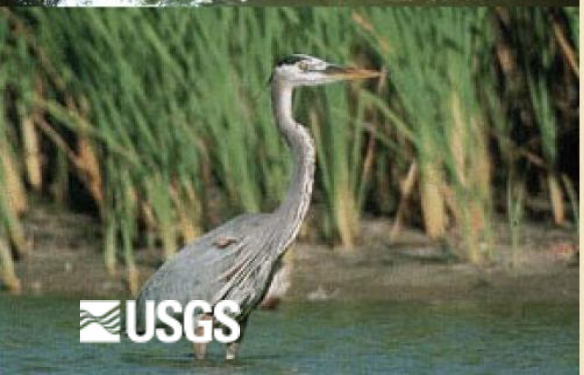


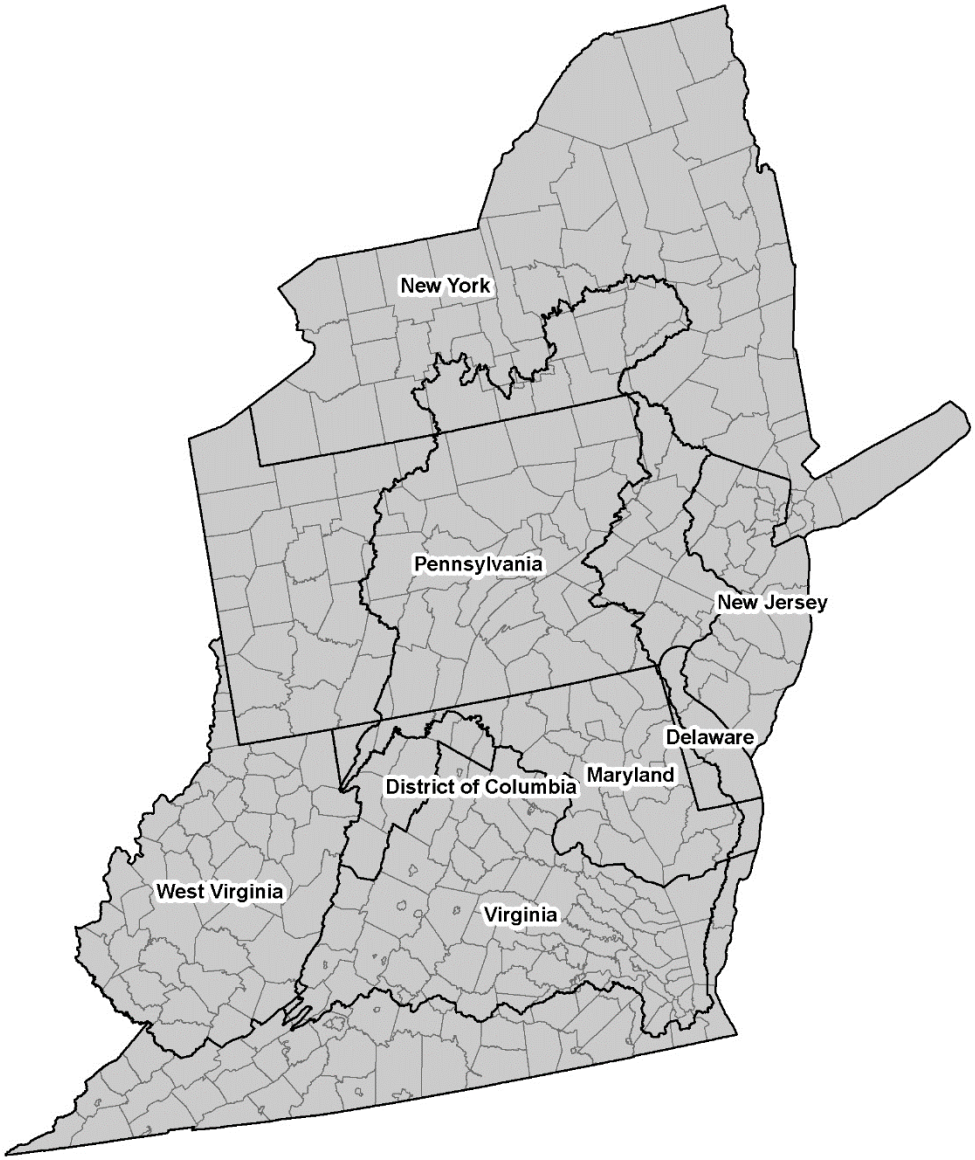
Chesapeake Bay Program
A Watershed Partnership

Update on State-Specific 2025 Forecasted Future Conditions

Karl Berger, Chair, Land Use Workgroup
Peter Claggett, Coordinator, Land Use Workgroup

WQGIT Conference Call
May 8, 2017

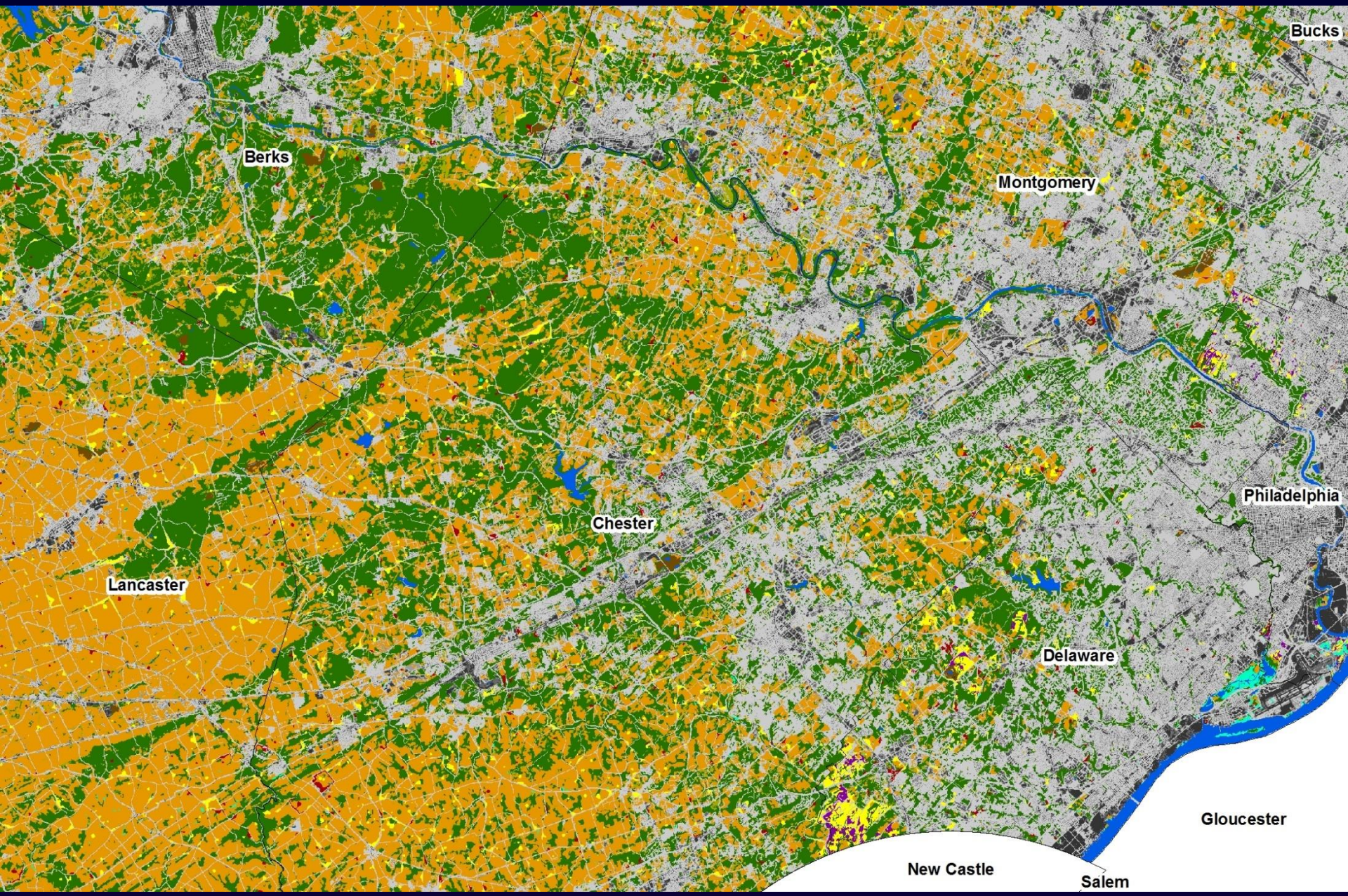
Chesapeake Bay Future Land Use Scenario Domain



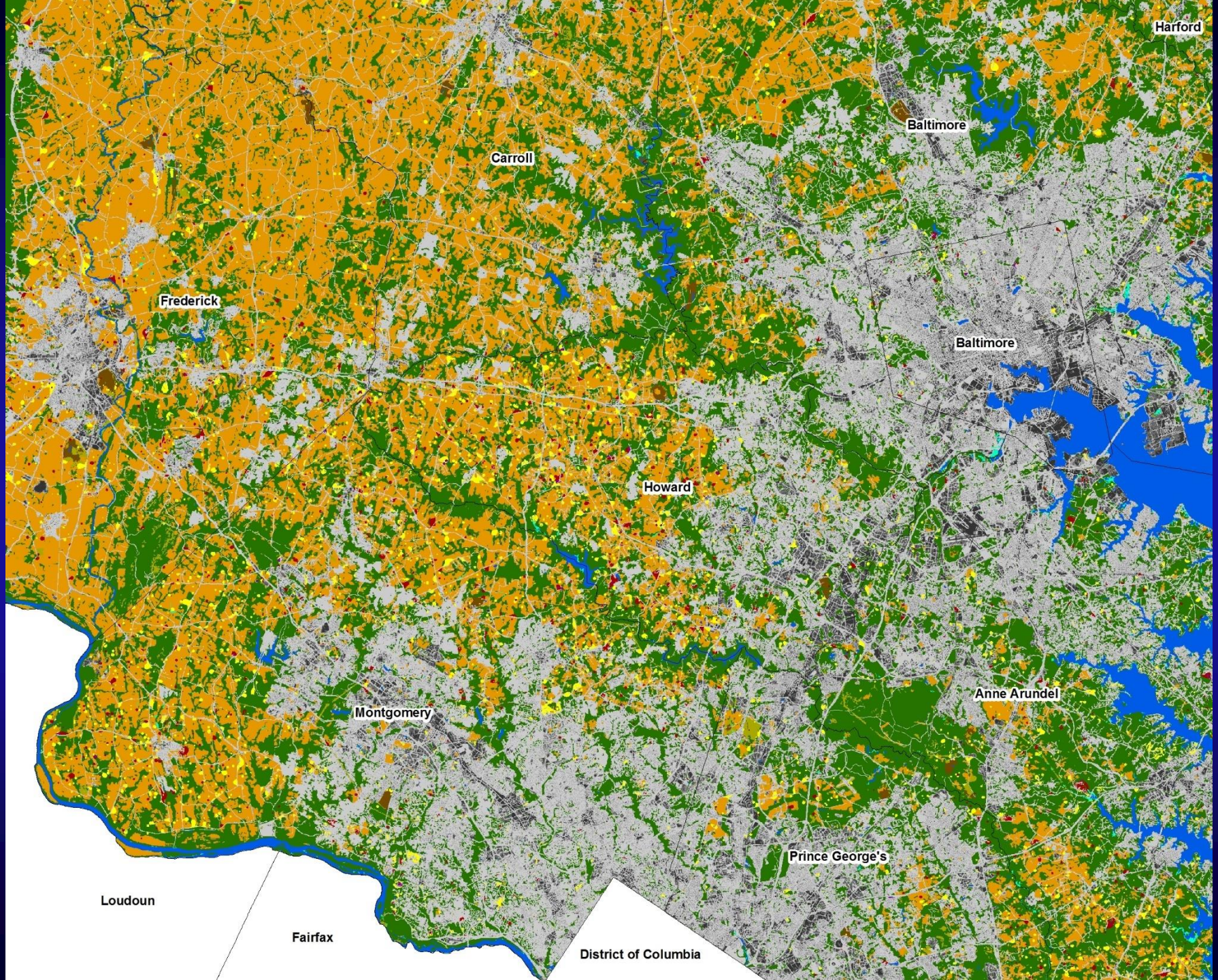
USGS

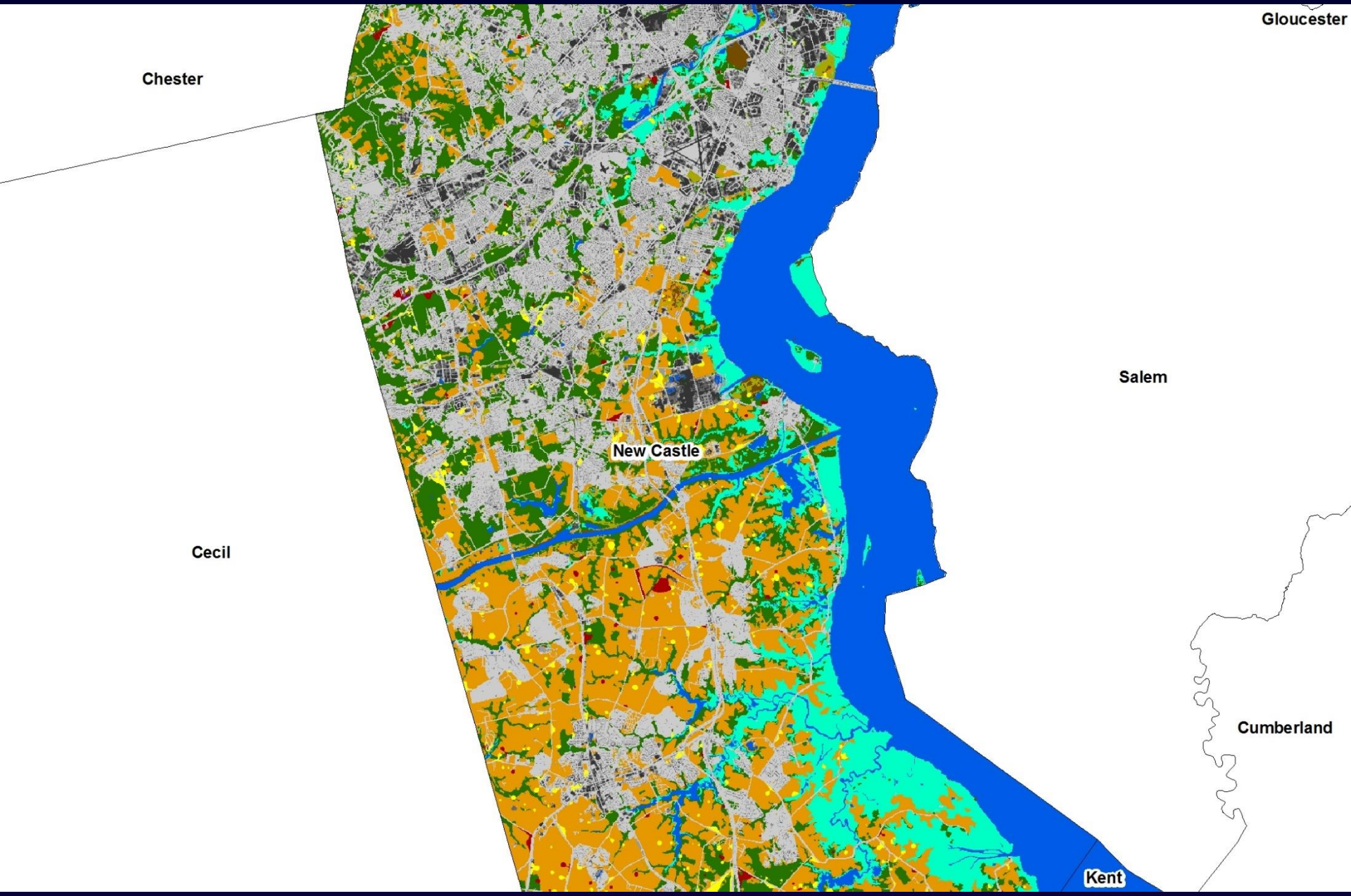
Chesapeake Bay Future Land Use Scenario Domain


Tompkins
Cortland
Tompkins
Chenango
Broome
Tioga
Susquehanna
Bradford

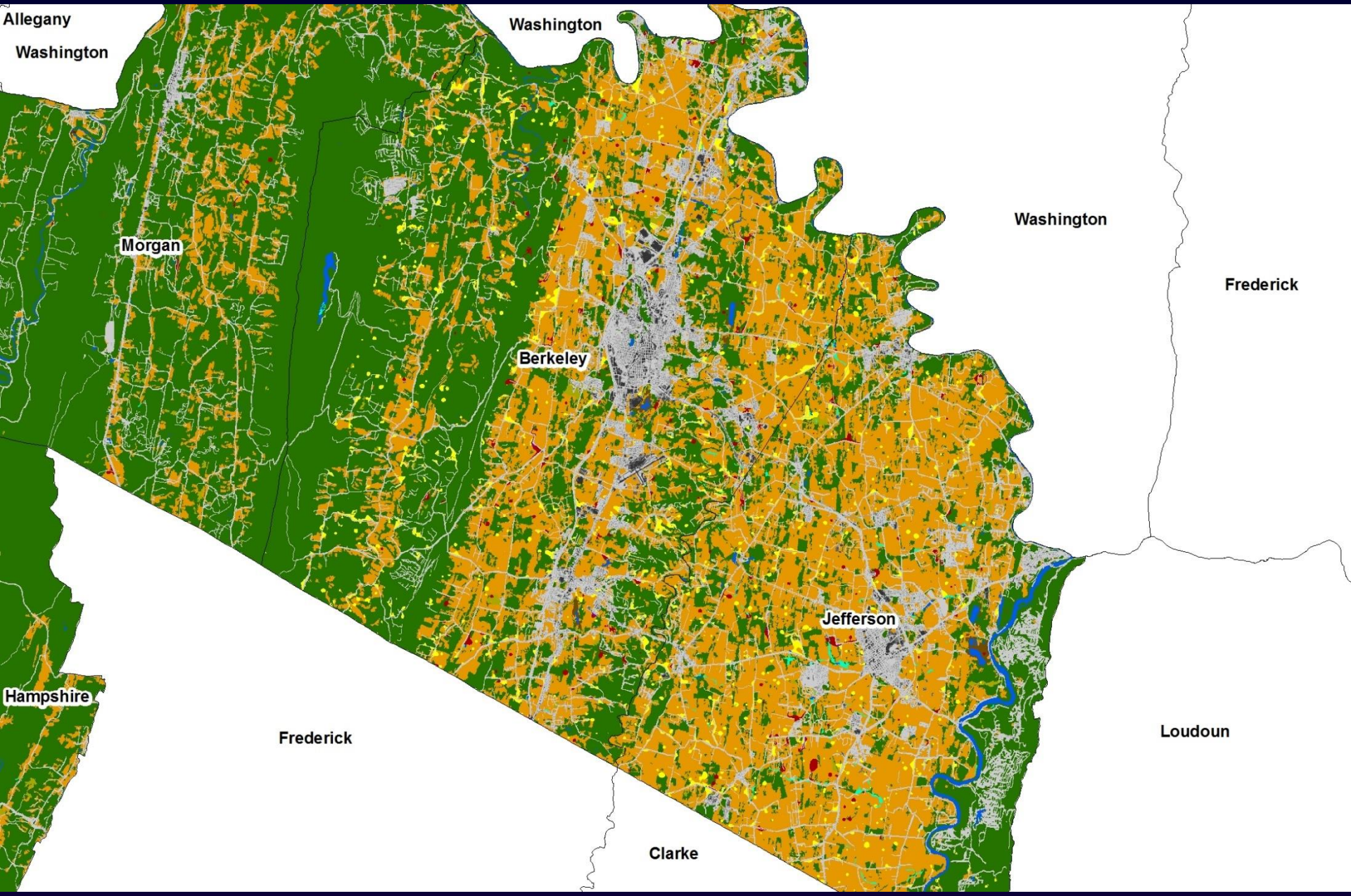

Bucks
Berks
Montgomery
Philadelphia
Chester
Lancaster
Delaware
Gloucester
New Castle
Salem

USGS

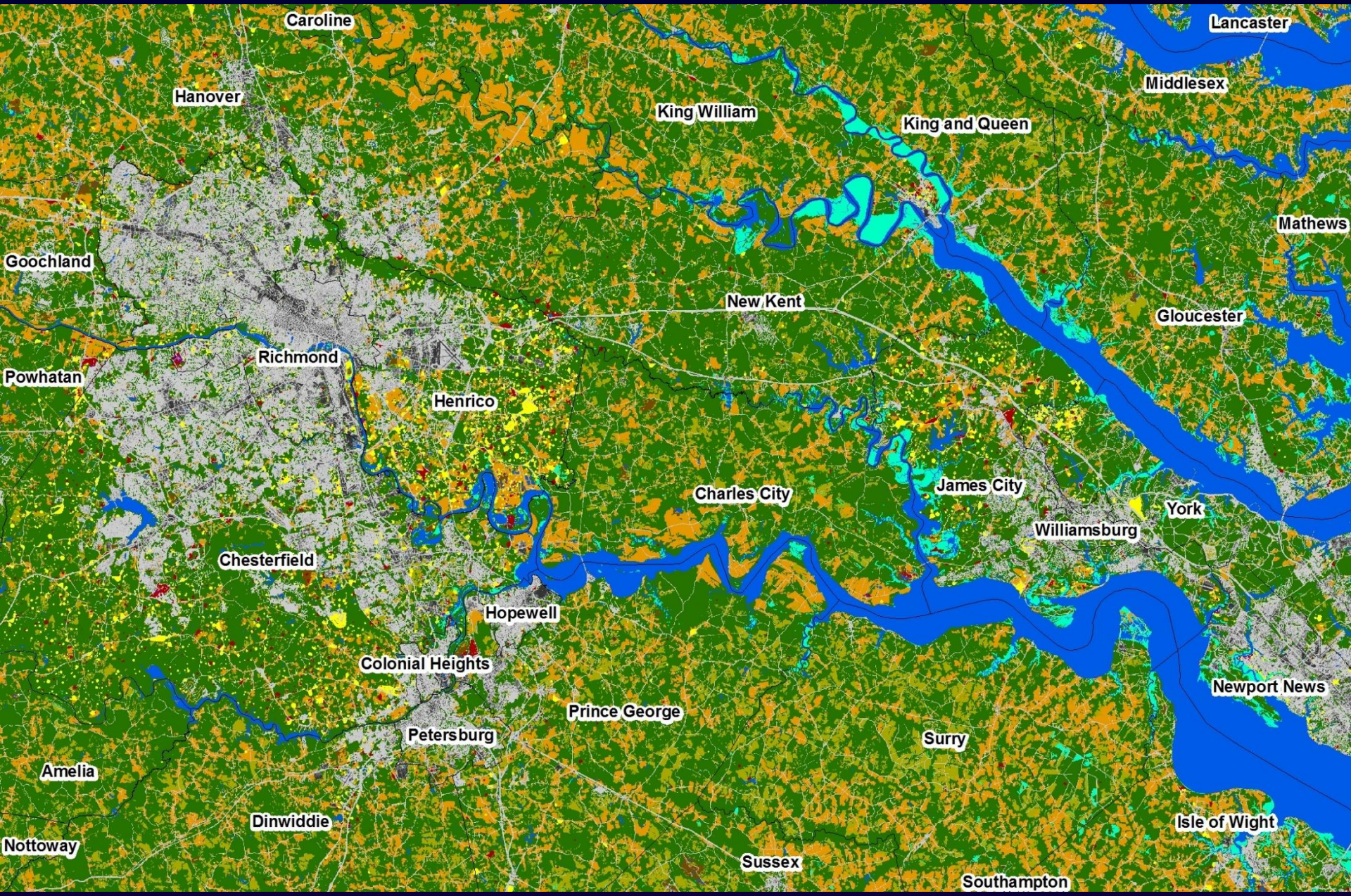

Harford
Baltimore
Carroll
Frederick
Baltimore
Howard
Anne Arundel
Montgomery
Prince George's
Loudoun
Fairfax
District of Columbia


Chester
Gloucester
Salem
New Castle
Cecil
Cumberland
Kent

USGS


Allegany
Washington
Washington
Washington
Morgan
Berkeley
Frederick
Jefferson
Hampshire
Frederick
Clarke
Loudoun

USGS


Caroline
Lancaster
Hanover
Middlesex
King William
King and Queen
Mathews
Goochland
New Kent
Gloucester
Richmond
Powhatan
Henrico
Charles City
James City
York
Williamsburg
Chesterfield
Hopewell
Colonial Heights
Newport News
Prince George
Petersburg
Surry
Amelia
Dinwiddie
Isle of Wight
Nottoway
Sussex
Southampton

USGS

Pennsylvania

regressions - Notepad

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```
Logistic Regression Model

 lrm(formula = Value ~ LnCD_UAC00 + LnCD_Res01 + LnCD_Com01 +
     LnSlope, data = RES_Sample)

                       Model Likelihood      Discrimination    Rank Discrim.
                          Ratio Test            Indexes          Indexes
 Obs         140732    LR chi2    138372.53    R2       0.835   C        0.969
  0           70366    d.f.               4    g        4.801   Dxy      0.938
  1           70366    Pr(> chi2)   <0.0001    gr     121.664   gamma    0.939
 max |deriv|  8e-10                           gp       0.474   tau-a    0.469
                                              Brier    0.055

           Coef    S.E.   Wald Z  Pr(>|Z|)
 Intercept  24.2414 0.1386  174.89 <0.0001
 LnCD_UAC00 -0.4450 0.0101  -43.95 <0.0001
 LnCD_Res01 -0.6075 0.0109  -55.60 <0.0001
 LnCD_Com01 -1.2248 0.0109 -112.62 <0.0001
 LnSlope    -0.4026 0.0113  -35.52 <0.0001

Logistic Regression Model

 lrm(formula = Value ~ LnCD_UAC00 + LnCD_Res01 + LnCD_Com01 +
     LnSlope, data = COM_Sample)

                       Model Likelihood      Discrimination    Rank Discrim.
                          Ratio Test            Indexes          Indexes
 Obs         209082    LR chi2    199801.99    R2       0.821   C        0.965
  0          104541    d.f.               4    g        4.508   Dxy      0.929
  1          104541    Pr(> chi2)   <0.0001    gr      90.775   gamma    0.930
 max |deriv|  4e-09                           gp       0.470   tau-a    0.465
                                              Brier    0.059

           Coef    S.E.   Wald Z  Pr(>|Z|)
 Intercept  22.4408 0.1090  205.88 <0.0001
 LnCD_UAC00 -0.8478 0.0082 -103.65 <0.0001
 LnCD_Res01 -0.3555 0.0103  -34.66 <0.0001
 LnCD_Com01 -0.9236 0.0079 -117.27 <0.0001
 LnSlope    -0.3421 0.0094  -36.21 <0.0001
```

Virginia

regressions - Notepad

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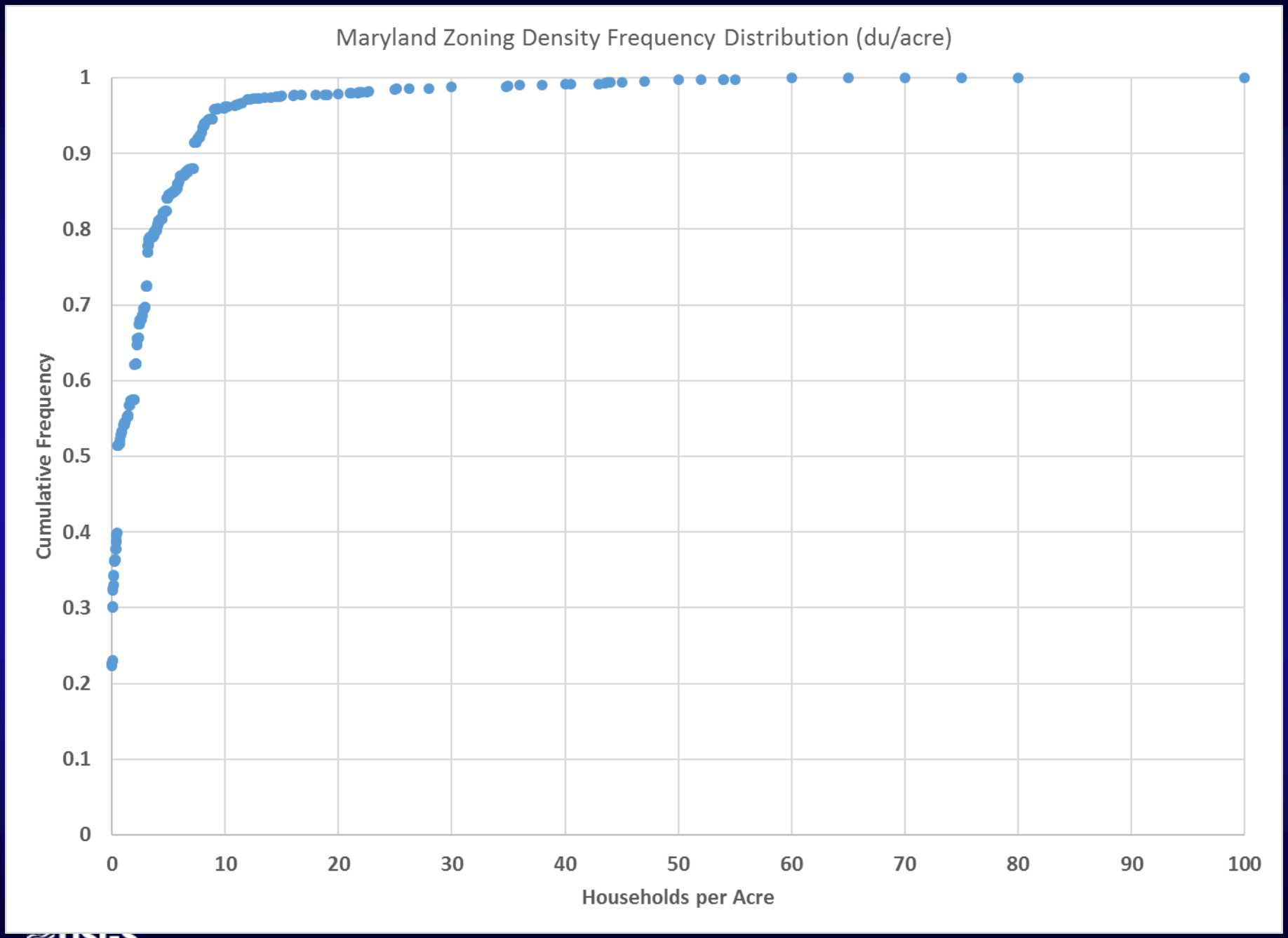
```
Logistic Regression Model

 lrm(formula = Value ~ LnCD_UAC00 + LnCD_Res01 + LnCD_Com01 +
     LnSlope, data = RES_Sample)

                       Model Likelihood      Discrimination    Rank Discrim.
                          Ratio Test            Indexes          Indexes
 Obs         115570    LR chi2    130081.11    R2       0.901   C        0.985
  0           57785    d.f.               4    g        5.755   Dxy      0.969
  1           57785    Pr(> chi2)   <0.0001    gr     315.855   gamma    0.970
 max |deriv|  8e-10                           gp       0.488   tau-a    0.485
                                              Brier    0.032

           Coef    S.E.   Wald Z Pr(>|Z|)
 Intercept  27.3417 0.1972 138.62 <0.0001
 LnCD_UAC00 -0.4922 0.0134 -36.65 <0.0001
 LnCD_Res01 -0.7922 0.0185 -42.93 <0.0001
 LnCD_Com01 -1.2247 0.0159 -76.93 <0.0001
 LnSlope    -0.3871 0.0129 -29.96 <0.0001

Logistic Regression Model

 lrm(formula = Value ~ LnCD_UAC00 + LnCD_Res01 + LnCD_Com01 +
     LnSlope, data = COM_Sample)

                       Model Likelihood      Discrimination    Rank Discrim.
                          Ratio Test            Indexes          Indexes
 Obs         217756    LR chi2    229526.81    R2       0.869   C        0.977
  0          108878    d.f.               4    g        5.142   Dxy      0.955
  1          108878    Pr(> chi2)   <0.0001    gr     171.015   gamma    0.956
 max |deriv|  2e-09                           gp       0.482   tau-a    0.477
                                              Brier    0.042

           Coef    S.E.   Wald Z Pr(>|Z|)
 Intercept  26.8986 0.1318 204.02 <0.0001
 LnCD_UAC00 -0.6387 0.0082 -78.35 <0.0001
 LnCD_Res01 -0.9353 0.0135 -69.09 <0.0001
 LnCD_Com01 -0.8398 0.0102 -82.43 <0.0001
 LnSlope    -0.4033 0.0087 -46.09 <0.0001
```

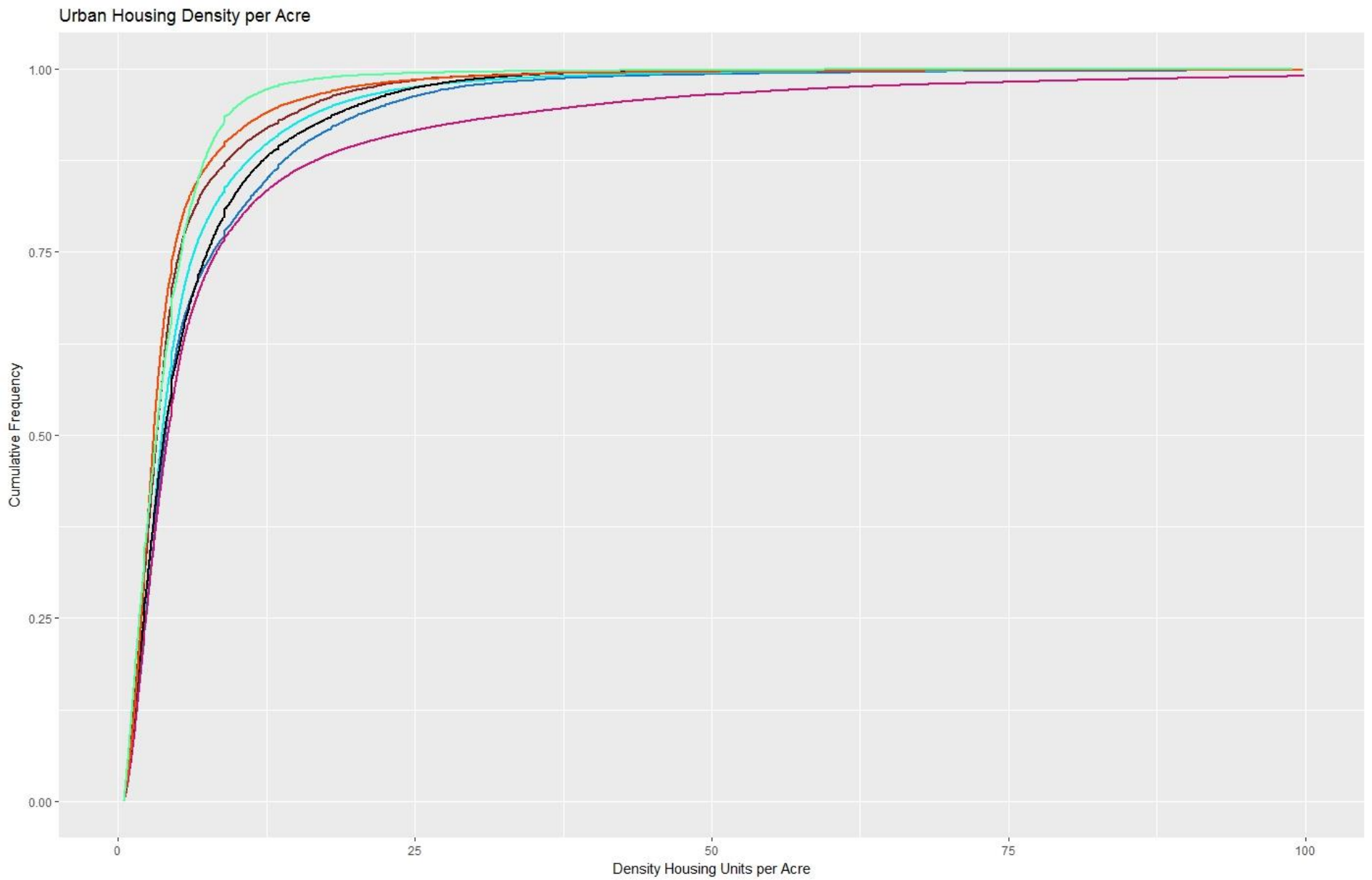
USGS

R^2 Values for Logistic Regressions

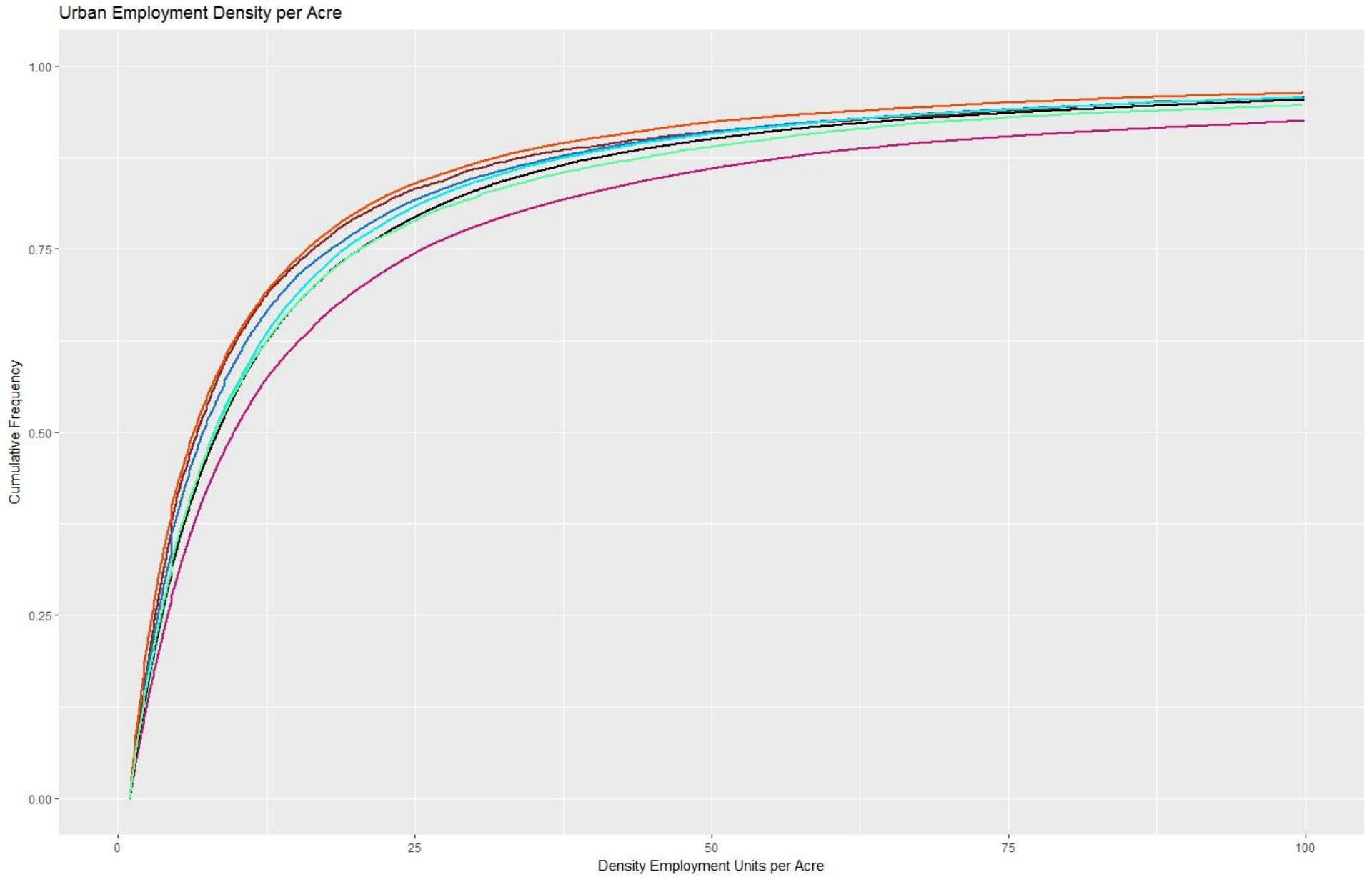
State	Residential	Commercial
Delaware	0.766	0.555
District of Columbia	n/a	n/a
Maryland	0.778	0.718
New York	0.871	0.867
Pennsylvania	0.835	0.821
Virginia	0.901	0.869
West Virginia	0.908	0.921

USGS


Maryland Zoning Density Frequency Distribution (du/acre)
Cumulative Frequency
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
Households per Acre


Urban Housing Density per Acre
1.00
0.75
0.50
0.25
0.00
Cumulative Frequency
0
25
50
75
100
Density Housing Units per Acre

USGS


Urban Employment Density per Acre
1.00
0.75
0.50
0.25
0.00
Cumulative Frequency
0
25
50
75
100
Density Employment Units per Acre

USGS

Next Steps

1. Regionalize regression variables

2. Add new regression variables
   - Distance to all roads
   - Travel distance to regional employment centers
   - Travel distance to lacustrine, estuarine, and ocean waterbodies

3. Aggregate and reallocate demand by commuter shed; compare with county-level controls

4. Post raster outputs and NHD+ aggregates on Phase 6 Land Use Viewer website to solicit rapid feedback from LUWG on model runs.

5. Continue collecting of zoning, permit, and/or comp plan data.

6. Organize joint LGAC/LUWG workshop to ensure future scenarios are plausible and useful for informing local government decisions.

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Alternative Futures Production Schedule

Schedule	Deliverable / Decision
End of April 2017	"Historical Trends" Scenario results available. LUWG works to develop Alternative Future Scenarios.
May 31 2017	Deadline for receipt of zoning, planning, and/or permit data to be incorporated into the "Current Policy" Scenario. Refinement of "Historical Trends" scenario.
June 7, 2017 LGAC/LUWG Forum	Joint LUWG-LGAC forum on future scenarios. Finalization of Alternative Future Scenarios. WQGIT invited!
July (TBD) LUWG Call	Results of "Historical Trends", "Current Policy", and alternative future scenarios presented to LUWG.
July 2017	LUWG and WQGIT review scenarios. Issues identified during the review are resolved.
Mid-August 2017	Draft final future scenario results available.
September 6, 2017	LUWG approves draft final future scenarios.
September 11, 2017	WQGIT approves draft final future scenarios.
Early October 2017	Management Board approves draft final future scenarios.
Late October 2017	Principal's Staff Committee approves draft final future scenarios.

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