Socio-economic Considerations for Managing Environmental Futures

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Key Points

- Social, economic and environmental systems form tightly coupled, complex and dynamic relationships.
- ***Environmental problems are inherently social phenomena*** - understanding environmental change needs to consider connections between human activities, ecological and human impacts, and societal responses.
- These connections emphasize the need to consider economic, behavioral, sociocultural and institutional dimensions to understand drivers, impacts, and adaptive management of environmental change.
- Analysis and management of environmental issues require integrated frameworks across social-natural science disciplines, supported by interdisciplinary approaches and data and informed by decision contexts.

Advancement Needs for Integrated Analysis

- Understand interactive drivers and factors across scales and systems
- Represent behaviors, institutional evolutions and social processes
- Capture social and demographic specificity
- Ability to model socioeconomic shocks
- Include multi-dimensional metrics and evaluation of well-being
- Provide decision-relevant exploration
- Integration of biophysical and socioeconomic data and analysis
- Collection of and access to consistent socioeconomic data across scales

Outline

- Social science perspectives on climate change drivers, vulnerability, responses, and innovative methods and tools
- Case study: Socio-environmental indicators of wildfire risks, vulnerability and resilience
- Further thoughts on data, methods and decision-relevant research

Drivers of Climate Change

- Key factors driving climate change:
  - population growth and demographic shifts
  - economic systems (growth, consumption, production, and trade)
  - political power, social stratification and inequality
  - technology and infrastructure
  - land use change and land transformation (e.g., urbanization)
- These factors form dynamic interactions both in the short- and the long-term and across spatial scales
- Social and cultural contexts are important for understanding the drivers of emissions (such as consumption culture, norms, values, and lifestyles)
- The importance of understanding path dependency

Vulnerability to Climate Change

- Differential human vulnerability to environmental hazards results from a range of social, economic, historical, and political factors, which operate at multiple scales.
- Social vulnerabilities to climate change are both tangible (e.g., infrastructure) and intangible (e.g., social life).
- Access to resources is one critical factor that shapes communities' ability to plan for and respond to the impacts of climate change.
- Cultural systems shape how people understand environmental change, while at a local or regional scale culture and history may constrain the feasible responses to climate-change threats.
- The information that individuals, organizations, communities, and societies have about likely future climate conditions and how they use it are crucial in determining their vulnerability.

Innovative Interdisciplinary Methods

- Social sciences provide a range of quantitative and qualitative methods and data to study coupled human and natural systems (e.g., integrated assessment modeling, multi-scale and multi-sector analysis of impacts and resilience)

- Innovative tools and recent advancements:
  - Geospatial tools, e.g., remote sensing coupled with socioeconomic data
  - Agent-based modeling
  - Big Data
  - Real-time disaster response data (e.g., cellphone use, social media)

- In addition to modeling, empirical analysis, scenarios, indicators, case studies, surveys can be incorporated

- Measurements of both the tangible (e.g., economic, infrastructure) and the intangibles (e.g., way of life, ecosystem services)

Additional Resources & Publications

US Global Change Research Program Social Science Coordinating Committee
"Social Science Perspectives on Climate Change"

1. Characterizing differences between and within communities affecting *social vulnerability* to climate change
2. Providing social science perspectives on *drivers* of and *responses* to climate change
3. Identifying *innovative tools, methods, and analyses* to clarify the interactions of human and natural systems under climate change

https://www.globalchange.gov/content/social-science-perspectives-climate-change-workshop

Co-production of Knowledge

- Three-day workshop held in March 2017 at NASA
  - ~90 attendees
  - 13 federal agencies and IWGs
  - 23 universities
  - 4 professional associations
  - 3 NGOs

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Social Science Perspectives on Climate Change workshop

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The Social Science Perspectives on Climate Change workshop was held in Washington, DC in March 2017. The workshop was organized by the U.S. Global Change Research Program's (USGCRP) Social Science Coordinating Committee (SSCC) in cooperation with the American Anthropological Association, the American Association of Geographers, the American Sociological Association, and the Society for American Archaeology. The workshop had three aims:

- Demonstrate how the social sciences can add important methods, perspectives, and data to climate change mitigation and adaptation efforts;
- Enhance collaboration between academic and federal social scientists, and between natural and social scientists; and
- Develop products that support the Fourth National Climate Assessment, USGCRP's Interagency Working Groups, and federal agencies.

This workshop brought together about 30 academic, environmentally focused social scientists from archaeology, cultural anthropology, human geography, and sociology, with some 60 federal staff involved in climate change-related activities. Each of those disciplines has developed a large body of research on the human dimensions of climate change that can complement federal climate change research, but is not often considered.

The March 2017 workshop focused on three themes: identifying innovative tools, methods, and analyses to clarify the interactions of human and natural systems under climate change; describing key factors shaping differences in social vulnerability to climate change; and providing social science perspectives on drivers of global climate change. The themes were identified in advance of the workshop by the SSCC and representatives from the four participating associations. The associations, in turn, recruited scholars from their disciplines to serve with SSCC members on interdisciplinary writing teams for each of the themes. The teams prepared preliminary drafts for use in the March 2017 workshop. There the writing groups met with federal participants, who offered reactions and ideas for improving the white papers. They have been extensively revised since the workshop.

Drivers and Responses:

Social Science Perspectives on Climate Change, Part 2

Shirley Fiske, Klaus Hubacek, Andrew Jorgenson, Jia Li, Tom McGovern, Torben Rick, Juliet Schor, William Solecki, Richard York, Ariela Zycherman

April 2018

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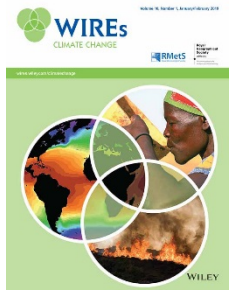

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Check for updates

WILEY WIREs CLIMATE CHANGE

ADVANCED REVIEW

Social science perspectives on drivers of and responses to global climate change

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This article provides a review of recent anthropological, archeological, geographical, and sociological research on anthropogenic drivers of climate change, with a particular focus on drivers of carbon emissions, mitigation and adaptation. The four disciplines emphasize cultural, economic, geographic, historical, political, and social-structural factors to be important drivers of and responses to climate change. Each of these disciplines has unique perspectives and makes noteworthy contributions to our shared understanding of anthropogenic drivers, but they also complement one another and contribute to integrated, multidisciplinary frameworks. The article begins with discussions of research on temporal dimensions of human drivers of carbon emissions, highlighting interactions between long-term and near-term drivers. Next, descriptions of the disciplines' contributions to the understanding of mitigation and adaptation are provided. It concludes with a summary of key lessons offered by the four disciplines as well as suggestions for future research.

This article is categorized under:
Climate Economics > Economics and Climate Change

KEYWORDS
adaptation, anthropology, archeology, climate change, geography, greenhouse gas emissions, mitigation, social science, sociology, sustainability

Socio-Environmental Indicators: A case study of wildfire risks, vulnerability and resilience

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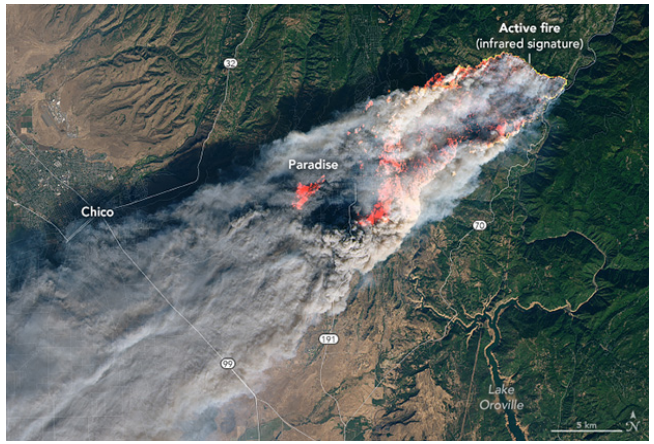
Wildfire Activity



Wildland Urban Interface

Fire Management

Climate Change Indicators

- Need to communicate, monitor, measure, and analyze complex information on dynamic trends related to climate change, impacts and vulnerabilities of socio-ecological systems, and inform and evaluate response decisions

- Many existing indicators focus largely on the indicator's ability to detect a physical change or response (e.g., temperature, precipitation) to climate change (NASA 2019; NOAA 2019; USEPA 2016) with less attention given to the development of proxies for the complex human dimensions (e.g., drivers, impacts, responses).

- **Barriers** to the development and operationalization of coupled socio-environmental system indicators: (1) conceptual differences regarding what should be measured and how, and (2) challenges to data integration, scale, and gaps in data collection.

Research Summary

- **Purpose:** Investigate strategies for developing coupled socio-environmental systems (SES) indicators that integrate socioeconomic data and indicators on human dimensions with more ‘traditional’, biophysical indicators of climate change.

- **Approach:** An interdisciplinary collaboration to assess social science and indicators literature and use a case-study approach to explores issues related to indicator goals and uses, multi-scalar indicator development, issues for integrating socioeconomic and environmental data.

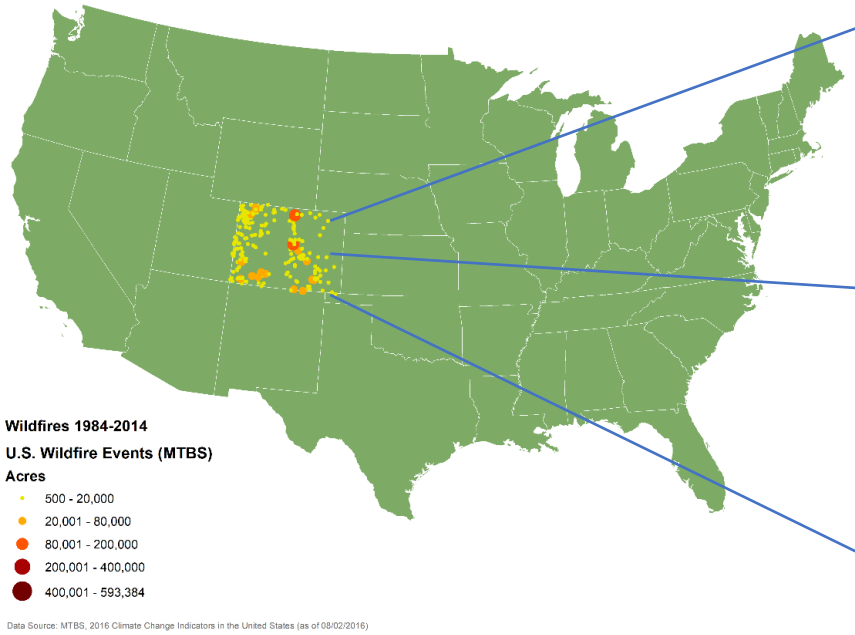
- **Case study**: Multi-scalar SES indicators of wildfire risks, vulnerability and resilience at national, state and local levels.

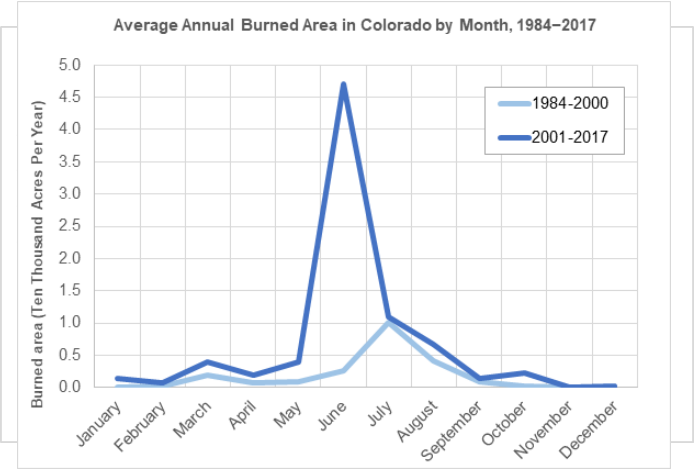
Example Wildfire Questions Across Scales

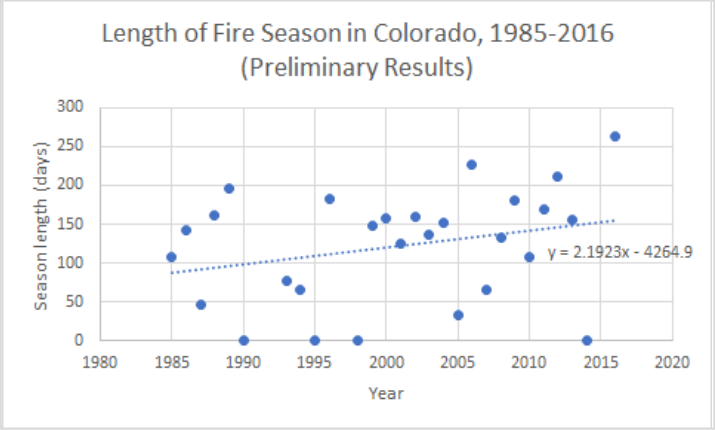
Scale	Example Questions
National	1. Under changing climate and socioeconomic conditions, what are trends in wildfire hazards, exposures, vulnerability and impacts? 2. Which areas are prone to increasing wildfires? 3. What is the economic risk of wildfires? 4. What population groups may be more vulnerable to wildfire risks?
Region/State	1. Similar questions as for “National” 2. What areas and populations are vulnerable to wildfires? 3. How should resources be allocated to increase resilience to wildfire events? 4. What measures are needed for forest management? 5. What the barriers are to increased resilience? What are the external and internal limits and drivers to change?
Local	1. Similar questions regarding wildfire risks and vulnerability as under “National”; 2. Which areas and housing are more prone to wildfire risks? 3. Which population groups are more vulnerable to wildfire risks? 4. How to improve targeting of fuel treatments and prescribed burns? 5. How to target community fire preparedness and resilience efforts? 6. How can local policies (e.g., zoning, building codes) enhance resilience of local community?

Case Study: Wildfires Activity and Related Trends

Indicators characterize physical changes related to U.S. wildfire activity, vulnerability, and exposure risk.







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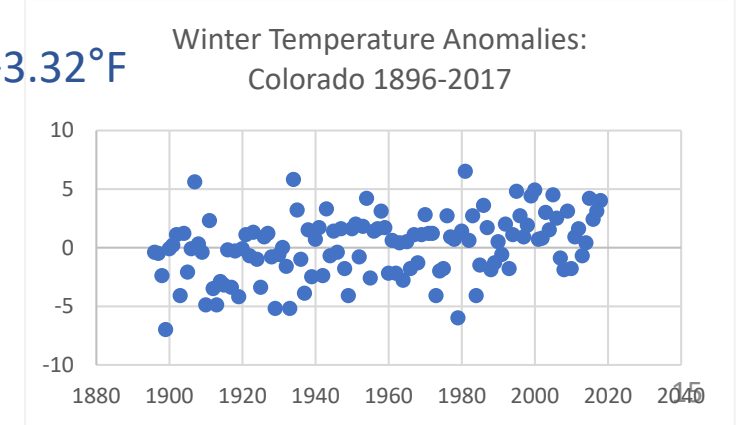


Other long-term trends over the last 30+ years (Western U.S): Earlier snowmelt, less summer rain, less snow days.

Wildland Urban Interface (WUI)

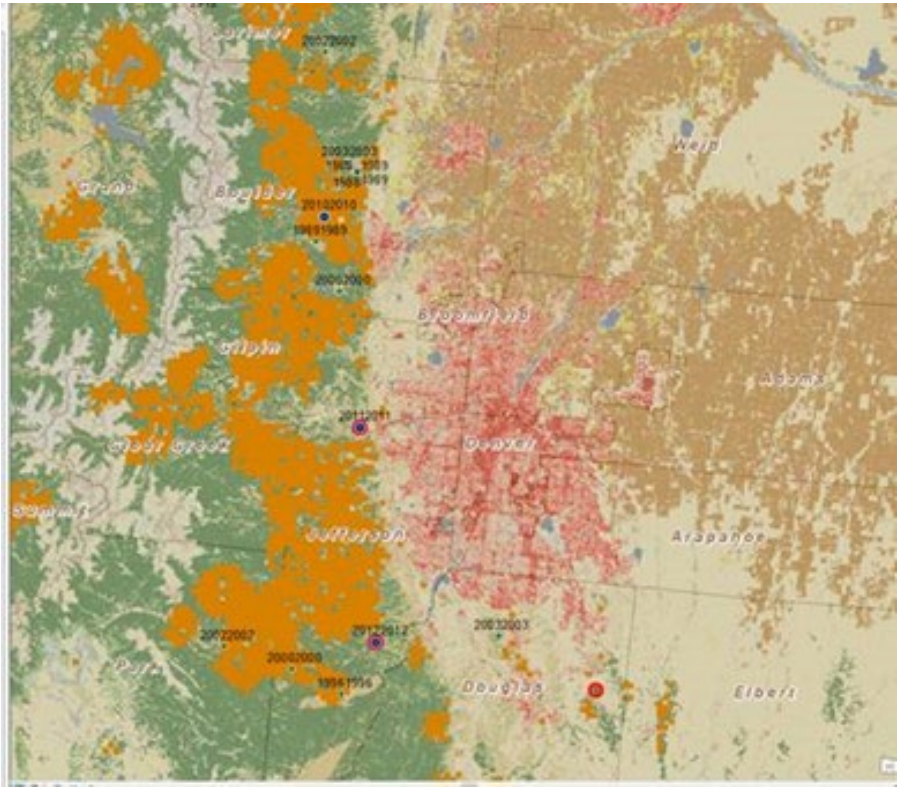
Waldo Canyon Fire. Source

Boulder County is experiencing key changes:

- Accumulation of wildland fuels from past suppression.
- Expansion of the wildland-urban interface.

35% growth in homes the last decade.
60% of this zone has been developed.
#1 densest development in Colorado.

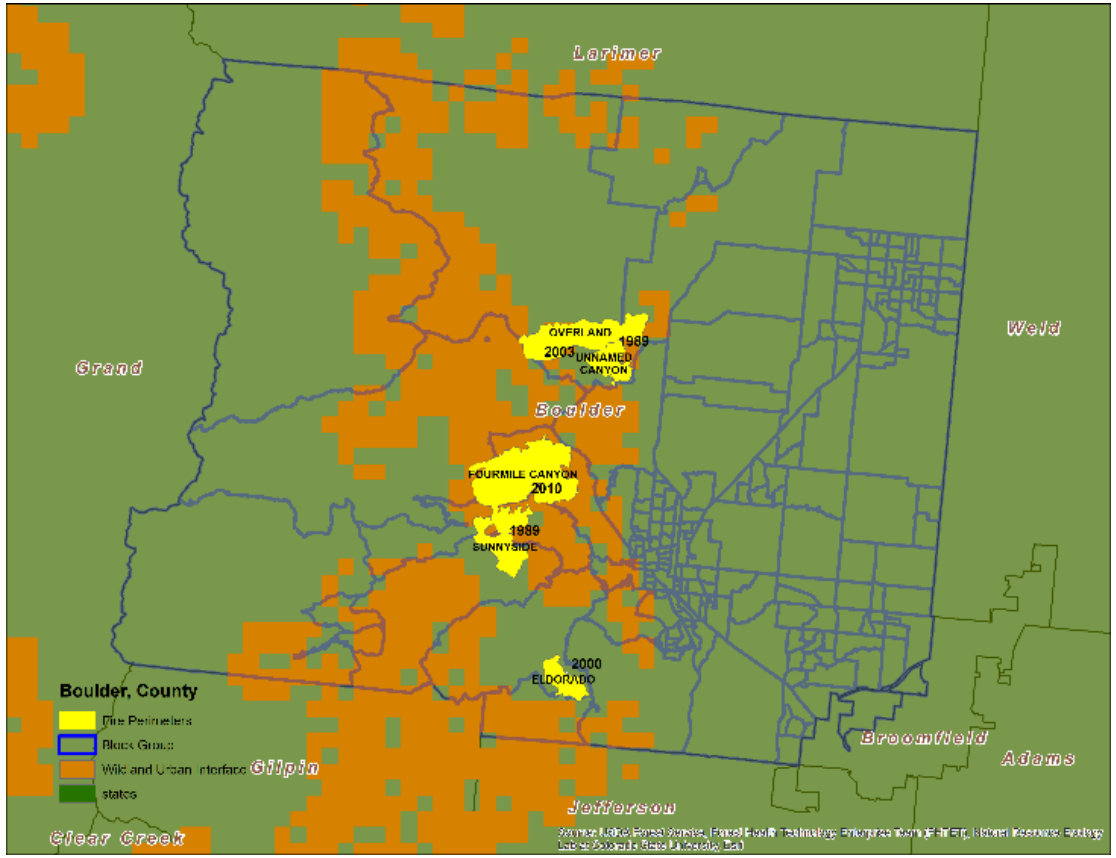
The WUI is defined as *"the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels."*

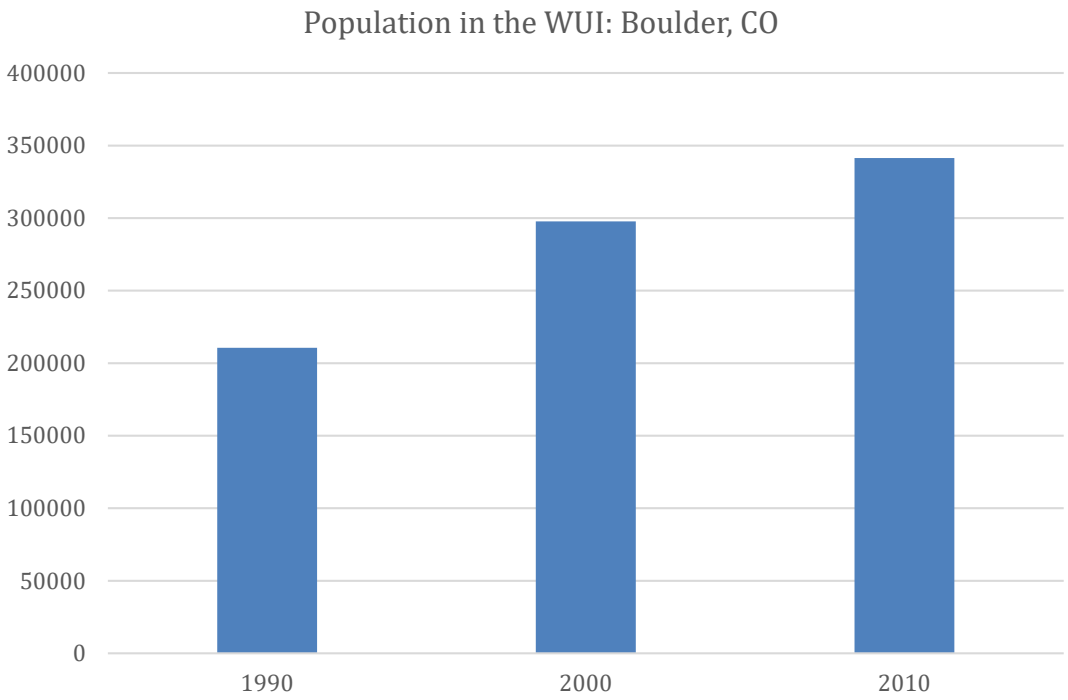


The challenge: WUI is dynamic; no consistent definition; scale dependent.

The WUI Boulder, CO consists of private land in many areas (not just public forests).

Boulder, County WUI and Population Change



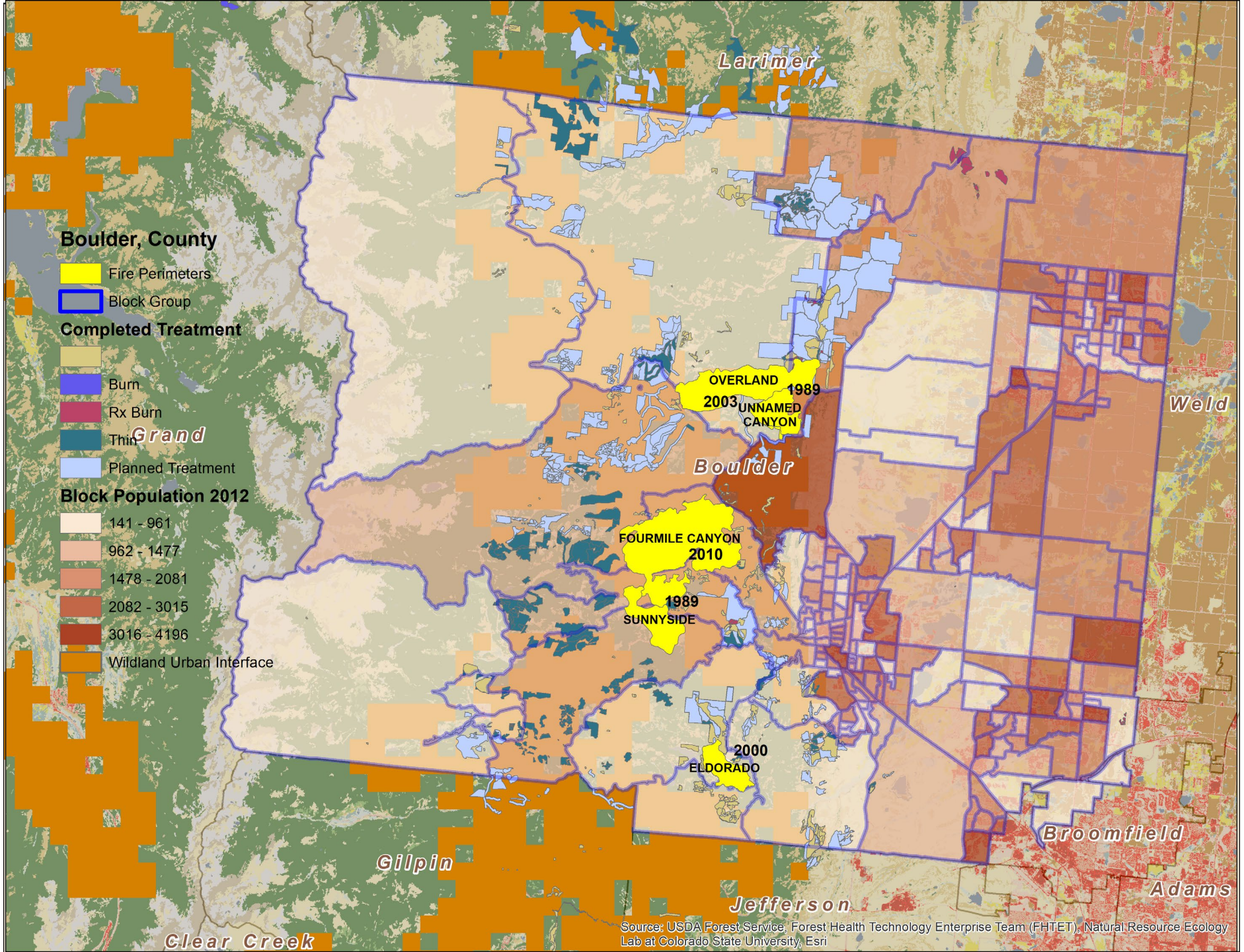


Change in Population in the Wildland Urban Interface: Boulder, Colorado

Local Vulnerability, Resilience and Adaptive Capacity

- Socioeconomic factors are multi-faceted, dynamic, and place specific, e.g.:
  - forest management practices (e.g., thinning, fuel treatment)
  - land use (e.g., zoning)
  - land ownership
  - residential ownership
  - Income/access to resources
  - demographics (e.g., number of seniors living alone)
  - risk perceptions
  - social networks and community cohesion

- A diverse set of information can be integrated to visualize and analyze the dynamic interactions between wildfires and social vulnerability at the local and community level.

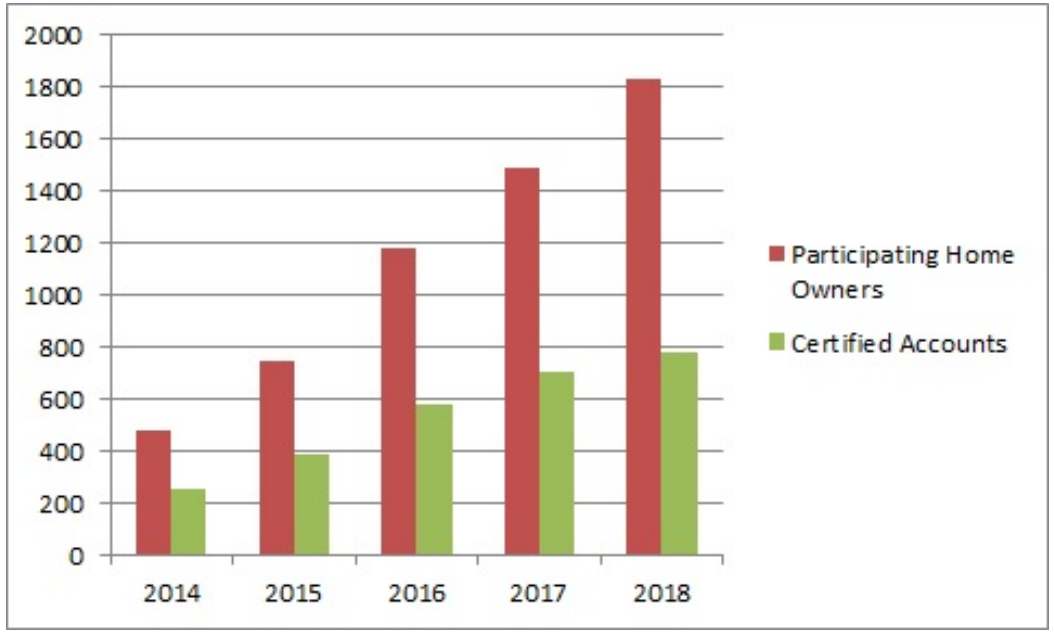

Boulder, County
Fire Perimeters
Block Group
Completed Treatment
Burn
Rx Burn
Thin
Planned Treatment
Block Population 2012
141 - 961
962 - 1477
1478 - 2081
2082 - 3015
3016 - 4196
Wildland Urban Interface
Larimer
Weld
Grand
Boulder
Gilpin
Jefferson
Broomfield
Adams
Clear Creek
OVERLAND
1989
2003
UNNAMED CANYON
FOURMILE CANYON
2010
1989
SUNNYSIDE
2000
ELDORADO
Source: USDA Forest Service, Forest Health Technology Enterprise Team (FHTET), Natural Resource Ecology Lab at Colorado State University, Esri

Dynamic changes to adaptive capacity

- In a series of case studies, researchers found the process of developing a Community Wildfire Protection Plan (CWPP) can lead to enhanced community adaptive capacity with social networks, learning, and community building (Jakes et al. 2007; Brenkert-Smith, Champ & Flores 2012).

Boulder County CWPP, a partnership of local governments and diverse stakeholders.

Figure: Boulder Wildfire Partners – home certification program.



Source: www.wildfirepartners.org/

Key Findings

- With increasing availability of scalable biophysical and socioeconomic data, indicators could be developed across scales and for different purposes

- As the wildfire case study demonstrates, there are common questions across scales, which affirms the value of developing indicators at various scales through a consistent framework

- The complexity and challenges of describing social dimensions increase when indicators are moving from national to regional to local scale. It is important for indicators to incorporate place-based data and local knowledge with input from stakeholders to be decision relevant

Key Findings (2)

- There are diverse approaches that can be used to develop SES indicators (e.g., statistical analysis, spatial analysis and mapping, case-studies, social network analysis, scenario analysis) and integrate socioeconomic and environmental data

- The existing, accessible datasets can serve as a starting point for developing SES indicators. However, there are critical gaps in data availability and consistency that need to be addressed to advance the development of SES indicators to measure coupled social and physical changes
  - Needs to harness, generalize and scale up case studies

Decision-Relevant Scientific Exploration

- Define clear goals and audience for analysis and use.
- Co-production of knowledge: Analysis (e.g., modeling, indicators) will be driven by clear questions and audiences.
- Design question-driven, user-inspired science and research, with effective translation at all levels throughout the research and implementation stages.
- Develop strategies for enhancing partnerships that cross federal, state, local and organizational boundaries, and create “community of practice”.