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2nd Webinar SOLVE

Agrivoltaic Systems

Solar Irradiance Assessment and Integration of Spectrally-Selective Solar Cells to Boost Spectral Sharing of Sunlight

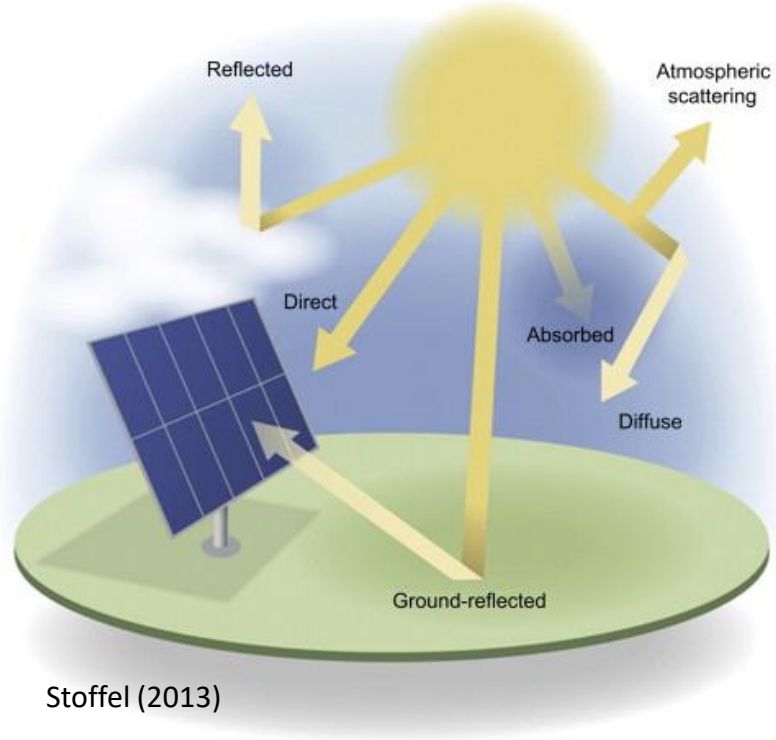
Agrivoltaics Classification

Proposed by Fraunhofer ISE. Adapted from Gorjian et al. (2022)

Solar Resource Assessment

To assess the **available solar potential** and the **amount of energy** that the **photovoltaic system** can convert from the Sun on an **annual basis**

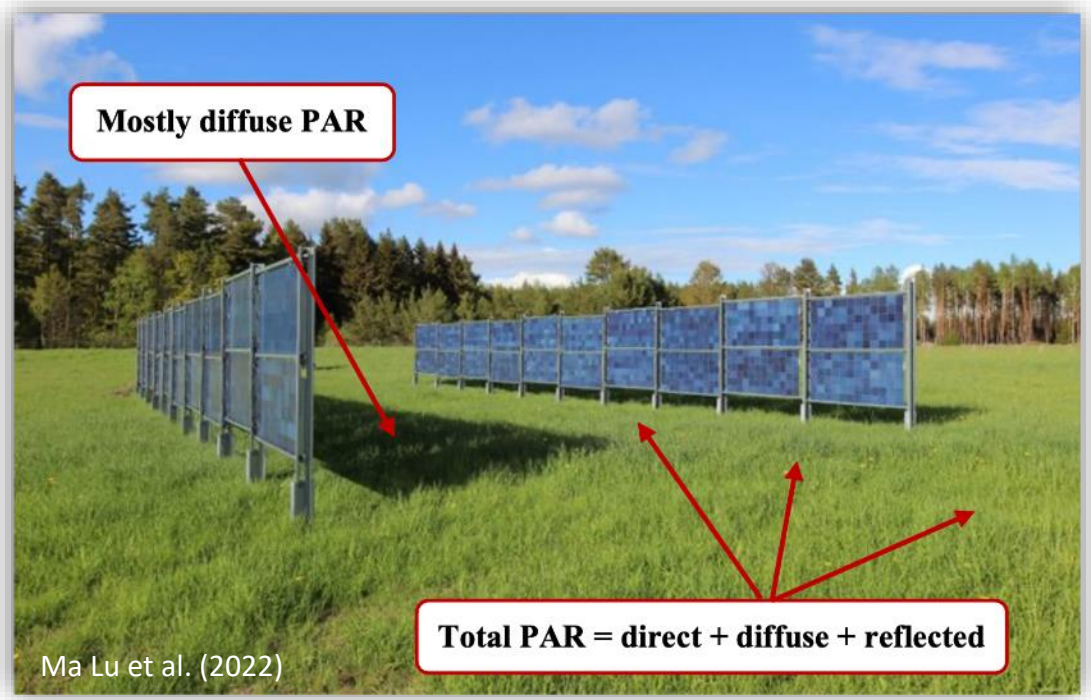
Conventional PV



Stoffel (2013)

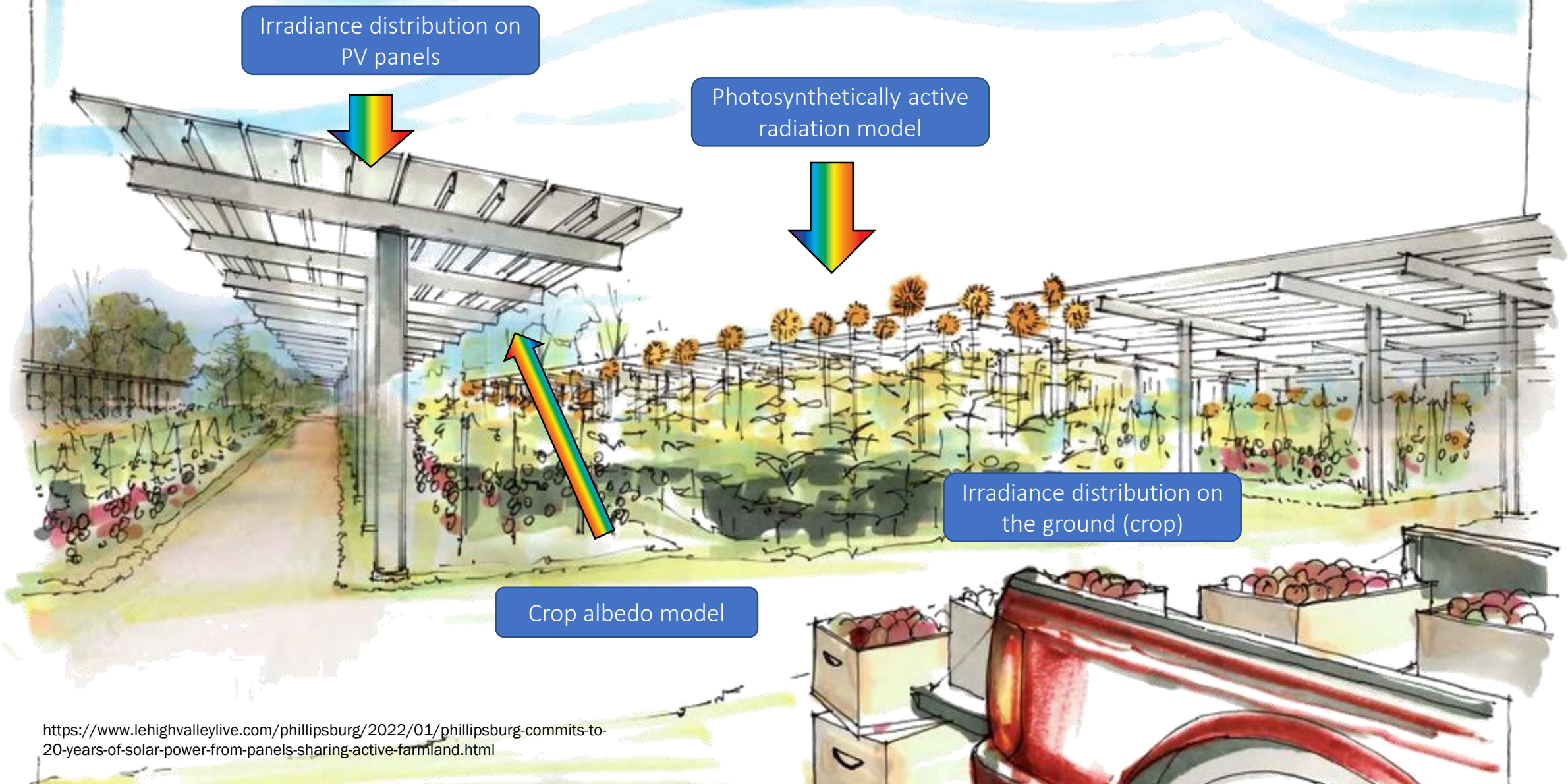
+ To assess the **received sunlight** or the **amount of photosynthetically active radiation (PAR)** that the **crops** can use for photosynthesis and biomass production on an **annual basis**

Agrivoltaic



Ma Lu et al. (2022)

Solar Irradiance Assessment in Agrivoltaic Systems

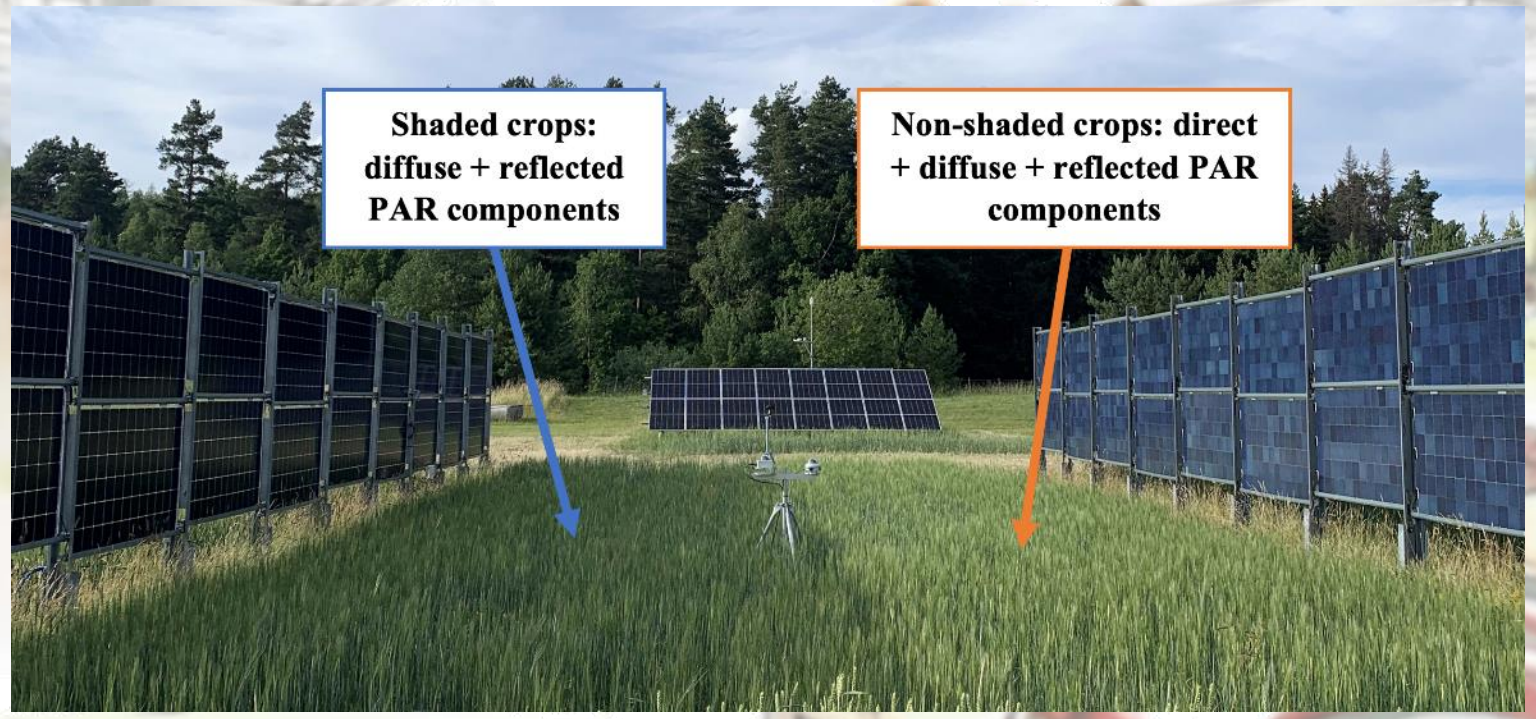


https://www.lehighvalleylive.com/phillipsburg/2022/01/phillipsburg-commits-to-20-years-of-solar-power-from-panels-sharing-active-farmland.html

Solar Irradiance Assessment in Agrivoltaic Systems

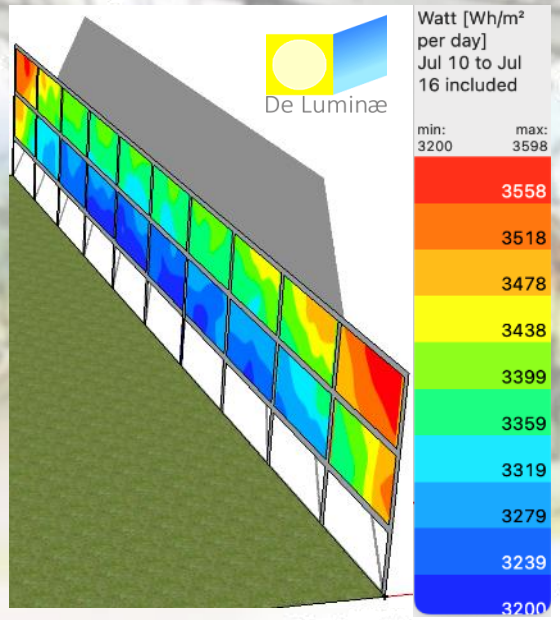
Models to get the diffuse component from the global or total one

Photosynthetically active radiation model

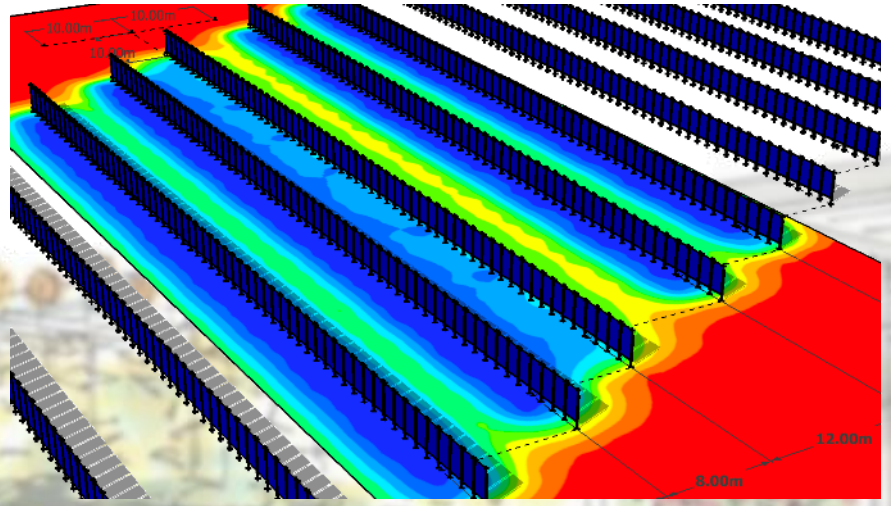


Solar Irradiance Assessment in Agrivoltaic Systems

Irradiance distribution on PV panels

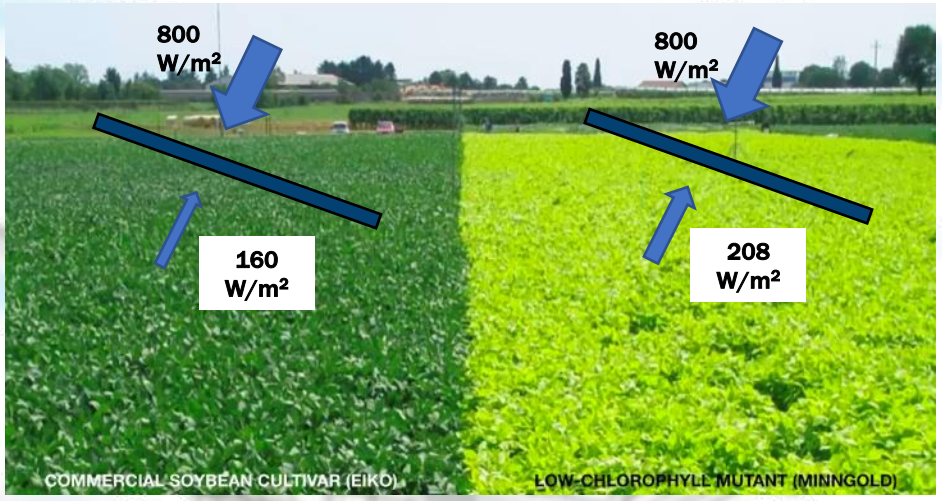


Analysis of different systems and PV technologies to find strategies for improving overall PV power output and crop yield



Irradiance distribution on the ground (crop)

Solar Irradiance Assessment in Agrivoltaic Systems



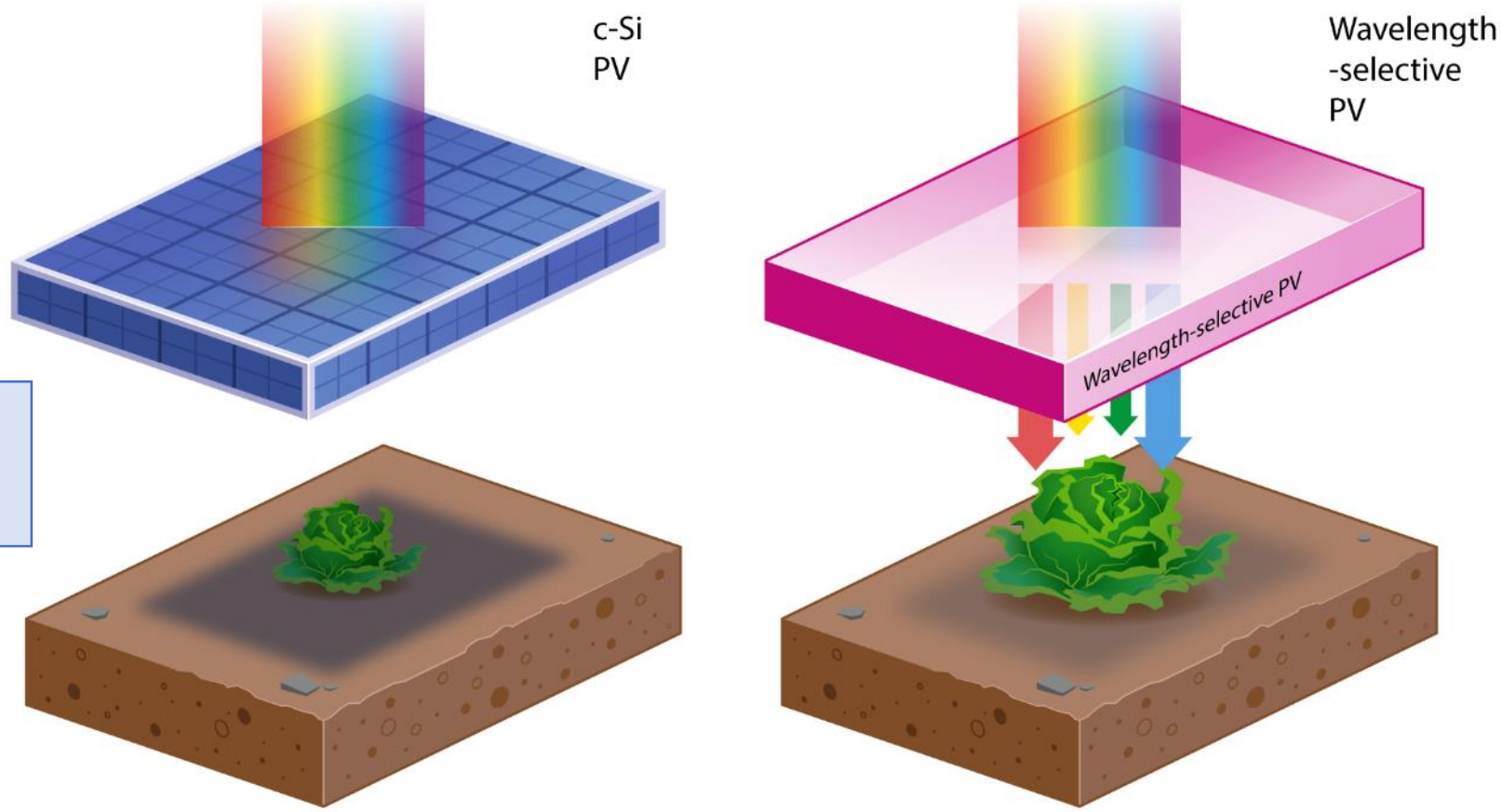
Miglietta, F. (2022 Oct 12).“Crop monitoring for automation in Agrivoltaics”. Side Event to the FAO Science and Innovation Forum. Online.

Models to account for seasonality, crop variety and daily variations of ground albedo that directly impacts PV power output estimations.

Fixed albedo for yearly evaluations should not be used!

Crop albedo model

Spectrally-Selective Solar Photovoltaics: A new approach



Electricity ↑
Biomass ↓

Electricity ↓
Biomass ↑

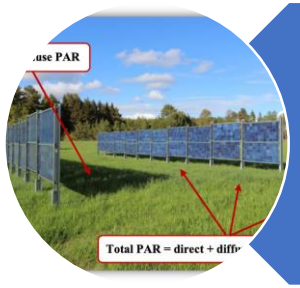
Initial Prototypes and Tests

PV Technology: Thin-film Cadmium Telluride
Transparencies: 50% and 70% (density of solar cells)
Crop: Broccoli
Period: July – October 2023
Location: Kärrbo Prästgård

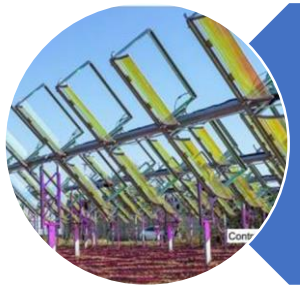
- Modelling of semi-transparent PV technologies
- Feasibility of this innovative approach

Take-aways

Many designs exist depending on the application, which increases the modelling complexity of the interactions between the agricultural activity and the PV system



Solar resource assessment in agrivoltaic systems needs to evaluate the solar potential on both the PV system and the agricultural land with the relevant indicators



New approaches in agrivoltaic systems are emerging that aim to efficiently share the light between the crops and the solar PV technology

Thank you for the attention! Questions?

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