Brief Review of Relevant Published Research + Existing Stormwater Guidance

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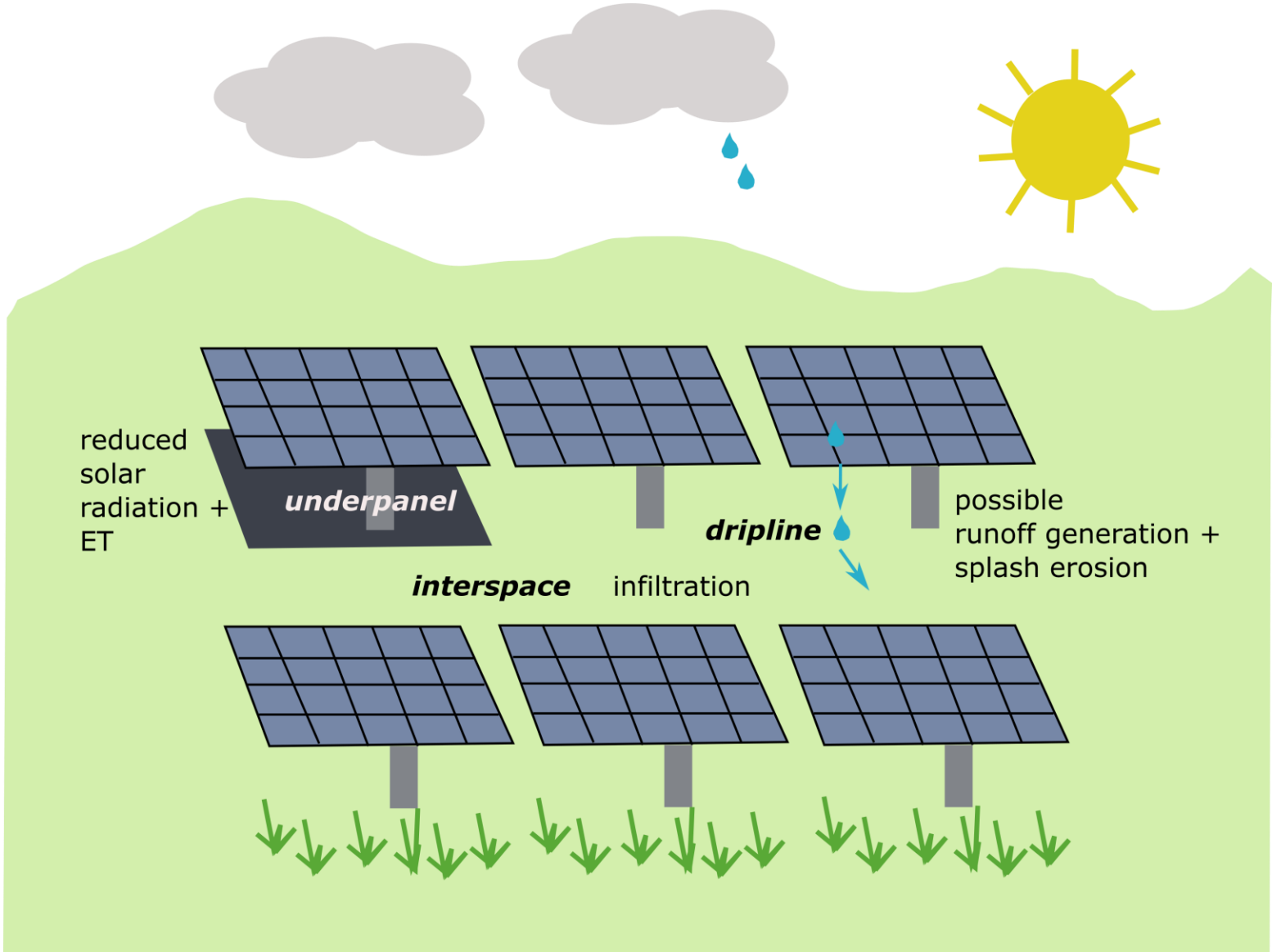
Guiding Questions

- *What do we know about how ground-mounted solar panels alter 'natural' hydrologic processes? Soil properties? Vegetation?*

- *What guidance/requirements exist for US states with respect to managing stormwater on solar farms?*


reduced
solar
radiation +
ET
underpanel
dripline
possible
runoff generation +
splash erosion
interspace
infiltration

For more details, check the pre-workshop reading packet

ENVIRONMENTAL RESEARCH
INFRASTRUCTURE AND SUSTAINABILITY

TOPICAL REVIEW

Minimizing environmental impacts of solar farms: a review of current science on landscape hydrology and guidance on stormwater management

Rouhangiz Yavari[1], Demetrius Zaliwciw[2], Raj Cibin[3] and Lauren McPhillips[4]

Existing field-based studies (as of last summer)

- 11 total studies worldwide
  - Western US, Europe, China
- Sites: Mix of cropped agri-voltaic, native vegetation
- Foci: Micro-meteorology, soil moisture, soil properties, vegetation…. but not runoff

Existing field-based studies indicate that addition of panels has led to….

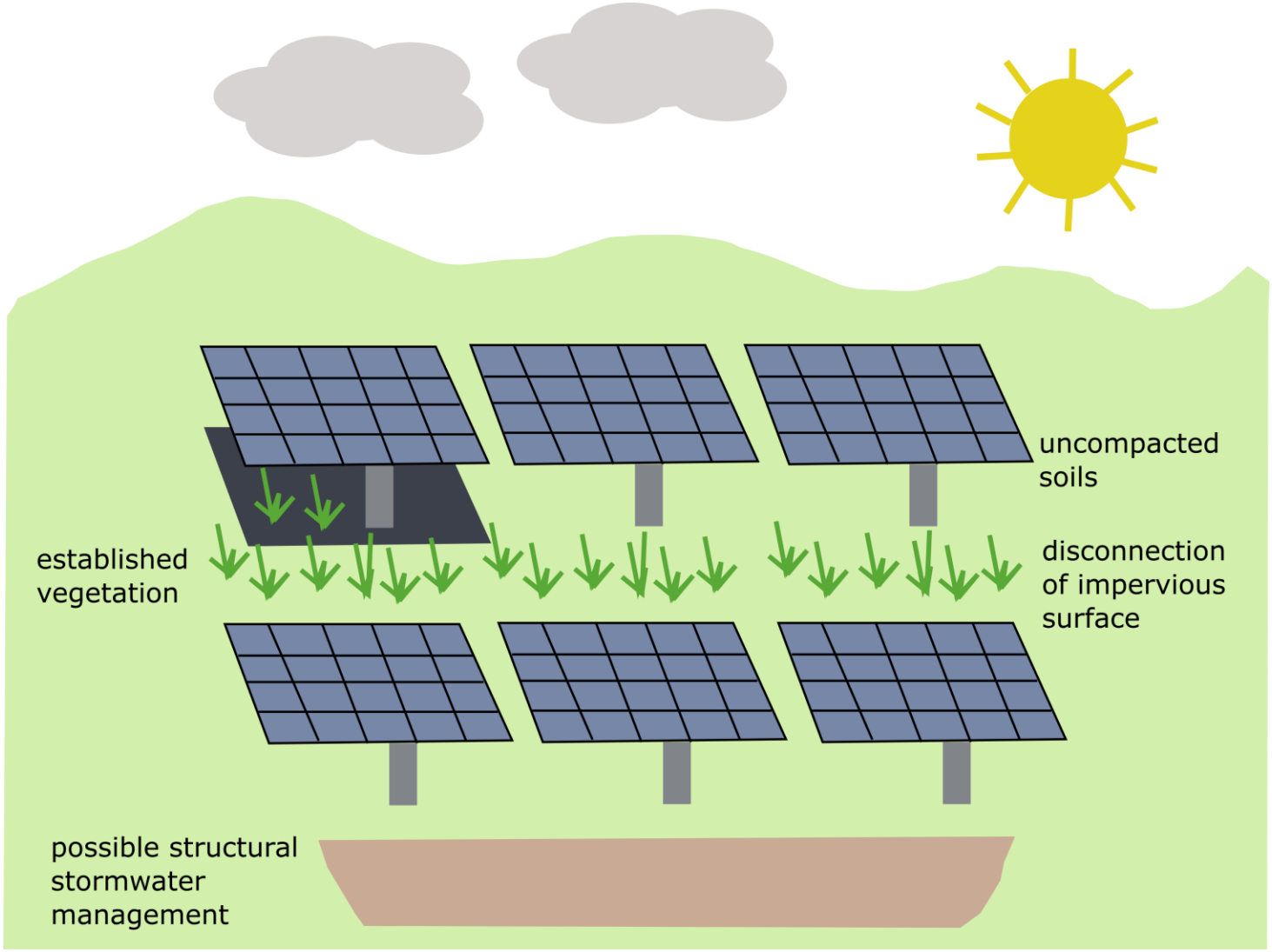
- Soil properties: no change, or some undesirable changes
- Micro-meteorology: reduced solar radiation + wind under panels, leading to reduced evapotranspiration (ET)
- Soil moisture: redistribution of water to dripline, but variable whether interspace or underpanel are wetter or drier
- Vegetation: either decreases or increases in biomass under panels has been observed, depending on climate

Existing model-based studies (as of last summer)

- 7 published studies
- Almost all existing modeling studies don't account for unique configuration of impervious panel over pervious surface
- Most studies indicated increases in runoff, though a custom MATLAB model by Cook & McCuen (2013) found that any changes in runoff from panels could generally be managed w/o structural stormwater management

What is current guidance in US states regarding solar-specific stormwater management?

As of 2022, 12 US states had solar-specific guidance for construction/ post-construction stormwater management



Examples regarding site conditions

- Ideally < 5-10%; over this, more extensive management considerations may be needed
- Shallow soils <1 ft to bedrock may require topsoil addition (NH)
- Soils with slip potential need to be more carefully evaluated, particularly in conjunction with higher slopes

Construction considerations

- Minimize compaction and disturbance (including topsoil removal), especially in interspace areas
- Implement temporary erosion & sediment controls

Runoff calculations for solar farms

- Some may not consider solar farms as impervious surface
- Several states consider solar farms as disconnected impervious surface
- Others have different considerations depending on slope and soil type

Post-construction site management

Disconnection of the impervious surface (i.e., solar panel rows) with well-established vegetation is key!

- Pervious interspace recommended >= panel width
- Adequate vegetation cover (e.g. >85%), slow-growing/ low maintenance vegetation, shade-tolerant vegetation
- Minimal mowing (>4 inch veg height)

Post-construction site management

Structural stormwater management may be needed in some cases, such as

- Infiltration basins or trenches
- Stone splash pads for erosion control