Example lab report

Relationship of Remotely Sensed Data to Conifer Quadratic Mean Diameter

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Introduction

Remotely sensed data are relatively easy to obtain and can provide complete census information for certain variables over a large area. These data may be able to be used to predict quadratic mean diameter of conifers (inches), especially band-5 reflectance.

Quadratic mean diameter (QMD) is used to derive wood volume. If band-5 reflectance could be used as a proxy for quadratic mean diameter, estimates of wood volume in a stand could then be made relatively rapidly and cheaply using remotely sensed data.

Methods

In 1998, the QMD of conifers was measured by field crews in 70 1-hectare plots as part of the Continuous Vegetation Survey (CVS). CVS plots are chosen for sampling each year based on a randomly located systematic grid of plots established by the USDA Forest Service in order to make inference to overall forest health and status in region 6 (Oregon and Washington). All 70 plots selected for the 1998 CVS sample in the Douglas-fir/Western Hemlock ecoregion of western Oregon were included in this study. Also in 1998, remotely sensed reflectance values were measured over the entire region and recorded for each 25 x 25 m unit of land (pixel). The reflectance data for the 70 CVS plots were extracted for use in analysis.

The following statistical model was fit to the data:

$$y_i = \beta_0 + \beta_1 x_i + \epsilon_i$$

where y_i is the observed QMD of conifers for the ith training stand, x_i is the band-5 reflectance for the ith training stand, and β_0 and β_1 are unknown parameters to be estimated. It was assumed that $\epsilon_i \sim \mathcal{N}(0, \sigma^2)$. This model assumes a linear relationship between QMD of conifers and band-5 reflectance, and also assumes that the variance of QMD of conifers among stands with the same reflectance value is the same as the variance of QMD of conifers among stands with a different reflectance value.

Results

Assumptions were checked and appeared to be reasonably met (Figure 1).

Band-5 reflectance was found to be a strong predictor of QMD ($p = 4 \times 10^{-6}$; Figure 2). The adjusted R^2 for the fit to the data was 0.26.
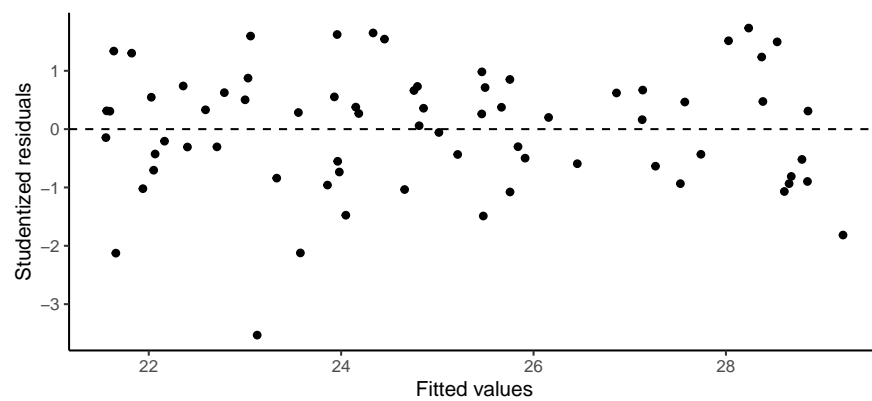
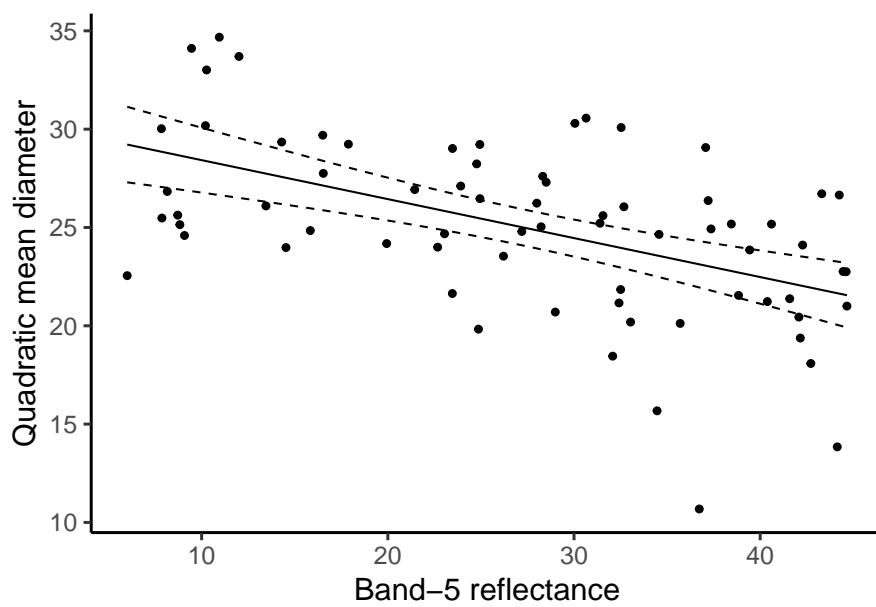Figure 1: Studentized residuals versus the fitted values.

Figure 2: Fitted model with 95% confidence intervals.

Conclusions

There was a significant relationship between QMD and band-5 reflectance but the R^2 was low. Because of the low R^2, band-5 reflectance might not be useful for making predictions of QMD of conifers.

More explanatory variables could be explored in the future to see if they could predict better.