Working version of Random Forests For Paper

Jeff Hollister

Wednesday, April 23, 2014

This document represents the various modeling efforts we have tried for the HKM2014 paper. First step in this analyis is to set up the groups of variables. Four groups, plus the Trophic State response variable were initially indentified.

First, are the water quality variables from NLA.

```
##  [1] "WSA_ECO9"  "BASINAREA" "DEPTHMAX"  "ELEV_PT"   "DO2_2M"
##  [6] "PH_FIELD"  "COND"      "ANC"       "TURB"      "TOC"
## [11] "DOC"       "NH4"       "NO3_NO2"   "NTL"       "PTL"
## [16] "CL"        "NO3"       "SO4"       "CA"        "MG"
## [21] "Na"        "K"         "COLOR"     "SIO2"      "H"
## [26] "OH"        "NH4ION"    "CATSUM"    "ANSUM2"    "ANDEF2"
## [31] "SOBC"      "BALANCE2"  "ORGION"    "CONCAL2"   "CONDHO2"
## [36] "SECMEAN"   "TminW"     "TmaxW"     "TmeanW"
```

Second,are the GIS based variables

```
##  [1] "MaxDist"          "AlbersX"          "AlbersY"
##  [4] "LakeArea"         "LakePerim"        "ShoreDevel"
##  [7] "DDs40"            "DDs45"            "DDs50"
## [10] "DDs55"            "MaxLength"        "MaxWidth"
## [13] "MeanWidth"        "FetchN"           "FetchNE"
## [16] "FetchE"           "FetchSE"          "MaxDepthCorrect"
## [19] "VolumeCorrect"    "MeanDepthCorrect"
```

Third, are the landscape variables based on total area

```
##  [1] "ImpervAreaKm2_MaxDist" "WaterKm2_MaxDist"
##  [3] "IceSnowKm2_MaxDist"    "DevOpenKm2_MaxDist"
##  [5] "DevLowKm2_MaxDist"     "DevMedKm2_MaxDist"
##  [7] "DevHighKm2_MaxDist"    "BarrenKm2_MaxDist"
##  [9] "DeciduousKm2_MaxDist"  "EvergreenKm2_MaxDist"
## [11] "MixedForKm2_MaxDist"   "ShrubKm2_MaxDist"
## [13] "GrassKm2_MaxDist"      "PastureKm2_MaxDist"
## [15] "CropsKm2_MaxDist"      "WoodyWetKm2_MaxDist"
## [17] "HerbWetKm2_MaxDist"    "ImpervAreaKm2_300m"
## [19] "WaterKm2_300m"         "IceSnowKm2_300m"
## [21] "DevOpenKm2_300m"       "DevLowKm2_300m"
## [23] "DevMedKm2_300m"        "DevHighKm2_300m"
## [25] "BarrenKm2_300m"        "DeciduousKm2_300m"
## [27] "EvergreenKm2_300m"     "MixedForKm2_300m"
## [29] "ShrubKm2_300m"         "GrassKm2_300m"
## [31] "PastureKm2_300m"       "CropsKm2_300m"
## [33] "WoodyWetKm2_300m"      "HerbWetKm2_300m"
## [35] "ImpervAreaKm2_1500m"   "WaterKm2_1500m"
## [37] "IceSnowKm2_1500m"      "DevOpenKm2_1500m"
## [39] "DevLowKm2_1500m"       "DevMedKm2_1500m"
## [41] "DevHighKm2_1500m"      "BarrenKm2_1500m"
```

```
## [43] "DeciduousKm2_1500m"    "EvergreenKm2_1500m"
## [45] "MixedForKm2_1500m"     "ShrubKm2_1500m"
## [47] "GrassKm2_1500m"        "PastureKm2_1500m"
## [49] "CropsKm2_1500m"        "WoodyWetKm2_1500m"
## [51] "HerbWetKm2_1500m"      "ImpervAreaKm2_3000m"
## [53] "WaterKm2_3000m"        "IceSnowKm2_3000m"
## [55] "DevOpenKm2_3000m"      "DevLowKm2_3000m"
## [57] "DevMedKm2_3000m"       "DevHighKm2_3000m"
## [59] "BarrenKm2_3000m"       "DeciduousKm2_3000m"
## [61] "EvergreenKm2_3000m"    "MixedForKm2_3000m"
## [63] "ShrubKm2_3000m"        "GrassKm2_3000m"
## [65] "PastureKm2_3000m"      "CropsKm2_3000m"
## [67] "WoodyWetKm2_3000m"     "HerbWetKm2_3000m"
```

Fourth, the percent landscape variables (also inlcluding percent impervious)

```
##  [1] "PercentImperv_MaxDist" "PercentImperv_300m"
##  [3] "PercentImperv_1500m"   "PercentImperv_3000m"
##  [5] "WaterPer_MaxDist"      "IceSnowPer_MaxDist"
##  [7] "DevOpenPer_MaxDist"    "DevLowPer_MaxDist"
##  [9] "DevMedPer_MaxDist"     "DevHighPer_MaxDist"
## [11] "BarrenPer_MaxDist"     "DeciduousPer_MaxDist"
## [13] "EvergreenPer_MaxDist"  "MixedForPer_MaxDist"
## [15] "ShrubPer_MaxDist"      "GrassPer_MaxDist"
## [17] "PasturePer_MaxDist"    "CropsPer_MaxDist"
## [19] "WoodyWetPer_MaxDist"   "HerbWetPer_MaxDist"
## [21] "WaterPer_300m"         "IceSnowPer_300m"
## [23] "DevOpenPer_300m"       "DevLowPer_300m"
## [25] "DevMedPer_300m"        "DevHighPer_300m"
## [27] "BarrenPer_300m"        "DeciduousPer_300m"
## [29] "EvergreenPer_300m"     "MixedForPer_300m"
## [31] "ShrubPer_300m"         "GrassPer_300m"
## [33] "PasturePer_300m"       "CropsPer_300m"
## [35] "WoodyWetPer_300m"      "HerbWetPer_300m"
## [37] "WaterPer_1500m"        "IceSnowPer_1500m"
## [39] "DevOpenPer_1500m"      "DevLowPer_1500m"
## [41] "DevMedPer_1500m"       "DevHighPer_1500m"
## [43] "BarrenPer_1500m"       "DeciduousPer_1500m"
## [45] "EvergreenPer_1500m"    "MixedForPer_1500m"
## [47] "ShrubPer_1500m"        "GrassPer_1500m"
## [49] "PasturePer_1500m"      "CropsPer_1500m"
## [51] "WoodyWetPer_1500m"     "HerbWetPer_1500m"
## [53] "WaterPer_3000m"        "IceSnowPer_3000m"
## [55] "DevOpenPer_3000m"      "DevLowPer_3000m"
## [57] "DevMedPer_3000m"       "DevHighPer_3000m"
## [59] "BarrenPer_3000m"       "DeciduousPer_3000m"
## [61] "EvergreenPer_3000m"    "MixedForPer_3000m"
## [63] "ShrubPer_3000m"        "GrassPer_3000m"
## [65] "PasturePer_3000m"      "CropsPer_3000m"
## [67] "WoodyWetPer_3000m"     "HerbWetPer_3000m"
```

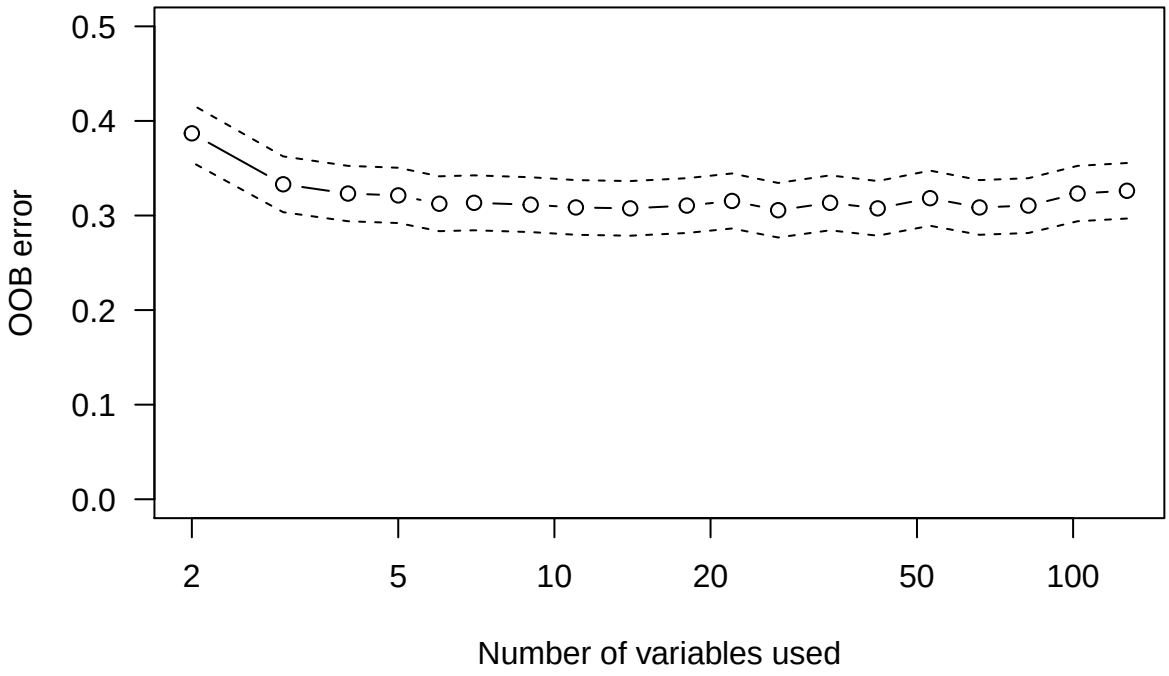
Lastly, the response variable

```
## [1] "TS_CHLA"
```

Chl *a* Trophic Status ~ All Variables + Landscape Total Area

This first random forest predicts Cholorophyl Trophic status using all NLA variables, all GIS variables except for the landscape variables summarized by total area.

```
##  Number.Variables
##  Min.   :  2.0
##  1st Qu.:  6.5
##  Median : 18.0
##  Mean   : 33.4
##  3rd Qu.: 47.5
##  Max.   :127.0
##
##                                                 Vars.in.Forest
##  SECMEAN + TURB                                               : 1
##  SECMEAN + TURB + PTL                                         : 1
##  SECMEAN + TURB + PTL + NTL                                   : 1
##  SECMEAN + TURB + PTL + NTL + TOC                             : 1
##  SECMEAN + TURB + PTL + NTL + TOC + WSA_ECO9                  : 1
##  SECMEAN + TURB + PTL + NTL + TOC + WSA_ECO9 + DEPTHMAX       : 1
##  (Other)                                                      :13
##       OOB             sd.OOB
##  Min.   :0.306   Min.   :0.0144
##  1st Qu.:0.309   1st Qu.:0.0145
##  Median :0.313   Median :0.0145
##  Mean   :0.319   Mean   :0.0146
##  3rd Qu.:0.322   3rd Qu.:0.0146
##  Max.   :0.387   Max.   :0.0152
##
```

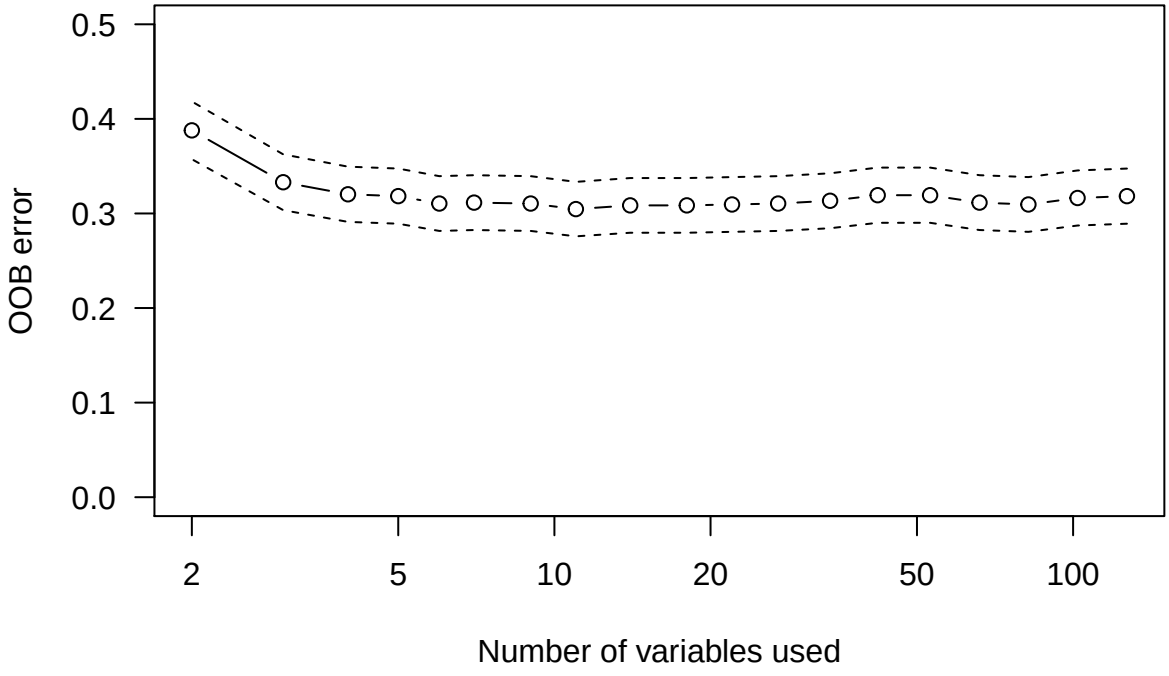


Chl *a* Trophic Status ~ All Variables + Landscape Percent

Our second model uses all NLA and GIS variables, and landscape var summarized by total percent.

```
##  Number.Variables
##  Min.   :  2.0
##  1st Qu.:  6.5
##  Median : 18.0
##  Mean   : 33.4
##  3rd Qu.: 47.5
##  Max.   :127.0
##
##                                                 Vars.in.Forest
##  SECMEAN + TURB                                        : 1
##  SECMEAN + TURB + PTL                                  : 1
##  SECMEAN + TURB + PTL + NTL                            : 1
##  SECMEAN + TURB + PTL + NTL + TOC                      : 1
##  SECMEAN + TURB + PTL + NTL + TOC + WSA_ECO9           : 1
##  SECMEAN + TURB + PTL + NTL + TOC + WSA_ECO9 + DEPTHMAX: 1
##  (Other)                                               :13
##       OOB             sd.OOB
##  Min.   :0.305   Min.   :0.0144
##  1st Qu.:0.310   1st Qu.:0.0145
##  Median :0.311   Median :0.0145
##  Mean   :0.318   Mean   :0.0146
```

```
##  3rd Qu.:0.319   3rd Qu.:0.0146
##  Max.   :0.388   Max.   :0.0152
##
```

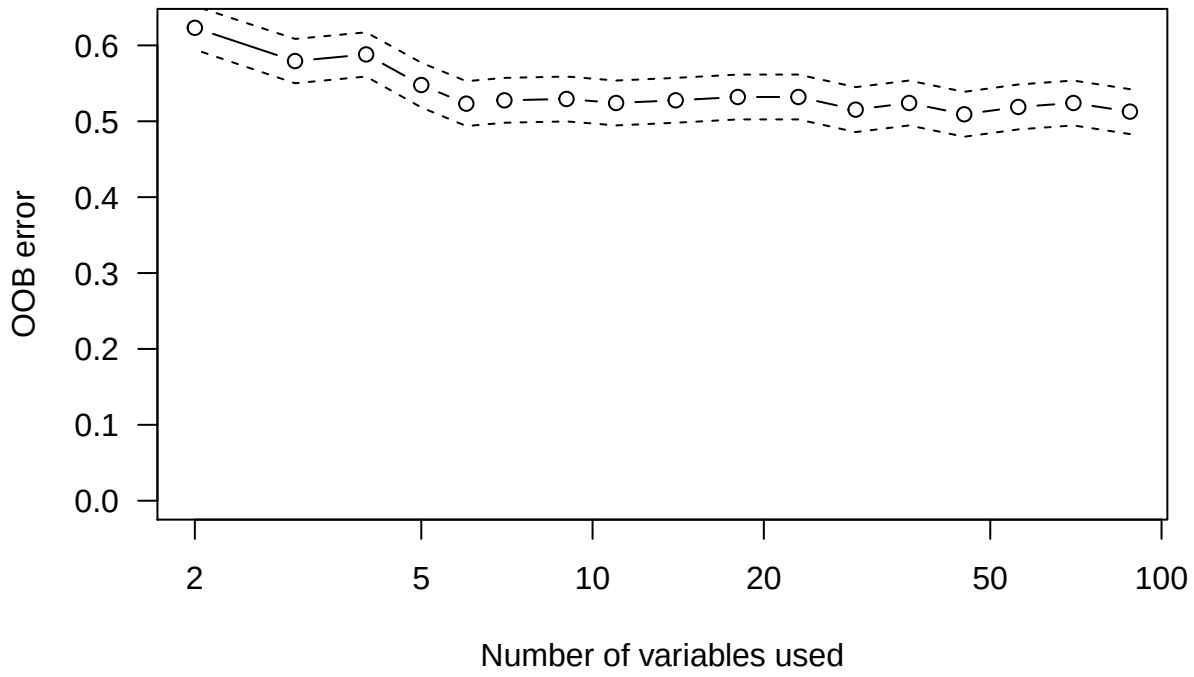


Chl *a* Trophic Status ~ GIS Only Variables + Landscape Total Area

This third model uses only GIS derived variables with landscape summarized by total area

```
##  Number.Variables
##  Min.   : 2.0
##  1st Qu.: 6.0
##  Median :14.0
##  Mean   :25.1
##  3rd Qu.:36.0
##  Max.   :88.0
##
##
##  EvergreenKm2_3000m + CropsKm2_3000m
##  EvergreenKm2_3000m + CropsKm2_3000m + AlbersX
##  EvergreenKm2_3000m + CropsKm2_3000m + AlbersX + CropsKm2_1500m
##  EvergreenKm2_3000m + CropsKm2_3000m + AlbersX + CropsKm2_1500m + MeanDepthCorrect
##  EvergreenKm2_3000m + CropsKm2_3000m + AlbersX + CropsKm2_1500m + MeanDepthCorrect + AlbersY
##  EvergreenKm2_3000m + CropsKm2_3000m + AlbersX + CropsKm2_1500m + MeanDepthCorrect + AlbersY + Evergr
##  (Other)
##       OOB            sd.OOB
```

```
##  Min.   :0.509   Min.   :0.0143
##  1st Qu.:0.523   1st Qu.:0.0148
##  Median :0.528   Median :0.0148
##  Mean   :0.538   Mean   :0.0147
##  3rd Qu.:0.532   3rd Qu.:0.0148
##  Max.   :0.623   Max.   :0.0148
##
```



Chl *a* Trophic Status ~ GIS Only Variables +Landscape Percent

This third model uses only GIS derived variables with landscape summarized by total area

```
##  Number.Variables
##  Min.   : 2.0
##  1st Qu.: 6.0
##  Median :14.0
##  Mean   :25.1
##  3rd Qu.:36.0
##  Max.   :88.0
##
##
##  EvergreenPer_3000m + CropsPer_3000m
##  EvergreenPer_3000m + CropsPer_3000m + AlbersX
##  EvergreenPer_3000m + CropsPer_3000m + AlbersX + CropsPer_1500m
##  EvergreenPer_3000m + CropsPer_3000m + AlbersX + CropsPer_1500m + EvergreenPer_MaxDist
```

```
##  EvergreenPer_3000m + CropsPer_3000m + AlbersX + CropsPer_1500m + EvergreenPer_MaxDist + EvergreenPe
##  EvergreenPer_3000m + CropsPer_3000m + AlbersX + CropsPer_1500m + EvergreenPer_MaxDist + EvergreenPe
##  (Other)
##       OOB             sd.OOB
##  Min.   :0.496   Min.   :0.0143
##  1st Qu.:0.512   1st Qu.:0.0146
##  Median :0.521   Median :0.0148
##  Mean   :0.539   Mean   :0.0147
##  3rd Qu.:0.582   3rd Qu.:0.0148
##  Max.   :0.631   Max.   :0.0148
##
```