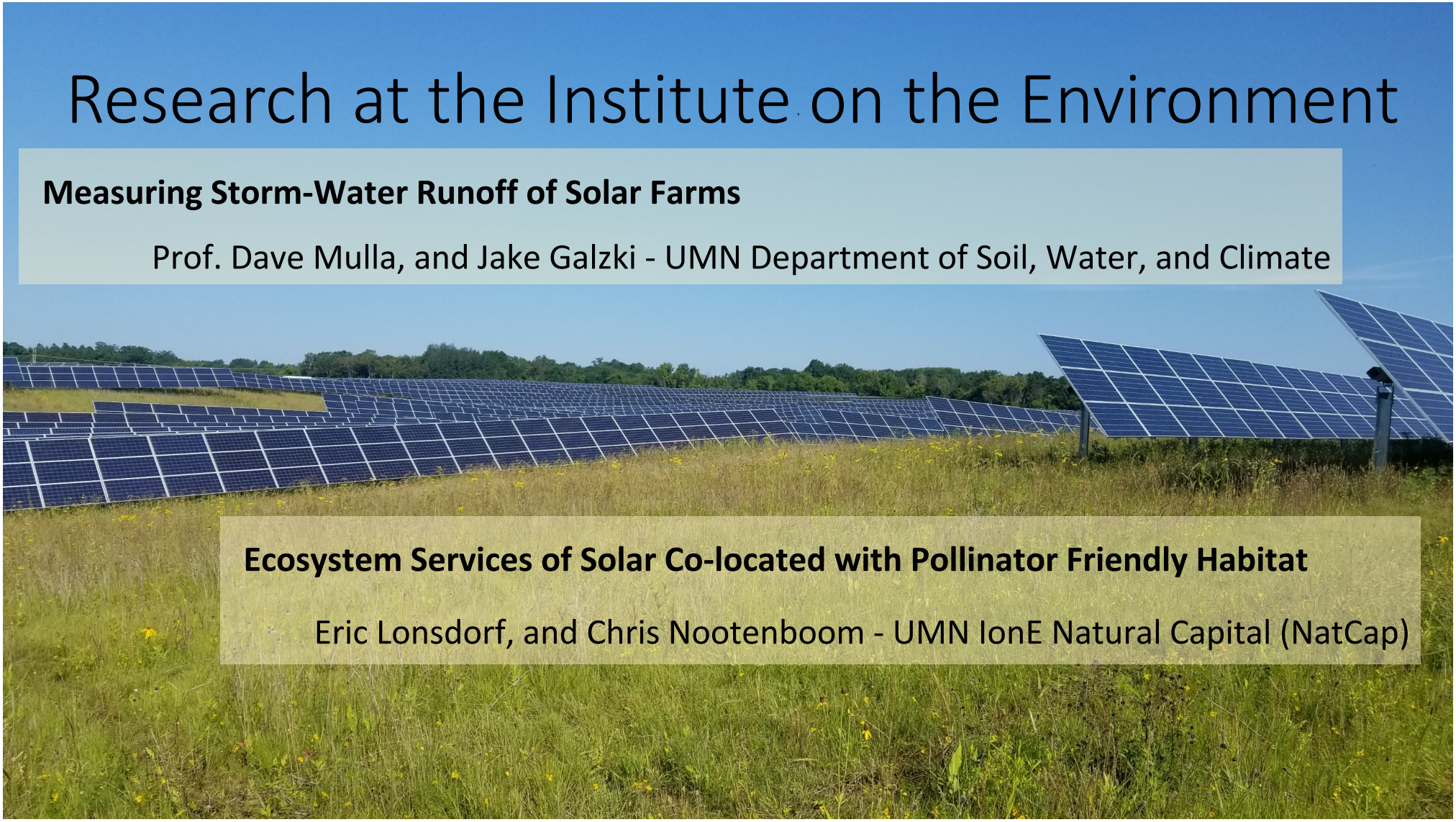
Ecosystem Value Stacking of Solar

Research at the Institute on the Environment

Measuring Storm-Water Runoff of Solar Farms

Prof. Dave Mulla, and Jake Galzki - UMN Department of Soil, Water, and Climate



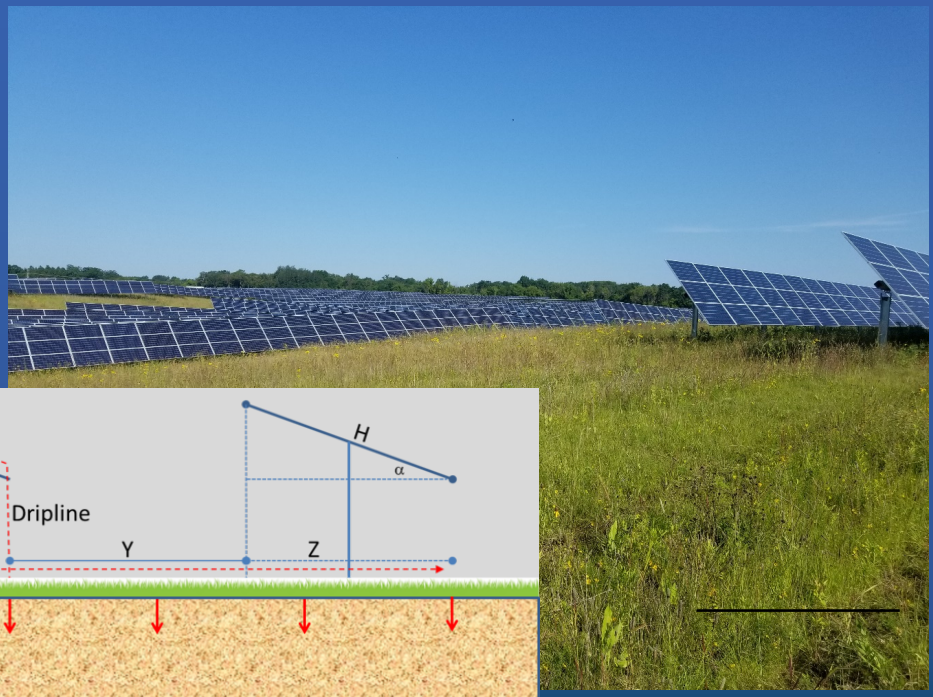
Ecosystem Services of Solar Co-located with Pollinator Friendly Habitat

Eric Lonsdorf, and Chris Nootenboom - UMN IonE Natural Capital (NatCap)


Pollinator habitat plantings can reduce runoff at solar collector sites while providing habitat for butterflies and bees

Background

- MPCA considers solar panel collector sites disconnected impervious surfaces
- MPCA has developed a spreadsheet-based solar collector stormwater calculator to estimate a surface runoff credit
- Average width under panel (Z) is considered impervious in calculator and must be accommodated as stormwater runoff




• Total Site Area ~40 acres
• 360 panels
• 10’ x 150’
= ~10 acres impervious

Matrix for Evaluation

SOLAR SITE EVALUATION				
		Types of solar panel mounts		
		South facing stationary mount (Arrays run E-W)	Single axis tracker (Arrays run N-S)	No Panels
Types of ground cover	Bare Soil			
	Grass			
	Pollinator			

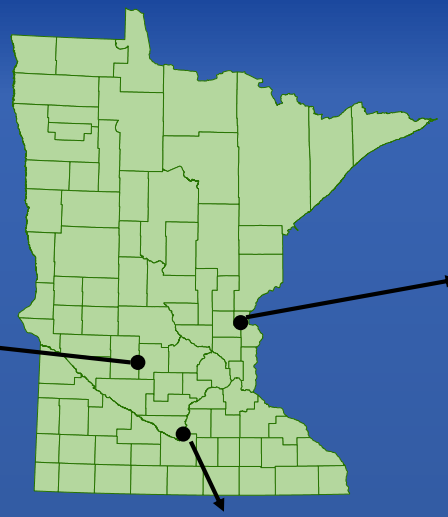
Visual Observations

Phase 1: Data Collection

Atwater, MN

Hydrologic Group B

Clay Loam



North Branch, MN

Hydrologic Group A

Sandy Clay Loam

Mankato, MN

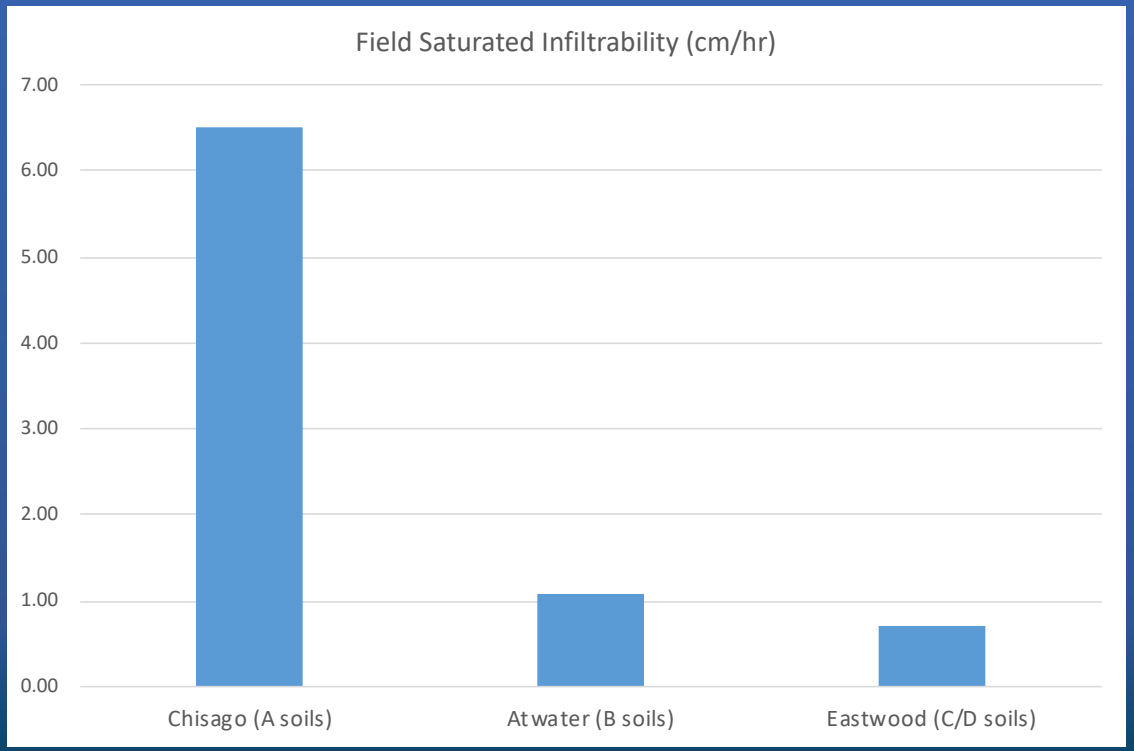
Hydrologic Group C/D

Clay

- Soil Texture analysis completed on 3 sites
- Soil infiltrability measurements collected with Cornell Sprinkle Infiltrometers
- Soil moisture monitoring complete for 2019 season

Infiltration Data

- Measurements taken at each site with Cornell Sprinkle Infiltrometer



Soil and Water Potential Benefits

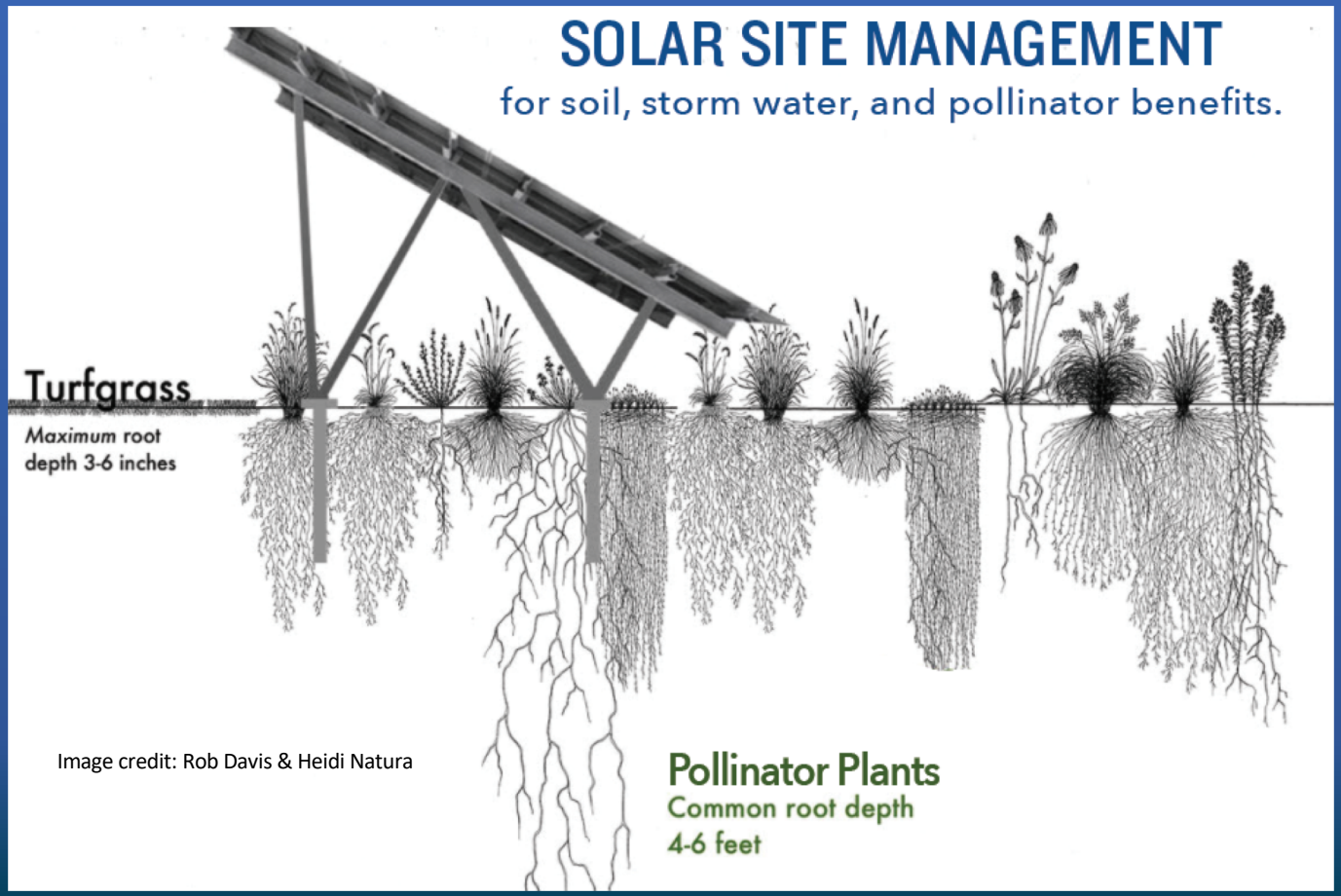
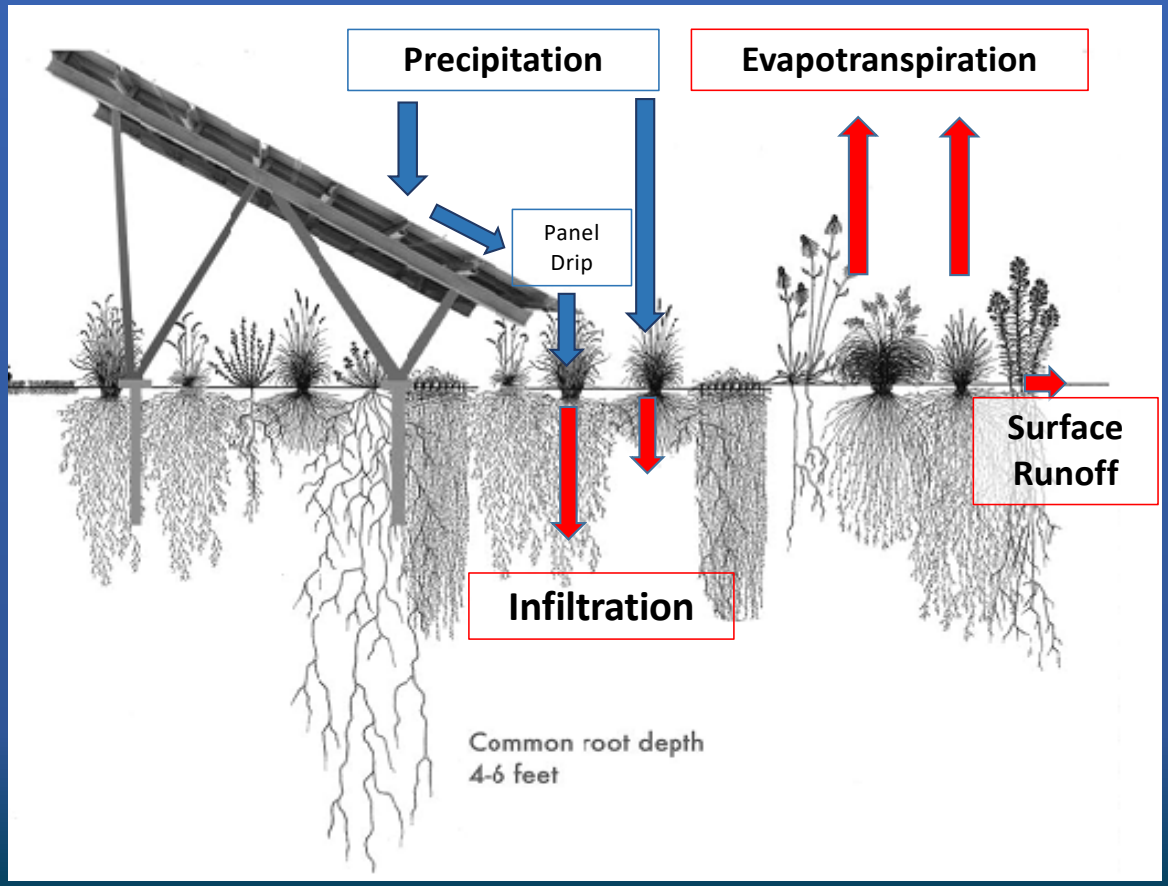


Image credit: Rob Davis & Heidi Natura

Phase 2: Hydrologic Modeling

- A one-dimensional flow simulation model such as Hydrus 1-D will be used to estimate soil water infiltration
- Calibration of the model will utilize site specific experimental data collected in Phase1



Draft Manuscript on Solar+Pollinator Ecosystem Services Modeling

State	Total Nameplate Capacity (MW)	Total Footprint Size (ha)
Illinois	38.5	86.7
Indiana	214.3	574.2
Iowa	9.2	15.9
Michigan	98.3	250.1
Minnesota	741.5	2,252.7
Missouri	61.1	173.2
Wisconsin	20.9	63.2
TOTAL	**1,183.8**	**3,416.0**

*Results pending peer-reviewed publication

Upcoming Research

- **PV Stormwater Management Research and Testing (PV-SMaRT)**
  - NREL, University of Minnesota, Great Plains Institute, and Fresh Energy
  - 3 years, 5 states, $800,000

1) Establish and engage Water Quality Task Force to provide technical and applied guidance
2) Conduct field research to quantify stormwater runoff and water quality
3) Calibrate and validate a 3-D hydrologic model
4) Develop PV-specific stormwater management best practices
5) Education and outreach to stakeholders

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