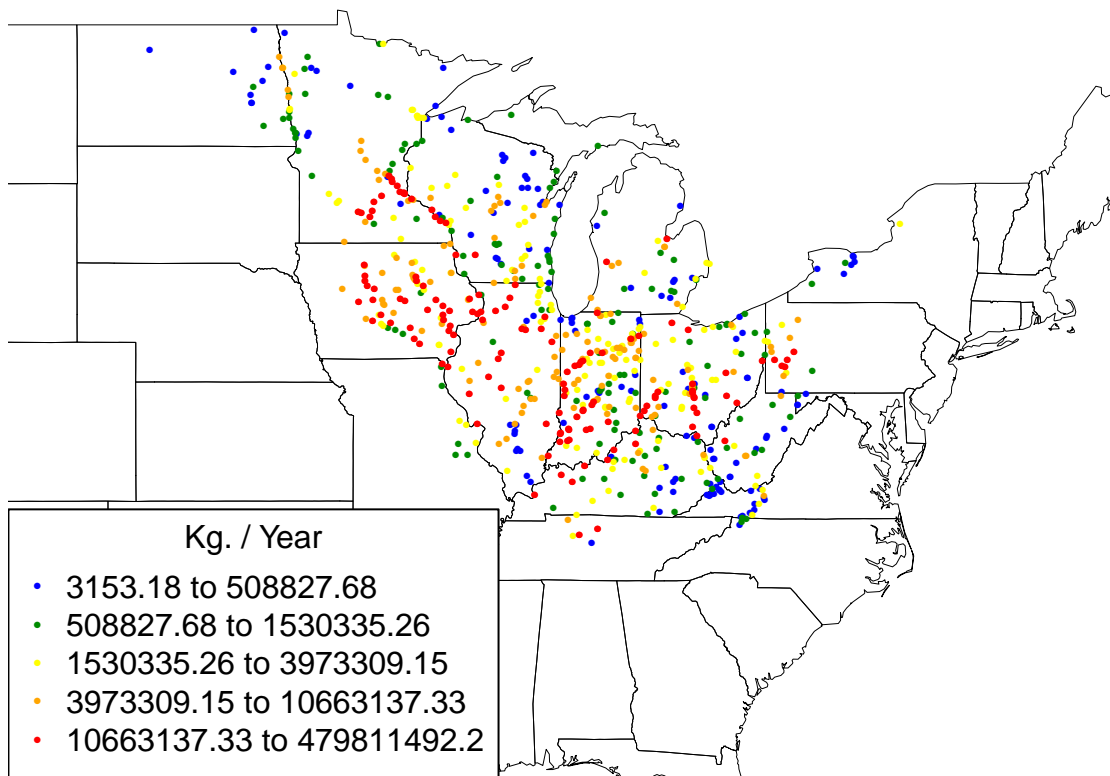


# **Model3b\_diagnostic\_plots.pdf Document Contents**

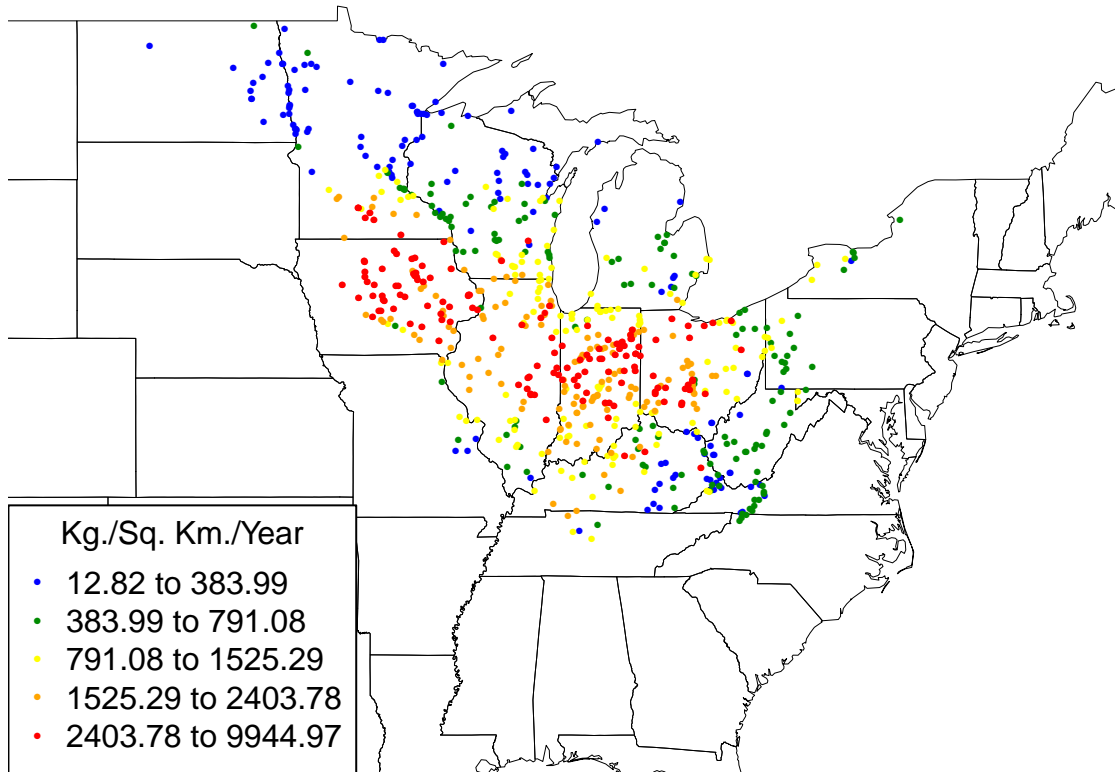
- Calibration Site Maps for User-Selected Attributes
- Model Estimation Performance Diagnostics
- Model Simulation Performance Diagnostics
- Maps of Model Residuals and Observed to Predicted Ratios for the Calibration Sites

## Calibration Site Maps for User-Selected Attributes

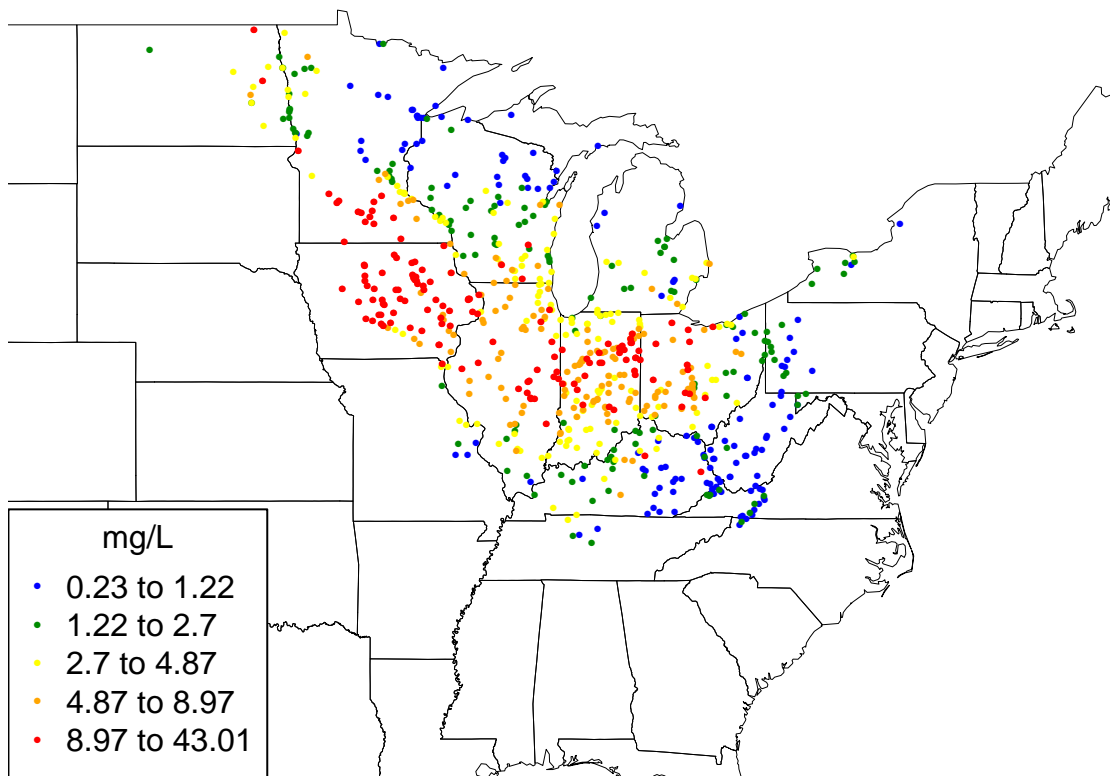
## Mean Annual Load at Calibration Sites



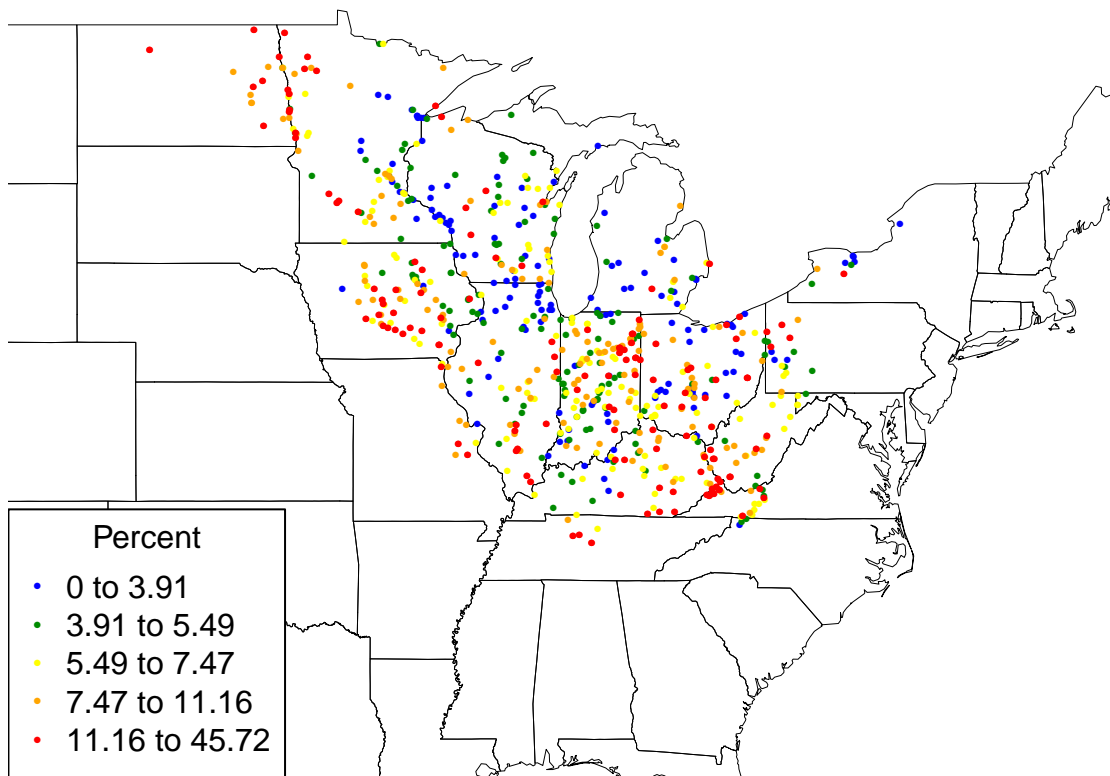
## Mean Annual Yield at Calibration Sites



## Mean Annual Flow-Weighted Concentration at Calibration Sites



## Percent Error in Mean Annual Load at Calibration Sites



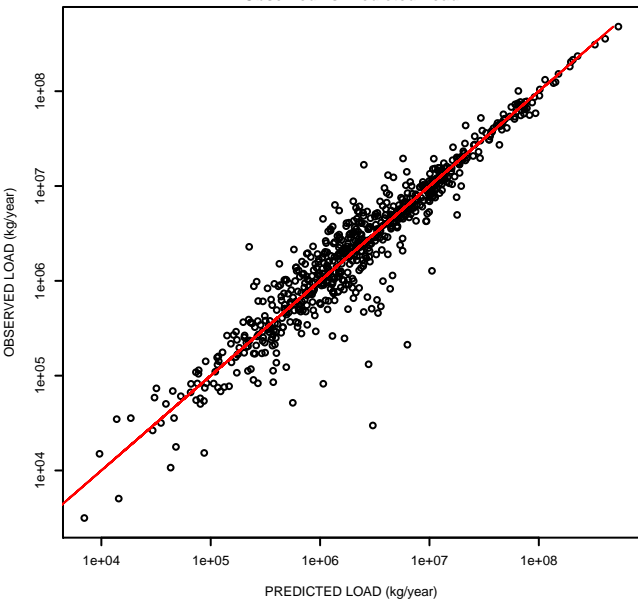
# Model Estimation Performance Diagnostics

Diagnostics are based on the use of conditioned (monitoring-adjusted) predictions. These predictions provide the most accurate reach predictions for use in calibrating the model. The associated residuals and observed to predicted ratios shown in the following section provide the most relevant measures of the accuracy of the model fit to observed loads.

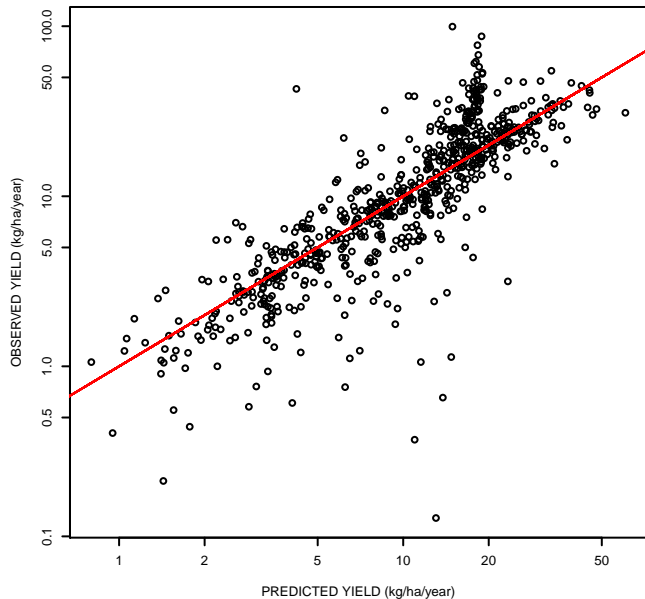
The diagnostic plots include:

- Four-plot panel for observed vs. predicted for loads and yields, and log residuals vs. predicted loads and yields
- Four-plot panel for boxplots of residuals and observed/predicted ratios, normal quantile plot of standardized residuals, and plot of squared residuals vs. predicted loads
- Plot of conditioned prediction loads vs. unconditioned (simulated) prediction loads
- Plots of the observed to predicted ratio vs. the area-weighted mean values of the user-selected explanatory variables for the incremental areas between calibration sites (output only if control setting `if_corrExplanVars<-'yes'` selected and a value of 1 entered for `'parmCorrGroup'` column in the `'parameters.csv'` file)
- Boxplots of the observed to predicted loads vs. the decile classes of the total drainage area for the calibration sites
- Boxplots of the observed to predicted loads vs. the contiguous spatial classes specified by users in the `'classvar'` control setting (e.g., HUC-4)
- Boxplots of the observed to predicted loads vs. the deciles of the land-use class variable specified by users in the `'class_landuse'` control setting, with the land-use classes expressed as a percentage of the incremental drainage area extending from the calibration site to the nearest upstream site locations.
- Four-plot panels reported separately for each of the contiguous spatial classes specified for the first variable entry for the `'classvar[1]'` control setting. The panels include: observed vs. predicted loads, observed vs. predicted yields, log residuals vs. predicted loads, and log residuals vs. predicted yields

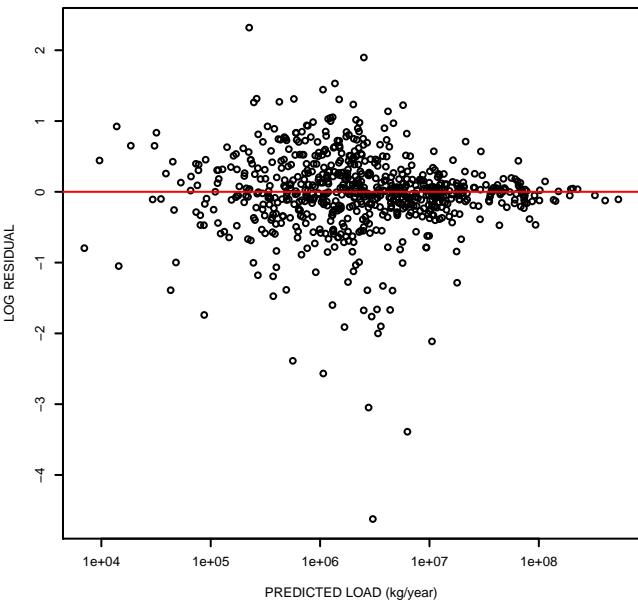
**MODEL ESTIMATION PERFORMANCE**  
**(Monitoring-Adjusted Predictions)**  
**Observed vs Predicted Load**



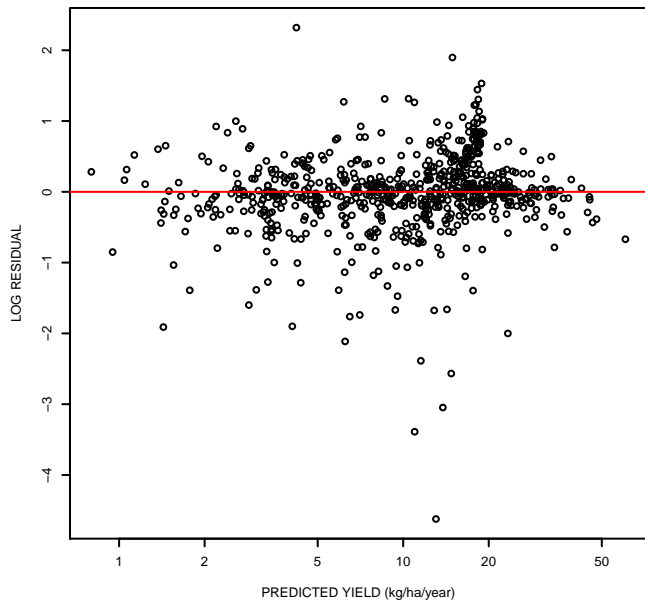
**MODEL ESTIMATION PERFORMANCE**  
**Observed vs Predicted Yield**



**Residuals vs Predicted Load**

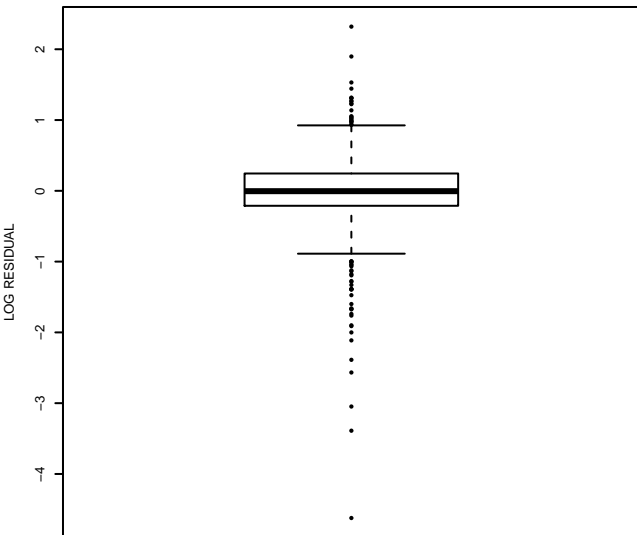


**Residuals vs Predicted Yield**

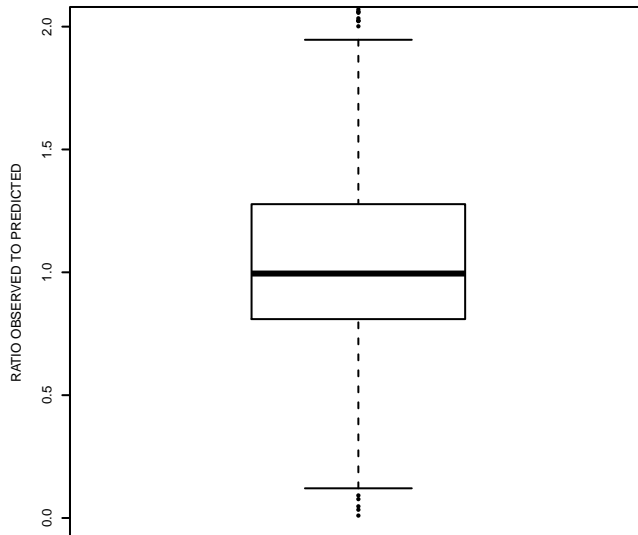




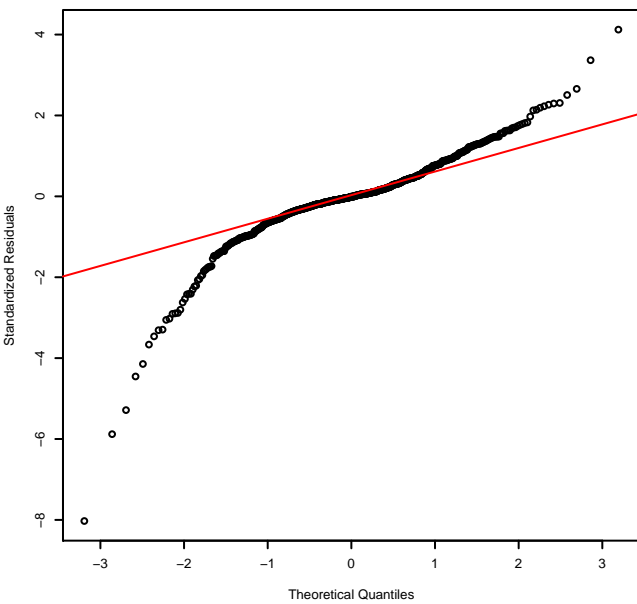
MODEL ESTIMATION PERFORMANCE  
Residuals



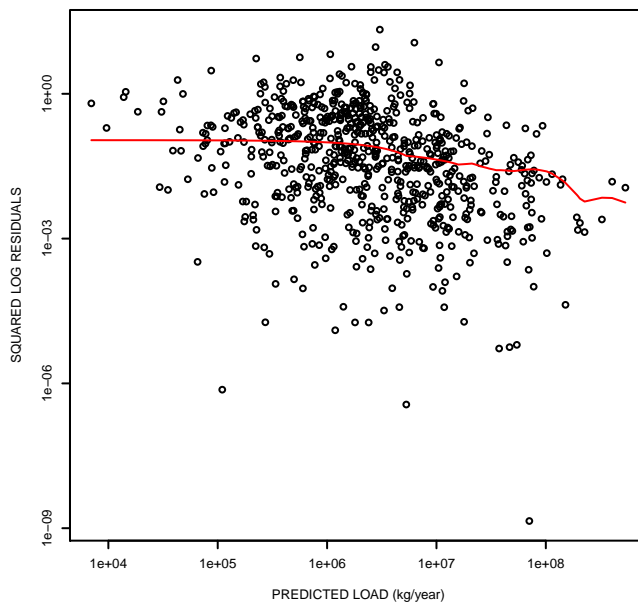
MODEL ESTIMATION PERFORMANCE  
Observed / Predicted Ratio



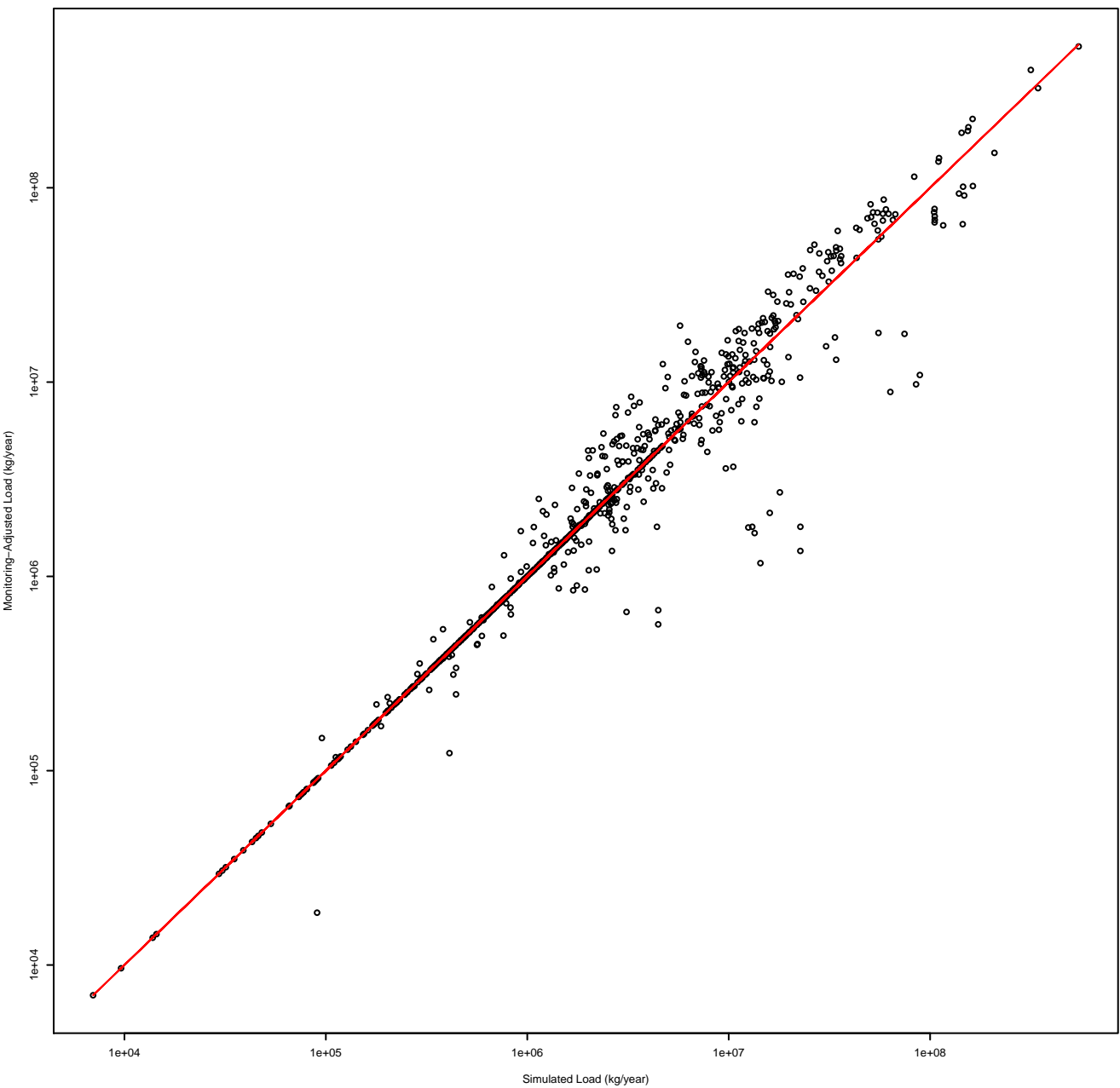
Normal Q-Q Plot



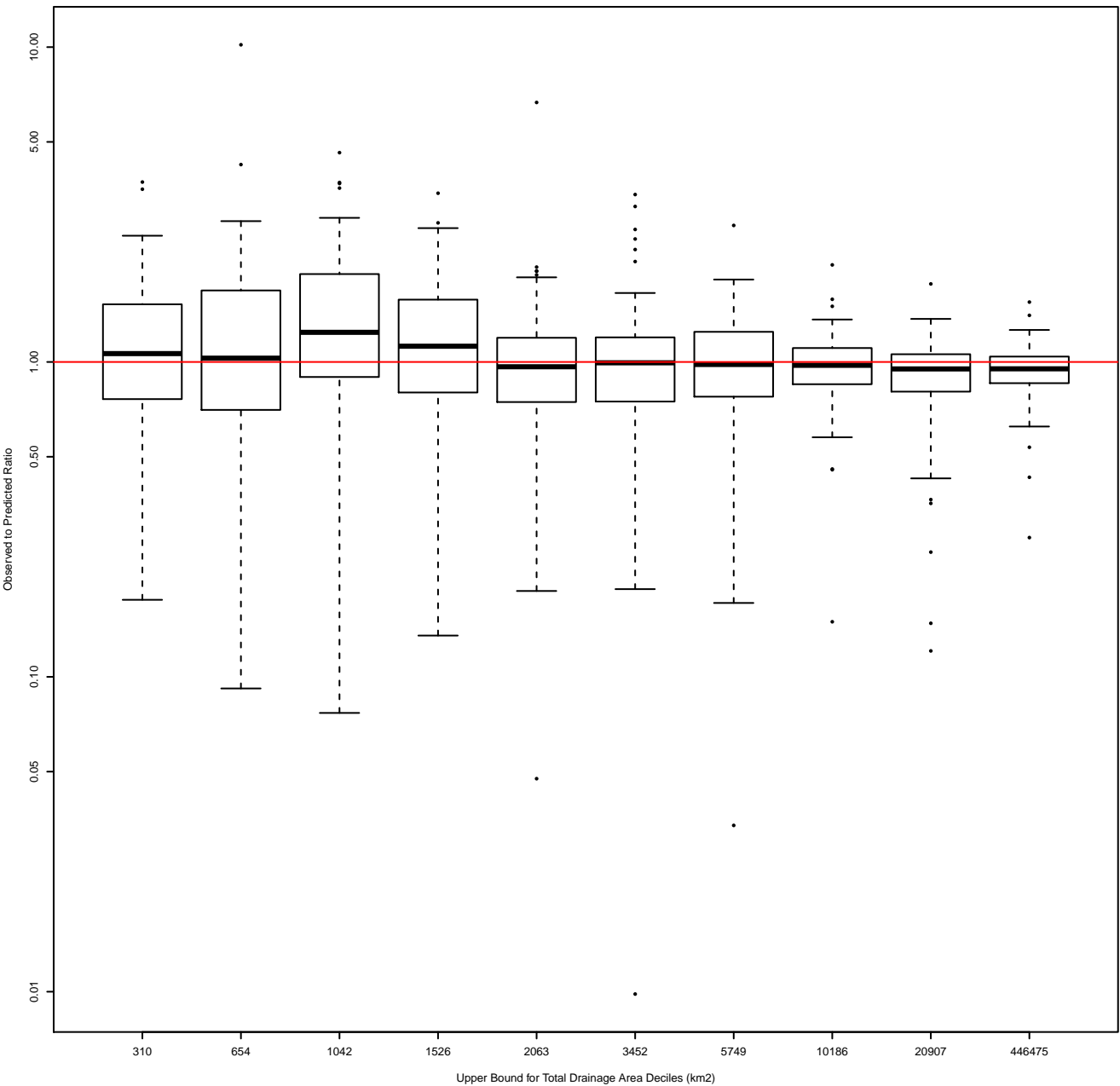
Squared Residuals vs Predicted Load



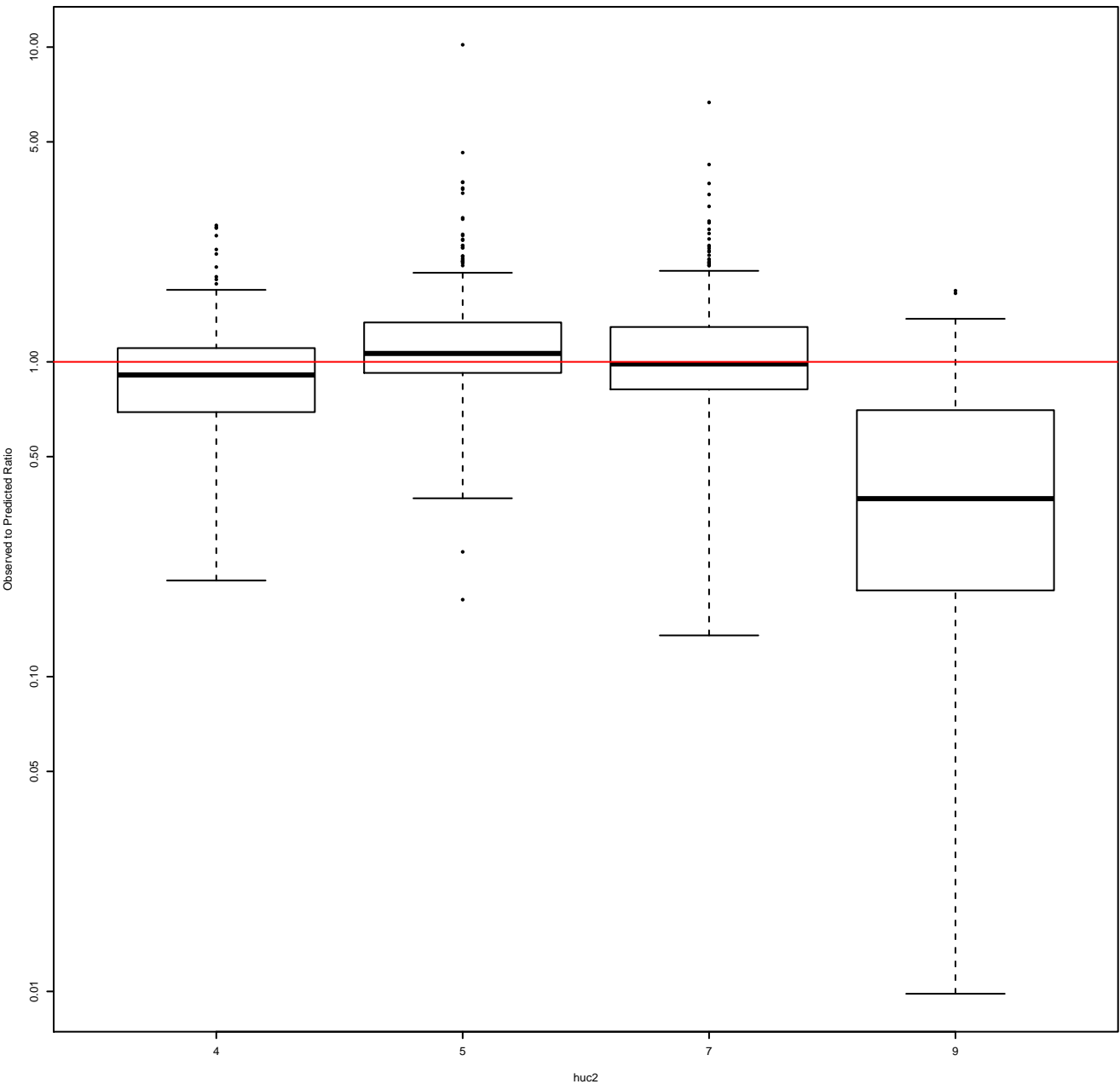
Monitoring-Adjusted vs. Simulated Loads



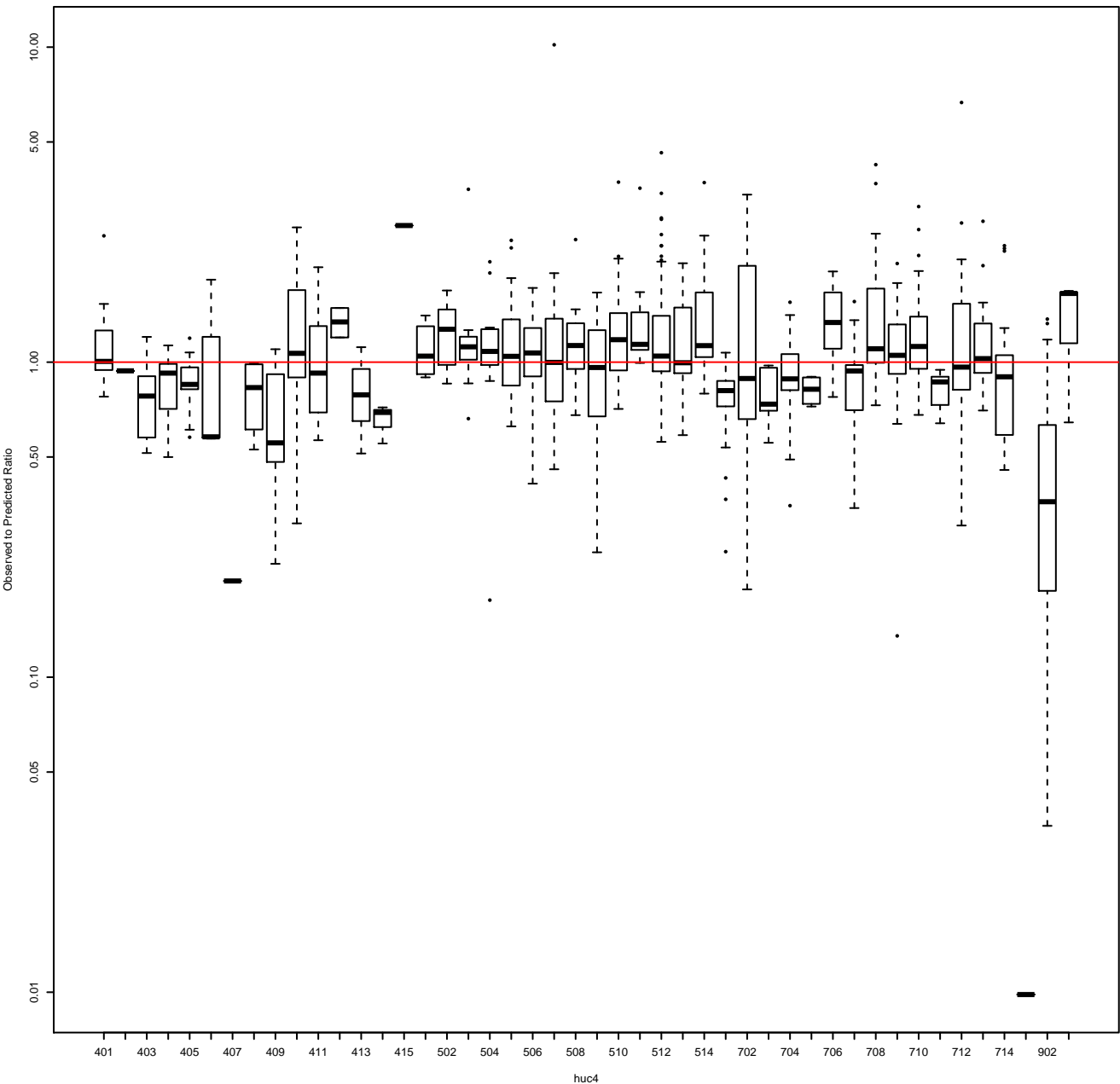
Ratio Observed to Predicted by Deciles



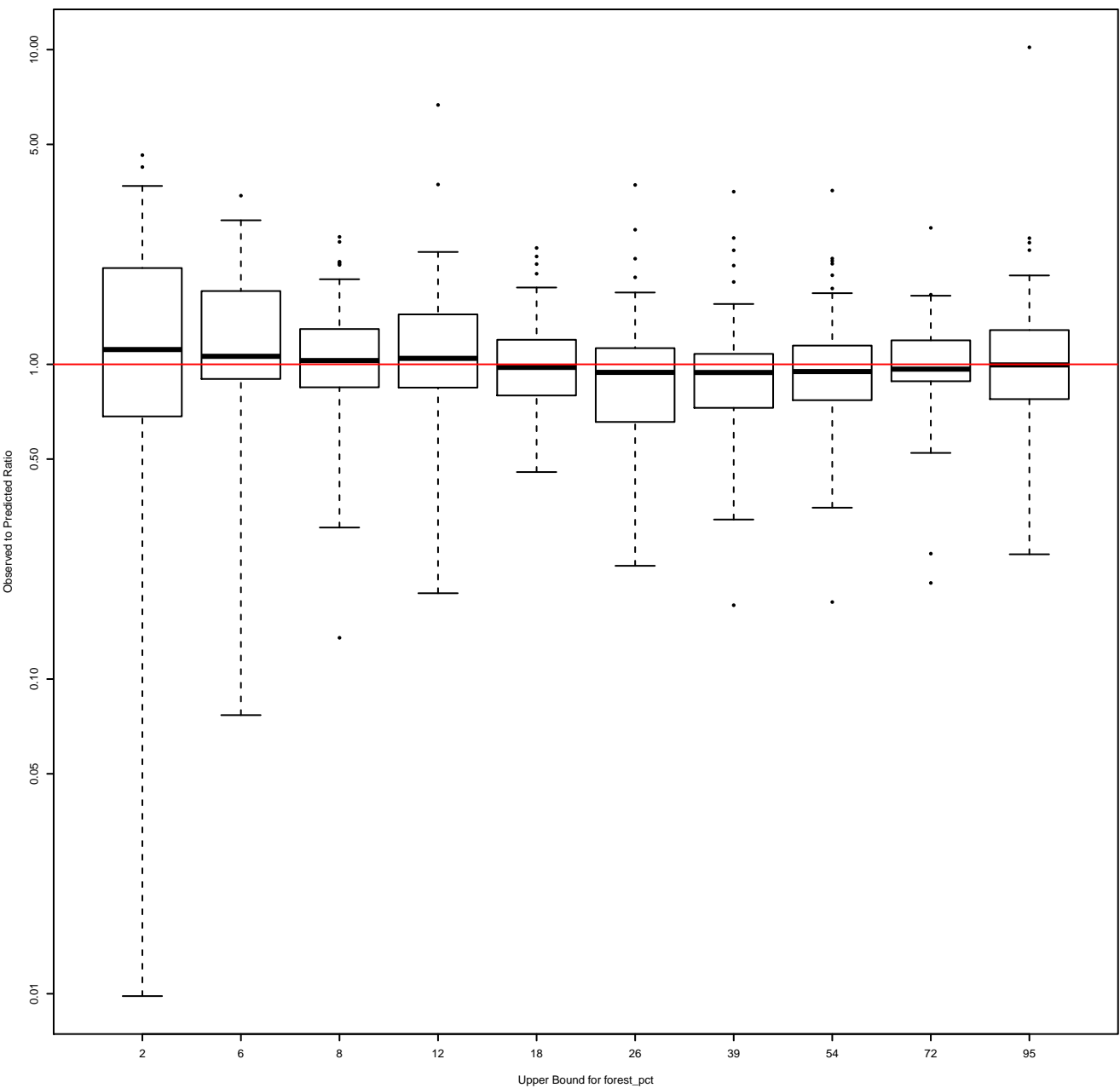
Ratio Observed to Predicted



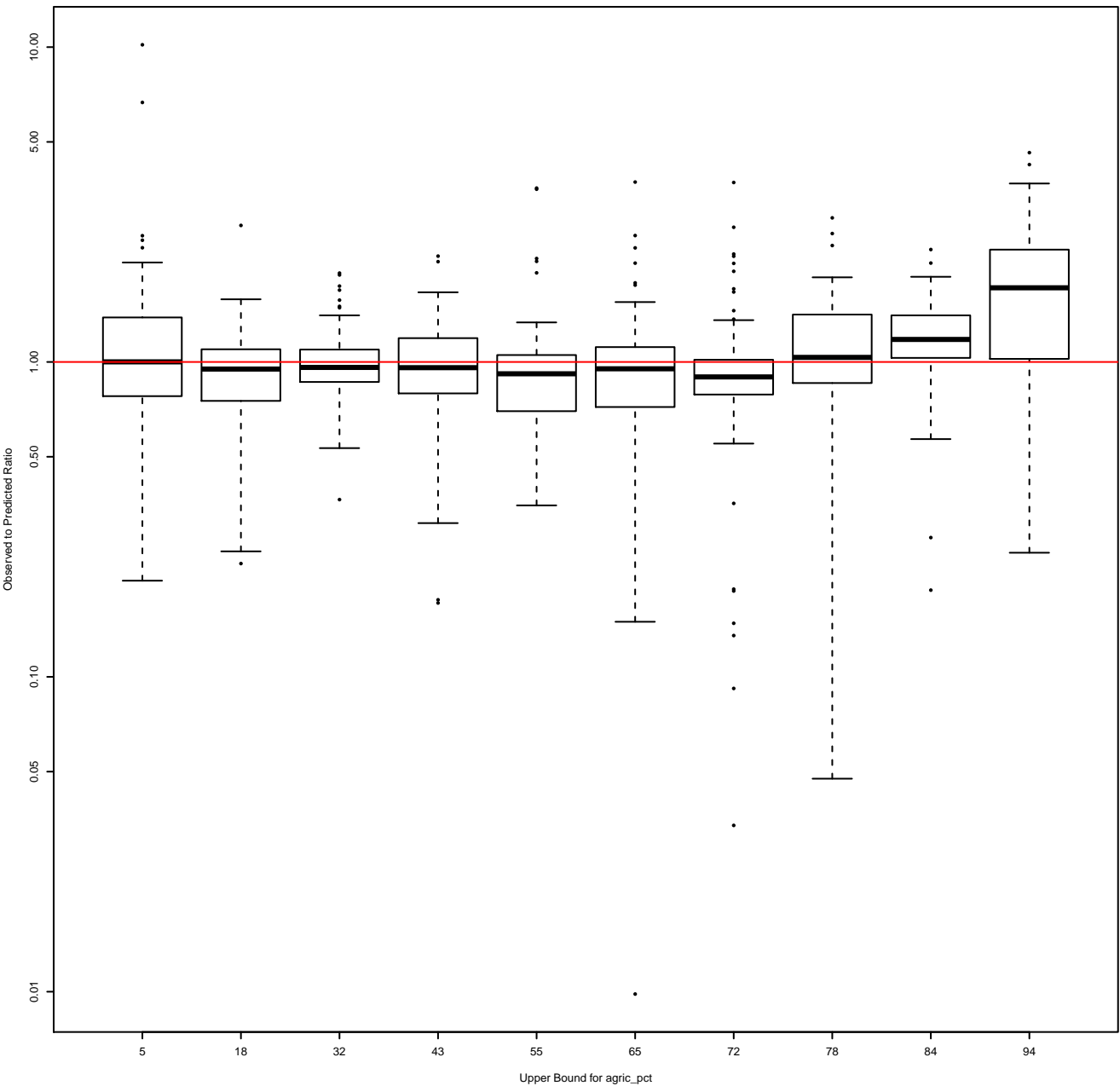
Ratio Observed to Predicted



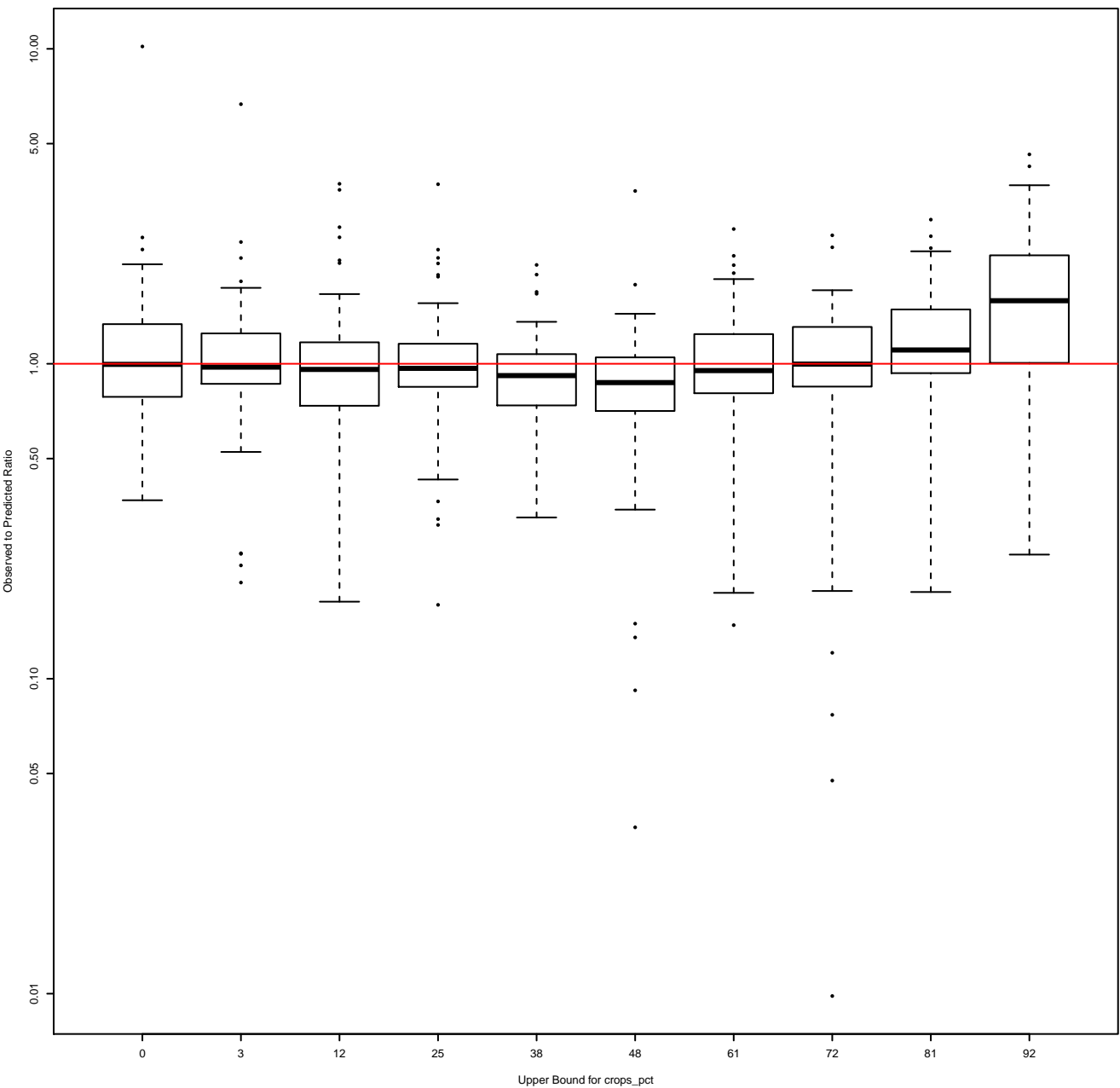
Ratio Observed to Predicted by Deciles



Ratio Observed to Predicted by Deciles

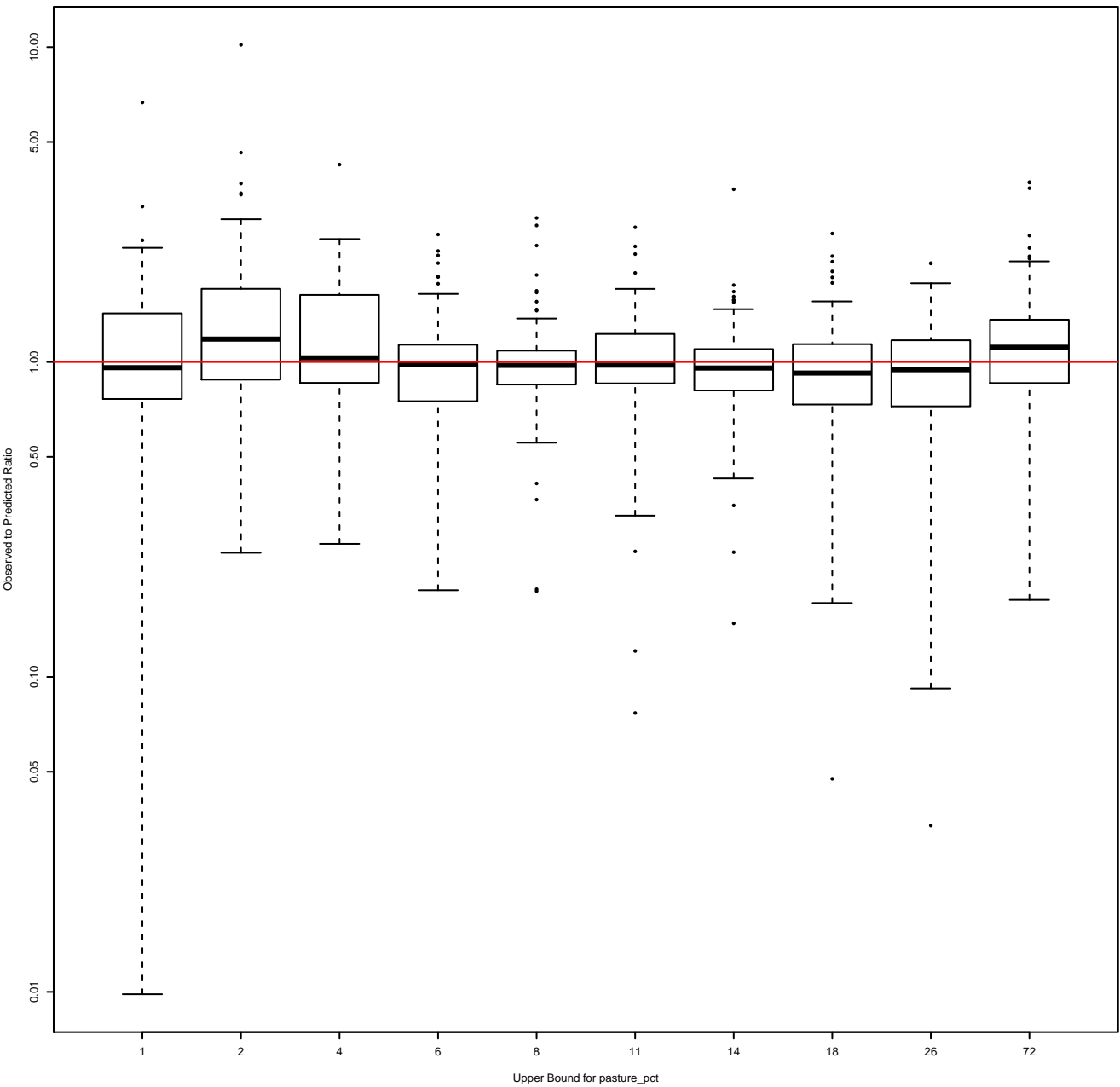


Ratio Observed to Predicted by Deciles

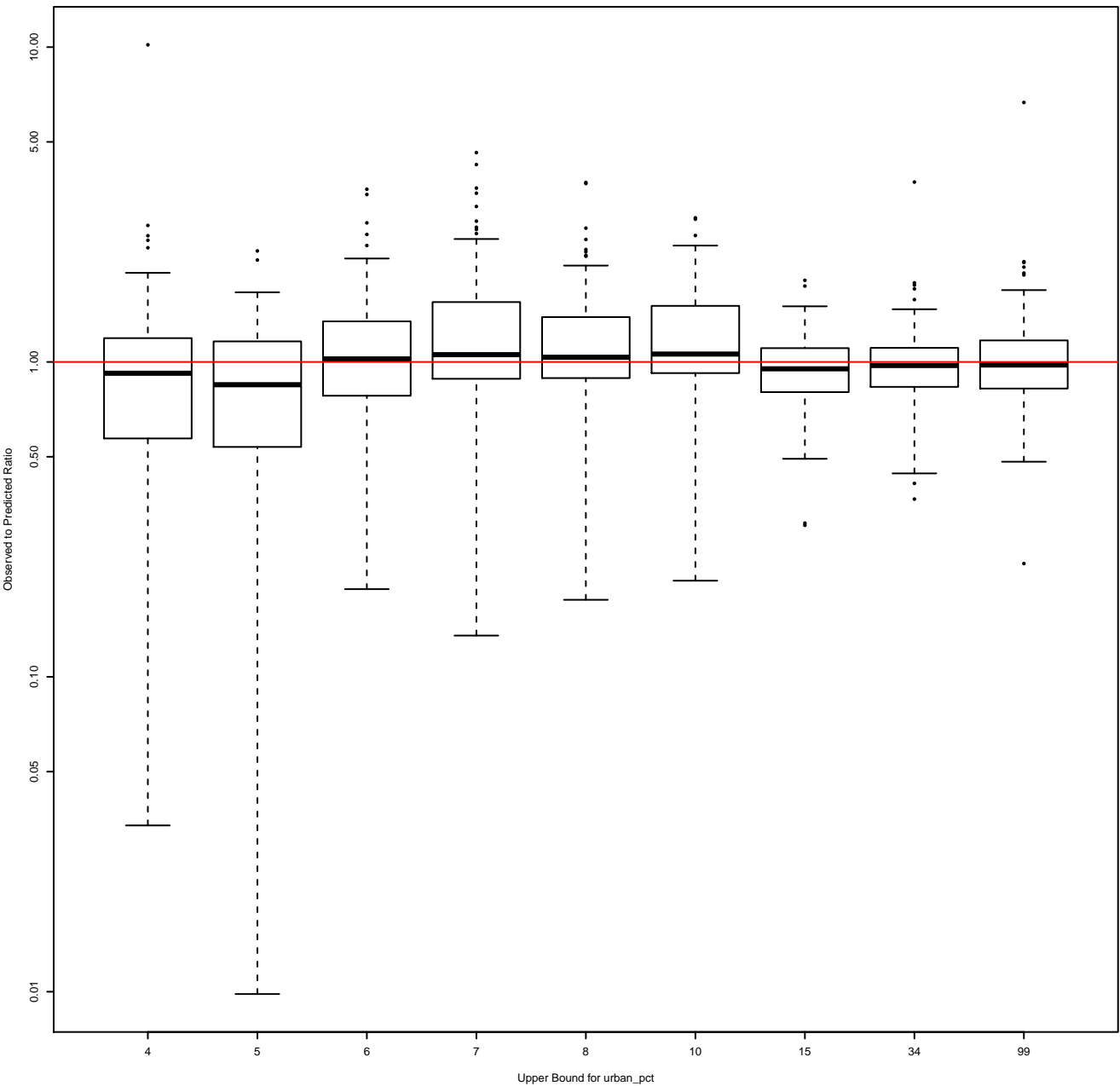




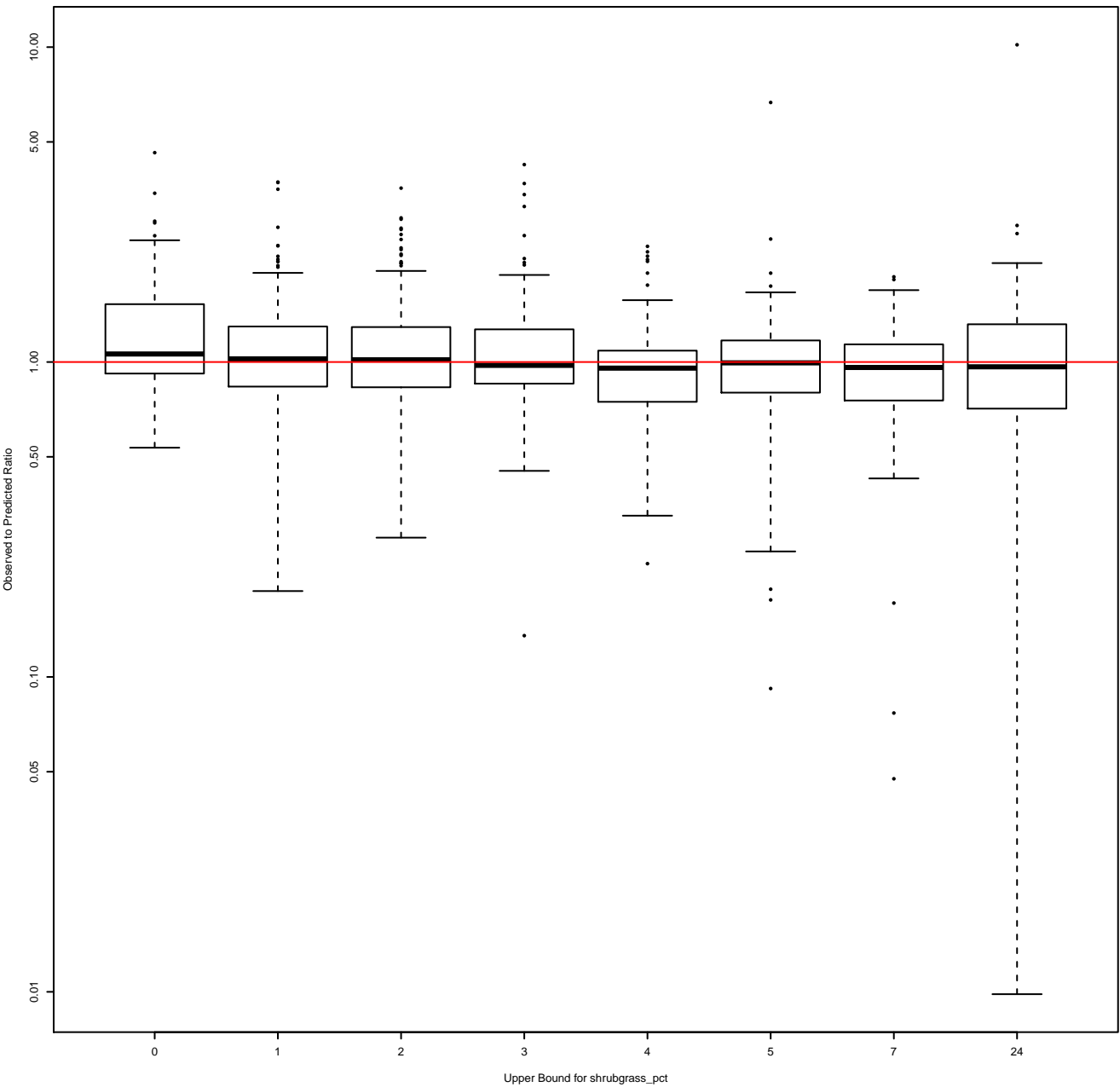
Ratio Observed to Predicted by Deciles



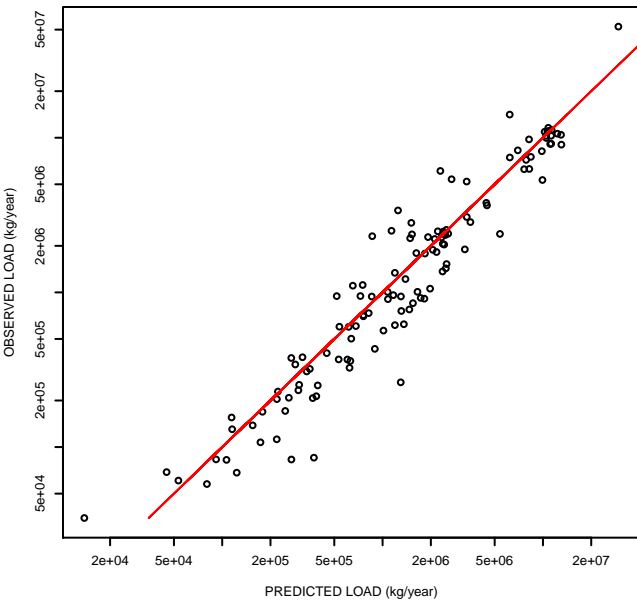
Ratio Observed to Predicted by Deciles



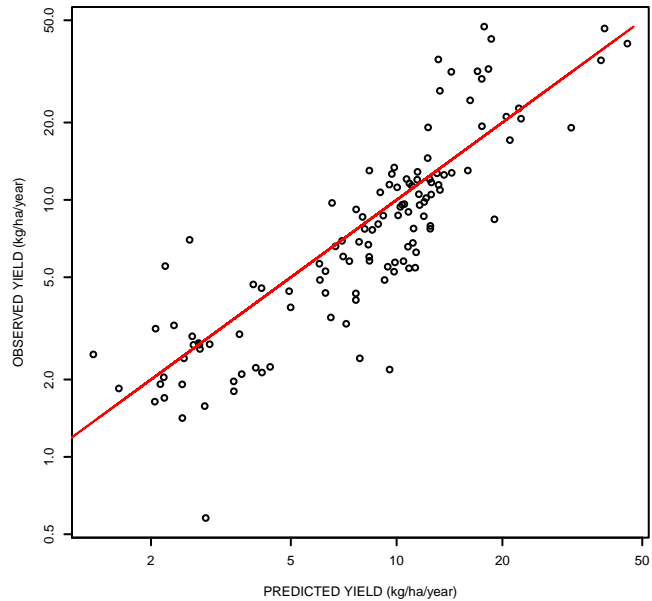
Ratio Observed to Predicted by Deciles



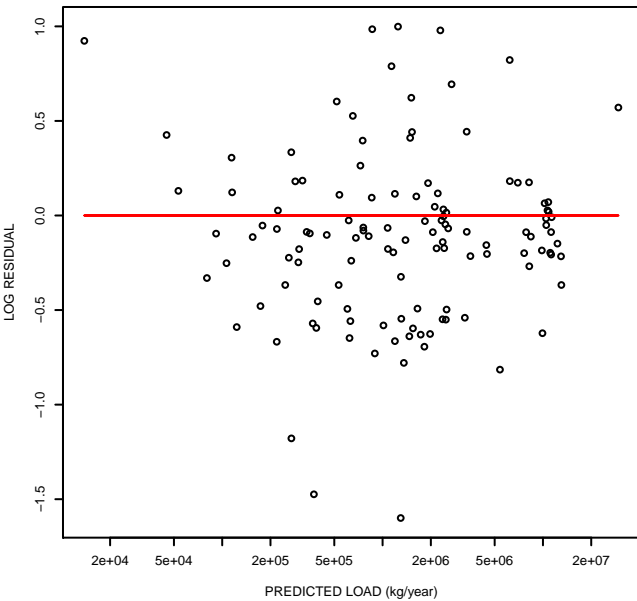
Observed vs Predicted Load  
CLASS Region = 4(n=121)



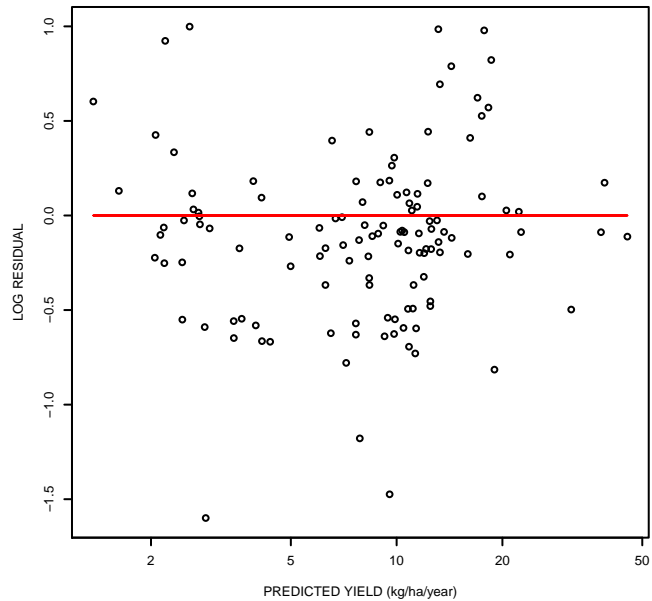
Observed vs Predicted  
Yield



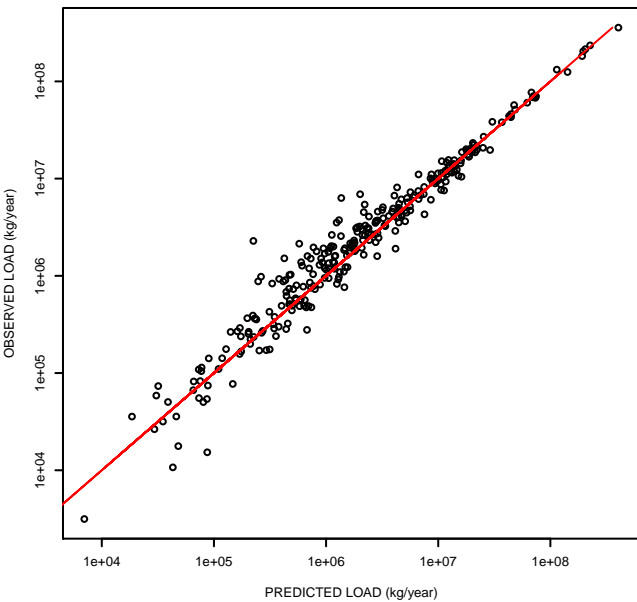
Residuals vs Predicted  
Load



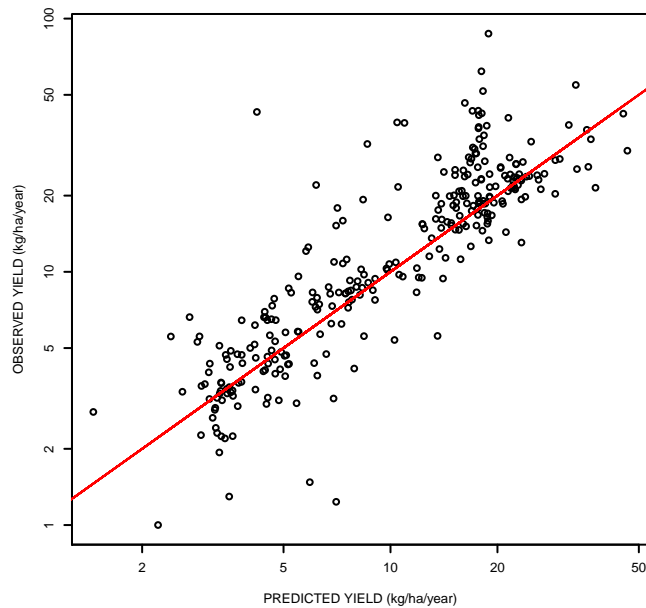
Residuals vs Predicted  
Yield



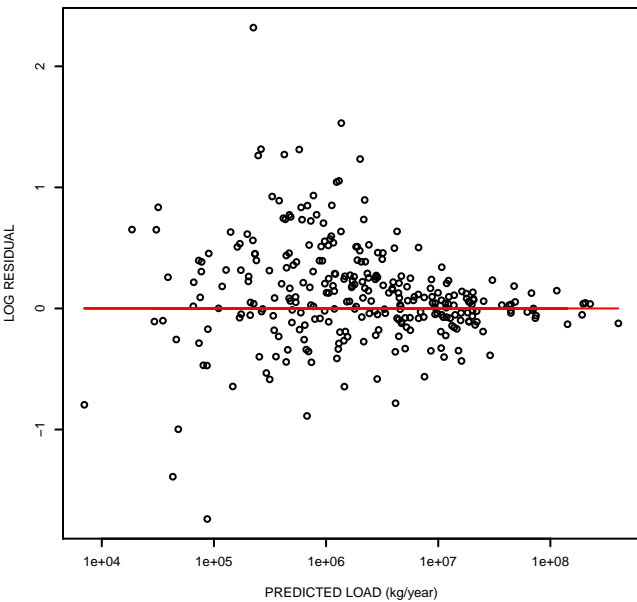
Observed vs Predicted Load  
CLASS Region = 5(n=295)



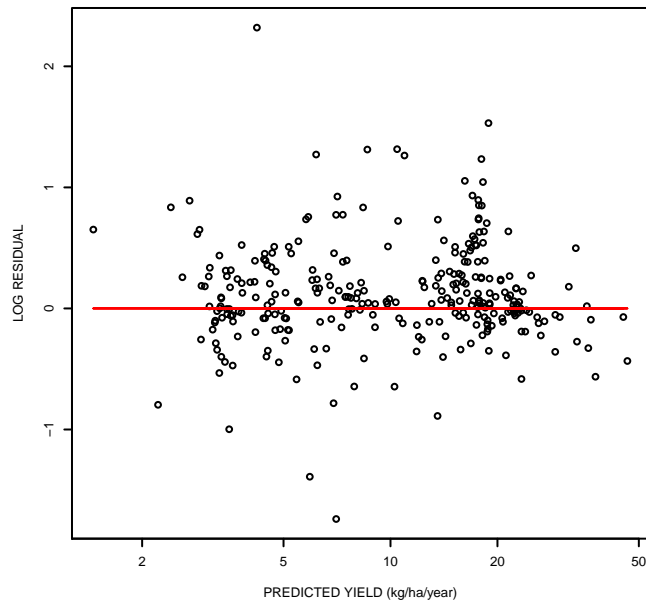
Observed vs Predicted  
Yield



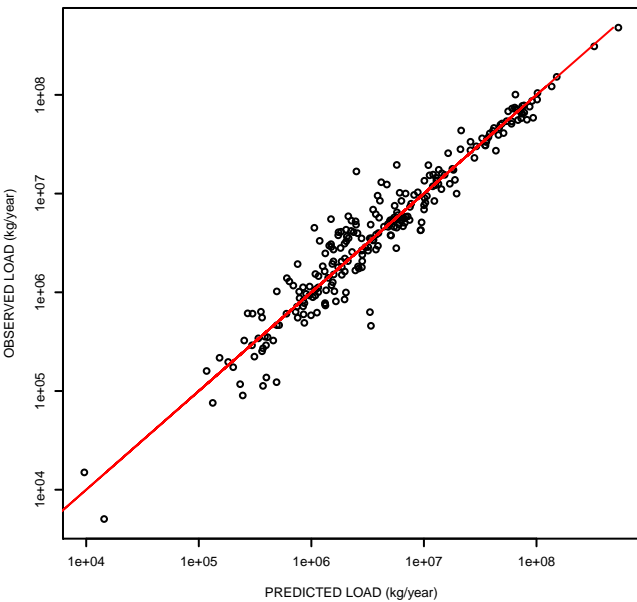
Residuals vs Predicted  
Load



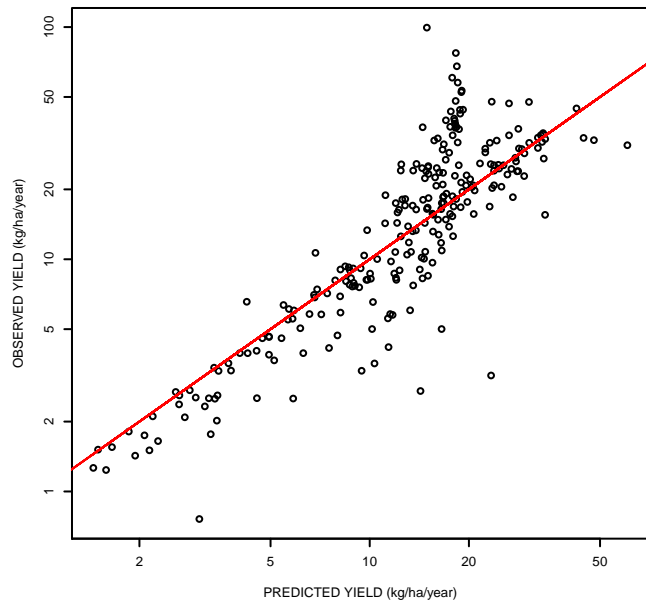
Residuals vs Predicted  
Yield



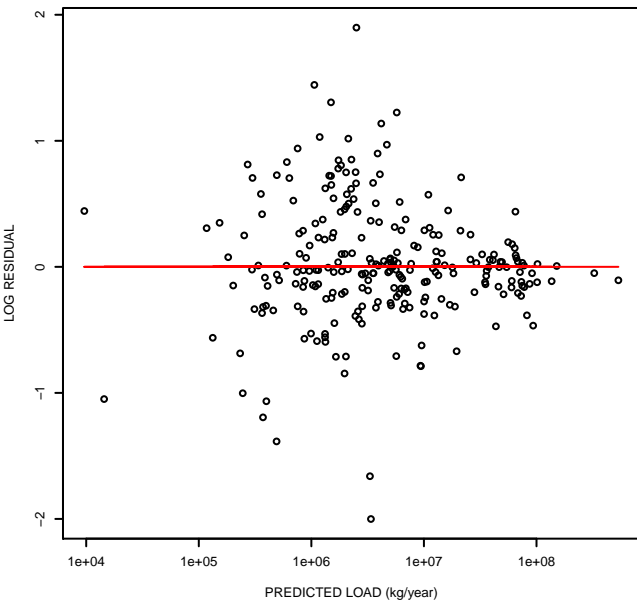
Observed vs Predicted Load  
CLASS Region = 7(n=252)



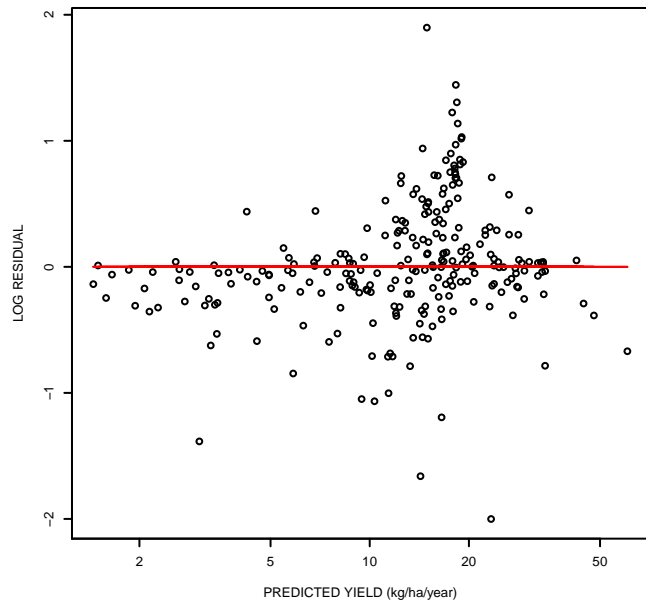
Observed vs Predicted  
Yield



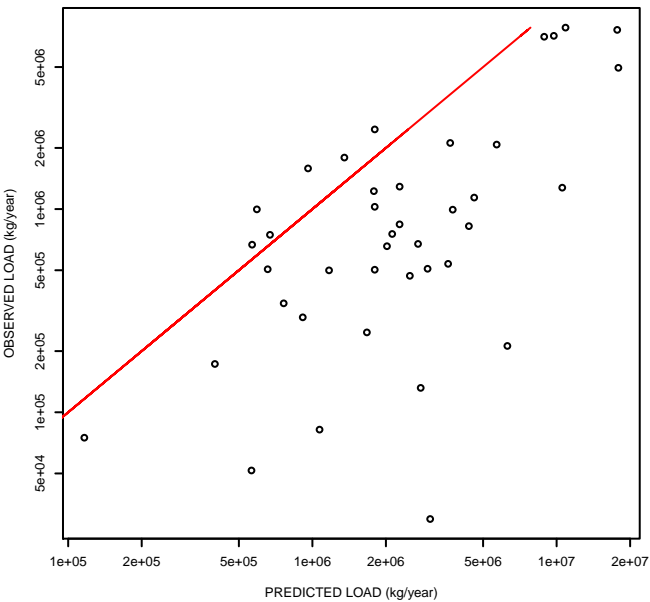
Residuals vs Predicted  
Load



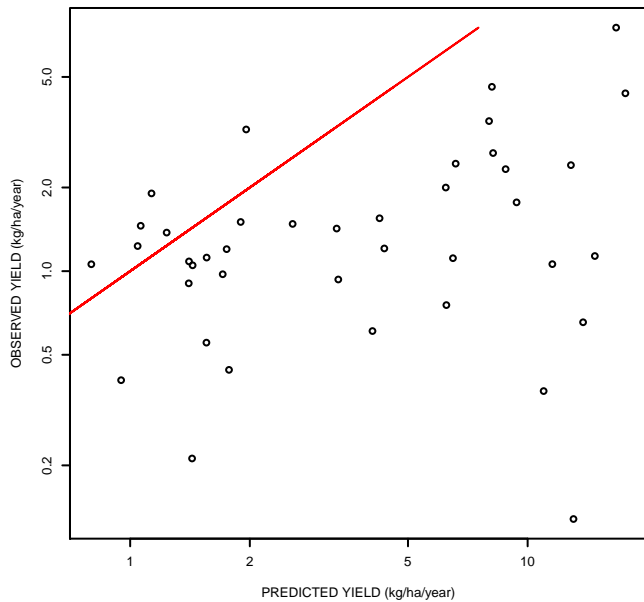
Residuals vs Predicted  
Yield



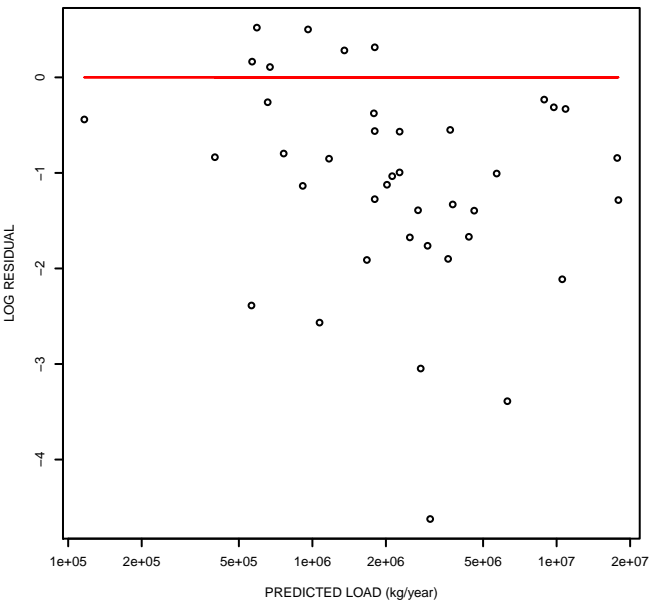
Observed vs Predicted Load  
CLASS Region = 9(n=40)



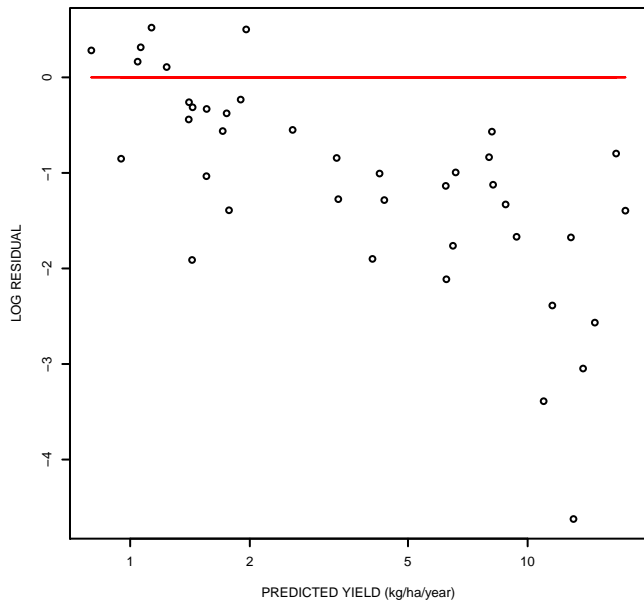
Observed vs Predicted  
Yield



Residuals vs Predicted  
Load



Residuals vs Predicted  
Yield



# Model Simulation Performance Diagnostics

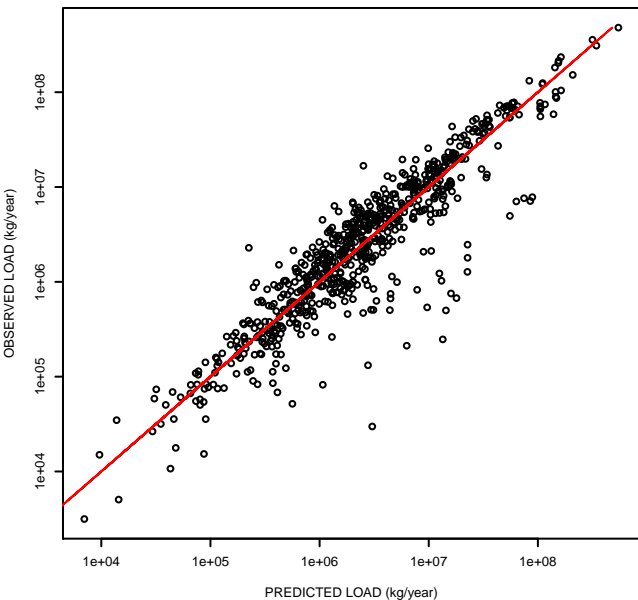
Diagnostics are based on the use of unconditioned predictions (i.e., predictions that are not adjusted for monitoring loads). These predictions (and the associated residuals and observed to predicted ratios shown in the following section) provide the best measure of the predictive skill of the estimated model in simulation mode. The simulated predictions are computed using mean coefficients from the NLLS model estimated with monitoring-adjusted (conditioned) predictions.

The diagnostic plots include:

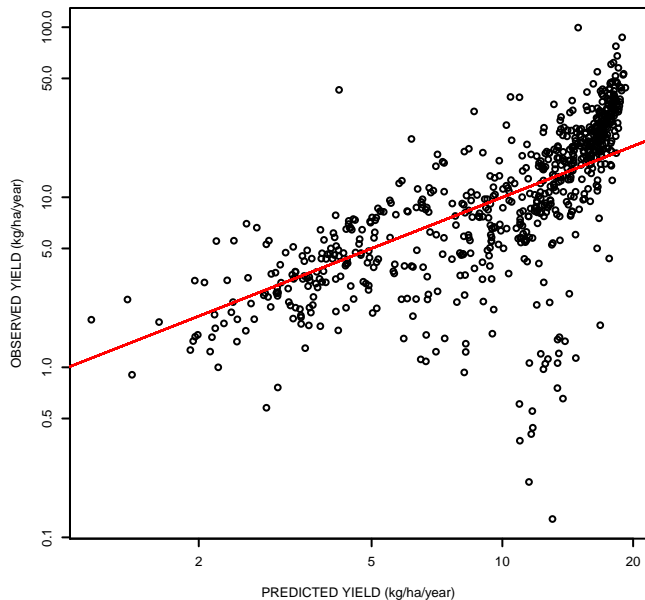
- Four-plot panel for observed vs. predicted for loads and yields, and log residuals vs. predicted loads and yields
- Four-plot panel for boxplots of residuals and observed/predicted ratios, normal quantile plot of standardized residuals, and plot of squared residuals vs. predicted loads
- Plot of conditioned prediction loads vs. unconditioned (simulated) prediction loads
- Plots of the observed to predicted ratio vs. the area-weighted mean values of the user-selected explanatory variables for the incremental areas between calibration sites (output only if control setting `if_corrExplanVars` = 'yes' selected and a value of 1 entered for 'parmCorrGroup' column in the 'parameters.csv' file)
- Boxplots of the observed to predicted loads vs. the decile classes of the total drainage area for the calibration sites
- Boxplots of the observed to predicted loads vs. the contiguous spatial classes specified by users in the 'classvar' control setting (e.g., HUC-4)
- Boxplots of the observed to predicted loads vs. the deciles of the land-use class variable specified by users in the 'class\_landuse' control setting, with the land-use classes expressed as a percentage of the incremental drainage area extending from the calibration site to the nearest upstream site locations.
- Four-plot panels reported separately for each of the contiguous spatial classes specified for the first variable entry for the 'classvar[1]' control setting. The panels include: observed vs. predicted loads, observed vs. predicted yields, log residuals vs. predicted loads, and log residuals vs. predicted yields



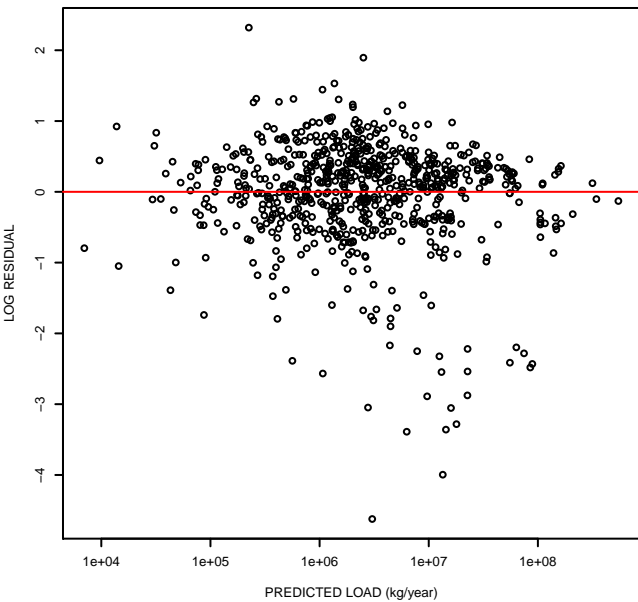
**MODEL SIMULATION PERFORMANCE**  
**Observed vs Predicted Load**



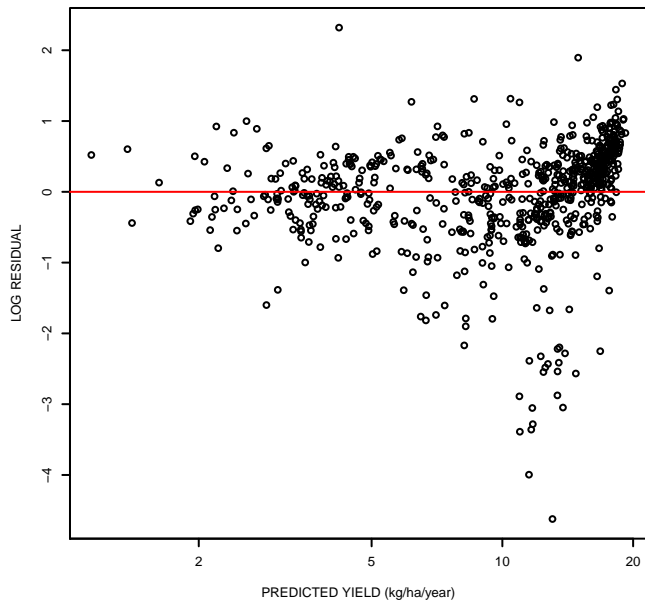
**MODEL SIMULATION PERFORMANCE**  
**Observed vs Predicted Yield**



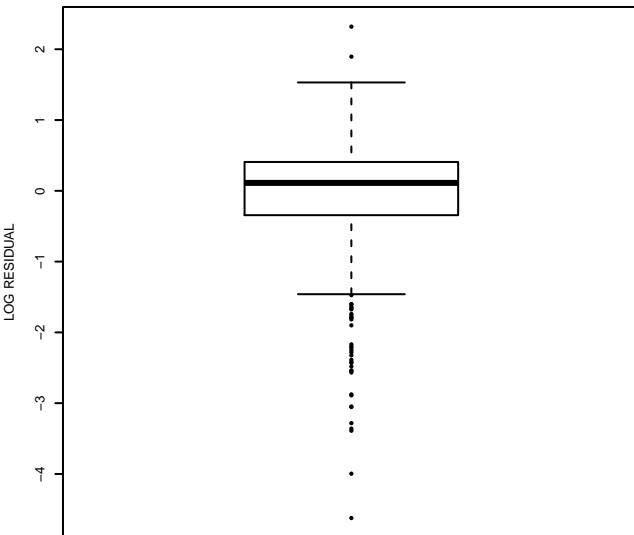
**Residuals vs Predicted Load**



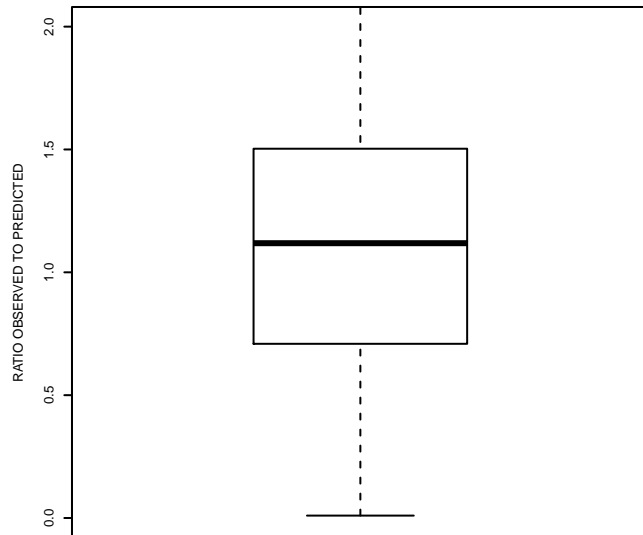
**Residuals vs Predicted Yield**



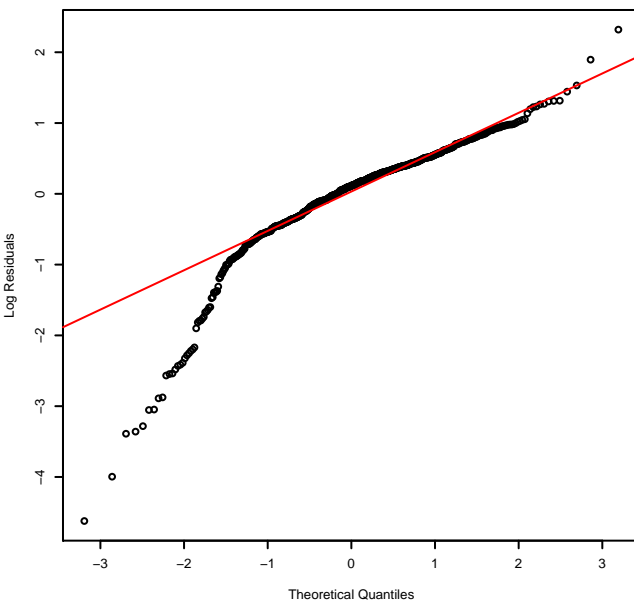
MODEL SIMULATION PERFORMANCE  
Residuals



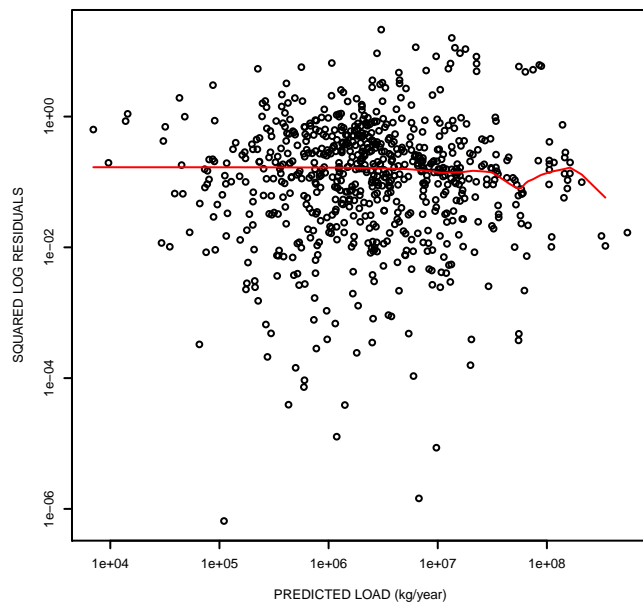
MODEL SIMULATION PERFORMANCE  
Observed / Predicted Ratio



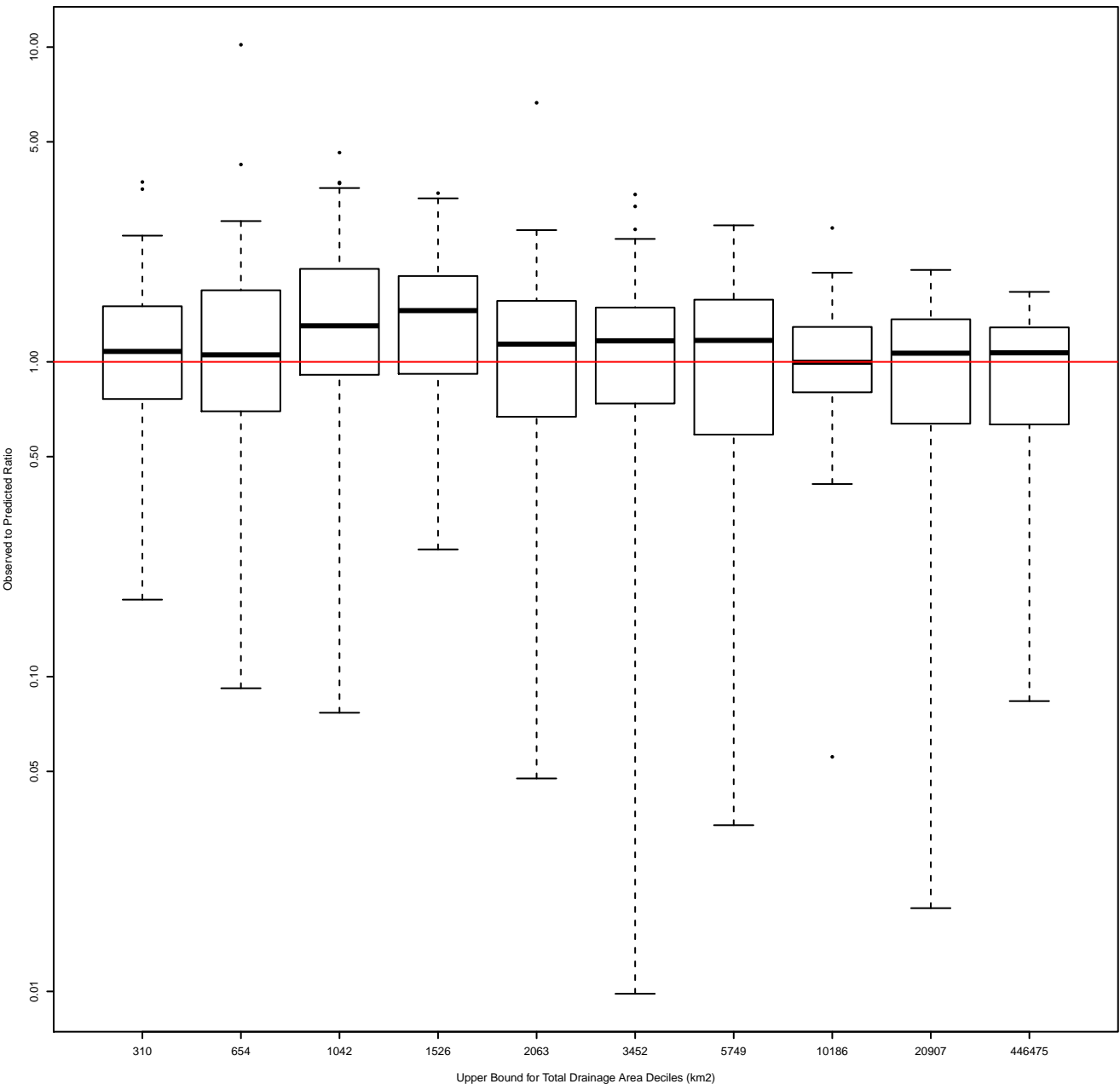
Normal Q-Q Plot



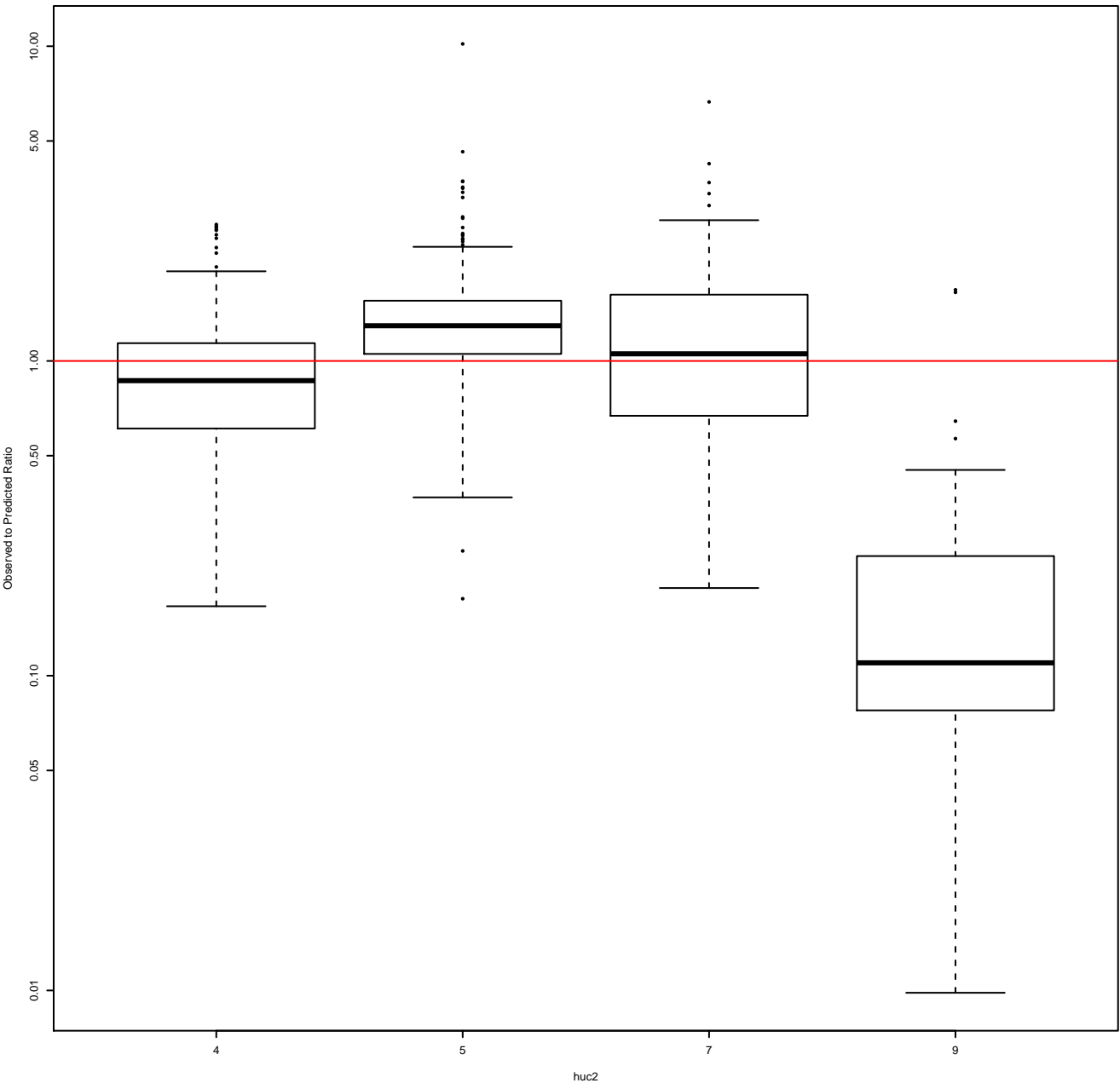
Squared Residuals vs Predicted Load



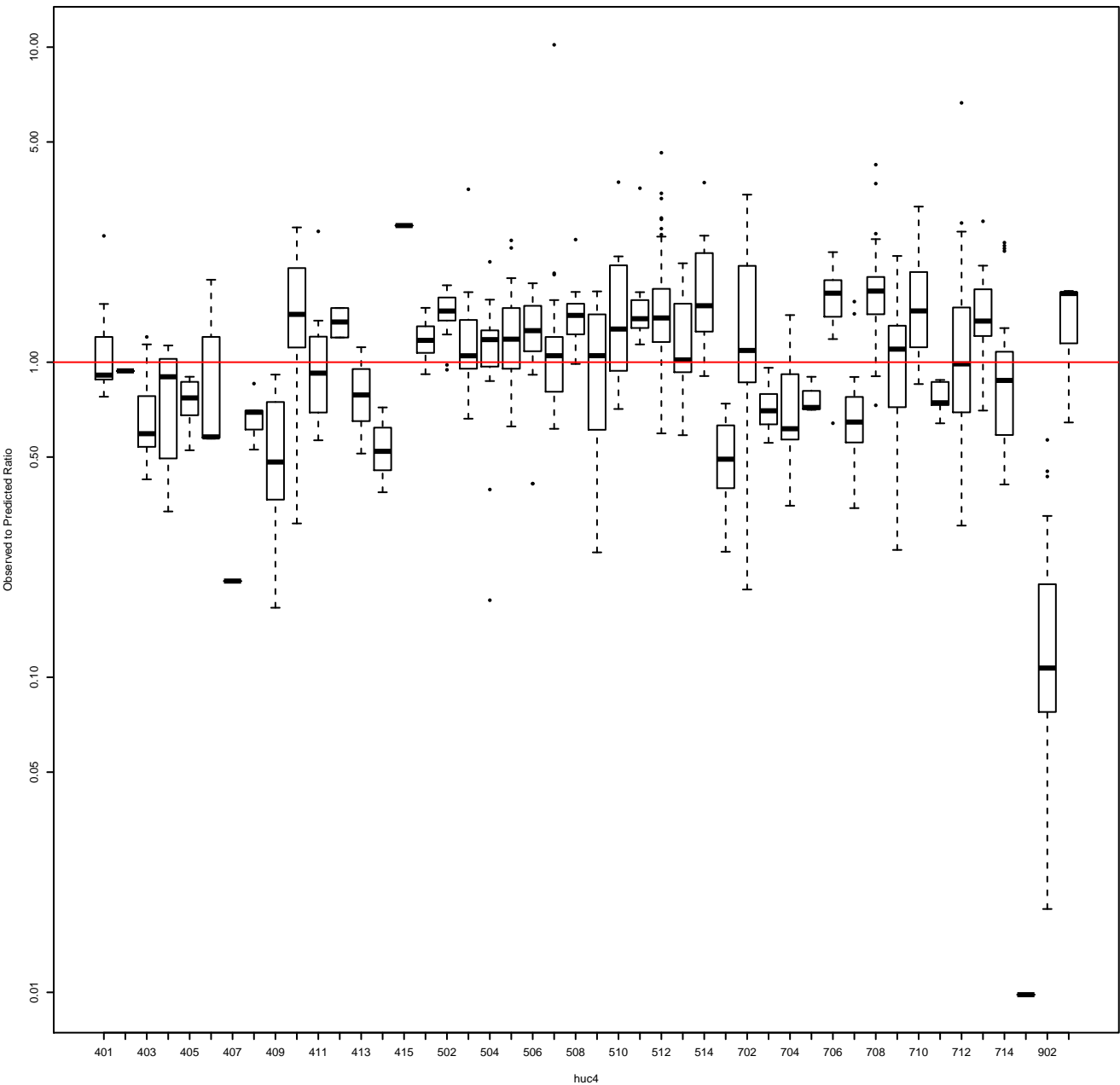
Ratio Observed to Predicted by Deciles



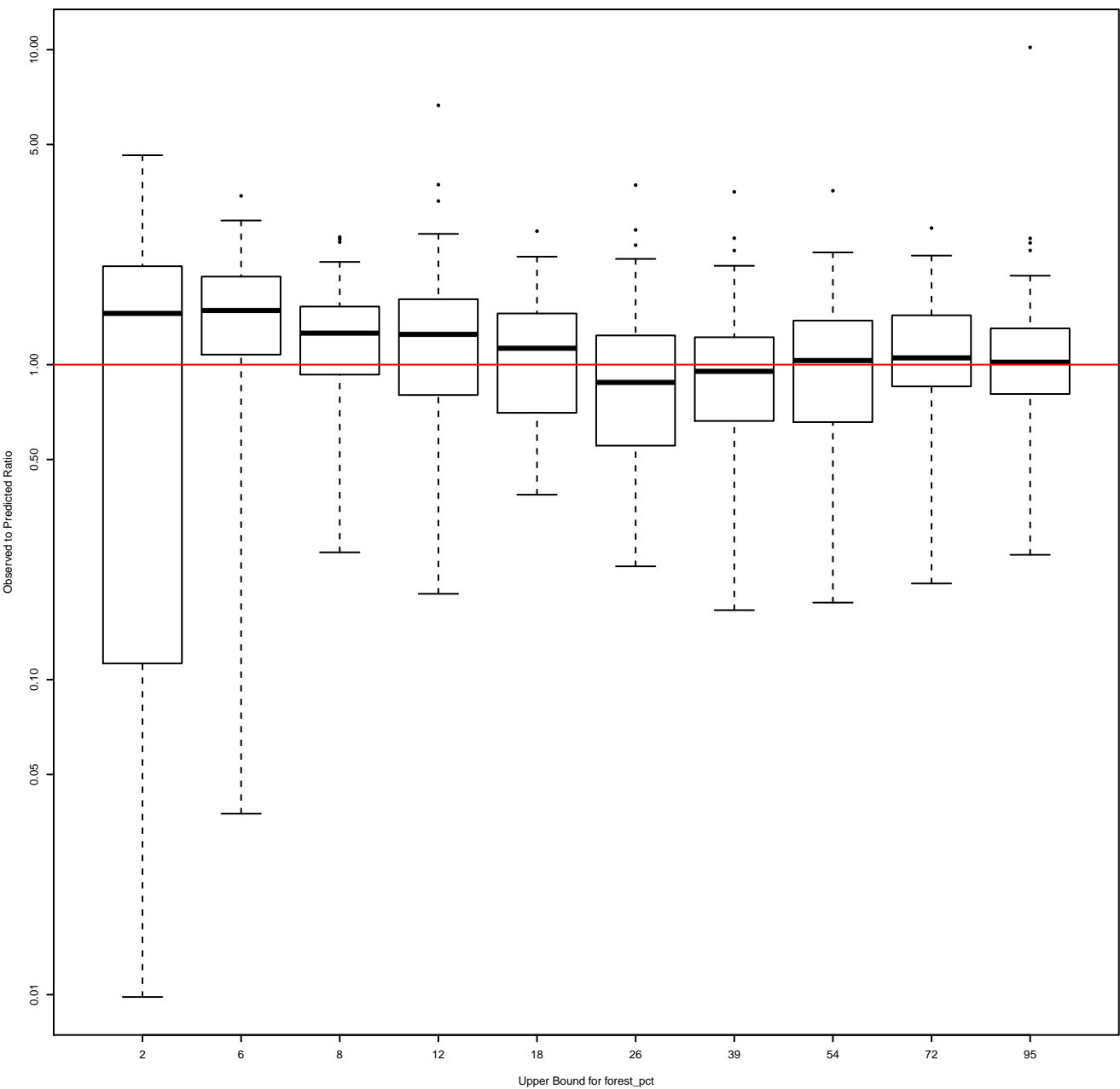
Ratio Observed to Predicted



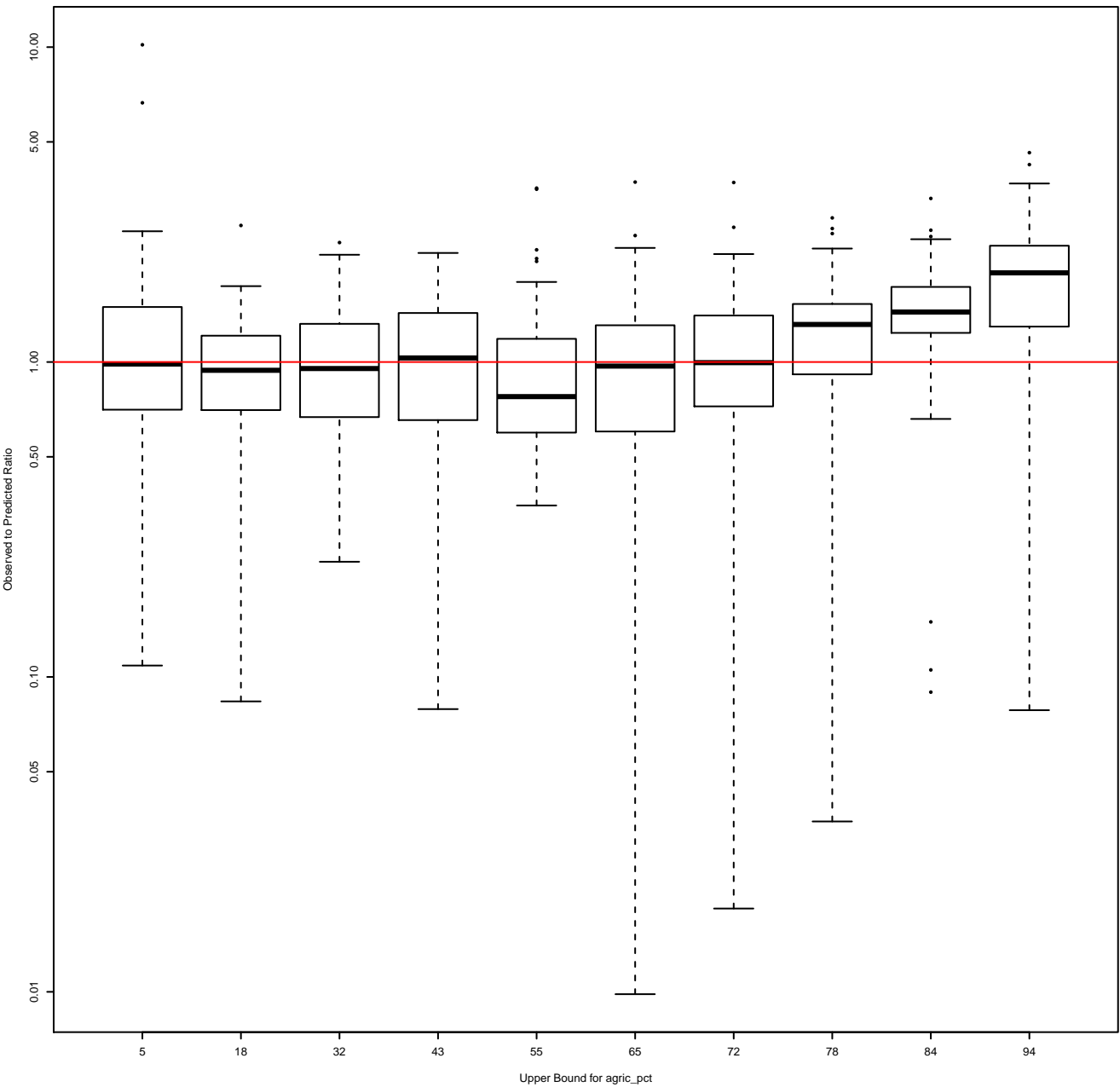
Ratio Observed to Predicted



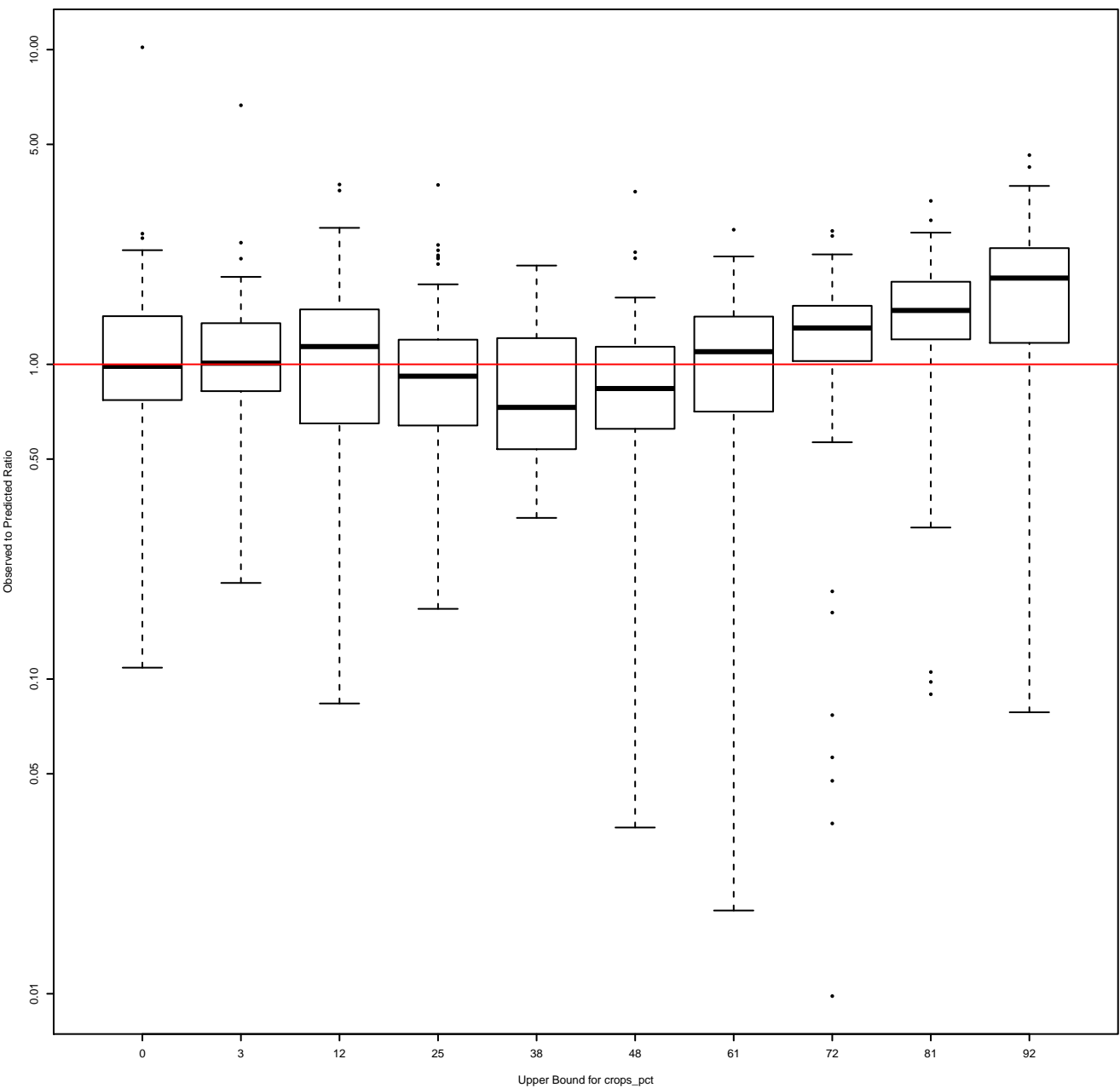
Ratio Observed to Predicted by Deciles



Ratio Observed to Predicted by Deciles

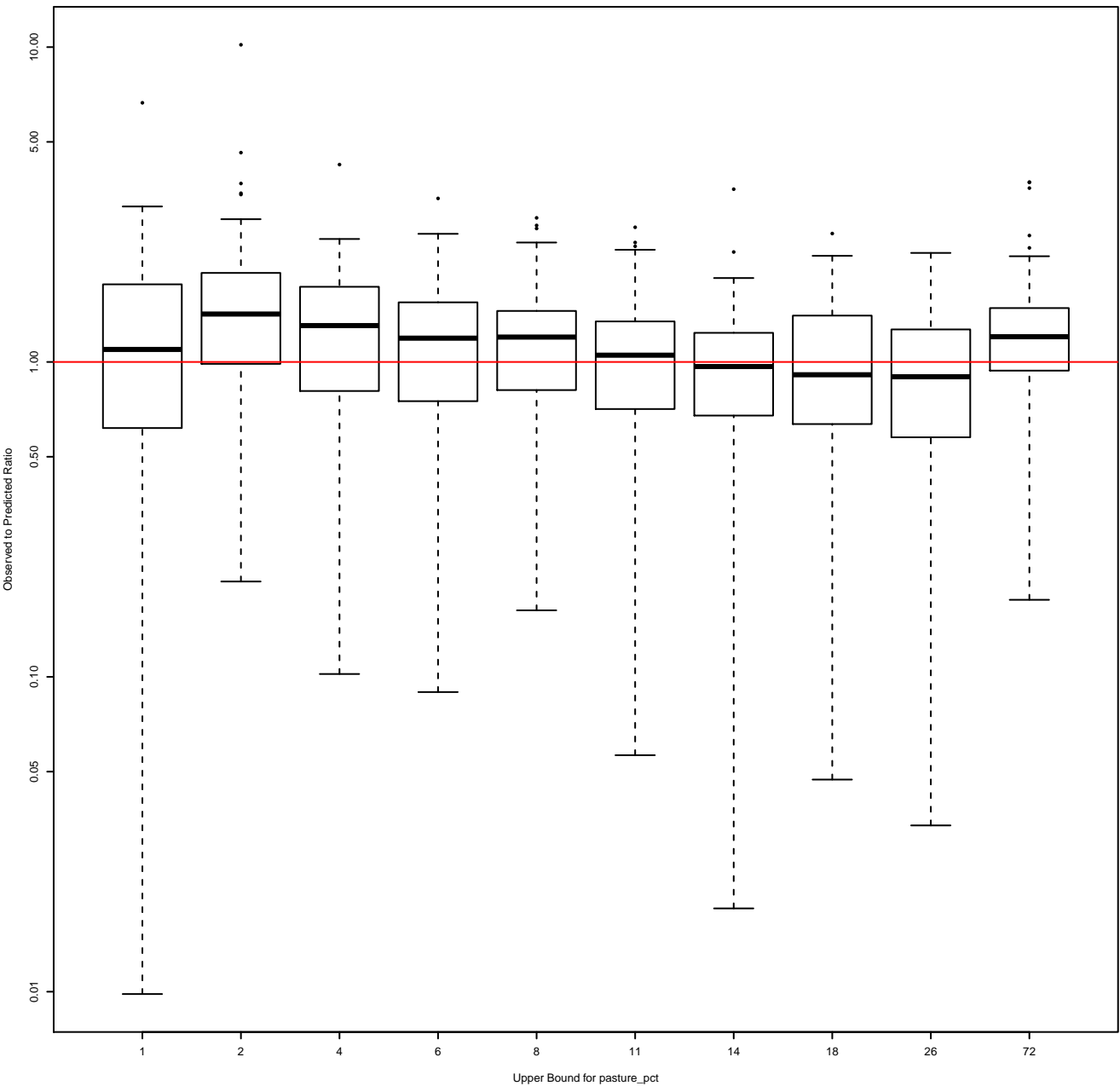


Ratio Observed to Predicted by Deciles

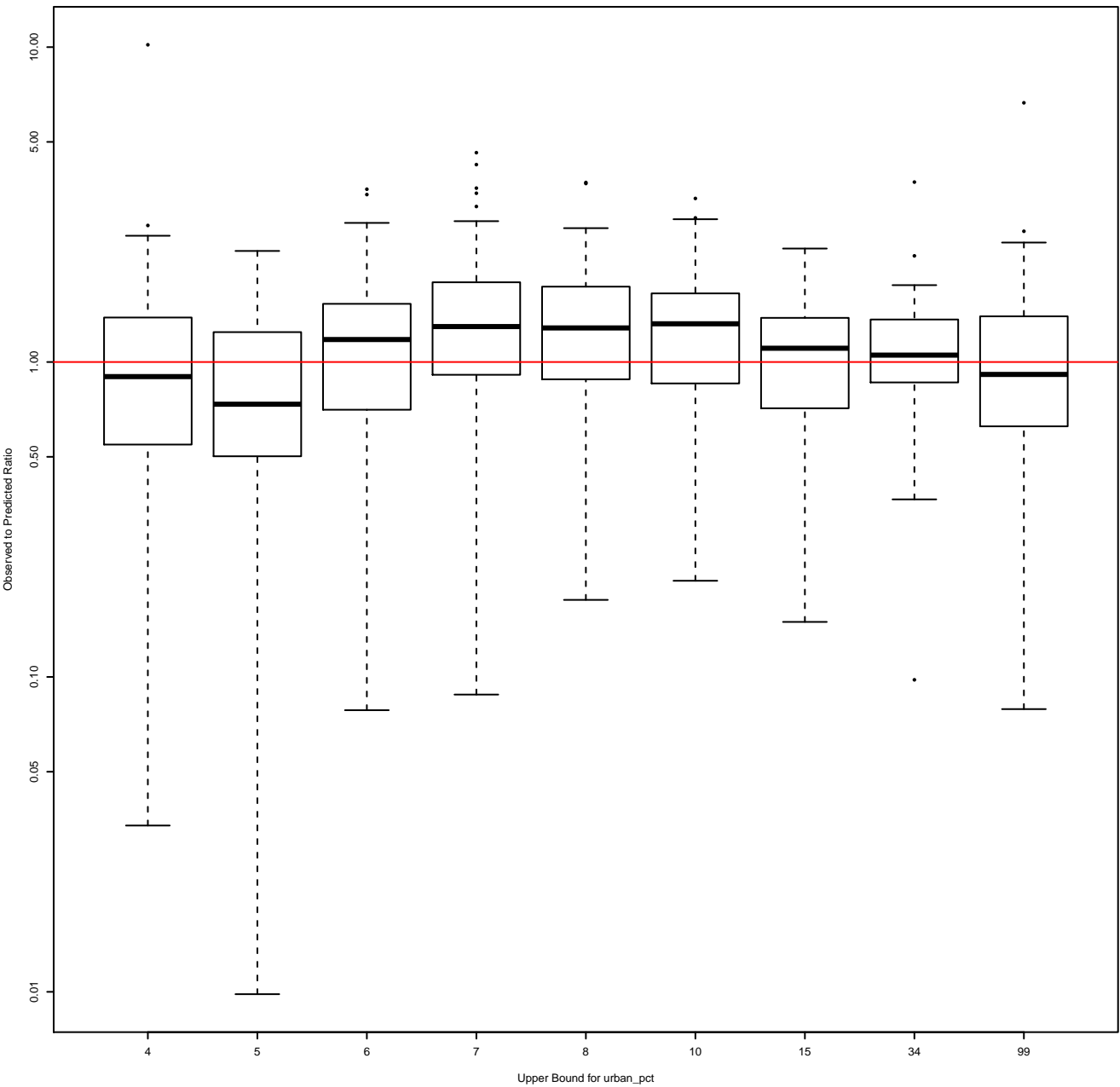




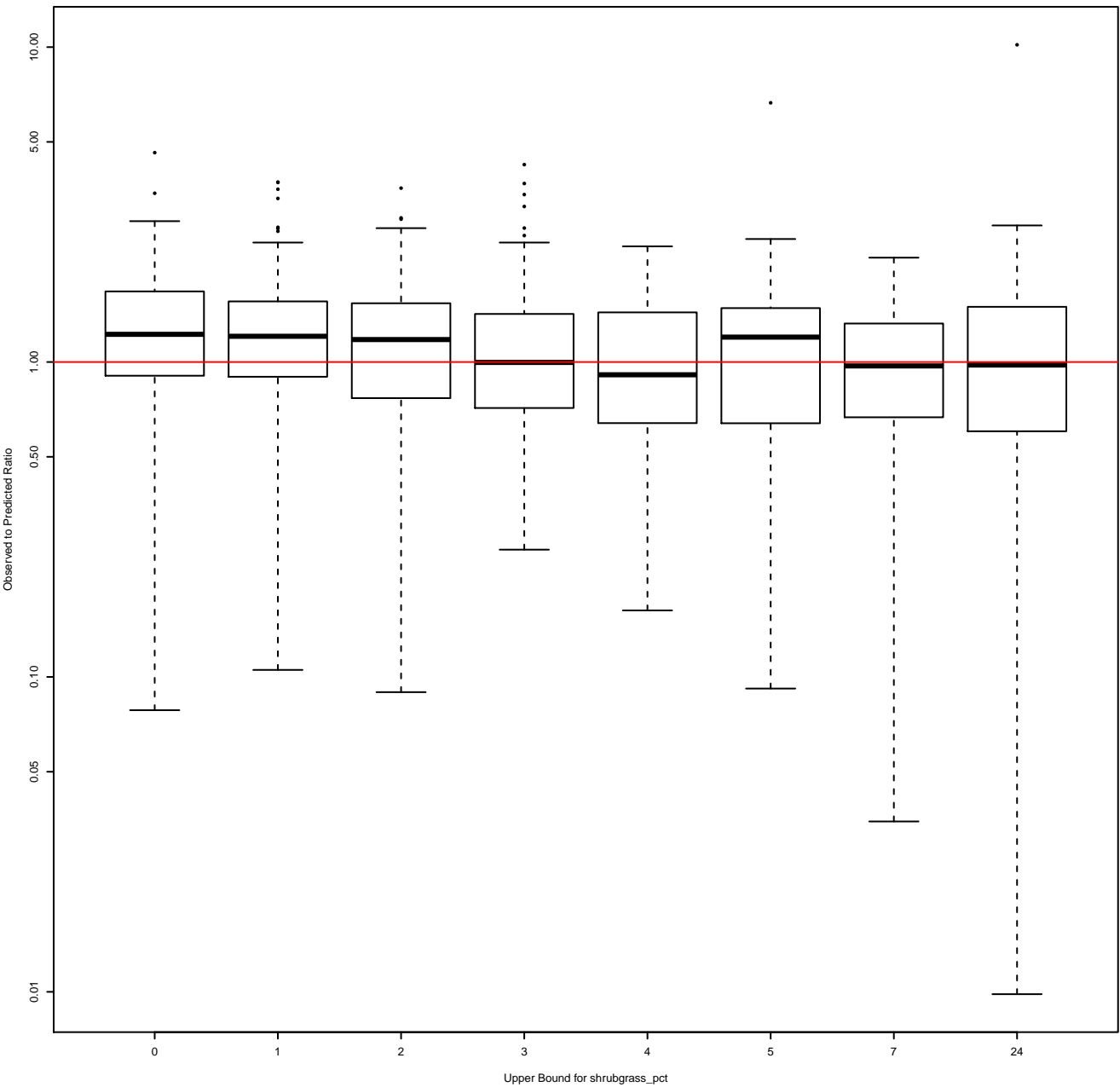
Ratio Observed to Predicted by Deciles



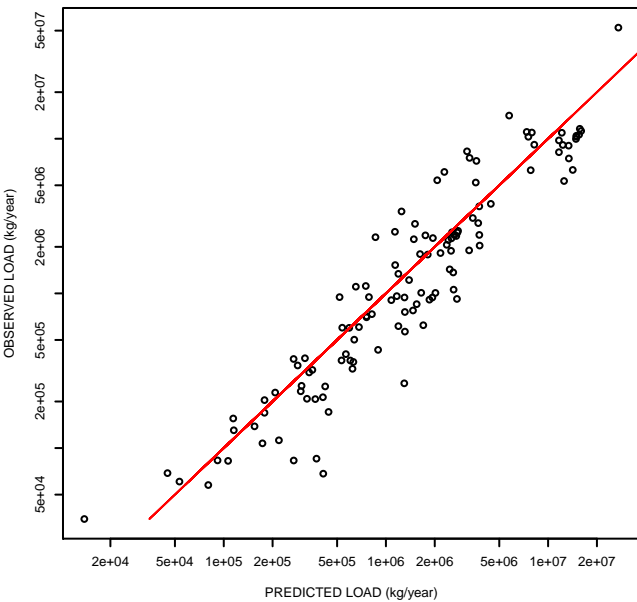
Ratio Observed to Predicted by Deciles



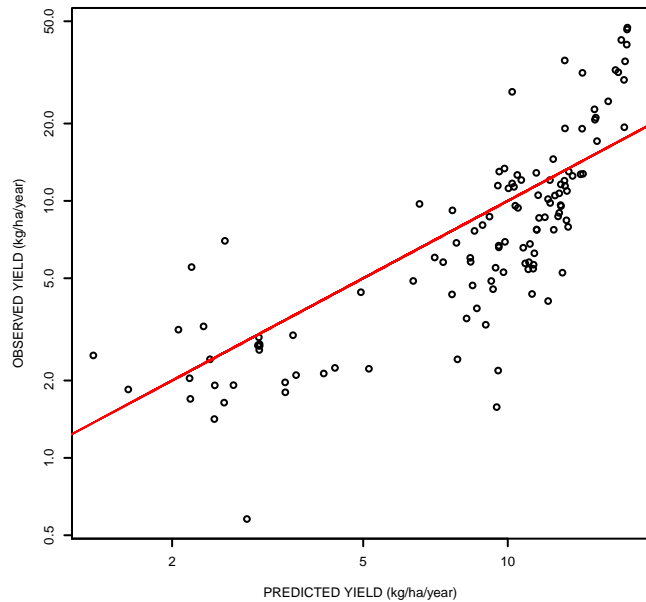
Ratio Observed to Predicted by Deciles



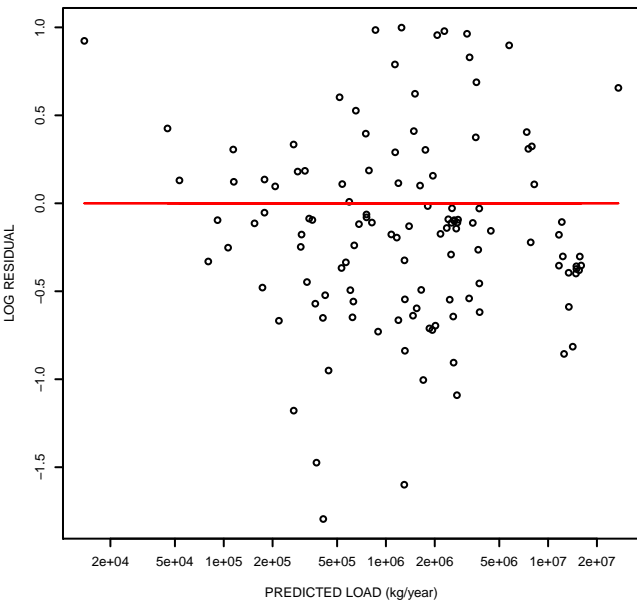
Observed vs Predicted Load  
CLASS Region = 4(n=121)



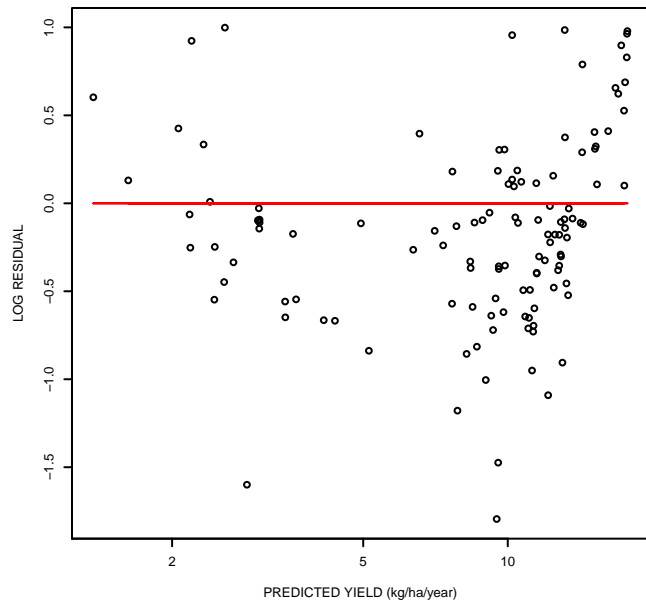
Observed vs Predicted  
Yield



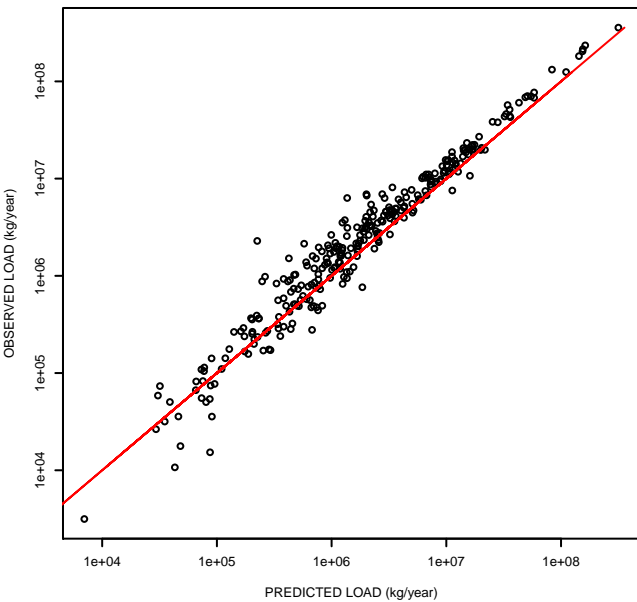
Residuals vs Predicted  
Load



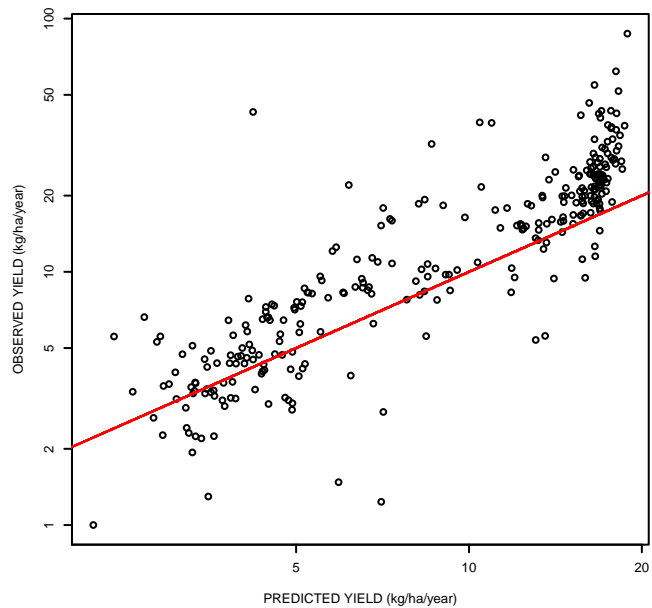
Residuals vs Predicted  
Yield



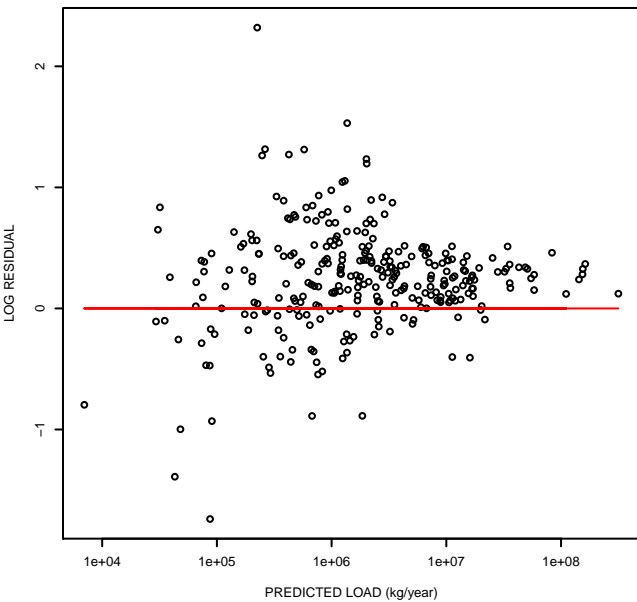
Observed vs Predicted Load  
CLASS Region = 5(n=295)



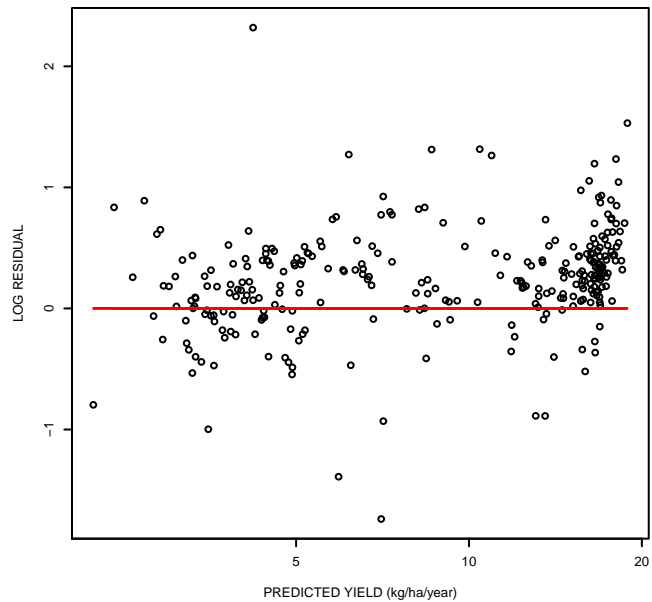
Observed vs Predicted  
Yield



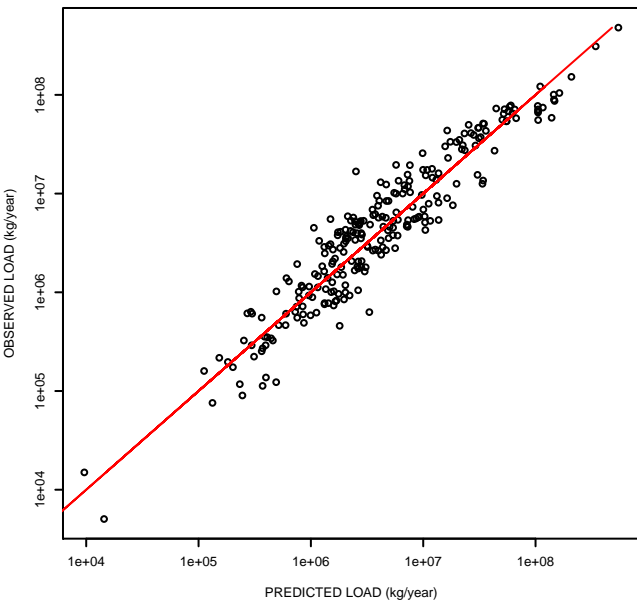
Residuals vs Predicted  
Load



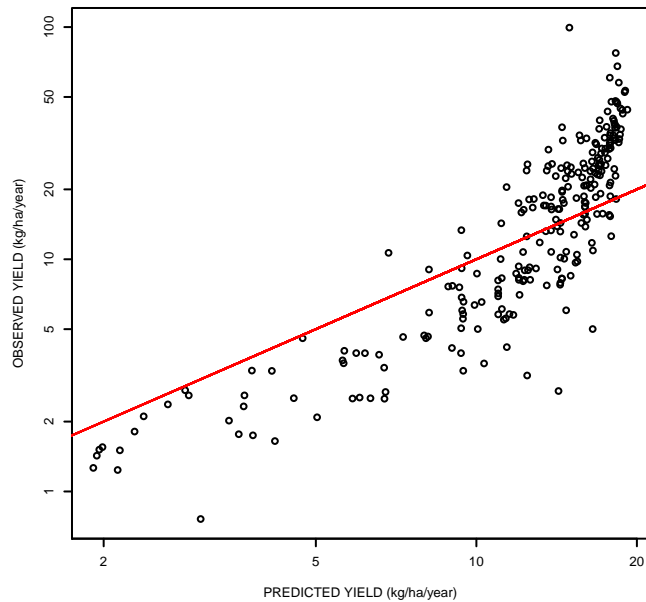
Residuals vs Predicted  
Yield



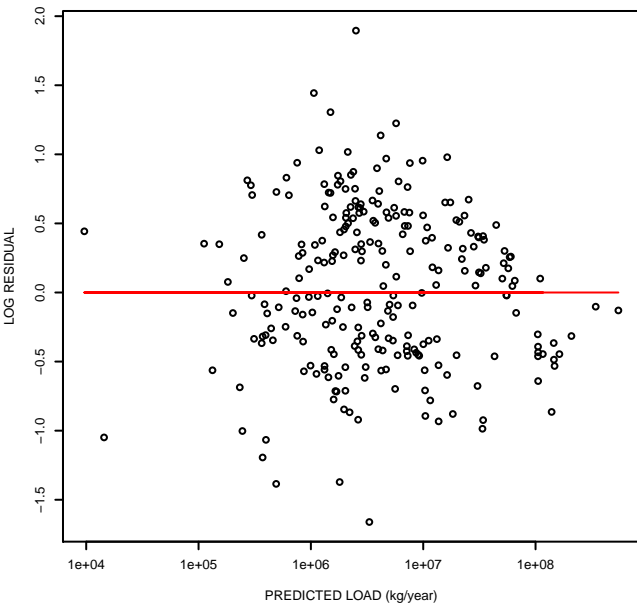
Observed vs Predicted Load  
CLASS Region = 7(n=252)



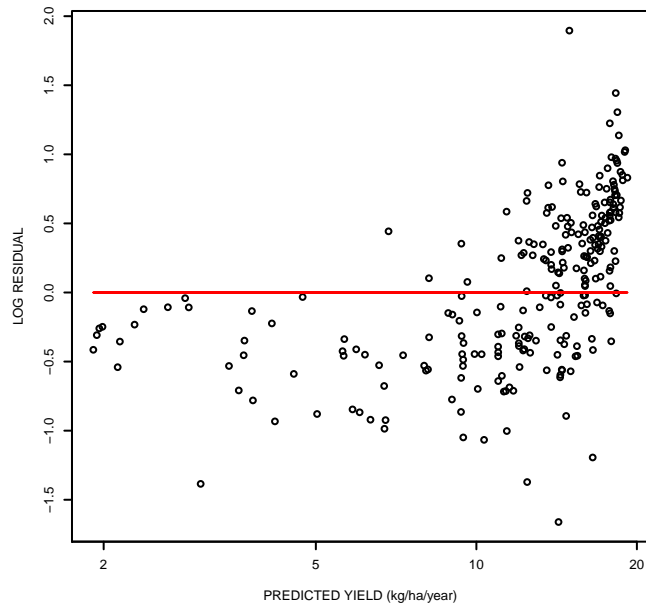
Observed vs Predicted  
Yield



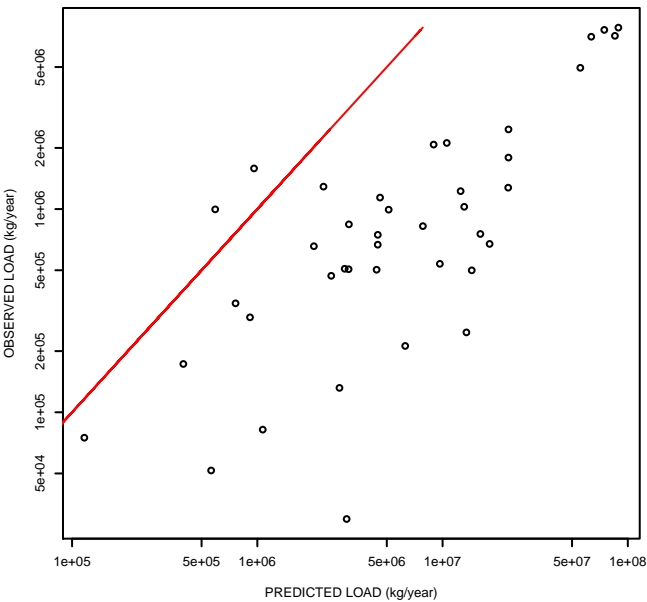
Residuals vs Predicted  
Load



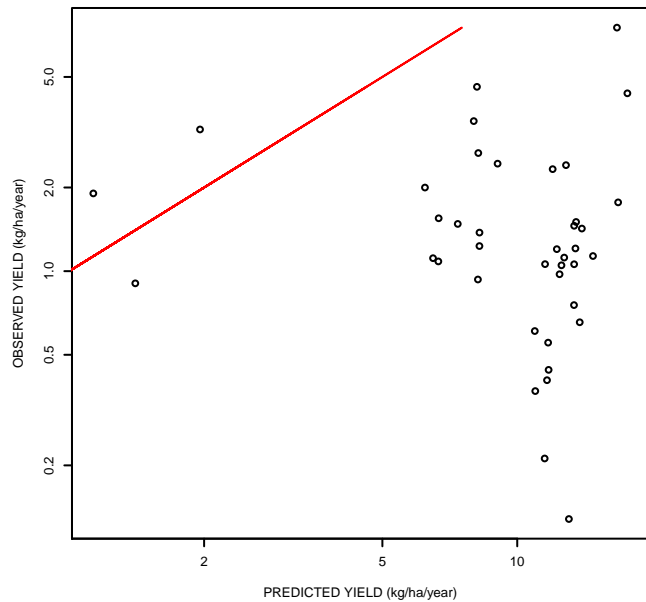
Residuals vs Predicted  
Yield



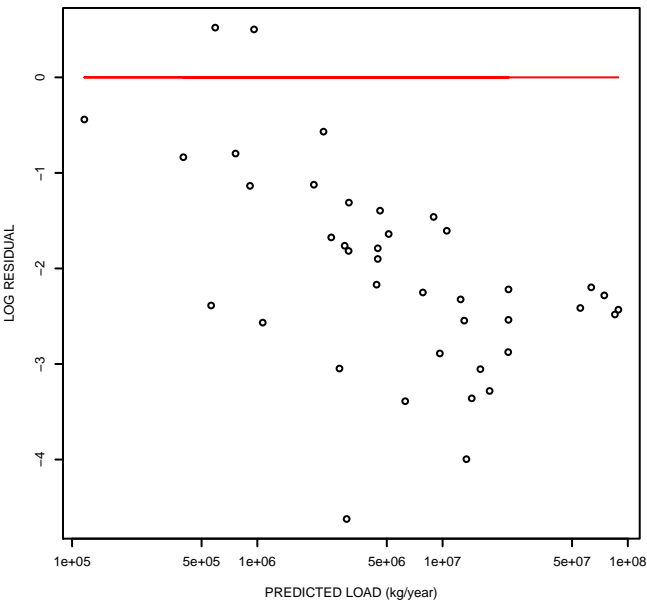
Observed vs Predicted Load  
CLASS Region = 9(n=40)



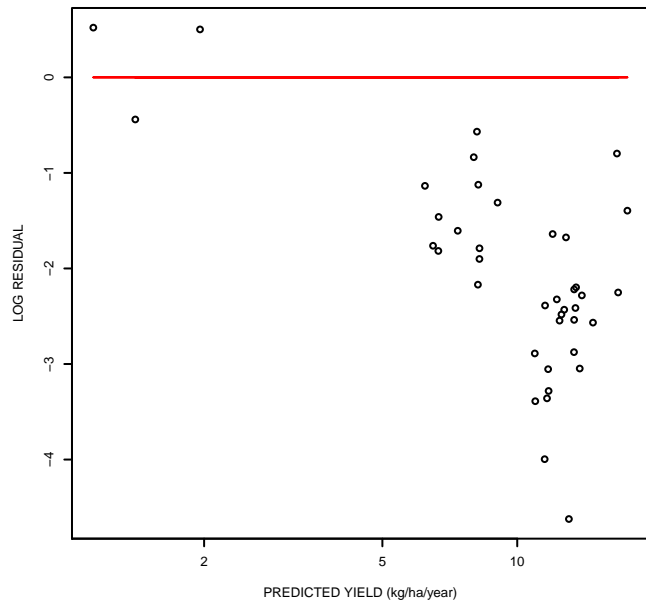
Observed vs Predicted  
Yield



Residuals vs Predicted  
Load



Residuals vs Predicted  
Yield



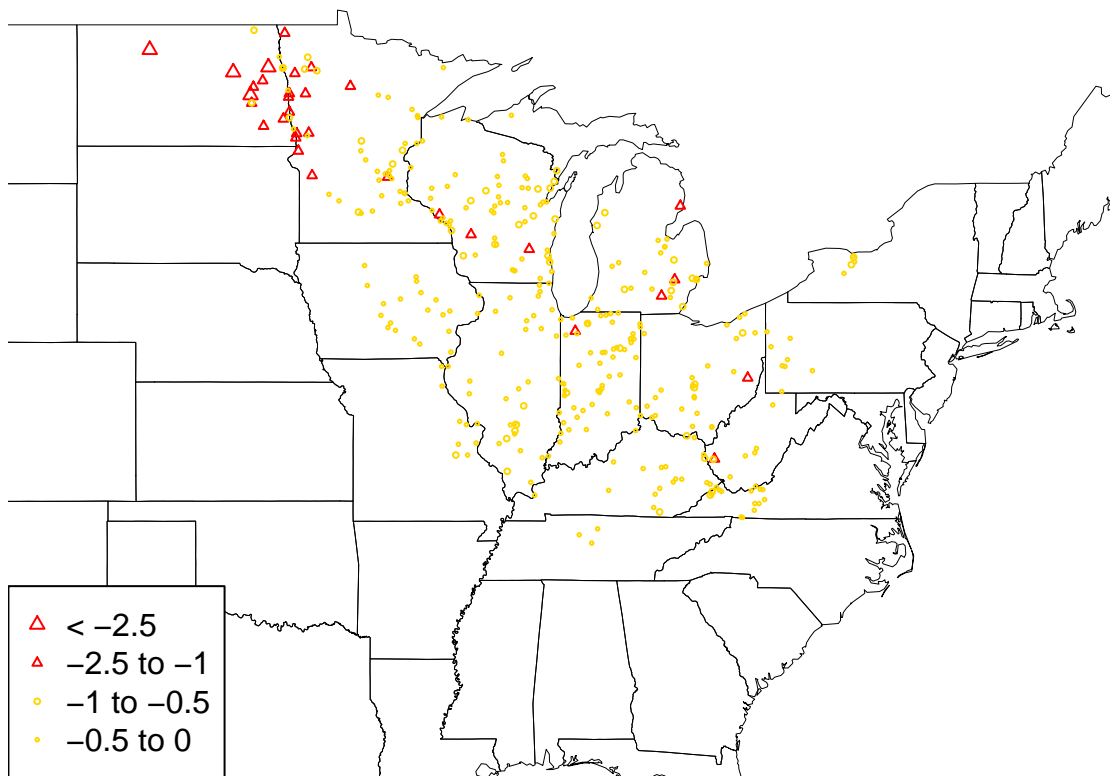
# Maps of Model Residuals and Observed to Predicted Ratios for the Calibration Sites

The maps include:

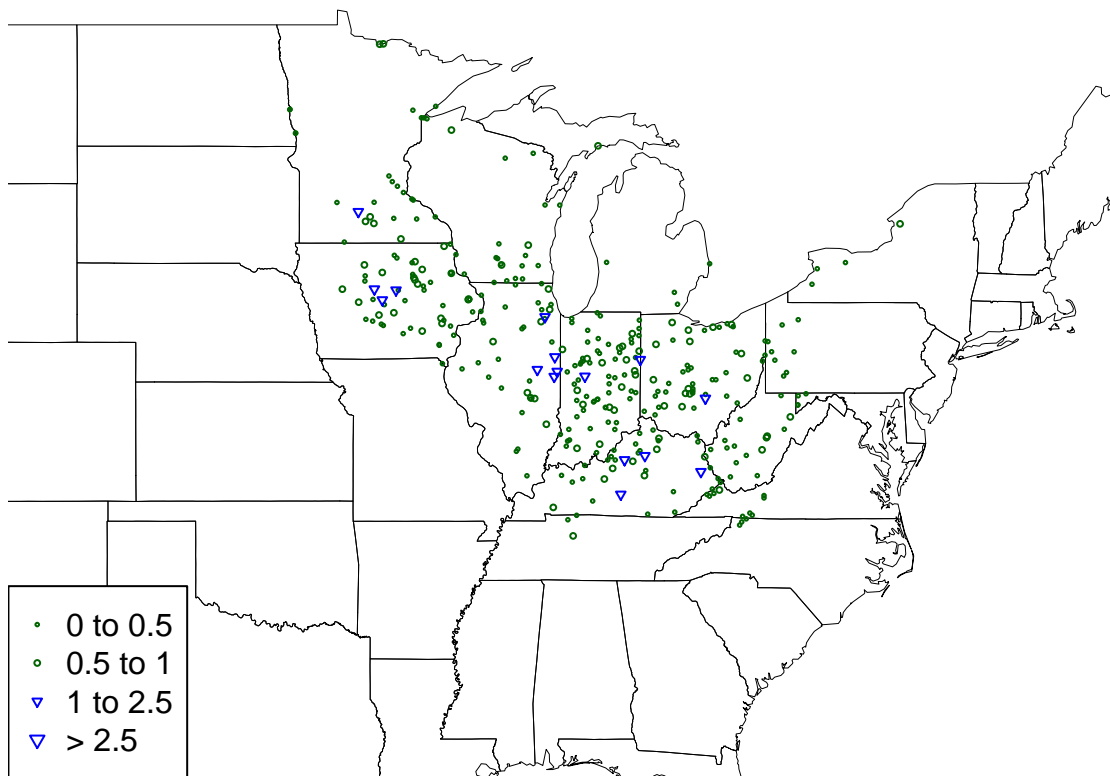
- Log residuals, based on monitoring conditioned predictions (i.e., model estimation residuals)
- Log residuals, based on the unconditioned predictions (i.e., model simulation residuals)
- Standardized residuals based on the monitoring conditioned predictions
- Ratio of observed to predicted loads for the conditioned predictions (i.e., model estimation ratio)
- Ratio of observed to predicted load for the unconditioned predictions (i.e., model simulation ratio)



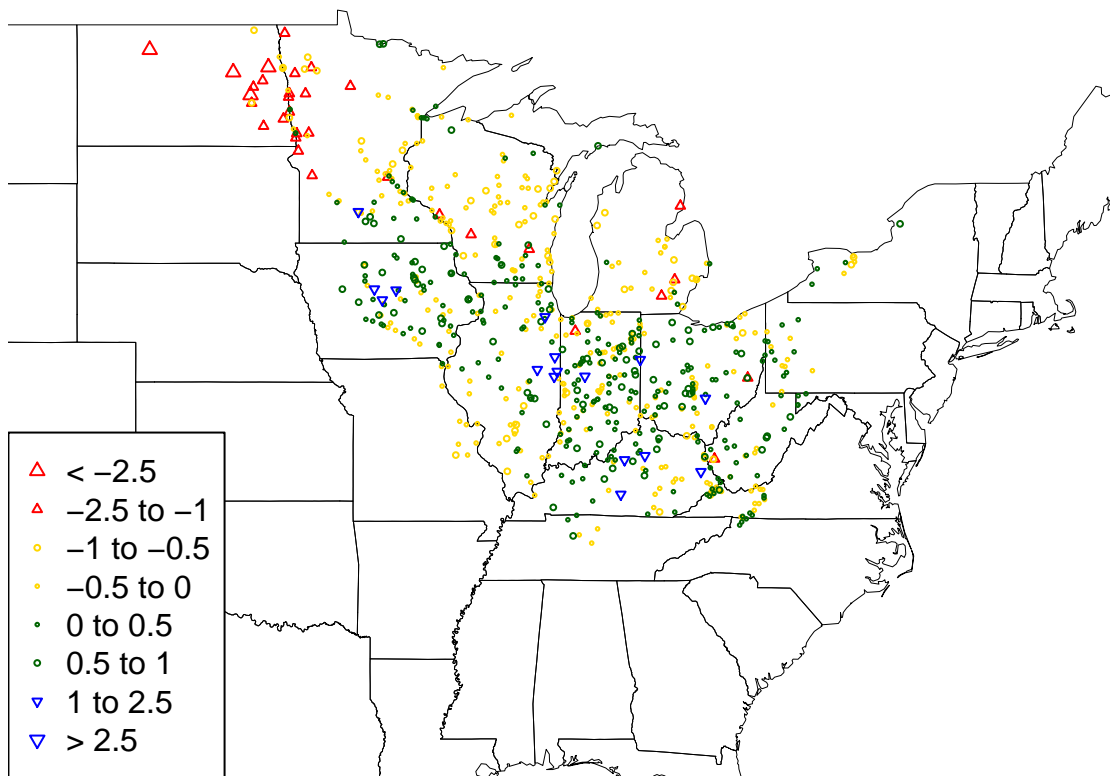
# Model Estimation Log Residuals – Over Predictions – n=363



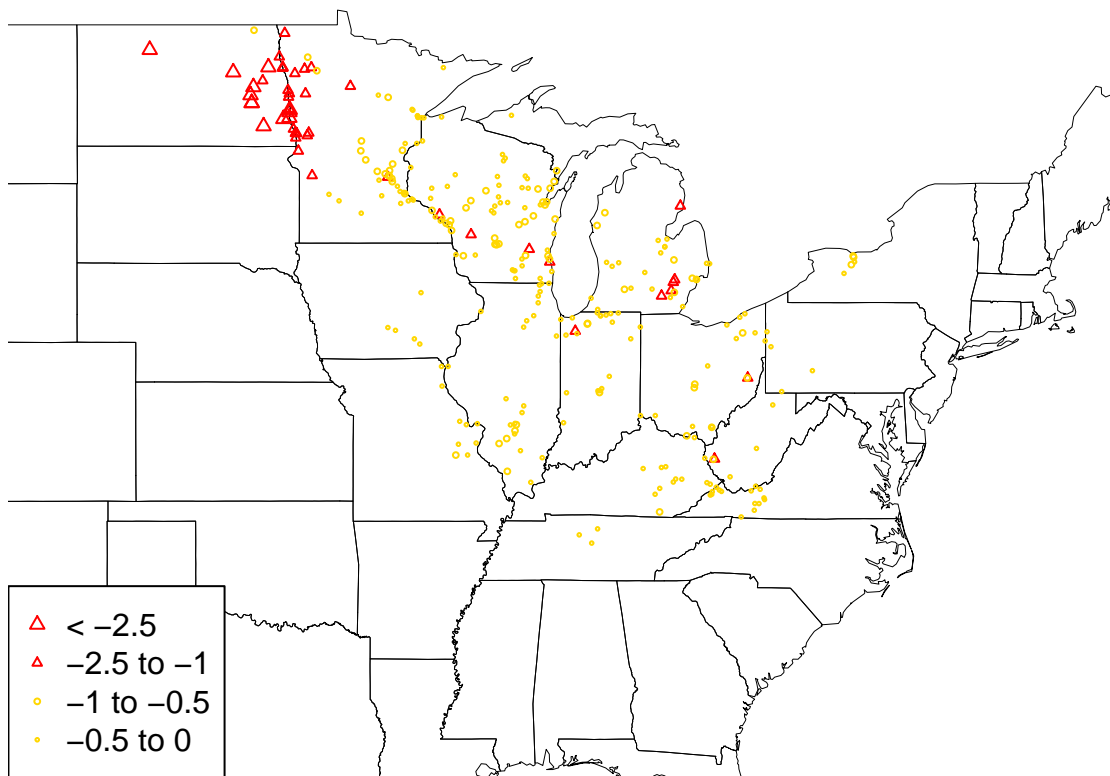
# Model Estimation Log Residuals – Under Predictions – n=345



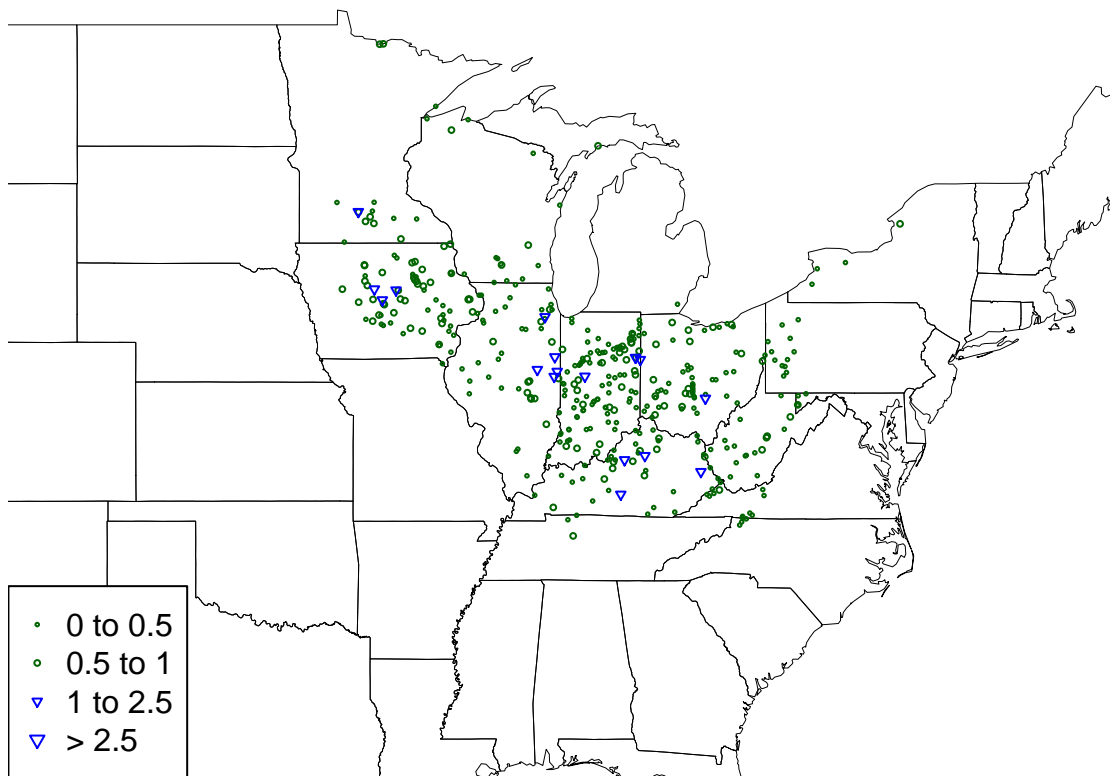
## Model Estimation Log Residuals



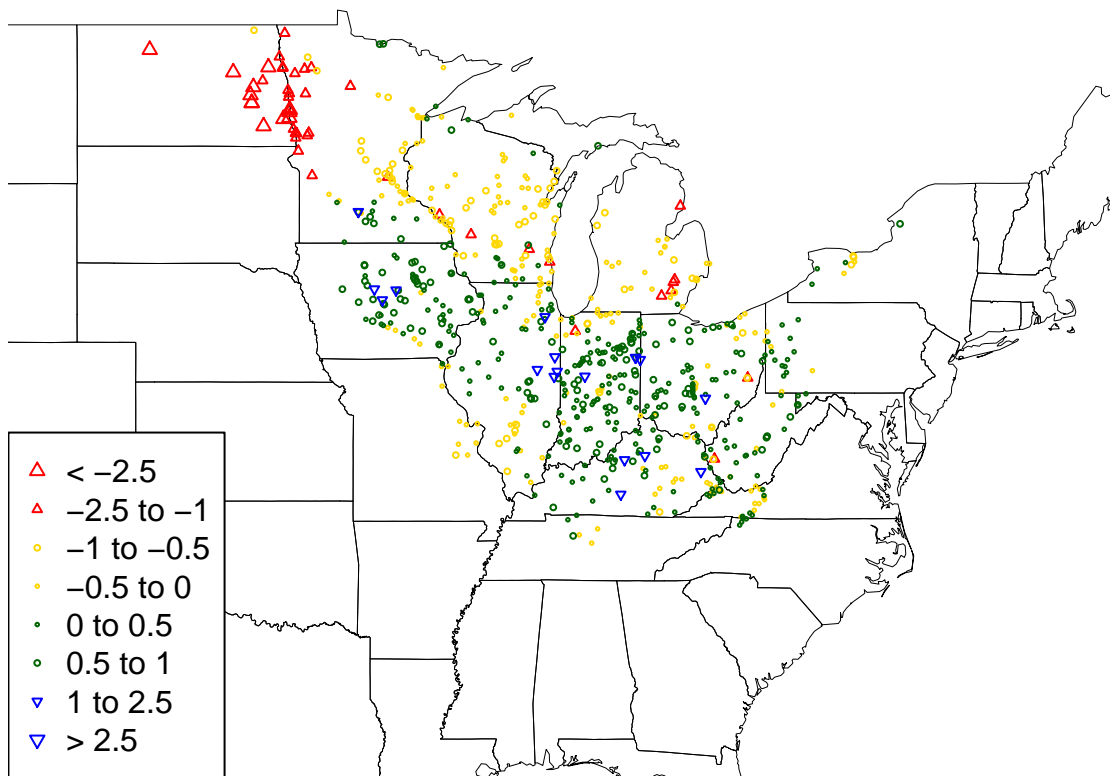
# Model Simulation Log Residuals – Over Predictions – n=305



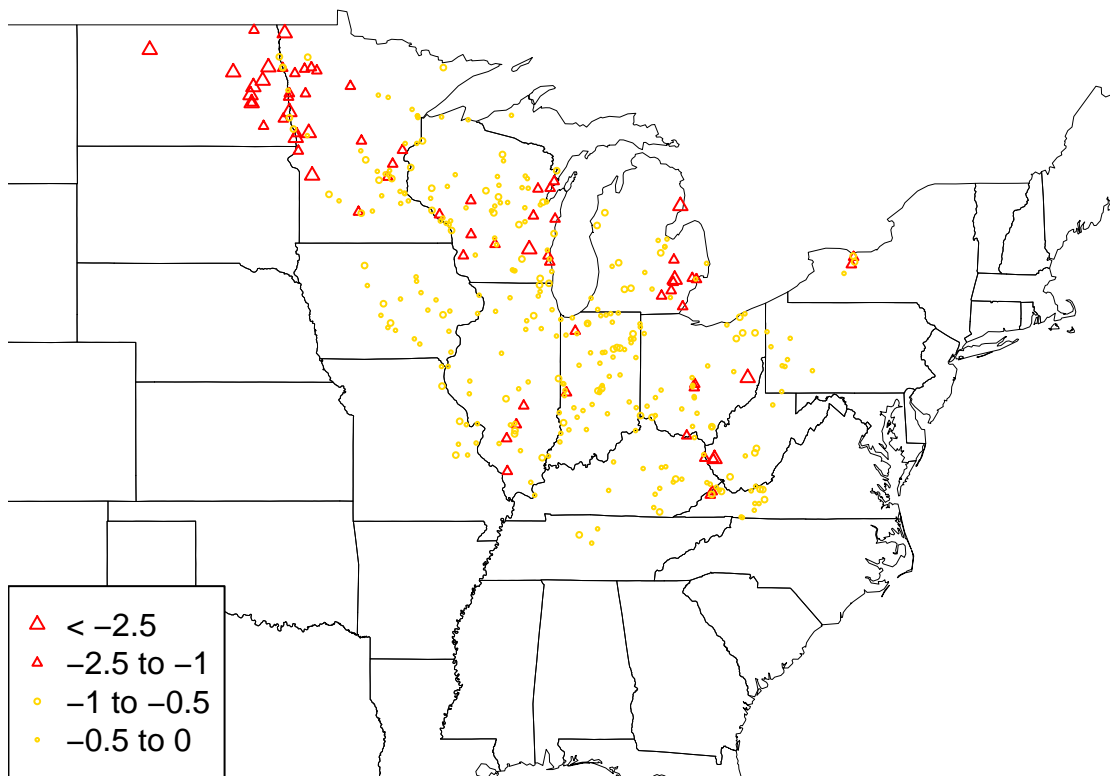
# Model Simulation Log Residuals – Under Predictions – n=403



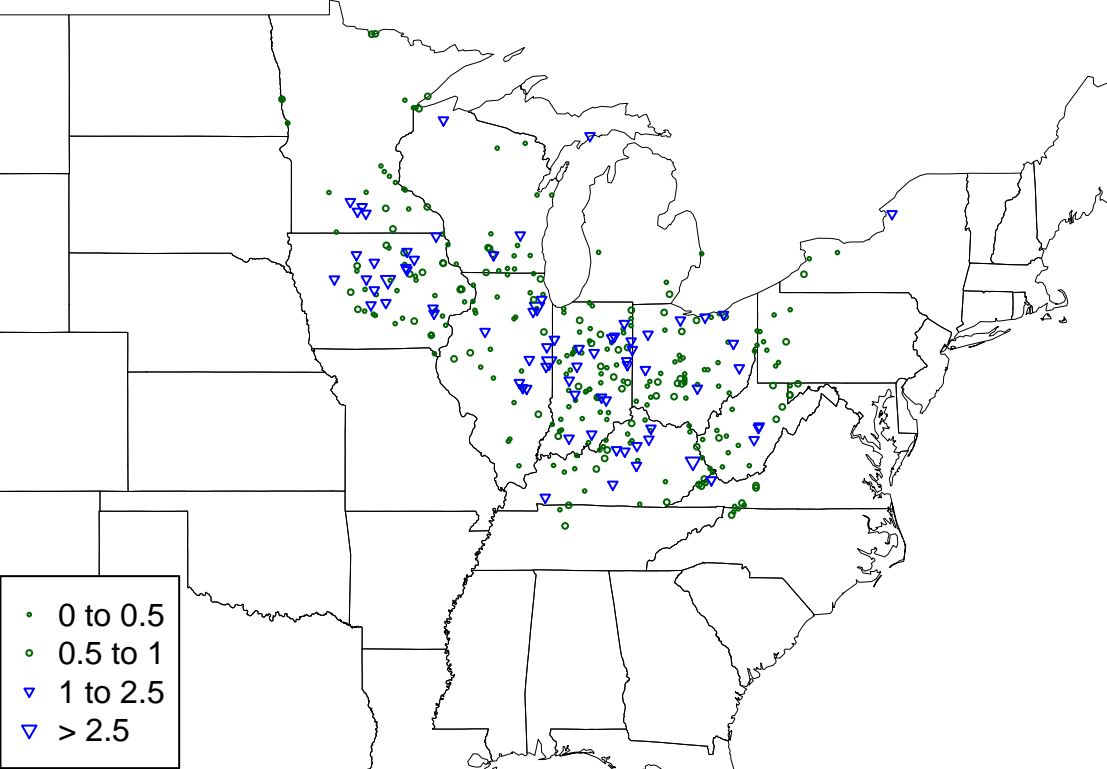
## Model Simulation Log Residuals



# Model Estimation Standardized Residuals – Over Predictions – n=363

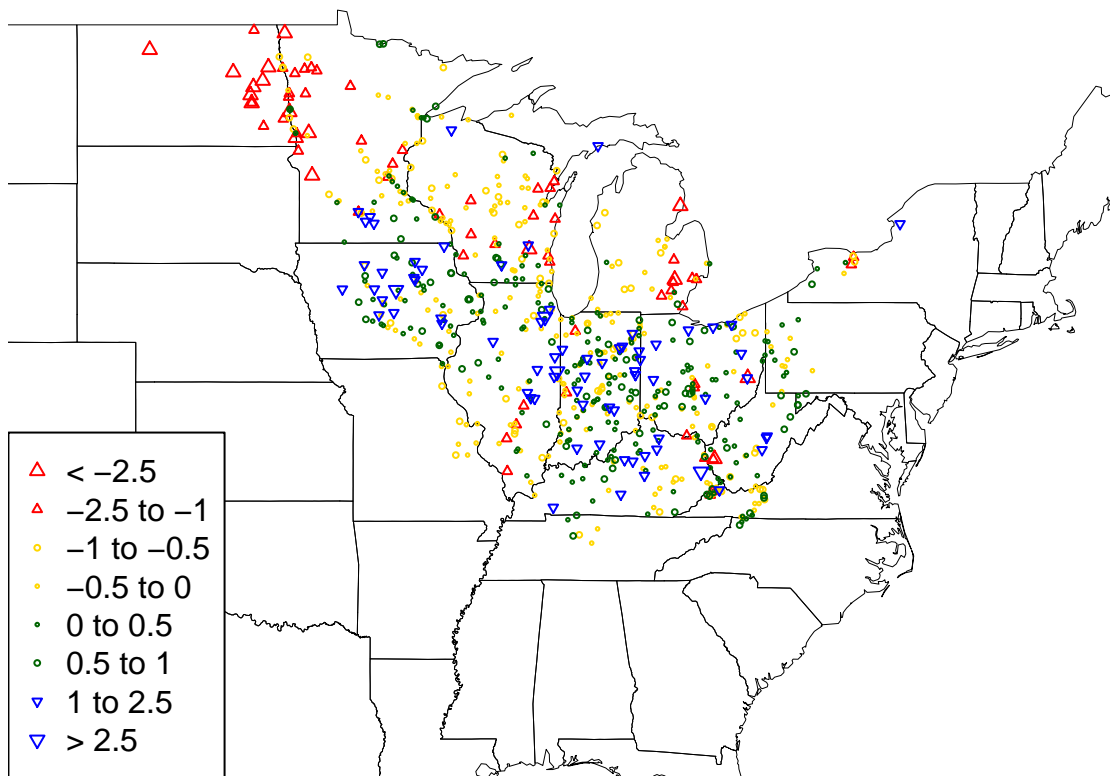


Model Estimation Standardized Residuals – Under Predictions – n=345

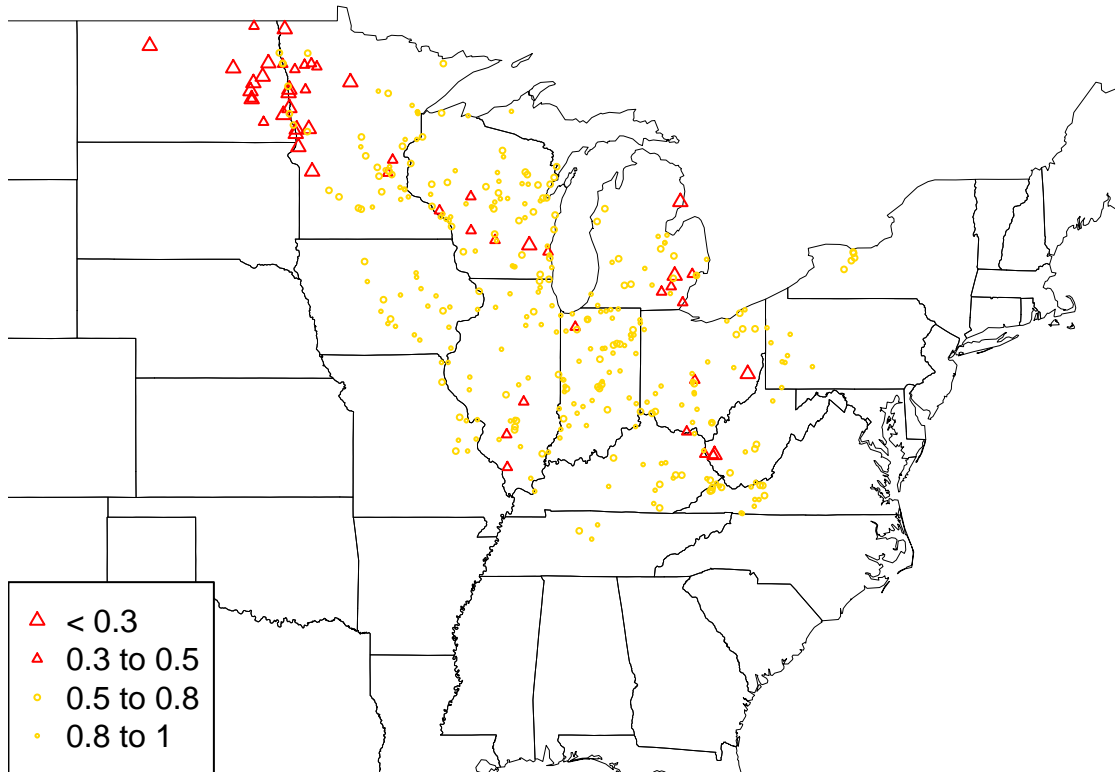




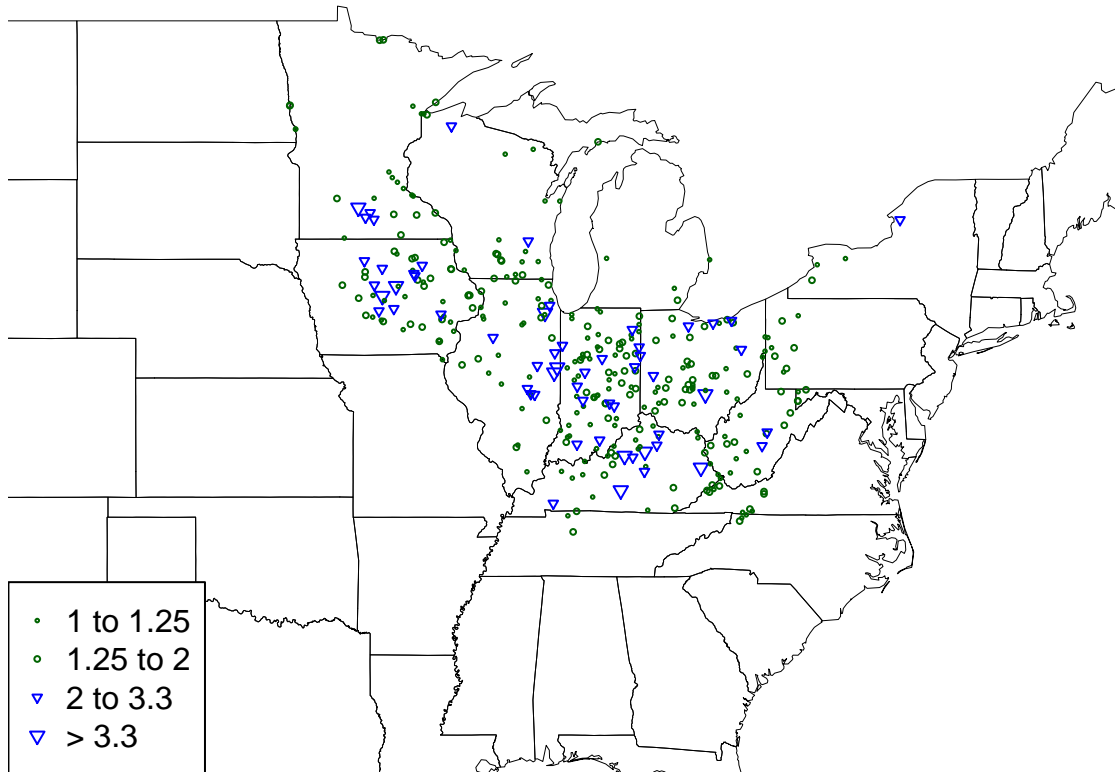
## Model Estimation Standardized Residuals



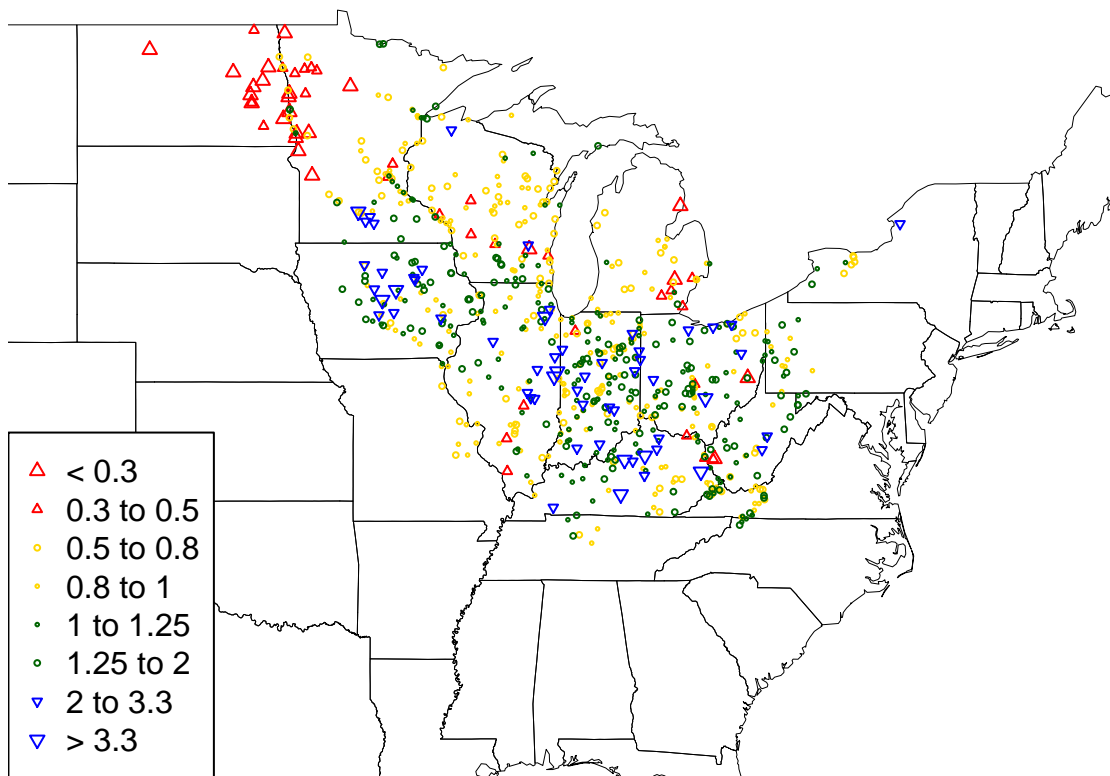
# Model Estimation Obs/Pred Ratio – Over Predictions – n=363



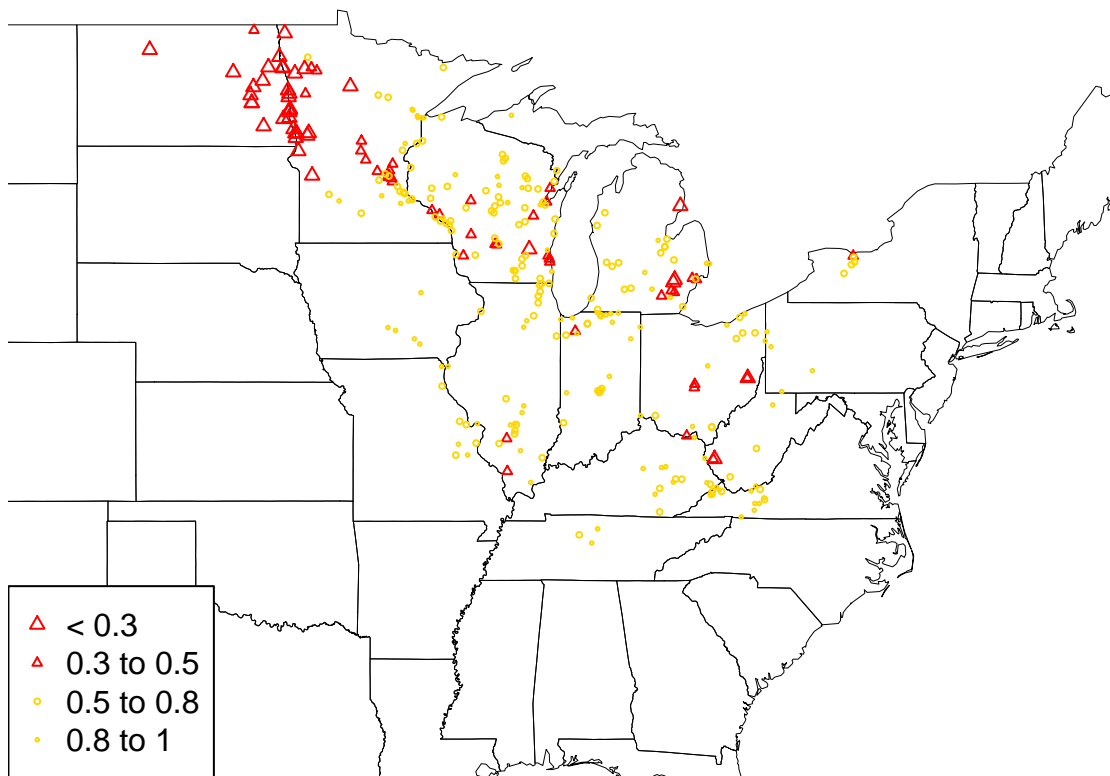
# Model Estimation Obs/Pred Ratio – Under Predictions – n=345



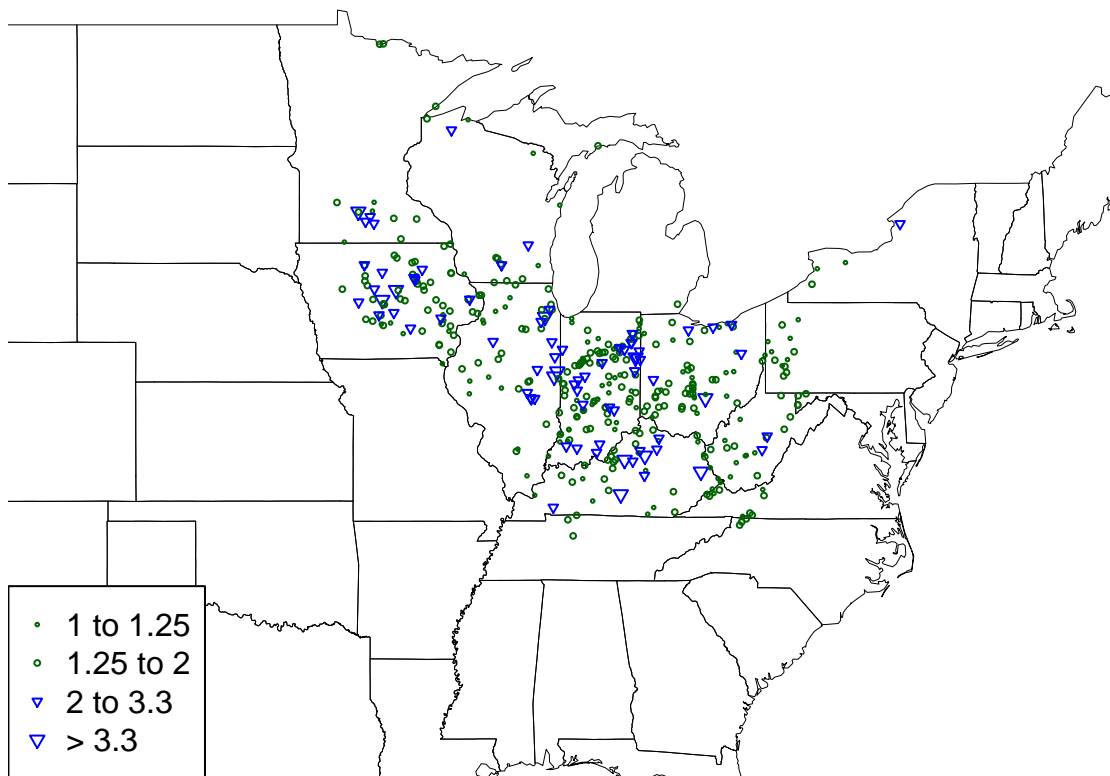
## Model Estimation Obs/Pred Ratio



# Model Simulation Obs/Pred Ratio – Over Predictions – n=305



# Model Simulation Obs/Pred Ratio – Under Predictions – n=403



## Model Simulation Obs/Pred Ratio

