



Preserving Colorado's Climate For Business And for Good Living

Stephen Saunders
President
The Rocky Mountain
Climate Organization

saunders@
rockymountainclimate.org

RMCO's Partners

City and County of Denver

Boulder County

City of Aurora

City of Fort Collins

City of Westminster

City of Boulder

City of Steamboat Springs

Town of Avon

Town of Vail

Town of Breckenridge

Town of Frisco

Town of Dillon

Denver Water

Colorado Association of Ski Towns

Colorado Conservation Trust

Colorado Municipal League

National Center for Atmospheric Research

Nature Conservancy of Colorado

New Belgium Brewing Company

RBI Strategy & Research

Westcliffe Publishers

Western Resource Advocates

Wright Water Engineers

“What did you do in the war?”

“Warming of the climate system is unequivocal.”

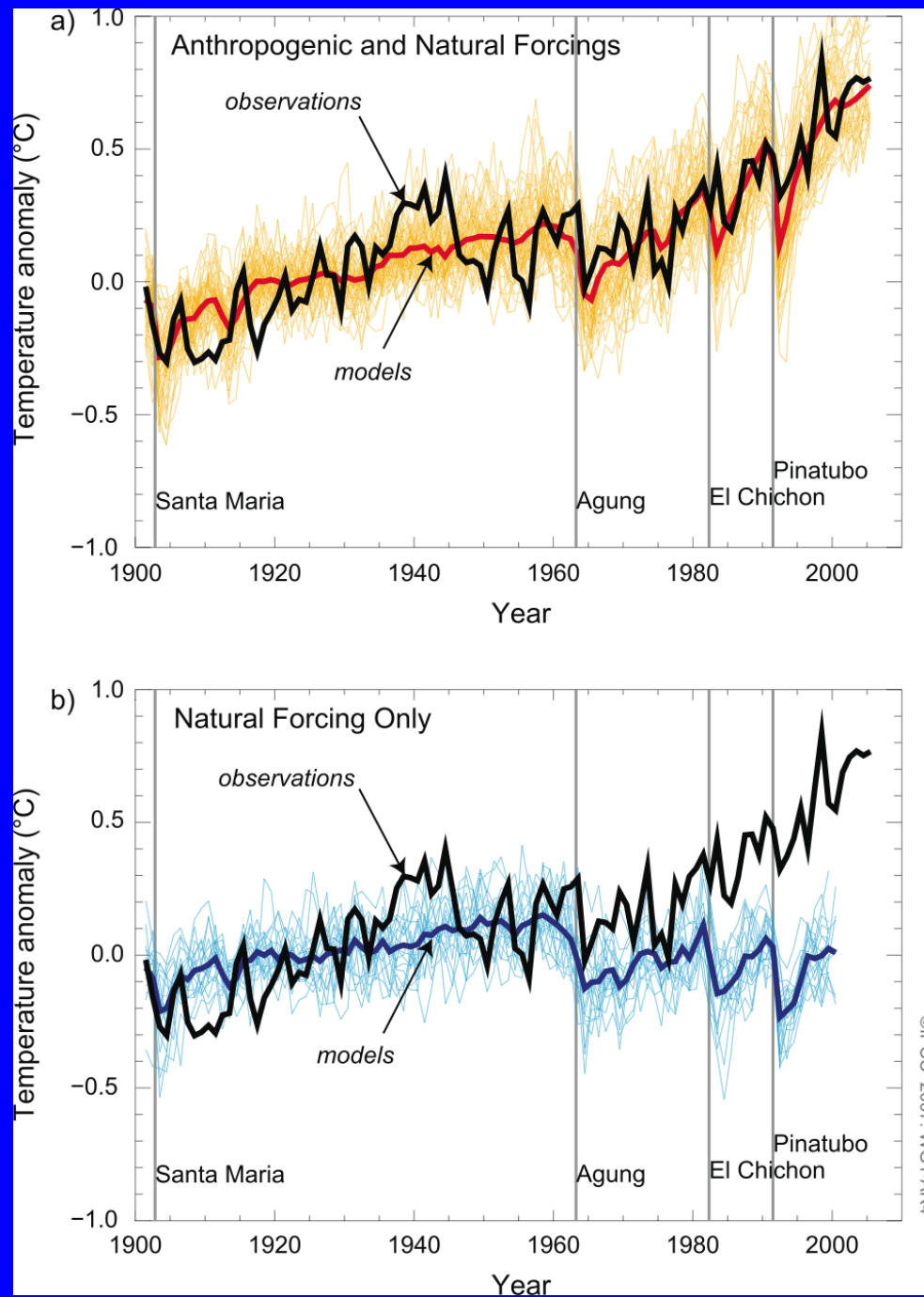
Intergovernmental Panel on Climate Change (2007)

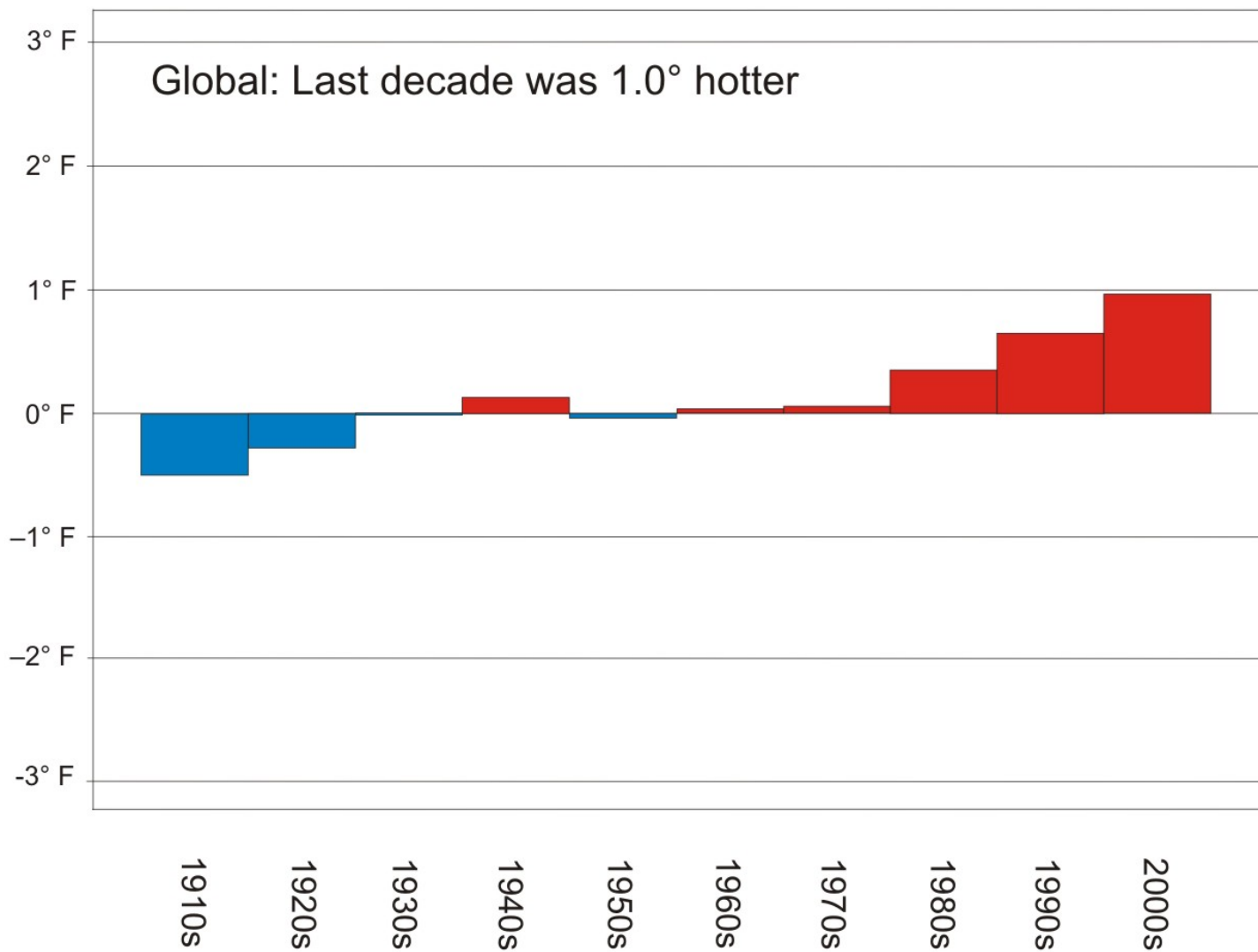
“Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.”

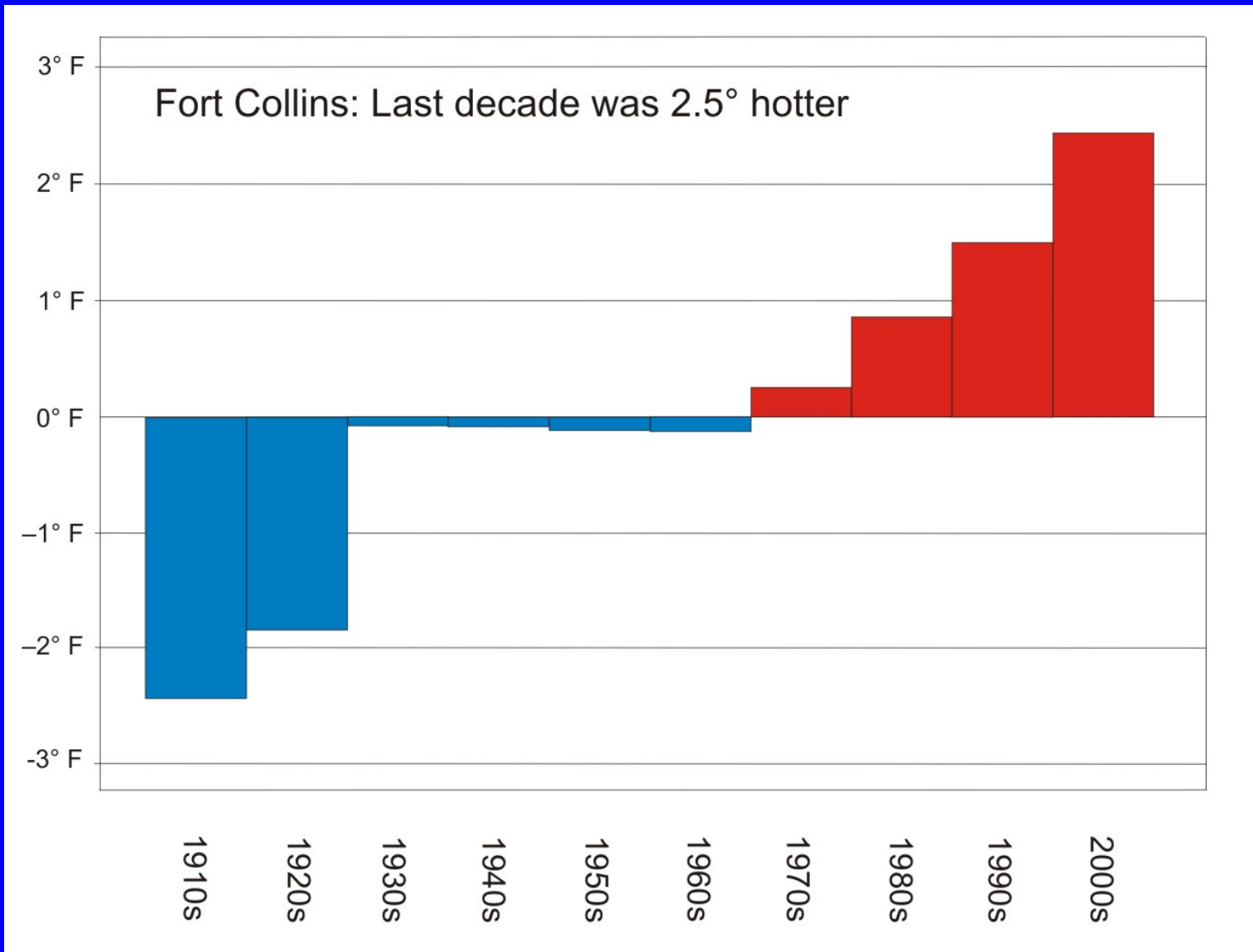
Intergovernmental Panel on Climate Change (2007)

“*very likely*” = 90% probability

Intergovernmental Panel on Climate Change (2007)

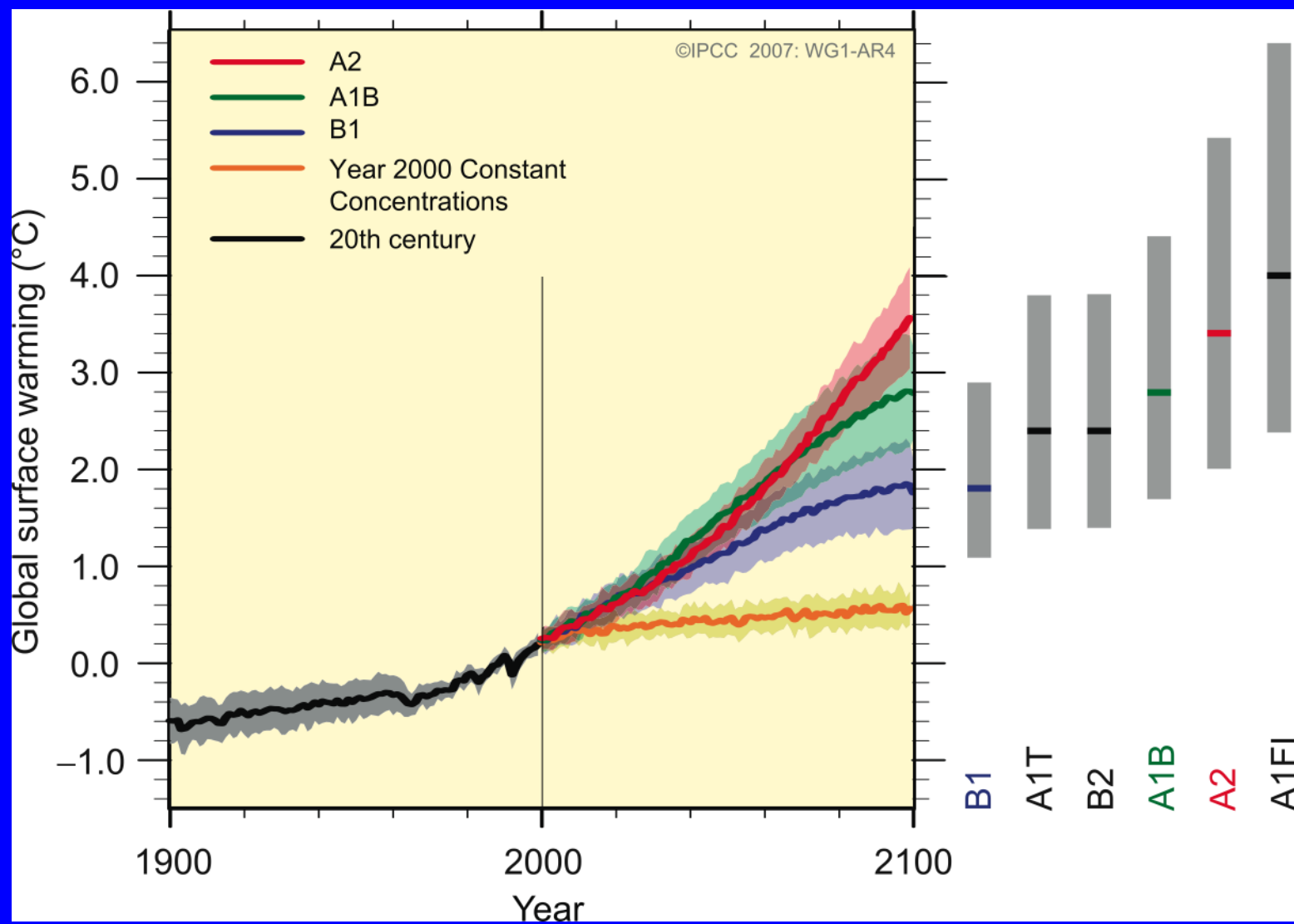






“A variety of research studies suggest that a further 2°F increase [beyond 1980-1999 levels] would lead to severe, widespread, and irreversible Impacts.”

*Global Climate Change Impacts
on the United States*



Fort Collins in 2070-2079

16 Climate Models, vs 1980-1999

Lower emissions (B2): 1.7 to 6.0°F

Average: 3.7°F
(Pueblo)

Higher emissions (A1): 2.8 to 8.2°F

Average: 6.2°F
(Albuquerque)

Impacts of climate disruption

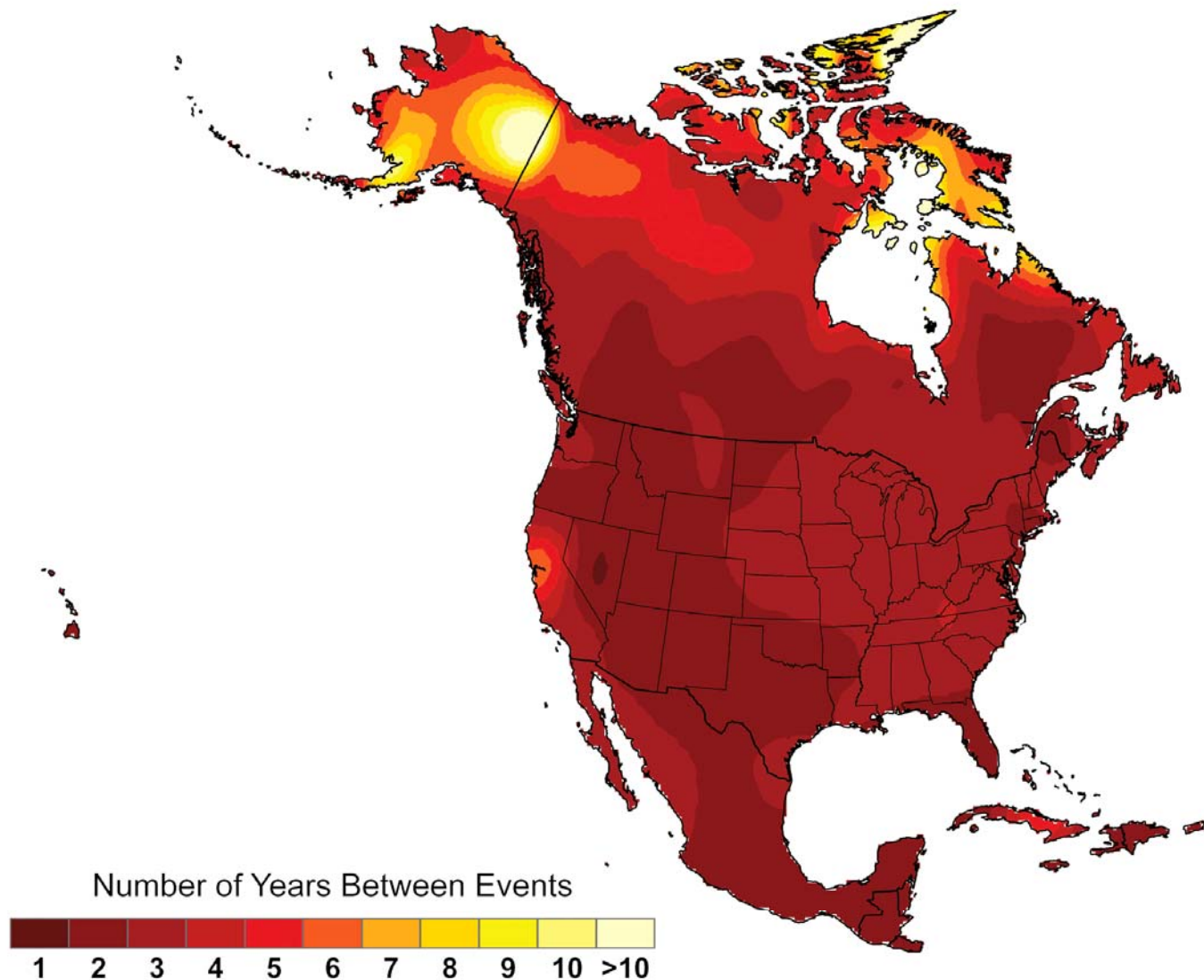
More heat waves

Less snow

Less water

More ecosystem disruption

More wildfires

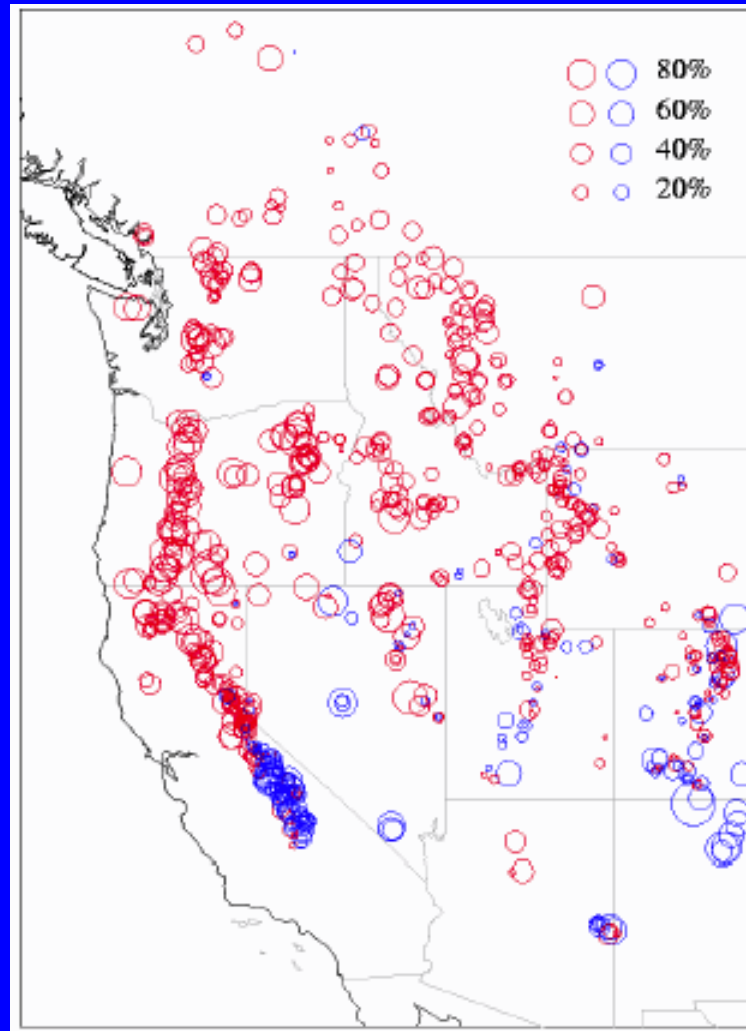


CMIP3-A⁹³

Simulations for 2080-2099 indicate how currently rare extremes (a 1-in-20-year event) are projected to become more commonplace. A day so hot that it is currently experienced once every 20 years would occur every other year or more frequently by the end of the century under the higher emissions scenario.⁹¹



Smaller Snowpacks, 1950-1997



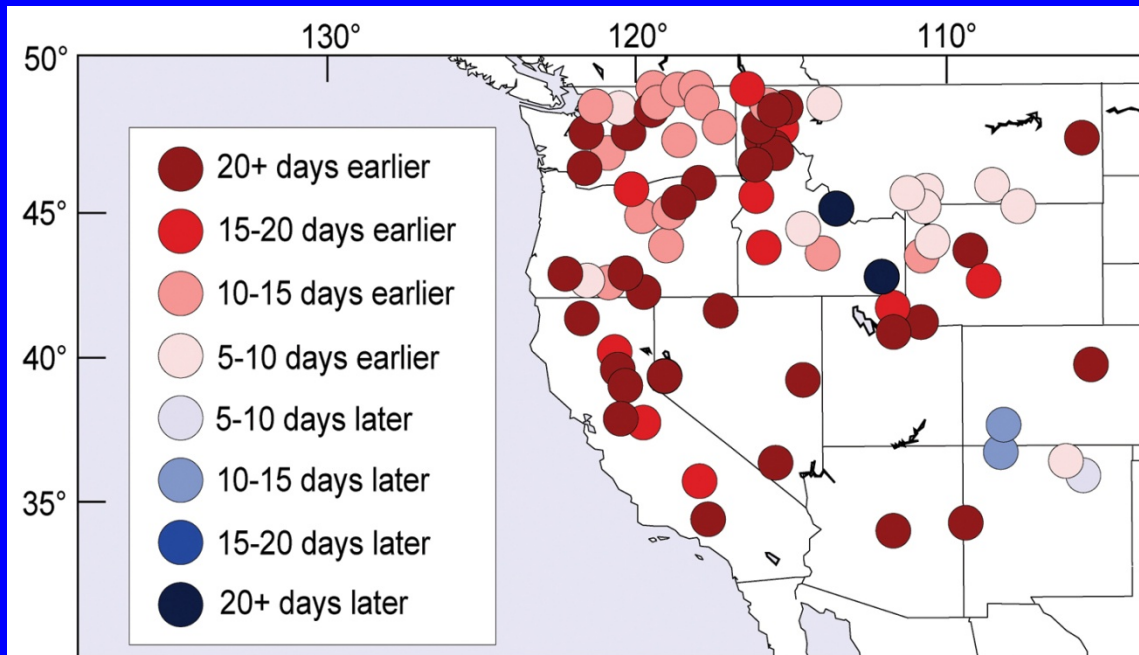
Mote et al 2005

Skiing in Aspen:

- By 2030, season 10 days shorter
- By 2100, season 4 to 10 weeks shorter
- “Ski resorts operate in deficit until March, when we make most of our profit. If you shorten our season on either end – take away March, for example – we go out of business.”

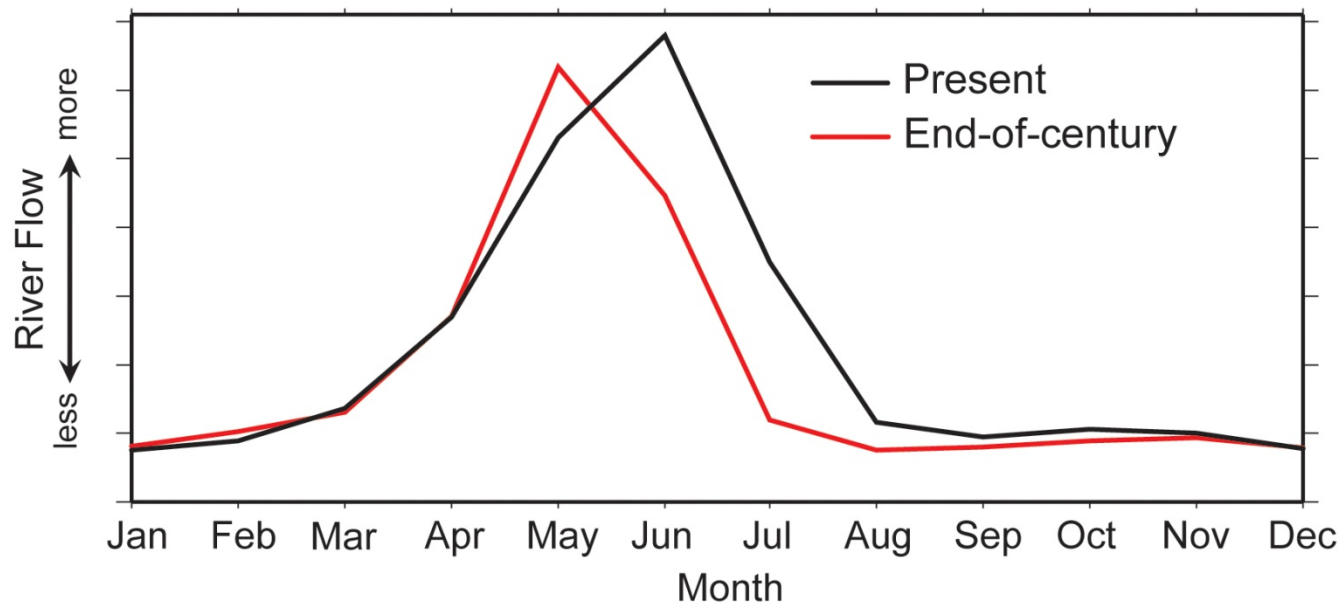


Earlier Snowmelt, 1948-2002



USGS¹¹⁶

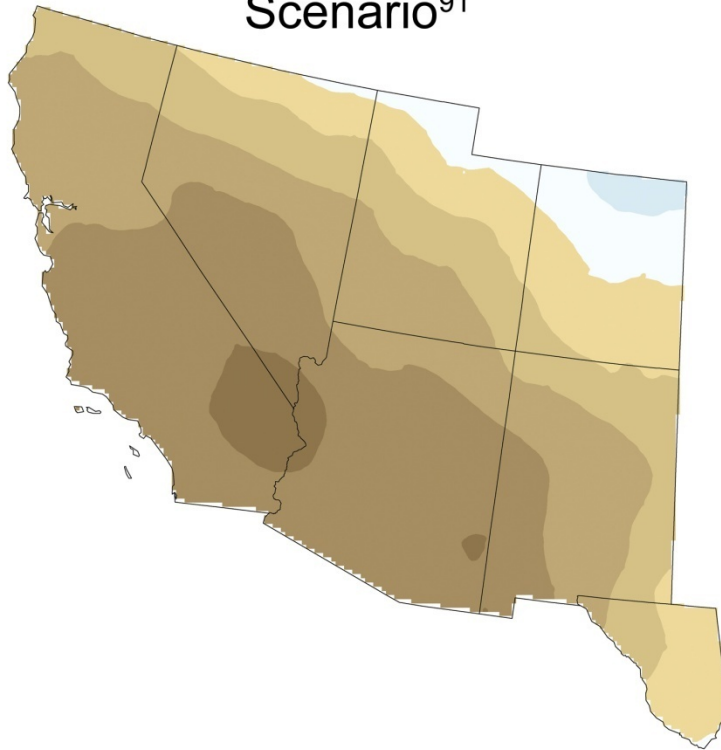
Date of onset of spring runoff pulse. Redish-brown circles indicate significant trends toward onsets more than 20 days earlier. Lighter circles indicate less advance of the onset. Blue circles indicate later onset. The changes depend on a number of factors in addition to temperature, including altitude and timing of snowfall.



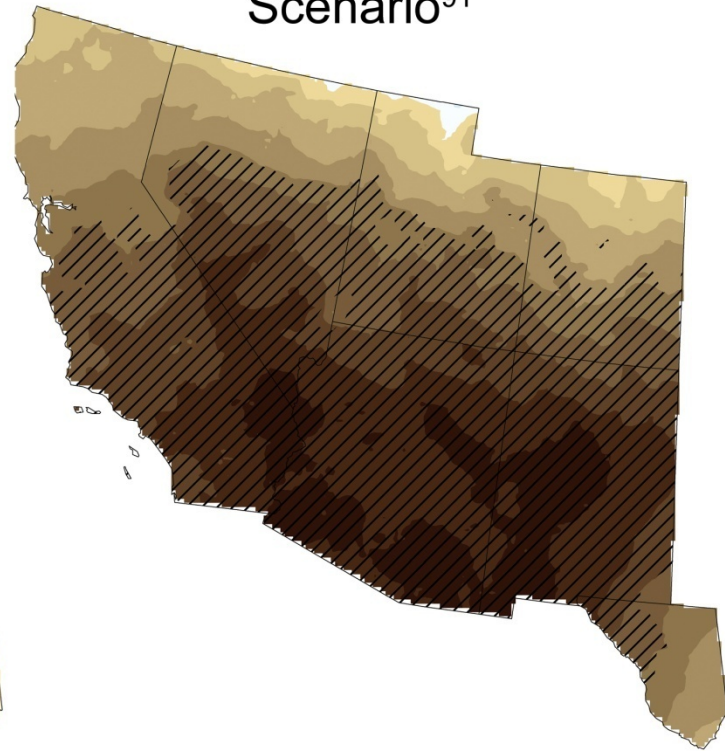
Christensen *et al.*¹⁵²

General schematic of changes in the annual pattern of runoff for snow-melt-dominated streams. Compared to the historical pattern, runoff peak is projected to shift to earlier in the spring and late summer flows are expected to be lower. The above example is for the Green River, which is part of the Colorado River watershed.

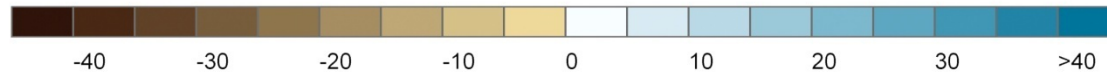
Lower Emissions Scenario⁹¹



Higher Emissions Scenario⁹¹

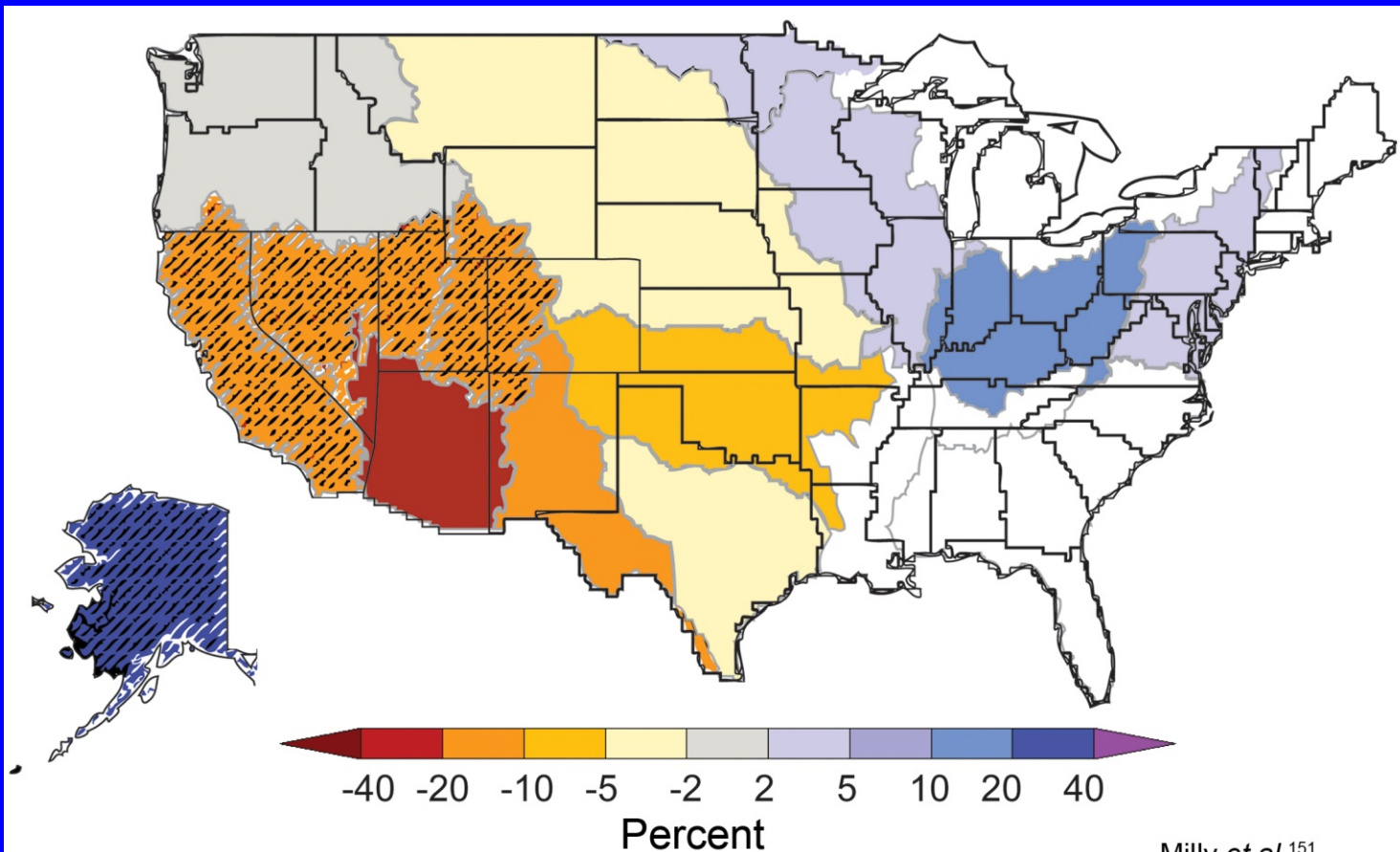


Precipitation Change in Percent



CMIP3-B¹¹⁷

Percentage change in March-April-May precipitation for 2080-2099 compared to 1961-1979 for a lower emissions scenario⁹¹ (left) and a higher emissions scenario⁹¹ (right). Confidence in the projected changes is highest in the hatched areas.



Milly *et al.*¹⁵¹

Projected changes in median runoff for 2041-2060, relative to a 1901-1970 baseline, are mapped by water-resource region. Colors indicate percentage changes in runoff. Hatched areas indicate greater confidence due to strong agreement among model projections. White areas indicate divergence among model projections. Results are based on emissions in between the lower and higher emissions scenarios.⁹¹

Percentage of Years With Colorado River Shortages

Averages of 11 Climate Models

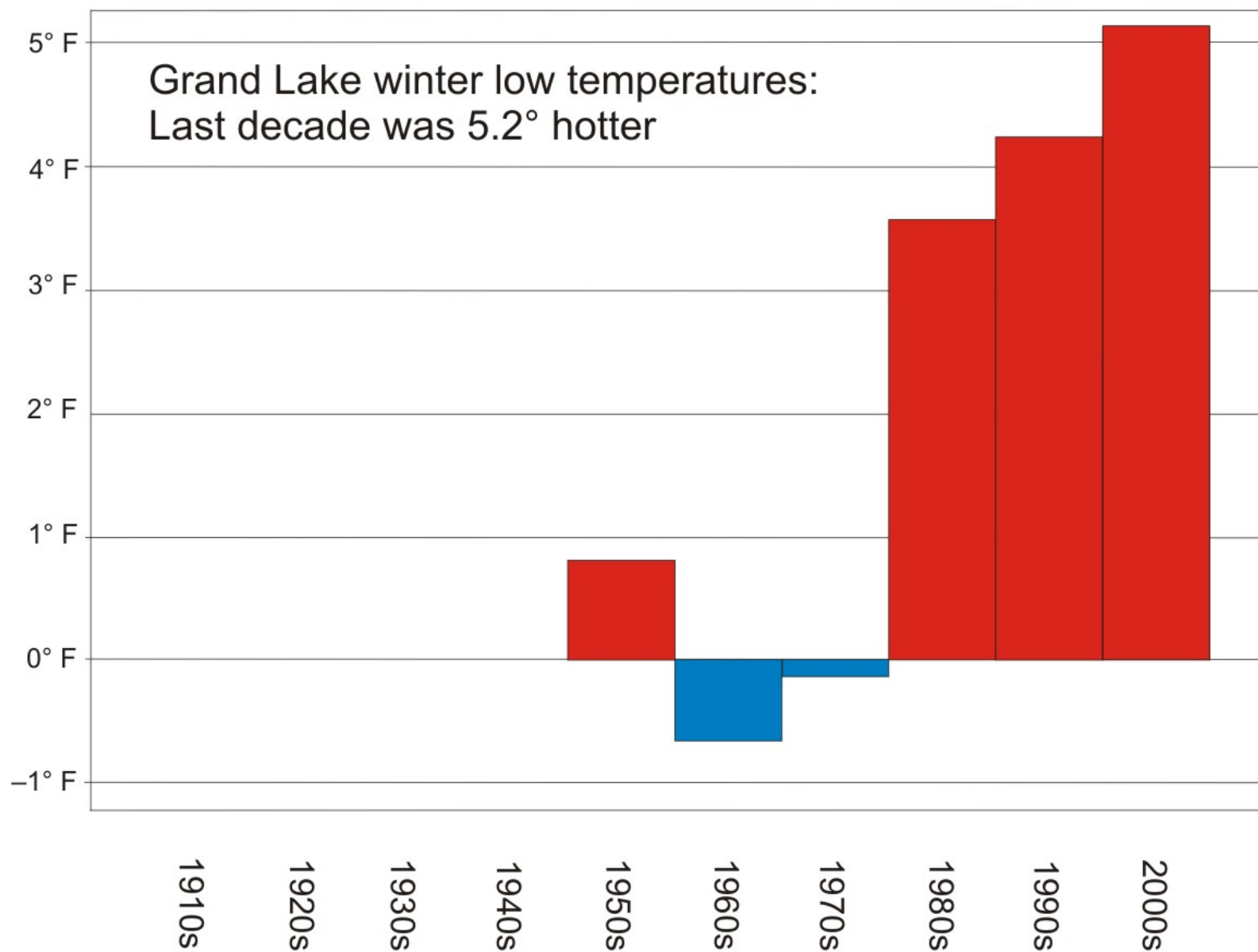
Time Periods	Lower Emissions	Higher Emissions
2010-2039	21%	21%
2040-2069	31%	35%
2070-2099	38%	42%

Christensen and Lettenmaier 2008

Mountain Pine Beetle



Grand Lake winter low temperatures:
Last decade was 5.2° hotter



1996

Wyoming

Colorado

Medicine Bow NF

Cheyenne

Walden

Arapaho and Roosevelt NF's

Routt NF

Fort Collins

Craig

Boulder

Glenwood Springs

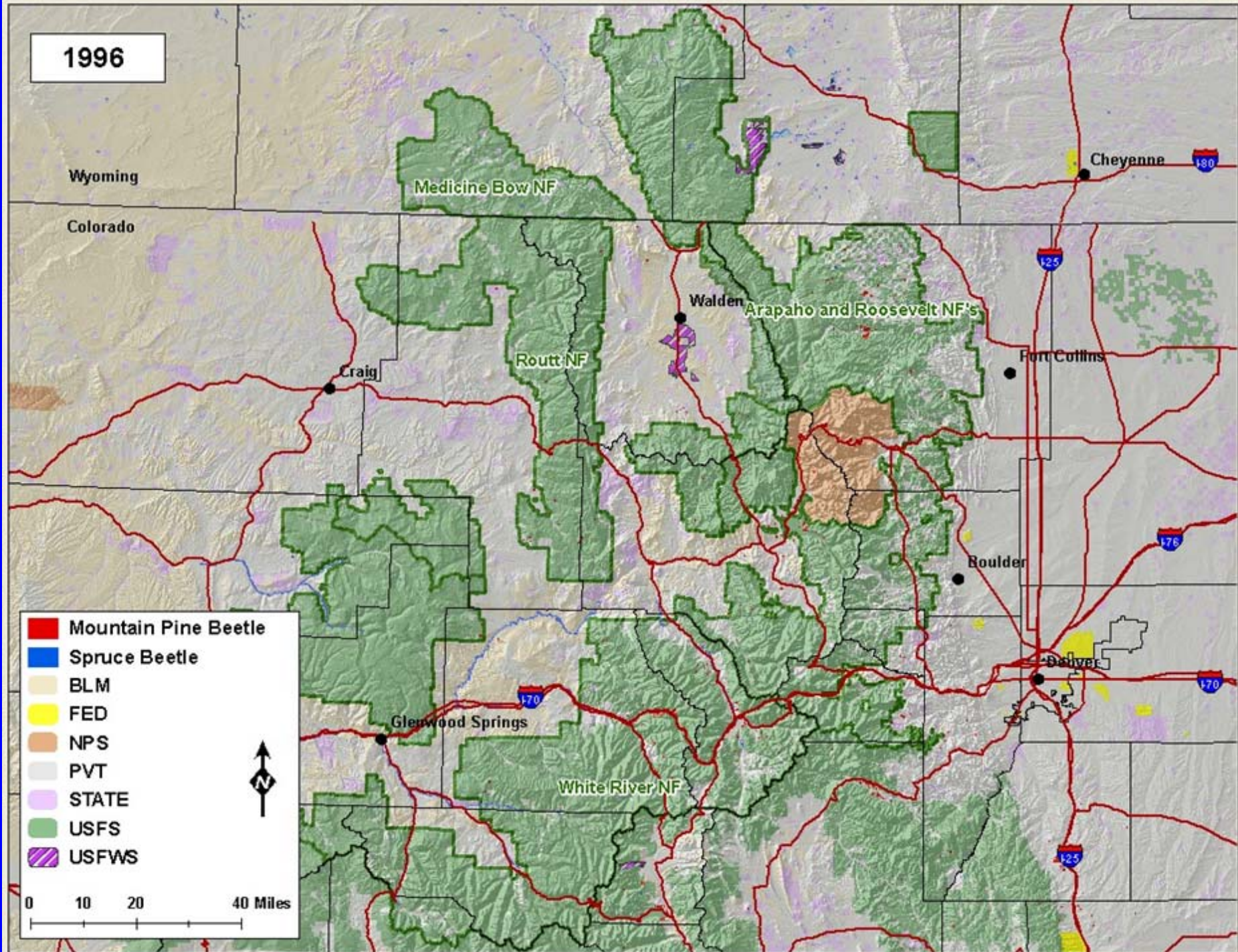
Denver

White River NF

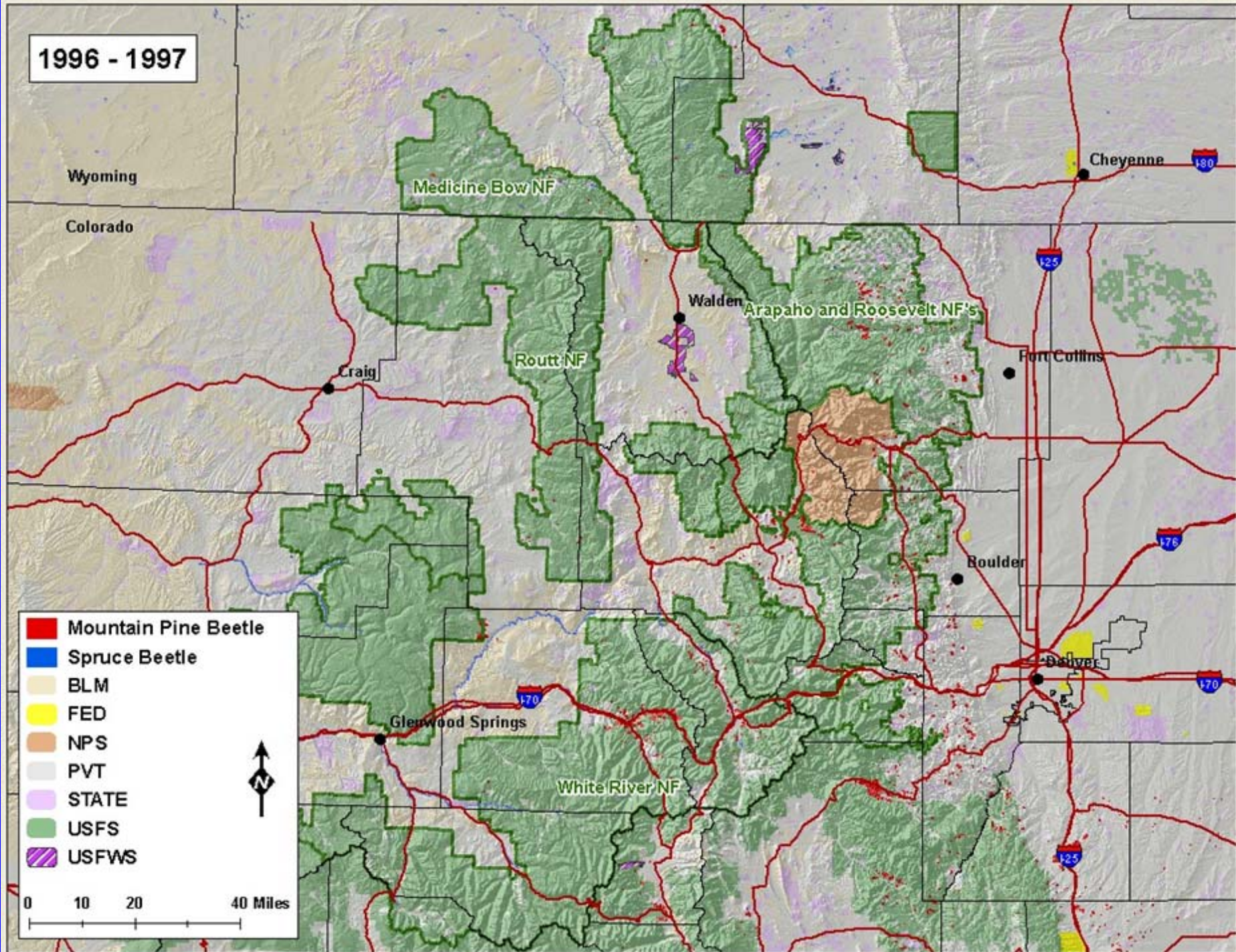
- Mountain Pine Beetle
- Spruce Beetle
- BLM
- FED
- NPS
- PVT
- STATE
- USFS
- USFWS



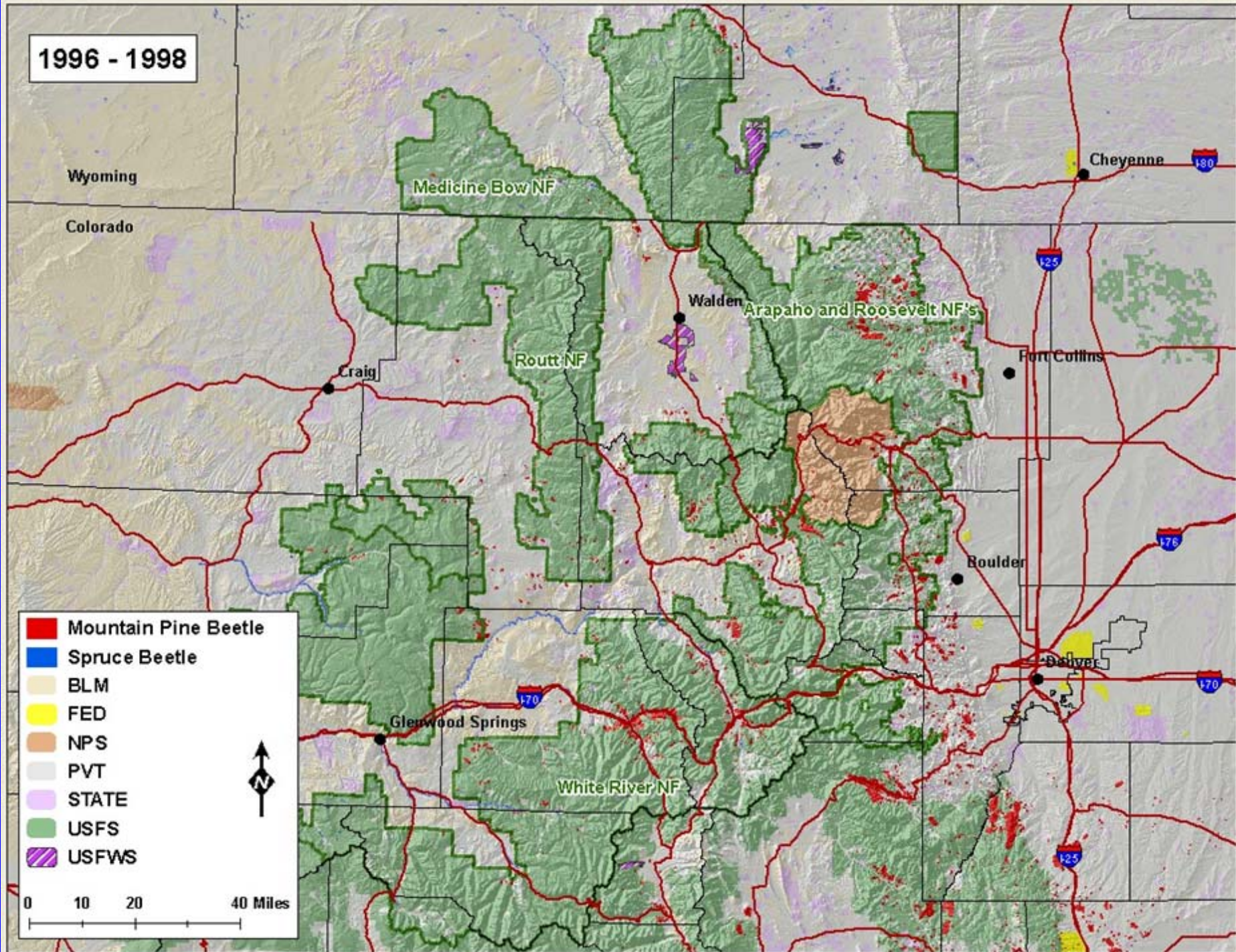
0 10 20 40 Miles



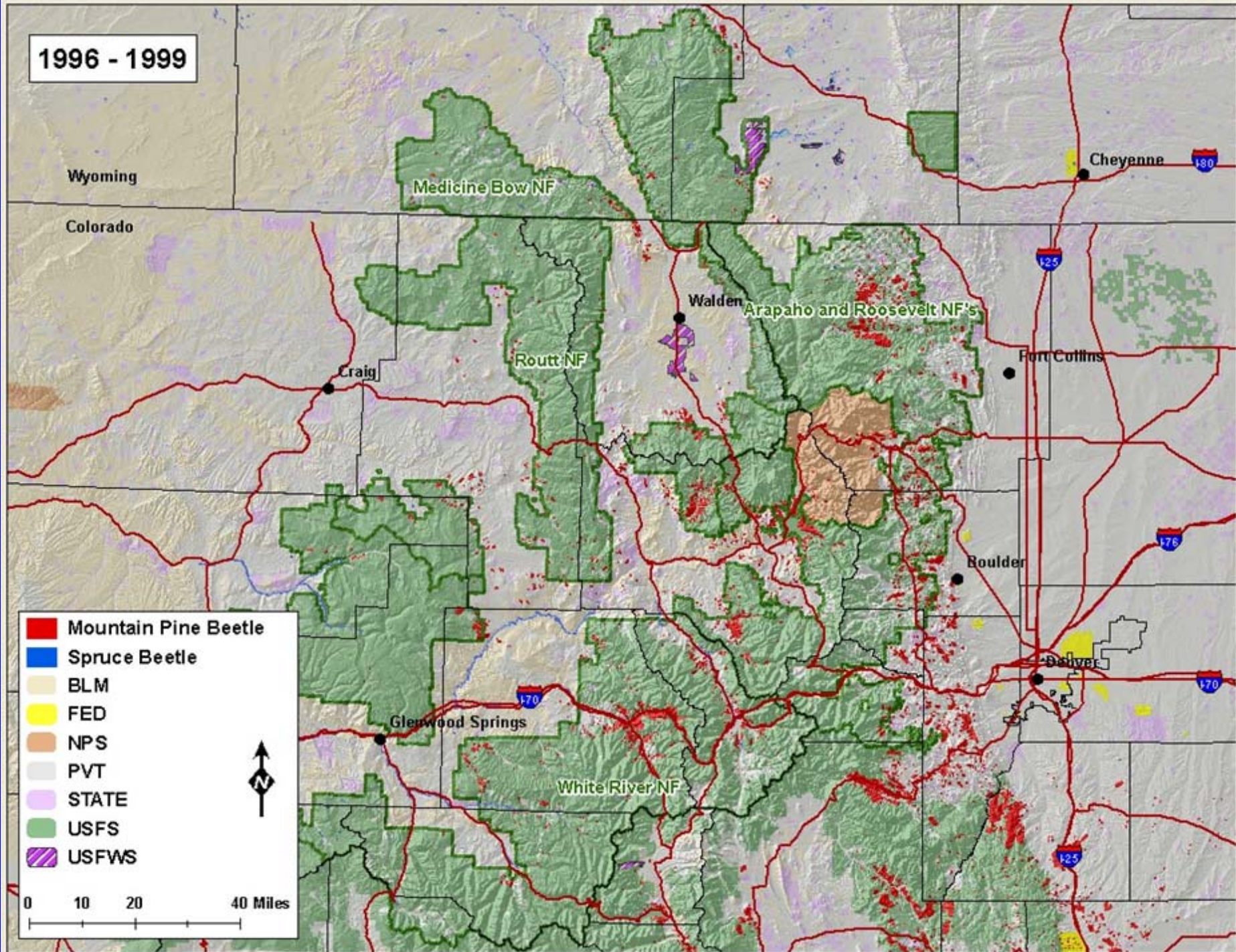
1996 - 1997



1996 - 1998



1996 - 1999



1996 - 2000

Wyoming

Colorado

Medicine Bow NF

Cheyenne

Walden

Arapaho and Roosevelt NF's

Routt NF

Fort Collins

Craig

Boulder

Glenwood Springs

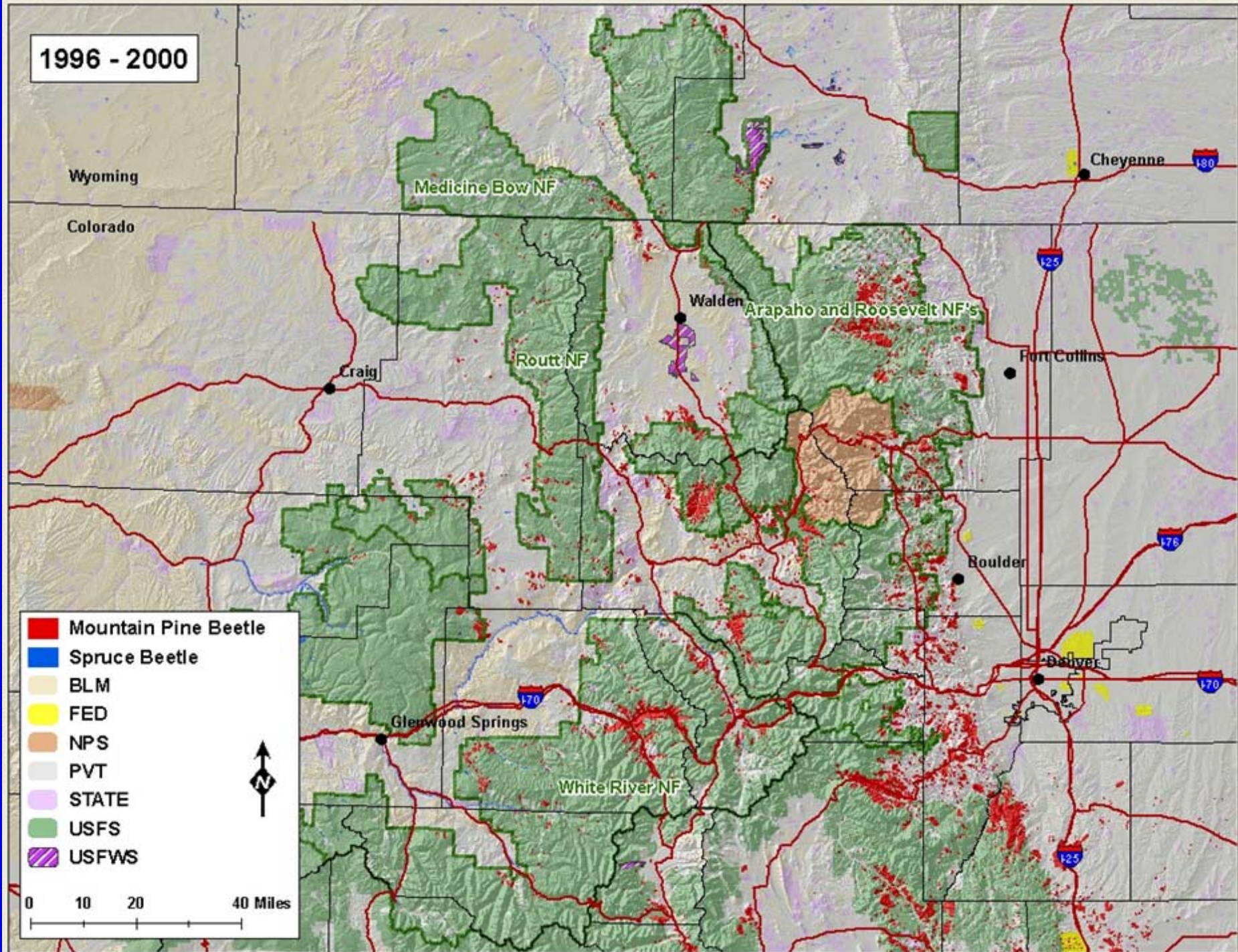
Denver

White River NF

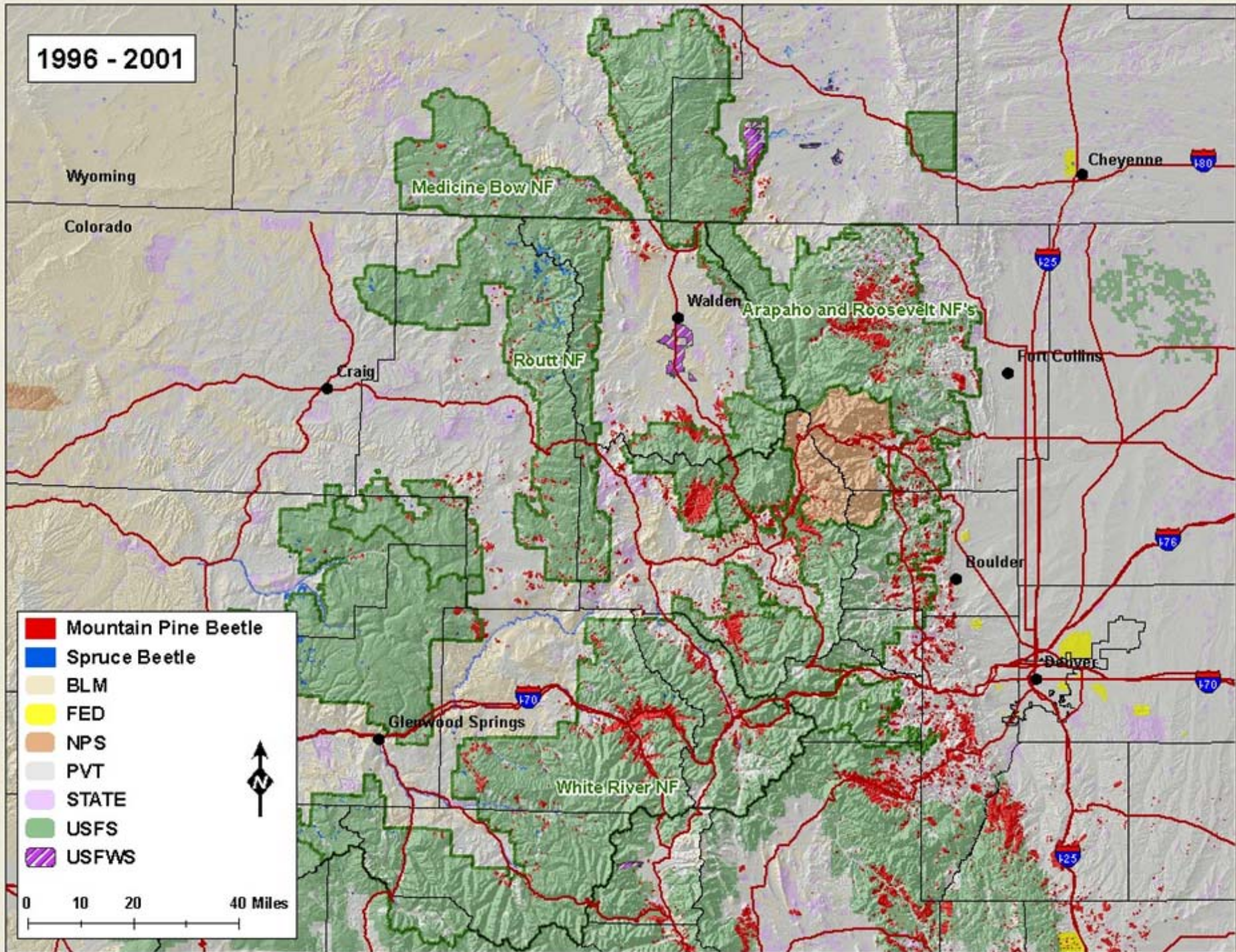
- Mountain Pine Beetle
- Spruce Beetle
- BLM
- FED
- NPS
- PVT
- STATE
- USFS
- USFWS



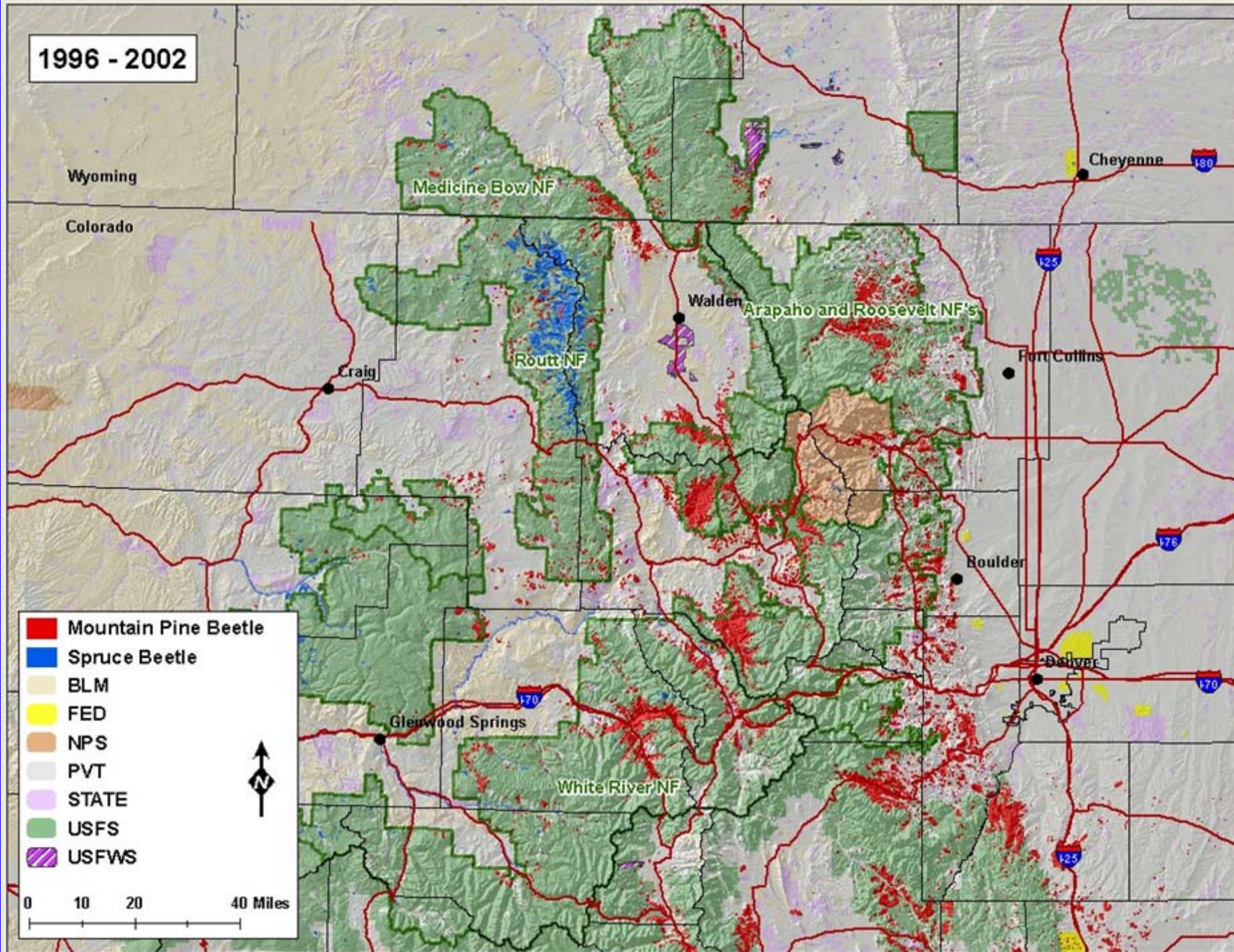
0 10 20 40 Miles



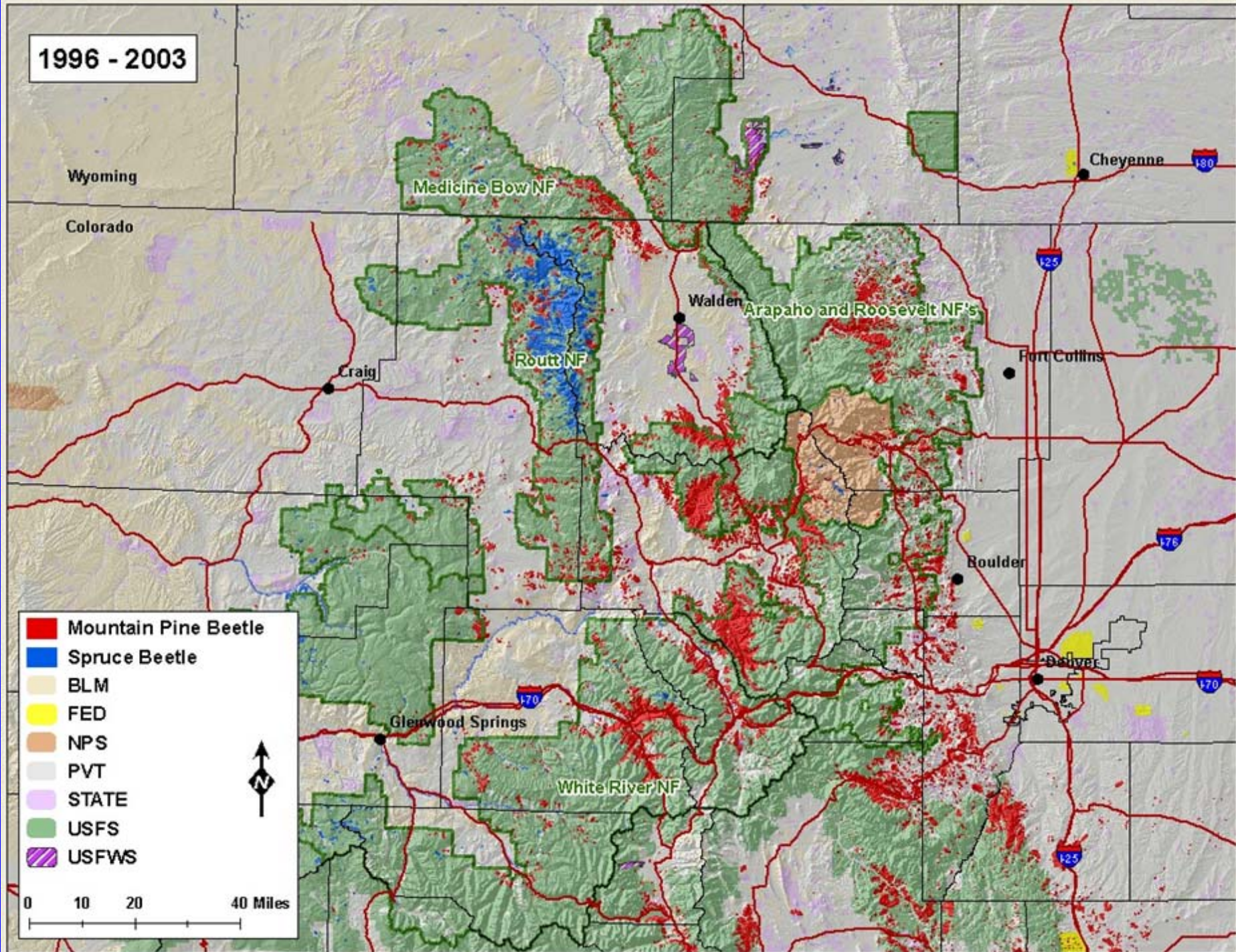
1996 - 2001



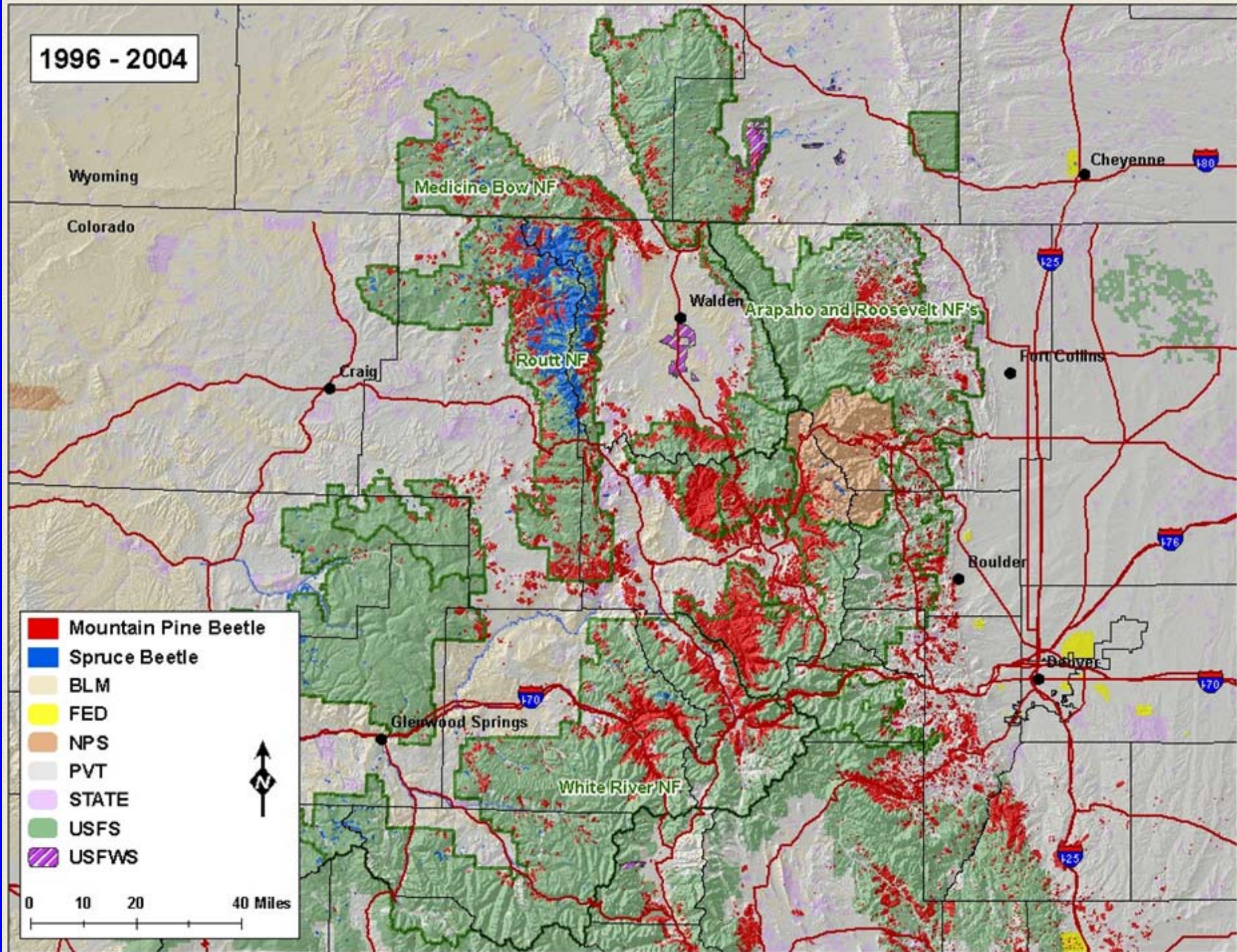
1996 - 2002



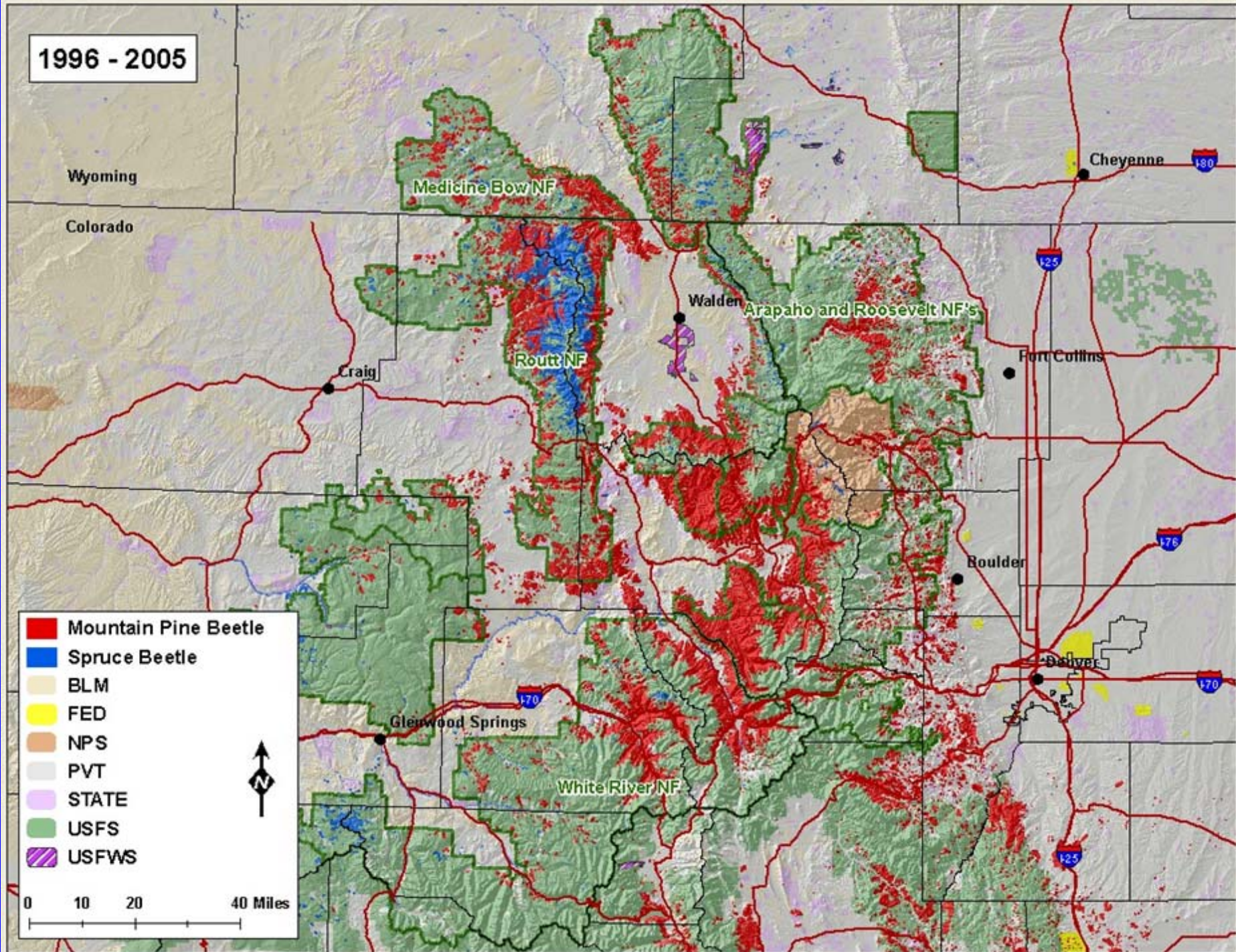
1996 - 2003



1996 - 2004



1996 - 2005



1996 - 2006

Wyoming

Colorado

Medicine Bow NF

Cheyenne

Walden

Arapaho and Roosevelt NF's

Routt NF

Fort Collins

Craig

Boulder

Glenwood Springs

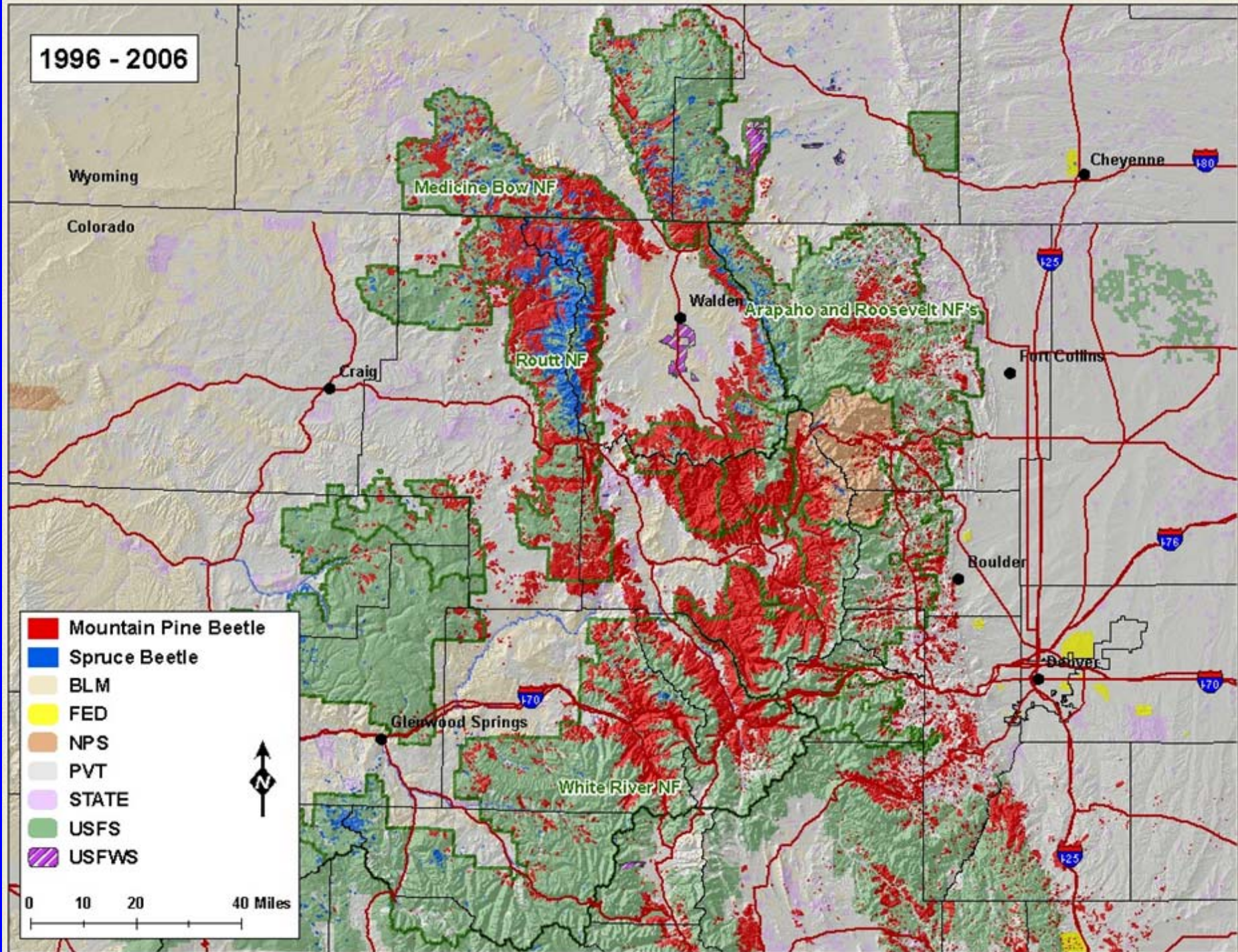
White River NF

Denver

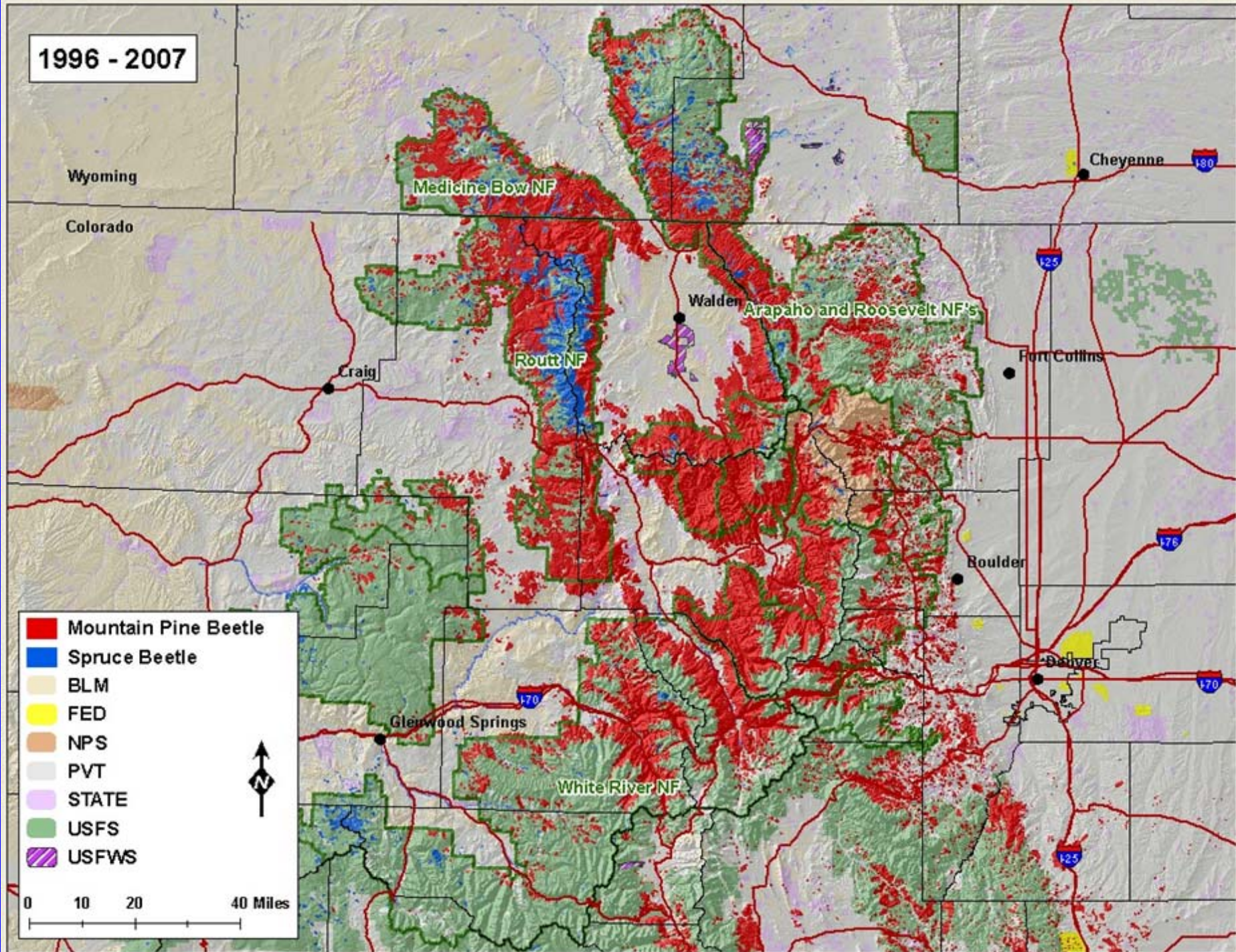
- Mountain Pine Beetle
- Spruce Beetle
- BLM
- FED
- NPS
- PVT
- STATE
- USFS
- USFWS



0 10 20 40 Miles



1996 - 2007



1996 - 2008

Wyoming

Colorado

Medicine Bow NF

Cheyenne

Walden

Arapaho and Roosevelt NF's

Fort Collins

Craig

Routt NF

Boulder

Glenwood Springs

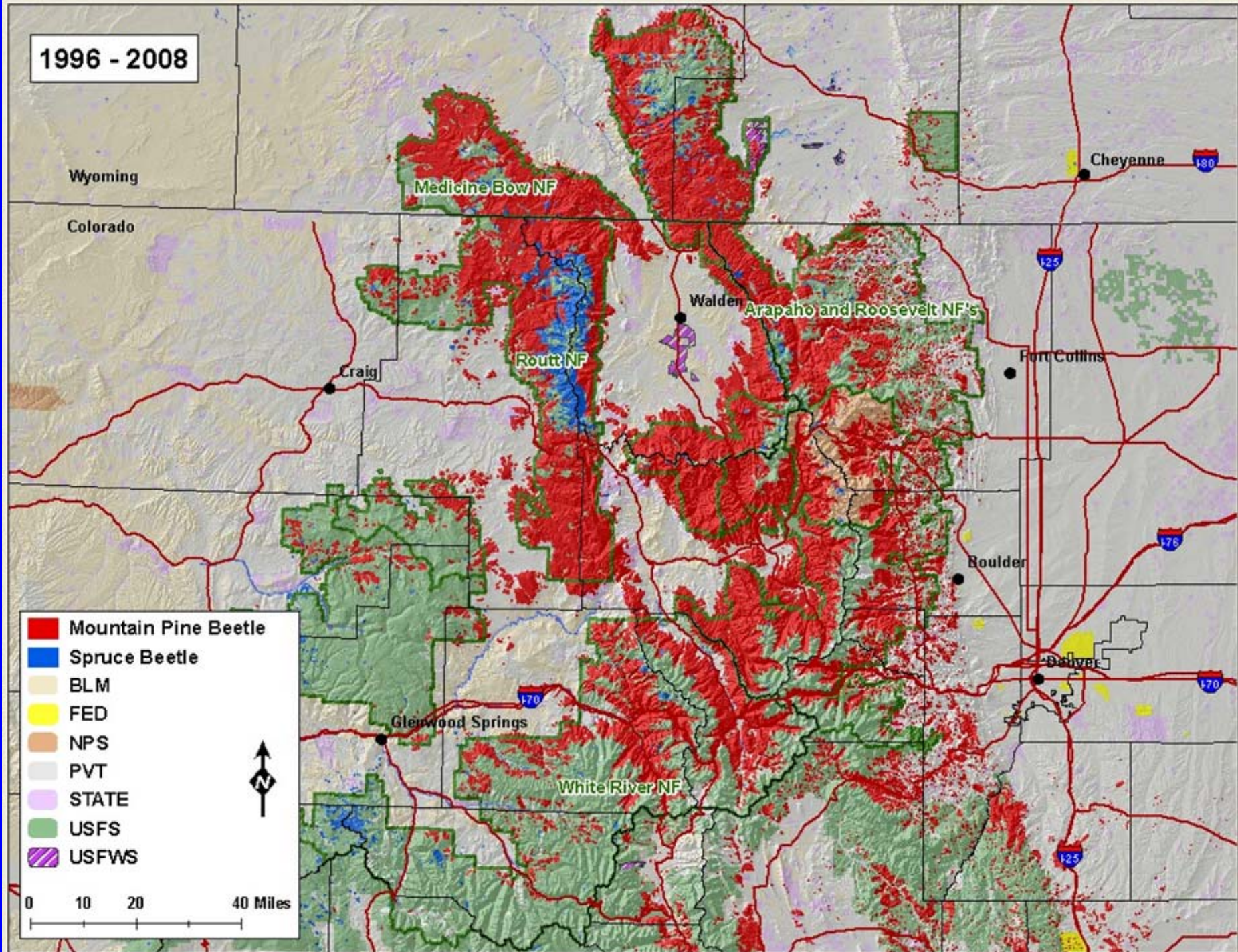
White River NF

Denver

- Mountain Pine Beetle
- Spruce Beetle
- BLM
- FED
- NPS
- PVT
- STATE
- USFS
- USFWS

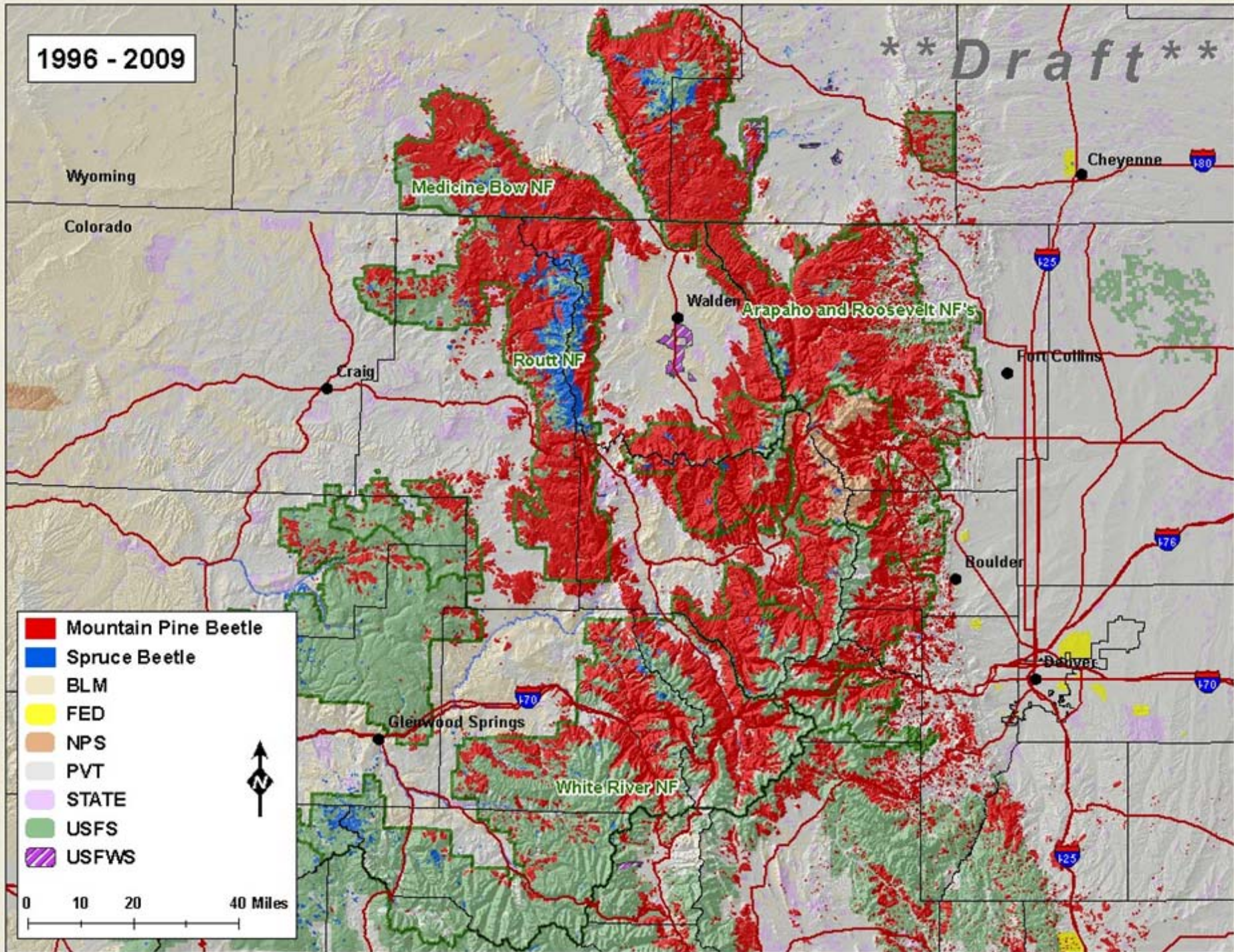


0 10 20 40 Miles



1996 - 2009

*** Draft ***



“I guess we’re the lucky ones
because in our lifetime we got to see
these forests. Our children won’t. For
many that’s a bitter pill to swallow.”

Jan Burke
U.S. Forest Service



Western wildfires in 1988-2005 vs. 1970-1987:

- 78 more days in wildfire season
- 4 times as many fires
- 5 times as long to put out average fire
- 6.5 times as much acreage burned

“You won’t find them [climate change skeptics] on the fire line in the American West anymore.”

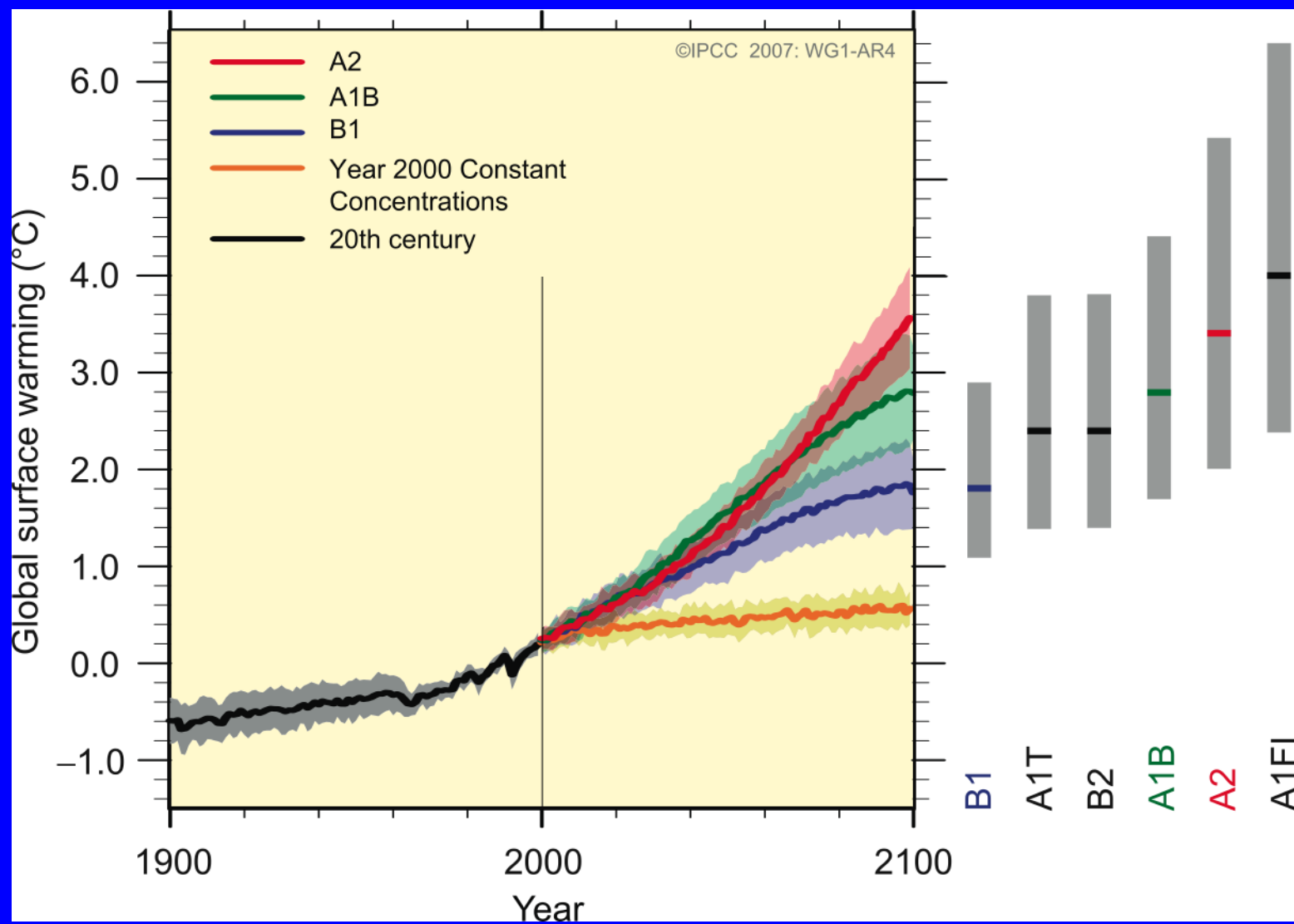
Tom Boatner
Chief of Operations
National Interagency Fire Center

“A variety of research studies suggest that a further 2°F increase [beyond 1980-1999 levels] would lead to severe, widespread, and irreversible Impacts.”

*Global Climate Change Impacts
on the United States*

“To have a good chance (but not a guarantee) of avoiding temperatures above those levels, it has been estimated that atmospheric concentration of carbon dioxide would need to stabilize in the long term at around today’s levels.”

*Global Climate Change Impacts
on the United States*



“None of these scenarios, not even the one called “lower”, includes implementation of policies to limit climate change or to stabilize atmospheric concentrations of heat-trapping gases..”

*Global Climate Change Impacts
on the United States*

The good news:

“There are many benefits of reducing greenhouse gases that go beyond doing our part to stem the tide of climate change...

“These benefits range from reduced air pollution, reduced energy bills for businesses and families, expanded recycling opportunities, new jobs, reduced urban sprawl and traffic congestion, and decreased reliance on non-renewable energy sources...

“If implemented, these actions will preserve and even improve the quality of life in our community.”

Local Action Plan to Reduce
Greenhouse Gas Emissions
City of Fort Collins (1999)

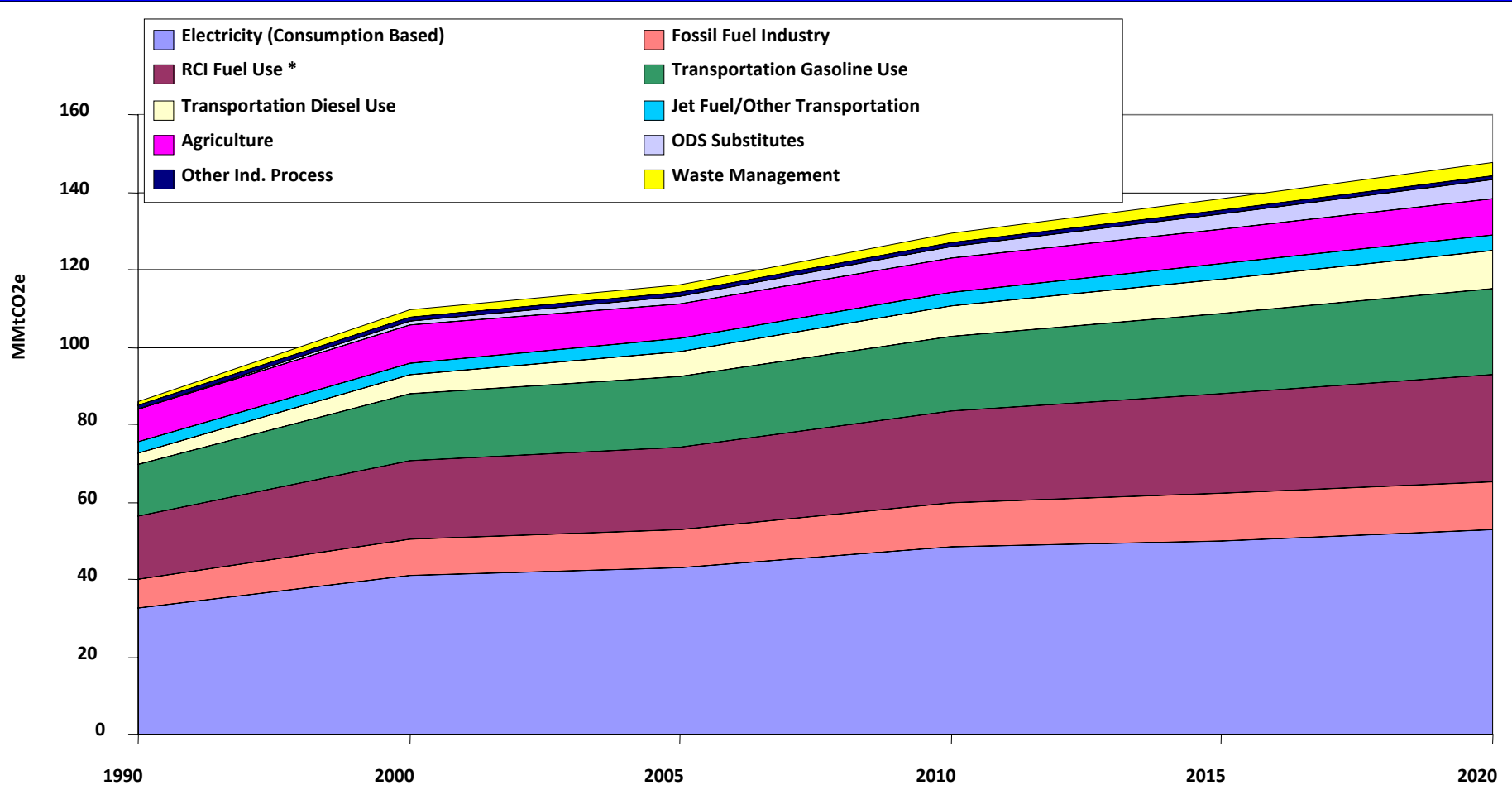
What we do in Colorado matters.

Compared to the world's 212 nations, Colorado emits more carbon dioxide from fossil fuels than 174 nations do.

Under current law, our emissions are projected to be 81% higher by 2020 than in 1990.

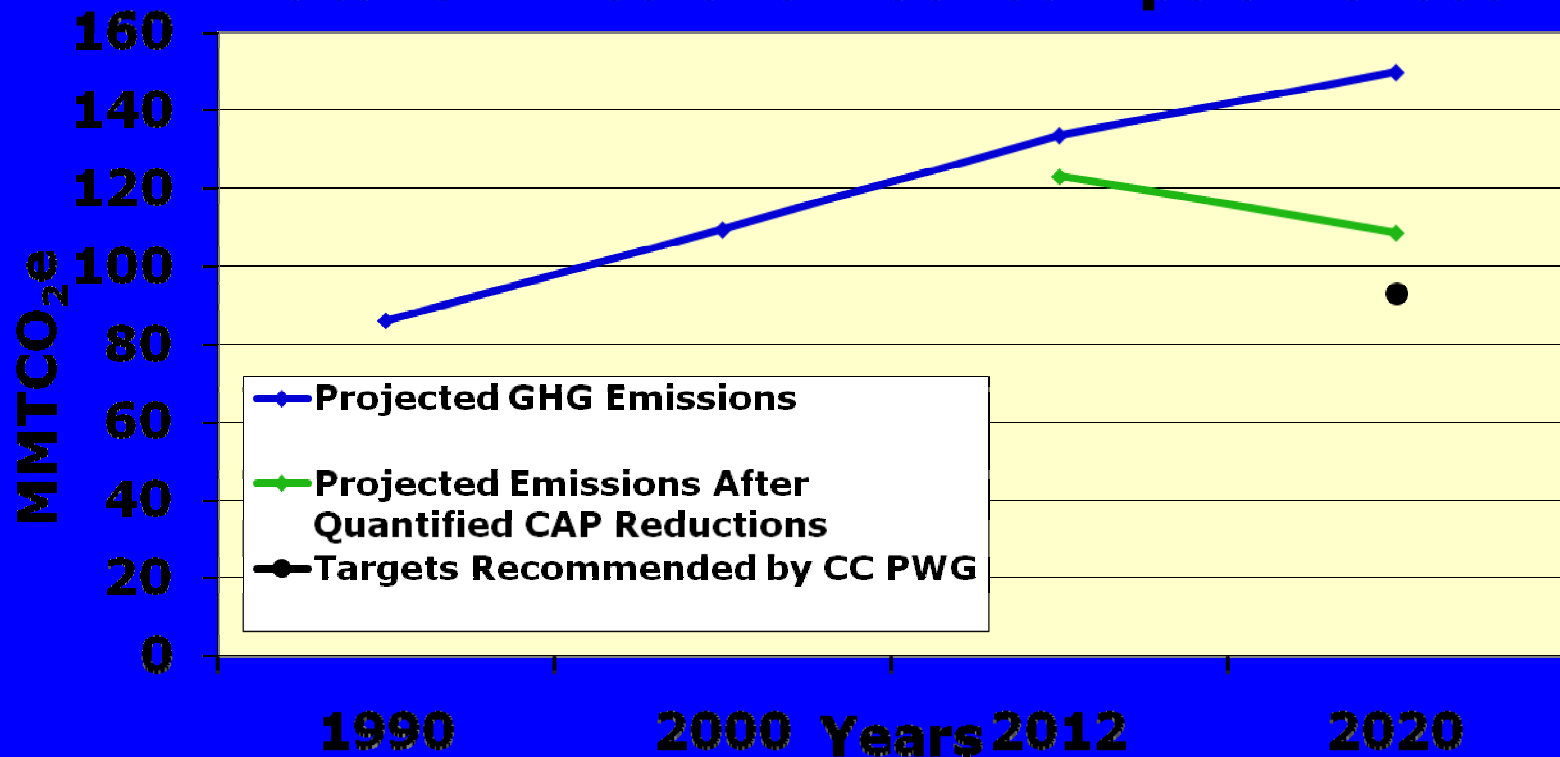
Inventory and Forecast

Colorado Gross GHG Emissions by Sector, 1990-2020



RMCO Climate Action Panel

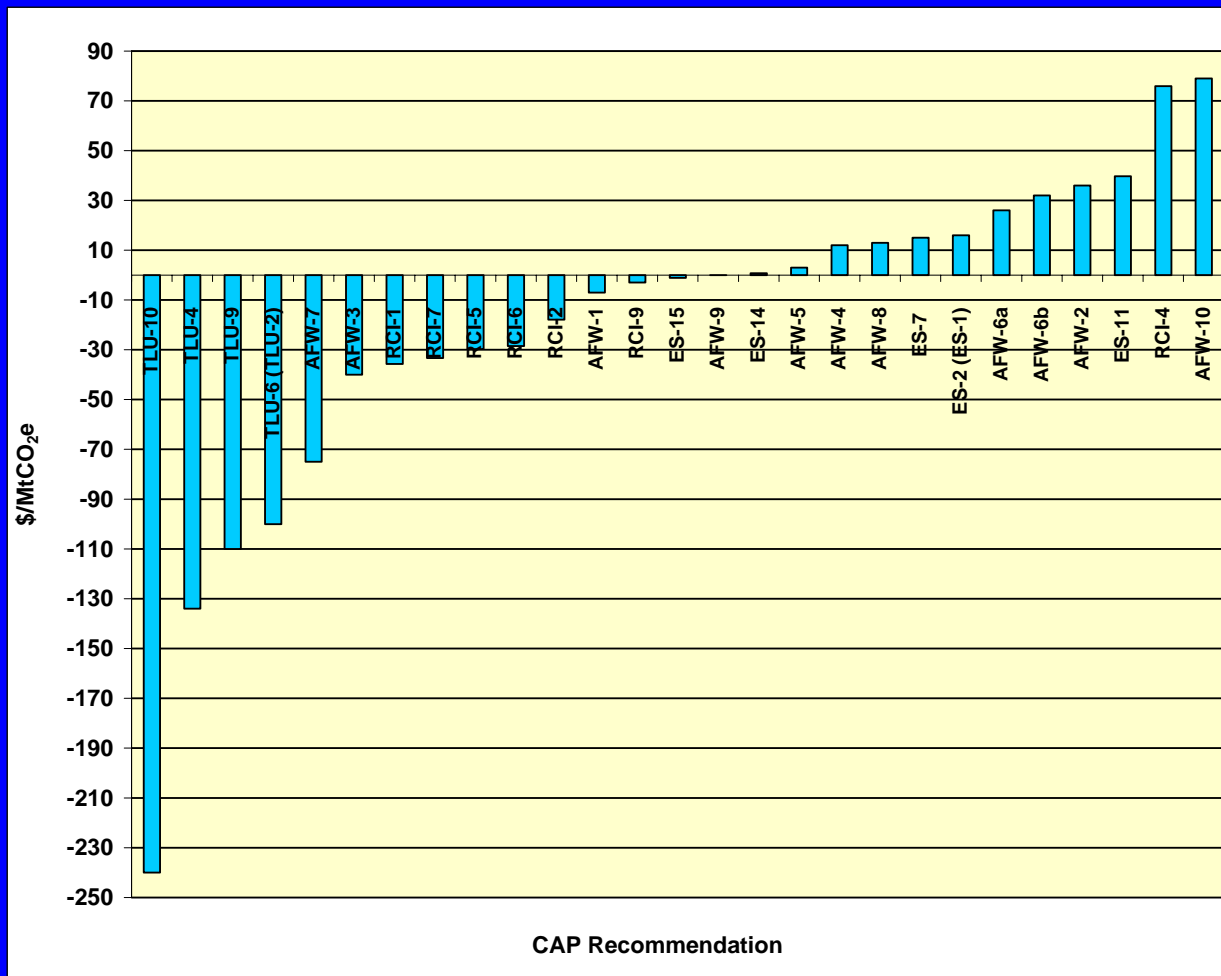
Future Emissions - Consumption Gross



“This has been a balanced, nonpartisan, centrist process that has produced a strong consensus about the things we can do to reduce our contribution and vulnerability to climate change.”

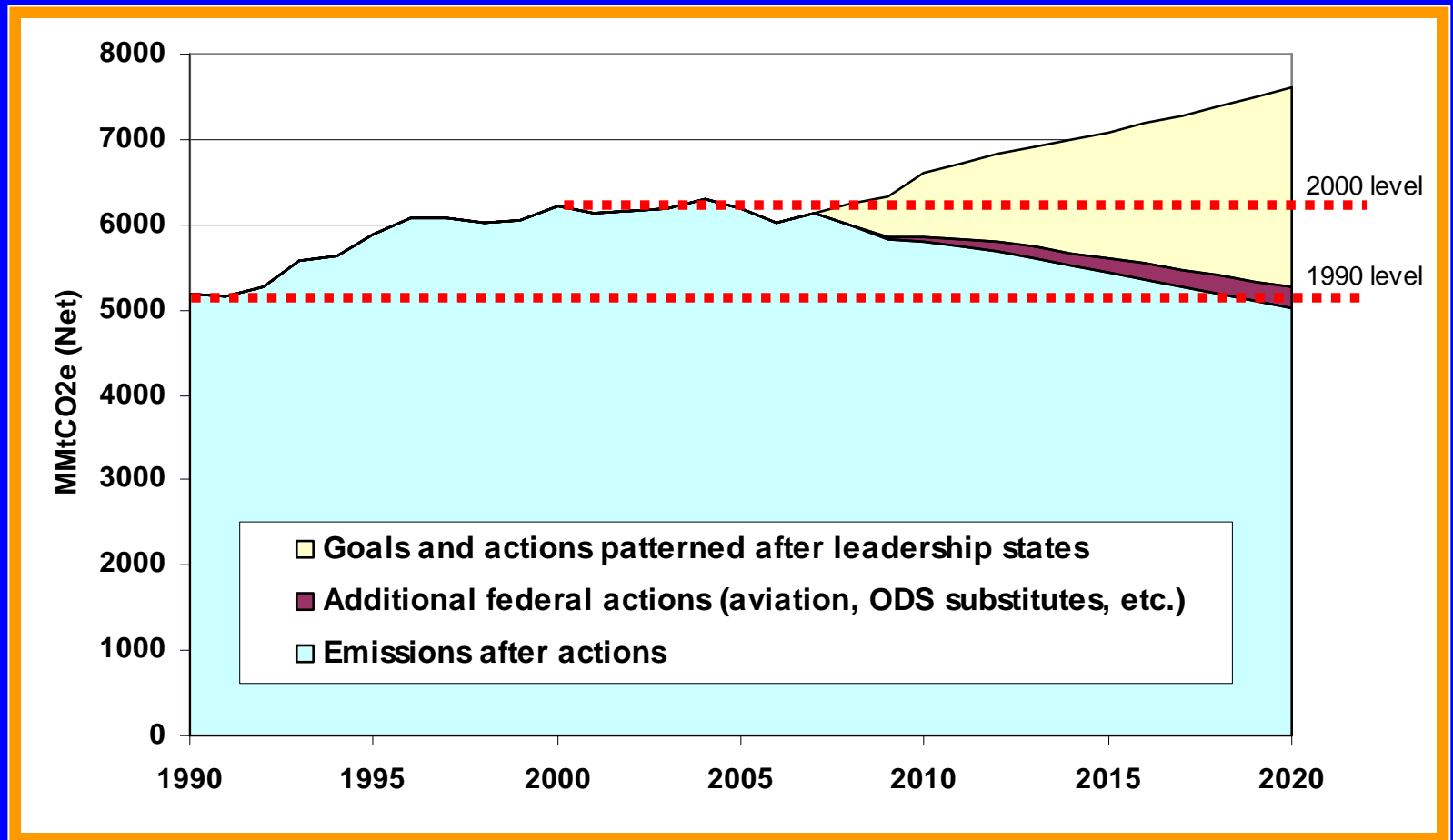
Doug Hutchinson
Mayor of Fort Collins

Costs (Savings) per Ton of Emissions



National Emissions Trajectory

Based on estimated reductions below BAU from planned/implemented actions in leadership states



Source: Center for Climate Strategies

Can we do all this?

It's "not the science and not the economics.
Rather it is the lack of public knowledge, the
lack of leadership, and the lack of political
will."

G. Michael Purdy
Cornell University

“We have not men fit for the times.”

John Adams (1775)

“We are the people we have been waiting for
and it is more than time to take action.”

MIT Vehicle Design Summit (2007)

“As our case is new, so we must think anew, and act anew. We must disenthrall ourselves, and then we shall save our country.”.

Abraham Lincoln (1862)



More information:

rockymountainclimate.org

Stephen Saunders

saunders@rockymountainclimate.org