**BTV 2ed**

Preliminary plan

*This is how I imagine the 2ed of Beyond the Visible. Edited to some extent after talking with Marcel and earlier exchanges of ideas with Eva Rosenqvist and Matt Robson, as well as comments from chapter authors from the first edition.*

**Handbook 2ed Title**

Suggestions, for a possible book title

1. *Field Methods in Plant Photobiology: From Principles to Practice*
2. *Plant Photobiology: Recomended Practices and Field Methods*

**Scope**

* Wavelength scope: 280–900 nm (expanded to include VIS and FR).
* Exclude methods used at the lab bench (as in first edition).
* Include gas-exchange and chlorophyll fluorescence? (As we have Wolgang, Eva, Otmar and also Alexey Shapiguzov as possible authors).
* Actual computations
  + My R packages can be used for many calculations relevant to the book. They will greatly simplify the production of many of the illustrations. However, I would rather keep the details of the R code out of BTV2 so that it does not become bloated.
  + The details of the use of the R packages for photobiology will go into a separate book, for which I already have a partial manuscript.

**Editors**

* Pedro Aphalo
* Marcel Jansen
* Wolgang Bilger (?)
* Eva Rosenqvist (?)

**Publisher**

* UV4Plants as web site, even pre-release chapter by chapter.
* CRC/Taylor & Francis (most likely in parallel with the open-access web site)
* other?

**Chapters for 2nd edition**

1. Radiation and optics

Previously: *Introduction*

1. Make text more accessible to those not-mathematically minded. (Pedro + LOB + Andreas Albert (?) + Ylianttila (?))
2. Update colour definitions to follow ISO/CIE. (Pedro)
3. Discuss reflectance vs. angle of incidence. (Pedro + LOB)
4. Discuss the mechanisms behind fluorescence and luminiscence. (Pedro + LOB)
5. Do we need a brief introduction to light sensing by plants? (Luis + Neha + Jorge Casal?) XX
6. *Move discussion of radiation in the environment to new chapter 2.*

2. The UV and VIS environment of plants

New chapter.

1. Emphasize more the climatology UV and VIS. Including up-to-date maps. (Daniele Griffoni + Anders Lindfords)
2. Latitudinal and diurnal variation in UV and VIS spectrum, including R:FR.
3. Discuss in depth waveband ratios in nature (Pedro + Matt?).
4. Discuss light distribution and sunflecks in canopies (Maxime Durand)
5. Update and expand text on light in aquatic environments. (Pirjo Huovinen + Ivan Gómez?)

3. Design, planning and data analysis from photobiological experiments

Previously: *Design of photobiological experiments*

1. Field and controlled experiments (New, Pedro + Marcel)
2. Statistical aspects (Pedro, not much to do.)
3. Sampling procedures for laboratory analyses (Pedro?, Neha?, Luis? Nina?)
4. Bases of expression for concentrations

4. Plant cultivation

Previously: *Plant cultivation*

1. Cultivation of terrestrial plants in controlled environments (Eva Rosenqvist + Pedro)
2. Guidelines for reporting conditions
3. Cultivation of terrestrial plants outdoors (Víctor Sadras? + Otmar Urban? + Pedro)
4. Weather stations and WMO requirements.
5. Computing the position of the sun.
6. DLI dialy light integral (Titta Kotilainen (?))
7. Cultivation of aquatic plants (Pirjo huovinen)

5. Manipulating UV and VIS radiation

Previosuly: *Manipulating UV radiation*

1. Update safety considerations to address current regulations and recommendations.
2. Expand material on LEDs, including approaches to dimming and pulse generation. (Pedro + Alan Morrison)
3. Lenses and reflectors used with LEDs (Pedro).
4. Discuss diffuse vs. direct light from artificial sources. (Pedro)
5. Update on films and filters needed (expand on the effect of angle of incidence)
6. Greenhouse screens (based on spectral data from Matthew Robson and Titta Kotilainen)
7. Greenhouse cladding (glass, films, PMM, PC, etc.)

6. Quantifying UV and VIS radiation

Previously: *Quantifying UV radiation*

1. Update information on input optics for spectrometers (new shapes, and performance). (Pedro)
2. Temperature dependence of calibrations of spectrometers.
3. Expand response spectrum of broadband sensors (examples of errors, PAR, ePAR, R, FR, UVA1, UVA2, UVB, pyranometers).
4. ePAR vs. PAR
5. R:(R + FR) vs. R:FR
6. Add computations for Pfr:Ptot photoequilibrium and photocycling.
7. Update equipment examples to those currently available. (Pedro)
8. Simulation of the solar spectrum (Anders Lindfors / Maxim Durand + Pedro)

7. Imaging in UV, VIS and IR

Possible new chapter.

1. Still, video and time lapse imaging as research tools (Pedro + Eva).
2. Cameras, lenses (Pedro + Ylianttila?).
3. Camera Filters, etc., (Pedro)
4. Multispectral and hyperspectral imaging (Pedro + Alexey?).
5. Thermal imagining (Pedro + ?).
6. UV induced VIS and NIR fluorescence and VIS induced NIR fluorescence (Pedro + Ylianttila (?)).
7. Image editing (Eva + Pedro).

a. White balance, noise reduction, contrast enhancement.

b. Multi-image methods: HDR, focus stacking, panoramas

c. Colour profiles and light sources.

d. Image editing when images are used as scientific evidence.

8. Measurement of optical properties of leaves and materials

New chapter.

1. Epidermal transmittance, etc. (Wolfgang Bilger)
2. Reflectance and transmittance of whole leaves (and flowers?) (Matt? + Pedro).
3. Filters, etc., (Pedro)
4. Fluorescence of leaves (and glass filters!) (Pedro).
5. Optical measurement of chloroplast accumulation (Justyna (?) + Pawel (?))
6. In-situ measurement of plant pigments (Matt? + Wolfgang + Marcel?).

9. Plant phenotyping for the crowds

New chapter.

1. Introduction to image analysis with ImageJ (Fang Wang + Pedro).
2. Using AI and ML approaches (Pedro + ?).
3. Fluorescence of leaves (and glass filters!)
4. Optical measurement of chloroplast accumulation (Justyna (?) + Pawel (?))
5. Porometry (Maxime? + Pedro + Eva?).
6. Gas-exchange (Alexey + Eva? + Pedro).
7. Chlorophyll fluorescence (Eva + Wolfgang? + Alexey).

10. Data acquisition and logging

New chapter.

1. Examples of modern dataloggers, large and small (Pedro + Eva?).
2. IOT (Internet of Things) (Alan?).
3. Communication protocols (USB, Wifi, USB, LORA, etc) (Pedro + Alan?).
4. Protocols SDI-12 and “intelligent sensors” (Pedro + Alan?).
5. Time coordinates (Pedro).
6. On-line weather and climate data sources (Pedro + Max).
7. On-line sources of UV, VIS, and NIR irradiance estimates based on satellite sensing (FMI, Kaisa).
8. Remote sensing of pigments and photosynthesis (Albert Porcar et al. ?)

Appendixes

1. Further reading
2. Suppliers
3. Glossary