

# Energetics

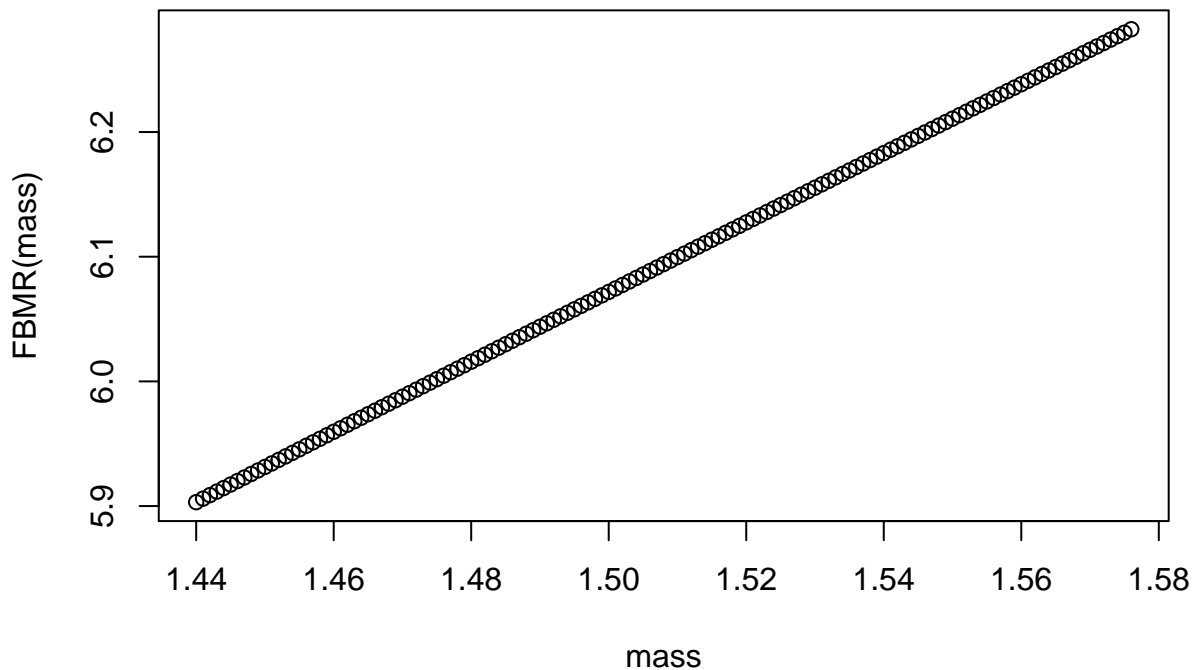
## Calculate basal metabolic rate (BMR)

This is the function taken from Humbolt paper

```
FBMR <- function(mass)4.59*mass^0.69
FBMR(1.4)
```

```
## [1] 5.7895
```

```
mass<-(1440:1576)/1000
plot(FBMR(mass)~mass)
```



## Using the spreadsheet equation taking into account temperature and windspeed

As I understand it from the spreadsheet this set of equation should calculate the metabolic rate in the same units ()

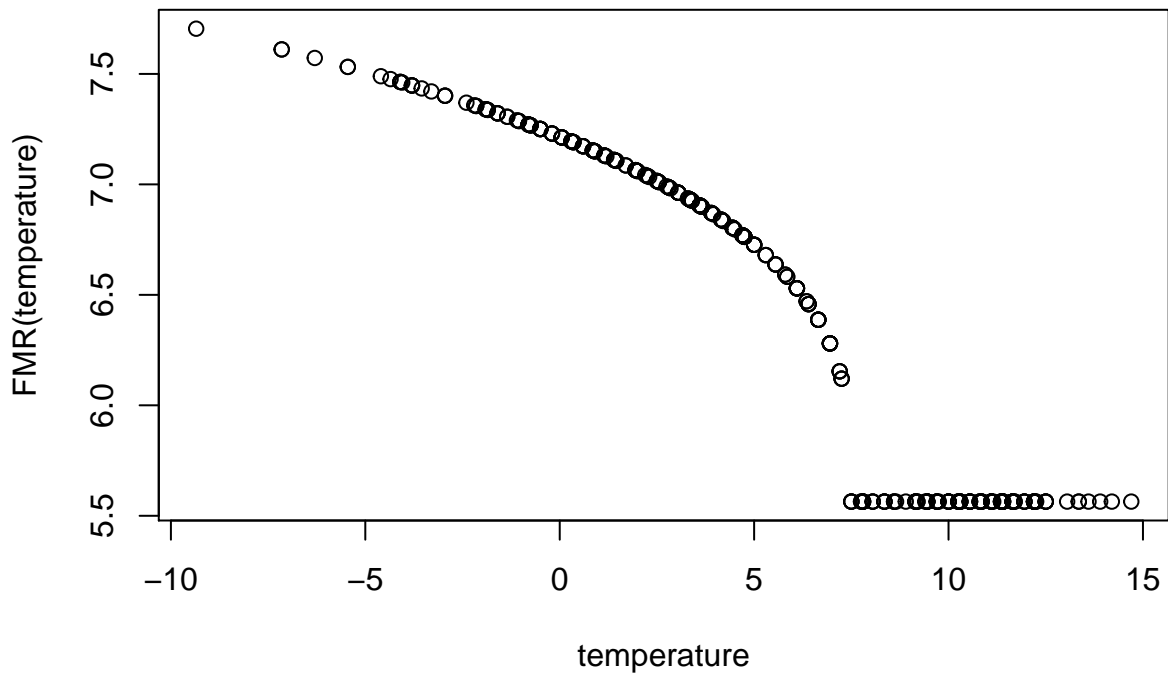
```
FMR<-function(temperature=-10,windspeed=2,mass=1500)
{
  TBrant<-7.5
  temperature[temperature>TBrant]<-TBrant
  windspeed[windspeed<0.5]<-0.5
  DeltaT<-TBrant-temperature
  b<-0.0092*mass^0.66*DeltaT^0.32
  a<-4.15-b*sqrt(0.06)
  a+b+sqrt(windspeed)
}
FMR(10)
```

```
## [1] 5.564214
```

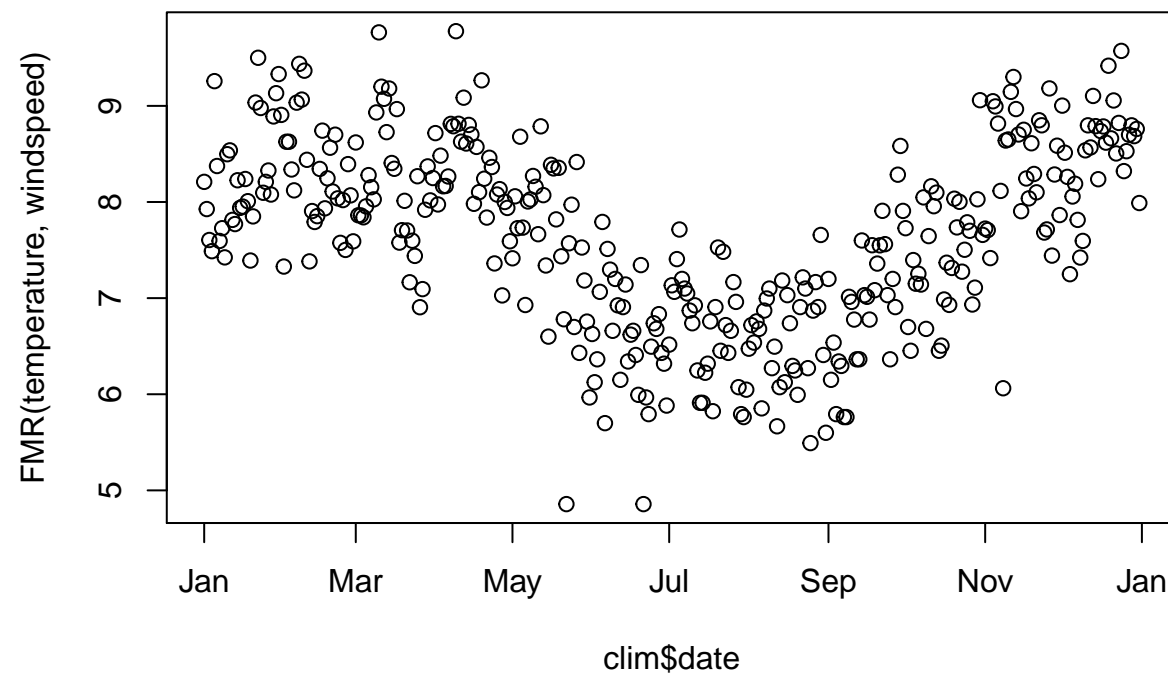
## Testing against a year's climate data

I haven't got data for the whole of 2016.

```
clim<-subset(clim,as.numeric(format(clim$date,'%Y'))==2015)
temperature<-(clim$tmin+clim$tmax)/20
windspeed<-clim$avwind/10
plot(temperature,FMR(temperature))
```

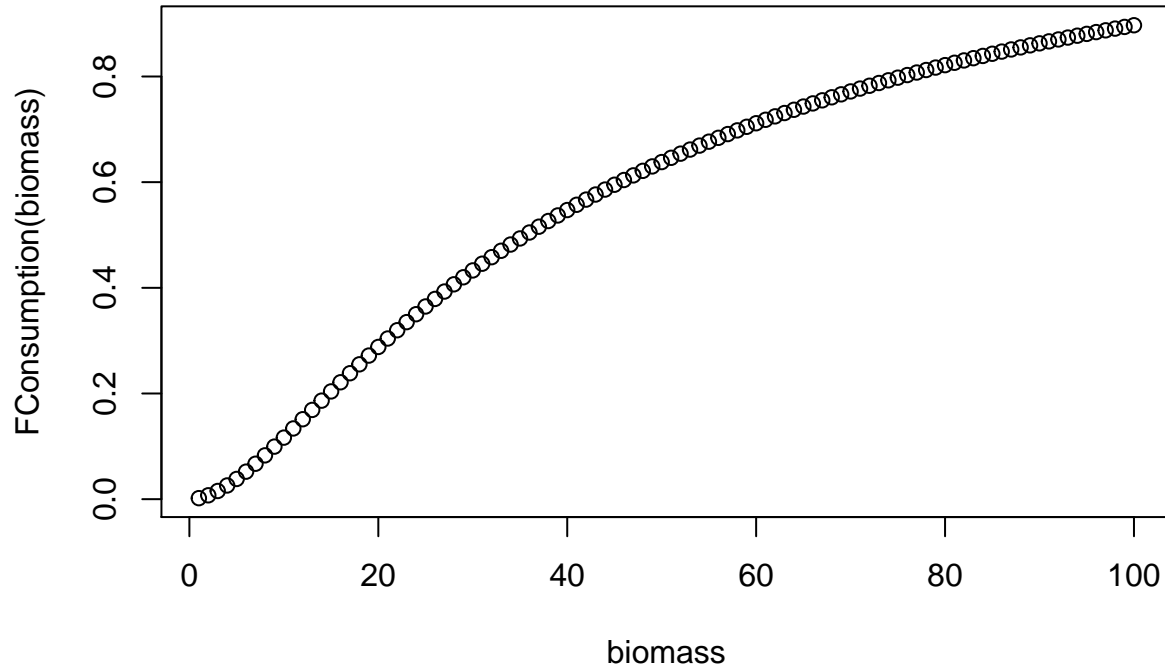


```
plot(clim$date,FMR(temperature,windspeed))
```



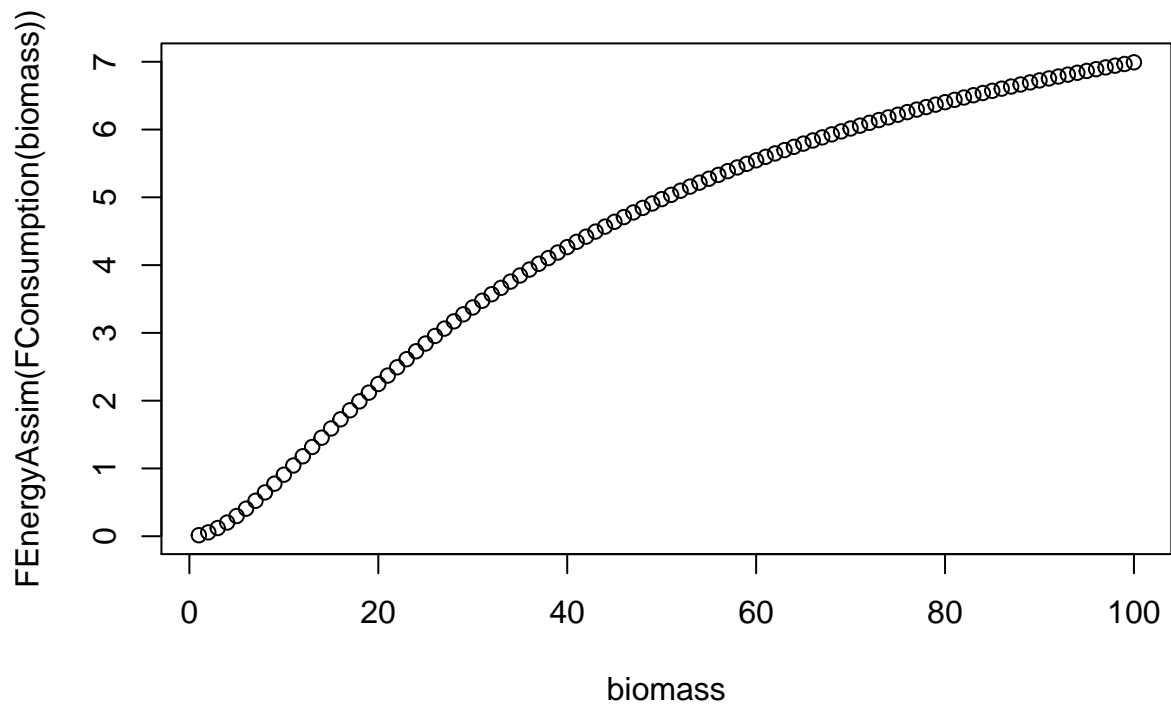
## Consumption function from the Humbolt paper

```
biomass<-1:100  
FConsumption<-function(biomass)100*0.01028*(1-exp(-0.105*biomass))*(1.0373*(1-exp(-0.0184*biomass)))  
plot(FConsumption(biomass)~biomass)
```

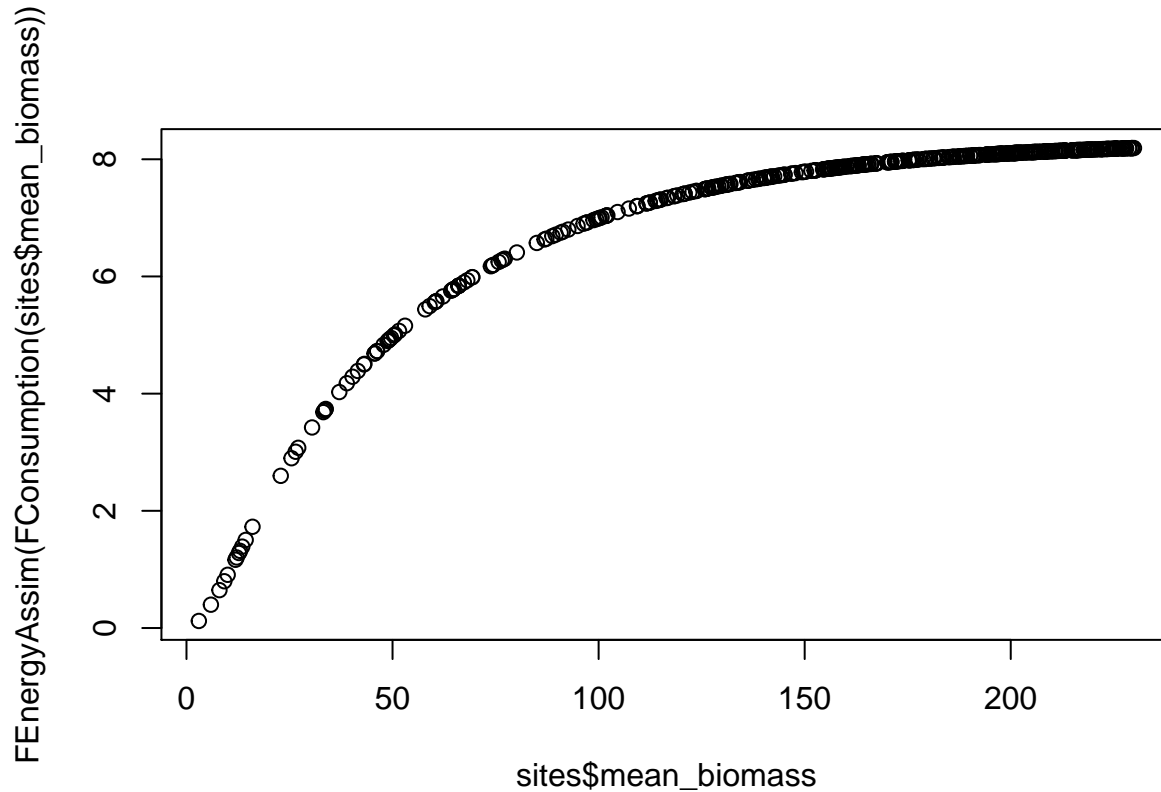


Converting into energy assimilated

```
FEnergyAssim<-function(consumption, a=0.464, E= 16.8)consumption*a*E  
plot(FEnergyAssim(FConsumption(biomass))~biomass)
```



```
plot(FEnergyAssim(FConsumption(sites$mean_biomass))~sites$mean_biomass)
```



## A Utility function to calculate day or night

Use the `insol` package. This produces an object with sunrise and sunset times, so if the hour falls between them it is day.

```
FIsDay<-function(tm,Lat=55.32,Lon=-162.8)
{
  hr<-as.numeric(format(tm, format='%H'))
  day_len<-data.frame(daylength(Lat, Lon,JD(tm), tmz=-10))
  isday<-ifelse(hr>day_len$sunrise & hr< day_len$sunset,"Day","Night")
  isday}
```

```
tm<-FMakeTime(2016,1,1,10)
FIsDay(tm)
```

```
## [1] "Day"
```

```
tm<-FMakeTime(2016,1,1,7)
FIsDay(tm)
```

```
## [1] "Night"
```