

Estimating Basin Impervious Surface Area Using Hard and Soft Classifiers

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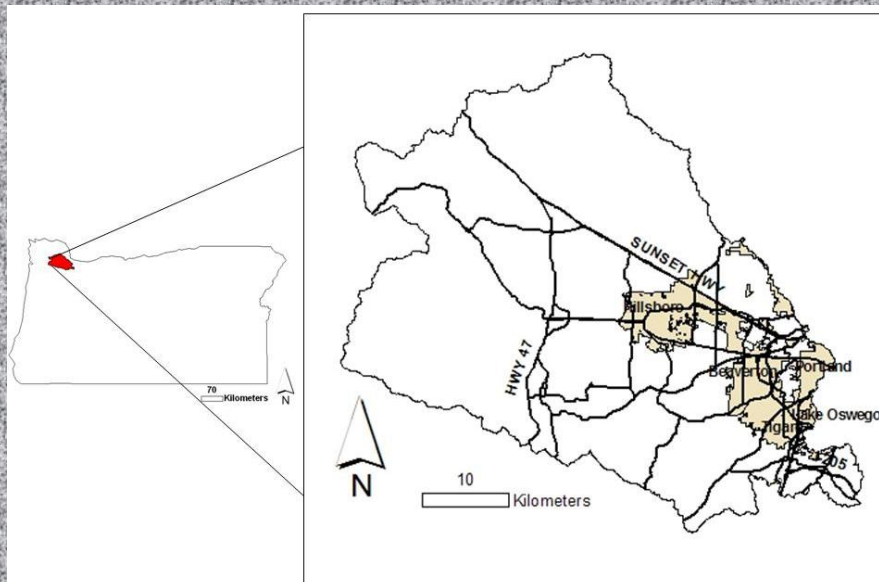
Outline

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 - Supervised classification
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 - Sub-pixel unmixing
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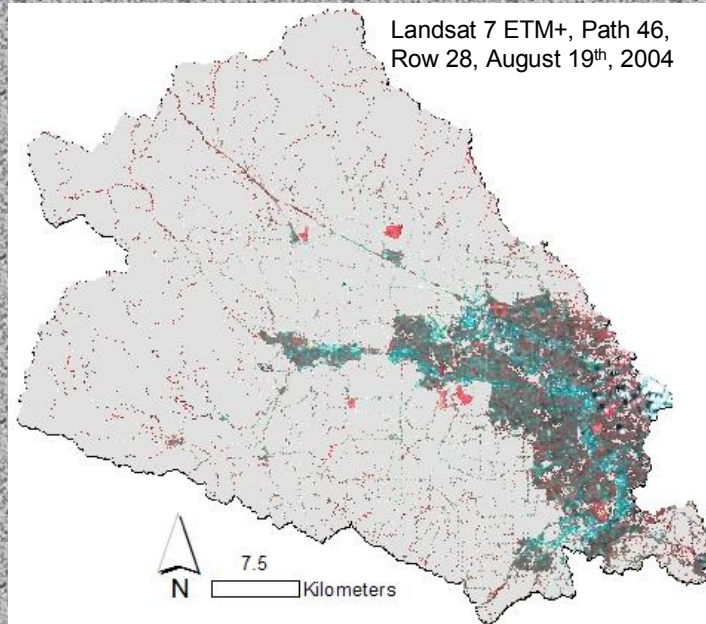
Background

- Impervious surface area affects basin hydrology and climate
 - Higher surface runoff
 - Lower groundwater recharge
 - Increased “flashiness”
 - Higher water temperatures
 - Impaired water quality
 - Urban heat island
- Urban areas are spectrally heterogeneous, with many mixed pixels
- Impervious surface areas may have diverse spectral signatures

Study Area

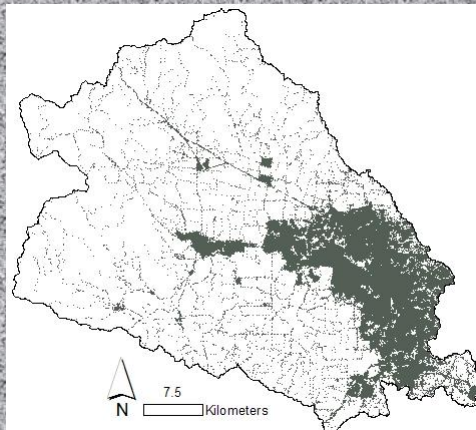


Imagery



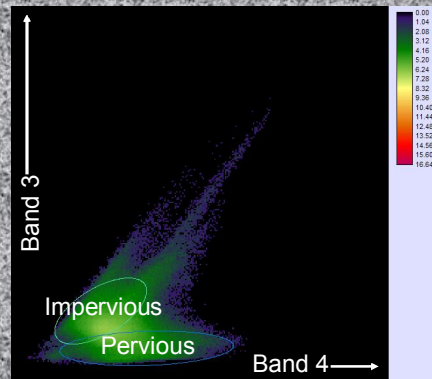
Methods: Pre-Processing

- Extract by mask to basin area
- Extract by mask to urban area in 2001 NLCD



Methods: Supervised Classification

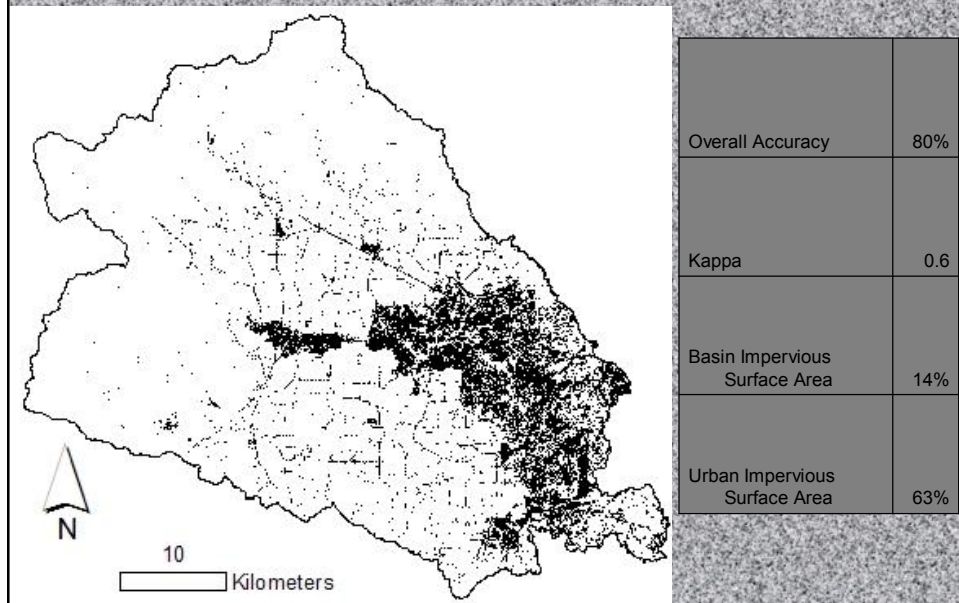
- Minimum distance (IDRIDI)
- FUZCLASS (IDRISI)
- Subpixel unmixing (ERDAS)



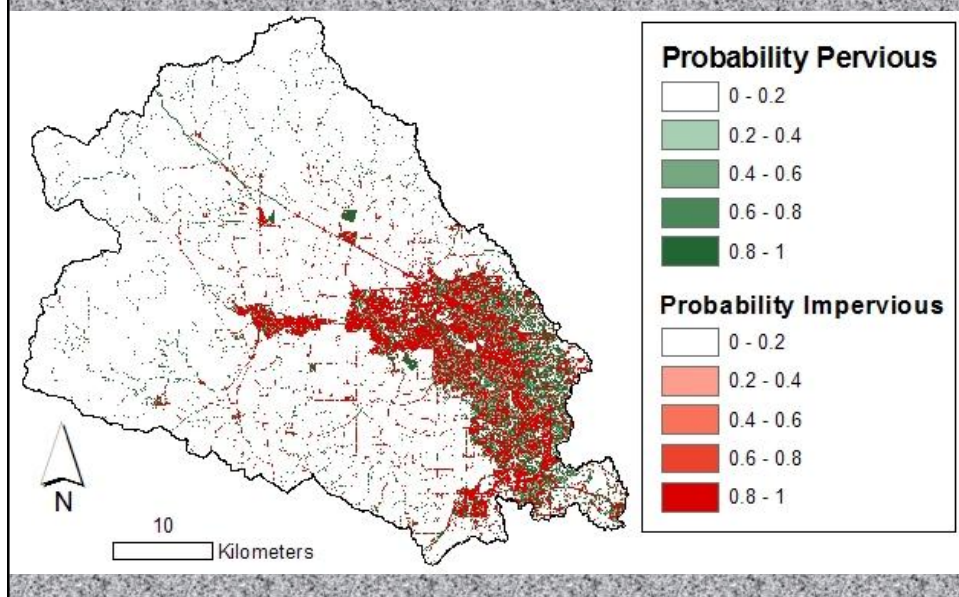
Methods: Accuracy Assessment

- 100 equalized random sample points
- Used original image as reference
- Assessed accuracy of:
 - Minimum distance classification
 - Hardened fuzzy classification
 - Fuzzy classification with probability impervious of >90%, >80%, >70%
 - Subpixel unmixing classification with impervious surface area of >90%, >80%

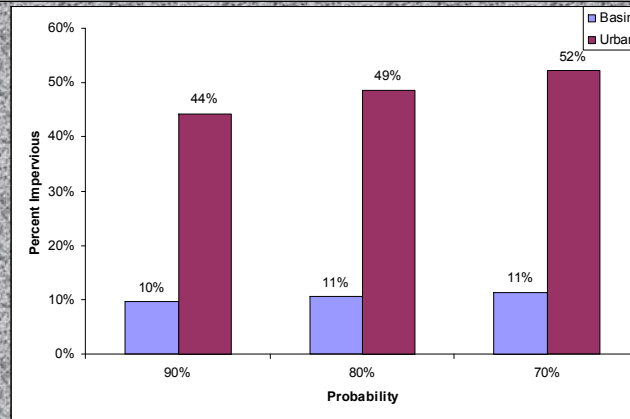
Results: Minimum Distance



Results: Fuzzy Classification

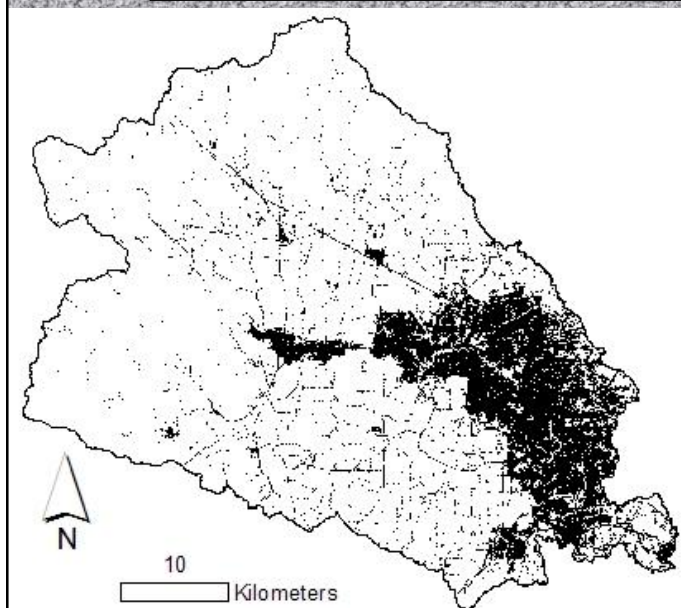


Results: Fuzzy Classification



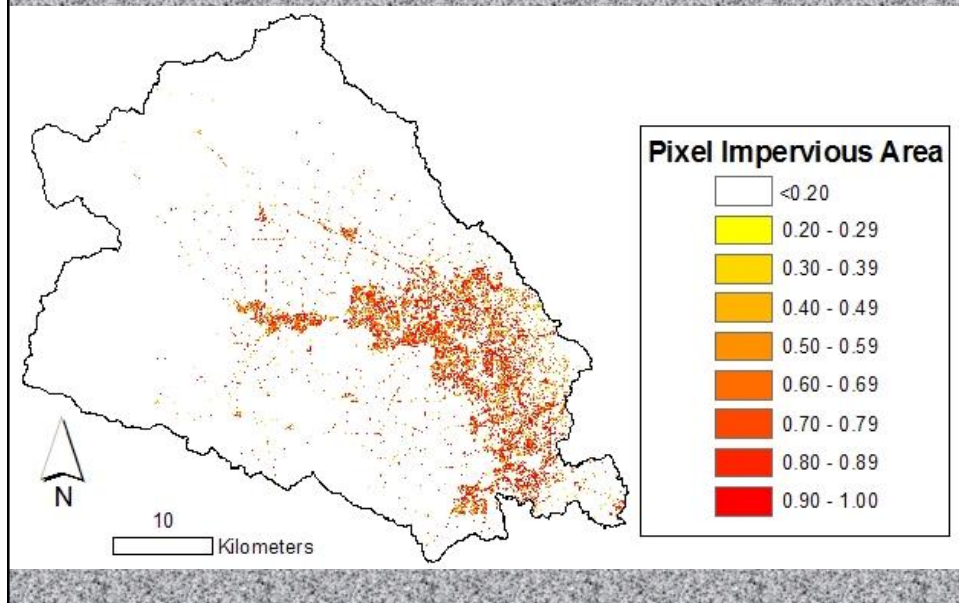
Probability Impervious	Overall Accuracy	Kappa
>90%	93%	0.86
>80%	96%	0.92
>70%	86%	0.72

Results: Hardened Fuzzy

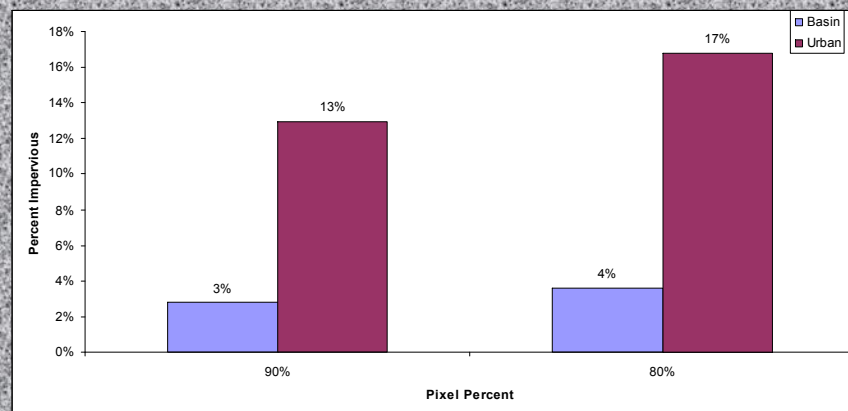


Overall Accuracy	83%
Kappa	0.66
Basin Impervious Surface Area	18%
Urban Impervious Surface Area	80%

Results: Sub-Pixel Unmixing

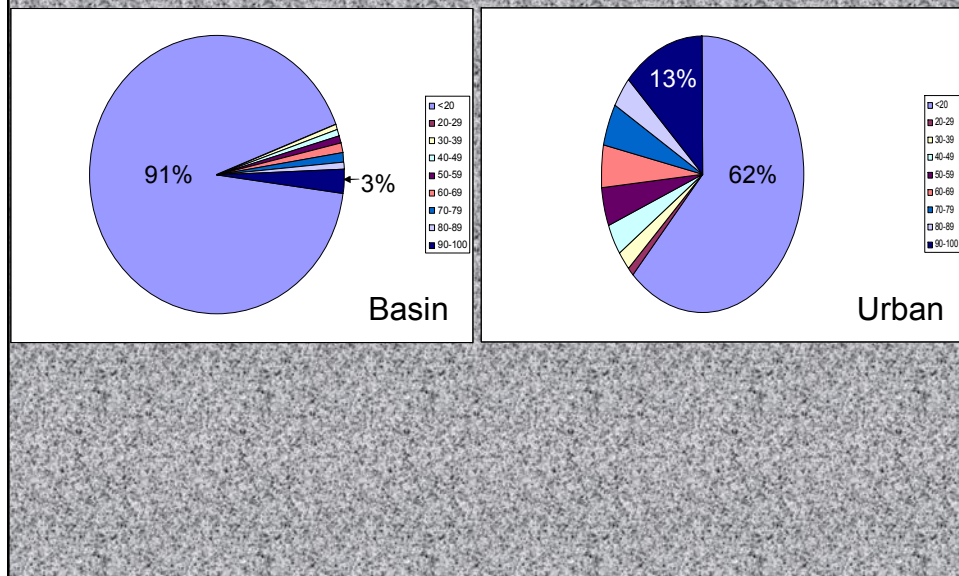


Results: Sub-Pixel Unmixing

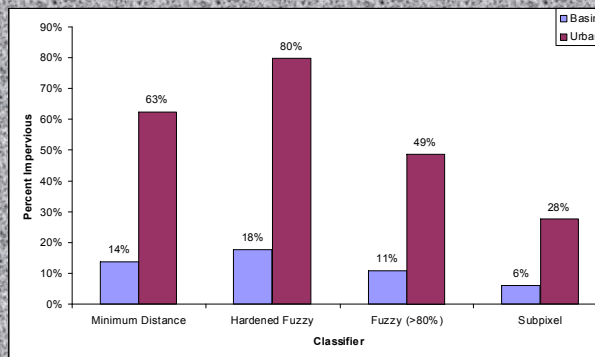


Percent Impervious	Overall Accuracy	Kappa
>90%	97%	0.94
>80%	91%	0.82

Results: Sub-Pixel Unmixing

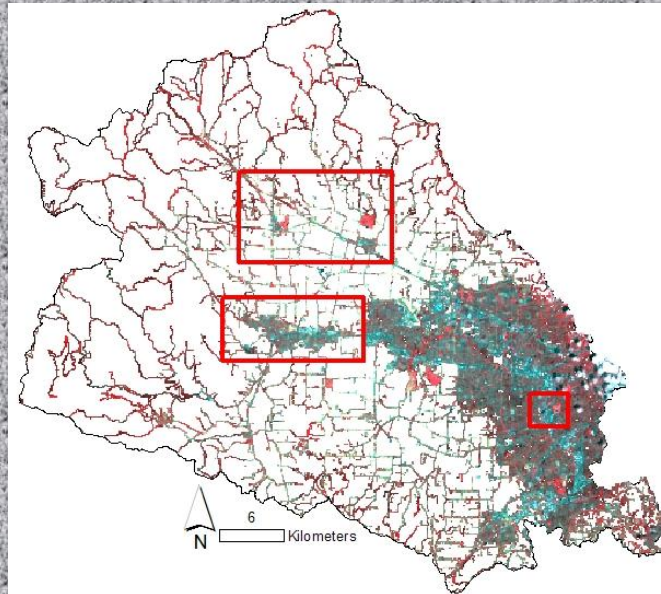


Results: Comparison

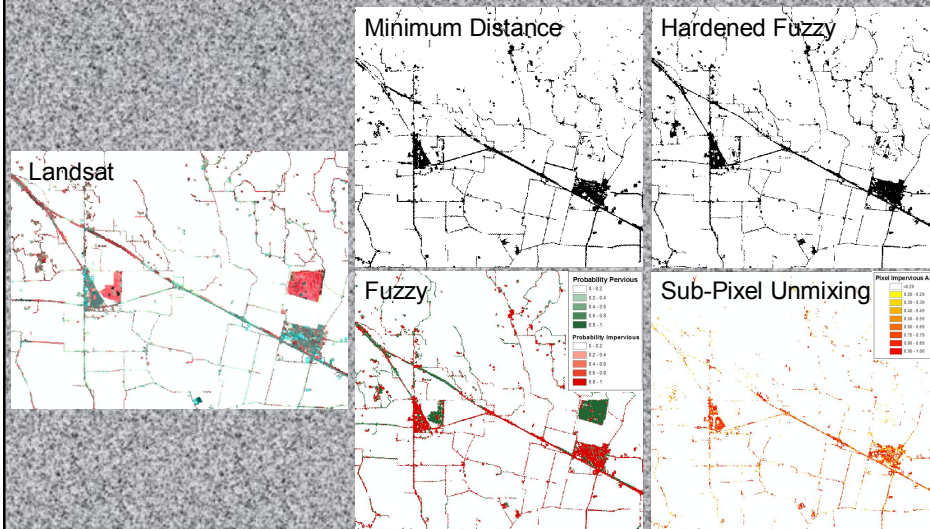


Classification	Overall Accuracy	Kappa
Minimum Distance	80%	0.6
Hardened Fuzzy	83%	0.66
Fuzzy (>80%)	96%	0.92
Subpixel (>90%)	97%	0.94

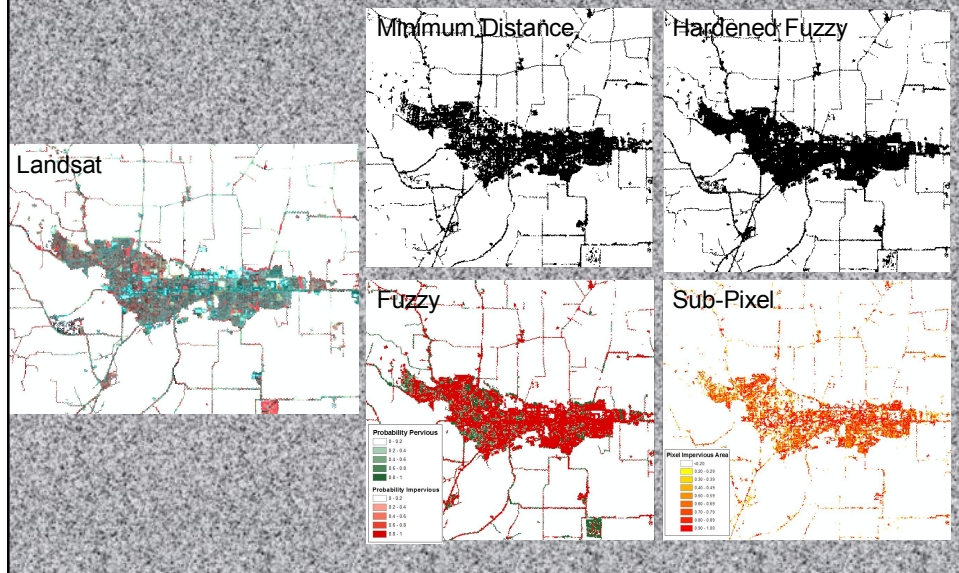
Results: Close-Up Views



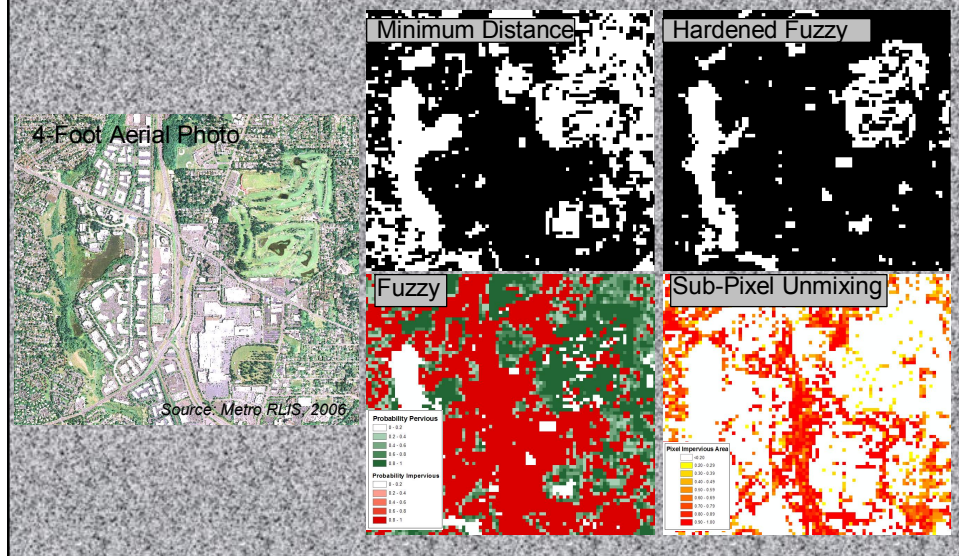
Results: Banks and North Plains



Results: Forest Grove



Results: SW Scholls Ferry Road



Conclusion

- Most accurate classification was sub-pixel unmixing, followed by fuzzy and hard classifiers
- Impervious surface area was less under the sub-pixel and fuzzy methods than the hard classifiers
- Ancillary data, such as streets, may improve accuracy of classification

References

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- ERDAS, Inc. 2008. *ERDAS Field Guide: Volume 2*. Norcross, GA.
- Metro. 2009. Regional Land Information System (RLIS). Accessed 5/28/09. http://www.metro.dst.or.us/index.cfm/go/by_web/id=505.
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- Yang, L., G. Xian, J.M. Klaver, and B. Deal. 2003. Urban land-cover change detection through sub-pixel imperviousness mapping using remotely sensed data. *Photogrammetric Engineering and Remote Sensing* 69:1003-1010.