**Analysis**:

For our analysis, we ran mixed effect linear models with land use as fixed effects and ecoregion as random effects in order to account for variability between ecoregions without considering each ecoregion as its own factor. We created models for both Chlorophyll a and Secchi depth as response variables for each of the three seasons making a total of six models. To determine the most parsimonious models, we eliminated non-significant variables with the highest p-values one by one until all remaining variables were significant. To check that this model was the best fit for the data, we ran an anova on all of the models together to determine which model had the lowest AIC. If our simplest model had the lowest AIC or it’s AIC was not more than 3 points away from the lowest score, we chose that model as our best fit.

**Results:**

Early Season Chla:

The significant predictors of early season chlorophyll a are Open Urban Percent (p = 2.453\*10^-5), Forest Percent (p < 2.2 \*10^-16), Pasture Percent (p = 2.853\*10^-5), Row Crop Percent (p = 0.04671), and Lake IWS Ratio (p = 2.737\*10^-6). The marginal R^2 = 0.1058 (﻿represents the variance explained by the fixed effects), and the conditional R^2 = 0.1058 (﻿interpreted as a variance explained by the entire model, including both fixed and random effects).

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Open Urban | -0.0107689 |
| Forest | -0.0152622 |
| Pasture | 0.0084965 |
| Row Crop | 0.00320106 |
| Ratio | -0.3086167 |

Since the outcome variable of the model is log transformed, the coefficients must be exponentiated to be interpreted. In table NNNNNN are presented the percentage increase or decrease that a 1% increase of the explanatory variables have on early season chlorophyll a

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Open Urban | -2.5% |
| Forest | -3.5% |
| Pasture | 2.0% |
| Row Crop | 0.7% |
| Ratio | -50.9% |

Early Season Secchi:

The significant predictors of early season secchi depth are Open Urban Percent (p < 2.2 \*10^-16), Barren Percent (p = 0.0316103), Forest Percent (p = < 2.2 \*10^-16), Grass Shrub Percent (p = 0.0007119), and Lake IWS Ratio (p = 1.856\*10^-7). The marginal R^2 = 0.1081, and the conditional R^2 = 0.2648. This tells us that 16% of the variability in secchi depth in the early season can be explained by the variance of ecoregion (check this phrase).

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Open Urban | 0.01236809 |
| Barren | 0.01956408 |
| Forest | 0.01228808 |
| Grass Shrub | 0.01024311 |
| Ratio | 0.2144161 |

Since the outcome variable of the model is log transformed, the coefficients must be exponentiated to be interpreted. In table NNNNNN are presented the percentage increase or decrease that a 1% increase of the explanatory variables have on early season secchi depth.

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Open Urban | 2.9% |
| Barren | 4.6% |
| Forest | 2.9% |
| Grass Shrub | 2.4% |
| Ratio | 63.8% |

Prime Season Chla:

The significant predictors of prime season chlorophyll a are Intense Urban Percent (p < 2.2 \*10^-16), Open Urban Percent (p < 2.2 \*10^-16), Forest Percent (p < 2.2 \*10^-16), Grass Shrub Percent (p < 2.2 \*10^-16), Wetland Percent (p < 2.2 \*10^-16), Row Crop Percent (p < 2.2 \*10^-16), and Lake IWS Ratio (p < 2.2 \*10^-16). The marginal R^2 = 0.1665 and the conditional R^2 = 0.2513. This tells us that 9% of the variability in prime season chlorophyll a can be explained by the variance of ecoregion.

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Intense Urban | -0.0100841 |
| Open Urban | -0.0252362 |
| Forest | -0.024479 |
| Grass Shrub | -0.0252642 |
| Wetland | -0.0125302 |
| Row Crop | -0.0069355 |
| Ratio | -0.4174341 |

Since the outcome variable of the model is log transformed, the coefficients must be exponentiated to be interpreted. In table NNNNNN are presented the percentage increase or decrease that a 1% increase of the explanatory variables have on prime season chlorophyll a.

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Intense Urban | -2.3% |
| Open Urban | -5.6% |
| Forest | -5.5% |
| Grass Shrub | -5.7% |
| Wetland | -2.8% |
| Row Crop | -1.6% |
| Ratio | -61.8% |

Prime Season Secchi:

The significant predictors of prime season secchi depth are Intense Urban Percent (p = 3.028\*10^-7), Open Urban Percent (p < 2.2 \*10^-16), Barren Percent (p = 0.04061), Forest Percent (p < 2.2 \*10^-16), Grass Shrub Percent (p < 2.2 \*10^-16), Pasture Percent (p = 1.234\*10^-8), Row Crop Percent (p < 2.2 \*10^-16), and Lake IWS Ratio (p < 2.2 \*10^-16). The marginal R^2 = 0.1241 and the conditional R^2 = 0.4032. This tells us that 28% of the variability in prime season secchi depth can be explained by the variance of ecoregion

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Intense Urban | 0.00423021 |
| Open Urban | 0.01558668 |
| Barren | 0.00759661 |
| Forest | 0.01596932 |
| Grass Shrub | 0.01445791 |
| Pasture | 0.00332981 |
| Row Crop | 0.00463991 |
| Ratio | 0.3943152 |

Since the outcome variable of the model is log transformed, the coefficients must be exponentiated to be interpreted. In table NNNNNN are presented the percentage increase or decrease that a 1% increase of the explanatory variables have on prime season secchi depth.

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Intense Urban | 1.0% |
| Open Urban | 3.7% |
| Barren | 1.8% |
| Forest | 3.8% |
| Grass Shrub | 3.4% |
| Pasture | 0.8% |
| Row Crop | 1.1% |
| Ratio | 147.9% |

Late Season Chla:

The significant predictors of late season chlorophyll a are Intense Urban Percent (p = 3.663\*10^-6), Open Urban Percent (p < 2.2 \*10^-16), Forest Percent (p < 2.2 \*10^-16), Grass Shrub Percent (p = 0.3.231\*10^-5, coefficient = -0.02814891), Wetland Percent (p = 0.035393), and Lake IWS Ratio (p = 0.001653). The marginal R^2 = 0.1515 and the conditional R^2 = 0.2314. This tells us that 8% of the variability in late season chlorophyll a can be explained by the variance of ecoregion.

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Intense Urban | -0.0133056 |
| Open urban | -0.0237716 |
| Forest | -0.02487 |
| Grass Shrub | -0.0281489 |
| Wetland | -0.0112843 |
| Ratio | -0.2633484 |

Since the outcome variable of the model is log transformed, the coefficients must be exponentiated to be interpreted. In table NNNNNN are presented the percentage increase or decrease that a 1% increase of the explanatory variables have on late season chlorophyll a.

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Intense Urban | -3.0% |
| Open urban | -5.3% |
| Forest | -5.6% |
| Grass Shrub | -6.3% |
| Wetland | -2.6% |
| Ratio | -45.5% |

Late Season Secchi:

The significant predictors of late season secchi are Intense Urban Percent (p = 0.03779), Open Urban Percent (p < 2.2 \*10^-16), Forest Percent (p < 2.2 \*10^-16, coefficient = ), Grass Shrub Percent (p = 8.468\*10^-5), and Lake IWS ratio (p = 3.170\*10^-6). The marginal R^2 = 0.1595 and the conditional R^2 = 0.1889. This tells us that 3% of the variability in late season secchi depth can be explained by the variance of ecoregion.

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Intense Urban | 0.00386273 |
| Open Urban | 0.01453631 |
| Forest | 0.01619299 |
| Grass Shrub | 0.01761664 |
| Ratio | 0.2467001 |

Since the outcome variable of the model is log transformed, the coefficients must be exponentiated to be interpreted. In table NNNNNN are presented the percentage increase or decrease that a 1% increase of the explanatory variables have on late season secchi.

|  |  |
| --- | --- |
| Predictor | Coefficient |
| Intense Urban | 0.9% |
| Open Urban | 3.4% |
| Forest | 3.8% |
| Grass Shrub | 4.1% |
| Ratio | 76.5% |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Chlorophyll a** | |  | **Secchi Depth** | |  |
| **Predictor** | **Early** | **Prime** | **Late** | **Early** | **Prime** | **Late** |
| Intense Urban |  | -0.0101 | -0.0133 |  | 0.0042 | 0.0039 |
| Open Urban | -0.0108 | -0.0252 | -0.0238 | 0.0124 | 0.0156 | 0.0145 |
| Barren |  |  |  | 0.0196 | 0.0076 |  |
| Forest | -0.0153 | -0.0245 | -0.0249 | 0.0123 | 0.016 | 0.0162 |
| Grass/Shrub |  | -0.0253 | -0.0281 | 0.0102 | 0.0145 | 0.0176 |
| Wetland |  | -0.0125 | -0.0113 |  |  |  |
| Pasture | 0.0085 |  |  |  | 0.0033 |  |
| Row Crop | 0.0032 | -0.0069 |  |  | 0.0046 |  |
| Lake IWS Ratio | -0.3086 | -0.4174 | -0.2633 | 0.2144 | 0.3943 | 0.2467 |