



A comparison of the 1992 and 2001 National Land Cover Datasets in the Lamprey River Watershed, NH



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Introduction

Background:

Two National Land Cover Datasets (NLCD) have been created for both 1992 and 2001 by the Multi-Resolution Land Characteristics (MRLC) Consortium. These maps were created using Landsat TM imagery of the entire conterminous United States. The two National Land Cover Datasets can be used for a variety of applications, both independently and together; however, land cover change was predicted to be one of the more valuable utilizations of the data since there are two separate years of land cover maps. However, differences in classification techniques and class definitions make it unwise to directly compare the 1992 and 2001 NLCDs. Therefore, the MRLC created a Land Cover Change Retrofit (LCCR) product (Fry et. al., 2009).

LCCR Creation:

- Both years were reclassified at a modified Anderson Level I with broad categories (Anderson et. al., 1976)
- Parts of the 1992 imagery were reclassified using the 2001 approach so that the two would be compatible for comparison
- A change analysis was completed between the two years, with some modifications where the two maps were still incompatible (Fry et. al., 2009)

Objective:

To determine how well the LCCR product remedied the discrepancies between the 1992 and 2001 NLCDs and whether it is a usable source for land cover change in the Lamprey River Watershed, in seacoast New Hampshire.

New NLCD Categories

To compare the Land Cover Change Retrofit (LCCR) product with the 1992 and 2001 NLCDs, the original sets of NLCD maps were recoded using the modified Anderson Level I class descriptions from the LCCR product (Table 1) (Fry et. al., 2009).

1992 NLCD Classes	2001 NLCD Classes	Anderson Level I Classes
11 Open Water	11 Open Water	1 Open Water
12 Perennial Ice/Snow	12 Perennial Ice/Snow	8 Ice/Snow
85 Urban/Recreational Grasses	21 Developed, Open Space	2 Urban
21 Low Intensity Residential	22 Developed, Low Intensity	2 Urban
22 High Intensity Residential	23 Developed, Medium Intensity	2 Urban
23 Commercial/Industrial/Transportation	24 Developed, High Intensity	2 Urban
31 Bare Rock/Sand/Clay	31 Barren Land (Rock/Sand/Clay)	3 Barren
32 Quarries/Strip Mines/Gravel Pits		3 Barren
33 Transitional		3 Barren
41 Deciduous Forest	41 Deciduous Forest	4 Forest
42 Evergreen Forest	42 Evergreen Forest	4 Forest
43 Mixed Forest	43 Mixed Forest	4 Forest
51 Shrubland	51 Dwarf Scrub	5 Grassland/Shrub
	52 Shrub/Scrub	5 Grassland/Shrub
61 Orchards/Vineyards/Other		6 Agriculture
71 Grasslands/Herbaceous	71 Grassland/Herbaceous	5 Grassland/Shrub
81 Pasture/Hay	81 Pasture/Hay	6 Agriculture
82 Row Crops	82 Cultivated Crops	6 Agriculture
83 Small Grains		6 Agriculture
84 Fallow		6 Agriculture
91 Woody Wetlands	90 Woody Wetlands	7 Wetlands
92 Emergent Herbaceous Wetlands	95 Emergent Herbaceous Wetlands	7 Wetlands

Table 1. Anderson Level I classes for the equivalent NLCD classes.

References

- Anderson, J.R., E.E. Hardy, J.T. Roach, and R.E. Wither, 1976. A land use and land cover classification system for use with remote sensor data: U.S. Geological Survey Professional Paper 964, 28 p.
- Congalton, R.G., R.G. Odeh, and R.A. Mead, 1983. Assessing Landsat classification accuracy using discrete multivariate statistical techniques. *Photogrammetric Engineering and Remote Sensing*, 49(12):1671-1678.
- Fry, J.A., M.J. Coan, C.G. Homer, D.K. Meyer, and J.D. Wickham, 2009. Completion of the National Land Cover Database (NLCD) 1992-2001 Land Cover Change Retrofit product: U.S. Geological Survey Open-File Report 2008-1379, 18 p.

NLCD Change

A change analysis was then performed to find places of change between the two years (Figure 1). The areas of each of the habitats in each of the NLCDs is compared in a change matrix (Table 2).

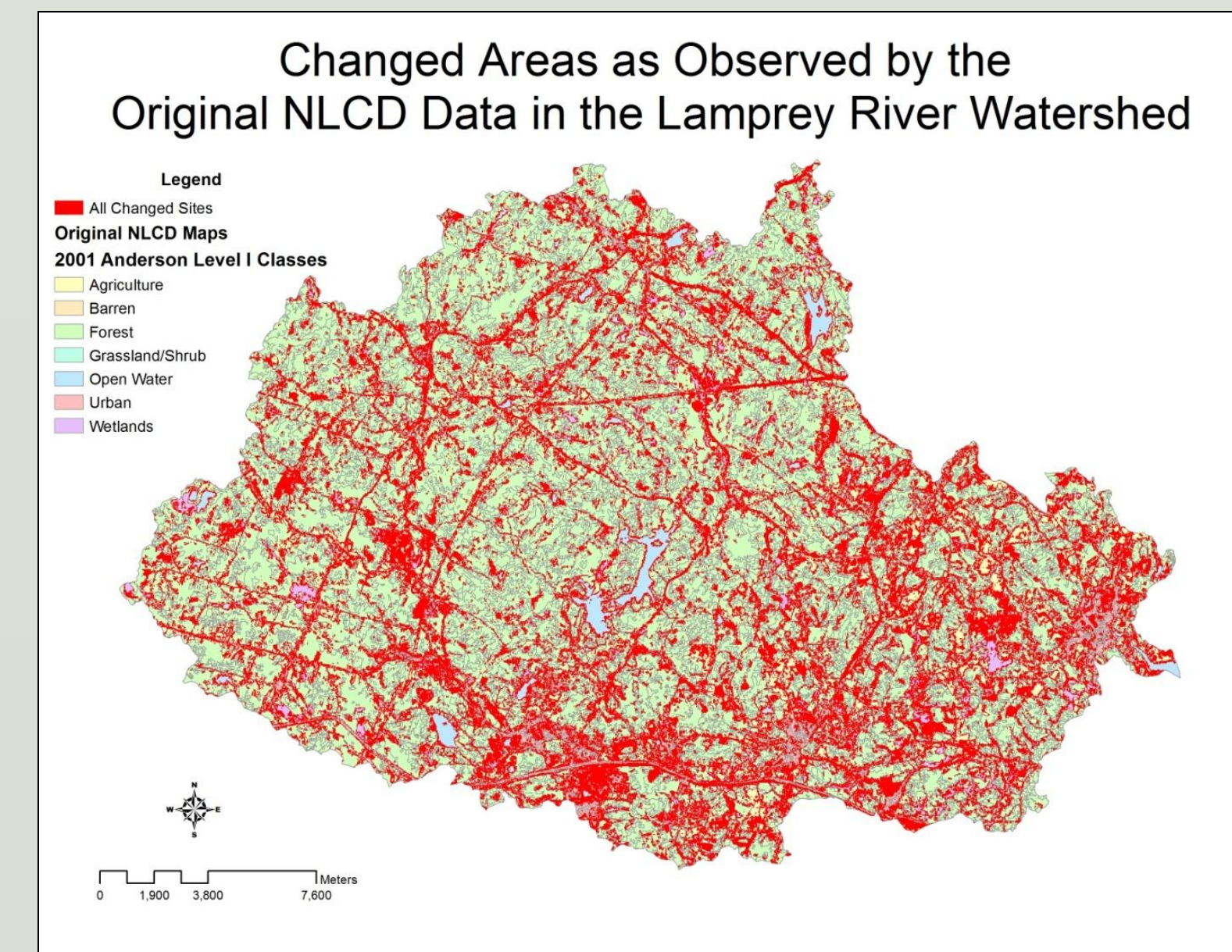


Figure 1: The red areas represent the areas of change between the 1992 and 2001 NLCDs.

- **Low agreement between years (KHAT = 0.34)** (Congalton et. al., 1983)
- **28% of the total area changed classes**
- **54% of the 1992 urban class changed labels in 2001**

Table 2: A change matrix comparing the areas of the habitats in the 1992 and 2001 NLCDs.

1992 NLCD (ha)	2001 NLCD (ha)							Total
	Open Water	Urban	Barren	Forest	Grassland/Shrub	Agriculture	Wetlands	
Open Water	698.70	22.52	4.96	316.71	30.09	22.01	278.66	1373.66
Urban	13.47	1249.39	84.74	936.53	132.95	304.12	131.51	2852.71
Barren	1.13	73.43	25.31	40.40	20.60	61.17	16.25	238.29
Forest	155.59	2709.06	136.23	34936.03	986.96	1535.01	2281.30	42740.18
Grassland/Shrub	0.00	0.57	0.49	3.45	2.79	1.64	0.15	9.08
Agriculture	1.89	786.06	185.77	1006.44	110.32	1515.55	82.81	3688.84
Wetlands	43.74	532.41	35.84	2346.69	206.68	264.76	1041.24	4471.37
Totals	914.52	5373.44	473.35	39586.24	1490.41	3704.27	3831.92	55374.14

LCCR Change

To test whether the Land Cover Change Retrofit product adequately solved some of the classification issues observed between the 1992 and 2001, another change analysis was completed for the LCCR product (Figure 2). The modified Anderson I labels given in the 1992 reclassified map and the 2001 labels were again compared using a change matrix (Table 3).

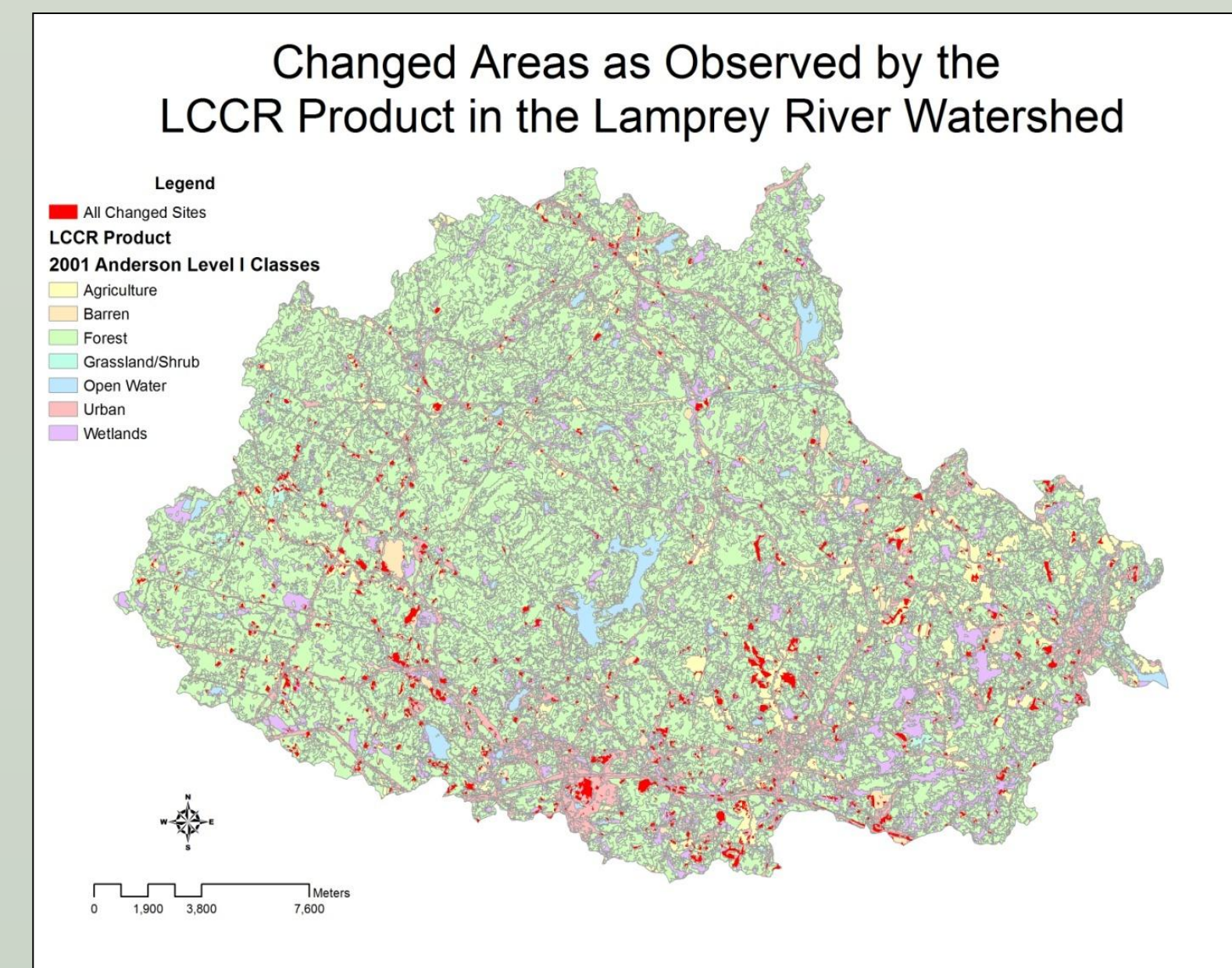


Figure 2: The red areas represent the areas of change between the 1992 and 2001 LCCR categories.

- **High agreement (KHAT = 0.96)**
- **2% of the total area changed classes**
- **1% of the urban category changed labels**

Table 3: A change matrix showing the areas of change in the LCCR product.

1992 LCCR Product Data	2001 LCCR Product Data (ha)							Total
	Open Water	Urban	Barren	Forest	Grassland/Shrub	Agriculture	Wetlands	
Open Water	904.15	0.00	0.00	1.89	8.08	2.36	7.92	924.40
Urban	0.00	5135.37	4.62	20.45	5.04	17.55	13.15	5196.18
Barren	0.00	0.00	392.87	0.00	0.00	0.00	0.00	392.87
Forest	5.36	296.32	82.23	39667.57	209.75	279.80	59.48	40600.52
Grassland/Shrub	0.00	0.00	0.00	0.00	1218.63	0.00	0.00	1218.63
Agriculture	0.00	0.00	0.00	0.00	0.00	3342.86	0.00	3342.86
Wetlands	0.61	0.00	0.00	5.09	0.00	0.81	3692.17	3698.68
Totals	910.12	5431.69	479.72	39695.00	1441.50	3643.38	3772.72	55374.14

Conclusions, Implications, and Future Work

Conclusions:

(1) Something other than land cover change is creating the observed changes between the two NLCD maps, confirmed by:

- Low agreement between the two years of NLCD maps
- High amount of change in the urban category from 1992 to 2001 in the NLCD maps
- Low agreement between 1992 NLCD and 1992 LCCR product classifications (KHAT= 0.39)
- Average agreement between the 2001 NLCD and 2001 LCCR product classifications (KHAT= 0.61)

(2) The Land Cover Change Retrofit product gives more reasonable estimates of land cover change between 1992 and 2001, with some drawbacks:

- The modified Anderson Level I classes are very broad and only useful for studies looking at very general changes in the Lamprey River Watershed
- The estimates of change provided may have actually been low due to:
 - The very general definitions of the land cover classes
 - The 1992 LCCR cover map was not created independently of the 2001 map

Implications:

It is unlikely that the LCCR product will be very useful for land cover change detection at the scale of the Lamprey River Watershed.

However, for the conterminous United States, it is probably a very good general estimate for change.

Future Work:

- Comparison of the accuracy of the Anderson Level II classes for the NLCD maps:
 - Determine which classes might be usable in a change detection despite differences in the NLCD, using the LCCR to determine which classes likely did not change in definition between the two years, for example:
 - Forest classes
 - 1992: increased 5% (NLCD to LCCR)
 - 2001: increased 0.2%
 - Urban classes
 - 1992: increased 82%
 - 2001: increased 1%
 - Therefore, the Anderson Level II forest classes potentially could be used in a specific change detection, but the urban category is likely not eligible.
- Use the original Landsat TM5 data from 1984 to present to do change detection
 - This will allow for yearly comparisons of land cover change as well as more specific changes in vegetation

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