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Johnson, Kenneth M. and Stewart, Susan I., "The Implications of Demographic Change for Resource Management in the Northern Forest" (2011). *Sociology Scholarship*. 86.

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The Implications of Demographic Change for Resource Management in the Northern Forest

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Completion date: 7/2011

Investigating demographic change in the Northern Forest provides a powerful tool for advancing integrated research and finding sustainable solutions for the communities of the Northern Forest.

Funding support for this project was provided by the Northeastern States Research Cooperative (NSRC), a partnership of Northern Forest states (New Hampshire, Vermont, Maine, and New York), in coordination with the USDA Forest Service.

<http://www.nsrcforest.org>

PROJECT SUMMARY

The Northern Forest spans over 26 million acres in four states. Population and housing growth in this long-settled region has been modest, but there is considerable internal variation, with some places growing rapidly while nearby communities diminish. The future of the Northern Forest and the communities embedded in it depends on the ability to anticipate change and respond appropriately. This is a particular concern for resource managers because natural resources respond to change slowly and benefit from long-range planning and management. Our demographic analysis provides a powerful tool for advancing integrated research and ultimately, finding sustainable solutions for the communities of the Northern Forest.

We combine longitudinal demographic data from the Census with economic, spatial and forest data from other sources to investigate population redistribution trends. We compare demographic trends in the 34 Northern Forest counties (Forest counties) to that in 58 nearby counties (non-Forest counties).

Population change in the Northern Forest reflects the interaction between fertility, mortality and migration over a protracted period. In 2010, 2,289,000 resided in the Forest counties. Population gains were greater in these counties (3.4 percent) than in the non-Forest counties (2.3 percent). Both natural increase (births – deaths) and migration contributed to the modest population gain in the Northern Forest. Net migration was critical to the region's recent growth because the Northern Forest counties gained migrants between 2000 and 2010, rather than losing them as they had during the 1990s. The inflow of migrants was particularly significant in high amenity counties where population gains were the greatest. In contrast, population gains were smallest in manufacturing counties, where migration gains were minimal.

PROJECT SUMMARY

The Northern Forest population is growing older due to aging in place among current residents and because it is losing young adults and gaining older adults from migration. Racial diversity is on the increase in the region with children in the vanguard of this change. The housing stock has grown modestly over the last several decades, though changes in housing density and timing have been spatially uneven. Yet, forests remain widespread, even in areas with moderately high housing densities. These changes have produced an extensive intermix of people and forest in the region that resource managers must be cognizant of in planning for the future of the Northern Forest, its people and institutions.

This research demonstrates how population redistribution has contributed to the transformation of the Northern Forest. It also provides a comprehensive representation of the interplay between economic, geographic and spatial factors that have produced demographic and housing changes in the region. By delineating the differential patterns of population redistribution and housing density shifts this research contributes to a better understanding of land use change and its implications for the future of the Northern Forest, its residents and institutions.

BACKGROUND AND JUSTIFICATION

- Demographic analysis has unrealized potential in resource planning and management because it enhances the capacity of resource managers to prepare for the region's future.
- Research on regional demographic trends impacts resource management by providing a powerful tool for advancing integrated research and ultimately, finding sustainable solutions for the communities of the Northern Forest.
- The future of the Northern Forest and the communities embedded in it depend on the ability of local leaders to anticipate change and respond appropriately.
- Demographic change has important implications for settlement patterns as well as for social, economic and ecological conditions.
- Investigating demographic change in the Northern Forest is important because it is a place where people and forests are intermixed. Thus, demographic change has significant implications for the region's forests and other natural resources.

BACKGROUND AND JUSTIFICATION

- Demographic trends in the Northern Forest must be viewed in the broader context of population redistribution trends underway in the region in which the Northern Forest is situated.
- Population change is fueled by natural increase (births – deaths) and migration. Both demographic components must be considered because they have differential spatial impacts.
- Migration is particularly important to future growth in the Northern Forest because large urban population concentrations exist in close proximity to the region's rich natural amenities. This increases the potential for urban residents to migrate to and potentially overwhelm small scenic communities.
- Demographic change in the Northern Forest will be reflected in the changing age structure and racial diversity of residents as well as in the size and distribution of the population.

METHODS: Research Questions

- **How has demographic change impacted settlement trends in the Northern Forest?**
 - Document population redistribution trends
 - Delineate housing growth patterns
- **How have demographic trends changed longitudinally?**
 - Examine patterns of natural increase and net migration
 - Document compositional shifts by age, race/Hispanic origin
 - Examine changes in housing density and distribution
- **What is the relationship between demographic change and landscape change?**
 - Analyze differential patterns of demographic change by metropolitan proximity, economic type and regional location

METHODS: Data

- **Analysis of demographic trends in the Northern Forest requires contemporary and historical data from multiple sources.**
 - Data from the 2010, 2000 and 1990 Decennial Census
 - Birth and Death data from the 1990-2009 Federal State Cooperative Population Estimates Series
 - County typology data from the Economic Research Service of the U.S.D.A.
 - Age specific net migration data from Johnson, et al. 2005
- **County is primary unit of analysis, but other units also used.**
 - Counties used because basis for considerable longitudinal demographic and economic data
 - Towns used to examine local population change
 - Partial block groups used to examine longitudinal housing cluster change and forest characteristics (Mockrin, et al. 2011)

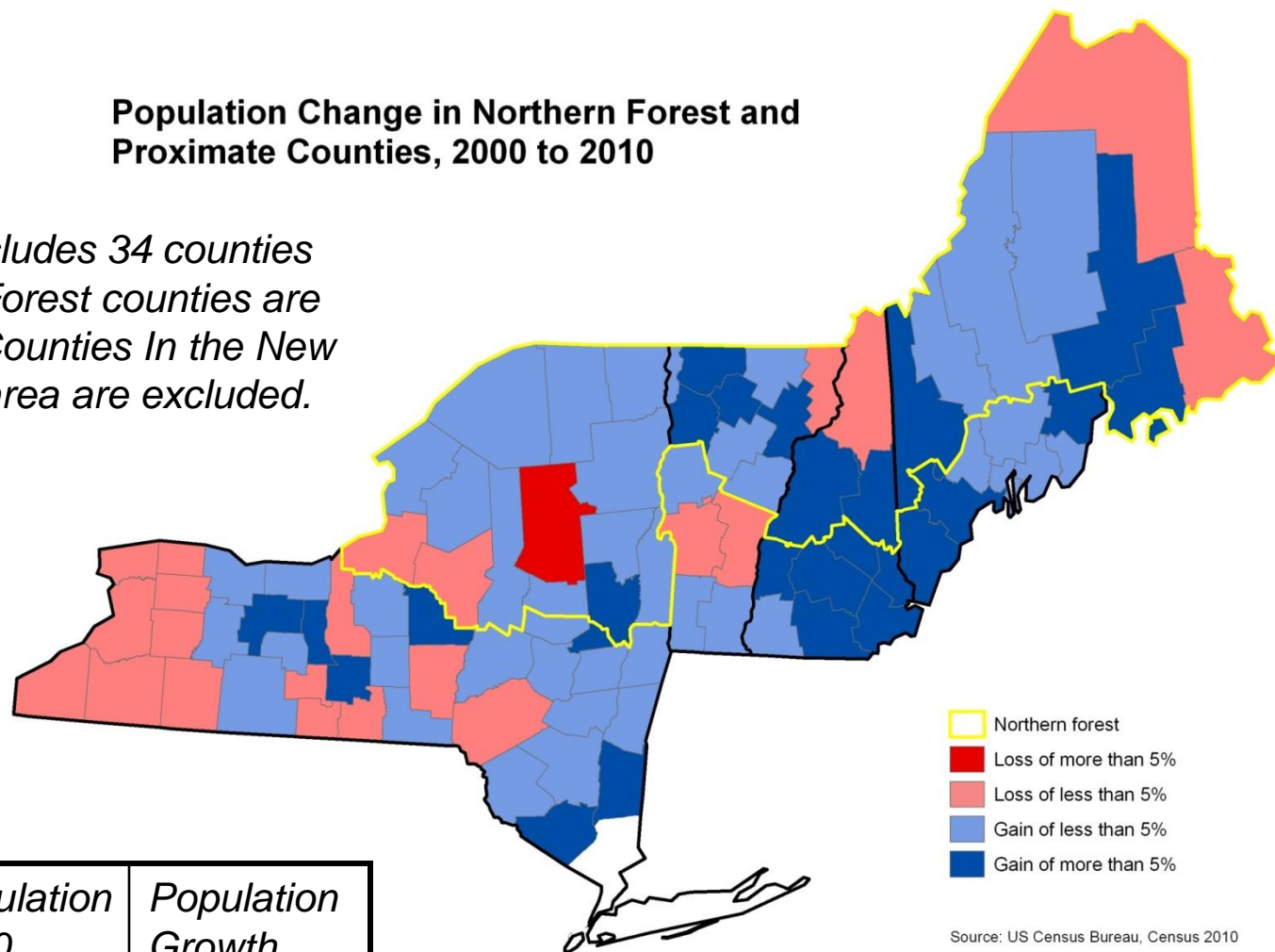
Johnson, K.M., P.R. Voss, R.B. Hammer, G.V. Fuguitt and S. McNiven. 2005. "Temporal and Spatial Variation in Age-Specific Net Migration in the United States." *Demography*, 42(4): 791-812.

Mockrin, M.H., S.I. Stewart, V.C. Radeloff, R.B. Hammer and K.M. Johnson. 2011. "Spatial and Temporal Residential Density Patterns from 1940 to 2000 In and Around the Northern Forest of New England." Conditional acceptance at *Population and Environment*.

METHODS: Study Area

Population Change in Northern Forest and Proximate Counties, 2000 to 2010

The Northern Forest includes 34 counties in four states. 58 non-Forest counties are used for comparison. Counties in the New York City metropolitan area are excluded.



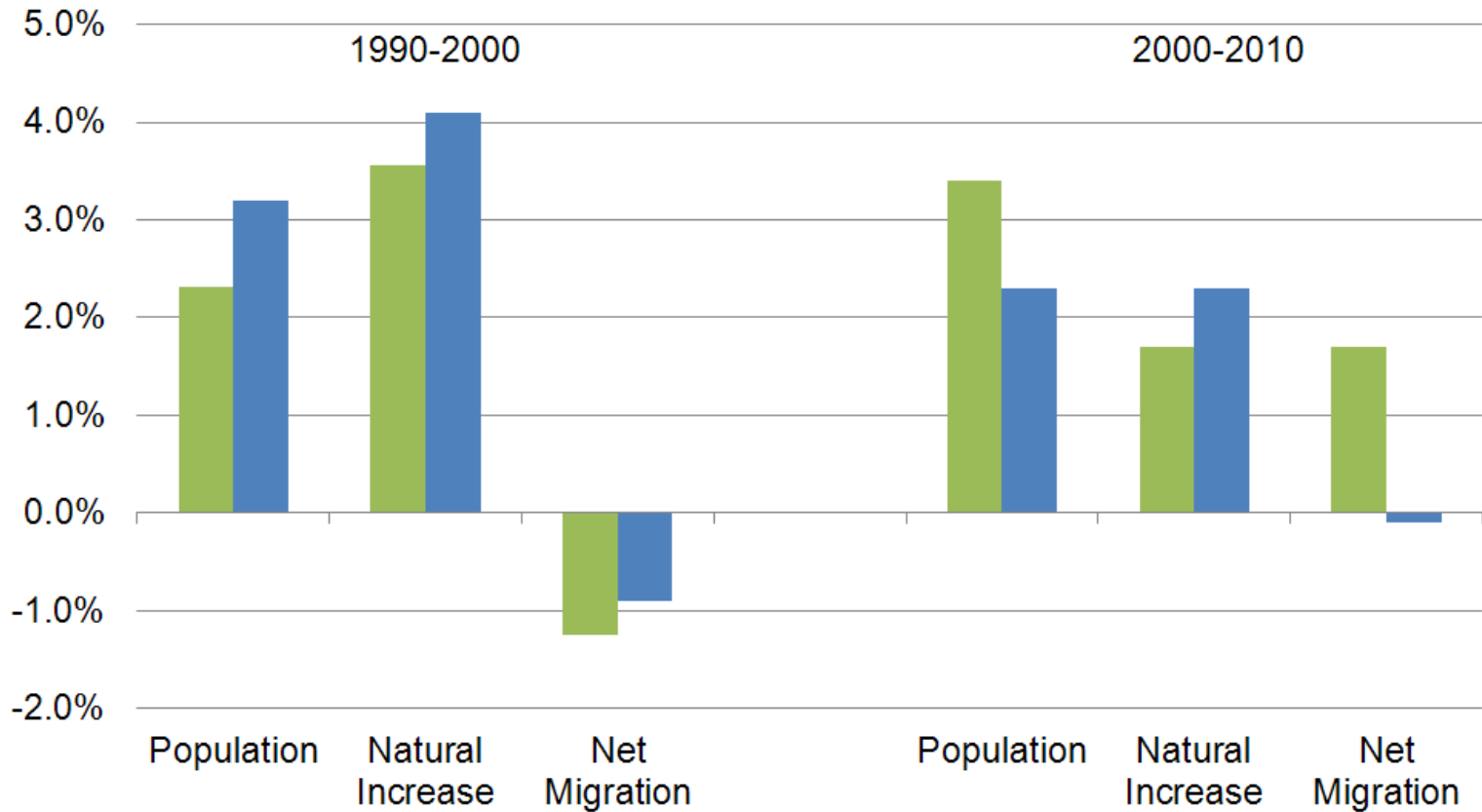
Counties	Population 2010	Population Growth
Forest	2,289,000	3.4%
Non-Forest	7,991,000	2.3%

Results: Overview

- **Northern Forest grew modestly from 2000-2010**
 - Gains greater than in the 1990s
 - Net migration critical to growth in Northern Forest counties
- **Demographic change in Northern Forest varies**
 - Growth greatest in high amenity counties
 - Growth least in manufacturing counties
- **Diversity is growing in Northern Forest**
 - Diversity still modest compared to overall U.S.
 - Children are in the vanguard of this growing diversity
- **Northern Forest population is aging**
 - Mostly due to aging in place
 - Older adult in-migration, younger adult outmigration
- **Moderate housing growth in the region**
 - Considerable spatial variability in housing growth and density
 - Forests remain widespread at relatively high housing densities
 - Extensive wildland-urban interface (WUI)

RESULTS: Northern Forest gains greater than surrounding area

Percent Change in Demographic Components in Northern Forest States, 1990-2010

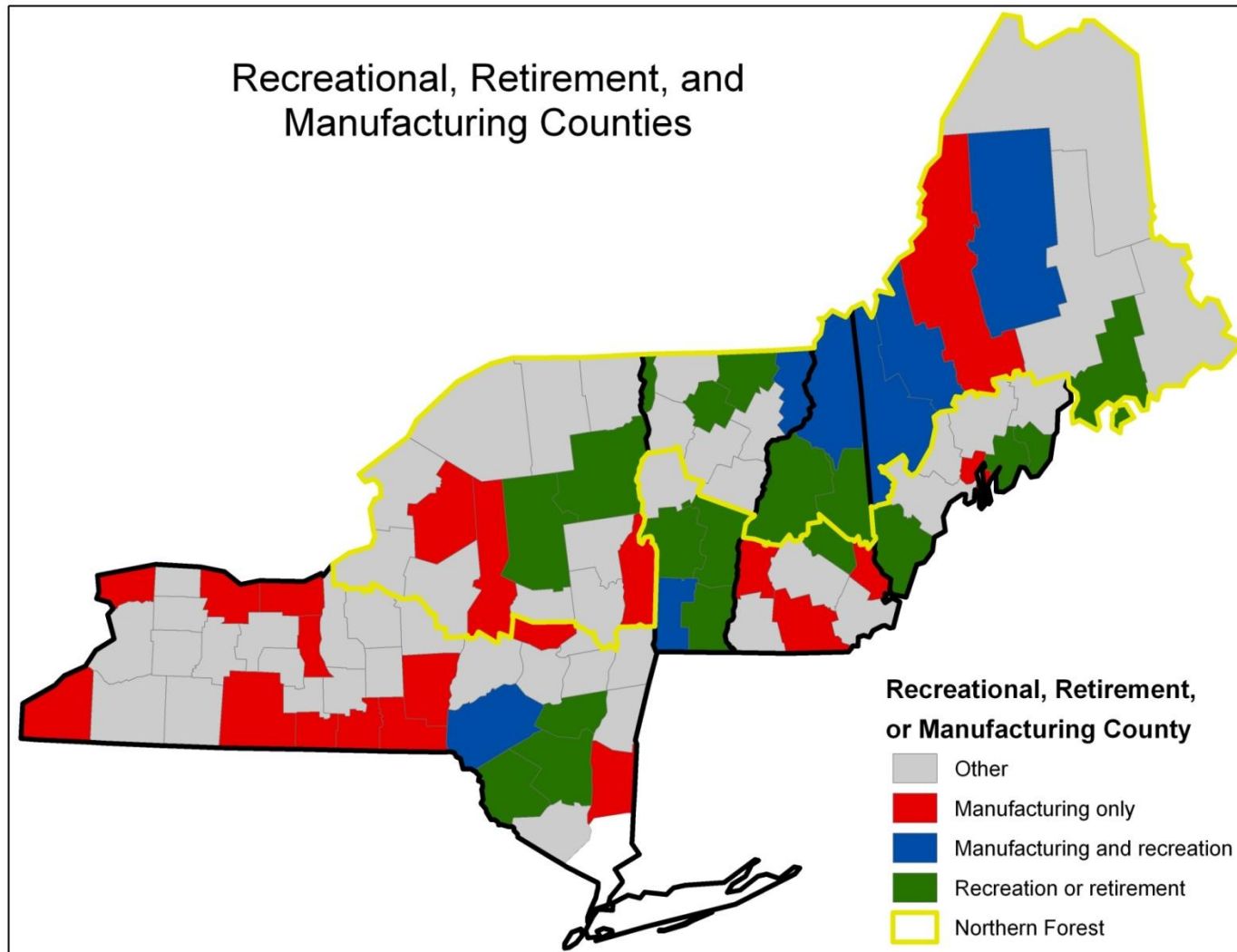


Source: U.S. Census 1990,2000,2010

■ Forest counties ■ Nonforest counties

Northern Forest counties continue to grow, though at a slower pace than the U.S. Migration was an important contributor to this growth between 2000 and 2010, but not during the 1990s.

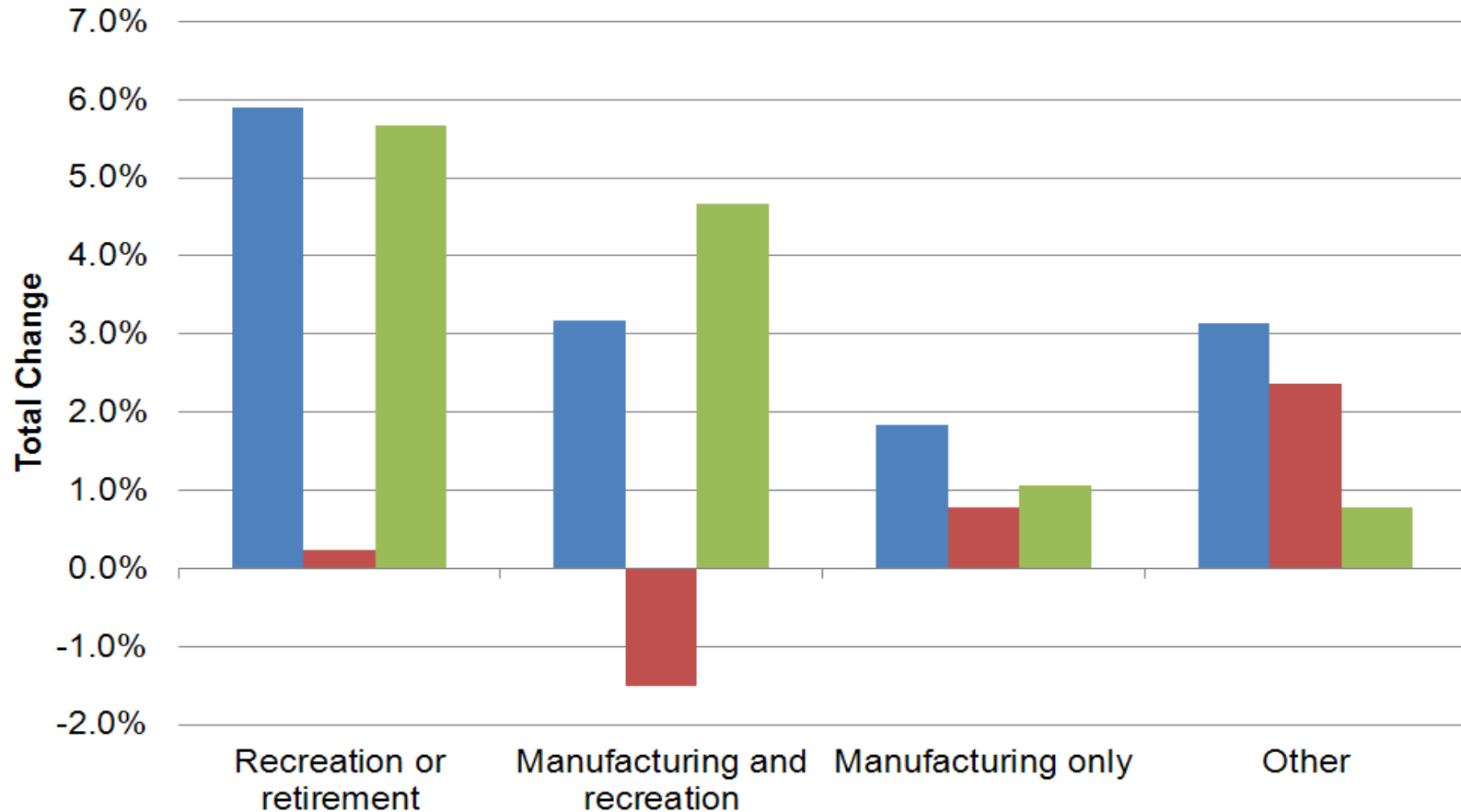
RESULTS: Northern Forest is economically diverse



The “Northern Forest” is a simple term describing a complex place and that complexity is reflect in regional demographic trends.

RESULTS: Demographic change varies by county type

Demographic Change for Selected County Types in the Northern Forest, 2000-2010



Source: U.S. Census Bureau Census 2000, 2010 and Population Estimates, 2010

■ Population Change

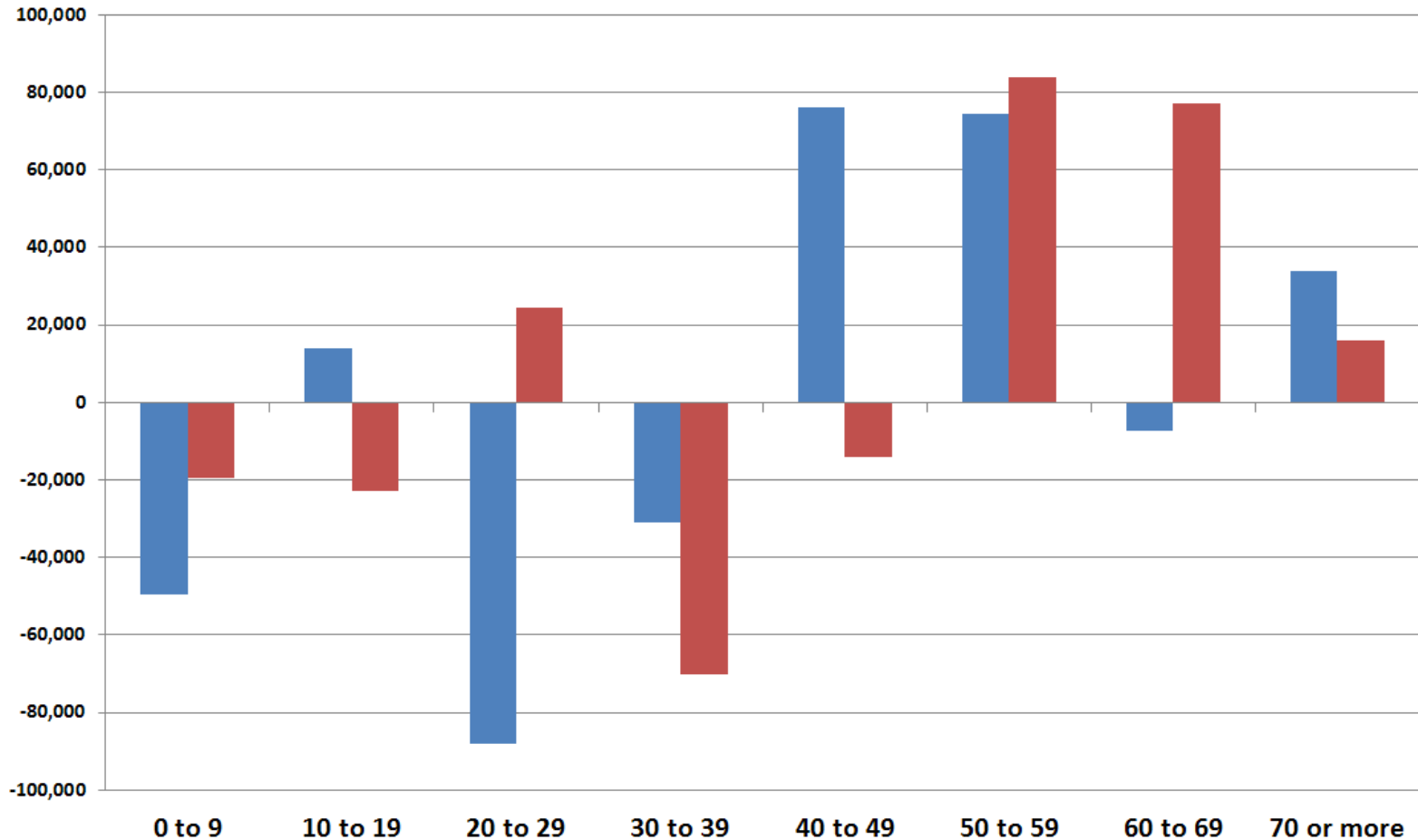
■ Natural Increase

■ Net Migration

There is considerable variation in demographic trends within the Northern Forest. Population gains are greatest in retirement and recreation areas, where migration is fueling the growth. In contrast, population gains are smallest in manufacturing counties.

RESULTS: Population is aging

Population Change by Age 1990 to 2010 for Forest Counties



Source: 1990, 2000, 2010 Census

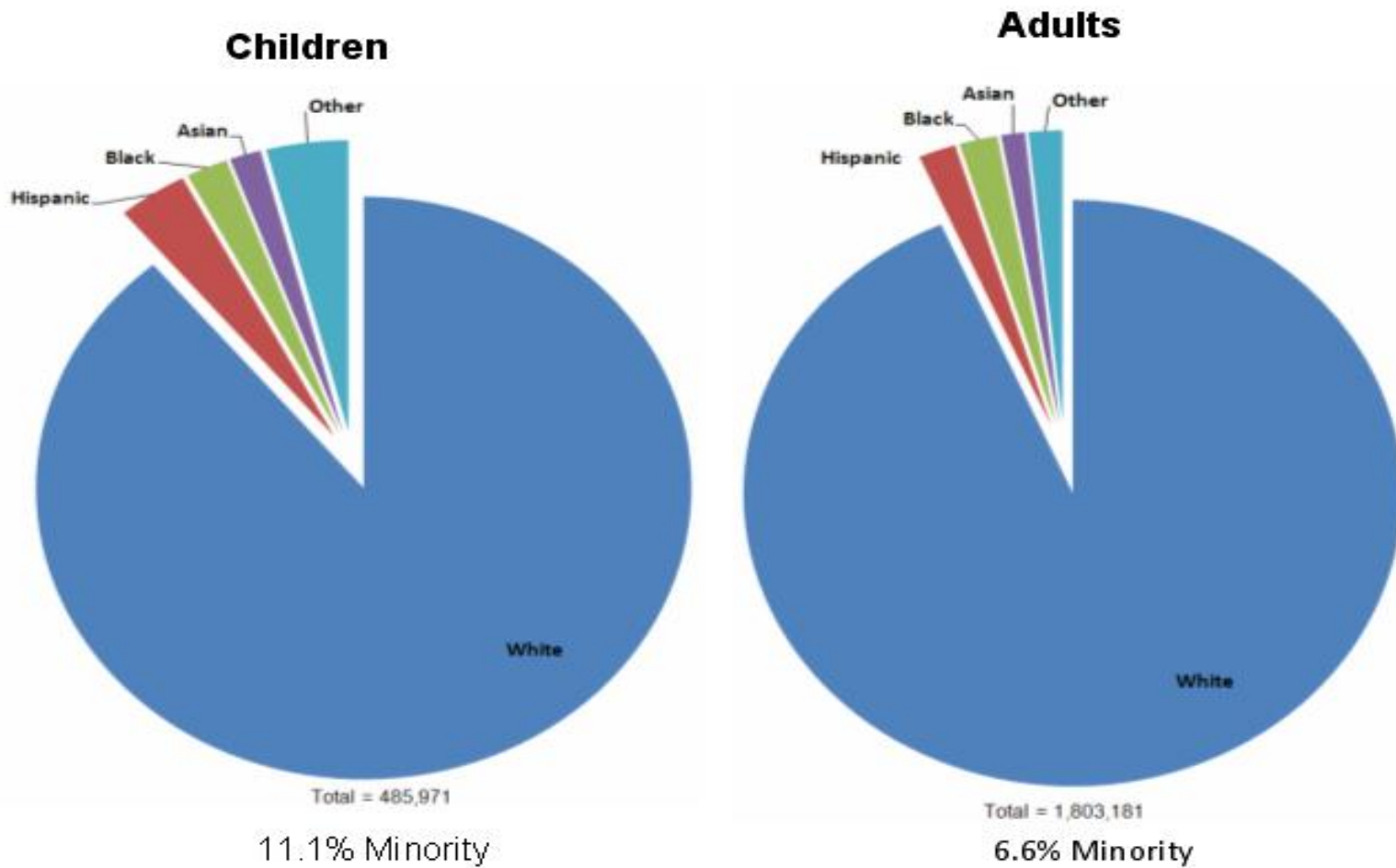
■ 1990-2000

■ 2000-2010

The population of the Northern Forest is growing older because of age specific migration trends and the aging in place of residents. This has implications for planners who need to estimate future land use trends and forest utilization as well as the needs of the aging population.

RESULTS: Diversity is growing

Forest Counties by Race and Hispanic Origin, 2010

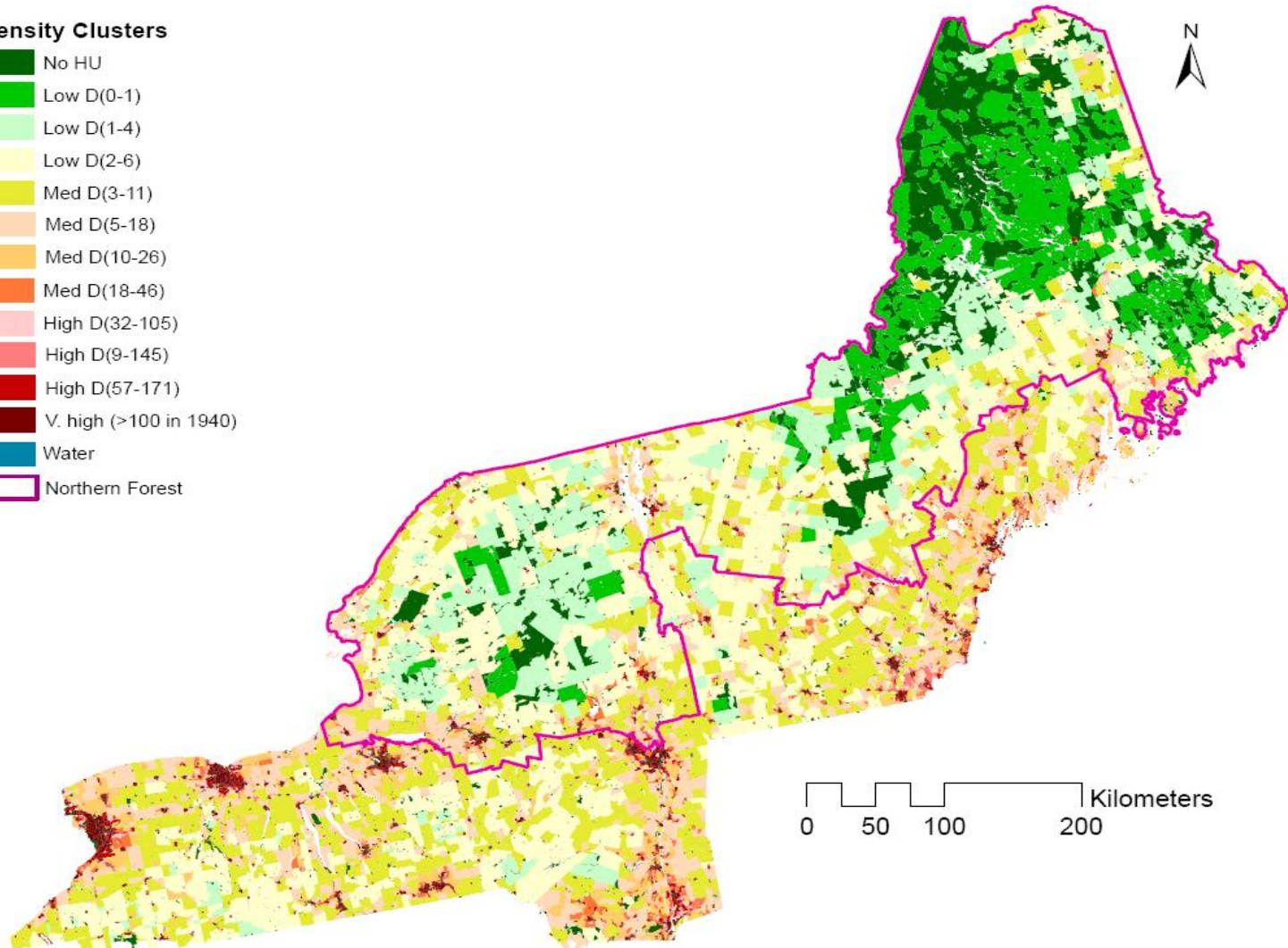
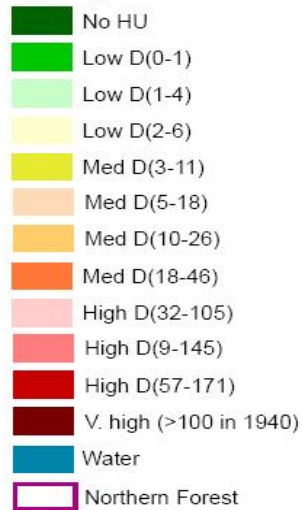


Source: U.S. Census 2010

The Northern Forest is becoming more diverse. Children are in the vanguard of this growing diversity. The number of non-Hispanic white children declined by 13.1% between 2000-2010. During the same period, the minority child population grew by 44%.

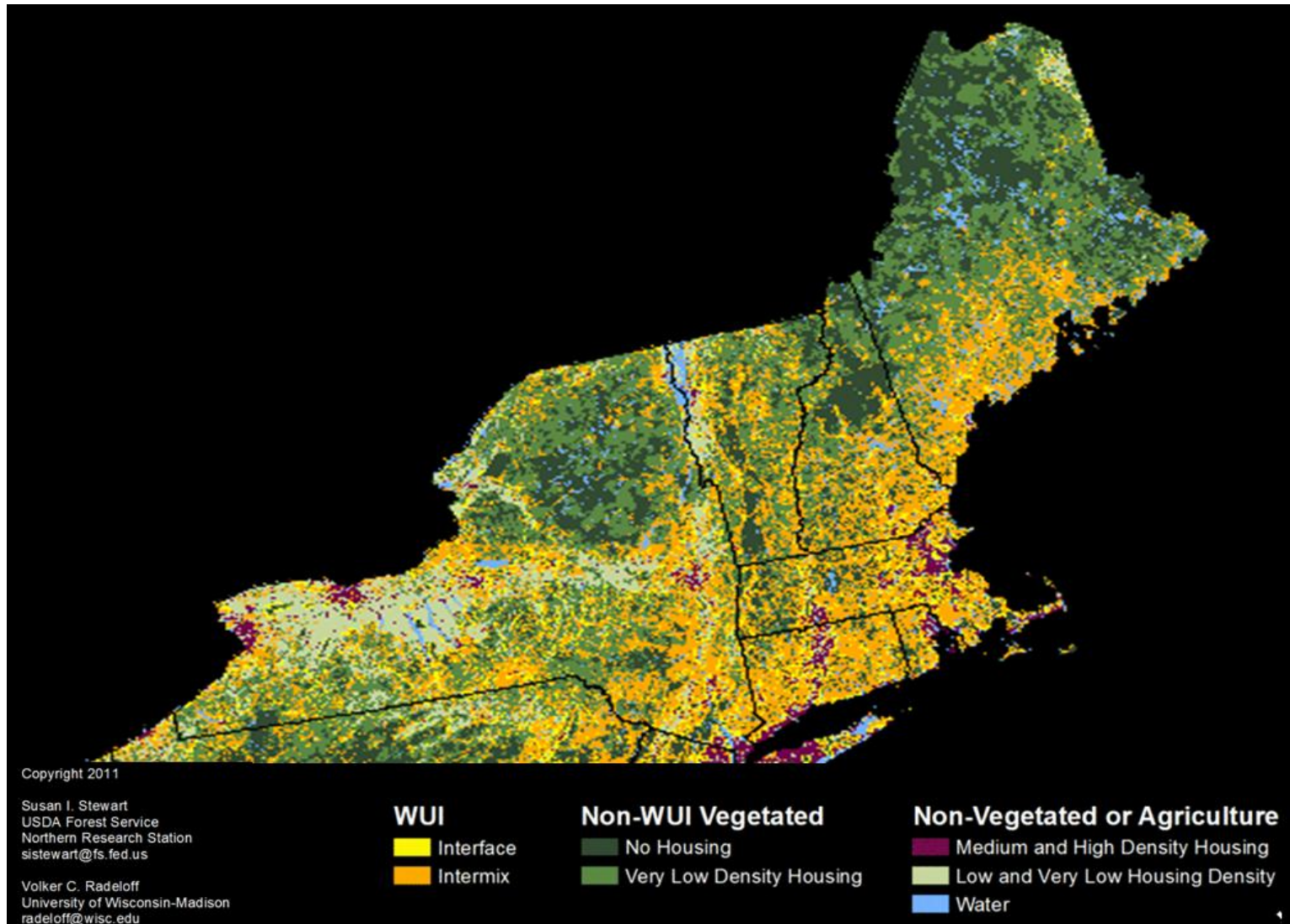
RESULTS: Significant spatial variation in housing density

Density Clusters



There is significant longitudinal housing growth in Northern Forest, but densities remain lower than in surrounding area. However, even at relatively high housing densities, much of land remains forested.

IMPLICATIONS: An extensive population and forest Intermix

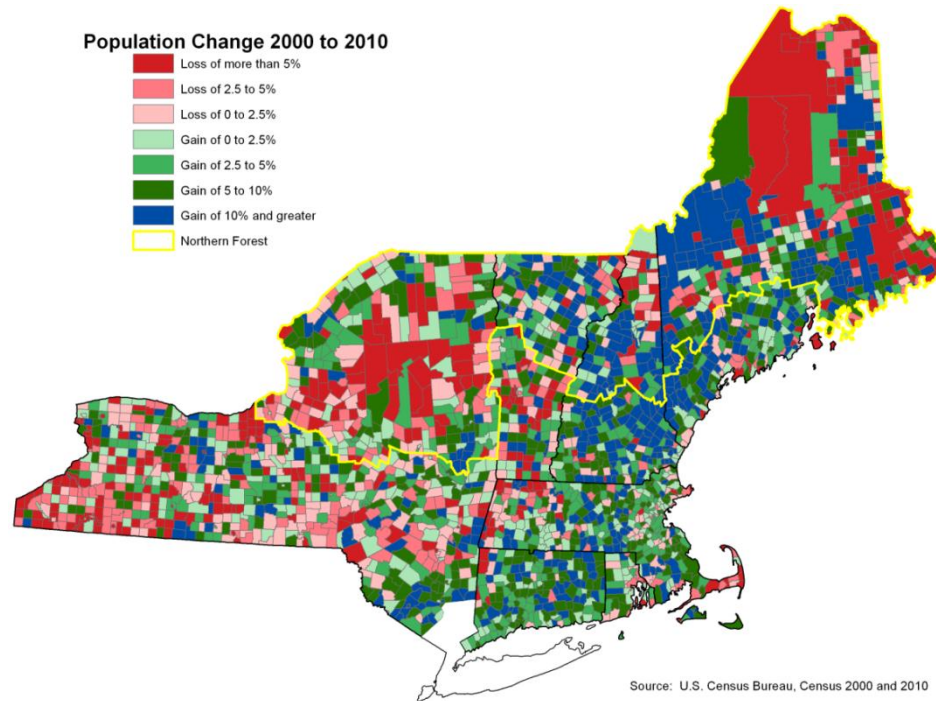


The significant demographic and housing density changes documented in this research have produced an extensive intermix of people and forest in the region that land managers must be cognizant of in planning for the future of the region, its people and institutions.

IMPLICATION AND APPLICATIONS: What does demographic analysis contribute to our understanding of the Northern Forest?

- Contributes to a better understanding of the role that population redistribution plays in the transformation of the Northern Forest
- Provides a comprehensive representation of the interplay between amenities and population concentration that together contribute to migration, population change and housing density shifts in the region
- Delineates differential patterns of population redistribution and housing density shifts which contributes to a better understanding of land use change and its implications for the working landscape.
- Analyzes migration and demographic change to provide a more comprehensive understanding of the social and economic changes that Northern Forest communities face in the future.
- Examines the linkage between recreation and migration, thereby contributing to quantifying and understanding the benefits and challenges that recreation and tourism provide to Northern Forest

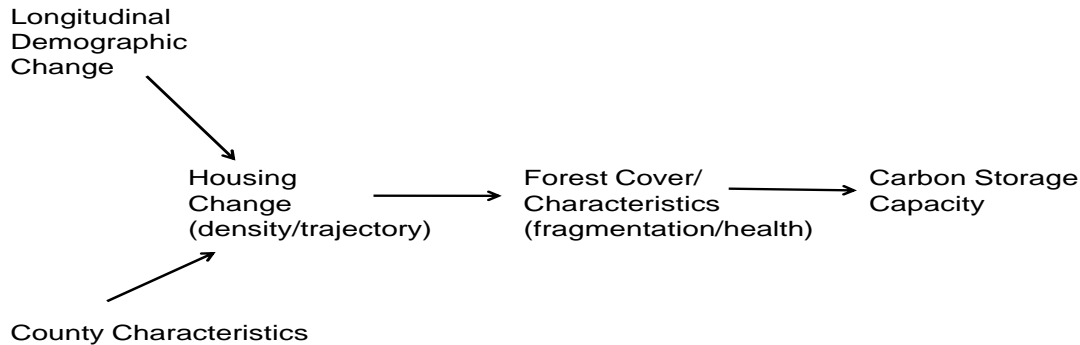
FUTURE DIRECTIONS: Next steps for demographic analysis



- Examine demographic trends in finer geographic detail.
 - County analysis was used here to obtain the longitudinal and demographic components of change data necessary to fulfill our objectives.
 - However, population redistribution trends are spatially differentiated within counties.
 - Finer scale analysis will provide a better understanding of these micro-level processes and more closely link demographic change to landscape change.

FUTURE DIRECTIONS: Next steps for demographic analysis

Hypothesized Influence of Demographic and Housing Change on Forest Cover and Characteristics and the Implications for Carbon Storage



- Examine linkage between demographic change, housing change and forest cover change
 - This project demonstrated the contribution of demographic analysis to a comprehensive overview of regional change.
 - The next step would be to more fully articulate the impact of demographic and housing density change on forest and land cover change.
- Combine demographic, housing and forest characteristics data to estimate forest carbon storage capacity
 - We hypothesize that demographic and housing trajectory data may supplement forest characteristic data to provide a more complete representation of the carbon storage capacity of forested areas in the Northern Forest

PRODUCTS

- **Publications**

- Mockrin, M.H., S.I. Stewart, V.C. Radeloff, R.B. Hammer and K.M. Johnson. 2011. “Spatial and Temporal Residential Density Patterns from 1940 to 2000 In and Around the Northern Forest of New England.” Conditional acceptance at *Population and Environment*.
- Johnson, K.M. and S.I. Stewart. 2012. “Demographic Trends in the Northern Forest.” *Carsey Institute Policy Brief*. In press (expected publication Spring 2012).

- **Grants**

- Johnson, K.M., S.I. Stewart and M.H. Mockrin. “Resource Management and 2010 Census Results: Analysis, Data and Insights.” Grant funded by the U.S.D.A Forest Service. (\$260,000). 2011-2015.
- Ducey, M.J. and K.M. Johnson. “Carbon in the Residential Forest: The Influence of Residential Density Patterns and Trajectories on Forest Characteristics of the Northern U.S.” Internal grant funded by Office of Senior Vice Provost for Research, University of New Hampshire. (\$45,000). 2010-2011.

PRODUCTS

- **Presentations**

- Johnson, K.M. 2011. “The Implications of Demographic Change for Resource Management in the Northern Forest.” Invited Presentation to the Northern States Research Cooperative Seminar, Burlington, VT. November, 2011.
- Mockrin, M.H, S.I. Stewart, V.C. Radeloff, R.B. Hammer. 2011. “Land Cover and Land Use in New England, 1940-2000.” Paper presented at Resilience 2011 Conference, Tempe, AZ. March, 2011.
- Susan I. Stewart. 2011. “Updating the WUI Maps: Changes, Issues and Results.” Presentation to Northeast Forest Fire Supervisors, U.S D.A. Forest Service. June, 2011. Traverse City, Michigan.
- Mockrin, M.H, S.I. Stewart, V.C. Radeloff, R.B. Hammer. 2011. “Land Cover and Housing Development in New England, 1940-2000.” Paper presented at the International Symposium on Society and Resource Management (ISSRM), Madison, WI. June, 2011.

PRODUCTS

- **Presentations**

- Johnson, K.M. and S.I Stewart. 2010. “Demographic Trends in the North Forest and Implications for the White Mountains National Forest.” Invited presentation to the Senior Management of the White Mountain National Forest. Campton, N.H. August, 2010.
- Mockrin, M. H., and S. I. Stewart. 2010. “Spatial and Temporal Patterns of Housing Development in and around the Northern Forest, 1940-2000. Presentation for American Association of Geographers Annual Meeting, Washington, DC.
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- Johnson, K.M. 2009. “Demographic Trends and Open Space in the Northeast and Midwest.” Invited Presentation to the Senior Leadership of the U.S. Forest Service at Chief’s Review of the East. Waterville Valley, N.H. June, 2009.