

Validation of Visually Estimated Percent Impervious Surface from NAIP CIR Imagery

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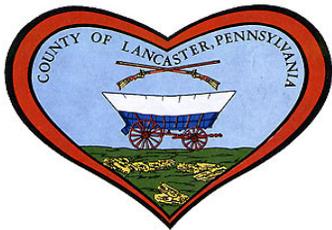
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(Provided Impervious Surface Reference Data)



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Maurie Kelly
Pennsylvania Spatial Data Access
www.pasda.psu.edu

Validation Test

How accurately is percent impervious area estimated for;

- Urban land uses.
- Urban land use subdivision (Residential vs. Industrial/Commercial/Institutional).
- Size of area by land use subdivision.

Background

Pennsylvania Area 45,308 sq mi (117,348 sq km)

Land use/Land cover created using both
visual interpretation and multispectral classification

31 Groups; Anderson Levels 2-4

14 Months/130K (total)/70K (visual interp.)

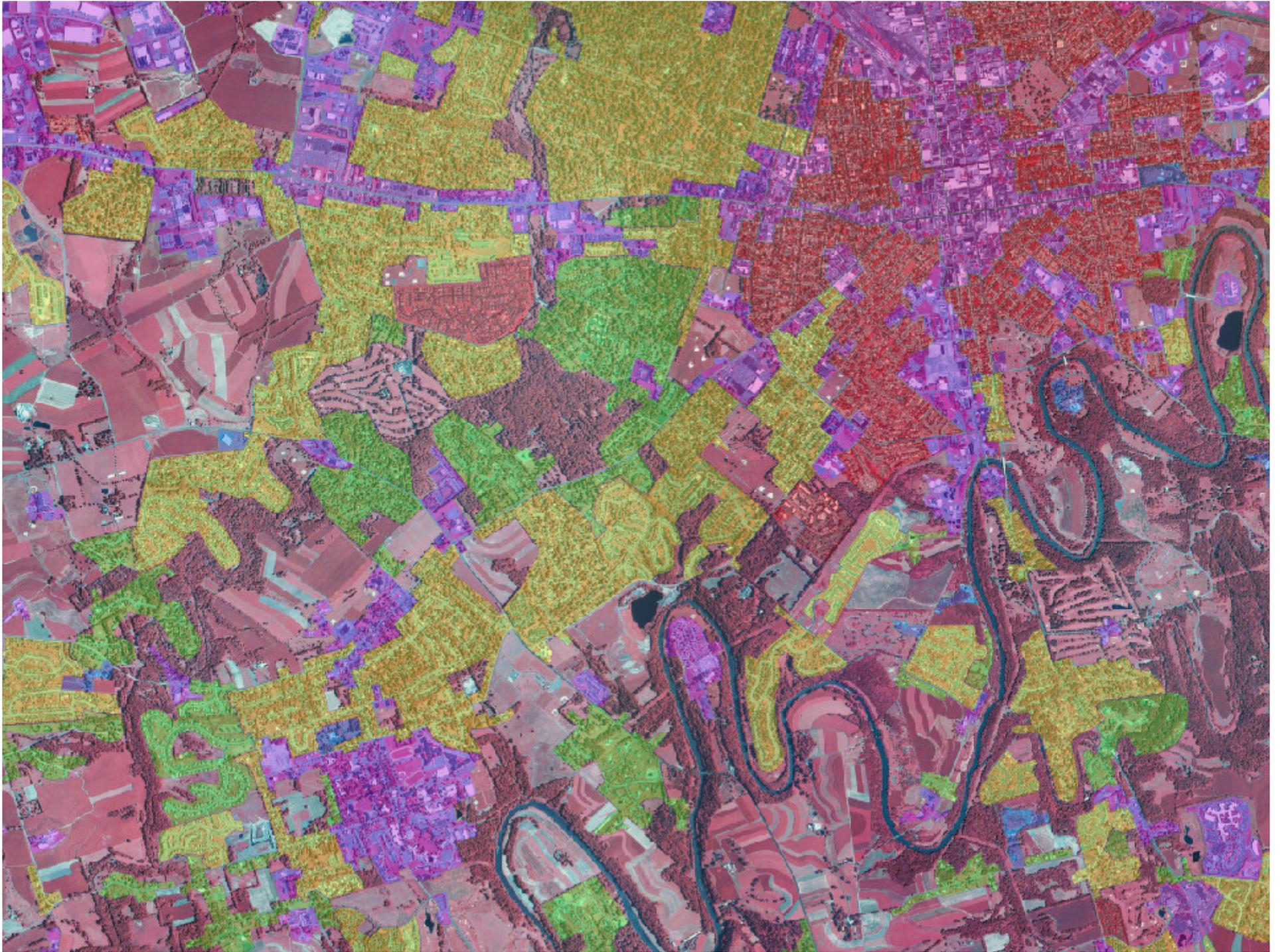
Visually interpretation describes area 8,903 sq km

Why Visual Interpretation?

- Use an approach that can be extended to historical scanned aerial photo data – Penn Pilot
- NAIP has high spatial resolution and accurate/consistent registration control.
- Algorithm classification approaches not feasible with limits on imagery/time.

Interpreted Data Description

- Visual interpretation of NAIP imagery mapped;
 - a. Airports
 - b. Golf Courses
 - c. Active and Highly Disturbed Mines
 - d. Urban Land
- Minimum Mapping Unit - 5 acres (20,234 m²)
75,500 polygons.
- NAIP imagery ('04);
 - a. County mosaics
 - b. CIR
 - c. 1 meter GSD
 - d. Orthorectified to +/- 10 meters from DOQQ



Urban Land Description

11 – Residential Use

111 - Residential; 5-30% impervious

112 - Residential; 31-74% impervious

113 - Residential; impervious > 74%

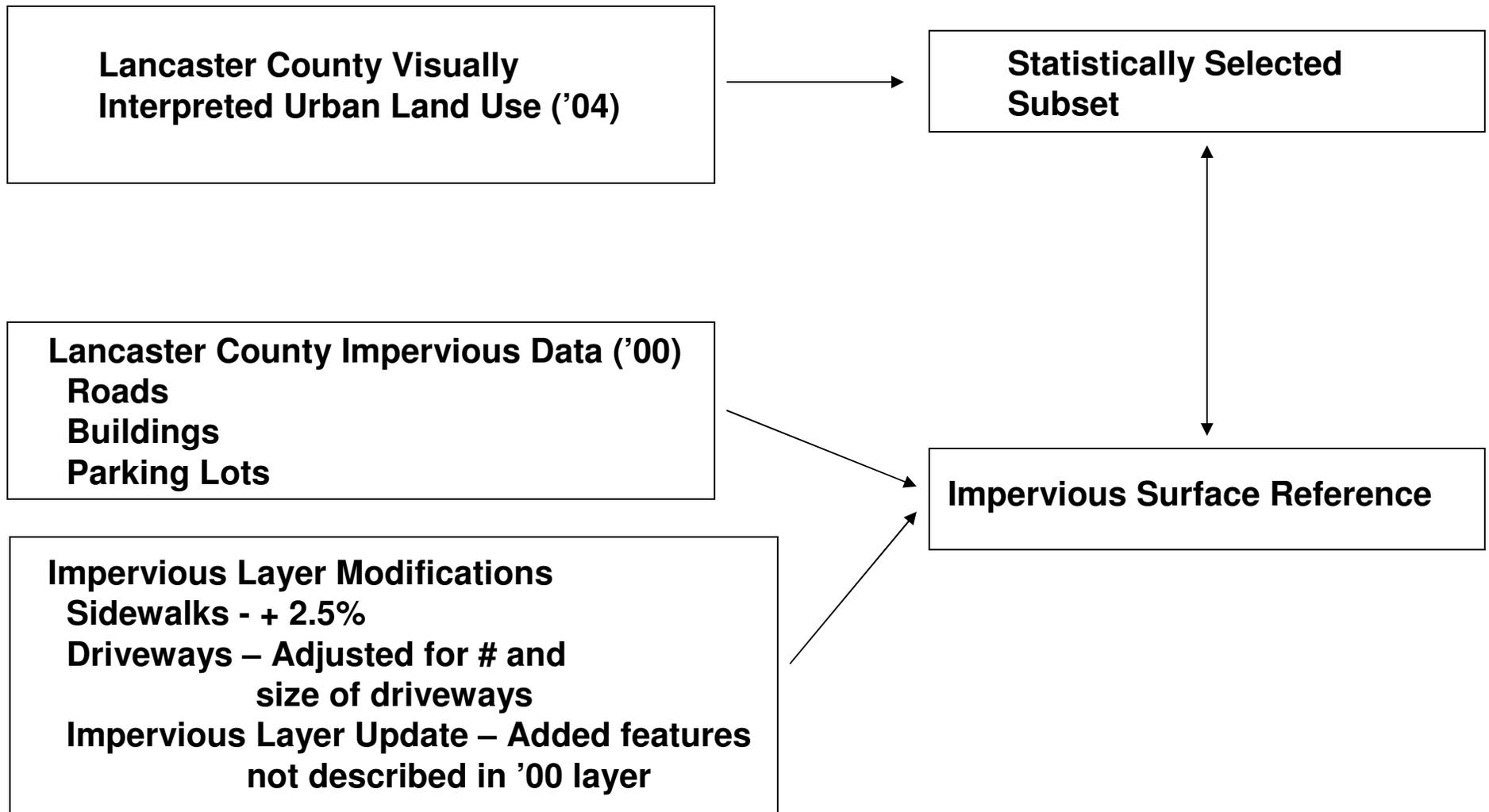
12 – Institutional/Industrial/Commercial Use

121 - Institutional/Industrial/Commercial; 5-30% impervious

122 - Institutional/Industrial/Commercial; 31-74% impervious

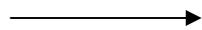
123 - Institutional/Industrial/Commercial; impervious > 74%

Methodology

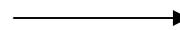


Polygon Sampling Scheme

Lancaster County
Urban Land Use



Determine groups
Criteria based on
percentiles
0-33 : 34-65 : 66<
(6 total subgroups)



Randomly select
polygons for each
Subgroup or
Total Available

2816 Polygons

521 Polygons

Impervious Surface Classification Error: Overall Assessment

Number of Polys By Group

93 – 111 polys

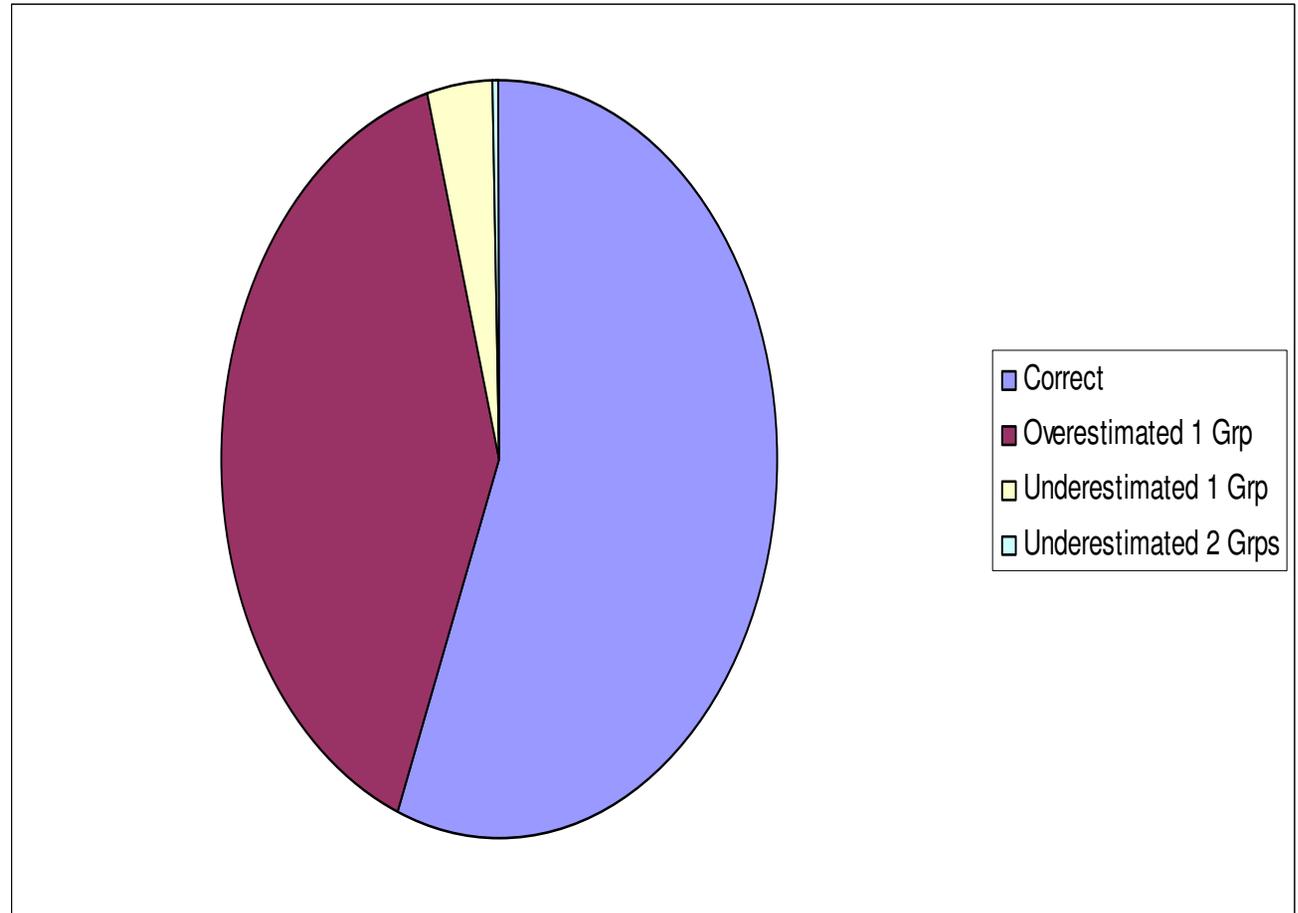
91 – 112 polys

42 – 113 polys

100 – 121 polys

91 – 122 polys

104 – 123 polys



Impervious Surface Classification Error by Land Use Group

Residential Error; $111 / 226 = 49\%$

Comm./Ind./Inst. Error; $121 / 295 = 41\%$

Overestimated 1 Group Error

Low Density Residential Labeled as Medium = 81% (75 polys)

Medium Density Residential Labeled as High = 39% (35 polys)

Low Density Comm/Ind/Inst Labeled as Medium = 33% (33 polys)

Medium Density Comm/Ind/Inst Labeled as Low = 75%(68 polys)

24 (32%) polys are less than 5% from 111/112 cut off

0 (0%) polys are less than 5% from 113/112 cut off (30% over)

11 (33%) polys are less than 5% from 122/121 cut off

19 (28%) polys are less than 5% from 123/122 cut off

Impervious Surface Classification Error by Land Use Group/Polygon Size

Residential

< 33 Percentile ; 57%

34 – 65 Percentile ; 35%

66 < Percentile ; 66%

Comm./Ind./Inst.

< 33 Percentile ; 44%

34 – 65 Percentile ; 40%

66 < Percentile ; 43%

Summary

- Error function of minimal training in impervious area distinction
- Impervious surface reference did not include many surfaces and so is probably underestimated
- Lancaster was done by predominantly by one analyst; should draw error samples from across state