# Analysis of invasion times

Data are time series of single site invasions from 30 randomly selected locations (same 30 sites for each parameter combination).

Load some libraries

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(ggplot2)
library(scales)
```

Navigate to folder and read the data.

```
setwd('~/Documents/code/wasps/output/')
wasps.invasion <- read.csv("wasps INVASION-EXPERIMENT-LAMBDA-table.csv", skip=6)
```

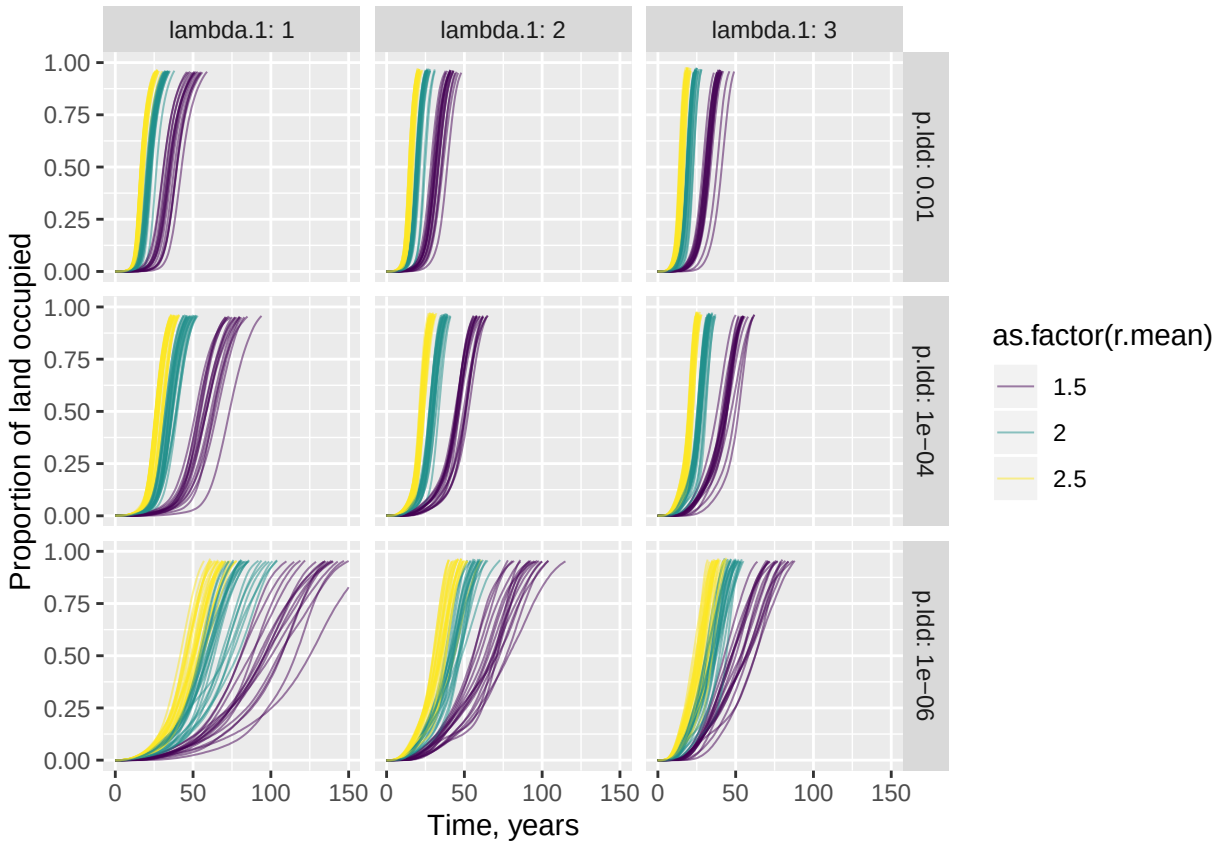
Select only variables we need.

```
wasps.sel <- select(wasps.invasion, 1:2 ,11, 15, 21:23)
```

## Time series plots

Panel plot of time series, lines coloured by intrinsic growth-rate `r.mean`, panels arranged by local mean dispersal distance `lambda.1` and probability of long distance dispersal `p.ldd`.

```
ggplot(filter(wasps.sel, lambda.1 %in% 1:3), aes(x=X.step., y=prop.occupied, color=as.factor(r.mean))) +
  geom_line(aes(group=X.run.number.), lwd=.35, alpha=0.5) +
  xlim(0, 150) + ylim(0, 1) +
  labs(x='Time, years', y='Proportion of land occupied') +
  scale_color_viridis_d(option='D') +
  facet_grid(p.ldd ~ lambda.1, labeller=label_both, as.table=FALSE)
```




## Trends in time to 95% occupancy

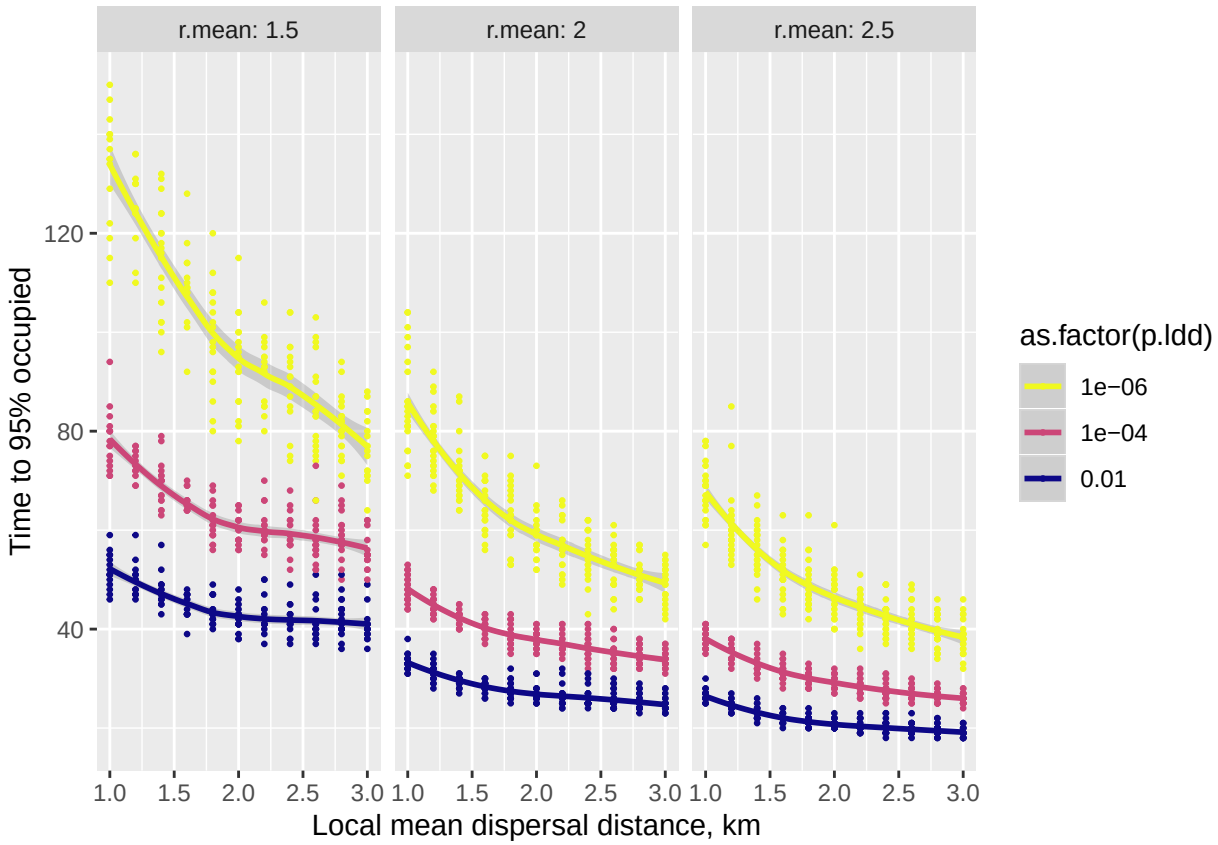
Determine times taken to 95% occupancy. These will be the last time step in each case, when `prop.occupied` >=0.95 at that time, since experiment runs used this as stopping criterion.

```
wasps.t <- wasps.sel %>%
  group_by(X.run.number., r.mean) %>%
  summarise_at('X.step.', max) %>%
  merge(wasps.invasion) %>%
  filter(prop.occupied >= 0.95)
```

And plot it

```
ggplot(wasps.t, aes(x=lambda.1, y=X.step., colour=as.factor(p.ldd))) +
  geom_smooth(aes(group=p.ldd)) +
  geom_point(size=0.5) +
  scale_colour_viridis_d(option='C', direction=-1) +
  facet_wrap(vars(r.mean), nrow=1, labeller=label_both) +
  labs(y='Time to 95% occupied', x='Local mean dispersal distance, km')
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```


r.mean: 1.5
r.mean: 2
r.mean: 2.5
Time to 95% occupied
120
80
40
1.0
1.5
2.0
2.5
3.0
Local mean dispersal distance, km
as.factor(p.ldd)
1e−06
1e−04
0.01