CROP WATER PRODUCTIVITY

AN ONLINE SHORT COURSE BY
DR. EGOR PRIKAZIUK
WITH SUPPORT OF
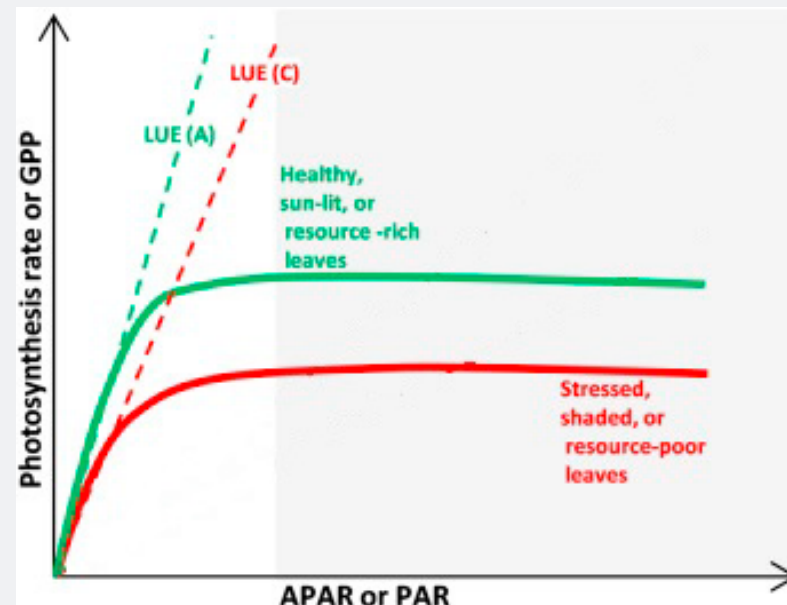THE EUROPEAN GEOSCIENCE UNION, EGU

YOU WILL LEARN TO

1. **Explain** the link between **crop yield** and **crop water demand** (reading, lecture)

2. **Link** the **components** of crop water productivity (CWP), plant productivity, evapotranspiration, with the respective **Earth Observation (EO) based modelling techniques** (reading, lecture)

3. **Calculate crop yield** from EO-based **gross primary productivity** (GPP) estimates (exercise, Excel)

4. Identify **phenological metrics** (start, end of the growing season) from EO data (exercise, Excel)

5. Produce **meaningful**, growing season-related **estimates** of CWP (exercise, WaPOR)

6. Conclude on the **efficiency of the water management scheme** in the study area (case study)

$$gross\ WP = \frac{\Sigma_{SOS}^{EOS} \textcolor{red}{GPP}}{\Sigma_{SOS}^{EOS} ET}$$

LIGHT USE EFFICIENCY (LUE) MODEL

MONTEITH 1972

$$GPP = [LUE_{max} \cdot f_{stress}] \cdot [fAPAR \cdot PAR]$$

- More light – more photosynthesis

- Light is Photosynthetically active radiation, PAR

- LUE_{max} is reduced by stress factors: temperature, humidity, excess light, soil water
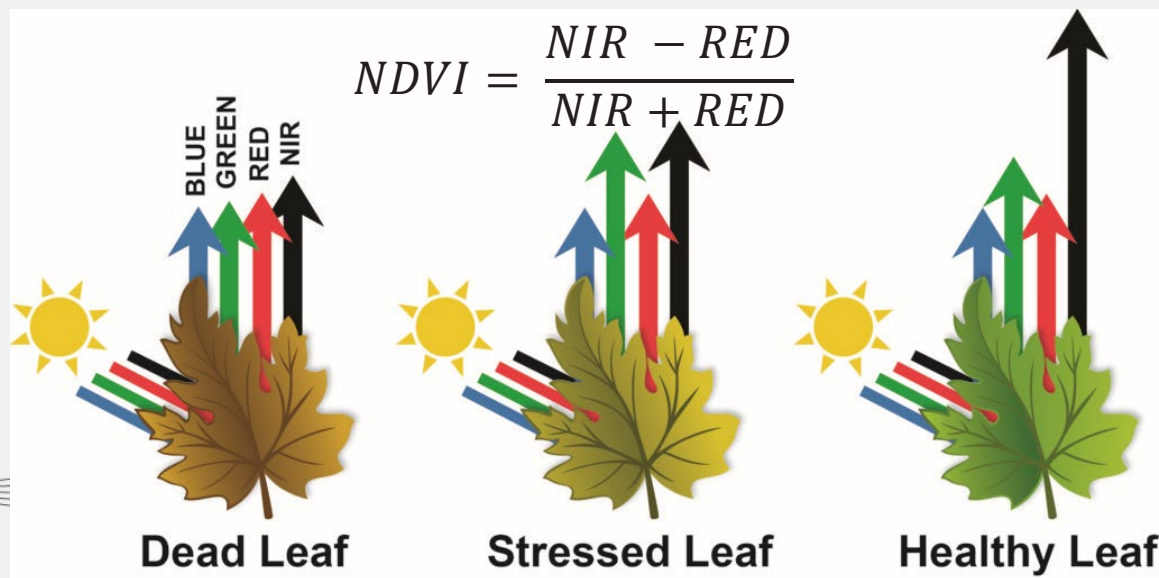

LUE (C)

LUE (A)

Photosynthesis rate or GPP

Healthy, sun-lit, or resource-rich leaves

Stressed, shaded, or resource-poor leaves

APAR or PAR

LUE_{max} is 2% or 2.5 gC MJ^{-1}

Gonsamo and Chen, 2018, Chapter 3.11

$$gross\ WP = \frac{\Sigma_{SOS}^{EOS}\ GPP}{\Sigma_{SOS}^{EOS} ET}$$

LIGHT USE EFFICIENCY (LUE) MODEL

MONTEITH 1972

$$GPP = [LUE_{max} \cdot f_{stress}] \cdot [fAPAR \cdot PAR]$$

- Normalized difference vegetation index (NDVI) is a good proxy of the fraction of absorbed light fAPAR
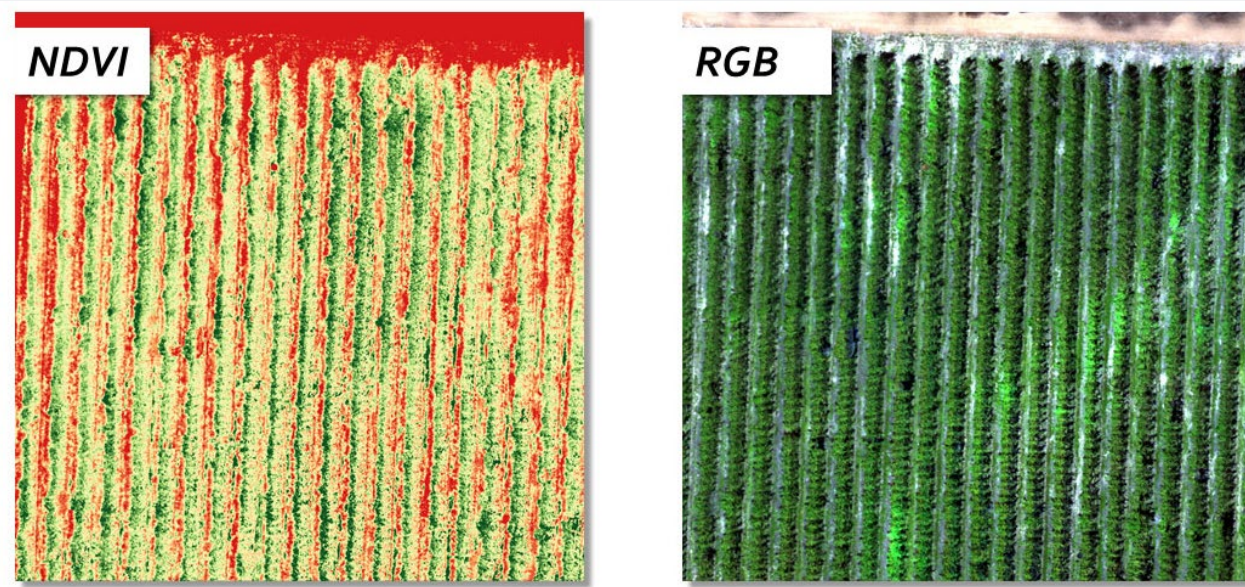

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

Dead Leaf   Stressed Leaf   Healthy Leaf

$$gross\ WP = \frac{\Sigma_{SOS}^{EOS}\ {\color{red}GPP}}{\Sigma_{SOS}^{EOS}\ ET}$$

LIGHT USE EFFICIENCY (LUE) MODEL

MONTEITH 1972

$$GPP = [LUE_{max} \cdot f_{stress}] \cdot [{\color{red}fAPAR} \cdot PAR]$$

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