photobiologySun Version 0.3.7
Catalogue of Solar Spectra

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1 Introduction

The plots show the solar spectral irradiance data included in the package.

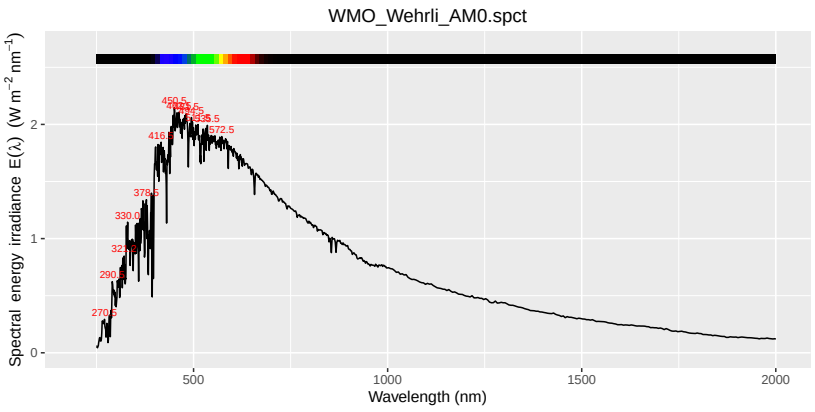
```
library(ggplot2)
library(ggspectra)
library(photobiology)
library(photobiologyWavebands)
library(photobiologySun)
library(lubridate)
```

```
options(photobiology.plot.annotations =
          c("boxes", "labels", "colour.guide", "peaks", "title"))
```

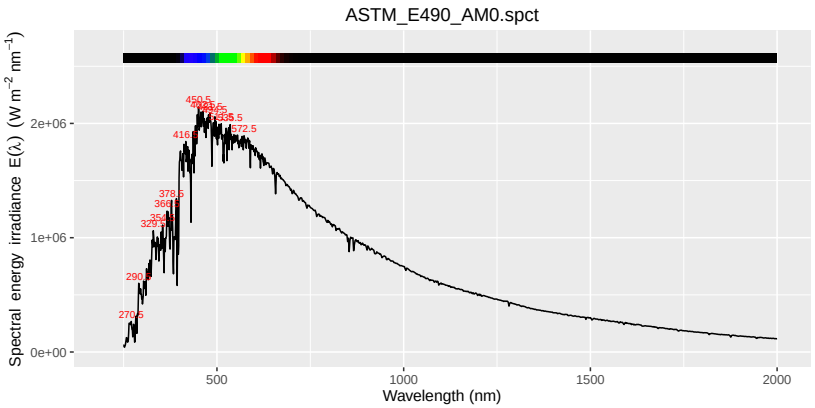
We define a function to do the actual plotting so as to not repeat code, and to make changes easier in the future.

2 Extraterrestrial solar spectra

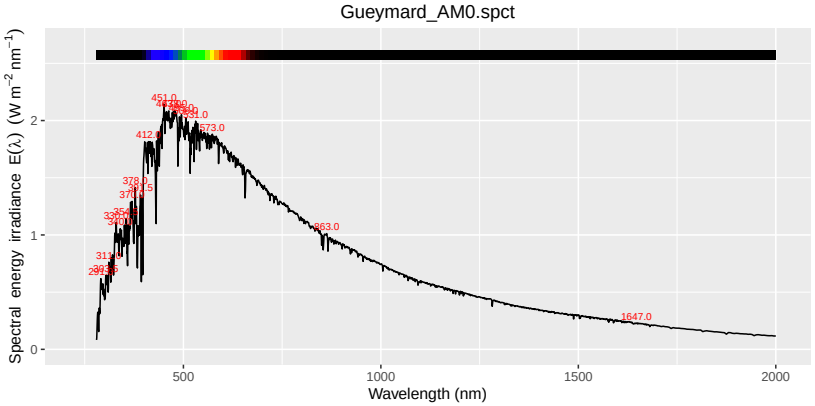
```
plot(WMO_Wehrli_AM0.spct, range=c(250, 2000), w.band = NULL)
```



```
plot(ASTM_E490_AM0.spct, range=c(250, 2000), w.band = NULL)
```

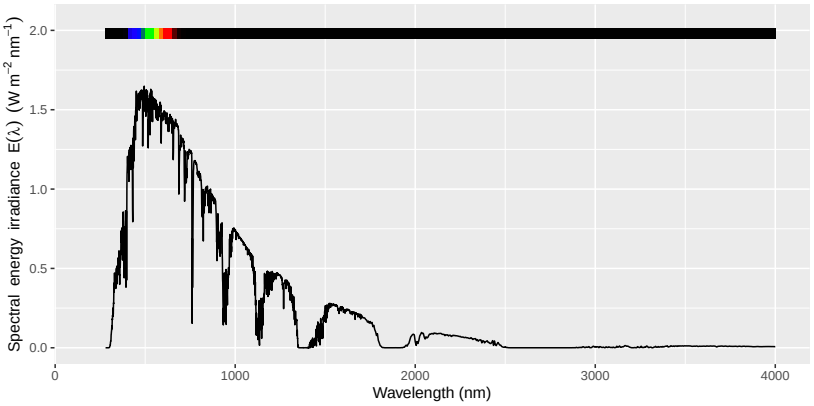



```
plot(Gueymard_AM0.spct, range=c(250, 2000), w.band = NULL)
```

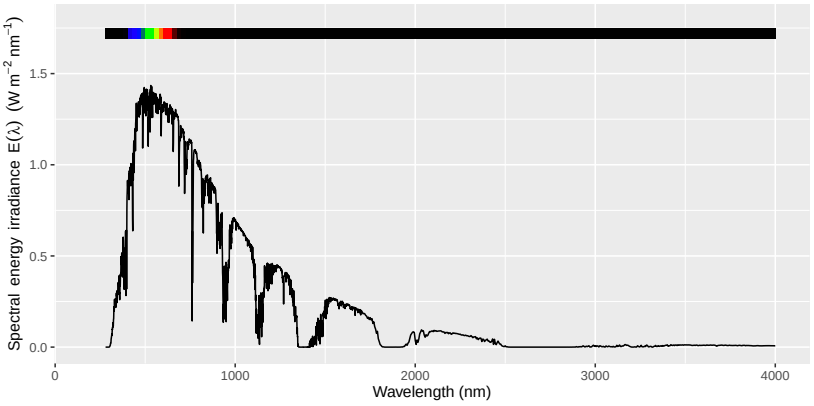


3 Standard terrestrial solar spectra

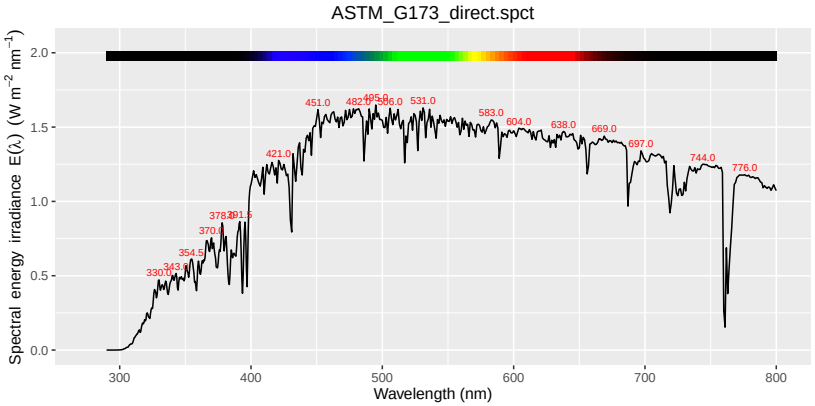
```
plot(ASTM_G173_direct.spct, annotations="colour.guide")
```



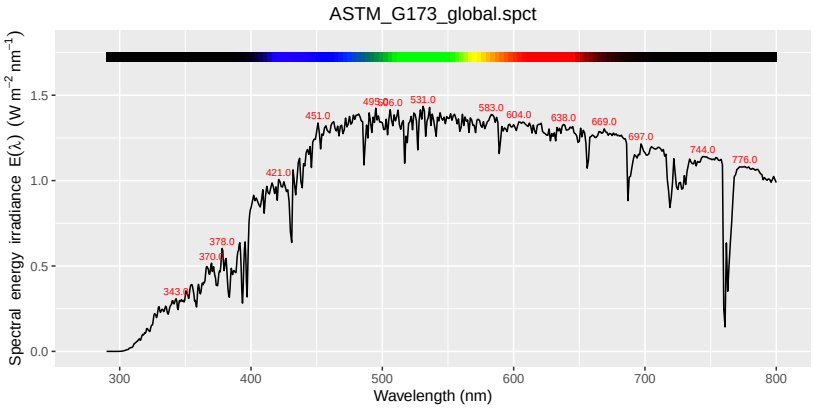

```
plot(ASTM_G173_global.spct, annotations="colour.guide")
```




```
plot(ASTM_G173_direct.spct, range=c(290, 800), w.band=PAR())
```

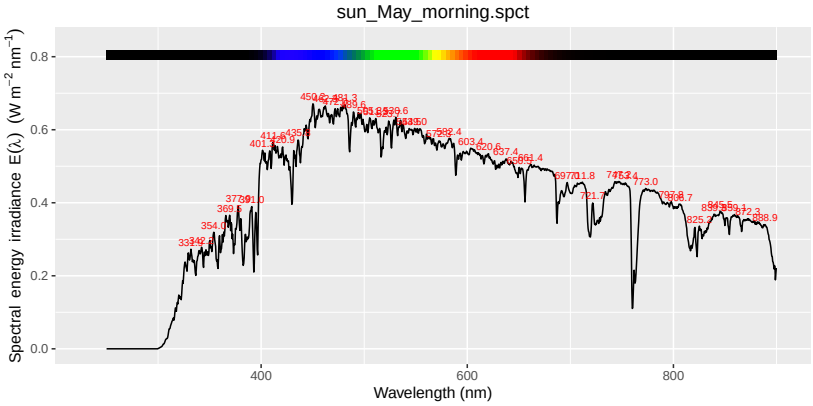



```
plot(ASTM_G173_global.spct, range=c(290, 800), w.band=PAR())
```

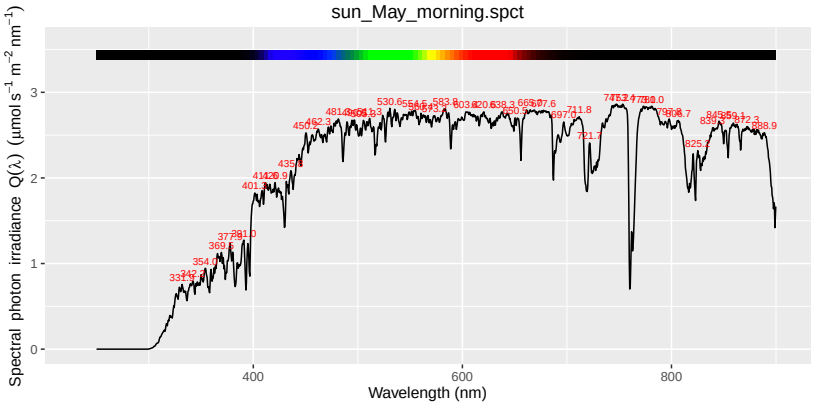


4 Measured daylight spectra

```
plot(sun_May_morning.spct)
```

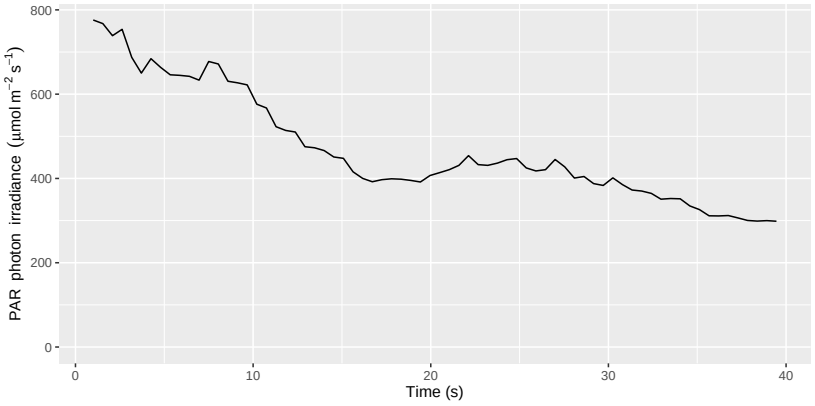



```
plot(sun_May_morning.spct, unit.out = "photon")
```

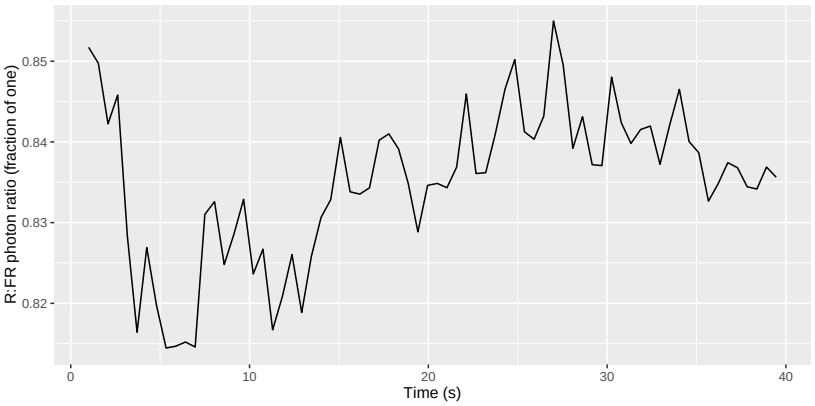


April in Helsinki, under birch trees, in a sunfleck.

```
ppfd.df <- q_irrad(gap.mspct, PAR())
ppfd.df$time <- seq(from = 1, by = attr(gap.mspct, "time.step"),
                    length.out = nrow(ppfd.df))
ggplot(ppfd.df, aes(time, q_irrad_PAR * 1e6)) +
  geom_line() + ylim(0, NA) +
  labs(x = "Time (s)",
       y = expression(PAR~~photon~~irradiance~~(mu*mol~m^{-2}~s^{-1})) )
```



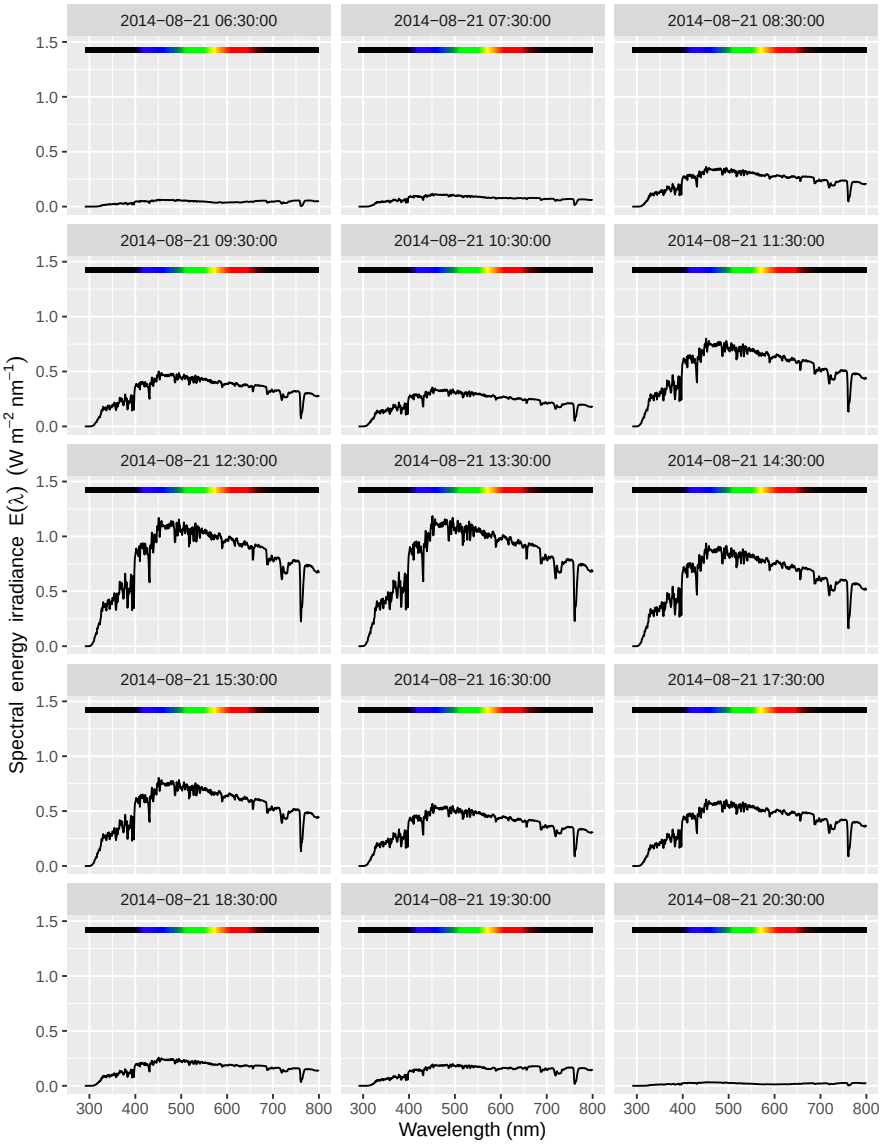

```
R_FR.df <- q_ratio(gap.mspct, Red("Smith10"), Far_red("Smith10"))
names(R_FR.df)[2] <- "R_FR"
R_FR.df$time <- seq(from = 1, by = attr(gap.mspct, "time.step"),
                    length.out = nrow(R_FR.df))
ggplot(R_FR.df, aes(time, R_FR)) +
  geom_line() +
  labs(x = "Time (s)",
       y = "R:FR photon ratio (fraction of one)")
```



5 Simulated hourly daylight spectra

Late summer in Helsinki, modelled spectra using a radiation transfer model.

```
plot(subset(sun_hourly_august.spct, day(EEST) == 21 & hour(EEST) < 21),
     annotations = "colour.guide") +
  facet_wrap(~EEST, ncol = 3)
```

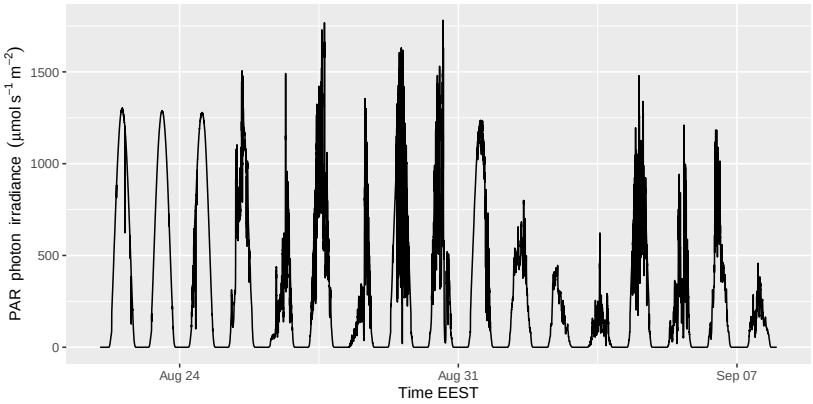


6 Measured irradiance data

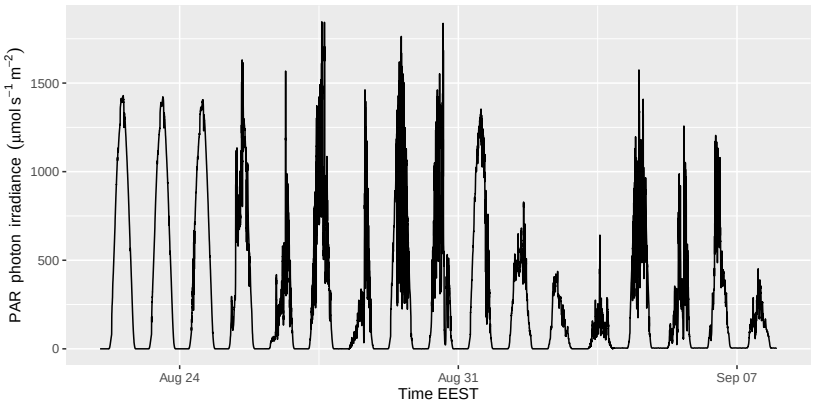
Late summer in Helsinki, 2015.

```
ppfd_label <- expression(PAR~~photon~~irradiance~~(mu*mol~s^{-1}~m^{-2}))
irrad_label <- expression(Global~~irradiance~~(W~m^{-2}))
time_label <- "Time EEST"
ppfd_labels <- labs(x = time_label, y = ppfd_label)
irrad_labels <- labs(x = time_label, y = irrad_label)
```

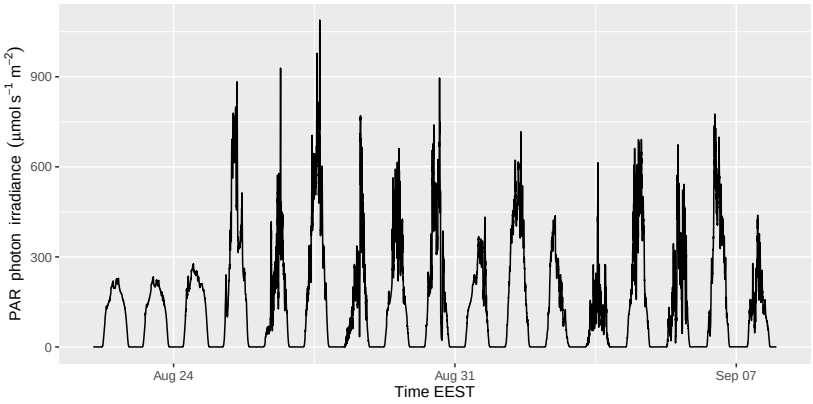
```
ggplot(ppfd.LICOR.data, aes(time_EET, ppfd_mean)) + geom_line() +
  ppfd_labels
```



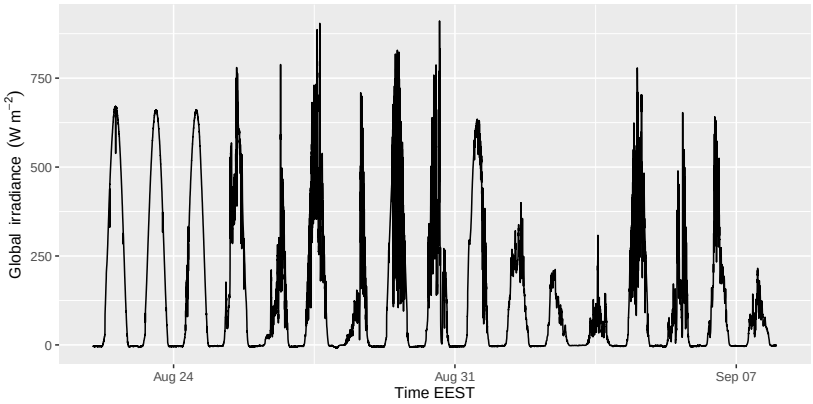

```
ggplot(ppfd.BF.data, aes(time_EET, ppfd_tot_mean)) + geom_line() +
  ppfd_labels
```



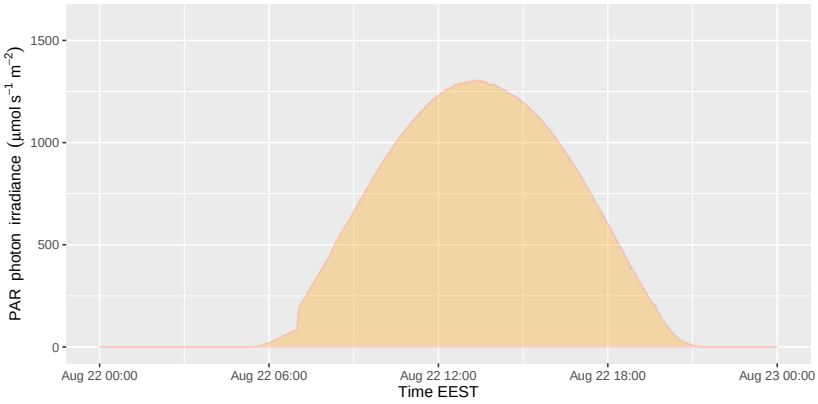

```
ggplot(ppfd.BF.data, aes(time_EET, ppfd_diff_mean)) + geom_line() +
  ppfd_labels
```




```
ggplot(irrad.Kipp.data, aes(time_EET, e_irrad_mean)) + geom_line() +
  irrad_labels
```




```
sunny.day.data <- subset(ppfd.LICOR.data,
                         time_EET >= ymd_hms("2015-08-22 00:00:00") &
                           time_EET < ymd_hms("2015-08-23 00:00:00") )
ggplot(sunny.day.data, aes(time_EET, ppfd_max)) +
  geom_area(fill = "orange", alpha = 0.3, colour = "tomato") +
  ylim(-0.3, 1600) + ppfd_labels
```




```
cloudy.day.data <- subset(ppfd.LICOR.data,
                          time_EET >= ymd_hms("2015-09-07 00:00:00") &
                            time_EET < ymd_hms("2015-09-08 00:00:00") )
ggplot(cloudy.day.data, aes(time_EET, ppfd_max)) +
  geom_area(fill = "orange", alpha = 0.3, colour = "tomato") +
  ylim(-0.3, 1600) + ppfd_labels
```