# Lab 3: Intensity dependent on covariate

This session covers tools for investigating intensity depending on a covariate.
The lecturer's R script is available here (right click and save).

### Exercise 1

The `bei` dataset gives the locations of trees in a survey area with additional covariate information in a list `bei.extra`.

1. Assign the elevation covariate to a variable `elev` by typing

```
elev <- bei.extra$elev
```

2. Plot the trees on top of an image of the elevation covariate.
3. Cut the study region into 4 areas according to the value of the terrain elevation, and make a texture plot of the result.
4. Convert the image from above to a tesselation, count the number of points in each region using `quadratcount`, and plot the quadrat counts.
5. Estimate the intensity in each of the four regions.

### Exercise 2

Assume that the intensity of trees is a function $\lambda(u) = \rho(e(u))$ where $e(u)$ is the terrain elevation at location u.

1. Compute a nonparametric estimate of the function $\rho$ and plot it by

```
rh <- rhohat(bei, elev)
plot(rh)
```

2. Compute the predicted intensity based on this estimate of $\rho$.
3. Compute a non-parametric estimate by kernel smoothing and compare with the predicted intensity above.
4. Bonus info: To plot the two intensity estimates next to each other you collect the estimates as a spatial object list (`solist`) and plot the result (the estimates are called `pred` and `ker` below):

```
l <- solist(pred, ker)
plot(l, equal.ribbon = TRUE, main = "",
     main.panel = c("rhohat prediction", "kernel smoothing"))
```

### Exercise 3

Continuing with the dataset `bei` conduct both Berman's Z1 and Z2 tests for dependence on `elev`, and plot the results.