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# Long-Term Trends in Ecological Systems: A Basis for Understanding Responses to Global Change



# Contents

Contributors .....	VIII
Technical Consultants .....	X

## ***Introduction to Cross-Site Comparisons and History and Organization of the EcoTrends Project***

Chapter 1: Long-Term Trends in Ecological Systems: An Introduction to Cross-Site Comparisons and Relevance to Global Change Studies .....	1
Chapter 2: History and Organization of the EcoTrends Project .....	21

## ***Cross-Site Comparisons of Ecological Responses to Global Change Drivers***

Chapter 3: Cross-Site Comparisons of Ecological Responses to Climate and Climate-Related Drivers .....	28
Chapter 4: Cross-Site Comparisons of State-Change Dynamics .....	36
Chapter 5: Patterns of Net Primary Production Across Sites .....	42
Chapter 6: Cross-Site Comparisons of Precipitation and Surface Water Chemistry .....	46
Chapter 7: Cross-Site Comparisons of Ecological Responses to Long-Term Nitrogen Fertilization .....	51
Chapter 8: Long-Term Trends in Human Population Growth and Economy Across Sites .....	54
Chapter 9: Disturbance Regimes and Ecological Responses Across Sites .....	58
Chapter 10: Cross-Site Studies “By Design”: Experiments and Observations That Provide New Insights .....	72

## ***Long-Term Trends in Global Change Drivers and Responses at Site and Continental Scales***

Chapter 11: Long-Term Trends in Climate and Climate-Related Drivers .....	81
Chapter 12: Long-Term Trends in Precipitation and Surface Water Chemistry .....	115
Chapter 13: Long-Term Trends in Human Demography and Economy Across Sites .....	162
Chapter 14: Long-Term Trends in Production, Abundance, and Richness of Plants and Animals .....	191
Chapter 15: Management and Policy Implications of Cross- and Within-Site Long-Term Studies .....	206
Chapter 16: Recommendations for Data Accessibility .....	216
Chapter 17: Long-Term Research Across Sites, Ecosystems, and Disciplines: Synthesis and Research Needs .....	226

## ***Appendices***

Appendix 1: Site Descriptions .....	234
Appendix 2: Average (Standard Error) Maximum, Mean, and Minimum Air Temperature and Annual Precipitation at Each Site .....	312

Appendix 3: Average (Standard Error) Ice Duration, Sea Level, Streamflow, Water Clarity, and Water Temperature for Sites With Data .....	314
Appendix 4: Regression Coefficients and R <sup>2</sup> Values for Nine Climatic Variables for Which Linear Regression Against Time Is Significant (p < 0.05) .....	316
Appendix 5: Annual Average (Standard Error) Nitrogen (as Nitrate) From Various Sources at Sites With Data .....	319
Appendix 6: Regression Coefficients and R <sup>2</sup> Values for Nitrogen (as Nitrate) From Various Sources for Which Linear Regression Against Time Is Significant (p < 0.05) .....	321
Appendix 7: Annual Average (Standard Error) Nitrogen (as Ammonium) From Various Sources at Sites With Data .....	323
Appendix 8: Regression Coefficients and R <sup>2</sup> Values for Nitrogen (as Ammonium) From Various Sources for Which Linear Regression Against Time Is Significant (p < 0.05) .....	325
Appendix 9: Annual Average (Standard Error) Sulfur (as Sulfate) From Various Sources at Sites With Data .....	326
Appendix 10: Regression Coefficients and R <sup>2</sup> Values for Sulfur (Sulfate) From Various Sources for Which Linear Regression Against Time Is Significant (p < 0.05) .....	328
Appendix 11: Annual Average (Standard Error) Chloride From Various Sources at Sites With Data ..	330
Appendix 12: Regression Coefficients and R <sup>2</sup> Values for Chloride From Various Sources for Which Linear Regression Against Time Is Significant (p < 0.05) .....	332
Appendix 13: Annual Average (Standard Error) Calcium From Various Sources at Sites With Data ...	334
Appendix 14: Regression Coefficients and R <sup>2</sup> Values for Calcium From Various Sources for Which Linear Regression Against Time Is Significant (p < 0.05) .....	336
Appendix 15: Human Population and Economy Variables in 2000 for the Focal County of Each Site, as Grouped by Ecosystem Type .....	338
Appendix 16: Annual Average (Standard Error) Aboveground Net Primary Production (ANPP) at Sites With Data .....	341
Appendix 17: Other Measures of Average (Standard Error) Terrestrial Production at Sites With Data..	343
Appendix 18: Average (Standard Error) Aquatic Production at Sites With Data .....	344
Appendix 19: Average (Standard Error) Biomass of Primary Producers (Plants, Algae) for Sites With Data .....	345
Appendix 20: Average (Standard Error) Plant Species Richness for Sites With Data .....	347
Appendix 21: Average (Standard Error) Animal Abundance for Sites With Data .....	349
Appendix 22: Average (Standard Error) Animal Species Richness for Sites With Data .....	352
Appendix 23: Regression Coefficients and R <sup>2</sup> Values for Plant and Animal Variables for Which Linear Regression of Each Variable Against Time Is Significant (p < 0.05) and the Trend Appears Linear .....	353
Appendix 24: Lead Principal Investigator(s) (PI), Information Managers (IM), and Administrative Program of the LTER Programs .....	355
Appendix 25: Researchers Involved in the EcoTrends Project at Non-LTER Sites .....	359

Appendix 26: List of Stations and Length of Record for Each Climate Variable by Site .....	362
Appendix 27: List of Stations and Length of Record for Each Precipitation or Surface Water Chemistry Variable by Site .....	367
Appendix 28: List of Stations and Length of Record for Each Plant and Animal Variable by Site, as Grouped by Ecosystem Type .....	371
Index .....	i

## Chapter 13

# Long-Term Trends in Human Demography and Economy Across Sites

In this chapter, we first describe the methods used to obtain data on human populations and the variables used in this report. We then show graphs of human population and economic data by county for each site, as well as summary maps at the continental scale. Scientific hypotheses and the rationale for comparing these data can be found in chapter 8.

### Methods of Obtaining Data and Selection of Variables

In the United States, the Census Bureau and the USDA National Agricultural Statistics Service are the original sources for many long-term population and economic data. These data are available online directly ([www.census.gov](http://www.census.gov)) or through separate initiatives, such as the Inter-University Consortium for Political and Social Research (<http://www.icpsr.umich.edu/icpsrweb/> ICPSR/ ). Since 1790, the Census Bureau has collected information every 10 years on the population and economic characteristics of the country. Sites east of the Appalachian Mountains typically have census data from 1790; most areas west of the Rocky Mountains have data starting after 1860, and Alaska has data since 1970. Because of funding constraints, we focused on collecting key population and economic variables for counties selected to represent each site. Census data are not available for sites in Antarctica or French Polynesia; thus a total of 47 sites are included in the current analysis (table 13-1). Scientists at each site provided the names of counties associated with their site that, in most cases, went beyond the boundaries of the research site per se.

We tabulated census data for three population variables for each county in each year of the census: total population, the percentage of the population living in urban areas, and the density of people in the county (number of people per km<sup>2</sup>). Because counties differ in their area covered, the total population size of a county in a year was divided by the county area to obtain an average density value for that year. We also tabulated

economic variables for each county—percentage of the population employed by one of four economic sectors: commercial industries, farming, manufacturing, and service industries. Data for these variables are also available on the EcoTrends website (<http://www.ecotrends.info>) and on an associated website (<http://coweeta.ecology.uga.edu/trends/>).

### Graphs Showing Long-Term Trends

We display the long-term data in two ways to show change through time across a range of spatial scales for each variable. First, we provide a summary of the data at the continental scale using maps that show either the change in total population for four time periods (1800 to 1850, 1850 to 1900, 1900 to 1950, and 1950 to 2000) or the percentage of the population that was urban at the end of each of the four time periods (1850, 1900, 1950, 2000). Following the continental maps, we show site-scale data through time using five panels: (1) a map showing the location of the counties associated with the site, (2) total population by county, (3) percentage of the population that was urban in each county, (4) population density by county, and (5) percentage of the population in each economic sector in the focal county where the site resides. The site graphs are organized by ecosystem type to allow comparisons of sites in the same type. For the 2000 census, total population, population density, urban percentage of the population, and percentage of the population in each economic sector in the focal county can be found in appendix 15.

### Summary

Several trends are noticeable at the continental scale. The settlement of the country progressed from the east coast and then jumped to the west coast by 1900, and then to the interior between 1900 and 1950 (figure 13-1). The Midwest lost population between 1950 and 2000. Most areas of the country had a high percentage of urban population by 1950 (figure 13-2). Urbanization continued for most of the country until 2000 with the Northeast, Appalachian Mountains, and northern Wisconsin providing notable exceptions.

**Table 13-1. Counties selected to represent each site used in the analysis of population and economic data**

(The focal county based on the location of the research site is in bold. Additional counties for some sites are available on the EcoTrends website at <http://www.ecotrends.info>.)

Site code	State	Counties
AND	OR	Benton, Deschutes, Douglas, <b>Lane</b> , Linn
ARC	AK	<b>North Slope Borough</b>
BEN	NC	<b>Buncombe</b>
BES	MD	Anne Arundel, <b>Baltimore City</b> , Baltimore County, Carroll, Howard
BLA	CA	<b>Lassen</b>
BNZ	AK	<b>Fairbanks North Star Borough</b>
CAP	AZ	<b>Maricopa</b> , Pinal
CCE	CA	Los Angeles, Orange, <b>San Diego</b> , Ventura
CDR	MN	<b>Anoka</b> , Hennepin, Isanti
CHE	OR	Lincoln, <b>Tillamook</b>
CRO	AR	<b>Ashley</b>
CSP	CA	<b>Mendocino</b>
CWT	GA	Rabun, Towns
	NC	Clay, Jackson, <b>Macon</b>
EOA	OR	<b>Harney</b>
FCE	FL	Broward, Collier, <b>Miami-Dade</b> , Monroe, Palm Beach
FER	WV	<b>Tucker</b>
FRA	CO	<b>Grand</b>
FTK	MT	<b>Custer</b>
GCE	GA	Bryan, Camden, Glynn, Liberty, <b>McIntosh</b>
GLA	WY	<b>Albany</b> , Carbon
GRL	OK	Caddo, Comanche, <b>Grady</b>
GSW	TX	<b>Bell</b> , Falls, McLennan
HAR	MS	<b>Harrison</b> , Stone
HBR	NH	<b>Grafton</b>
HFR	MA	Berkshire, Franklin, Hampden, Hampshire, <b>Worcester</b>
JRN	NM	<b>Doña Ana</b>
KBS	MI	Allegan, Barry, Calhoun, Eaton, <b>Kalamazoo</b>
KNZ	KS	Geary, Morris, Pottawatomie, <b>Riley</b> , Wabaunsee
LUQ	PR	Ceiba, Fajardo, Luquillo, Naguabo, <b>Rio Grande</b>

**Table 13-1. Counties selected to represent each site used in the analysis of population and economic data—Continued**

<b>Site code</b>	<b>State</b>	<b>Counties</b>
LVW	CO	Boulder, Grand, <b>Larimer</b>
MAR	MN	<b>Itasca</b>
MCM <sup>1</sup>		No data
MCR <sup>2</sup>		No data
NTL	WI	<b>Dane</b> , Oneida, Vilas
NWT	CO	<b>Boulder</b>
PAL <sup>1</sup>		No data
PIE	MA	<b>Essex</b> , Middlesex
PRI	ID	<b>Bonner</b>
RCE	ID	<b>Owyhee</b>
SAN	SC	<b>Berkeley</b>
SBC	CA	<b>Santa Barbara</b>
SEV	NM	Bernalillo, Sandoval, <b>Socorro</b> , Valencia
SGS	CO	<b>Weld</b>
	WY	Laramie
SPR	OK	<b>Woodward</b>
SRE	AZ	<b>Pima</b> , Santa Cruz
TAL	MS	<b>Lafayette</b>
VCR	VA	Accomack, <b>Northampton</b>
WBW	TN	Anderson, Loudon, <b>Roane</b>
WGE	AZ	Pima, <b>Santa Cruz</b>
WIN	WA	<b>Skamania</b>

<sup>1</sup> MCM and PAL are located in Antarctica.

<sup>2</sup> MCR is located at the island of Moorea in French Polynesia.

A Basis for Understanding Responses to Global Change

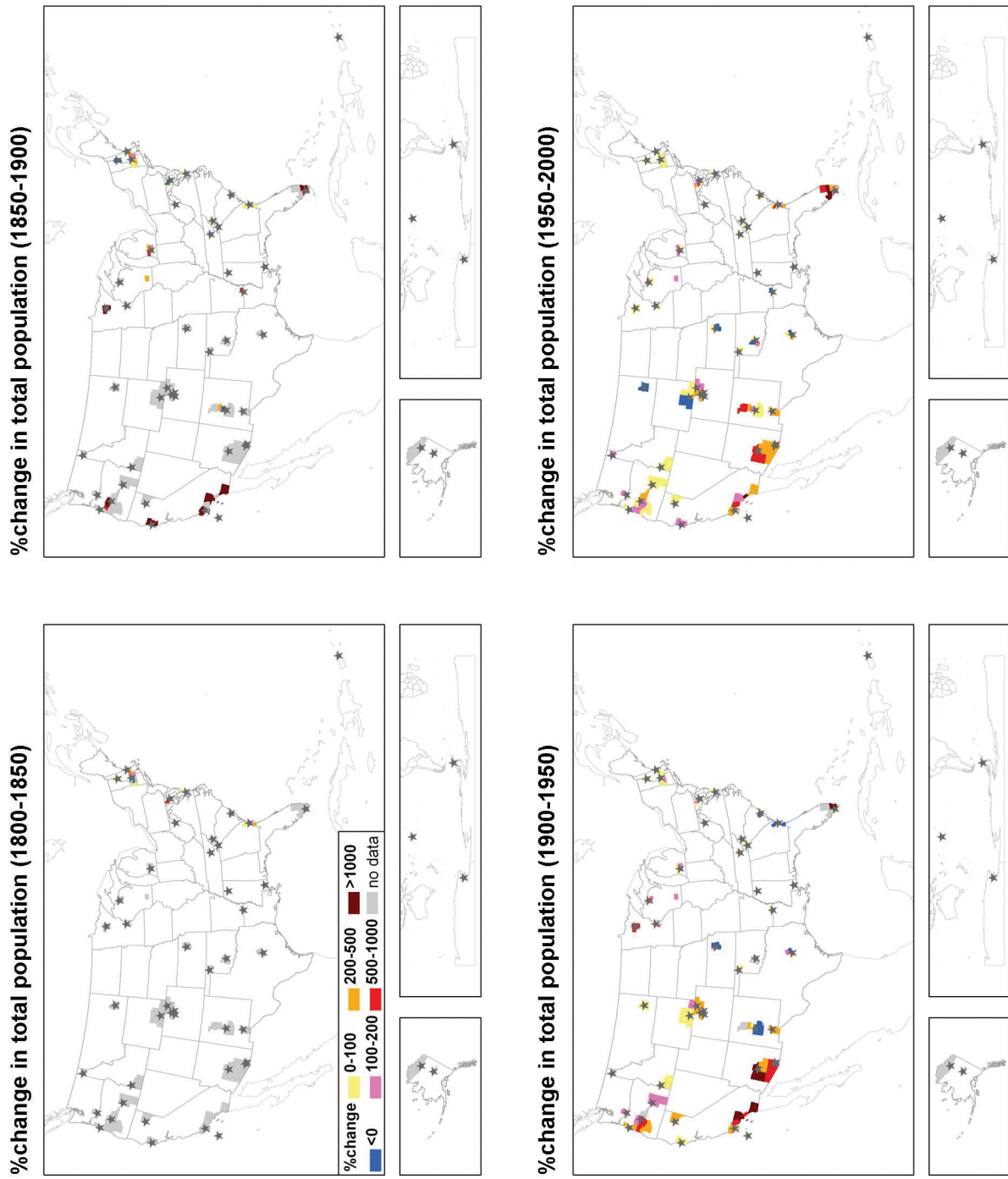


Figure 13-1. Continental pattern of percentage change in total population over time by county calculated as [(year 2 - year 1)/year 1] x 100 for 4 time periods: 1800-1850, 1850-1900, 1900-1950, and 1950-2000. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.



Long-Term Trends in Ecological Systems:

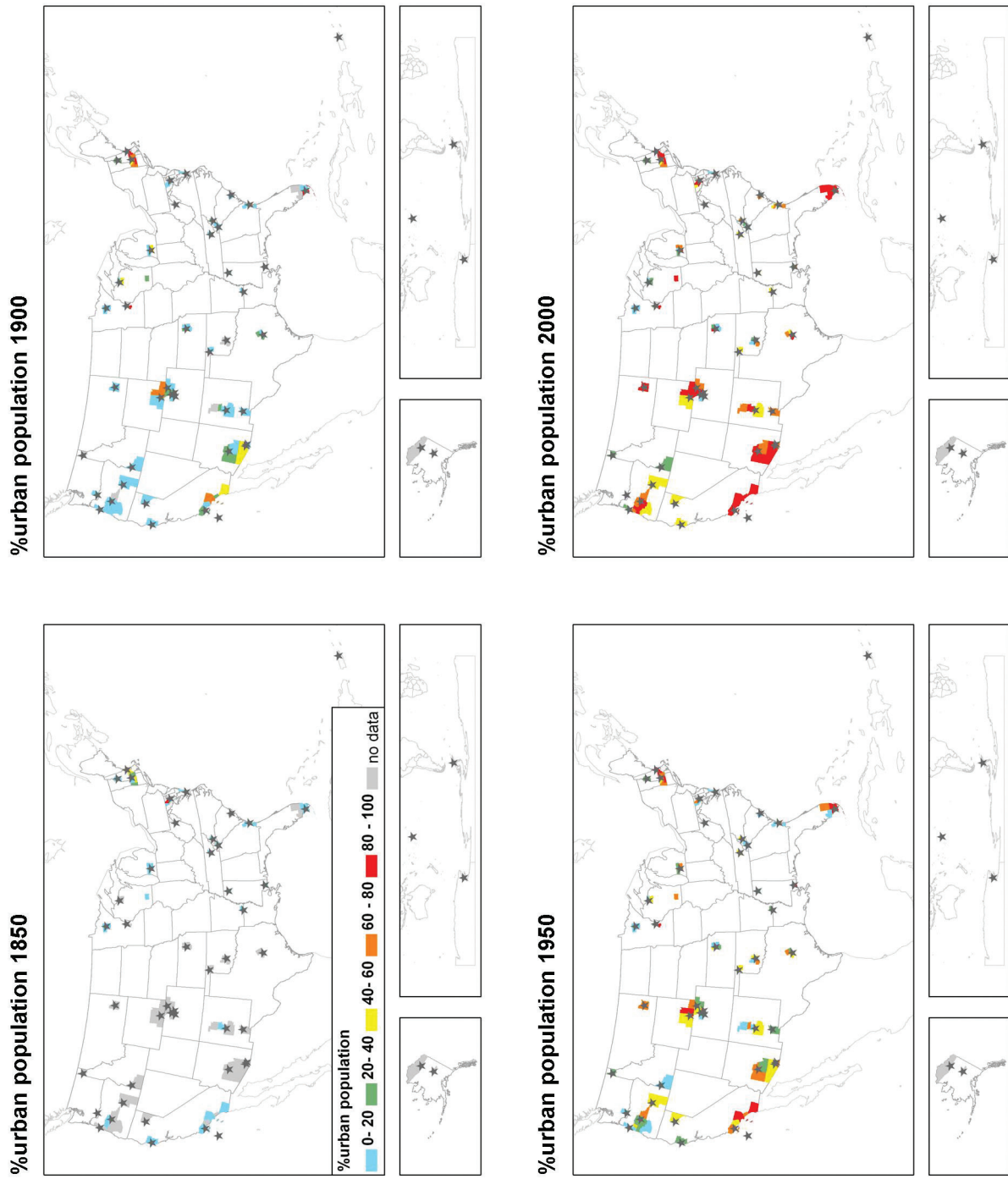
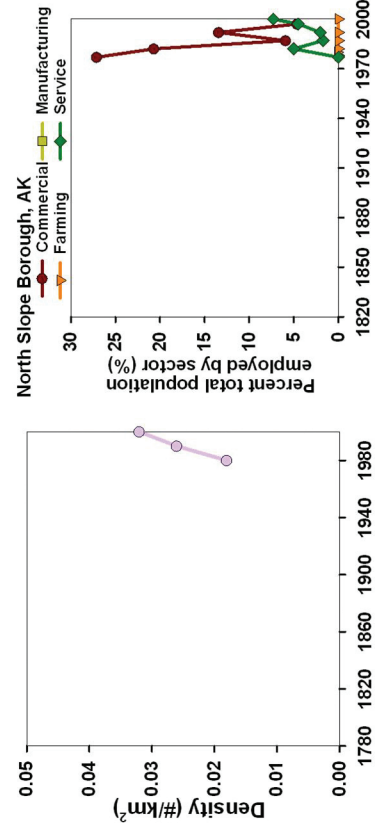
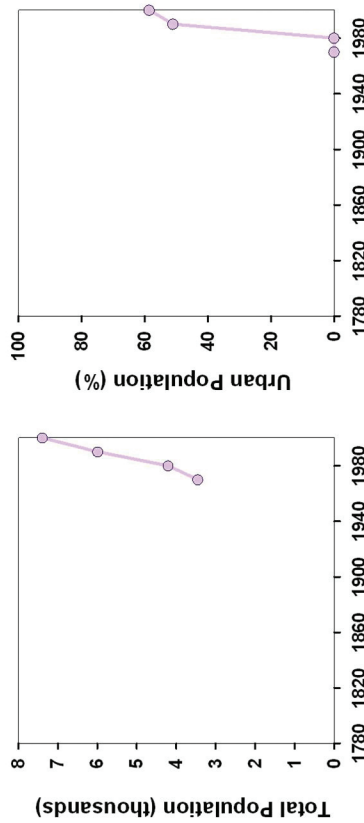


Figure 13-2. Continental pattern of percentage urban population by county over time calculated as (number of people living in urban areas / total number of people) × 100 in 1850, 1900, 1950, and 2000. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.

Arctic (ARC)



Glacier Lakes (GLA)

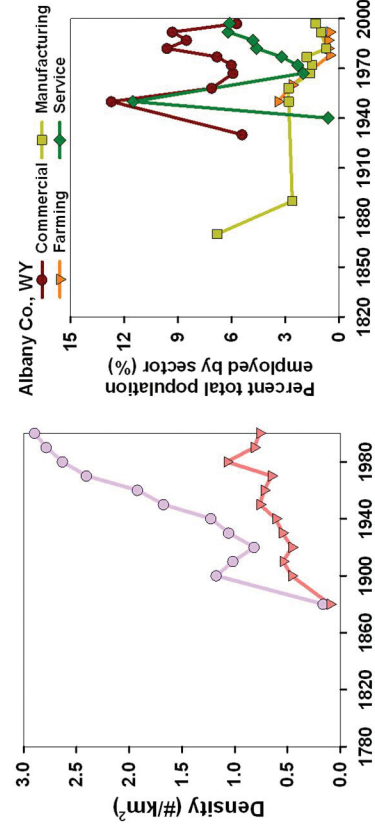
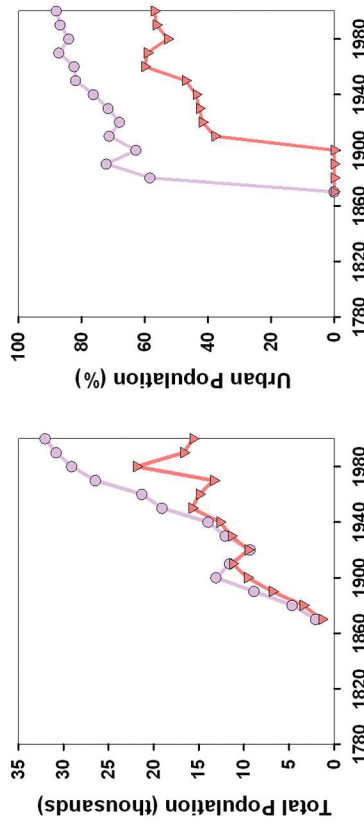
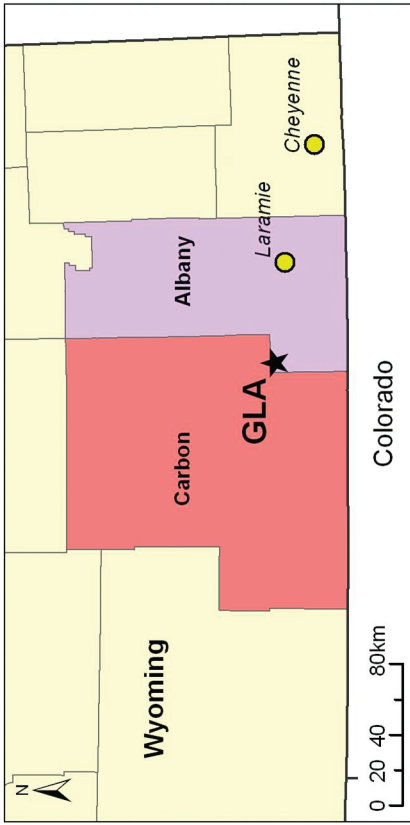
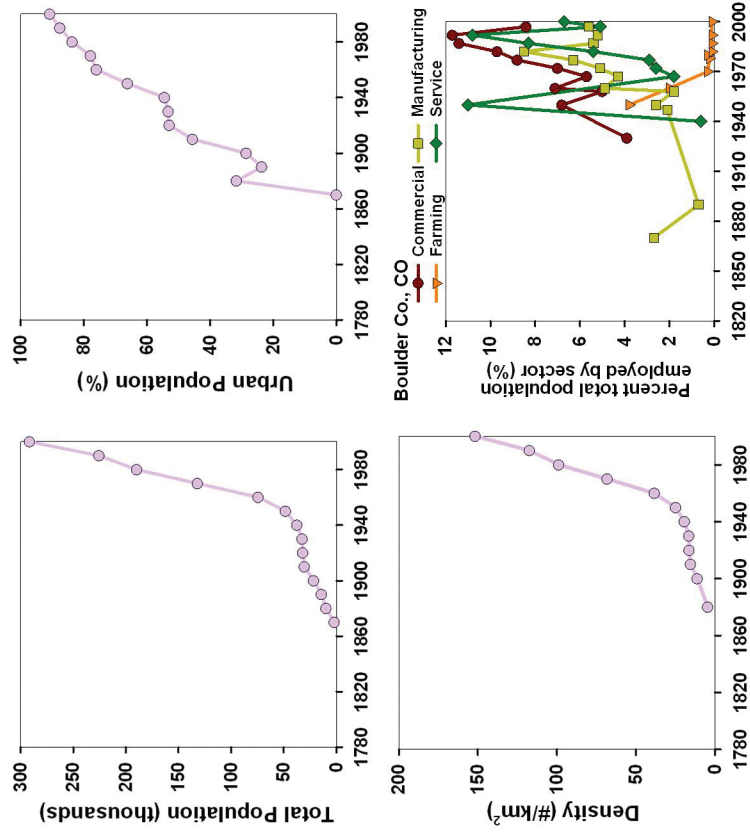


Figure 13-3 (Alpine and Arctic sites) continued next page.

Niwot Ridge Research Area (NWT)



Loch Vale Watershed (LVW)

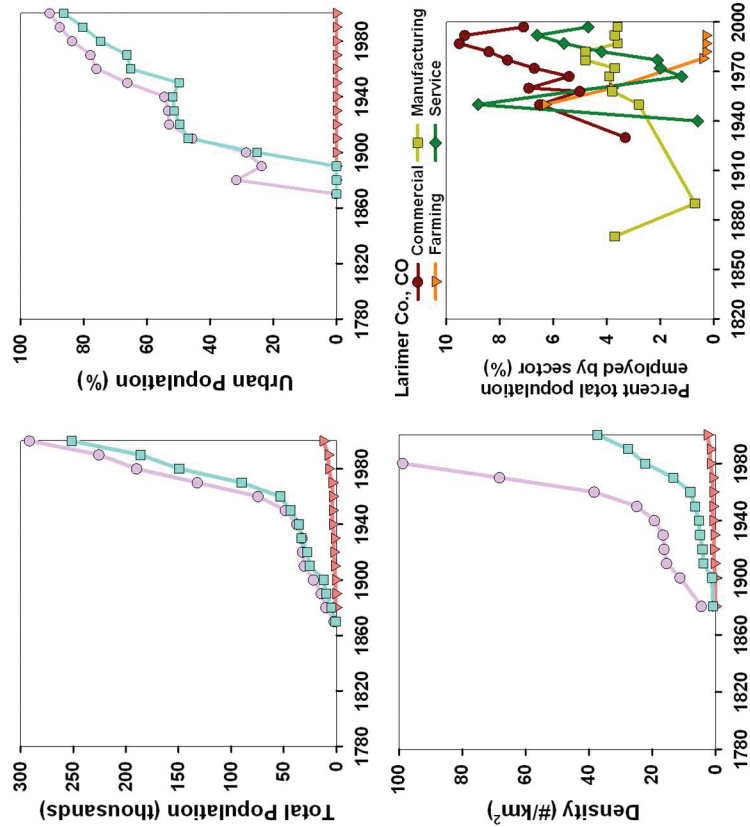
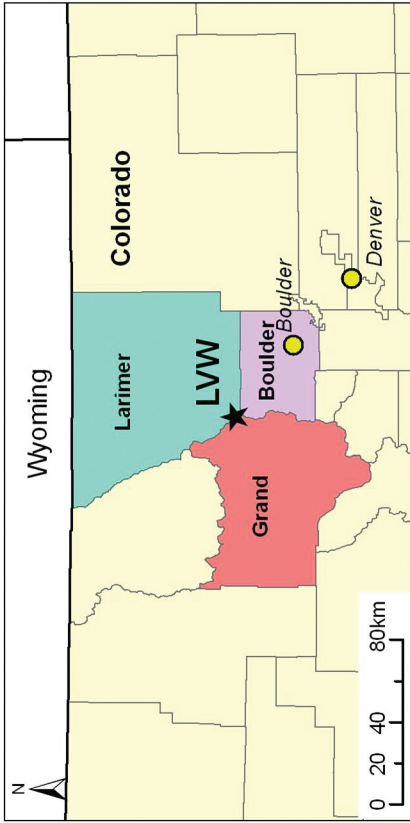
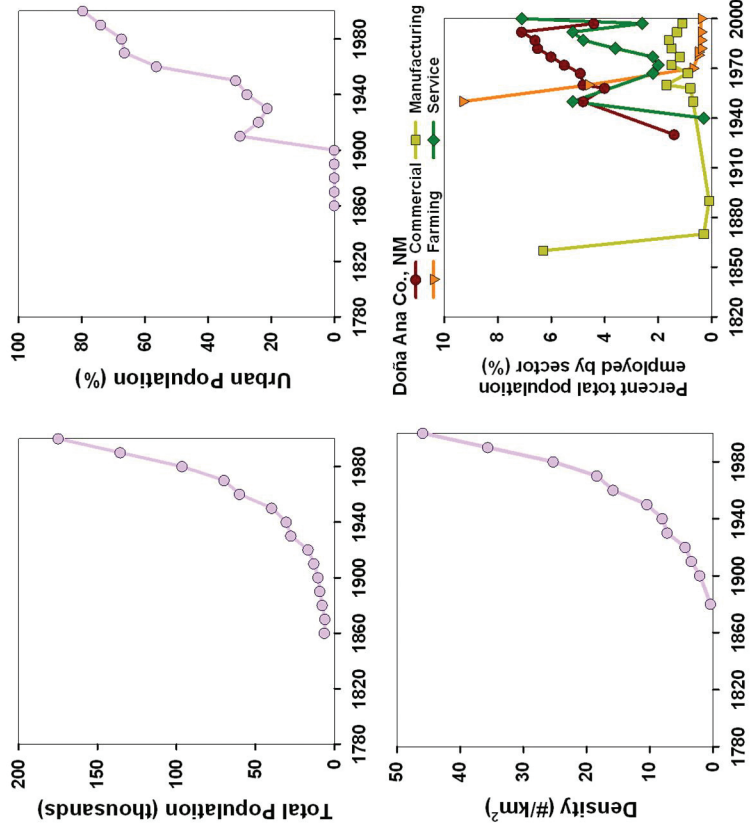
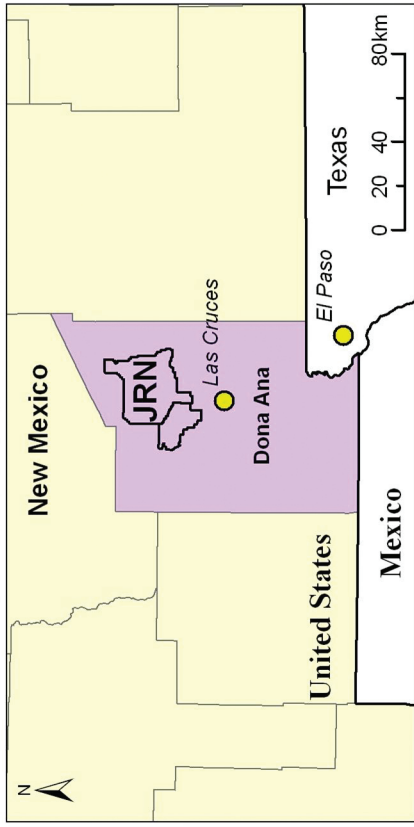


Figure 13-3. Trends for each alpine and arctic site: map of counties associated with the site (top left), total population size (top right), percentage urban population (top right), and population density (bottom left) in each county for the site; and percentage of total population employed by four sectors in the focal county for the site (bottom right). There are no data available for McMurdo Dry Valleys (MCM). Color of county corresponds with line color in the graphs. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.

**Jornada (JRN)**



**Eastern Oregon Agricultural Research Center (EOA)**

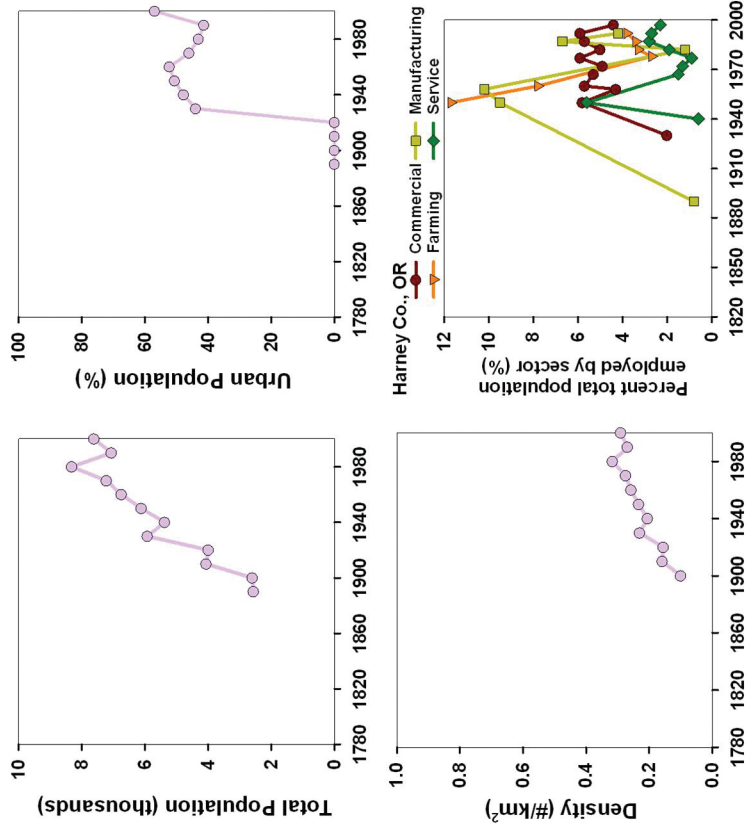
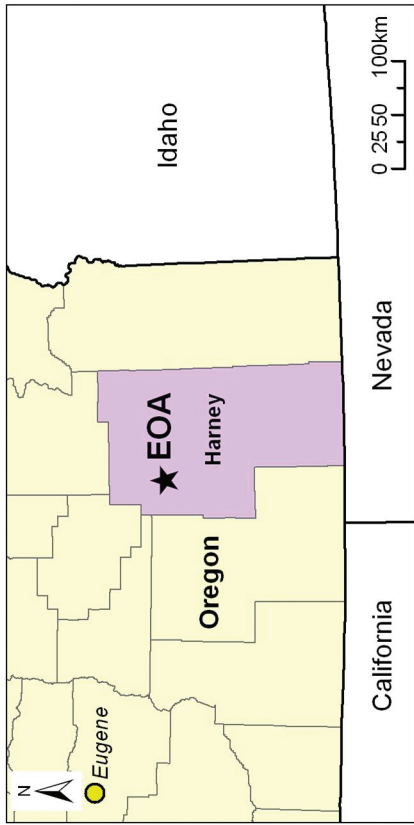
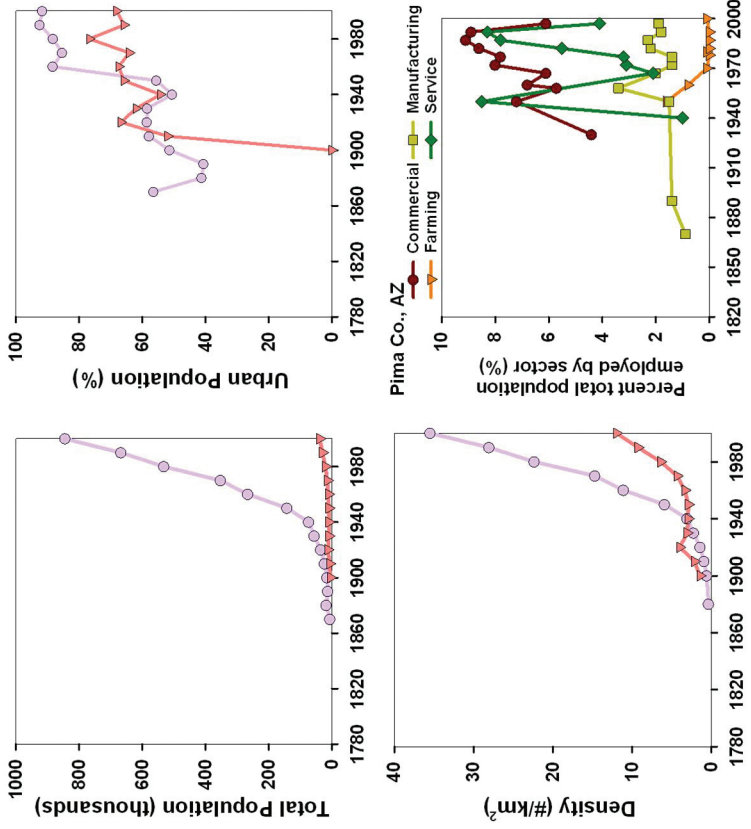
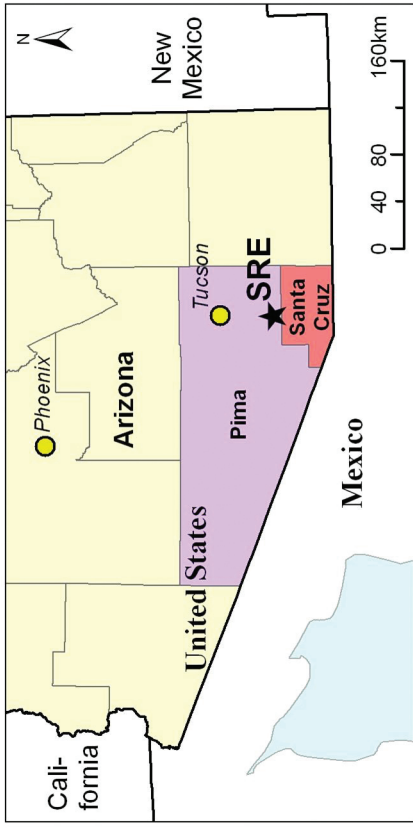


Figure 13-4 (aridland sites) continued next page.

**Santa Rita Experimental Range (SRE)**



**Reynolds Creek Experimental Watershed (RCE)**

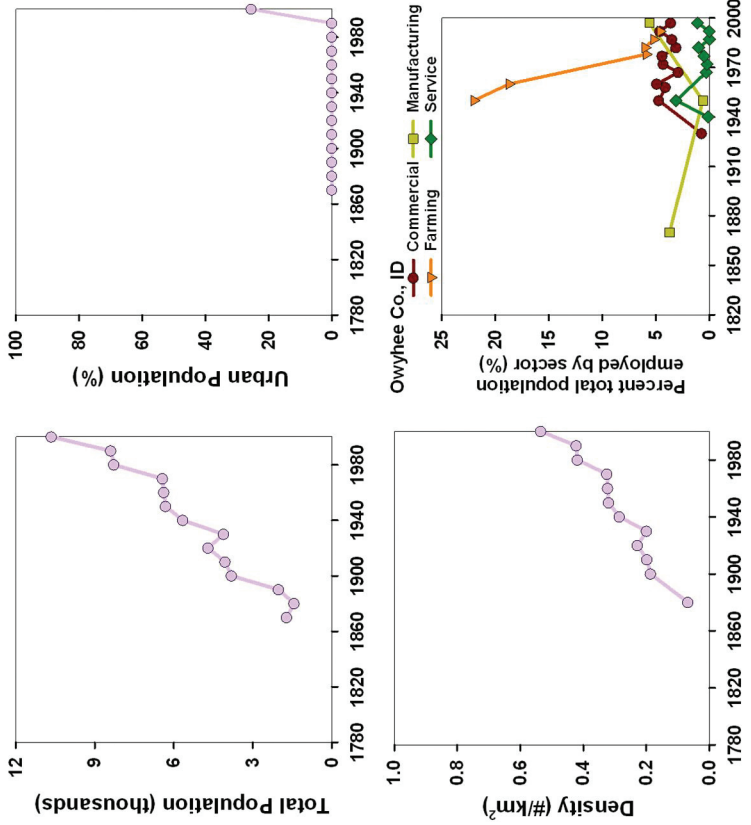
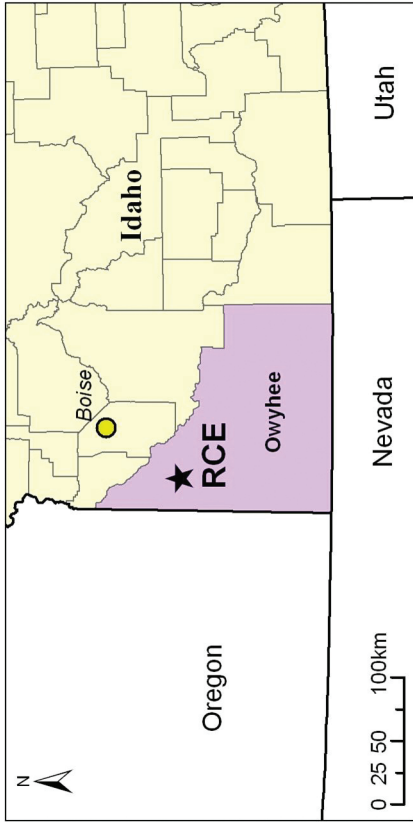
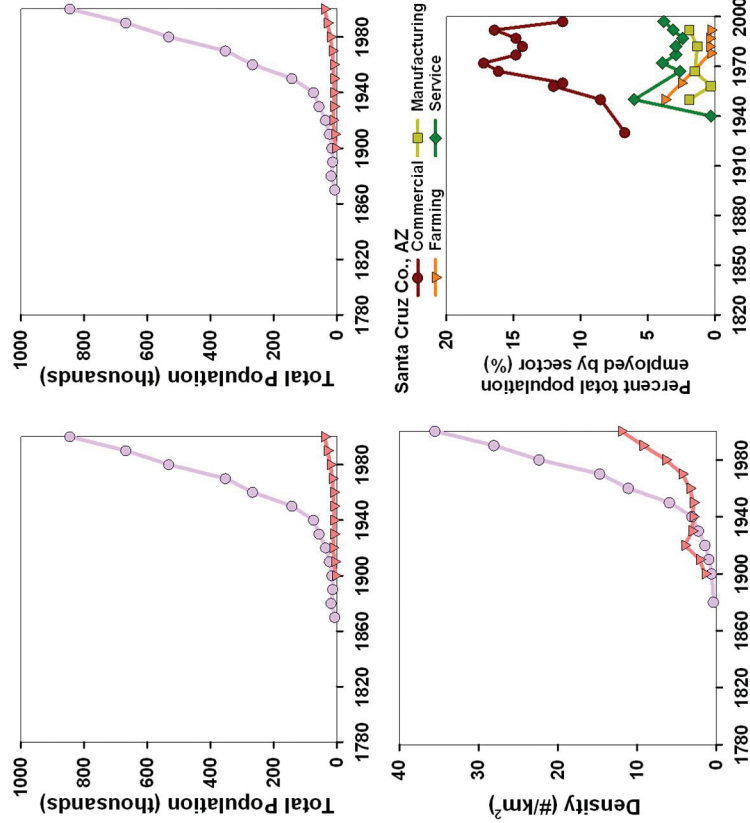
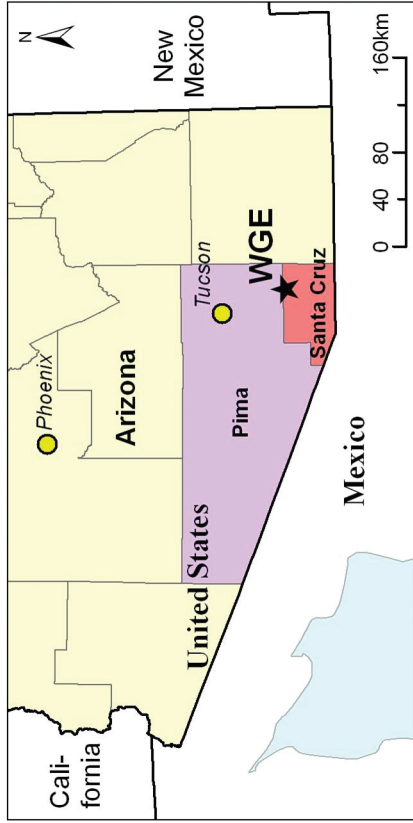


Figure 13-4 (aridland sites) continued next page.

Walnut Gulch Experimental Watershed (WGE)



Sevilleleta (SEV)

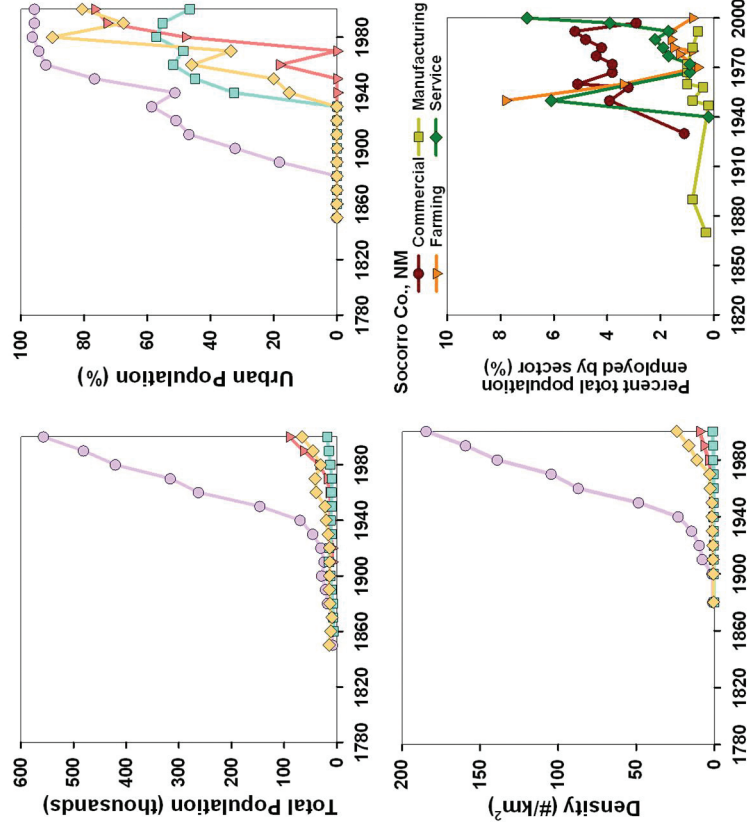
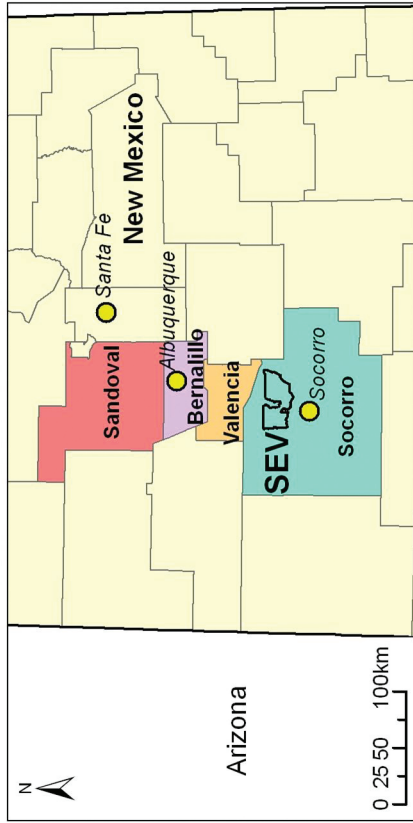
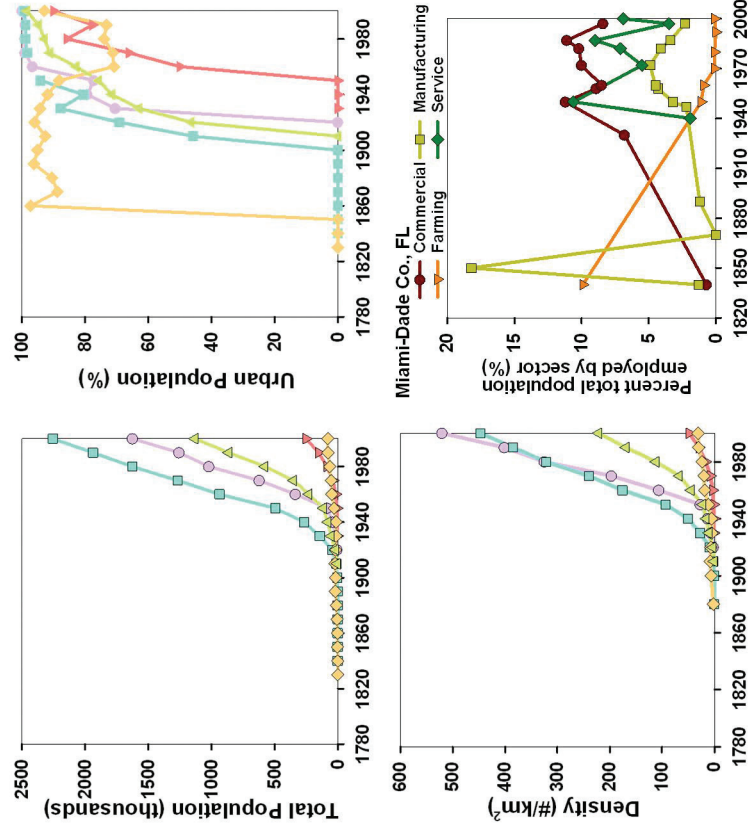
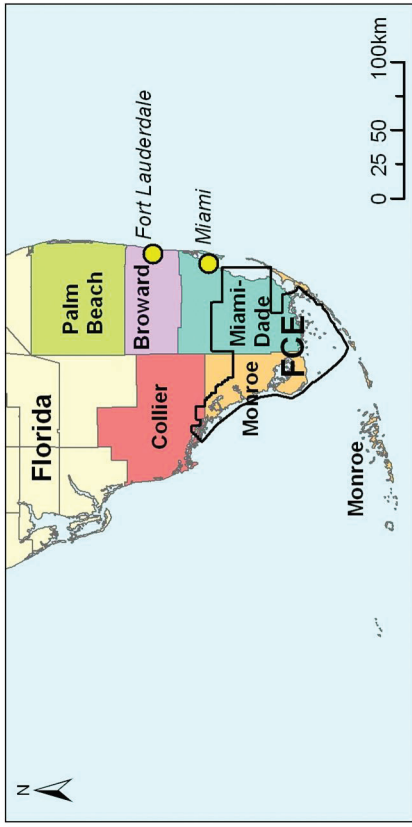


Figure 13-4. Trends for each aridland site: map of counties associated with the site (top), total population size (top left), percentage urban population (top right), and population density (bottom left) in each county for the site; and percentage of total population employed by four sectors in the focal county for the site (bottom right). The Sevilleleta site (SEV) also includes the middle Rio Grande riparian area from northern to central New Mexico. Color of county corresponds with line color in the graphs. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.

**Florida Coastal Everglades (FCE)**



**California Current Ecosystem (CCE)**

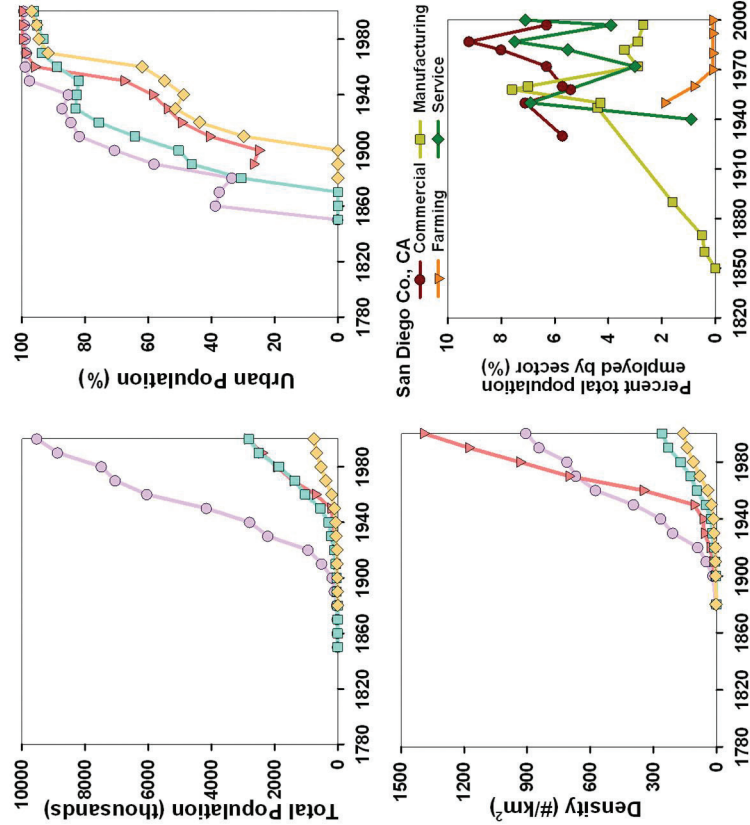
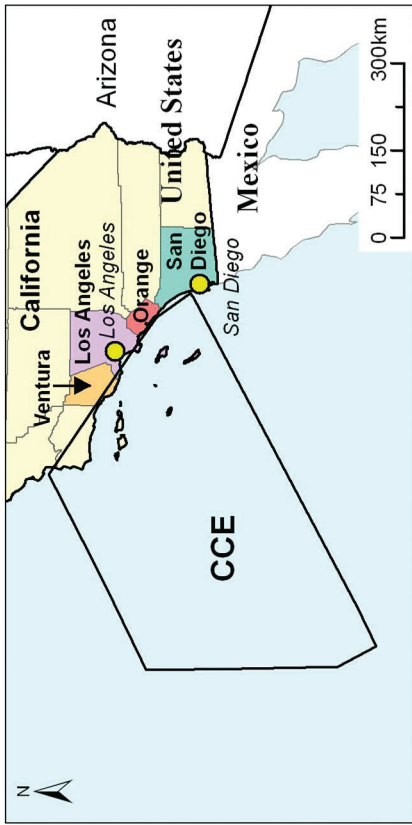
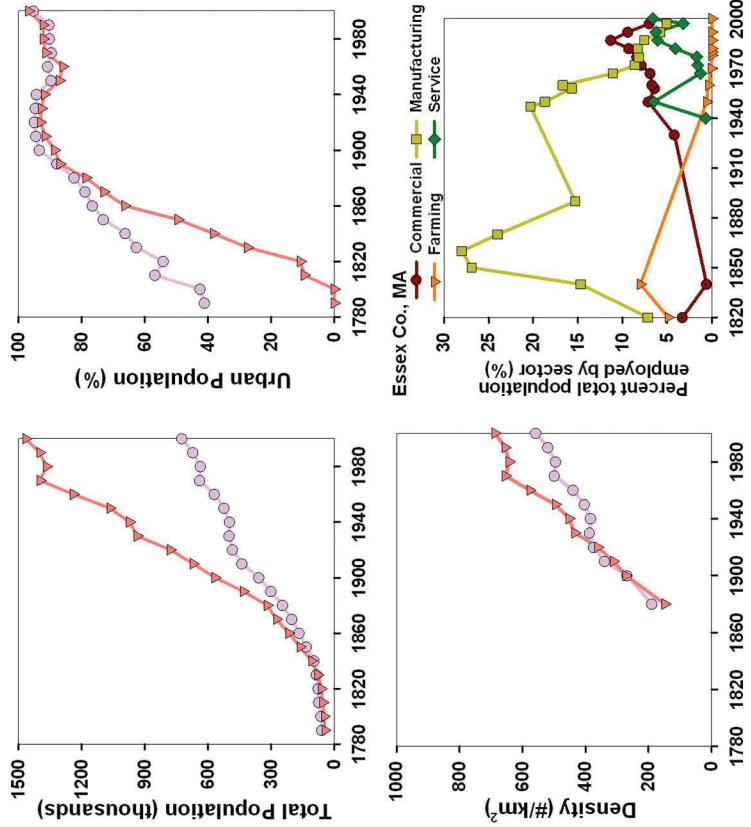
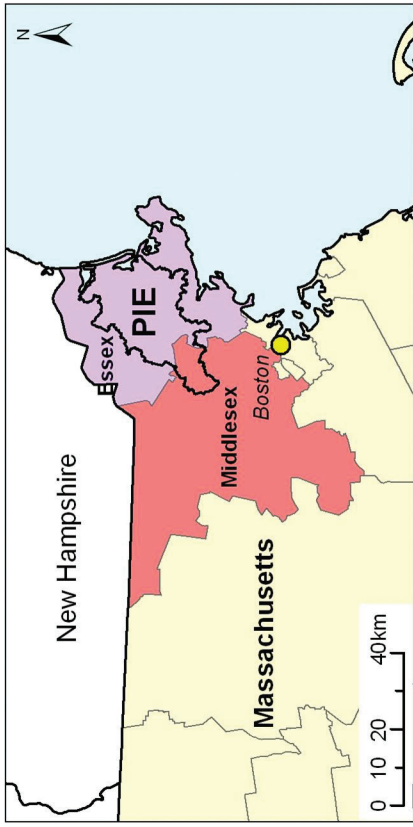


Figure 13-5 (coastal sites) continued next page.

**Plum Island Ecosystems (PIE)**



**Georgia Coastal Ecosystems (GCE)**

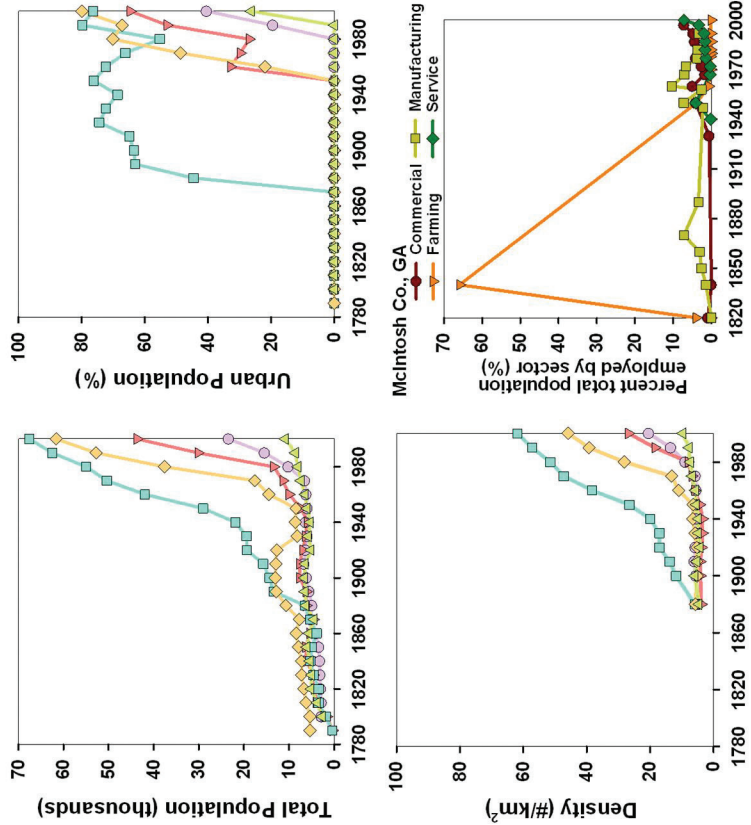
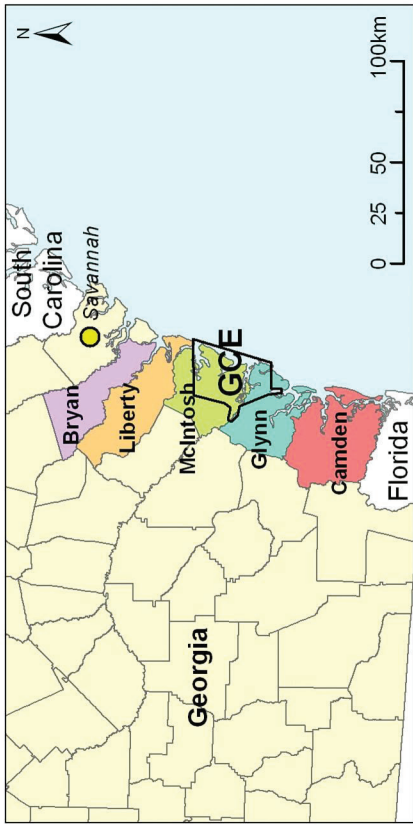
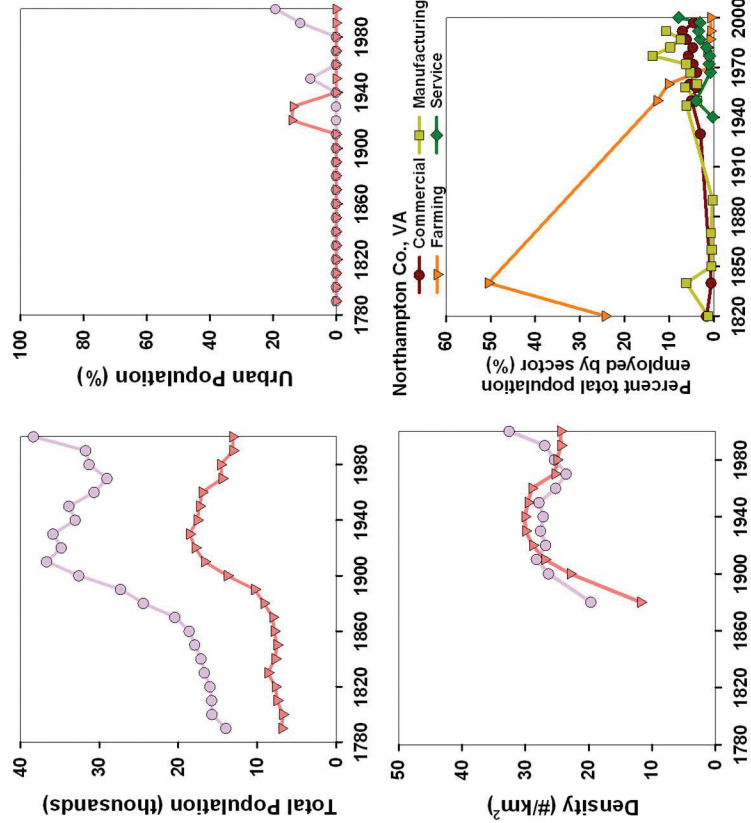
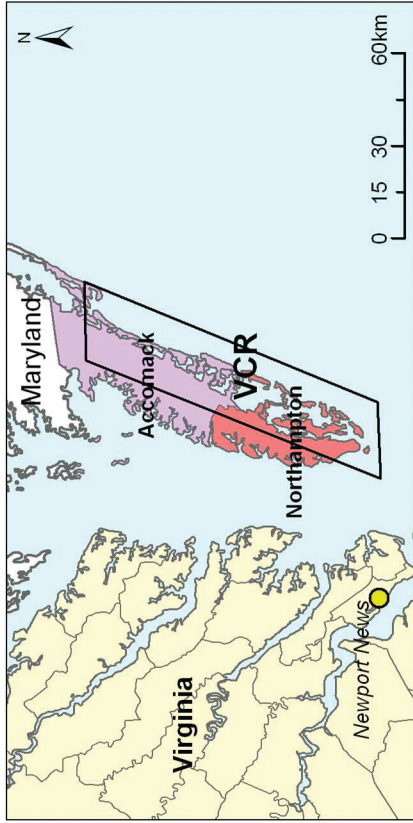


Figure 13-5 (coastal sites) continued next page.



Virginia Coast Reserve (VCR)



Santa Barbara Coastal (SBC)

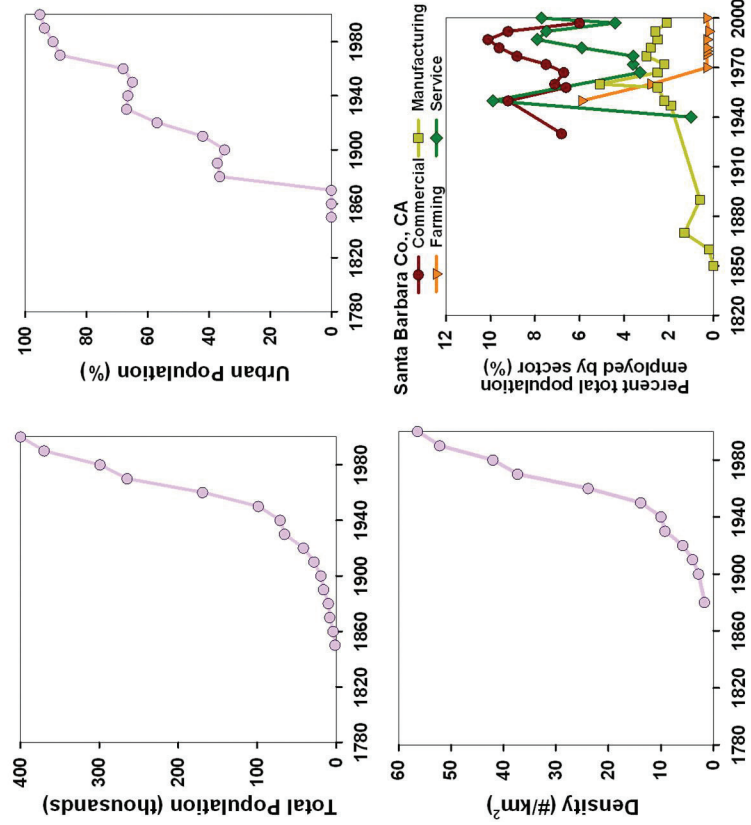
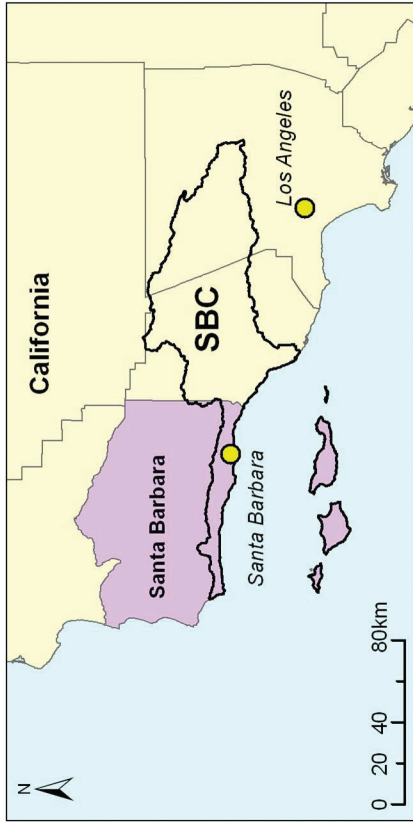
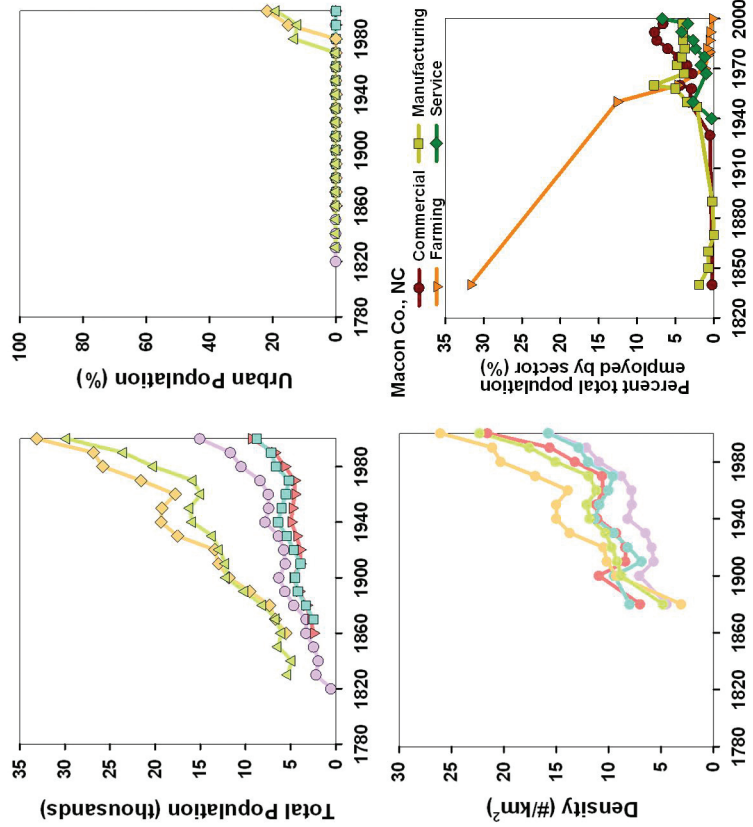
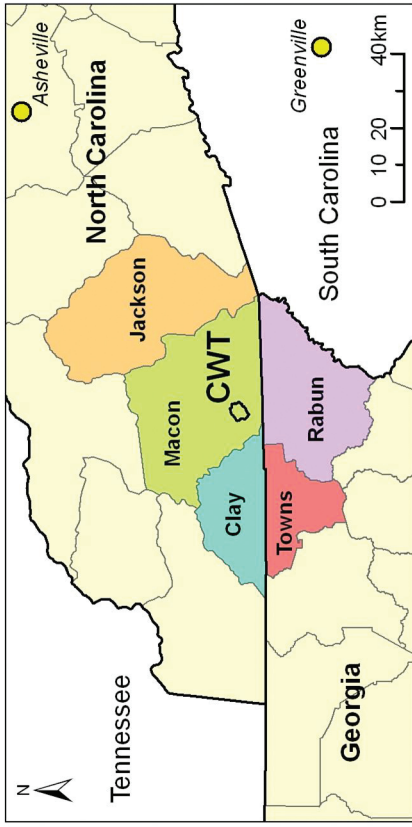


Figure 13-5. Trends for each coastal site: map of counties associated with the site (top), total population size (top left), percentage urban population (top right), and population density (bottom left) in each county for the site; and percentage of total population employed by four sectors in the focal county for the site (bottom right). There are no data available for Moorea Coral Reef (MCR) and Palmer Station (PAL). Color of county corresponds with line color in the graphs. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.

# A Basis for Understanding Responses to Global Change

## Coweeta (CWT)



## Bent Creek Experimental Forest (BEN)

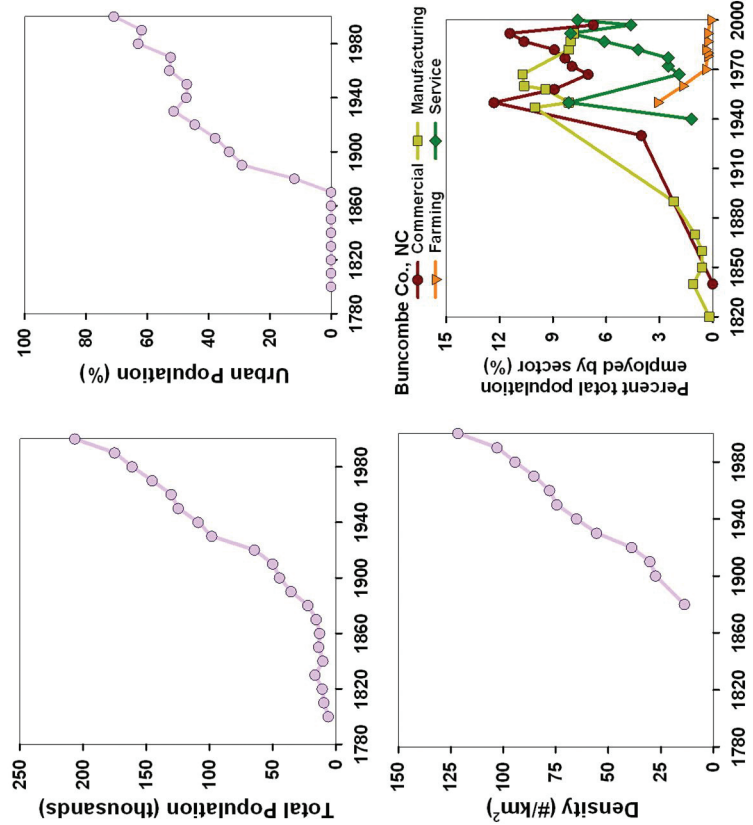
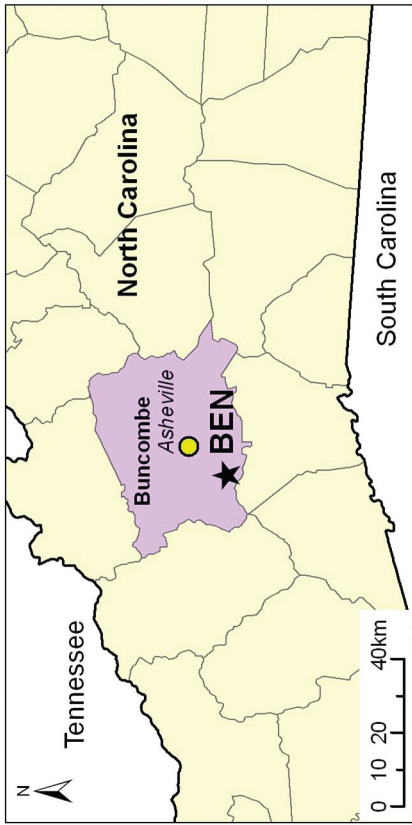
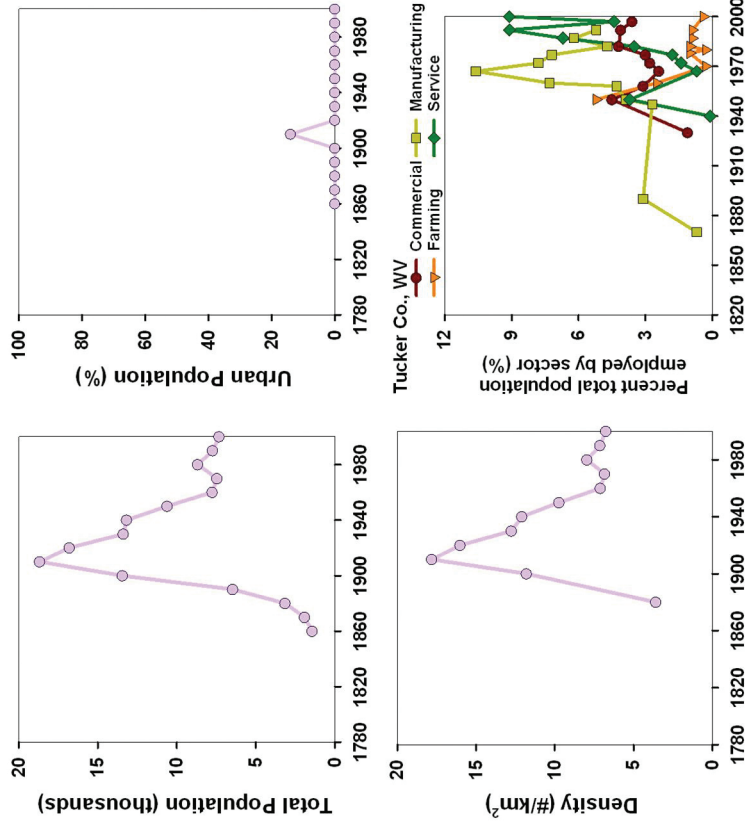
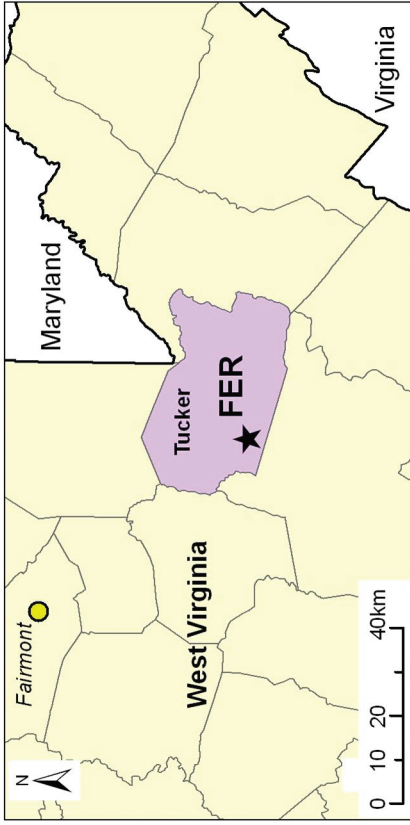


Figure 13-6 (eastern forest sites) continued next page.

Long-Term Trends in Ecological Systems:

Fernow Experimental Forest (FER)



Crossett Experimental Forest (CRO)

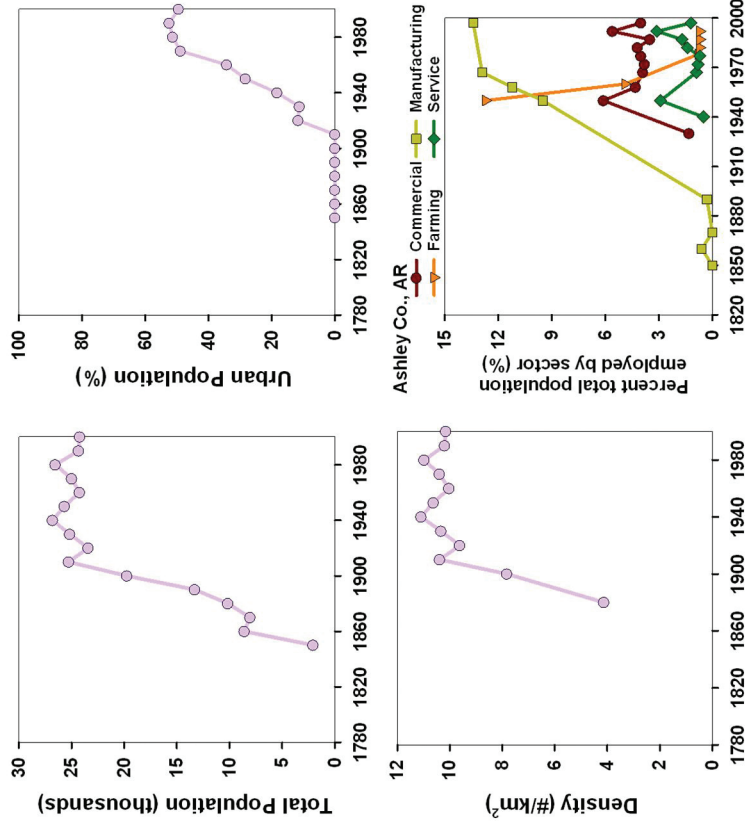
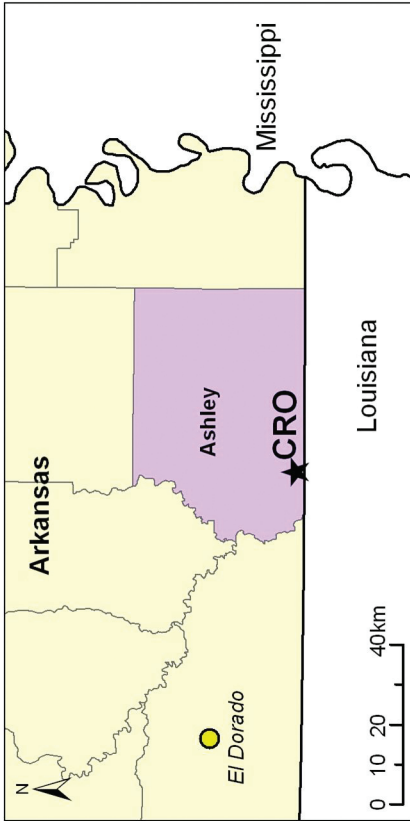
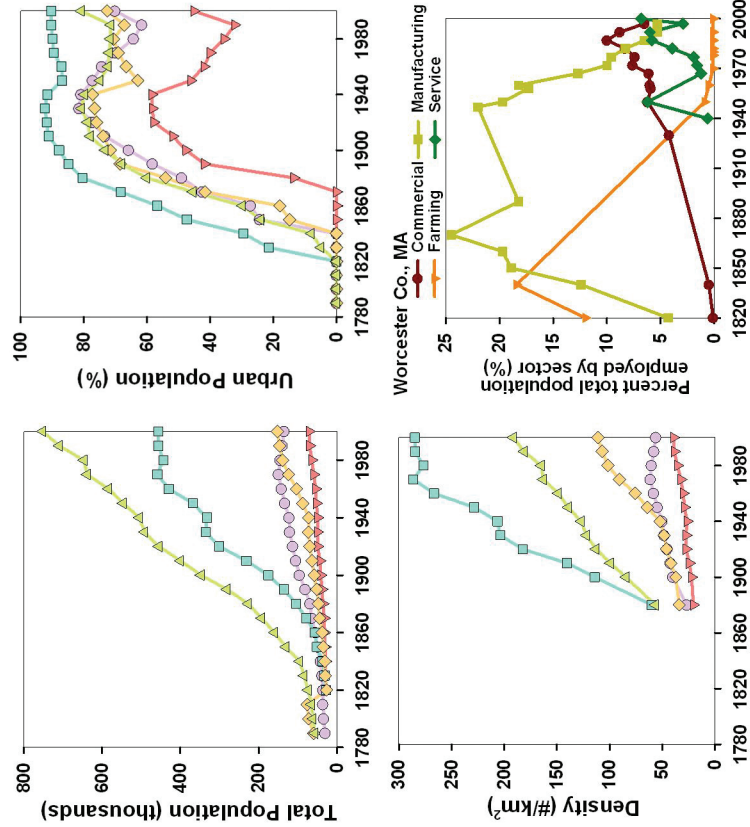
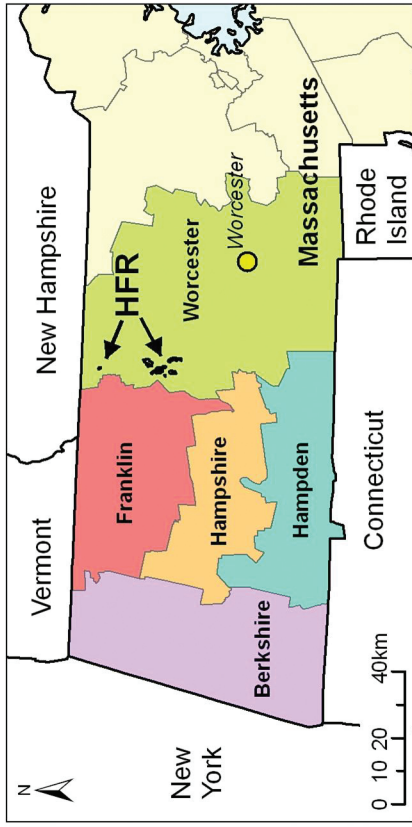


Figure 13-6 (eastern forest sites) continued next page.

Harvard Forest (HFR)



Harrison Experimental Forest (HAR)

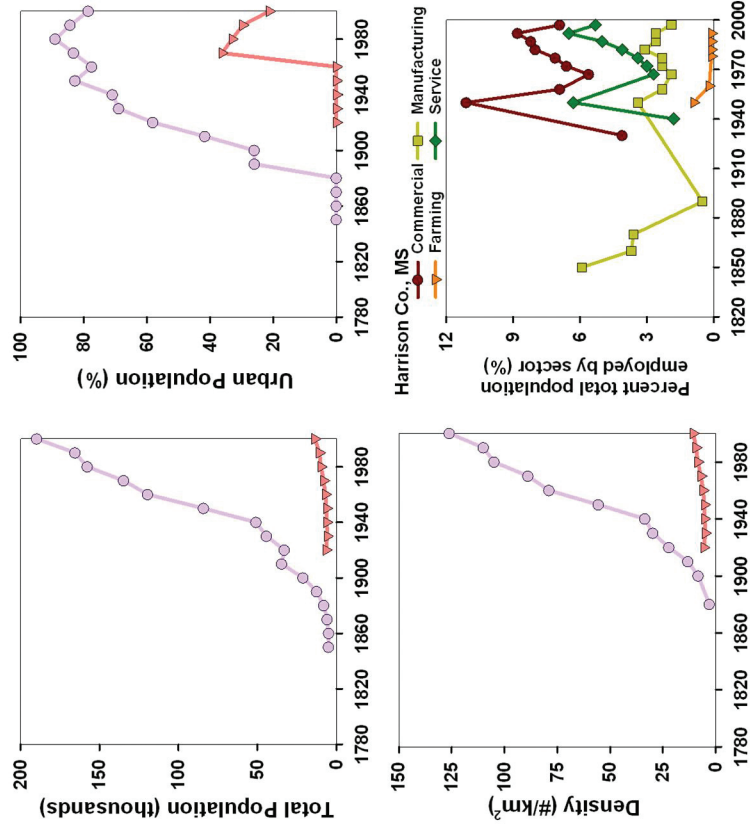
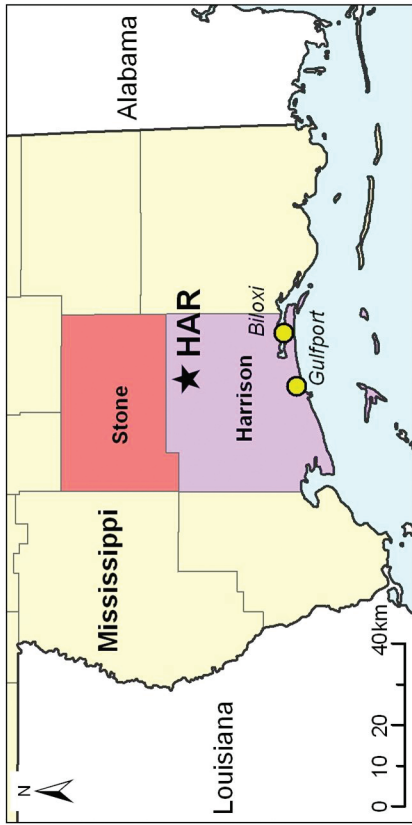
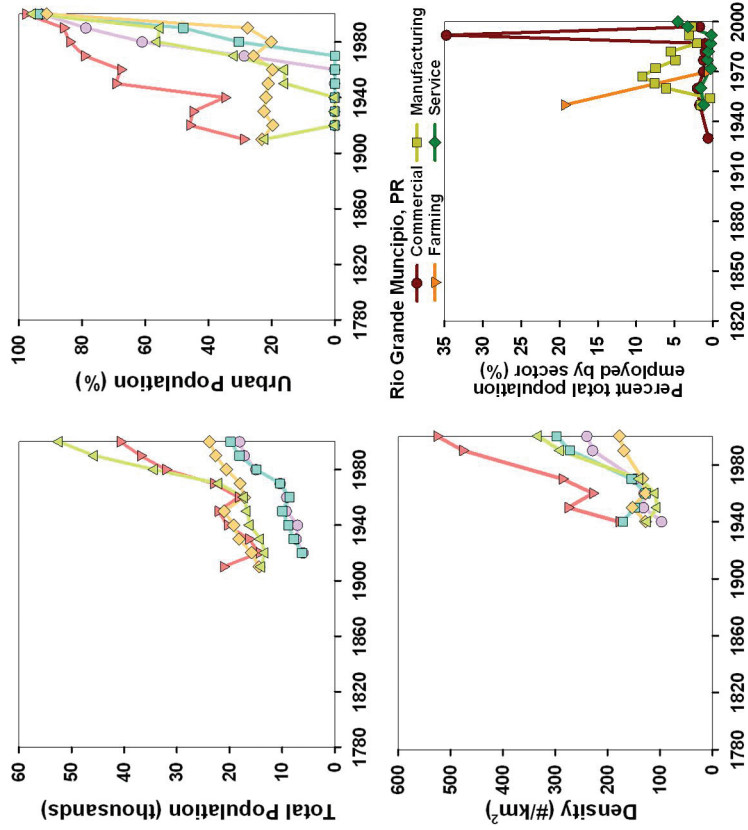
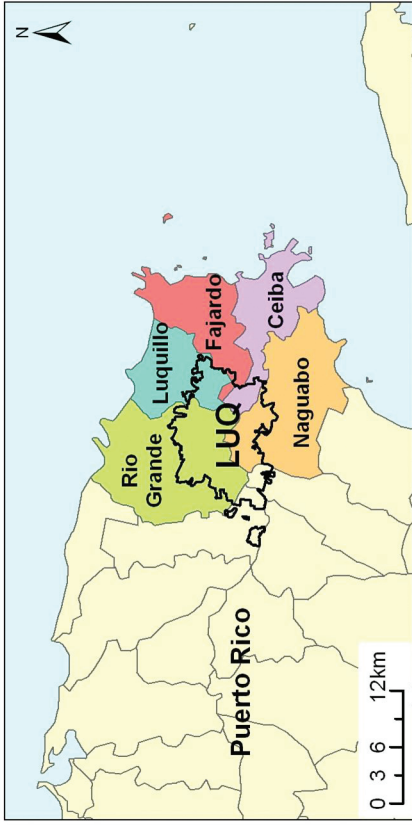


Figure 13-6 (eastern forest sites) continued next page.

Long-Term Trends in Ecological Systems:

Luquillo Experimental Forest (LUQ)



Hubbard Brook Ecosystem Study (HBR)

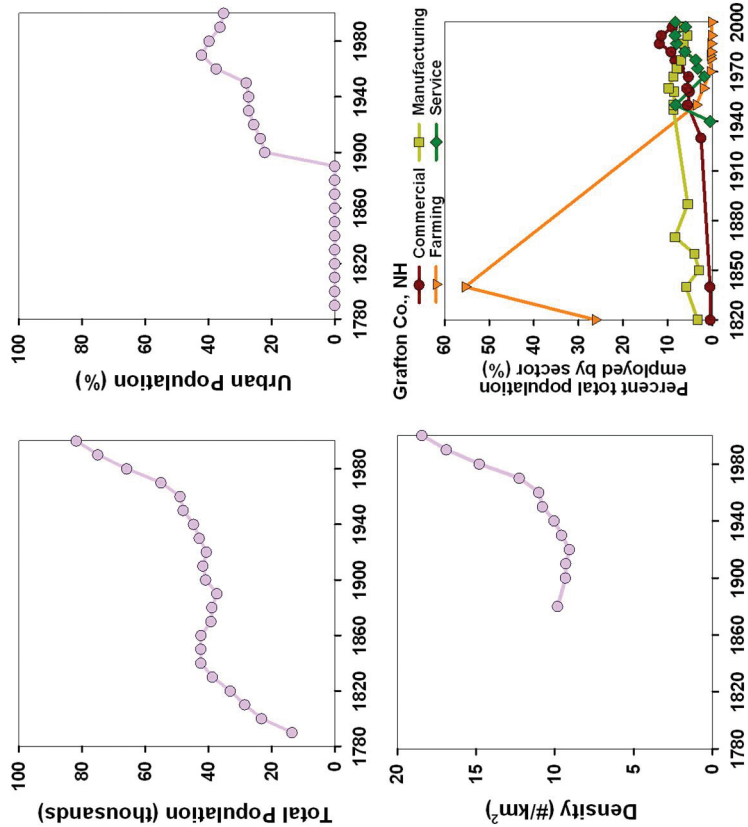
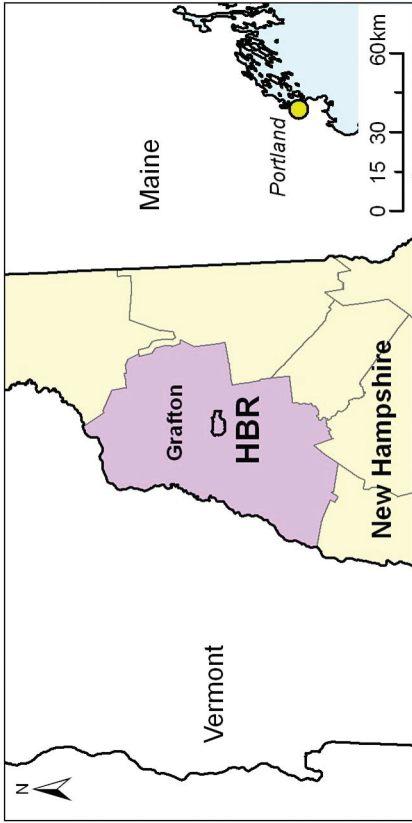
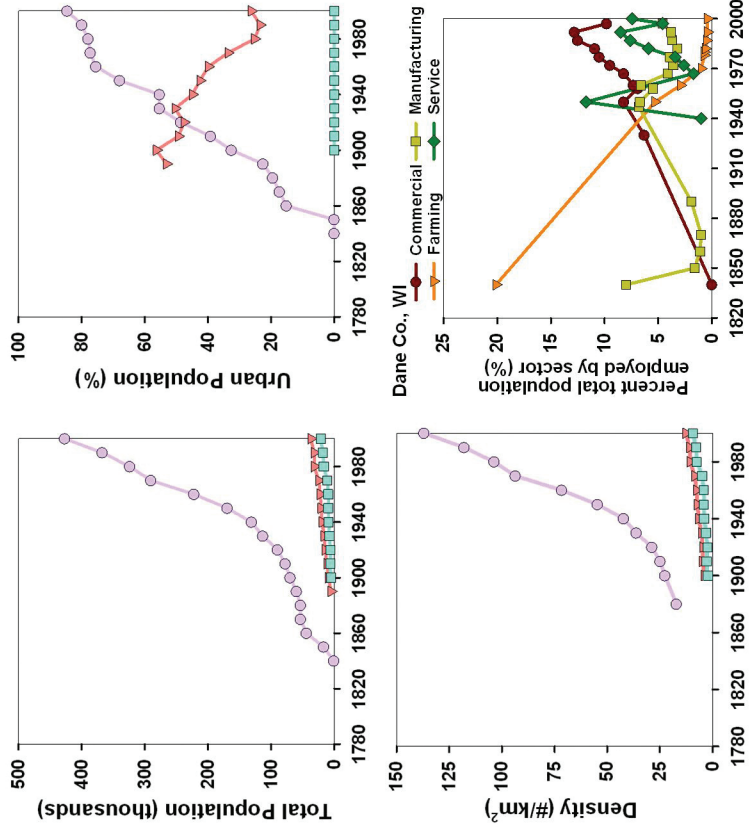
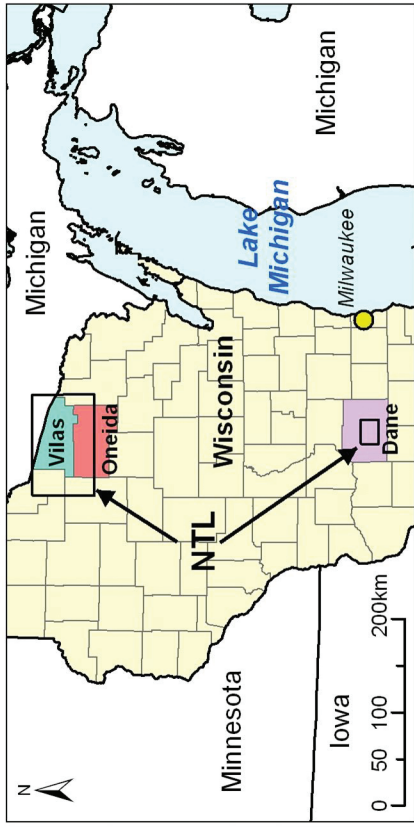


Figure 13-6 (eastern forest sites) continued next page.

North Temperate Lakes (NTL)



Marcell Experimental Forest (MAR)

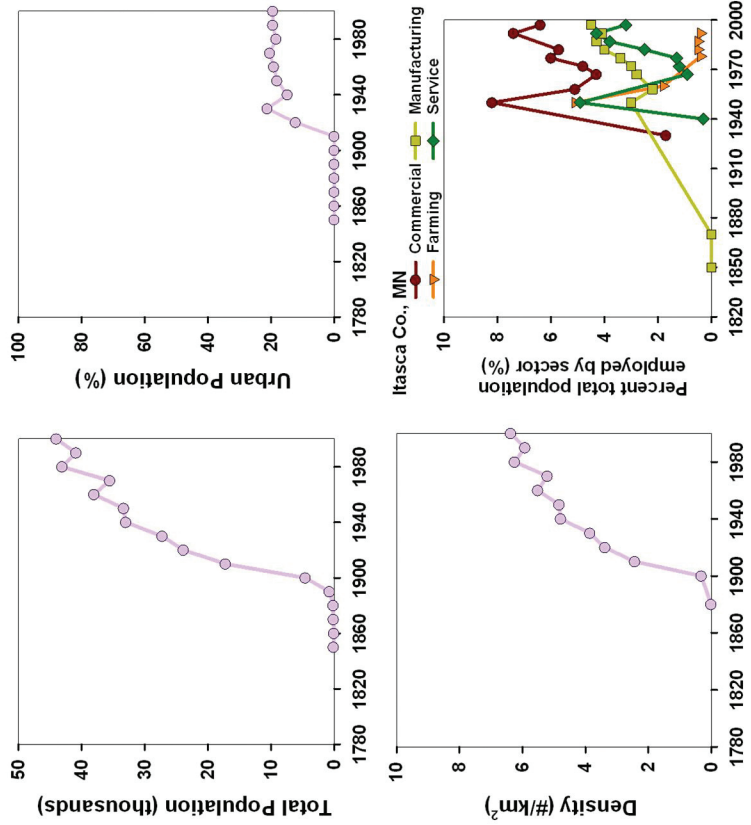
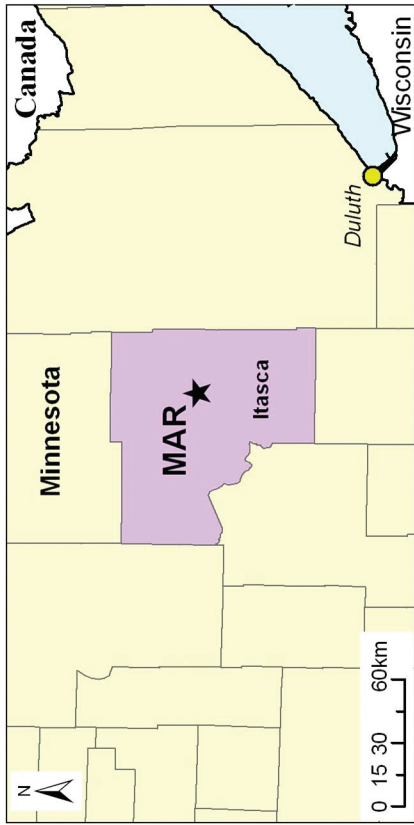
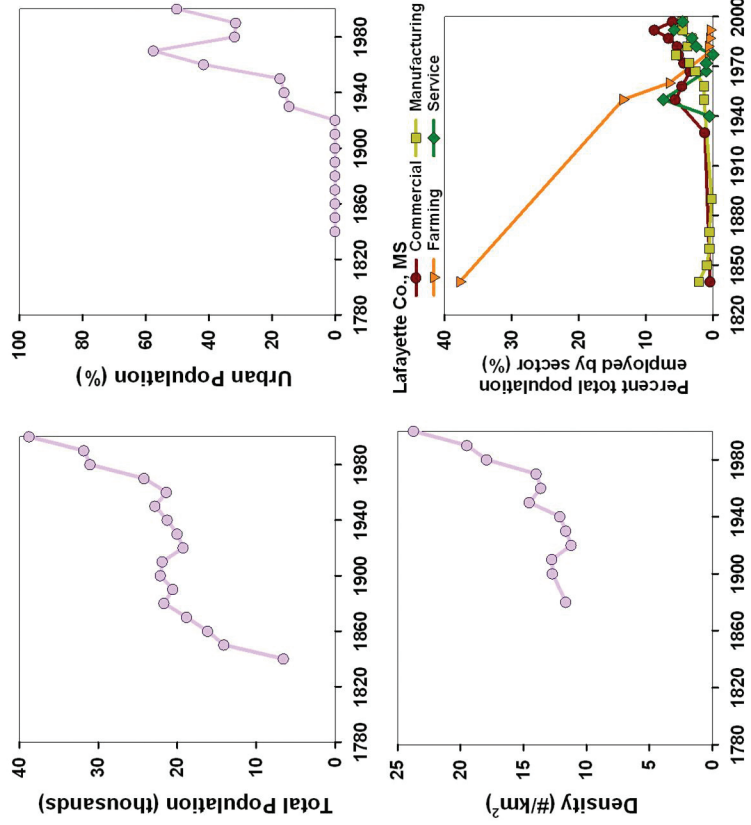


Figure 13-6 (eastern forest sites) continued next page.

Tallahatchie Experimental Forest (TAL)



Santee Experimental Forest (SAN)

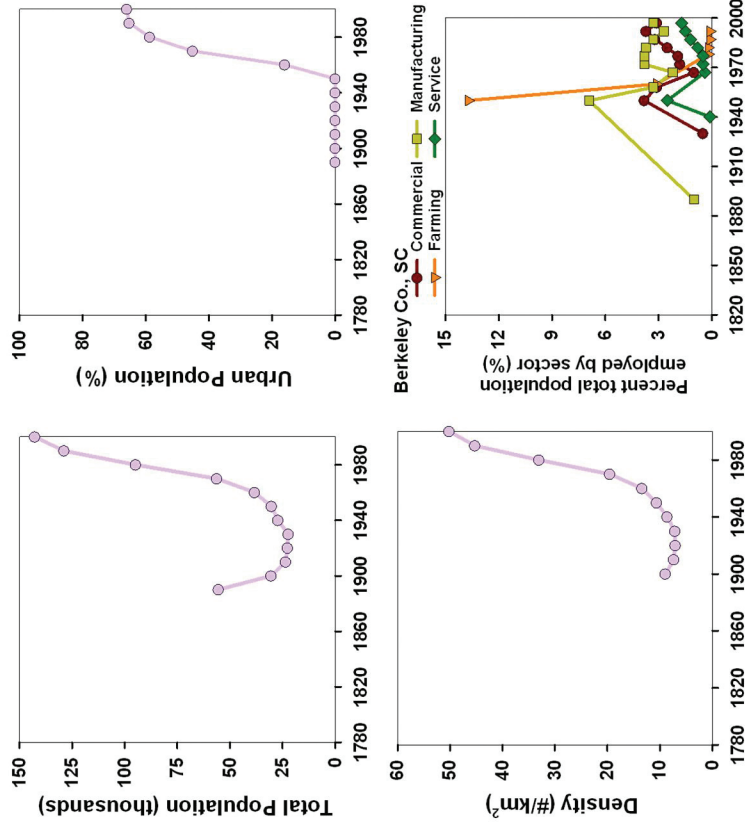
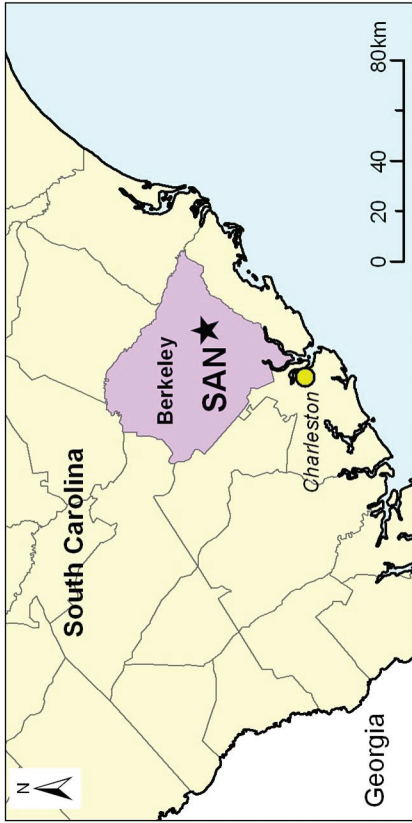


Figure 13-6 (eastern forest sites) continued next page.

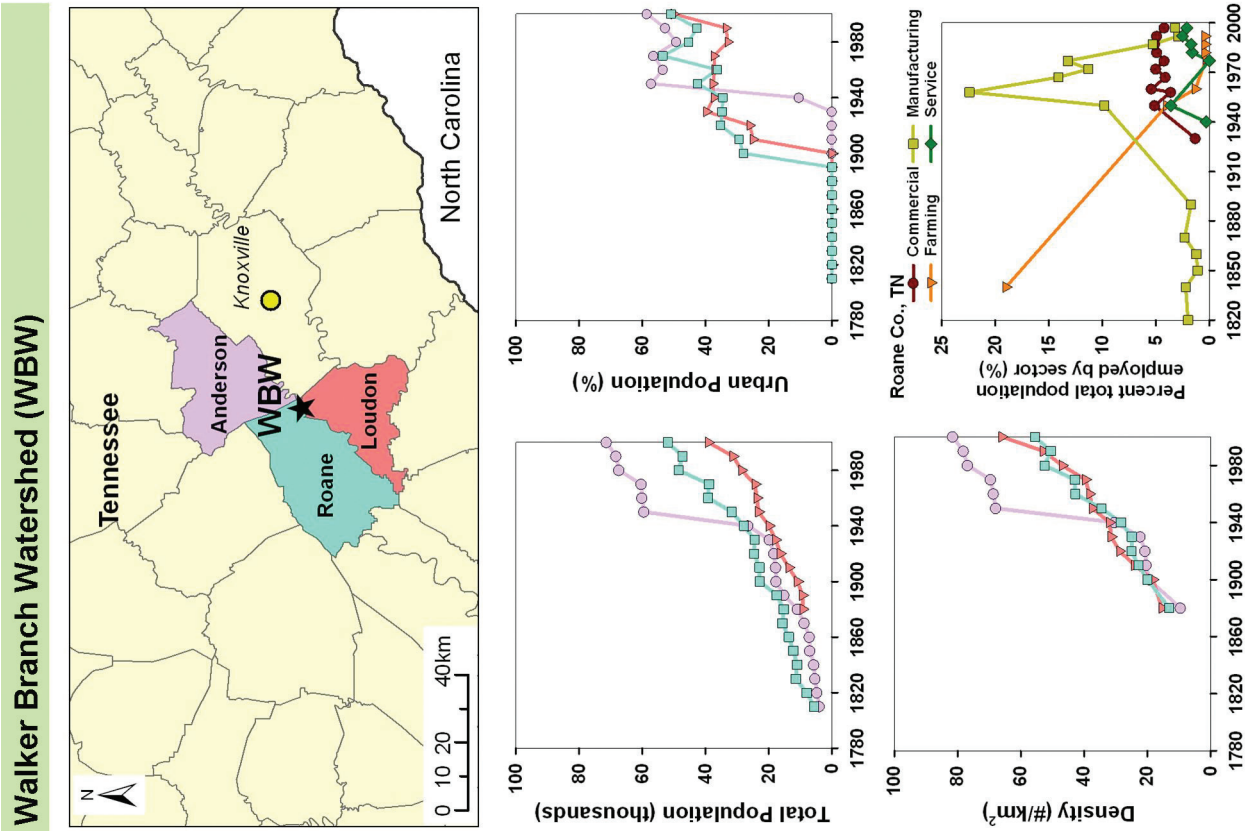
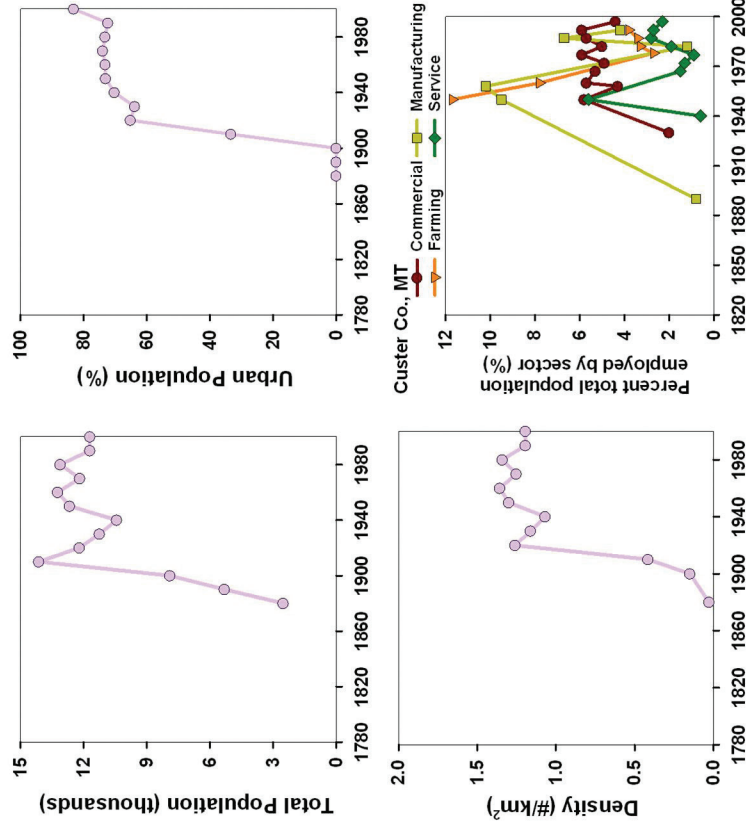


Figure 13-6. Trends for each eastern forest site: map of counties associated with the site (top), total population size (top left), total population (top right), and population density (bottom left) in each county for the site; and (bottom right) percentage of total population employed by four sectors in the focal county for the site. Color of county corresponds with line color in the graphs. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.



Long-Term Trends in Ecological Systems:

Fort Keogh Livestock & Range Research Laboratory (FTK)



Cedar Creek Ecosystem Science Reserve (CDR)

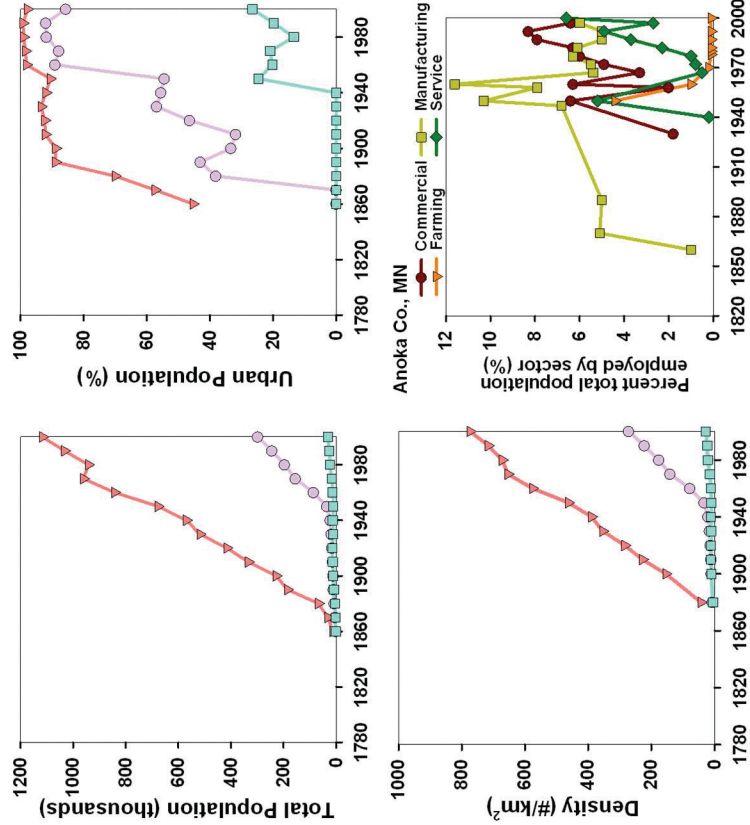
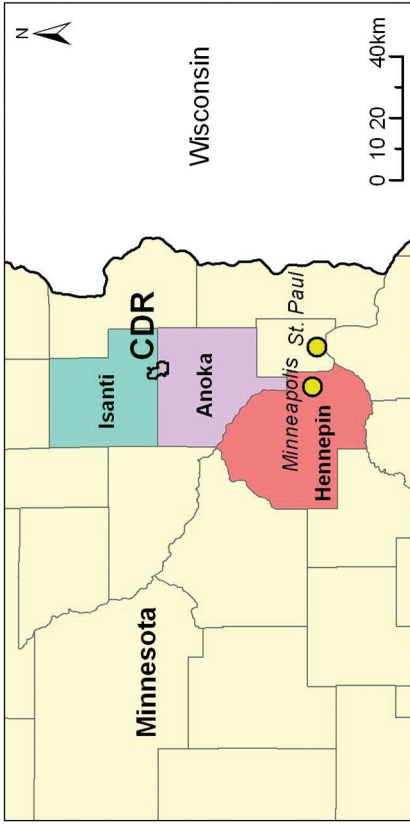
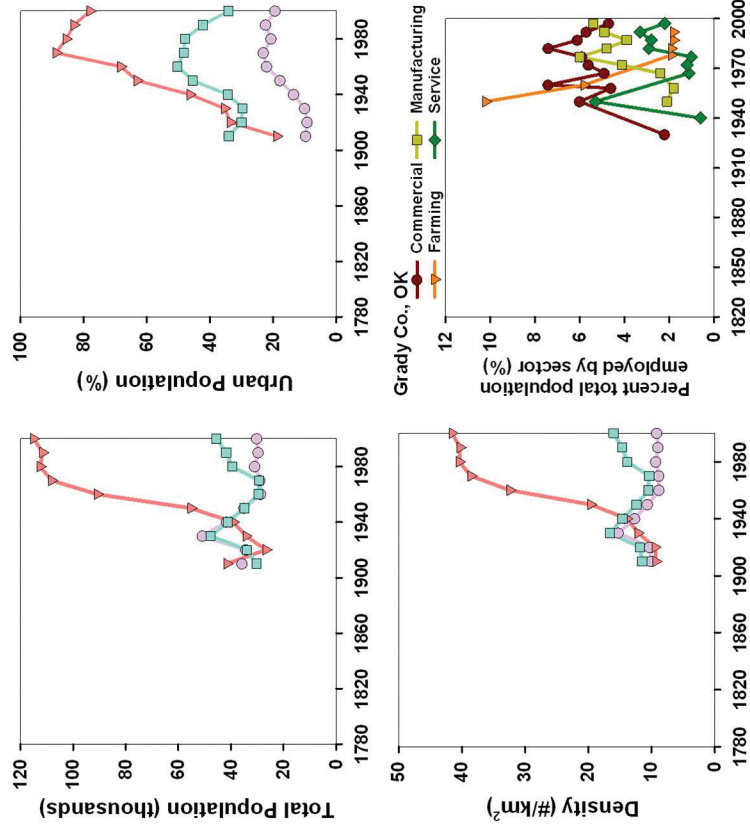
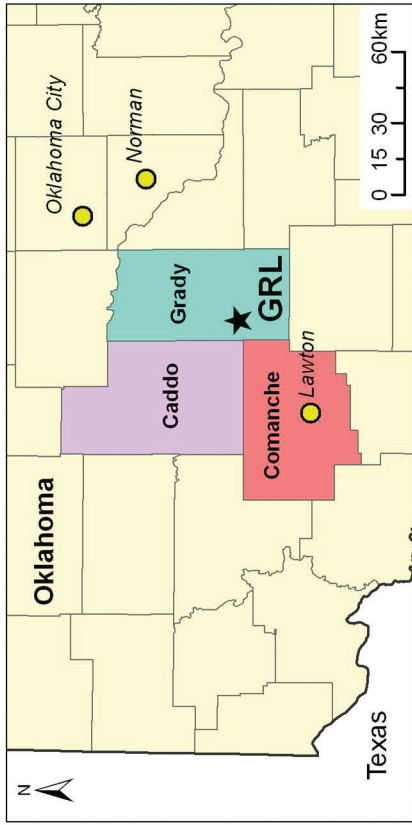


Figure 13-7 (grassland and savanna sites) continued next page.

**Grazinglands Research Laboratory (GRL)**



**Grassland, Soil and Water Research Laboratory (GSW)**

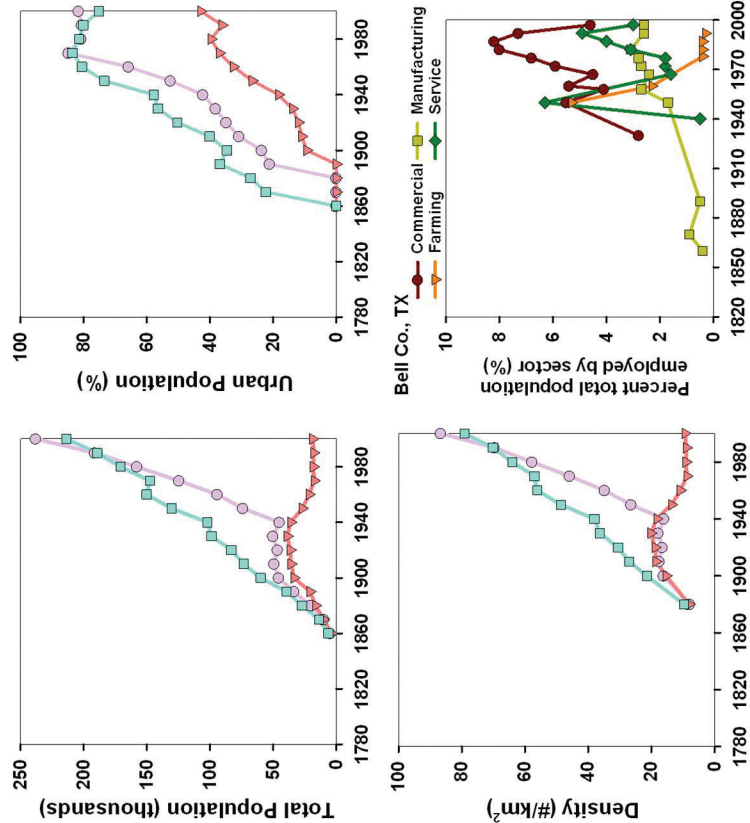
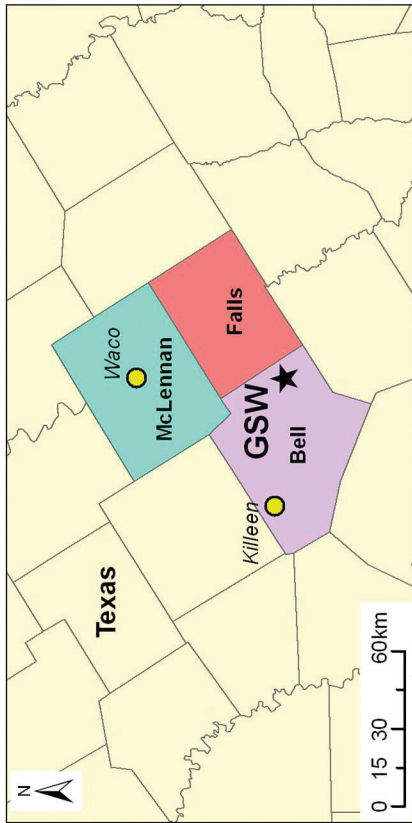
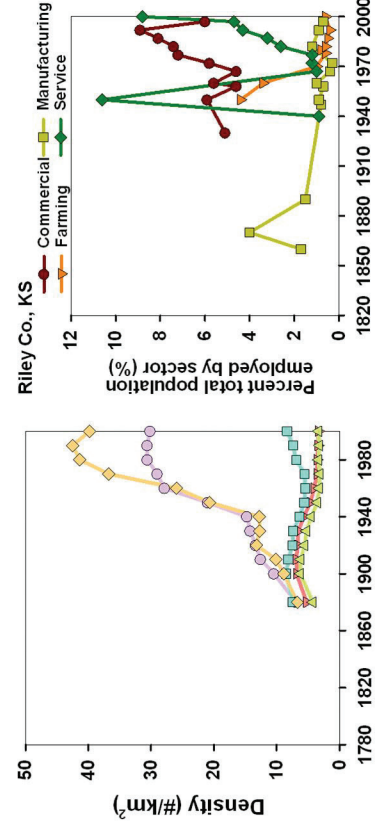
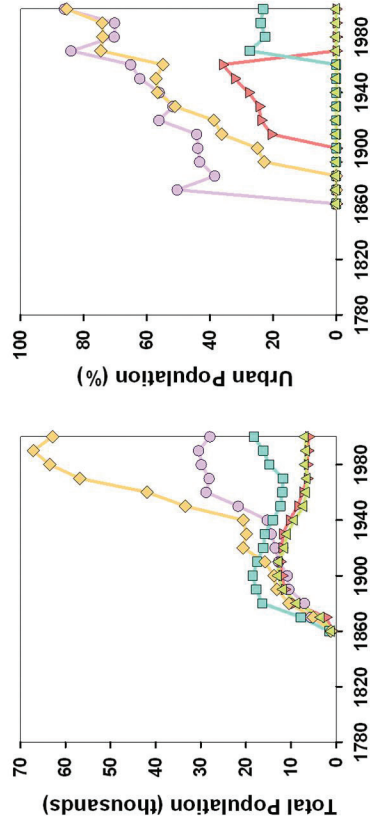


Figure 13-7 (grassland and savanna sites) continued next page.

Konza Prairie Biological Station (KNZ)



Kellogg Biological Station (KBS)

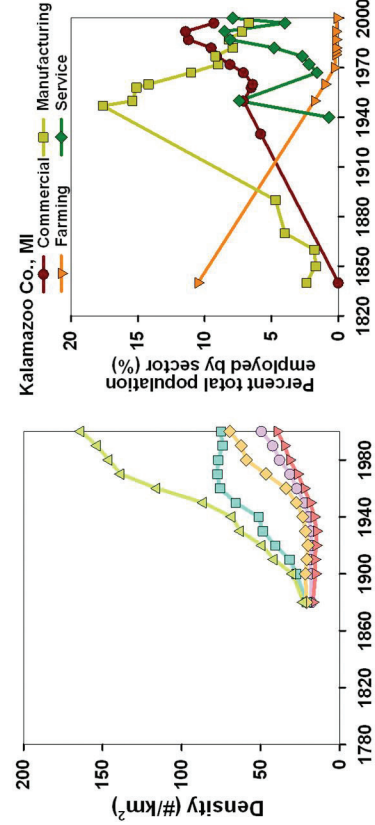
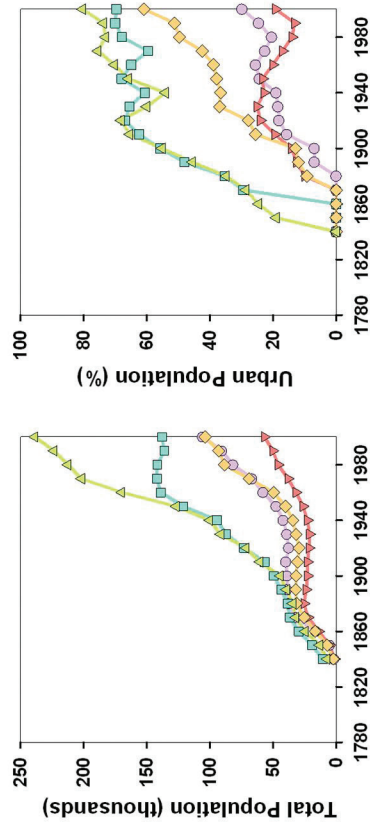
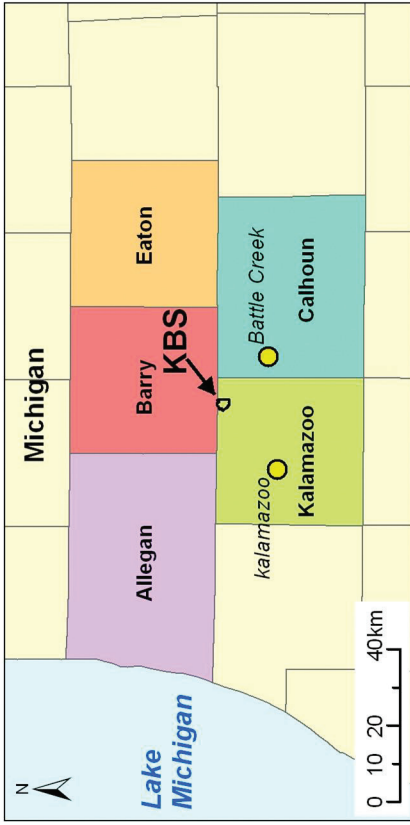
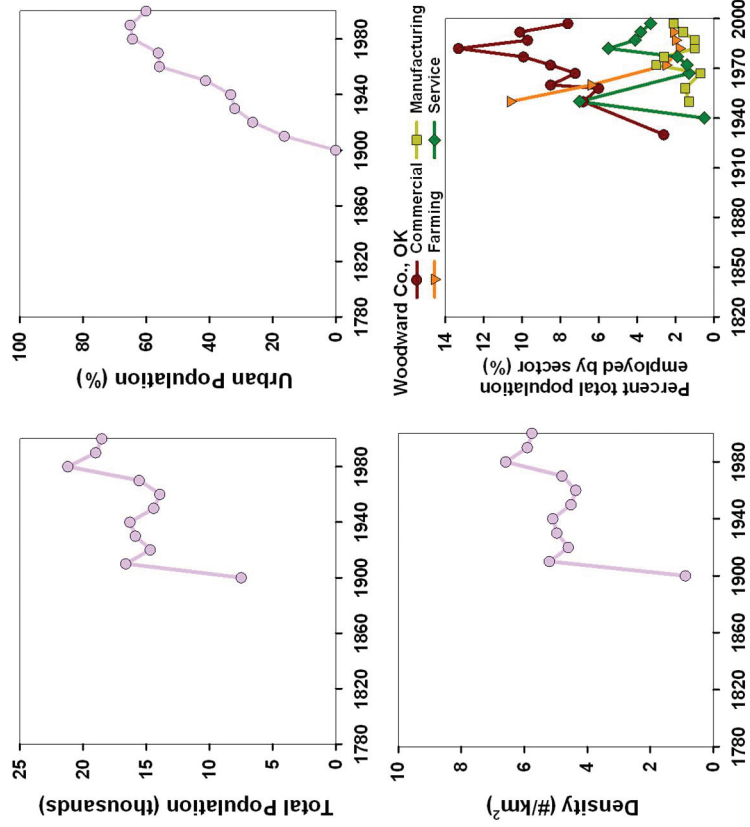
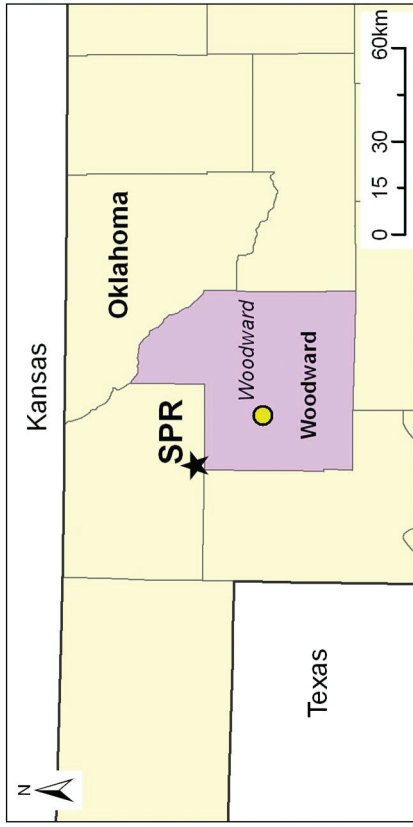


Figure 13-7 (grassland and savanna sites) continued next page.

Southern Plains Range Research Station (SPR)



Shortgrass Steppe (SGS)

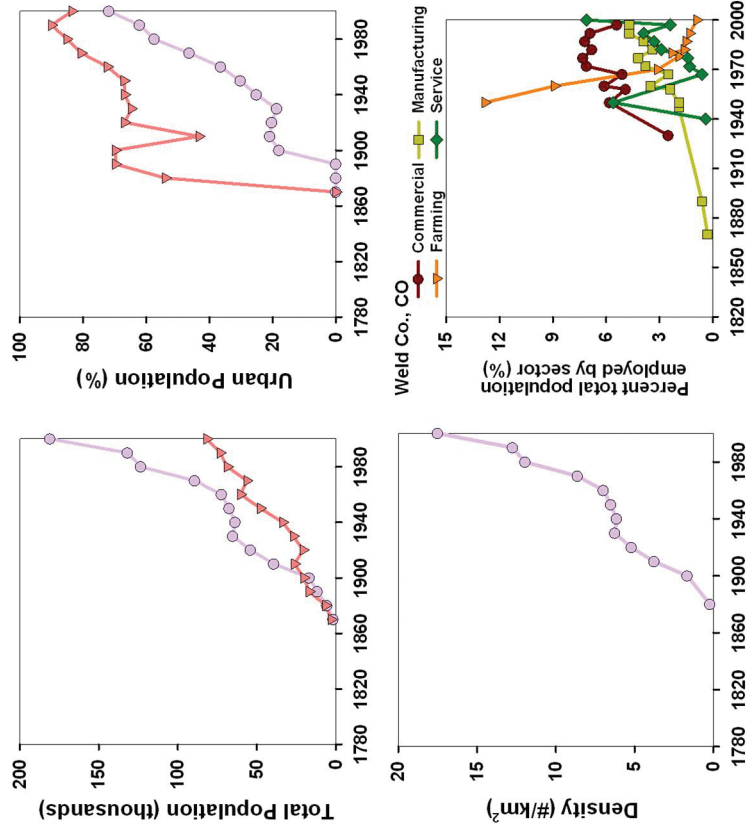
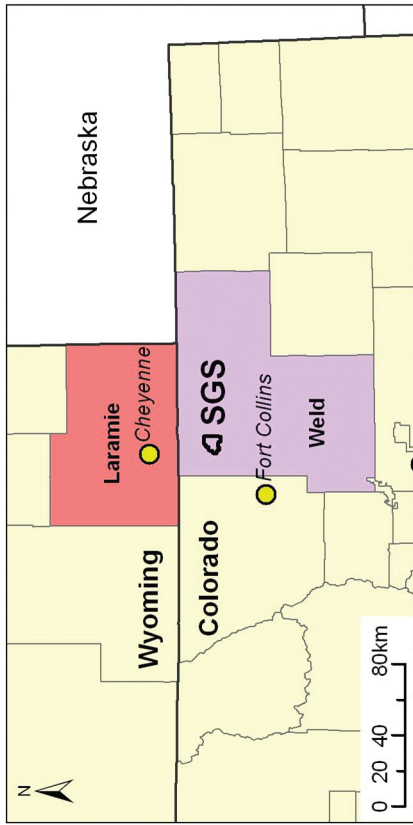


Figure 13-7. Trends for each temperate grassland and savanna site: map of counties associated with the site (top), total population size (top left), percentage urban population (top right), and population density (bottom left) in each county for the site; and percentage of total population employed by four sectors in the focal county for the site (bottom right). Color of county corresponds with line color in the graphs. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.

Long-Term Trends in Ecological Systems:

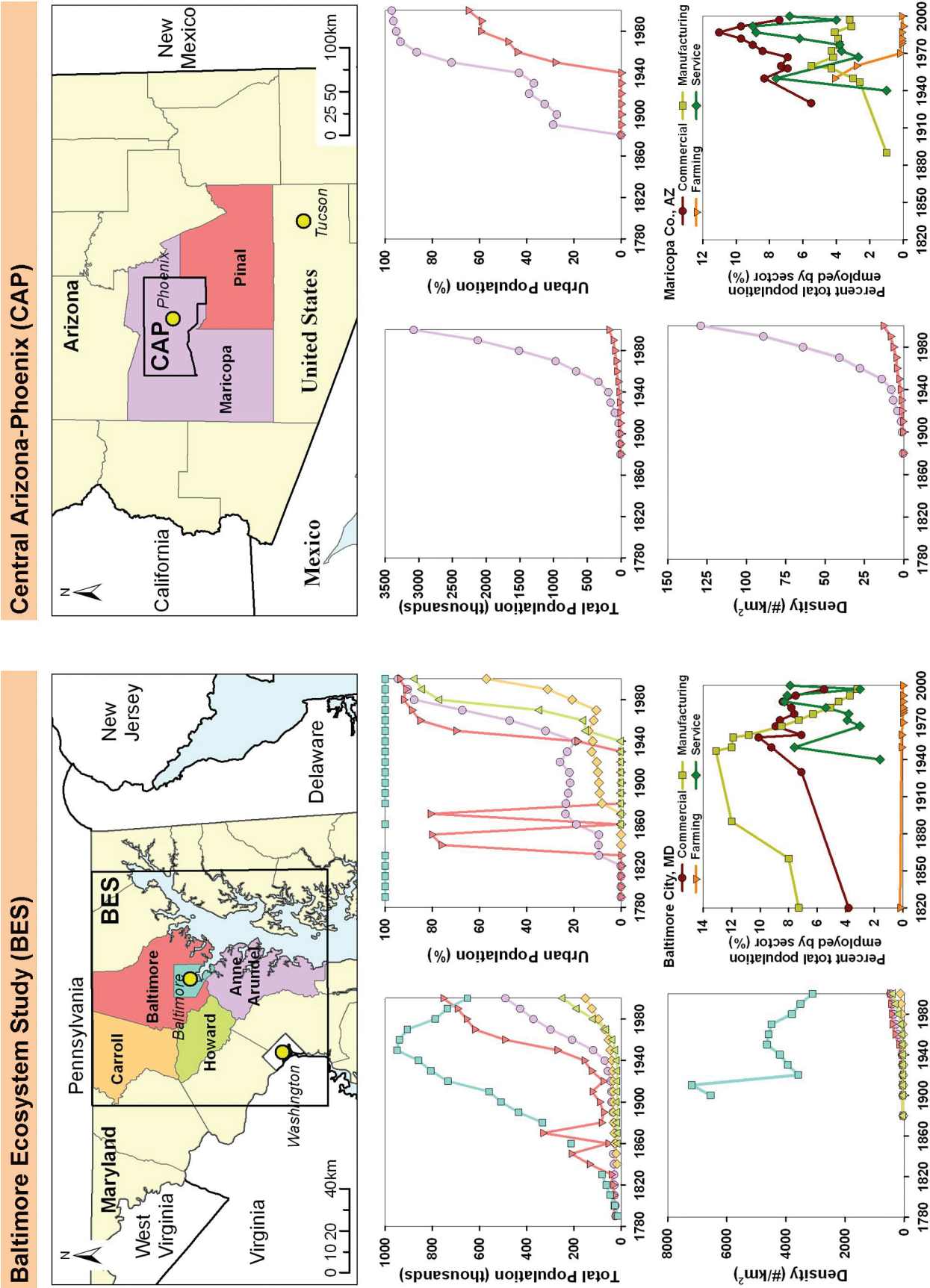
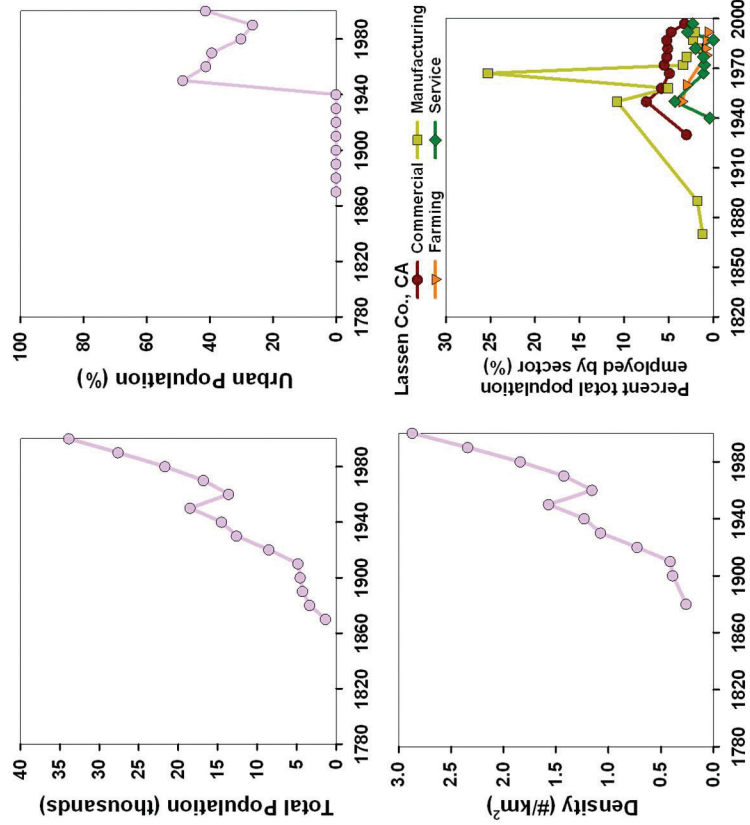
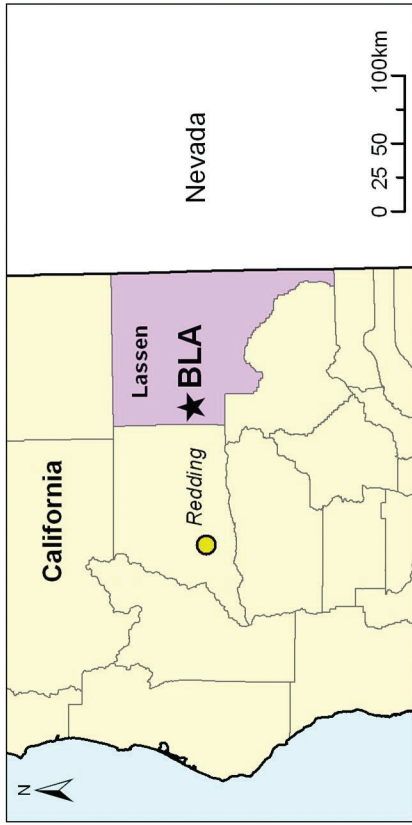


Figure 13-8. Trends for each urban site: map of counties associated with the site (top left), total population size (top left), percentage urban population (top right), and population density (bottom left) in each county for the site; and percentage of total population employed by four sectors in the focal county for the site (bottom right). Color of county corresponds with line color in the graphs. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.

**Blacks Mountain Experimental Forest (BLA)**



**Andrews Experimental Forest (AND)**

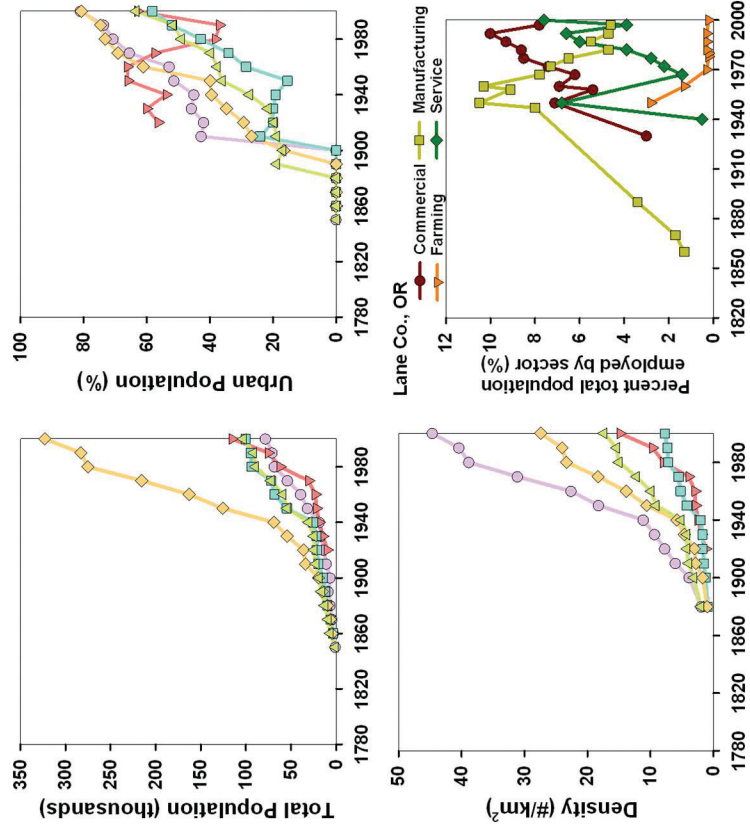
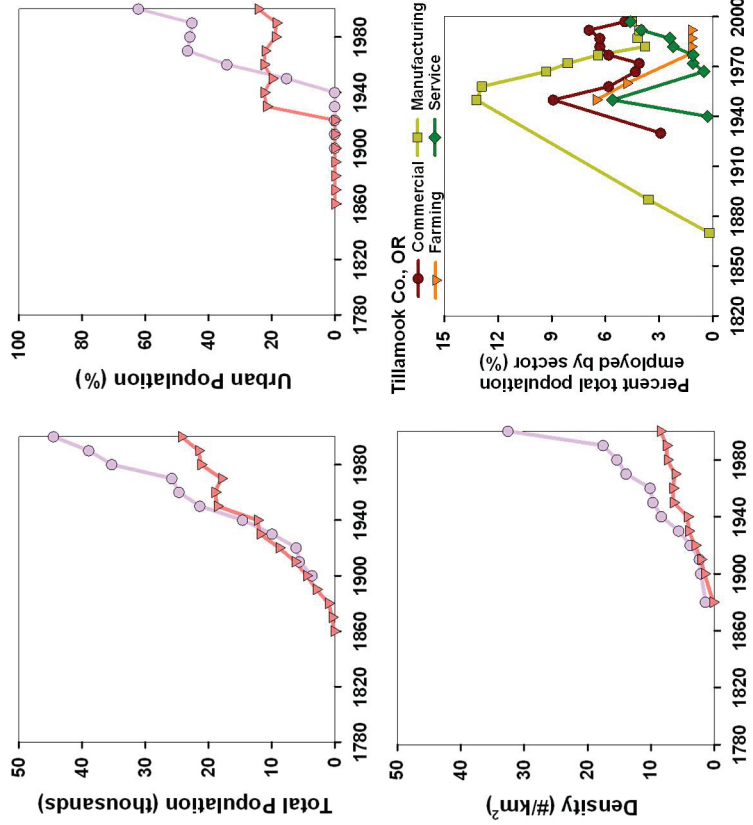


Figure 13-9 (western forest sites) continued next page.

Cascade Head Experimental Forest (CHE)



Bonanza Creek Experimental Forest (BNZ)

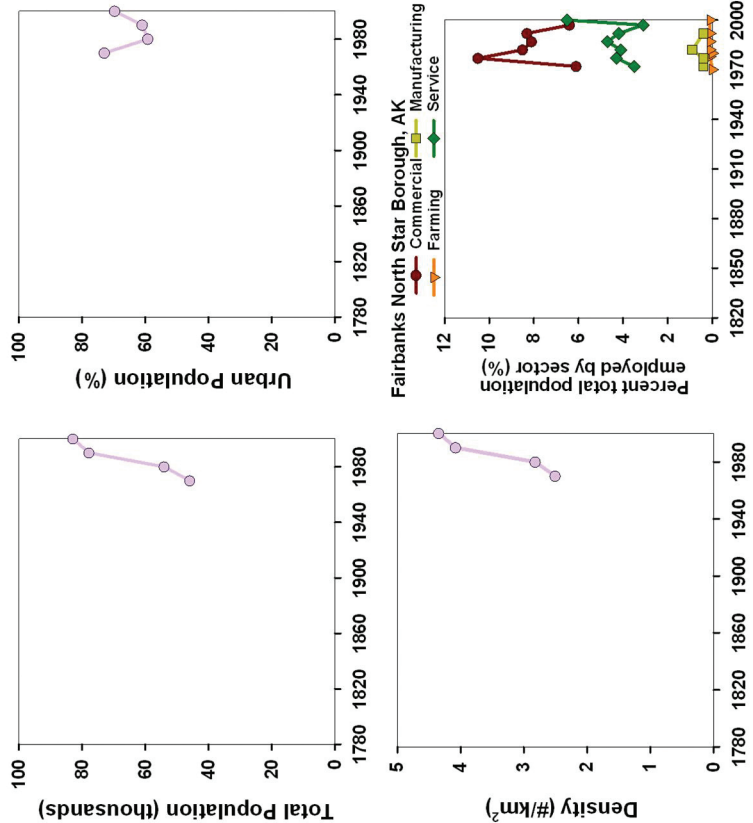
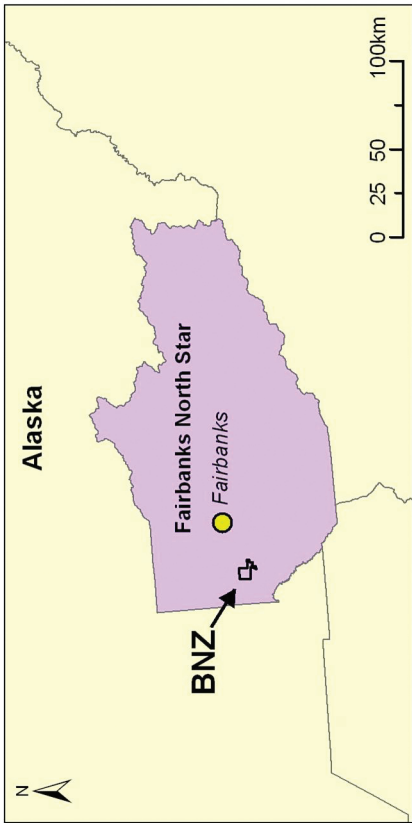
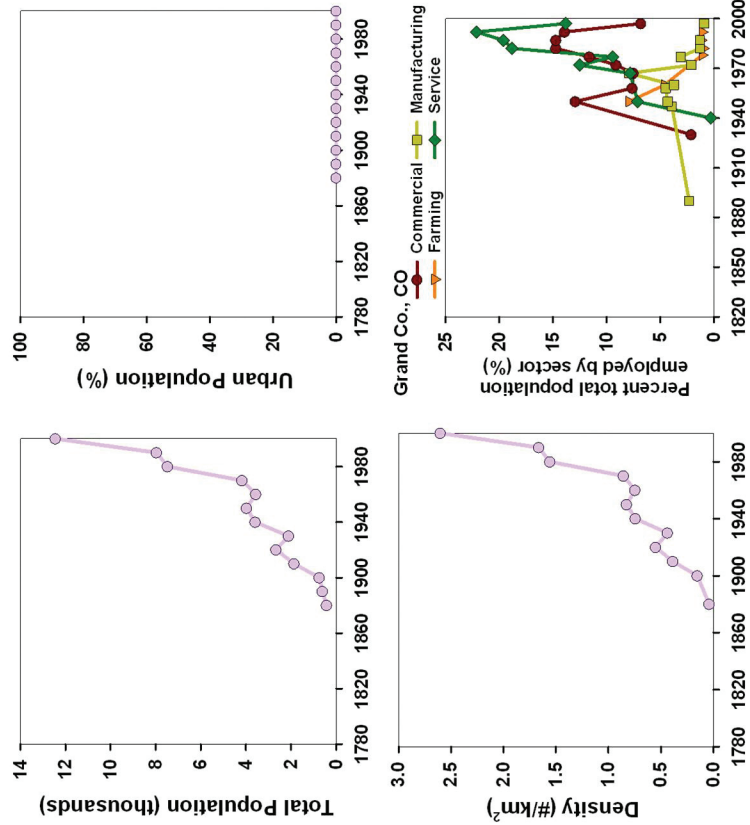


Figure 13-9 (western forest sites) continued next page.

Fraser Experimental Forest (FRA)



Caspar Creek Experimental Watershed (CSP)

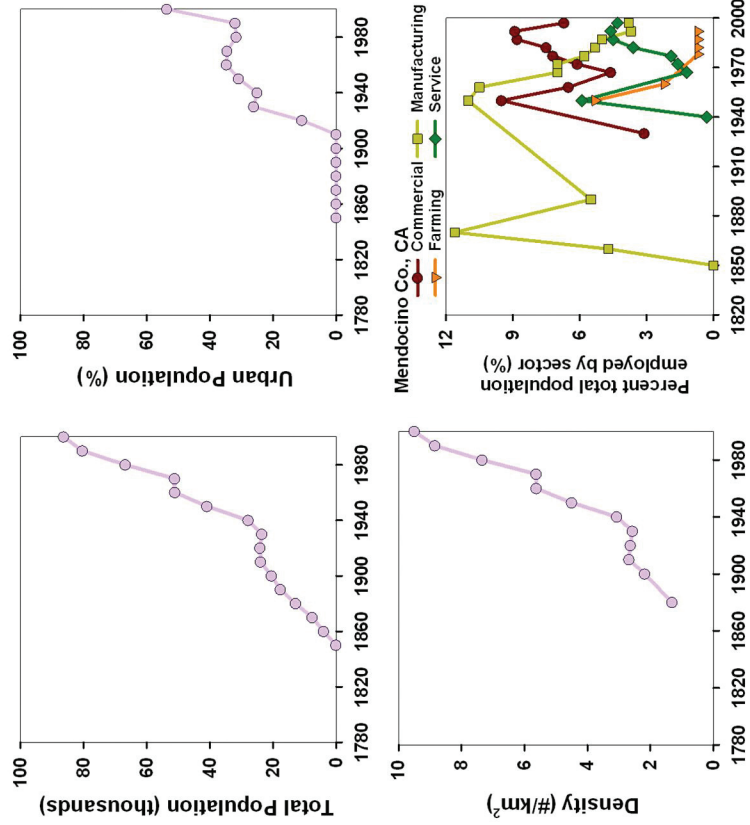
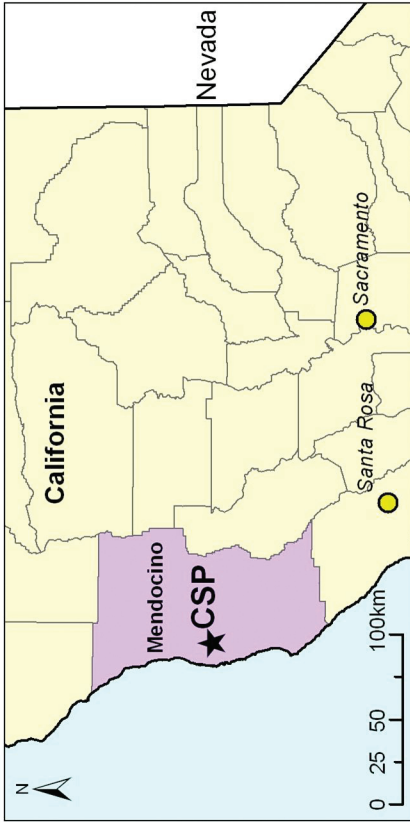
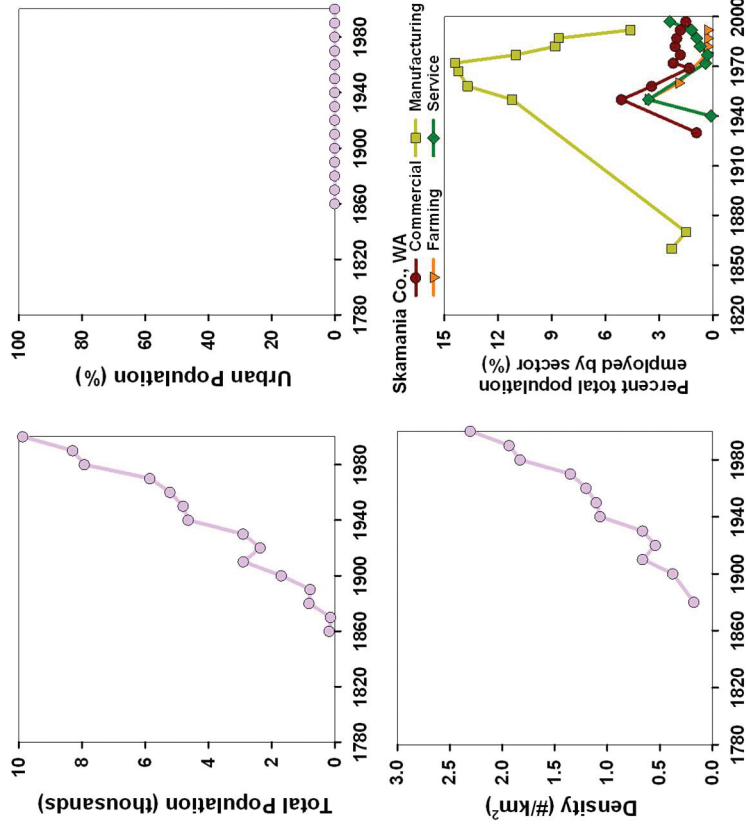
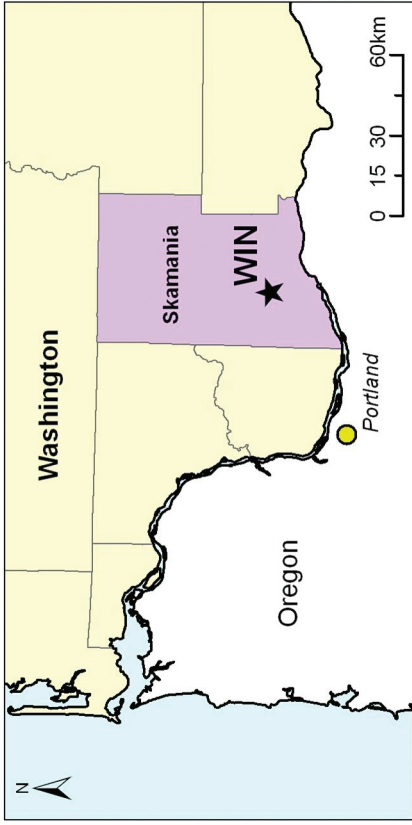


Figure 13-9 (western forest sites) continued next page.



Wind River Experimental Forest (WIN)



Priest River Experimental Forest (PRI)

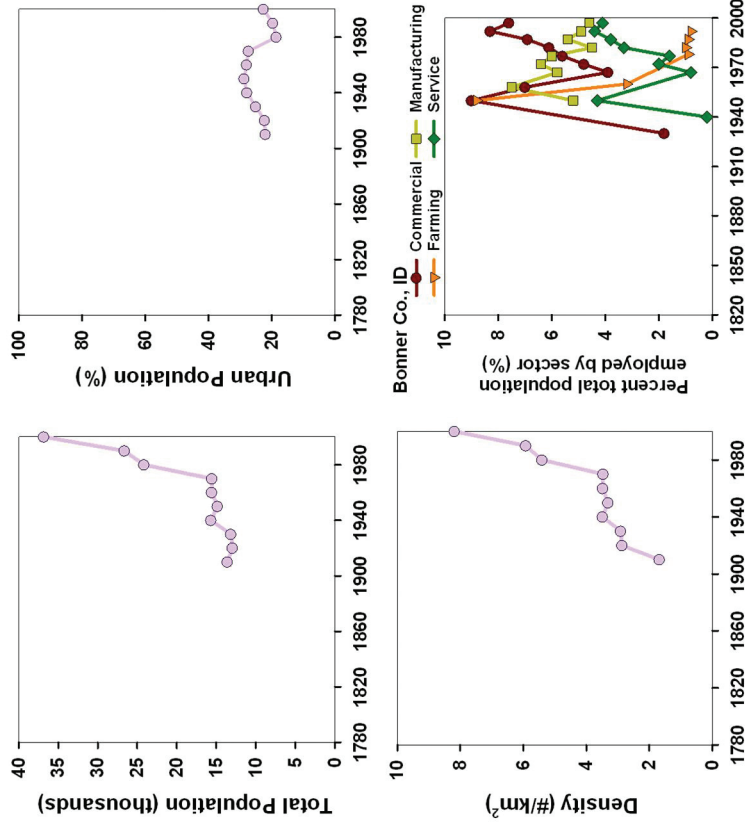
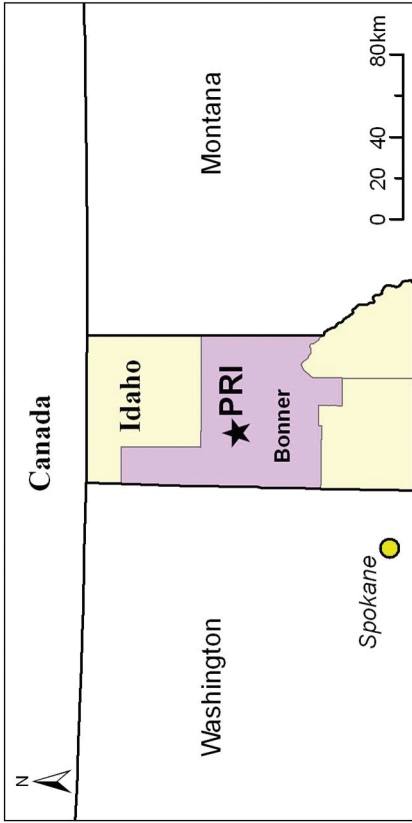


Figure 13-9. Trends for each western forest site: map of counties associated with the site (top), total population size (top left), percentage urban population (top right), and population density (bottom left) in each county for the site; and percentage of total population employed by four sectors in the focal county for the site (bottom right). Color of county corresponds with line color in the graphs. Original data from <http://www.census.gov>. Synthesized data from <http://www.ecotrends.info>.

