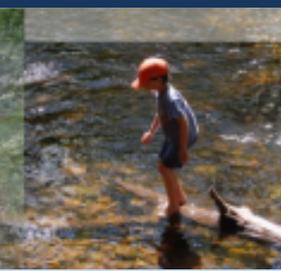
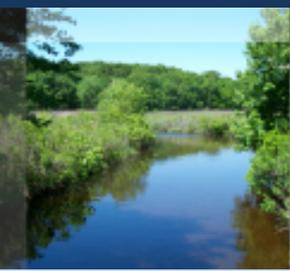
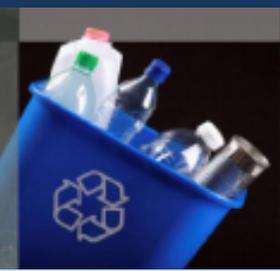




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Connecticut Department of
**ENERGY &
ENVIRONMENTAL
PROTECTION**

Monitoring Streamflow with Trail Cameras

April 5, 2019

Melissa Czarnowski

2019 CT Volunteer Water Monitoring Conference

Three Rivers Community College, Norwich, CT



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Overview

DEEP's trail camera project:
background & purpose



How to use a trail camera to monitor streamflow
DEEP's lessons learned

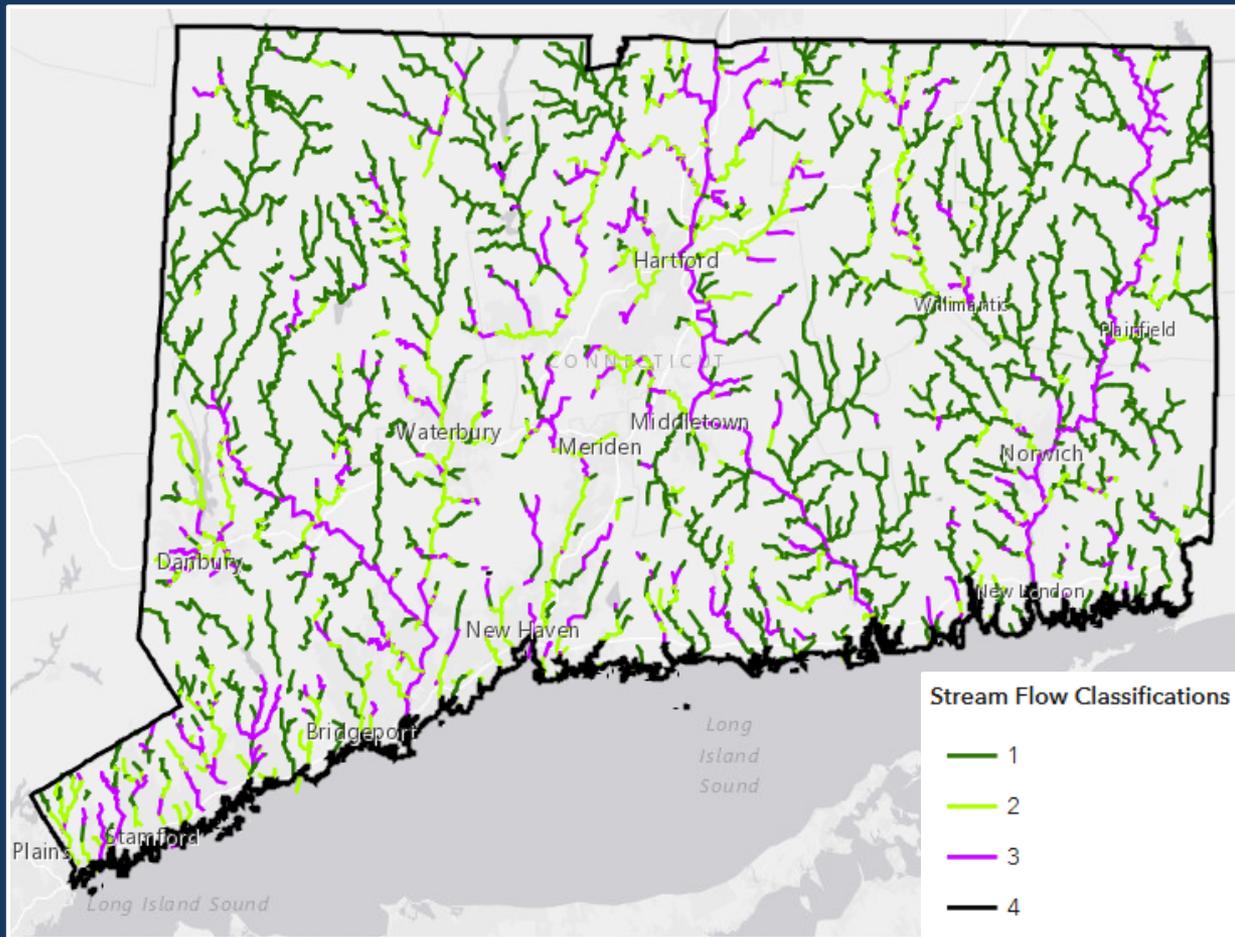


Grandfathered Groundwater Diversions

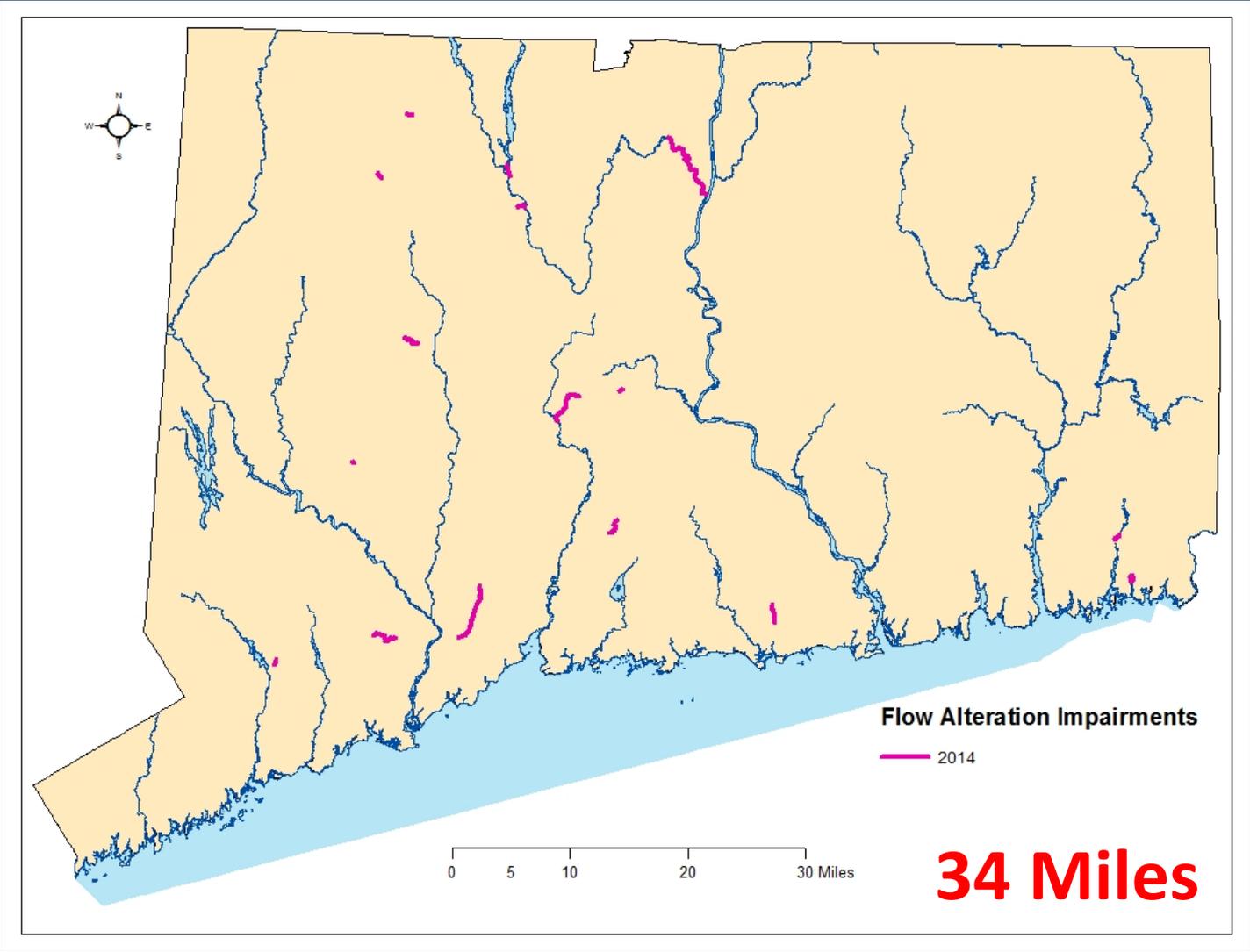


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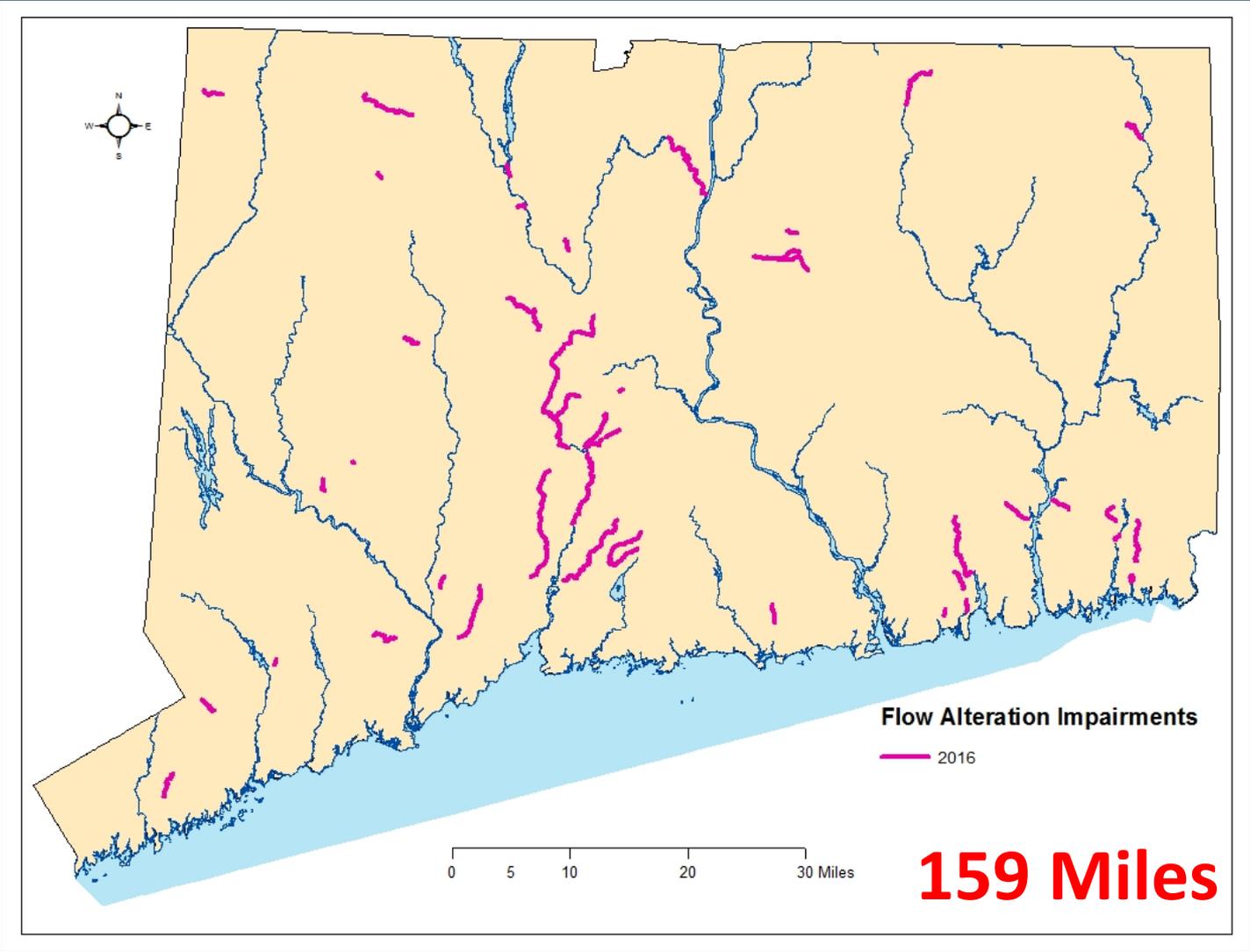
Streamflow Regulations



Flow Impaired Waters List - 2014

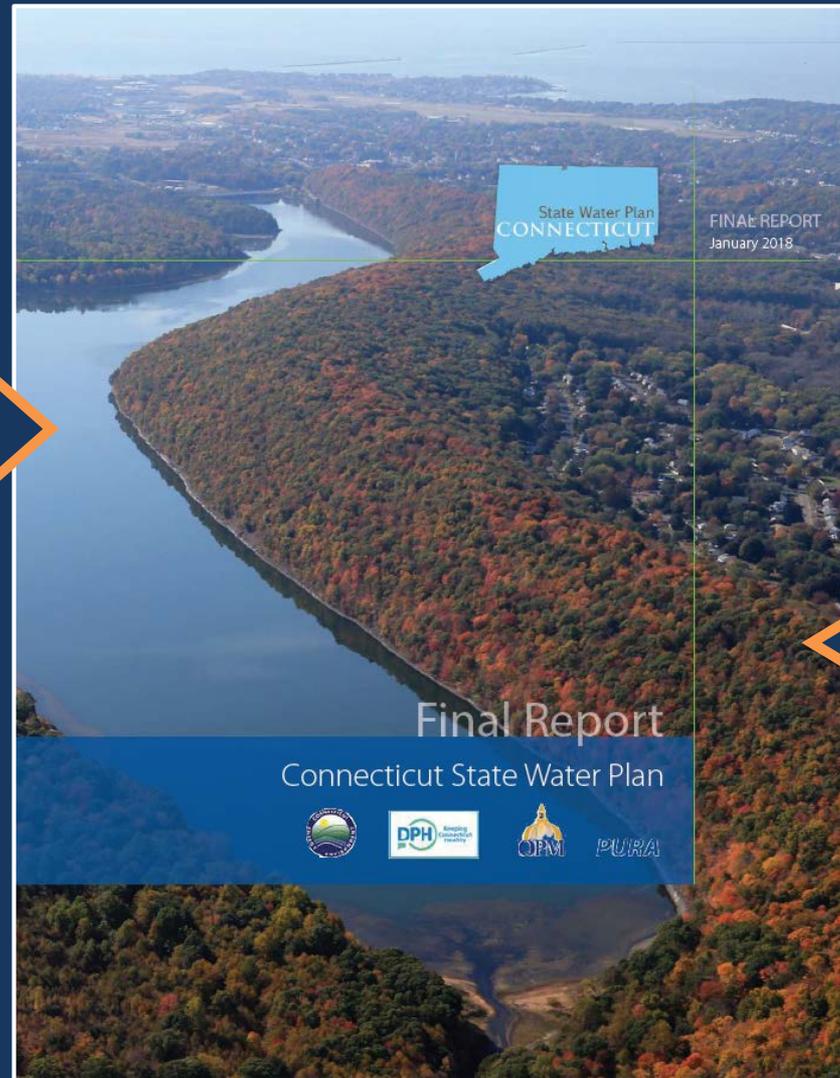


Flow Impaired Waters List - 2016



State Water Plan

“Define the extent of the problem – where are registered diversions causing adverse environmental impacts now?”



“Registered diverters could follow DEEP’s protocol on photo-documentation.”



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Purpose

- Visually observe and document the effects of withdrawal on streamflow
- Qualitative & semi-quantitative data that will assist in streamflow planning and management
- Identify flow impaired streams for the Integrated Water Quality Report



In the Beginning – Handheld Cameras



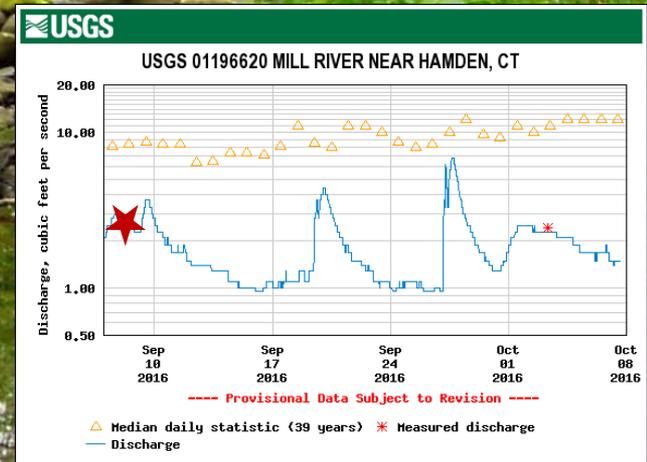
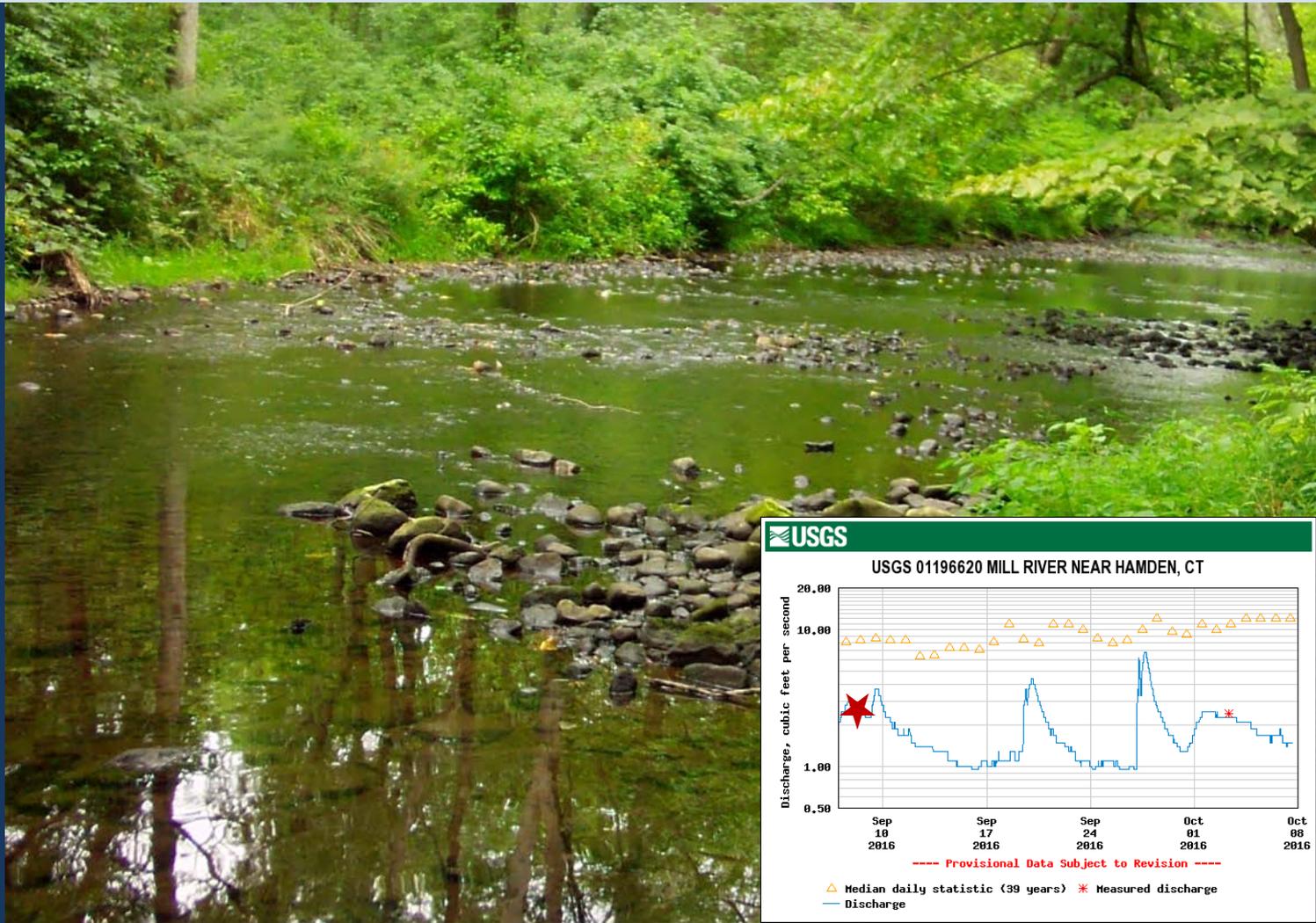
Trail Cameras!



- Set to take pictures at specific times each day
- Daily pictures
- Leave for weeks at a time
- Picture standardization



09/07/2016 – 2.70 cfs



MOULTRIE



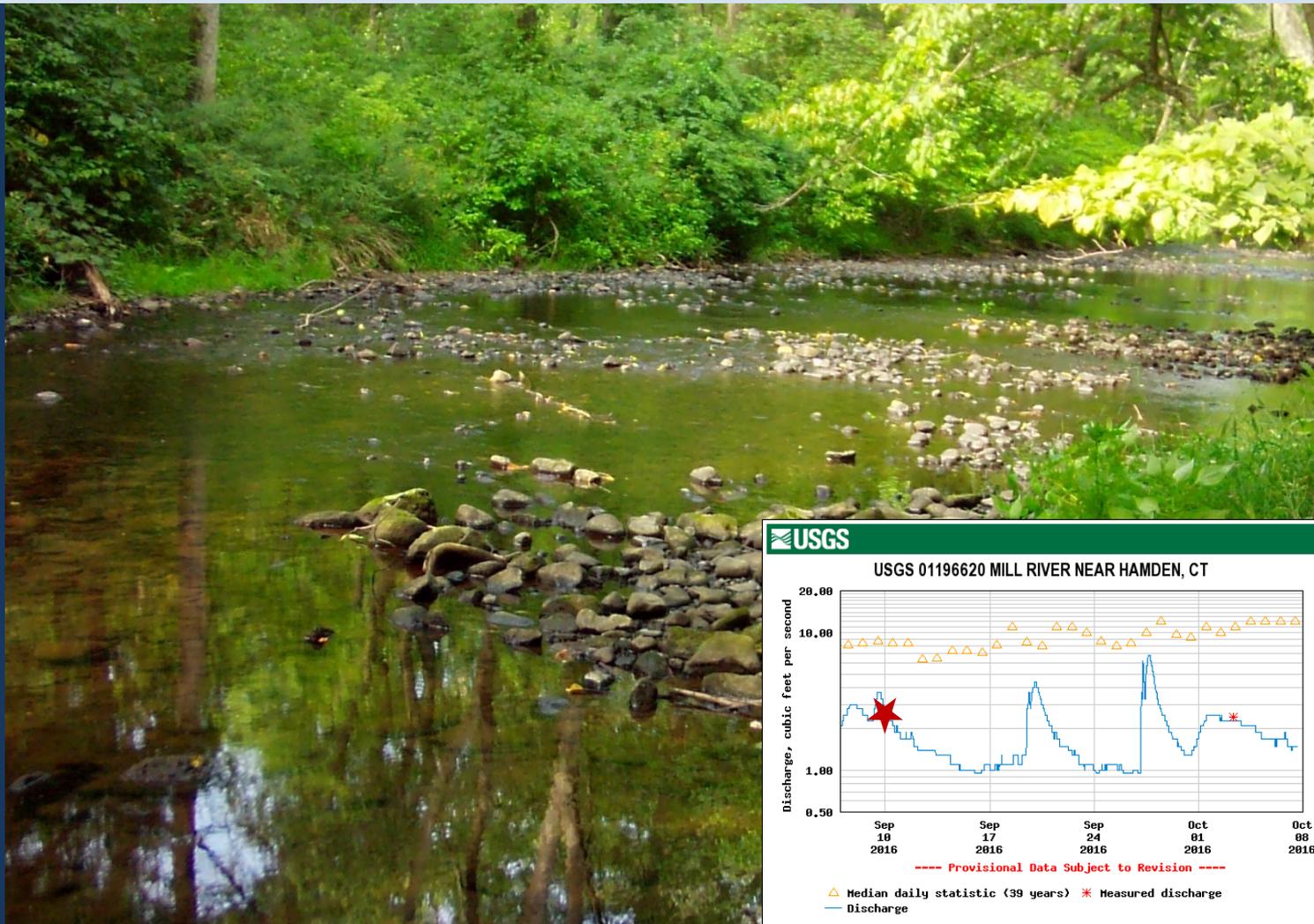
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MOULTRIECAM

07 SEP 2016 03:00 pm

Connecticut Department of Energy and Environmental Protection

09/10/2016 – 2.20 cfs



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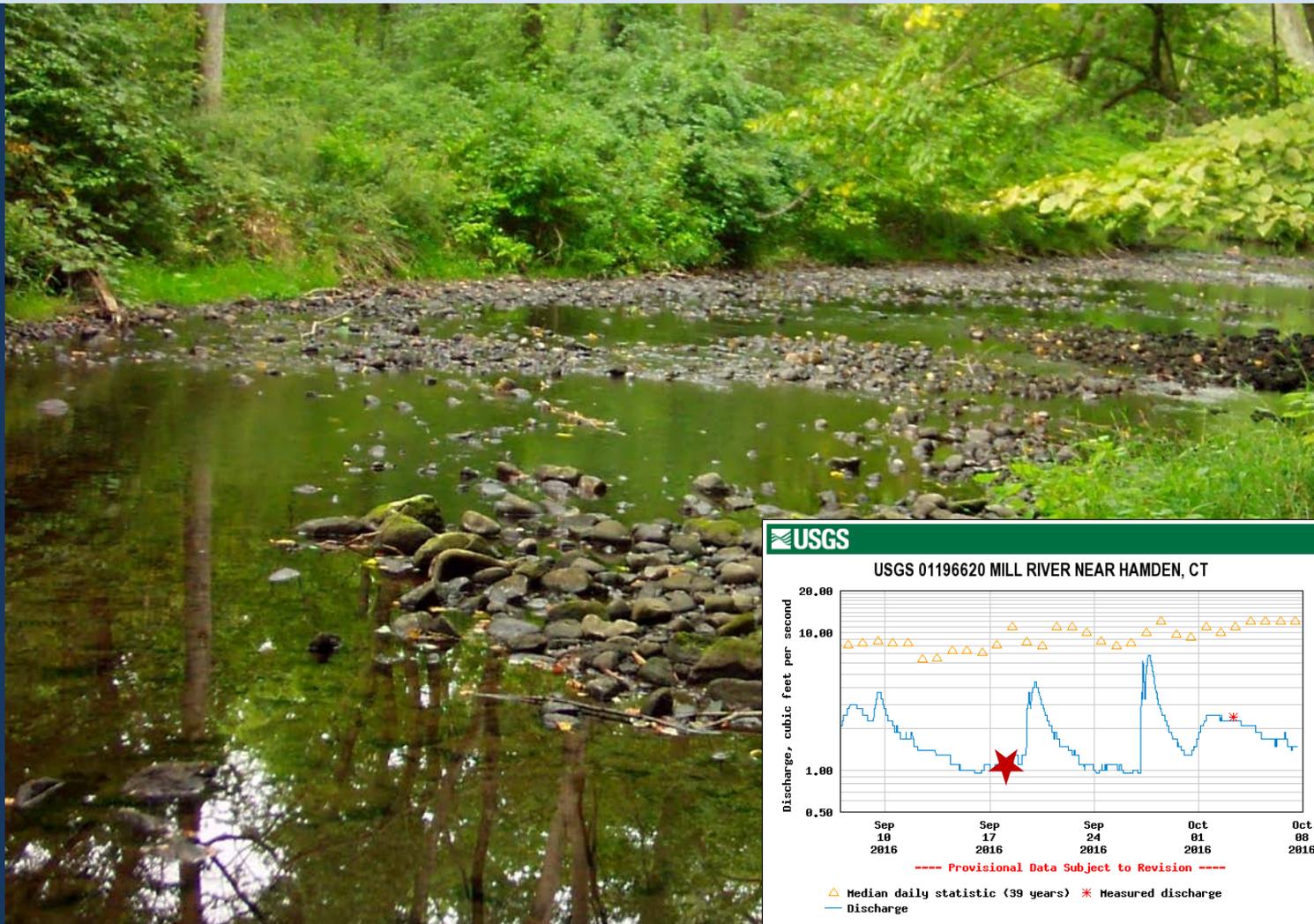
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Connecticut Department of Energy and Environmental Protection

09/18/2016 – 1.20 cfs



MOULTRIE

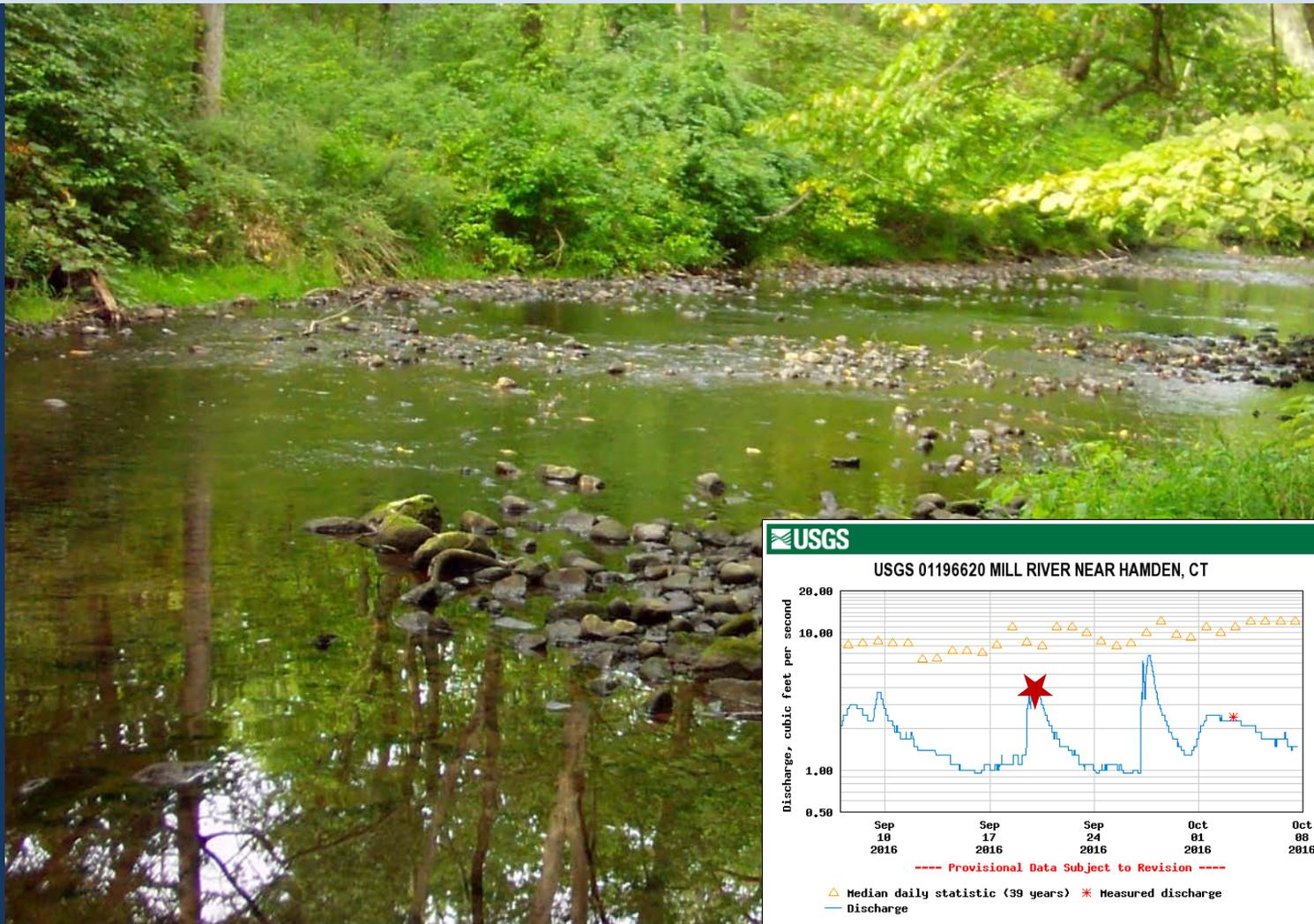
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Connecticut Department of Energy and Environmental Protection

09/20/2016 – 3.20 cfs



MOULTRIE

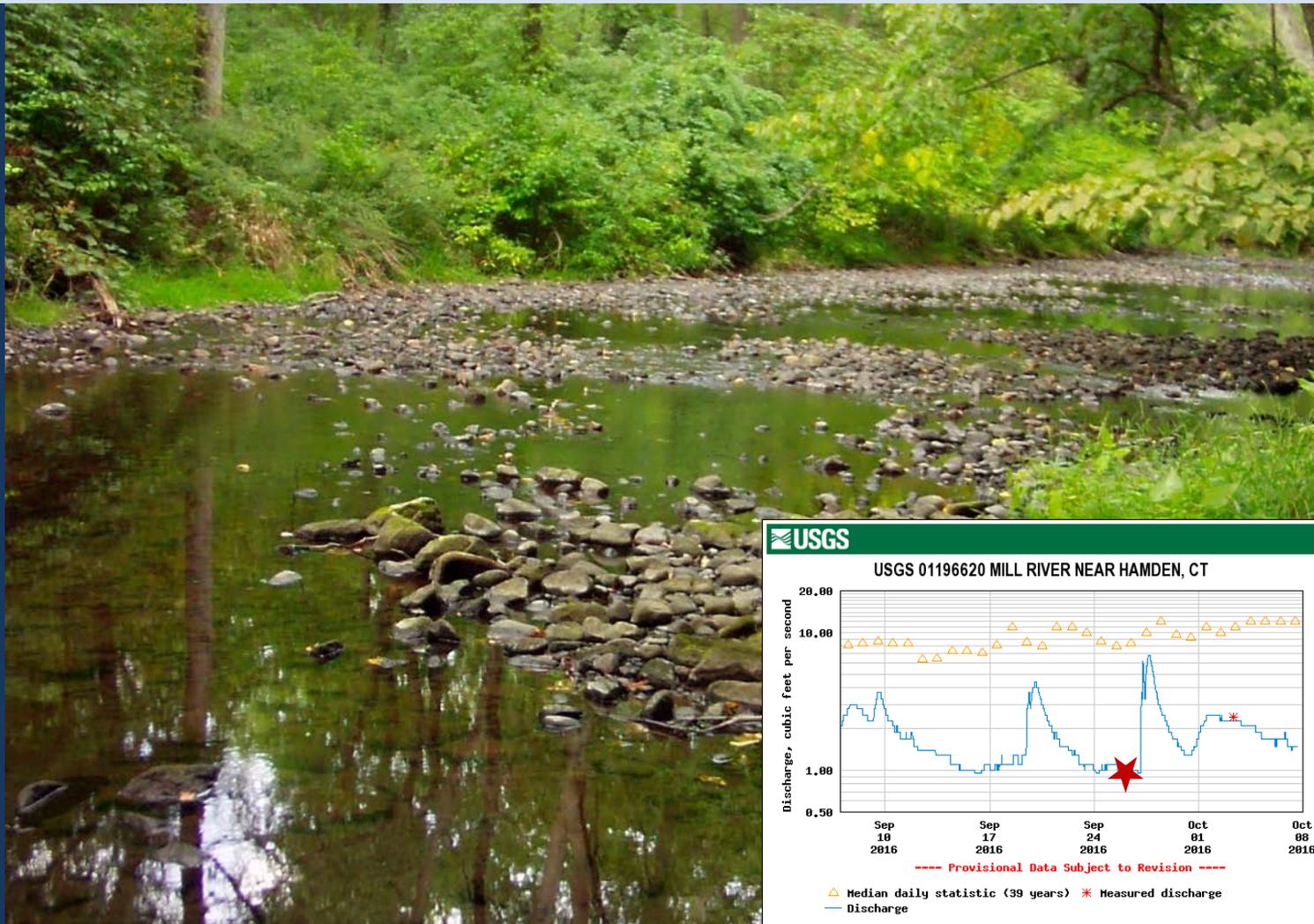
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Connecticut Department of Energy and Environmental Protection

09/26/2016 – 0.97 cfs



MOULTRIE

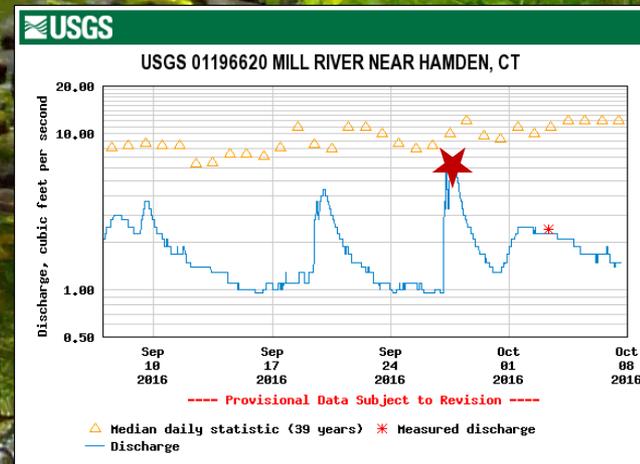
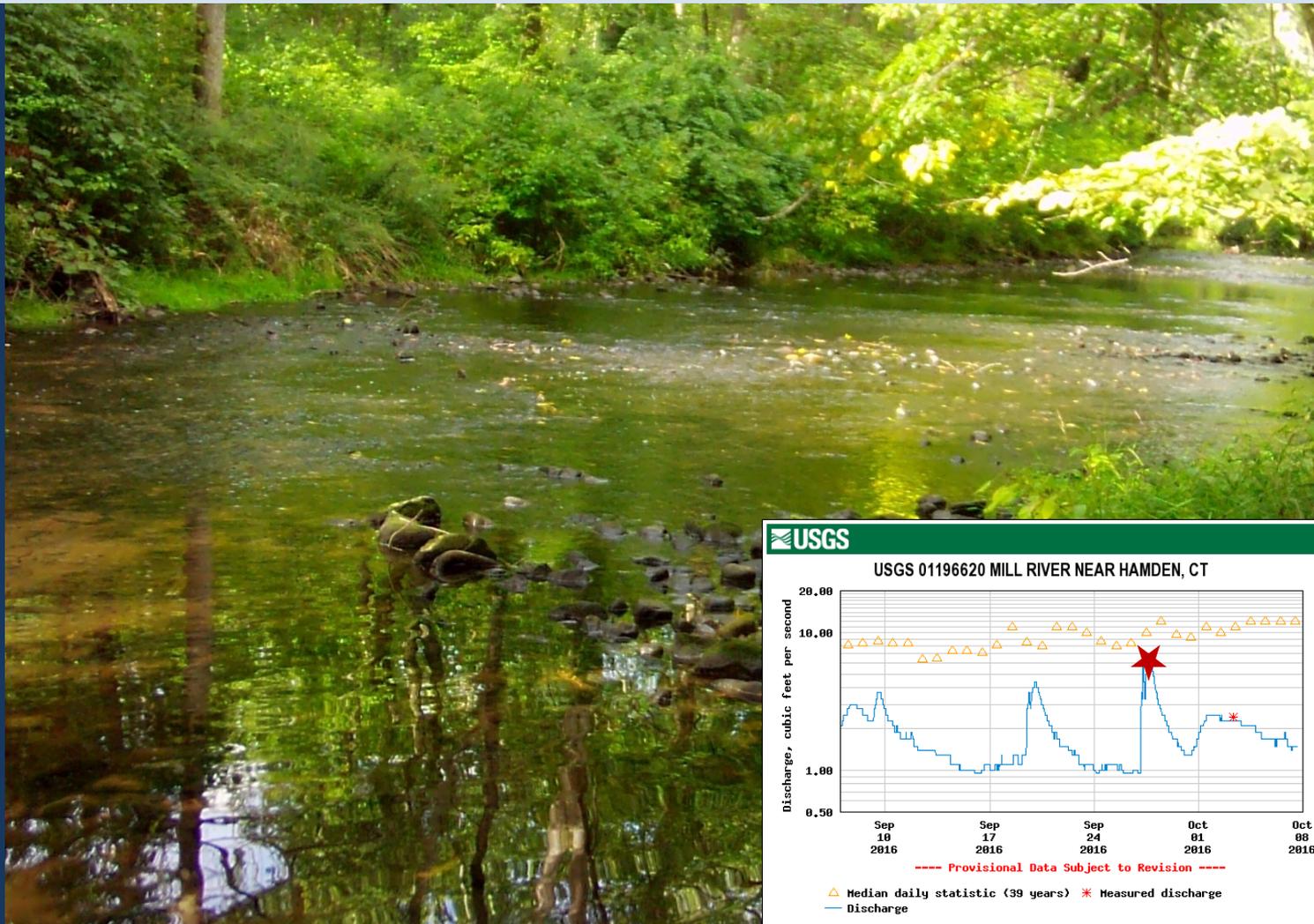
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Connecticut Department of Energy and Environmental Protection

09/27/2016 – 4.00 cfs



MOULTRIE

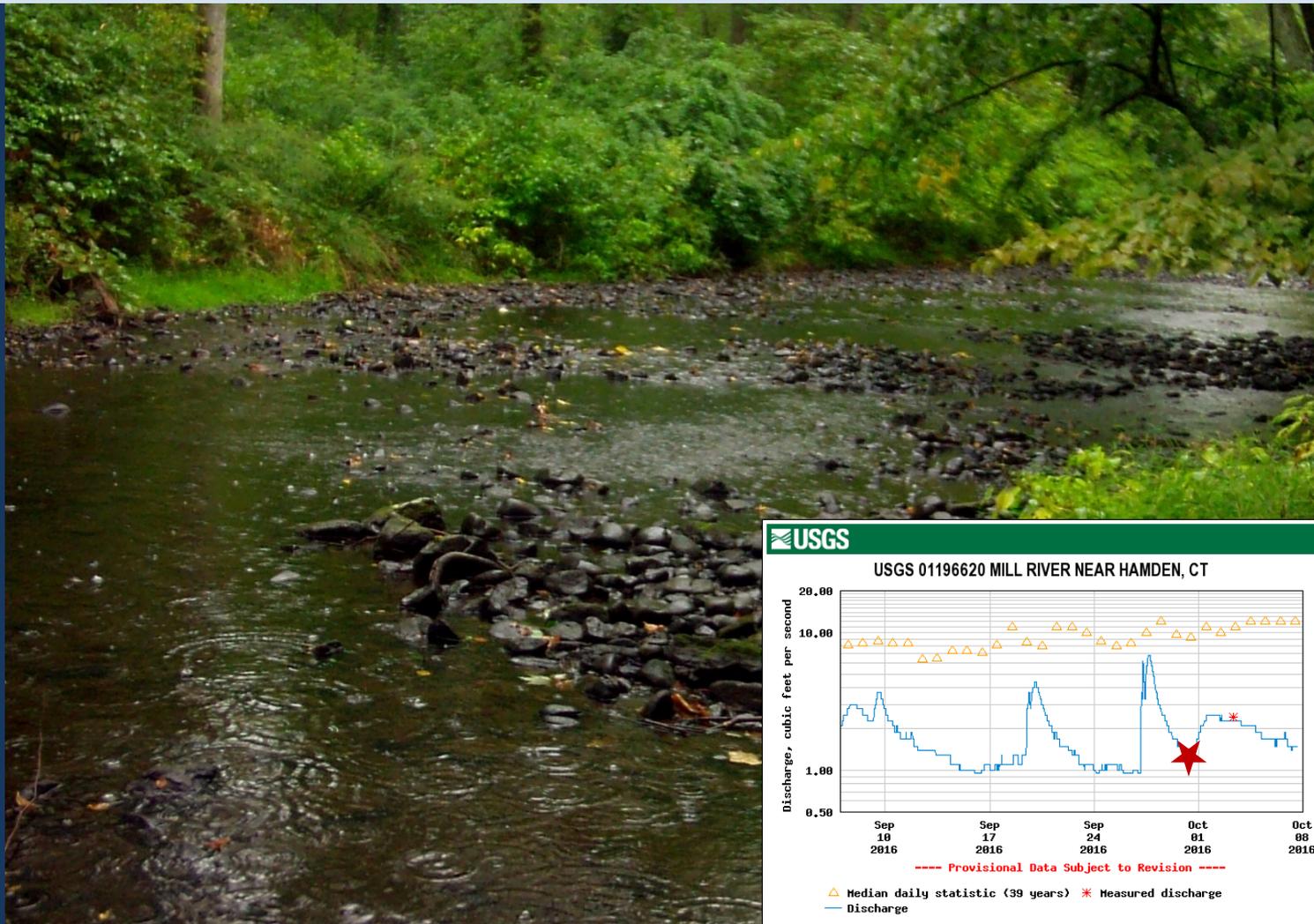
☾ 21°C

MOULTRIECAM

27 SEP 2016 03:00 pm

Connecticut Department of Energy and Environmental Protection

09/30/2016 – 1.40 cfs



MOULTRIE

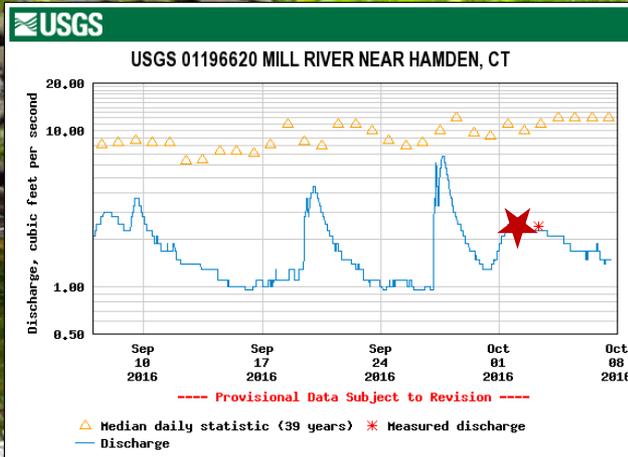
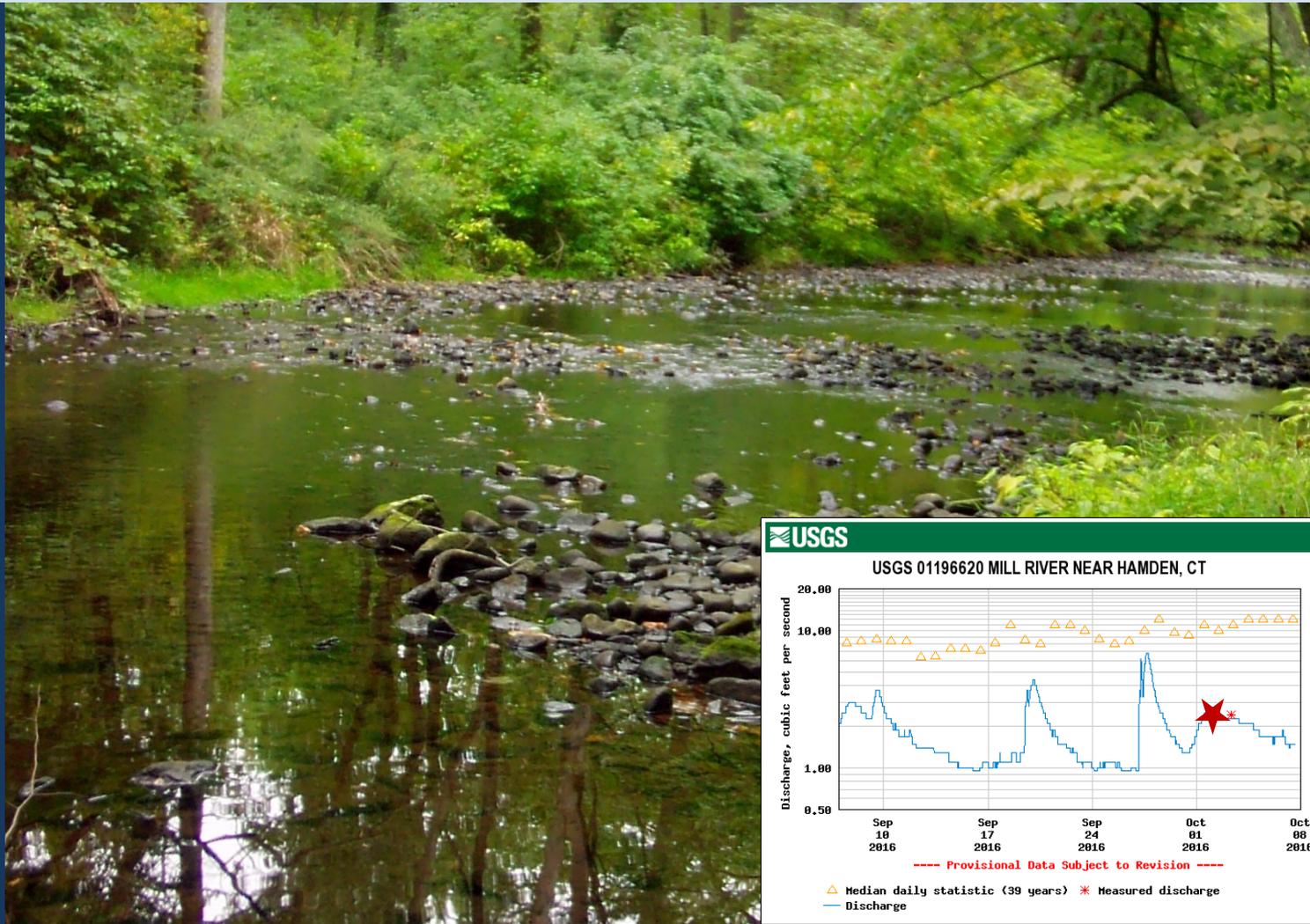
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MOULTRIECAM

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Connecticut Department of Energy and Environmental Protection

10/02/2016 – 2.40 cfs



MOULTRIE

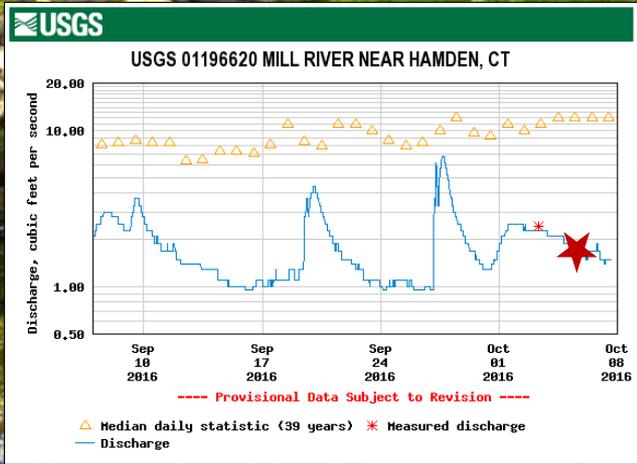
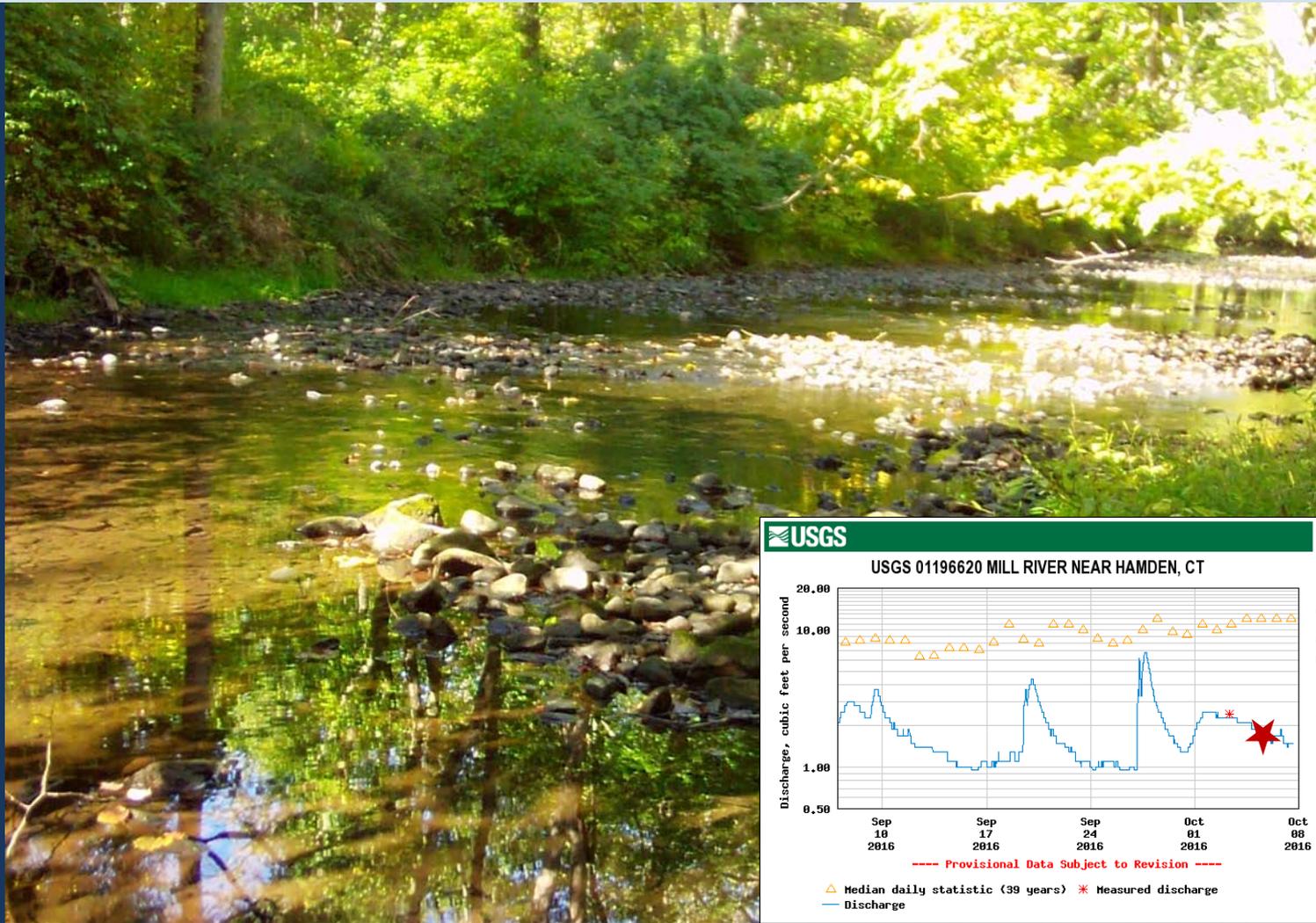
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MOULTRIECAM

02 OCT 2016 03:00 pm

Connecticut Department of Energy and Environmental Protection

10/06/2016 – 1.70 cfs



MOULTRIE

21°C

MOULTRIECAM

06 OCT 2016 03:00 pm

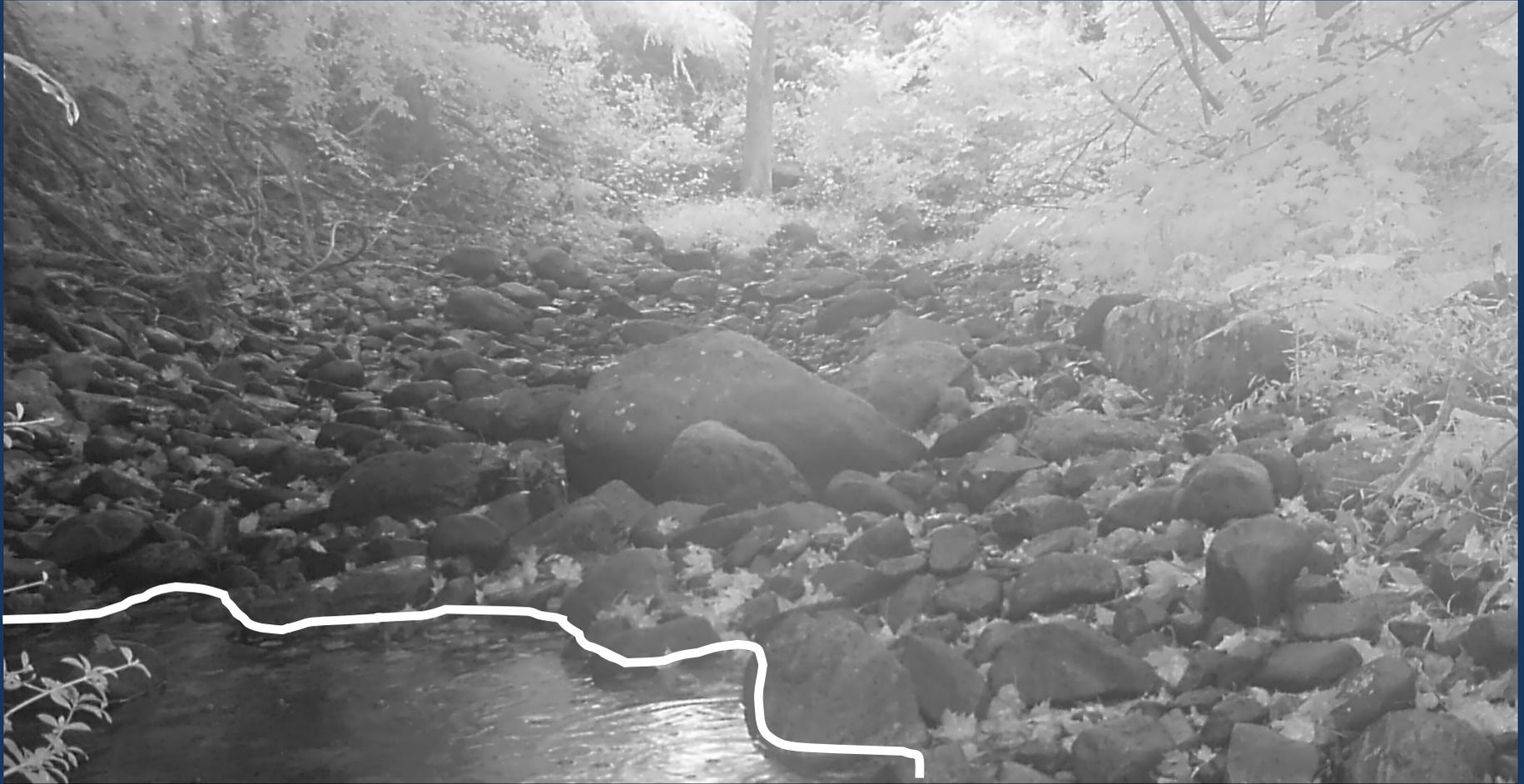
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Trail camera captures flood events



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10:55 AM



MOULTRIE  13°C **MOULTRIECAM** 25 SEP 2018 10:55 am



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11:55 AM



Connecticut Department of Energy and Environmental Protection

12:55 PM



MOULTRIE



14°C

MOULTRIECAM

25 SEP 2018 12:55 pm



Connecticut Department of Energy and Environmental Protection

1:55 PM

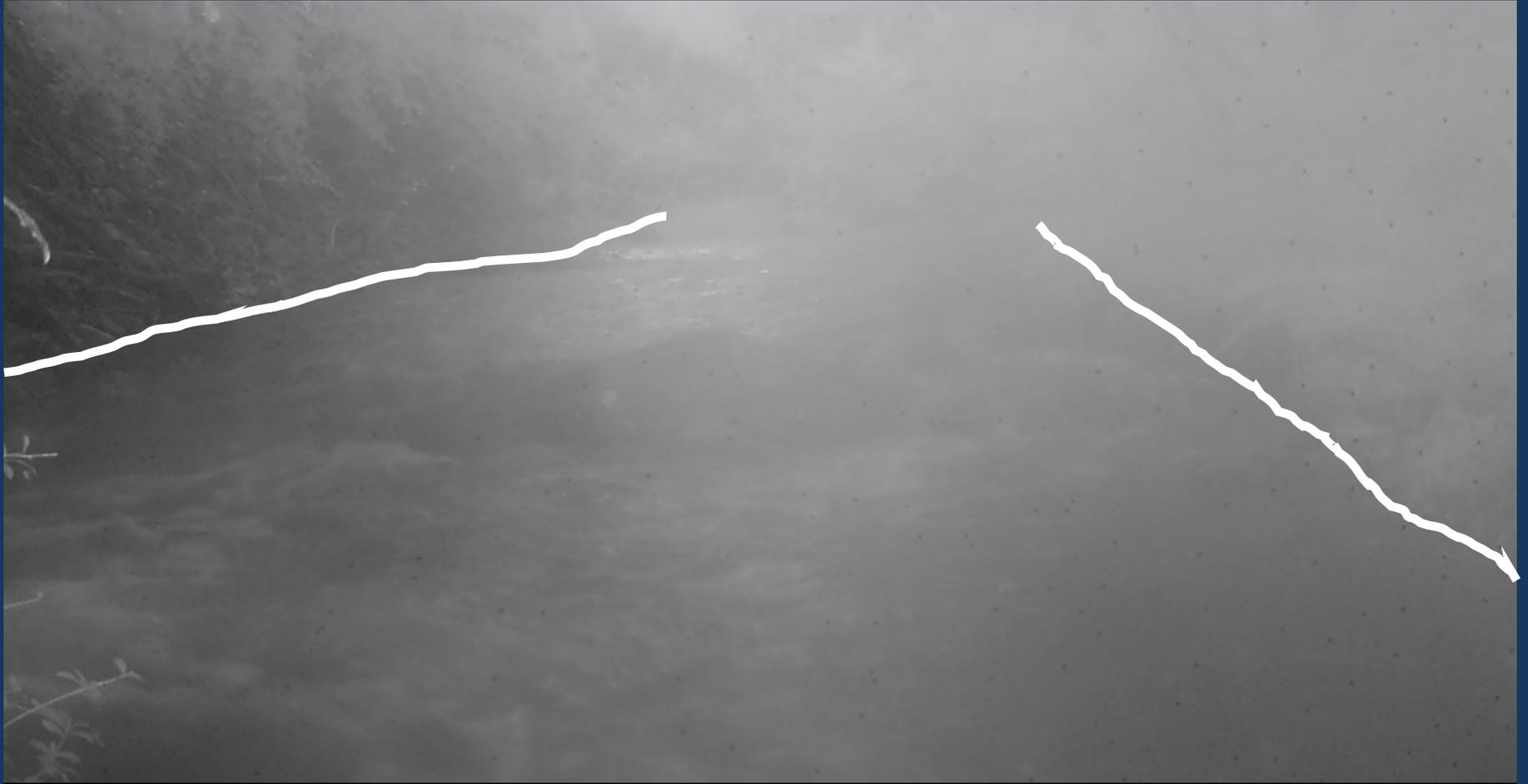


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Connecticut Department of Energy and Environmental Protection

2:55 PM



MOULTRIE  15°C **MOULTRIECAM** 25 SEP 2018 02:55 pm



Connecticut Department of Energy and Environmental Protection

3:55 PM



MOULTRIE



15°C

MOULTRIECAM

25 SEP 2018 03:55 pm

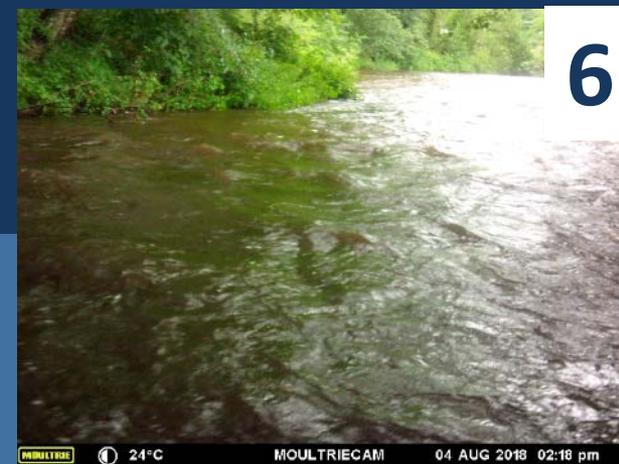


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Pictures are Data! Flow Habitat Categories



Disconnected

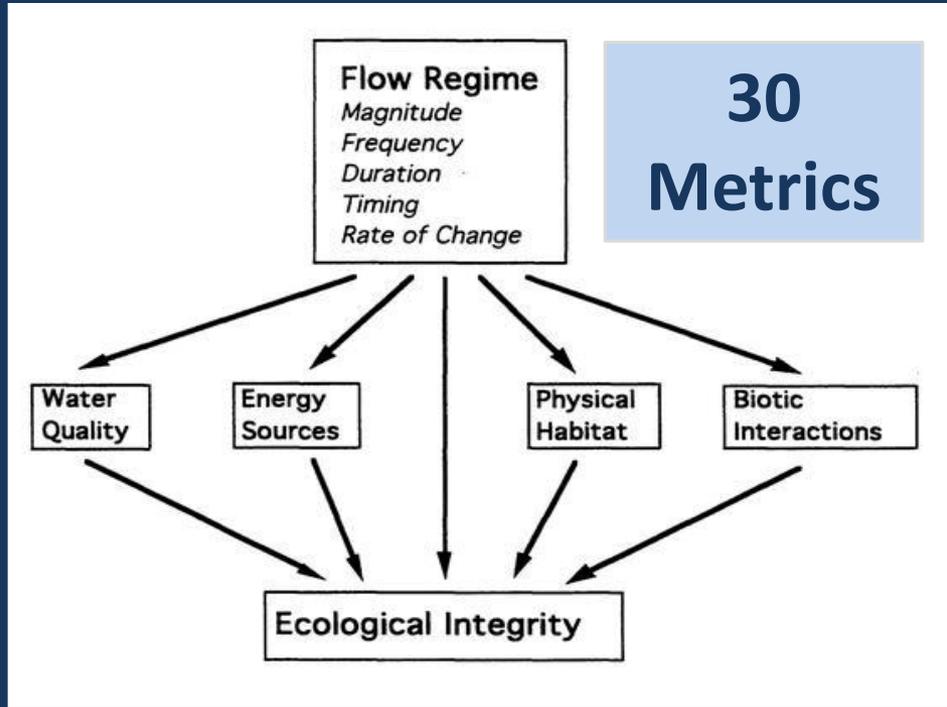


Connected



Pictures to Metrics

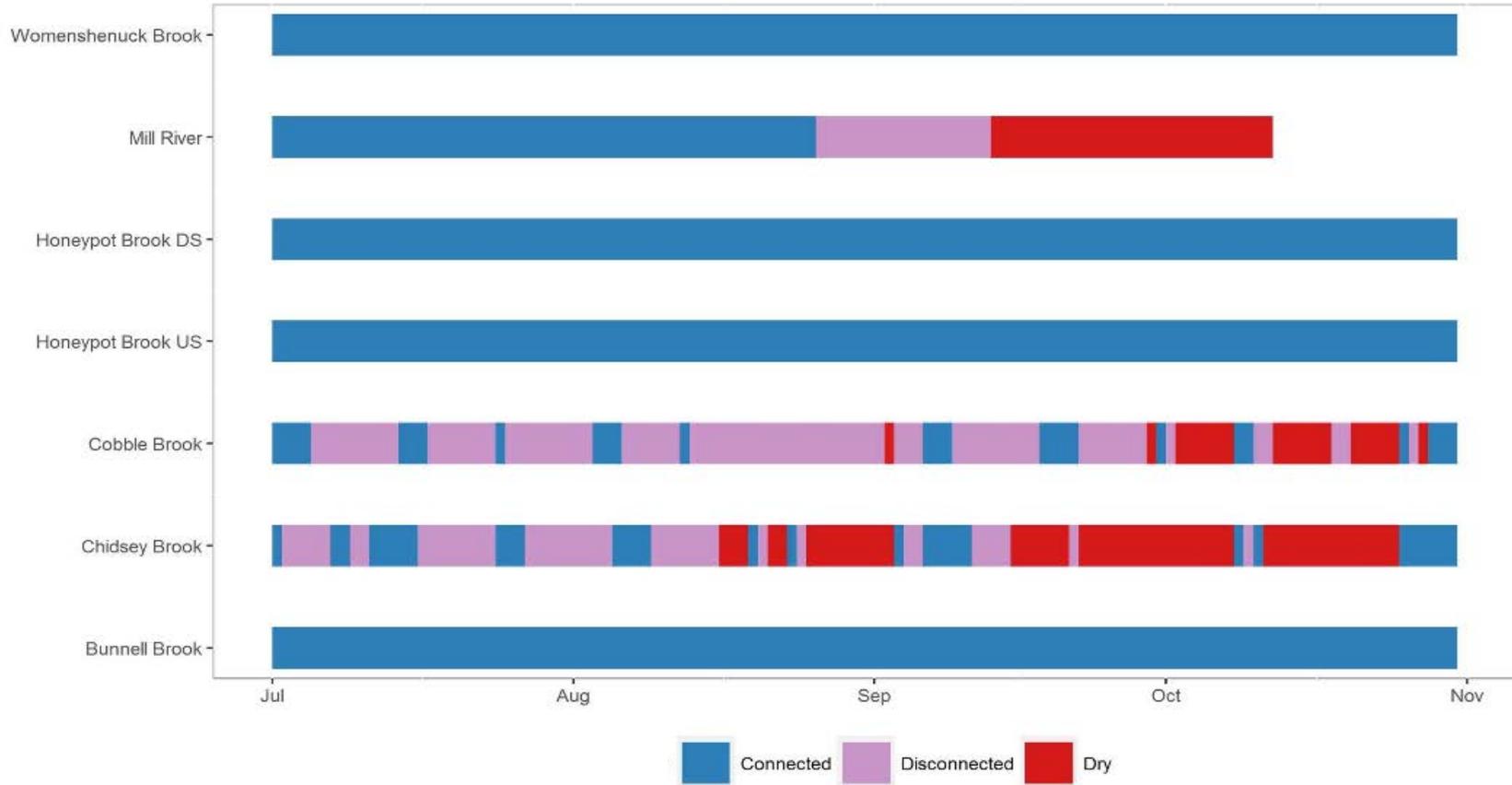
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 19657_BunnellBrook_040218_051718 (34)	4/4/2018 2:00 PM
 19657_BunnellBrook_040218_051718 (35)	4/4/2018 3:00 PM
 19657_BunnellBrook_040218_051718 (36)	4/4/2018 4:00 PM
 19657_BunnellBrook_040218_051718 (37)	4/4/2018 5:00 PM
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 19657_BunnellBrook_040218_051718 (40)	4/4/2018 8:00 PM
 19657_BunnellBrook_040218_051718 (41)	4/4/2018 9:05 PM
 19657_BunnellBrook_040218_051718 (42)	4/5/2018 12:50 AM
 19657_BunnellBrook_040218_051718 (43)	4/5/2018 5:00 AM
 19657_BunnellBrook_040218_051718 (44)	4/5/2018 6:00 AM
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 19657_BunnellBrook_040218_051718 (48)	4/5/2018 10:00 AM
 19657_BunnellBrook_040218_051718 (49)	4/5/2018 11:00 AM
 19657_BunnellBrook_040218_051718 (50)	4/5/2018 12:00 PM



- Average number of days in category 3
- Number of days in category 1 when reference USGS streams had normal flows (25-75 percentile)



Timing & Duration Metrics



How to Deploy a Trail Camera to Monitor Streamflow

Types of cameras, average cost, batteries, importance of high quality photos, field tips



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Situations where you could be using a trail camera

Streamflow

Ice-on, Ice-out

Lake levels



Types of Trail Cameras (DEEP's Experience)



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What the Trail Camera Sees

Problem: Some Trail Camera models do not allow you to view what the camera sees

Solution: SD Card reader OR Handheld digital camera



Trail Cameras & Deployment Cost

Item (upfront)	Approximate Cost
Brush clearing tools	\$100
Handheld camera	\$100-\$200
SD card reader	\$80
Multimeter	\$20
TOTAL:	\$300-\$400



Item (per deployment)	Approximate Cost
Trail Camera	\$150-\$600
Lithium Batteries (20 AA)	\$28
SD Card	\$15
Cable & Lock	\$10
TOTAL:	\$200-\$650



Lithium Batteries Recommended

Alkaline

Lithium



\$13/20 AA

\$28/20 AA

Shorter life span

Longer life span

Poor performance in cold

Performs well in cold

Leaking corrodes terminals

Minimal issues with leaking



Most Important Step!

Make sure that the firmware is up-to-date.

For Moultrie products, go to this website:

<https://www.moultriefeeders.com/firmware-faq>



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Importance of High Quality Photos

- Photos are data that provide a record of conditions
- Photos need to be clear, centered, and without any obstructions



Examples of high quality photos.



Examples of Poor Quality Photos



Overhanging branches obscuring the stream



Vegetation/bushes obscuring the stream



Field Tips

Clear image of stream

- No vegetation
- Centered as much as possible (on the bank of a meander)

Hide & lock to deter theft

Create a treasure map



Please Do Not Disturb!
DEEP Experiment
If found, please call 860-424-3735



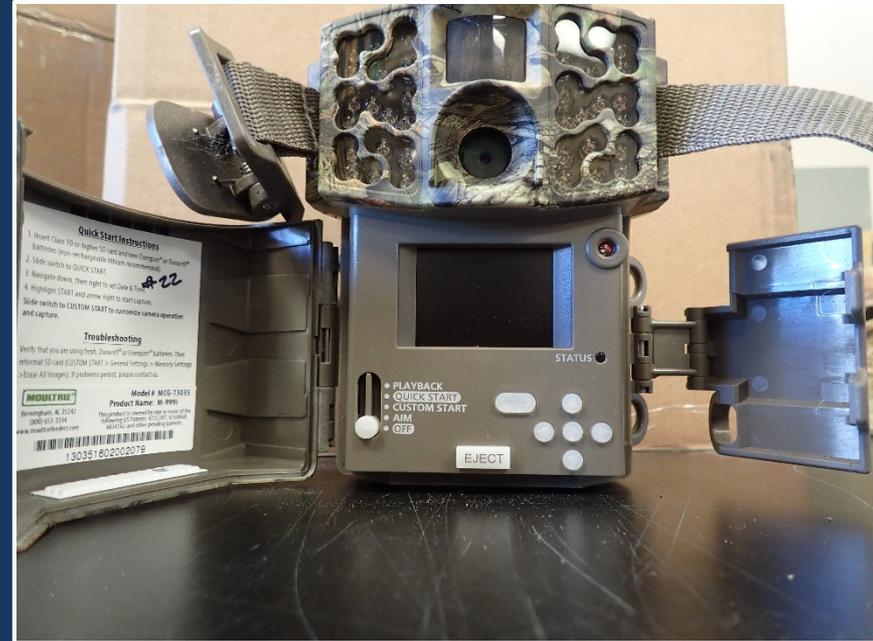
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Setting Tips

Keep infostrip on

Make sure photo quality is set to highest

If pointed towards road, turn motion detect off



Frequent Site Visits

Avoid data loss

- If camera got stolen
- If tree fell in front of camera
- If batteries failed

Check batteries

Swap SD card



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Treasure Map Example

Connecticut Department of ENERGY & ENVIRONMENTAL PROTECTION				Trail Camera Field Data Sheet	
Camera Model:	Moultrie 880	Trail Camera #:	13		
Stream Name:	Beacon Hill BK	Station ID:	19599		
Date of Deployment:	6/30/17	Time of Deployment:	1117		
Battery Brand:	Energizer	Start Battery Amp:	1.6		
Infostrip:	<input checked="" type="radio"/> on / <input type="radio"/> off	Motion Detect:	<input checked="" type="radio"/> yes / <input type="radio"/> no	Picture Quality Setting:	low / medium / high / enhanced / max zoom
Time Lapse Settings:	9 AM 3 PM	USGS Gage:	<input checked="" type="radio"/> yes / <input type="radio"/> no		
Location Description	WALK down Trout management Area path to river. WALK US, past blue house, + camera will be on left bank if facing us. camera is on tree w/ a smaller tree coming out from bottom. camera is facing US.				
Location Image					
Date of Retrieval:	11/3/17	Time of Retrieval:	0904		
Signs of Tampering:	NO	End Battery Amp:	Battery Issues		



Treasure Map Example

US of Trail Camera:



DS of Trail Camera:



Trail Camera (arrow is in direction of flow):

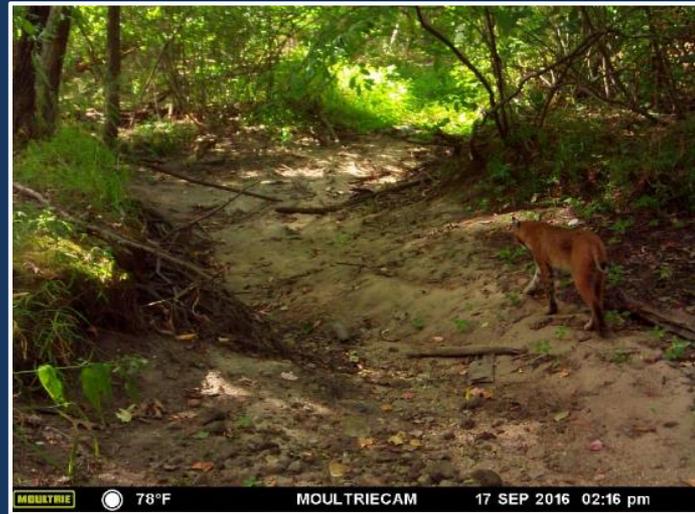


Camera Inventory

Camera Model	Serial Number	Camera Number	Date Received	Location
Moultrie M 550	130671607012759	1	7/1/2016	Field
Moultrie M 880	130671607013136	2	5/24/2017	Lab
Moultrie M 880	127171412005251	3	5/24/2017	Field
Moultrie M 999i	130351602002080	4	3/16/2018	Field
Moultrie M 999	130351602003207	5	3/16/2018	Lab
Moultrie M 40	131811610001019	6	8/14/2018	Returned to Moultrie under warranty (11/20/18)
Moultrie S-50i	131831701003626	7	10/11/2018	Stolen



Bonus – Wildlife Images



Questions?

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860-424-3091



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