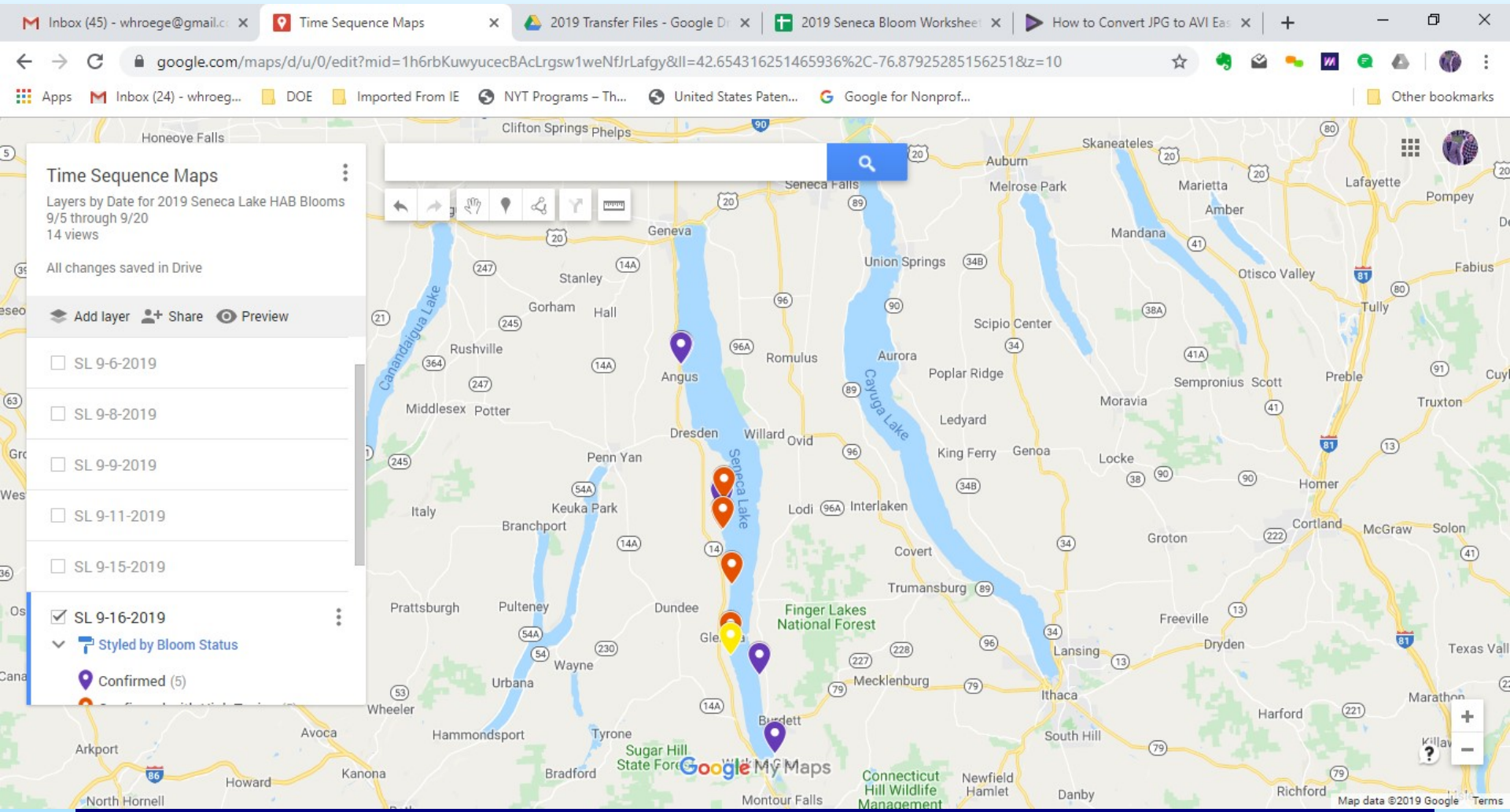
September 11



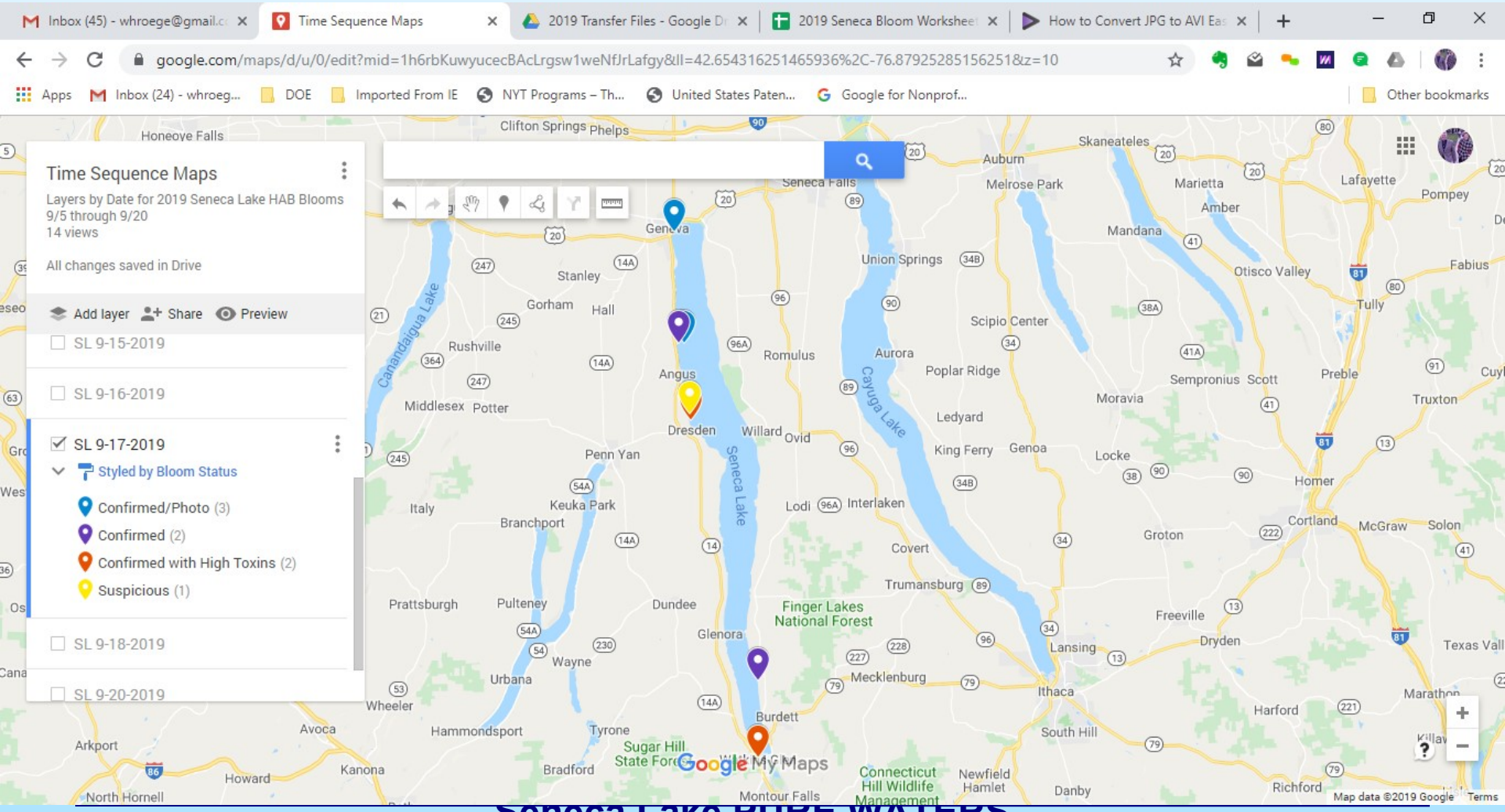
September 15



September 16



September 17



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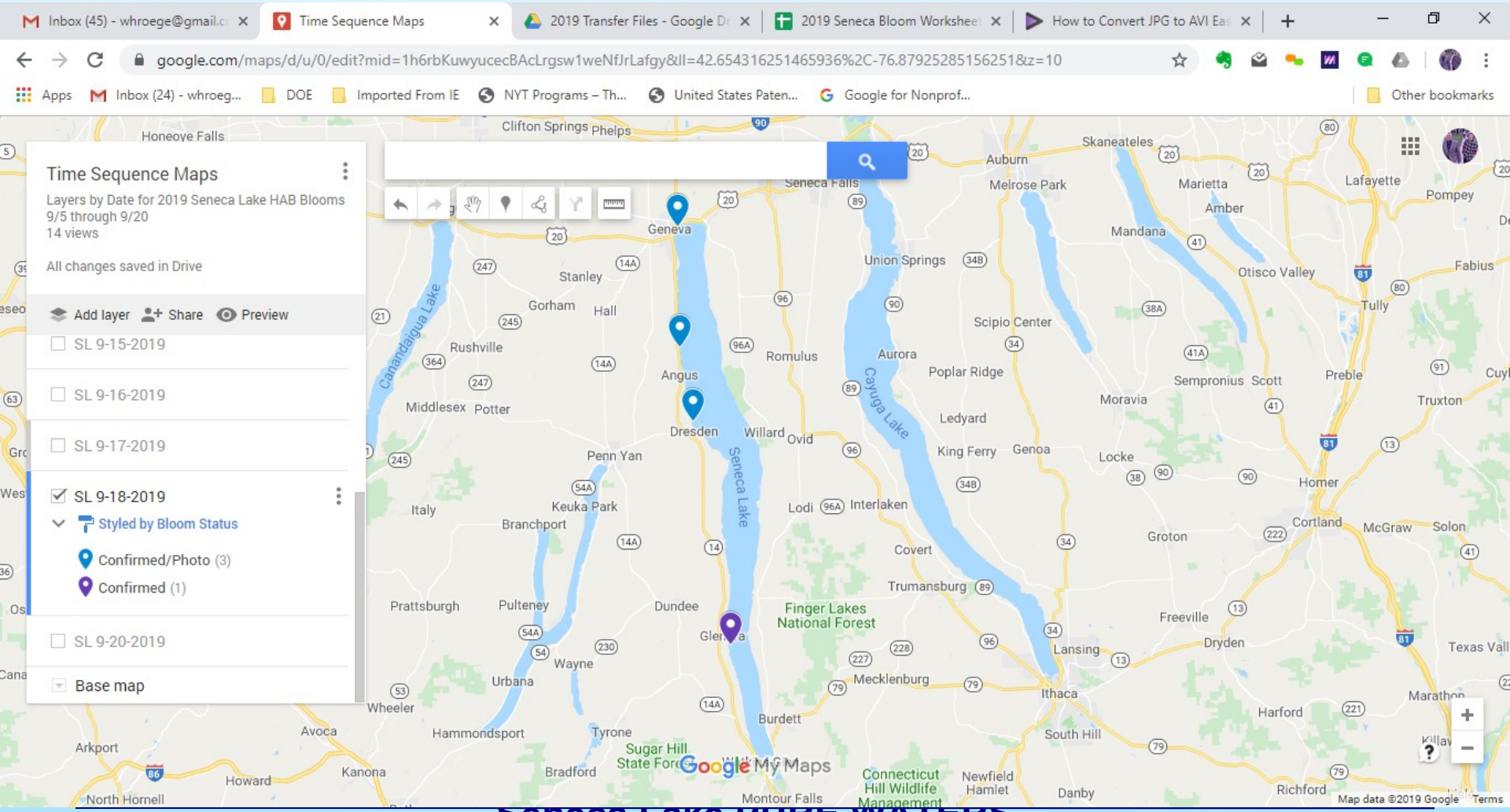

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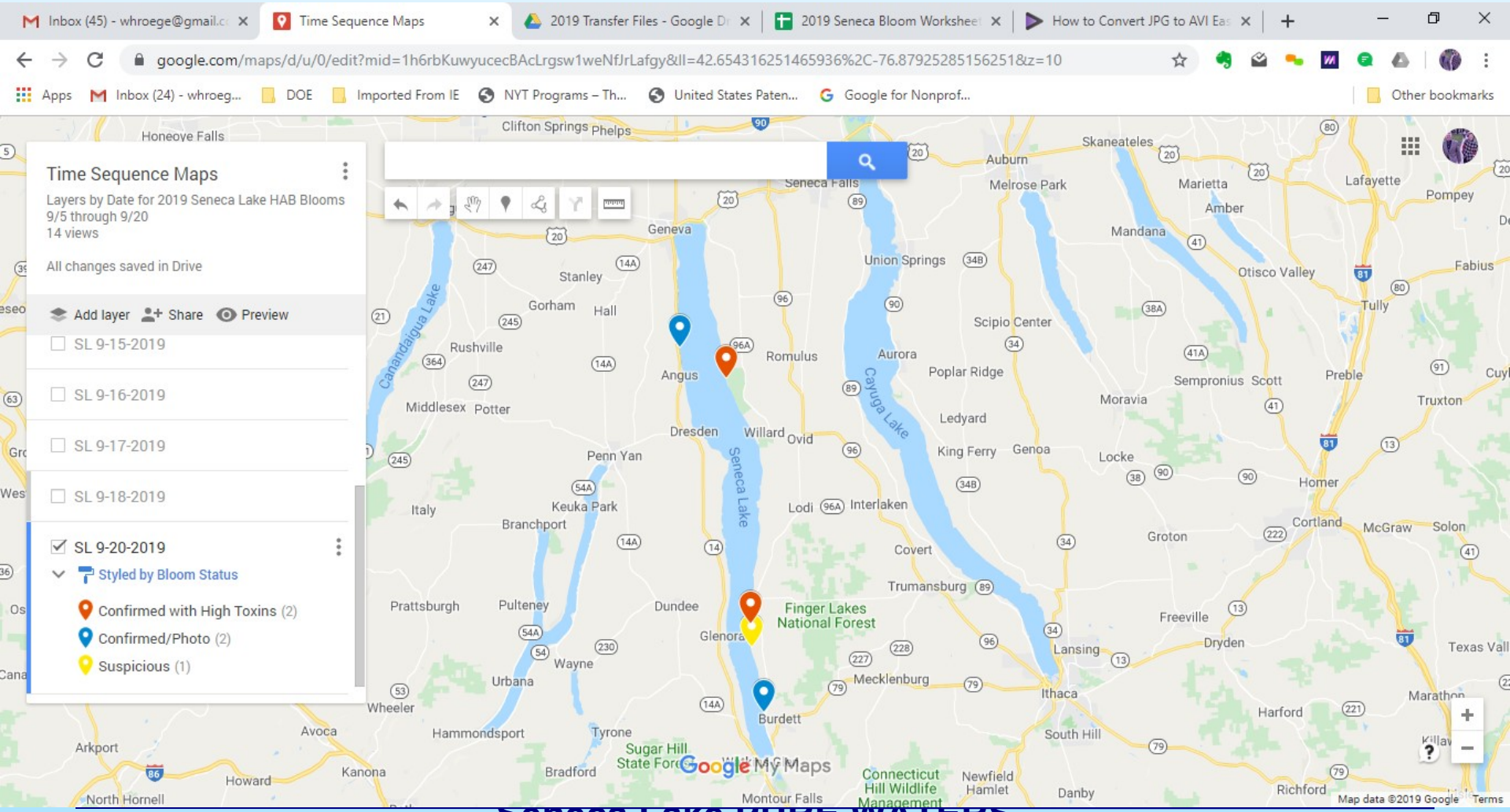

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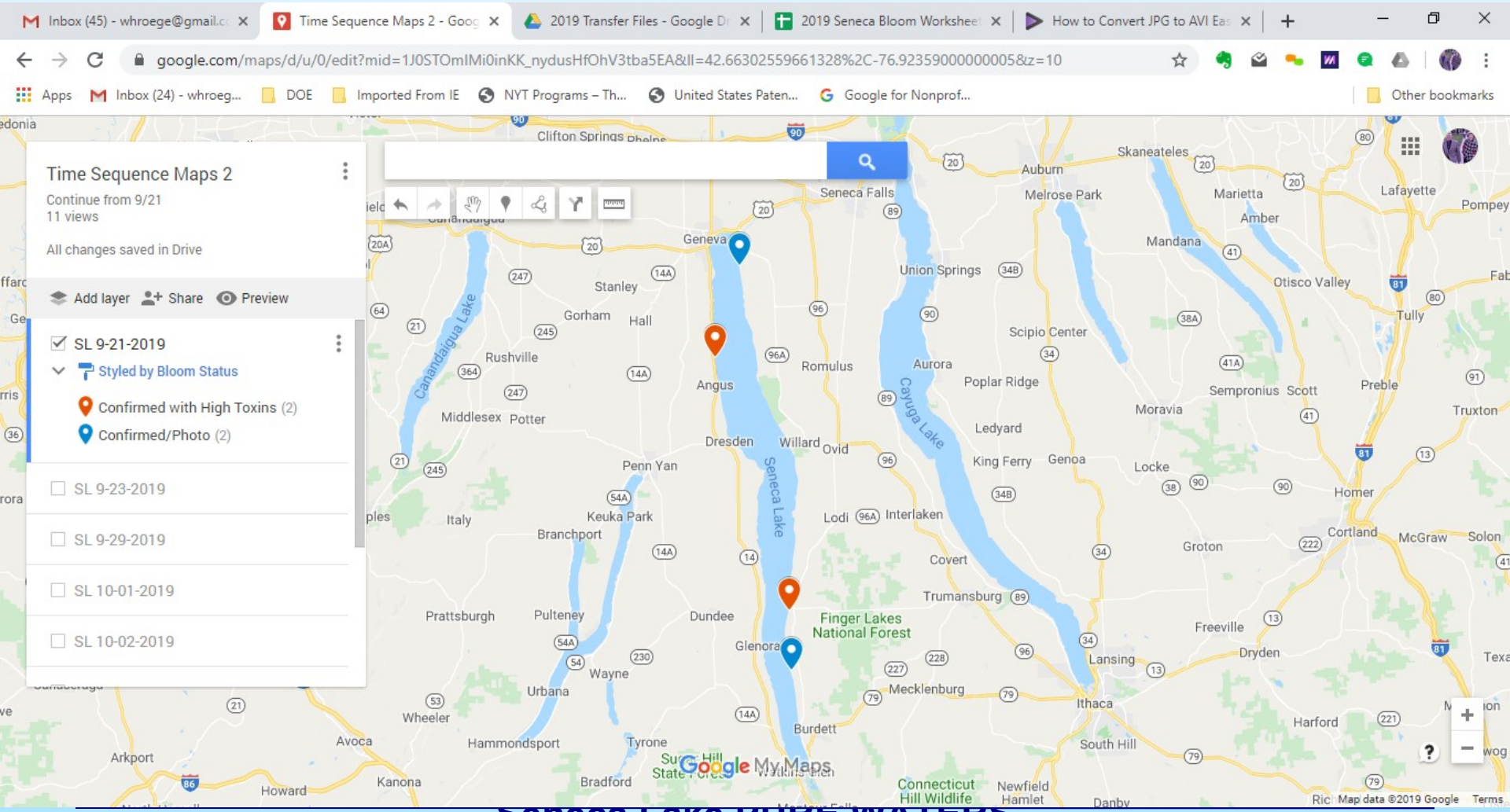

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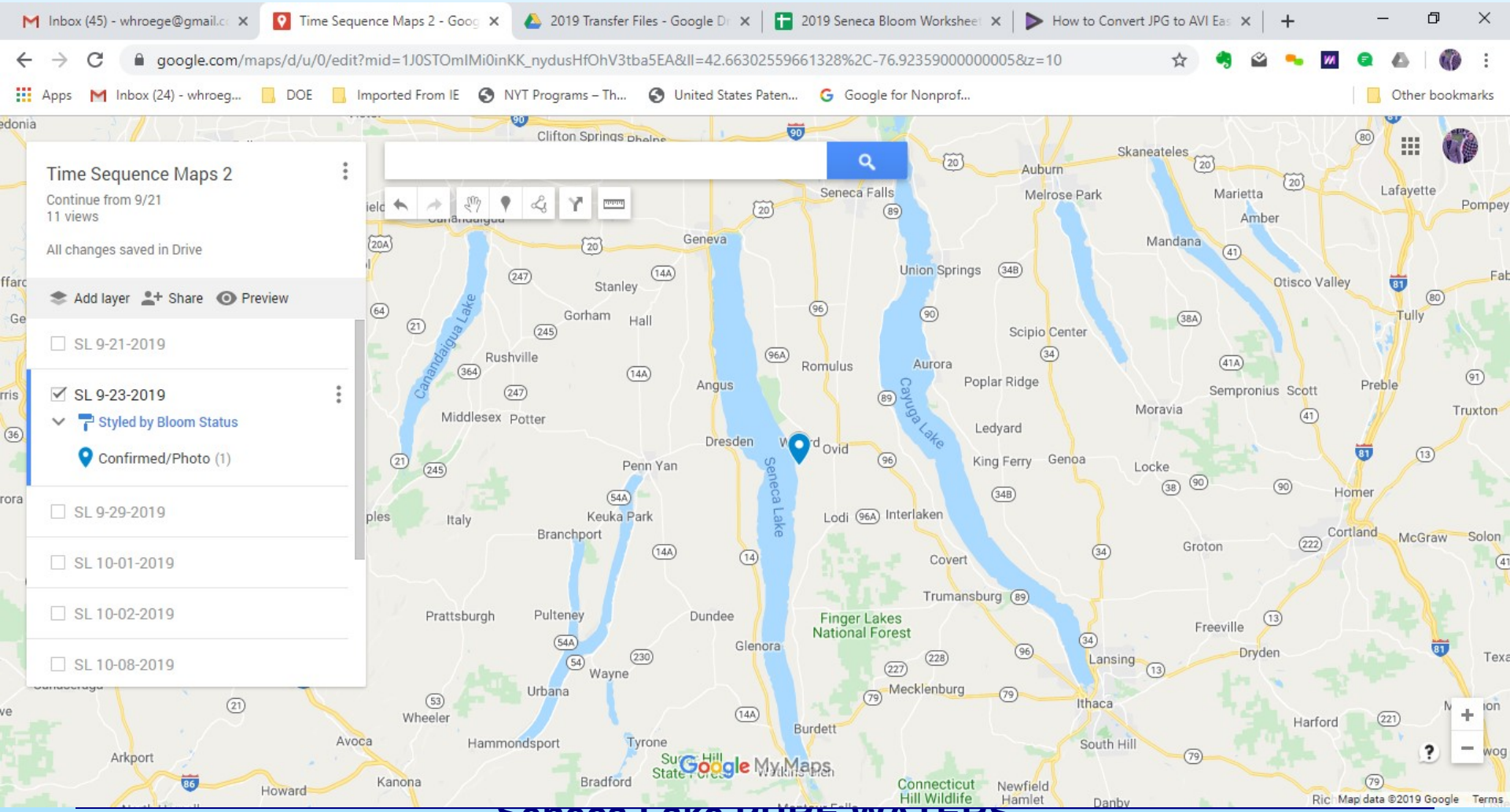

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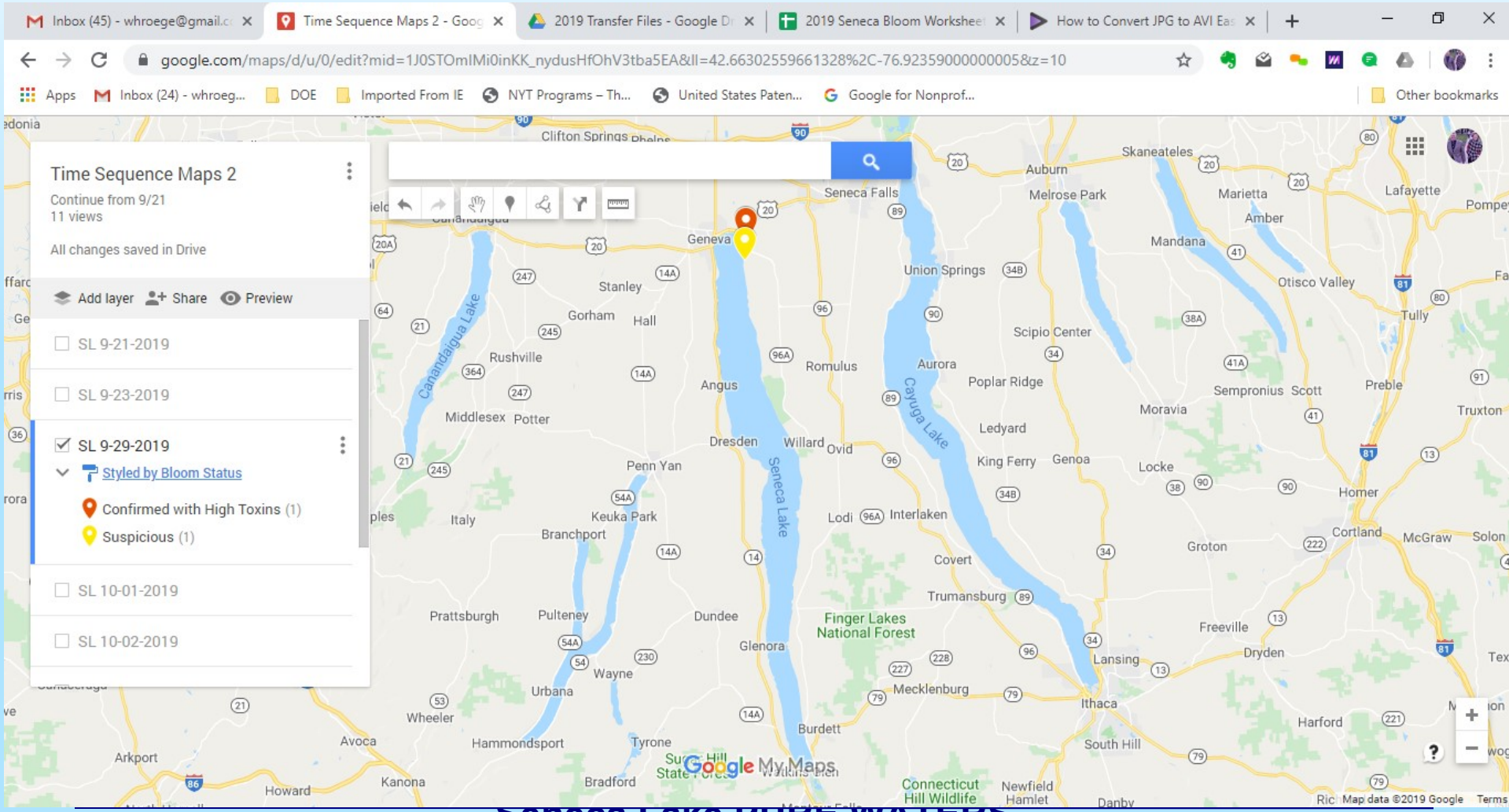

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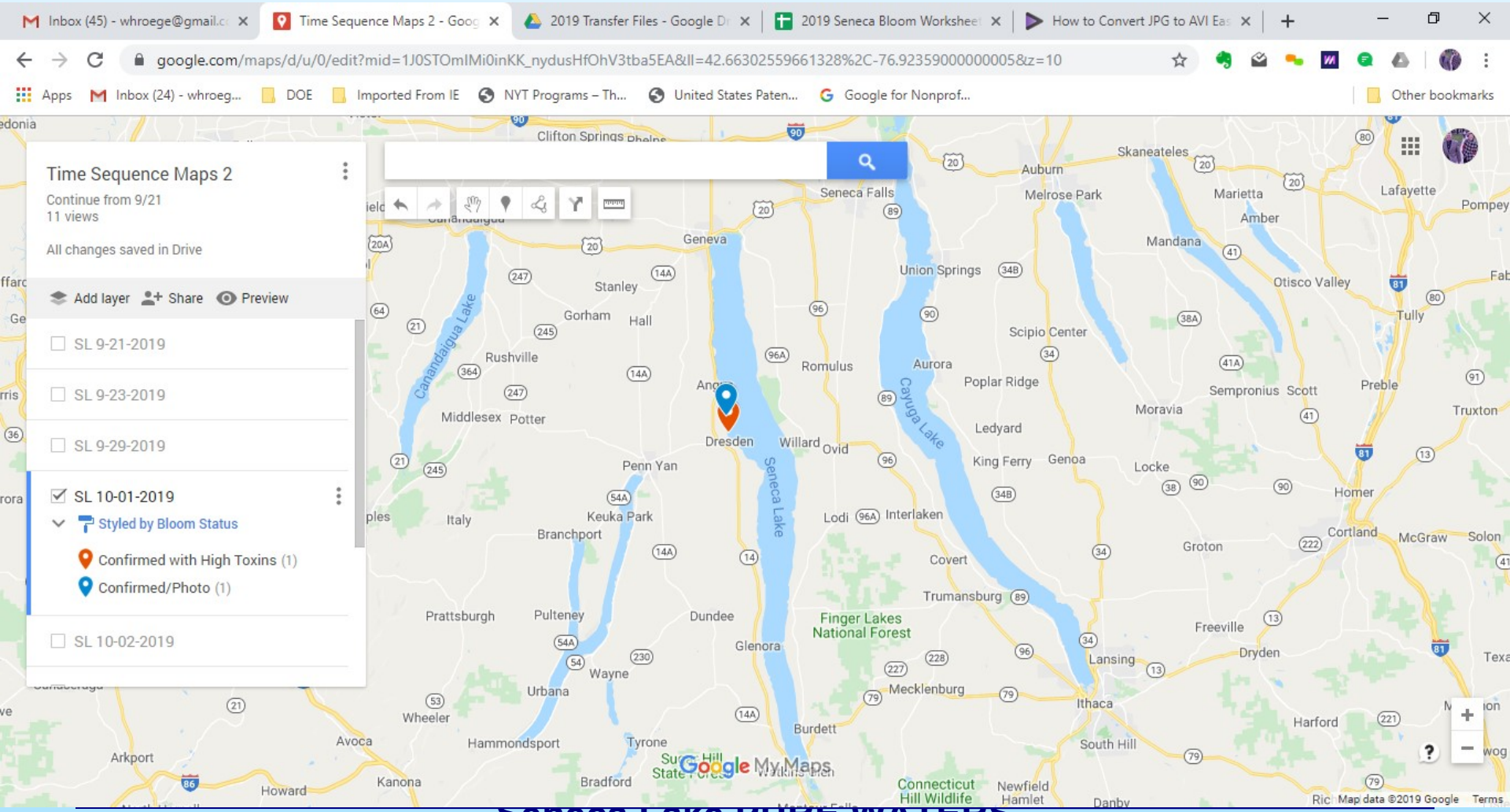
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11 views
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Add layer
Share
Preview
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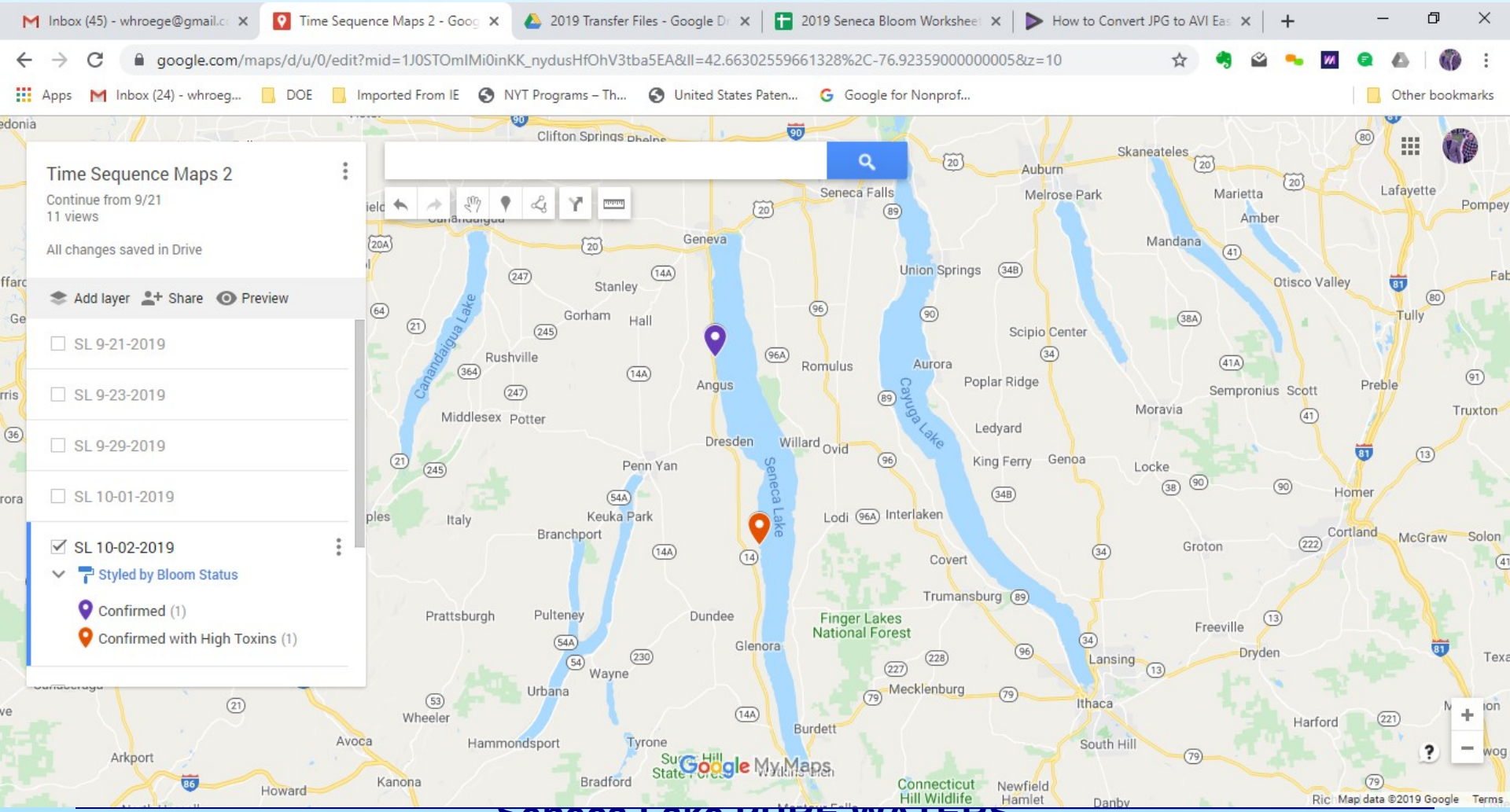
SL 9-23-2019
SL 9-29-2019
SL 10-01-2019
Styled by Bloom Status
Confirmed with High Toxins (1)
Confirmed/Photo (1)
SL 10-02-2019
Seneca Falls
Geneva
Dresden
Romulus
Aurora
Union Springs
Cayuga Lake
Seneca Lake
Canandaigua Lake
Finger Lakes National Forest
Ithaca
Google My Maps

October 2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SL 10-02-2019
Styled by Bloom Status
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Confirmed with High Toxins (1)
Seneca Falls
Geneva
Romulus
Angus
Dresden
Willard
Ovid
Penn Yan
Keuka Park
Branchport
Italy
Lodi
Interlaken
Covert
Trumansburg
Finger Lakes National Forest
Dundee
Glenora
Prattsburgh
Pulteney
Wayne
Urbana
Wheeler
Hammondsport
Tyrone
Burdett
Ithaca
Lansing
Mecklenburg
Union Springs
Aurora
Poplar Ridge
Scipio Center
Ledyard
King Ferry
Genoa
Locke
Moravia
Auburn
Melrose Park
Skaneateles
Marietta
Amber
Mandana
Otisco Valley
Tully
Lafayette
Pompey
Homer
Cortland
McGraw
Solon
Groton
Freeville
Dryden
Harford
South Hill
Connecticut Hill Wildlife
Newfield Hamlet
Danby
Avoca
Arkport
Howard
Kanona
Bradford
Canandaigua Lake
Seneca Lake
Cayuga Lake
Google My Maps
Map data ©2019 Google
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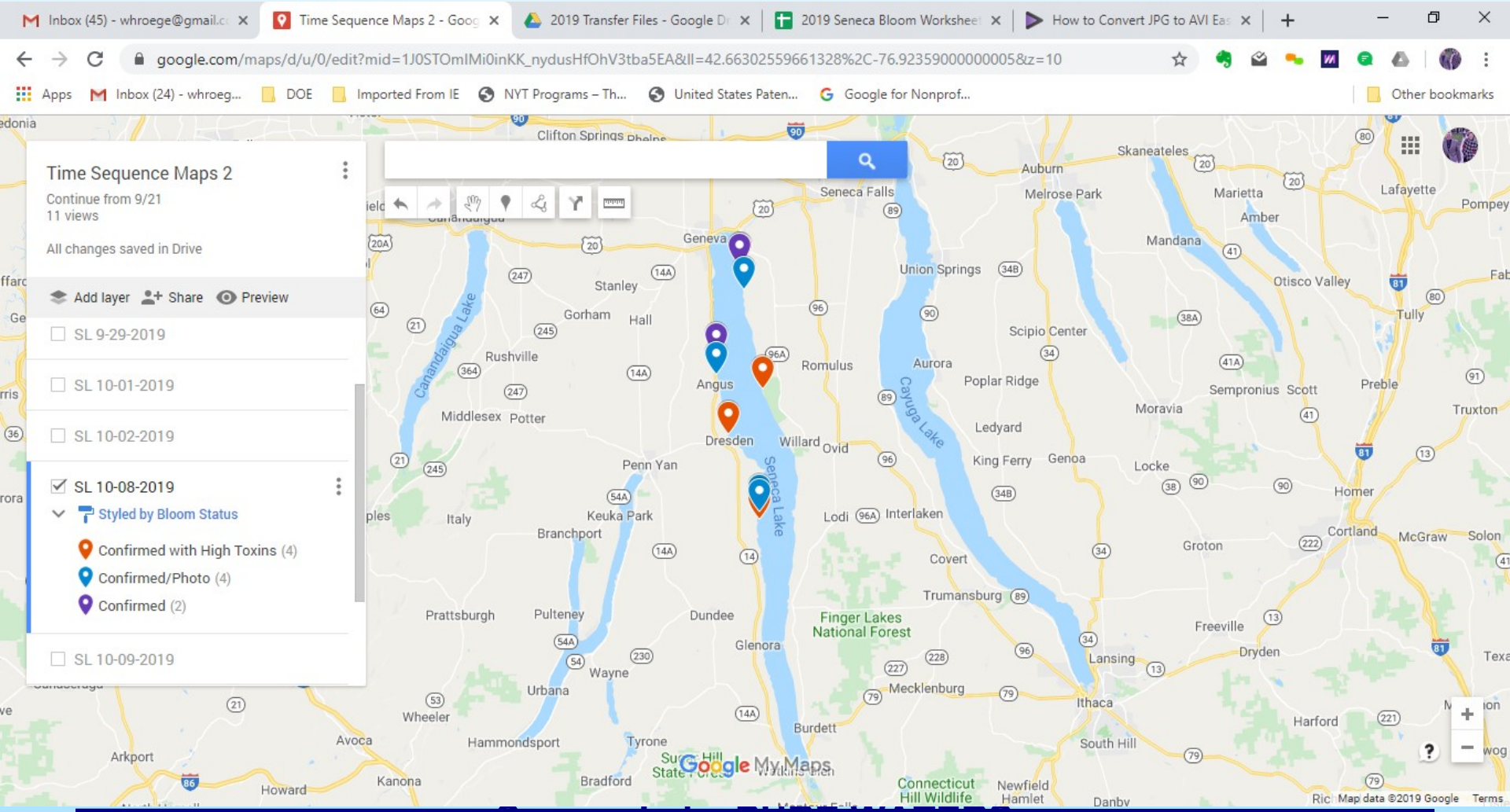
October 8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Geneva
Seneca Falls
Auburn
Skaneateles
Union Springs
Romulus
Angus
Dresden
Willard
Ovid
Penn Yan
Keuka Park
Branchport
Italy
Lodi
Interlaken
Covert
Trumansburg
Dundee
Prattsburgh
Pulteney
Glenora
Finger Lakes National Forest
Ithaca
Lansing
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Burdett
Hammondsport
Tyrone
Bradford
Wayne
Urbana
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Howard
Kanona
Canandaigua Lake
Seneca Lake
Cayuga Lake
Google My Maps
Map data ©2019 Google
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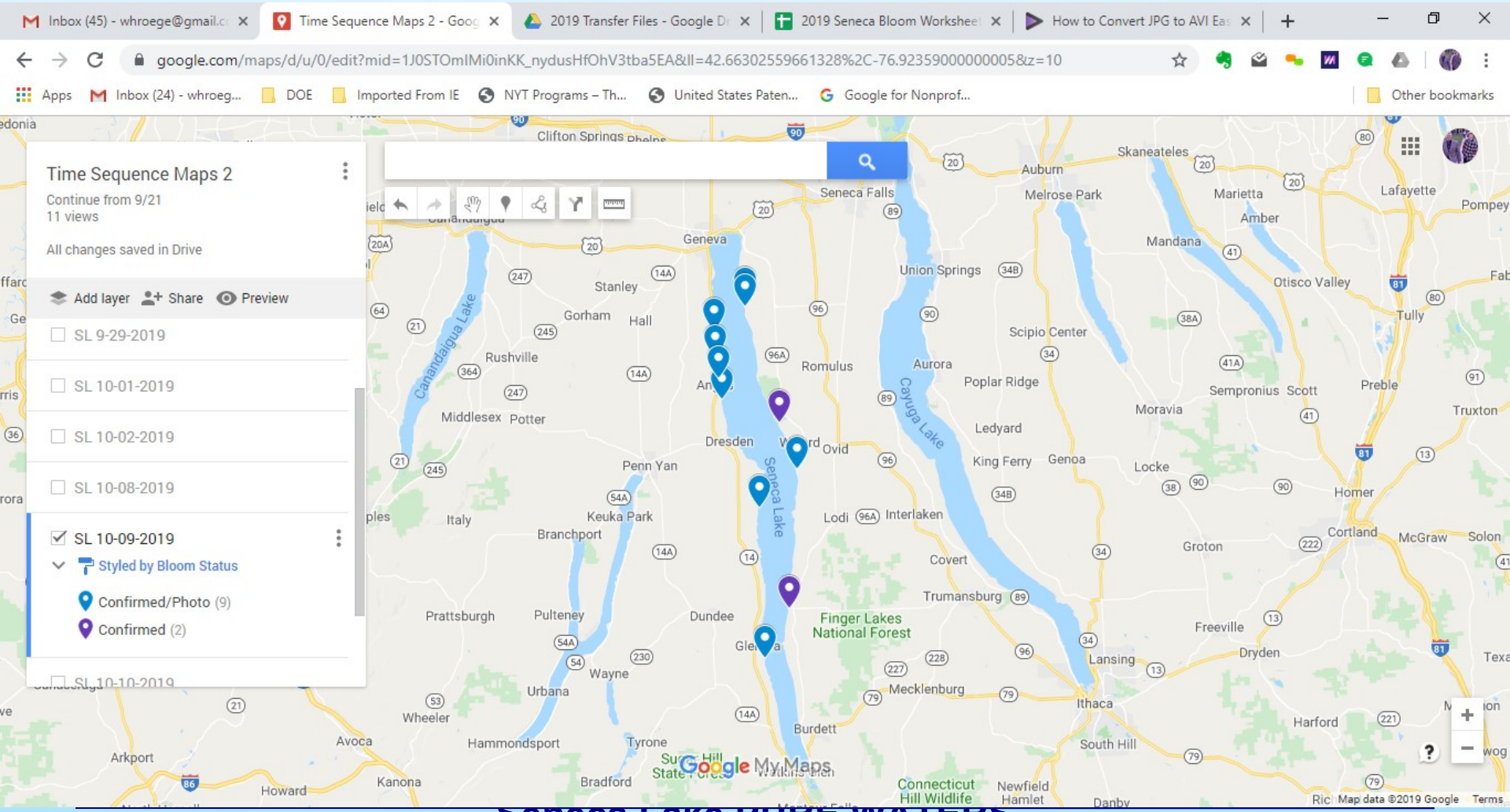
October 9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Seneca Falls
Geneva
Auburn
Skaneateles
Melrose Park
Marietta
Amber
Mandana
Union Springs
Otisco Valley
Tully
Scipio Center
Aurora
Poplar Ridge
Romulus
Ledyard
Moravia
Sempronius
Scott
Preble
Truxton
Cayuga Lake
Seneca Lake
Canandaigua Lake
Dresden
Ovid
King Ferry
Genoa
Locke
Homer
Cortland
McGraw
Solon
Groton
Covert
Trumansburg
Finger Lakes National Forest
Freeville
Dryden
Lansing
Ithaca
Mecklenburg
Burdett
South Hill
Harford
Danby
Newfield
Hamlet
Connecticut Hill Wildlife
Penn Yan
Keuka Park
Branchport
Italy
Lodi
Interlaken
Dundee
Pulteney
Prattsburgh
Wayne
Urbana
Wheeler
Hammondsport
Tyrone
Bradford
Howard
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Hall
Google My Maps
Map data ©2019 Google
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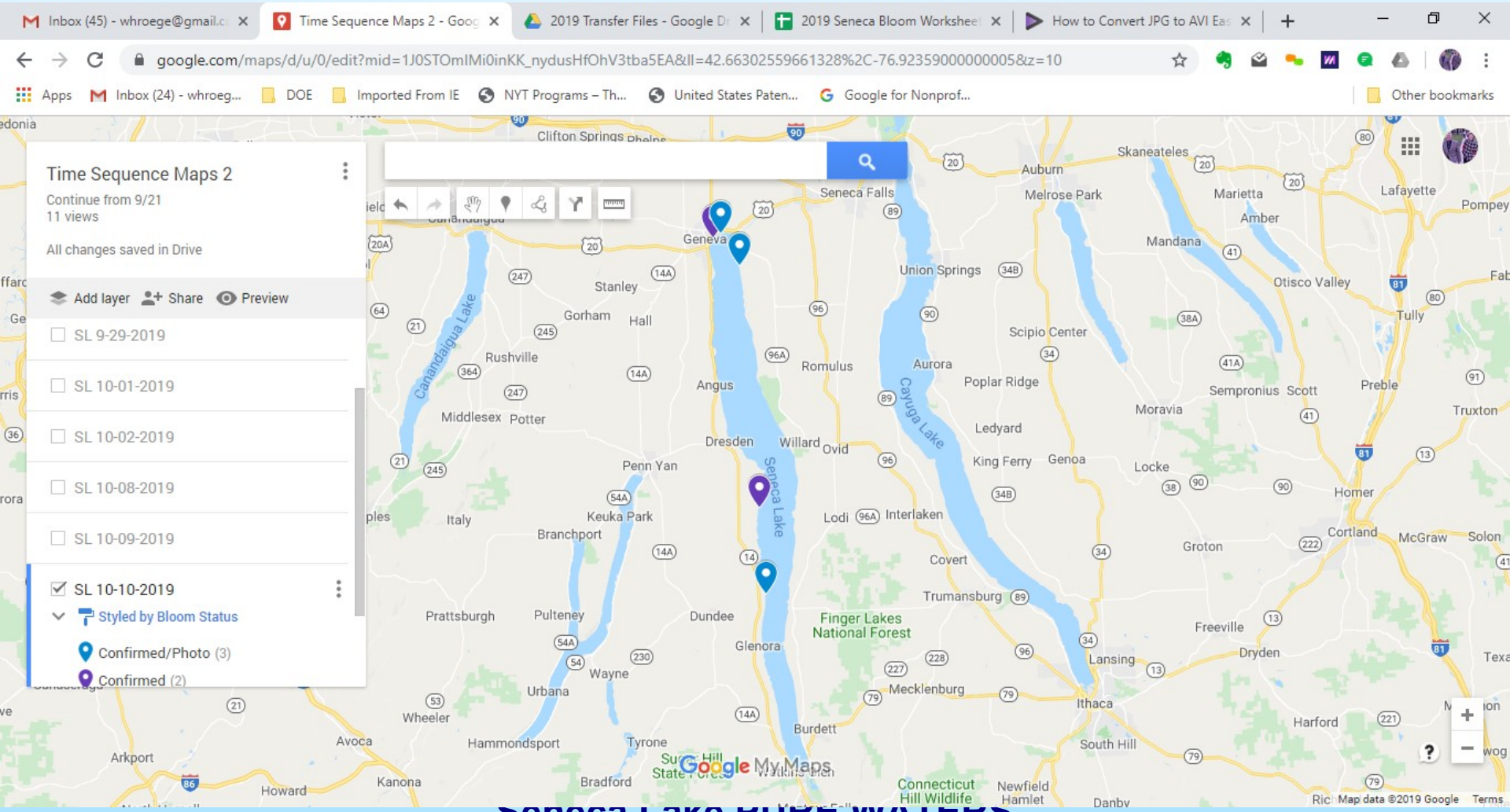
October 10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Confirmed (2)
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Geneva
Auburn
Skaneateles
Melrose Park
Marietta
Lafayette
Pompey
Amber
Mandana
Union Springs
Otisco Valley
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Scipio Center
Aurora
Poplar Ridge
Romulus
Angus
Stanley
Gorham
Hall
Rushville
Middlesex
Potter
Dresden
Willard
Ovid
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Keuka Park
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Howard
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Harford
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Google My Maps
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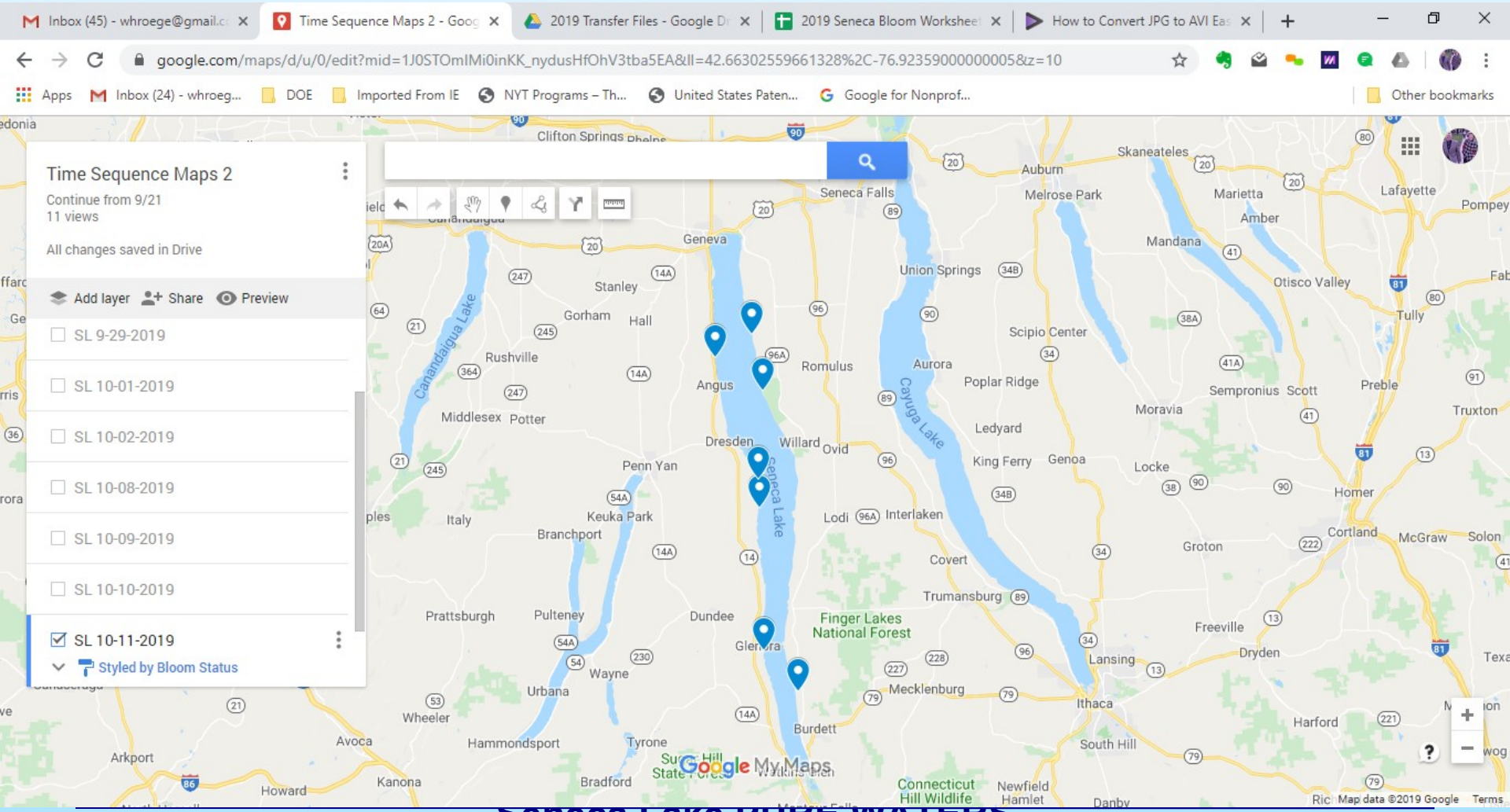
October 11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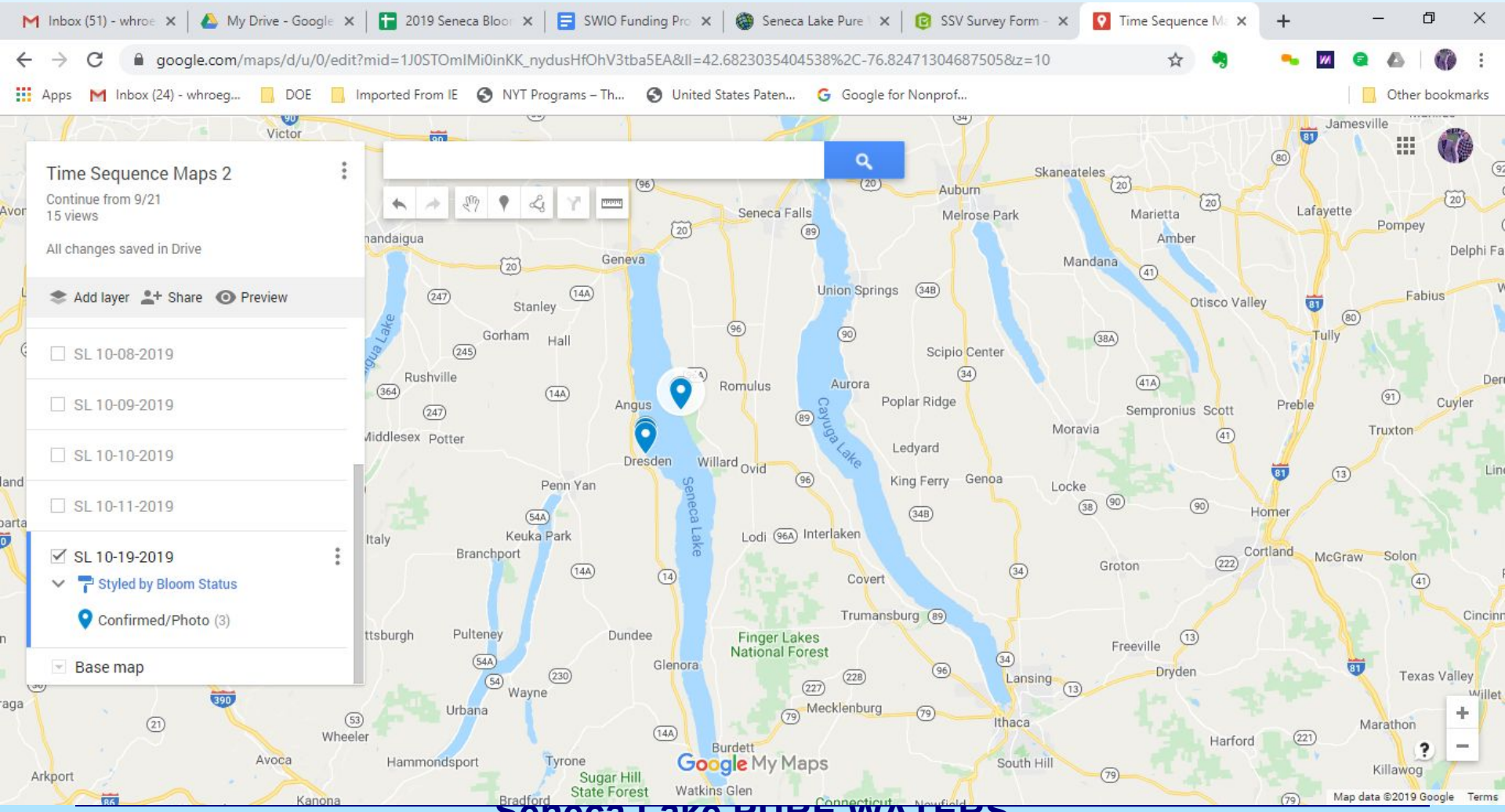
October 19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Confirmed/Photo (3)
Base map
Google My Maps
Map data ©2019 Google
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Agenda

- Item 1
- Item 2
- Item 3

Title Slide

Title

Text

- Outline Level 1
  - Outline Level 2
    - Outline Level 3
      - Outline Level 4

Title – 2 Column Layout

Column

Column