Socioeconomic Indicators for Watersheds

with application in Mariposa County, California

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November 2010

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Acknowledgments

The Sierra Institute for Community and Environment and the Sierra Nevada Alliance would like to thank the California Department of Water Resources for their support of this project.

We deeply appreciate the sustained help of Anne Steed, Connie Nelson, and Terry McLaughlin of the Upper Merced River Watershed Council/Mariposa County Resource Conservation District who identified key people to speak with and data sources and helped organize the many community workshops, focus groups, and other information exchanges that informed this report. Rita Kidd of Mariposans for the Environment and Responsible Government assisted with identification of key community contacts, helped with the workshops, and provided critical data and data sources. Rita and Tony Kidd generously opened their home to us, providing great place to reflect on the research and wind down a day. Jeanne Haben of Chowchilla Red Top Resource Conservation District also helped identify key community contacts and provided assistance securing critical watershed information.

We would also like to thank all the Mariposa residents, county officials, and state and federal agency representatives who participated in this study. They responded to our many requests for information and generously and patiently shared with us in interviews, community and focus group meetings, and workshops. Their time, energy, and knowledge made this work possible.

The report was improved immeasurably with the many thoughtful comments we received on drafts. The mistakes that remain are the sole responsibility of the authors.

Finally, thanks to Emily Creely and Tom Neill of the Sierra Institute for Community and Environment for their research and work on this report. Maps were created with ESRI 9.3.1 by Emily Creely of Sierra Institute GIS; graphics for the report were generated by the Sierra Institute for Community and Environment.

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Executive Summary

The purpose of this project is to develop and evaluate measures and indicators for assessing socioeconomic attributes of watersheds in California. Measures and indicators were developed and tested in three watersheds in Mariposa County, the Upper Merced River Watershed, Mariposa Stream Groups Watershed, and Upper Chowchilla River Watershed.

The project was funded by the California Department of Water Resources, managed by the Sierra Nevada Alliance, and implemented by the Sierra Institute for Community and Environment. Results will be used to inform the Department of Water Resource's Watershed Framework, a tool for assessing watershed indicators, trends, and progress of watershed programs.

The Sierra Institute reviewed literature on watershed-related socioeconomic indicators and involved stakeholders in an intensive participatory process to select relevant Mariposa County indicators and measures. Due to funding and time constraints, we were unable to gather primary data for several of the indicators. This report provides a list of the full suite of recommended indicators and associated measures as well as lessons learned Mariposa County and recommendations based on the indicators we were able to measure.

Following the Department of Water Resource's framework, we identified five key socioeconomic conditions of watersheds, indicators of each of these conditions, and metrics for measuring the indicators. The conditions, which are relevant for any watershed, are:

- Watershed character
- Public health
- Income and impoverishment
- Economic vitality
- Capacity to address watershed conditions and stressors

Tables *i-v* list indicators and measures that were selected to assess each of these conditions in Mariposa County watersheds. Each table is followed by a description of trends and conditions in Mariposa County. Due to difficulty of obtaining watershed specific data, with the exception of capacity to address watershed conditions and stressors, data are reported for communities and the county as a whole, not by watersheds.

Watershed Character

According to local stakeholders, the rural and agricultural nature of the watersheds, their remarkable scenic and recreational opportunities, and their historical and archaeological character are important watershed conditions that they wanted to be maintained. Extent, density, and location of residential development were identified as potential stressors on these

conditions. Table i shows indicators and measures that were used to assess watershed character in Mariposa County. In some cases, reliable secondary data were not available for indicators or measures of interest.

Table i. Indicators and measures of watershed character

Indicators	**Measures**
Land use	Acres of publicly owned land Acres of land enrolled in agricultural preserves (Williamson Act) Acres of land covered by conservation easements Acres of land zone 160-acre minimum parcel size Residential housing densities Number of subdivisions/new parcels created Number of building permits issued
Demographics	Total population, by age and cultural characteristics School enrollment, by grade
Unique characteristics	Total number of historic and cultural sites recommended for federal, state, or local protection Total number of historic and cultural sites given federal, state, or local designation

Current land ownership and land management constraints in Mariposa County help maintain large areas of agricultural land and open space. Nearly 80% of the land in Mariposa County is protected from significant development because it is publicly owned, enrolled in State Williamson Act or Timberland Production Zone, or covered by a privately held conservation easement. Under current County zoning, less than 14% of all land in the county is zoned to allow lot sizes below 160 acres. However, state or county policy changes or private landowner non-renewal in the Williamson Act or Timber Production Zone programs could increase the number of acres available for development, as could continued use of historic parcels to establish subdivisions and circumvent current county zoning.

Population in Mariposa County increased rapidly from 1990 to 2000, grew slowly from 2000 to 2008, and appears to have decreased since 2008. At the same time, the population has been aging, and school enrollment has declined significantly.

Mariposa County is rich in historic and archaeological resources, and local residents have a keen interest in seeing these protected. As of May 2010, there are 158 historic buildings and sites on the California Register of Historic Places, including 48 sites included in the National Register. These include historic buildings, districts, landmarks, and other sites of special interest. Another 391 sites have been determined “eligible” or “appears eligible” for national, state, or local designation. The California Office of Historic Preservation has determined 274 prehistoric archaeological sites eligible for special designation.

Public Health

Water quality and availability of drinking water are the public health conditions of greatest concern to Mariposa County stakeholders. There is also some interest in tracking air quality. Other indicators of public health, such as specific disease rates or access to health care, were not considered highly relevant in Mariposa County.

Table ii. Indicators and measures of public health

Indicators	Measures
Water availability (for human consumption)	Number of water shortages per year
Water quality	Number and type of reported water quality violations Number of fishing and/or swimming advisories per year
Air quality	Number and type of reported air quality violations

Although water quality and quantity are both of concern in Mariposa County, measuring these indicators is extremely time consuming and expensive because a large proportion of the population is served by private wells. These wells are located in fractured rock where water volume varies across short distances. There are a few cases of reported nitrate contamination in private wells and instances of wells running dry which suggest future research on well water levels and water quality would be useful. Air quality data is similarly limited to a few monitoring stations, and measurement at these stations is inconsistent. Primary data collection at key locations of concern would be necessary for useful air quality data.

Some secondary water quality data are available for public water supplies and surface waters. There have been no swimming or fishing water advisories in the county, and no reported surface water impairments. However, state reports show that eight public water supply wells have had well water contaminant exceedences since 1994, and there have been three sewage spill incidents in the town of Mariposa since 2007. The state is monitoring 13 leaking underground storage tanks in Mariposa County.

Income and Impoverishment

Table iii. Indicators and measures of income and impoverishment

Indicators	Measures
Income	Median household income
Impoverishment	Percent of labor force unemployed Percent of population with income below poverty level Percent of students enrolled in free and reduced lunch program Percent of households receiving public assistance

Median household income varies significantly across Mariposa County. In 2000, the Yosemite/El Portal/Wawona area had the highest median income in the county, exceeding incomes in the rest of the county by 25%. Within this part of the county income and impoverishment are

apparently quite diverse, as well: the Yosemite/El Portal/Wawona area had the highest median income but also the highest unemployment rate and highest percent of households below poverty level in 2000.

Unemployment and free and reduced school lunch enrollment trends suggest a significant increase in impoverishment across the county in recent years. According to state data, unemployment increased from below 6% in 2006 to over 10% in 2009, and student enrollment in the free and reduced school lunch program increased by 35% from 2006-2007 to the 2008-2009 school year.

Economic Vitality

Reliable secondary data were found for only a few measures for the indicators listed in Table iv. Other measures of business diversity were not measured because reliable data are unavailable.

Table iv. Indicators and measures of economic vitality

Indicators	**Measures**
Personal income sources	Proportion of personal income from salaries and wages versus transfer receipts
Business diversity	Employment, by industry
Employment and production in key industries	Accommodations and food services industry earnings Transient Occupancy Tax revenues Agricultural production rates
Access to technology	Broadband coverage

Typically, an aging population derives a higher proportion of its income from sources other than wage and salary income. From 1995 to 2008, Mariposa residents derived over half of their income from wages and salaries, while the state average is closer to two-thirds of personal income derived from wages and salaries. In 2008, transfer receipts, such as retirement, Social Security, and interest on investments, totaled 24% of personal income in Mariposa County, almost double the statewide average of 13%.

Business diversity is often considered a measure of economic health, because a variety of businesses are considered more able to weather an economic downturn. In Mariposa County, however, approximately 80% of all jobs are in either government or leisure and hospitality (accommodations and food services). Travel and tourism spending generates between 40% and 50% of the total employment in the county. County transient occupancy receipts from lodging establishments account for between 45% and 52% of the County General Fund, the county's discretionary or unrestricted budget.

Overall, the agricultural sector in Mariposa County has reported annual loses, not revenues. The economic health of the agricultural sector is important to locals, because they want to see these working landscapes sustained. In terms of both acreages in production and revenues, livestock and poultry are the largest agricultural crops in the county.

Capacity

Capacity to address watershed conditions and stressors was measured differently than the other indicators. Rather than identify and measure specific quantitative measures for each of the capitals listed in Table v, a panel of local experts was convened and were asked to individually and then collectively rank the status of each form of capital, in terms of how well it meets existing needs, and the overall capacity to address issues of concern in each watershed.

Table v. Indicators of capacity

Indicator	Definition
Financial capital	Dollars available and allocated to watershed issues.
Physical capital	The condition of the built environment and how well it contributes to or detracts from watershed health.
Human capital	Watershed-related skills, education, experiences, and general abilities (including having both time and energy) of people who live and work in the watershed.
Organizational capital	The existence of watershed-related organizations, programs, plans, and projects and the extent to which they are being implemented.
Social capital	The ability and willingness of people, agencies, and organizations to work together on watershed goals and projects.

The expert panel determined that the Upper Merced River Watershed had the highest overall capacity of the three watersheds, and the Mariposa Stream Groups had the lowest capacity. The primary reason for the Upper Merced River Watershed's higher capacity is the presence of high levels of organizational, financial, physical, and human capitals stemming largely from government and private interest in and expertise from Yosemite National Park.

The expert panel noted that residents and people who work in the Upper Chowchilla River Watershed have, in general, the necessary skills that would allow planning and management to move forward fairly readily given adequate funding and attention to physical capital needs. These characteristics resulted in a "medium" rating for human and organizational capital. But lower overall capacity of the Upper Chowchilla, compared to the Upper Merced, was the result of a lack of financial capital and limited physical infrastructure to address watershed needs.

The Mariposa Stream Groups Watershed is considered to have the lowest capacity of the three watersheds. The strength of this watershed is the skill set and knowledge of residents, but overall capacity suffers from a limited physical infrastructure, along with limited funds for work and organizations, and a small, dispersed, and less engaged population.

Expert panelists agreed that all three watersheds have knowledgeable people who are spread very thin while working with multiple community groups, and more education of the general public about watershed issues is needed.

Lessons learned and recommendations:

1. *Do not rely on pre-determined lists of indicators and measures* It is important that watershed planners and government agencies develop indicators and measures that are appropriate and responsive to local watershed conditions. Even where there is agreement about conditions of interest, there may be disagreement about specific indicators that describe conditions, and measures to assess selected indicators.
2. *Involve people who live and work in the watershed in the selection of conditions, indicators, and measures* Local knowledge is critical to identify and select conditions and indicators of concern in a watershed, and to help identify measures and data to evaluate indicators. Indicators should be chosen judiciously, after carefully assessing their relevance in the watershed, usefulness to watershed planning and management, and time and dollars required to gather quality data.
3. *Carefully select conditions, indicators, and measures.* Indicator selection should be based on their relevance, and usefulness for watershed planning and management. They also need to be selected with a sensitivity to the amount of time and expense needed to collect data for them.
4. *Be sensitive to scale when selecting indicators and measures.* Measurement data should be reported at the community watershed scale to be most useful for watershed planning and management.
5. *Not all data are created equal.* It is important to understand and critically evaluate methodologies used to collect measurement data because some secondary data are not reliable. This is especially true with data based on samples that are small or when relying on estimates based on historical trends.
6. *Community and governmental capacity to address watershed goals is important to assess in order to understand the potential for successful watershed planning and management*. Because there are currently no data collected that comprehensively inform these indicators, primary data collection is essential to capture this information. For this project, an expert panel was successfully convened to collect these data.
7. *Some primary data collection may be needed to understand critical issues and conditions.* Similar to indicators of capacity, in many cases, primary (new) data collection is needed to address locally important community and watershed issues.
8. *New research is sometimes needed.* New research may be needed to answer important questions or to assess critical conditions.
9. *Effective data interpretation may require consideration of influences beyond the watershed.* It is sometimes important to think broadly and consider influences beyond the data, such as the influence of regional, national, and global markets or management constraints imposed by distant state and federal regulatory agencies or water users.

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I. Introduction

Objectives

The purpose of this project is to identify and assess social and economic indicators and measures for watersheds in order to inform the California Department of Water Resources' Watershed Framework. This pilot project is focused on Mariposa County's three watersheds: the Upper Merced River watershed, the Upper Chowchilla River watershed, and the Mariposa Stream Groups watershed. Socioeconomic indicators and measures facilitate assessment of conditions and tracking of trends that could affect or be affected, either negatively or positively, by local watershed planning and other management actions.

The Department of Water Resources' Watershed Framework is a statewide effort that includes pilot projects to identify and assess indicators and measures of landscape and ecological condition and other biophysical characteristics and processes. The Mariposa pilot project is unique, as it is the only project in the Watershed Framework focused solely on social and economic indicators. The indicators and measures examined in Mariposa watersheds are applicable to other watersheds as well, and can be used to help resource managers, planners, and other stakeholders elsewhere understand important social and economic conditions and trends in watersheds.

Background

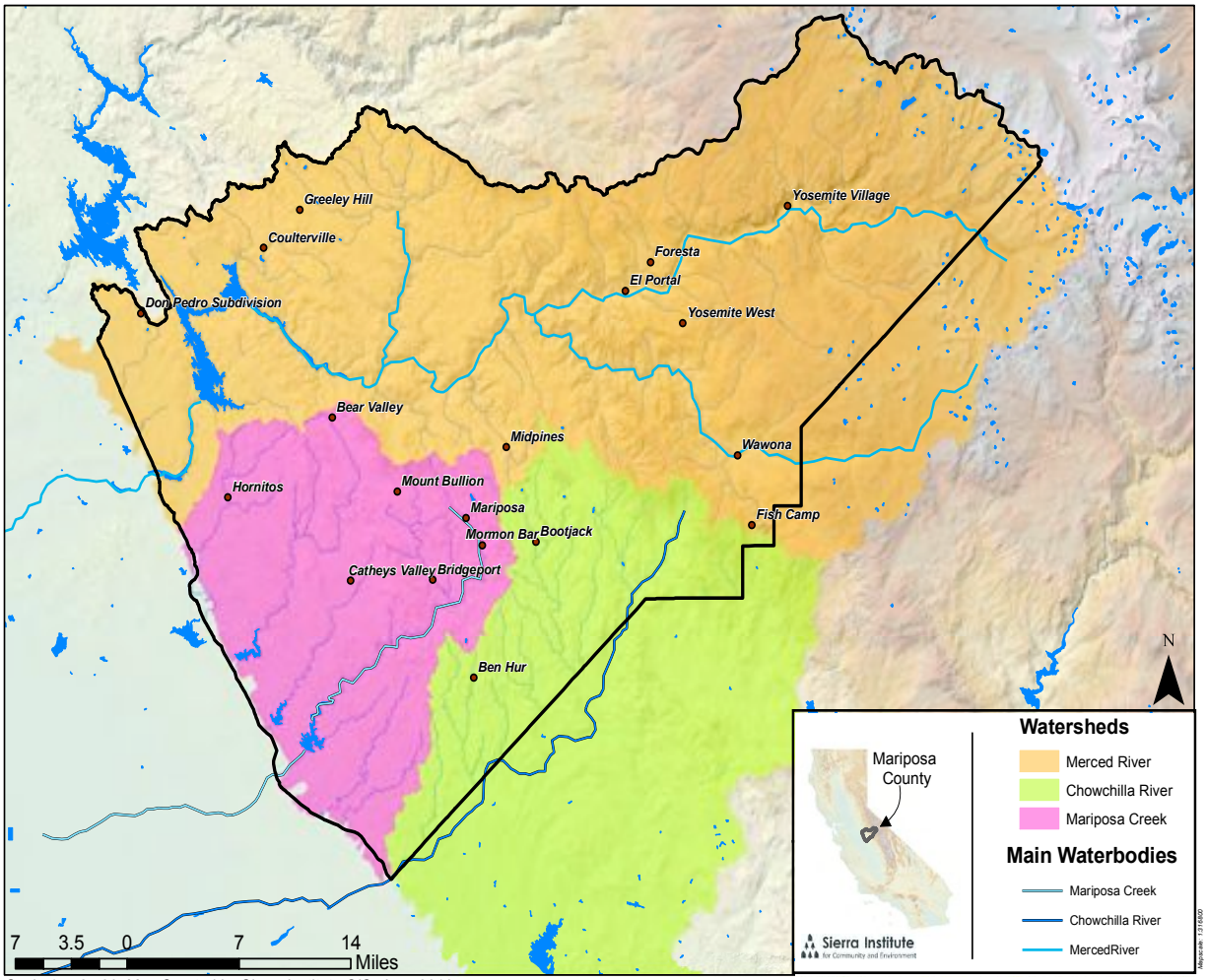
Both the U.S. Environmental Protection Agency and the California Department of Water Resources encourage planning and managing natural resources based on watershed boundaries. The watershed approach encourages the use of multidisciplinary and multijurisdictional partnerships that restore, maintain, and protect resources at a watershed scale. This encourages land managers and landowners to work together to address environmental conditions, such as invasive species or water quality, that cross political boundaries. The Environmental Protection Agency's watershed assessment framework suggests that to support adaptive management it is necessary to evaluate the effectiveness of such efforts using sound data and assessment methods in an iterative decisionmaking process. The Department of Water Resources has adopted this framework and, recognizing that human communities and sociopolitical systems are part of and affect watershed systems, have expanded it to include socioeconomic indicators.

In 2008, the Department of Water Resources funded the Sierra Nevada Alliance to develop socioeconomic indicators for watersheds and evaluate them in Mariposa County. The Sierra Nevada Alliance subcontracted local stakeholder involvement to the Mariposa County Resource Conservation District/Upper Merced River Watershed Council, the Chowchilla Red Top Resource Conservation District, and Mariposans for the Environment and Responsible Government. Development and measurement of socioeconomic conditions was subcontracted to the Sierra Institute for Community and Environment, which would do so working with local stakeholders, along with local, state, and federal agencies.

Mariposa County Watersheds

The largest watershed in the county is the Upper Merced River watershed, which originates in the high Sierra Nevada, largely within Yosemite National Park. The Upper Merced and two other watersheds in Mariposa County are shown in Figure 1. The Merced flows east to the New Exchequer Dam on Lake McClure. Much of the Upper Merced watershed is public land, managed by Yosemite National Park, the Sierra and Stanislaus National Forests, and the Bureau of Land Management. Most of this watershed is contained within Mariposa County; and approximately two thirds of Mariposa County lies within this watershed.

Figure 1. Watersheds in Mariposa County



Scale 1:443,520: Map Created by Sierra Institute GIS; June 2010

The Upper Chowchilla River watershed originates in the southern part of Mariposa County on Sierra National Forest and private land. The West, East, and Middle Forks of the river merge and flow into Eastman Lake on the border of Mariposa and Madera Counties. Less than half of this watershed lies within Mariposa County.

The Mariposa Stream Groups watershed is unique in that it is not defined by a single river basin, but rather includes the area draining into four streams: Burns, Bear, Owens, and Mariposa Creeks. Each of these creeks is dammed near the Mariposa–Merced County line. Virtually all of the stream groups' watershed above the dams lies within Mariposa County.

All three watersheds ultimately feed the San Joaquin River, a major water source for California's Central Valley. All of the water in these three watersheds is allocated to downstream users, and the Merced Irrigation and Chowchilla Water Districts, which manage the water primarily for flood control and irrigation. Though outside of the county, downstream management by these users often has upstream implications in Mariposa County.

Socioeconomic Conditions, Indicators, and Measures for Watersheds

Working with local residents and agency representatives, and following the Department of Water Resources' Management Framework, five socioeconomic conditions were identified. These are: watershed character, public health, income and impoverishment, economic vitality, and capacity to address watershed conditions and stressors. Indicators, which are observable characteristics that can be tracked to assess change in watershed conditions, were identified for each of the conditions. And for each of the indicators, measures that can be evaluated were selected to help determine the status of an indicator.

A good measure consists of units of information that summarize qualities and interrelations associated with an indicator.[1] For instance, an important indicator of watershed character in Mariposa County is land use. Several measures of land use were selected, including acres of land enrolled in agricultural preserves, Timberland Production Zones, and conservation easements. Tracking measures such as these over time can show changes in land use that could affect rural landscape and watershed.

A good measure is easily understandable, relevant, and useful for planning and management; based on information that is relatively easy to collect, easy to interpret, and sensitive to change; and, overall, cost-effective to measure. A measure must also be valid, which means it reflects real conditions and changes in a watershed.

Equally important, a good measure must be reliable, so that different people gathering data at the same time and place will get the same information. For example, percent of households receiving public assistance and percent of school children participating in the National School Lunch Program and receiving a free or reduced-cost lunch are both measures of impoverishment that rely on consistently collected data that can be used to track trends in impoverishment over time.

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[1] There is no single agreed upon usage or hierarchy of the terms conditions, indicators, and measures. Numerous assessment projects utilize only two levels, such as indicators and measures, and some use other terms, such as the widely-used forestry-focused Montreal Process, which uses criterion and indicators in place of indicators and measures. The Department of Water Resources has adopted three levels, but instead of the term "attributes" which they favor, we use the term "conditions." We believe it clearer.

Good indicators accompanied by sound measures improve knowledge. When evaluated over time, measures can describe trends, stressors affecting those indicators, and the ability of society to improve and maintain conditions that matter to them.

Indicator Selection Methodology

Selection of indicators and measures was based on a combination of research and local stakeholder input.

In addition to building on our past work on socioeconomic condition and capacity, monitoring, and evaluation, the Sierra Institute reviewed four types of literature on measuring and evaluating natural resource planning and management using socioeconomic indicators. This literature included: (1) guides to developing and applying indicators of community sustainability that have been used at the municipal, county, and state levels since the mid-1990s; (2) guides and sets of indicators that address environmental, economic, and social issues as part of an integrated system; (3) research evaluating watershed and other collaborative resource management efforts in the United States; and (4) work on measuring socioeconomic condition and capacity.

There are literally hundreds of socioeconomic indicators and measures recommended for and being used to evaluate sustainable development and collaborative resource management efforts, including watershed planning and management. Based on a review of others' and our own work on socioeconomic condition and capacity, monitoring, and evaluation, and local input, we recommend measuring indicators of each of the following watershed conditions:

- Watershed character
- Public health
- Income and impoverishment
- Economic vitality and
- Capacity to address watershed conditions and stressors.

Capacity, or community and governmental ability and willingness to address local issues, is an important but typically overlooked watershed condition. Capacity may include measures such as the allocation of funds to watershed planning and management, institutional commitment to participate in collaborative processes, and public support for watershed planning and management. Community and government capacity often determine the success or failure of watershed planning and management efforts.

Initial local stakeholder input was gathered in fall 2008 through community workshops, key stakeholder interviews, and document review. At the community workshops, participants identified desired conditions in the Mariposa County watersheds, stressors on those conditions, and strategies and actions that could be taken to reduce stressors and maintain or improve conditions. In interviews, key stakeholders from local government, local watershed and conservation groups, water utilities, the ranching and farming community, and land management agencies provided more detailed information about locally important conditions

and issues (additional information on the stakeholder involvement process is in Appendix I: Stakeholder-guided Approach to Identifying Socioeconomic Indicators). In addition to this direct stakeholder input, the Sierra Institute reviewed the Mariposa County General Plan and the report and notes from the Sierra Institute's work on the assessment of the effects of the 1997 flood and resultant closure of Yosemite National Park.[2] These reviews were conducted to identify additional issues, measures, and indicators that could be relevant to watershed management and planning in Mariposa County.

Based on the literature review and local stakeholder input, a draft list of potential socioeconomic indicators and measures was developed and shared with local stakeholders at focus group meetings in March 2010. Based on stakeholder feedback, a set of locally useful measures was developed. The final list of indicators and measures to be applied in Mariposa County was selected based on the availability of good quality data and the feasibility of gathering and analyzing the data in a relatively short timeframe.

Indicators and Measures Selected for Mariposa County Watersheds

Working with local individuals and groups in April and May 2010, the indicators shown in Table 1. were selected for measurement. No specific measures were selected for the capacity indicators; instead, the status of each of these indicators was assessed for each watershed by convening an expert panel to assess key dimensions of these indicators.

Table 1. Indicators selected for measurement

Conditions	Indicators	Measures
Watershed character	Land use (Rural, agricultural character)	*Acres of public land* *Acres of land enrolled as agriculture preserve (Williamson Act)* *Acres of land enrolled in Timberland Production Zone* *Acres of land covered by conservation easements* *Acres of land zoned 160-acre minimum parcel size* *Residential housing densities* *Number of subdivisions/new parcels created* *Number of building permits issued*
	Unique characteristics (historical and cultural character, scenic and recreational characters)	*Total number of historic and cultural sites recommended for federal, state, or local protection* *Total number of historic and cultural sites given federal, state, or local designation*
	Demographics	*Total population, by age* *School district enrollment, by grade level*
Public health	Water availability	*Number of water shortages per year*
	Water quality	*Number and type of reported water quality violations* *Number of fishing and/or swimming advisories per year*
	Air quality	*Number and type of reported air quality violations* *Ozone and particulates levels at specific locations*

[2] *Doak, Sam and Jonathan Kusel. 1997. A Social Assessment of the Highwater Incident, Yosemite National Park, prepared for the supervisor of Yosemite National Park. 37 p.*

Income and impoverishment	Income	*Median household income*
	Impoverishment	*Percent of labor force unemployed* *Percent of population with income below poverty level* *Percent of households receiving public assistance* *Percent of students enrolled in free and reduced lunch program*
Economic vitality	Personal income sources	*Proportion of personal income from salaries and wages versus transfer receipts*
	Business diversity	*Employment, by industry*
	Employment and production in key industries	*Accommodations and food services industry earnings* *Transient occupancy tax revenues* *Agricultural production rates*
	Access to technology	*Broadband coverage*
Capacity	Financial capital	
	Physical capital	
	Human capital	
	Organizational capital	
	Social capital	

II. Findings

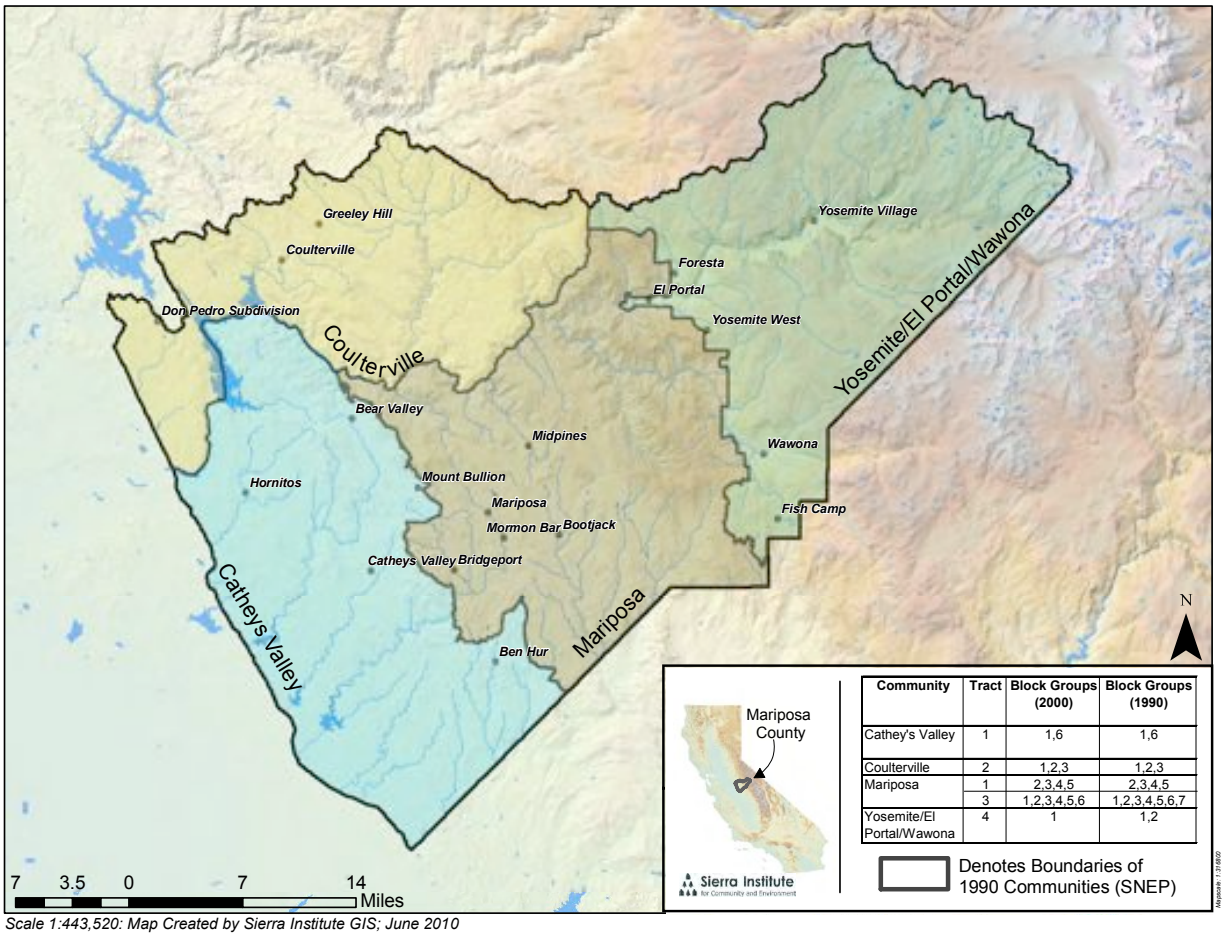
A Note on the Data

Indicator data for the three watersheds in Mariposa County are drawn from a variety of sources. One of the most significant challenges for understanding socioeconomic conditions in watersheds and rural communities is that comprehensive data are not commonly collected for areas with low populations. Regularly collected data are typically available only at the county level and therefore may not accurately reflect conditions in specific communities or watersheds. Little or no secondary socioeconomic data is collected based on watershed boundaries. It is sometimes possible to disaggregate secondary data and re-aggregate it by watersheds, but in most cases reporting data at a watershed scale requires primary data collection.

The U.S. Census Bureau collects the most comprehensive and often the most reliable demographic and economic data. These data are available at the community level (by census block), but the bulk of these data are collected only every ten years. While some data for the 2010 Census data will be released in 2011, most of the data will not be available before 2012. Therefore much of the demographic and economic data presented here is for 1990 and 2000. Where possible, this information is presented not only for the county as a whole but also for four large community areas – Mariposa, Yosemite/El Portal/Wawona, Coulterville, and Catheys Valley, shown in Figure 2. These areas were chosen based on areas developed for the Sierra Nevada Ecosystem Project,[3] for which: (1) county planners mapped block groups by community, block groups were aggregated where appropriate; (2) planners and other experts reviewed and modified community maps consisting of aggregated block groups; and (3) community experts reviewed and finalized the maps. Recent demographic and development trends, however, suggest that in future it would be useful to reexamine community aggregation of Census blocks. For example, in 1990 the Lake Don Pedro community did not exist, but due to its proximity to Merced and the new University of California, Merced campus, this area has grown and is expected to continue to grow to a large community with very different demographics than those in the greater Coulterville area.

[3] *Doak, Sam and Jonathan Kusel. 1996. "Well-Being in Forest Dependent Communities, Part II: A Social Assessment Focus," in Sierra Nevada Ecosystem Project: Final Report to Congress, Volume II: Assessments and Scientific Basis for Management Options. Wildland Resources Center Report No. 37, 375-402 pp.*

Figure 2. Map of community areas



Scale 1:443,520: Map Created by Sierra Institute GIS; June 2010

In some cases, county-level Census data have been updated since 2000 using sampling and growth models. These data represent estimates, not actual counts. Similarly, much of the economic data reported by the Bureau of Labor Statistics, Bureau of Economic Analysis, California Economic Development Department, and California Department of Finance are based on samples and estimates, not comprehensive counts, and are available only at the county level. When using secondary data it is important to review the purposes for which the data were gathered, the methodologies used, and, where possible, compare data from different sources. When using numbers projected from data collected at an earlier date, it is important to consider if changing conditions (i.e., the recent recession) make it inappropriate to assume historical trends provide a sound basis for current extrapolation. For instance, the severe recession that started in 2008 has affected economic and demographic patterns and led to projections based on conditions in the 1990s and early 2000s inaccurate.

Qualitative, or non-numerical, descriptive data are particularly useful for measuring some socioeconomic conditions. When gathered and analyzed in a consistent way, for instance by identifying repeated themes when reviewing comments made on surveys, and in interviews and focus groups, these data can provide a reliable assessment of conditions and stressors. If

the same questions are asked of a similar population in the future, and the answers collected similarly, responses can be compared to assess trends over time.

For this project, watershed capacity data were collected through a workshop involving experts with knowledge about each of the Mariposa watersheds. The methodology used was initially developed for and tested in the Sierra Nevada Ecosystem Project. In this project, expert participants independently and collectively assessed physical, financial, human, organizational, and social capital that determine overall watershed capacity.

Watershed Character

This section discusses two aspects of watershed character considered especially important to the three watersheds within Mariposa County: rural, agricultural character and historical and cultural character. Measures of scenic and recreational conditions, which some stakeholders consider the most important indicators of watershed character in Mariposa County, were either unavailable or beyond the scope of this study to collect. Future work might include measures of visitation levels, miles of trails, number and quality of recreational access points, and visitor experiences, along with identifying the kind and intensity of visitor use. Additional work might also focus on the number and quality of unimpeded open space views.

Rural, Agricultural Character

Much of the land in Mariposa County is protected from significant development because it is publicly owned, enrolled in State Williamson Act or Timberland Production Zones (TPZ), covered by a privately held conservation easement, or zoned for a minimum 160-acre parcel size.

Land enrolled in the Williamson Act is restricted to agricultural or related open-space use with limited development, through a contract between the county government and private landowner. All Williamson Act contracts in Mariposa are for 20 years. Importantly, such contracts allow land to continue to be working agricultural land and reduce the tax assessment in exchange for restriction of development.

Land enrolled in the state Timberland Production Zone program is similarly covered by a contract between the landowner and the county, in this case to manage the land for timber production and compatible uses for a minimum of 10 years. Owners of this land also benefit from reduced tax assessment.

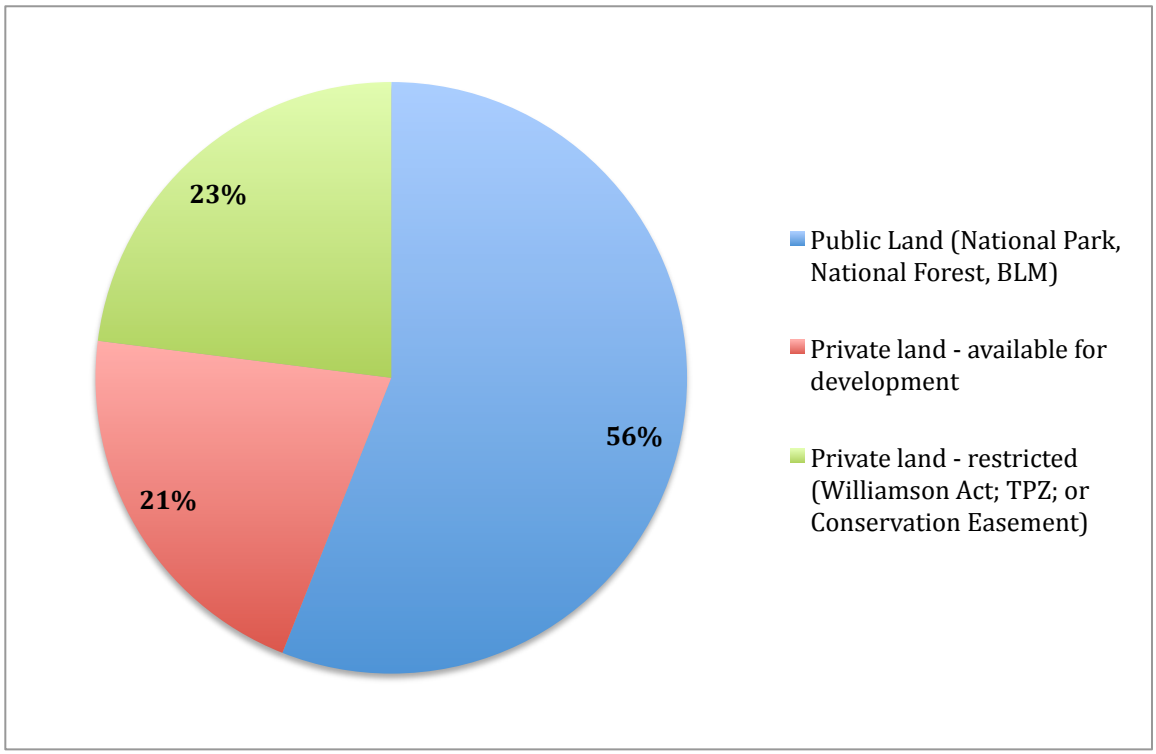
A conservation easement is a legal agreement between a landowner and a land trust or government agency that permanently limits uses of the land in order to protect conservation values. Landowners with conservation easements give up some rights, typically development rights, and these restrictions are passed on to future landowners when the property is sold.

Land zoned “Agriculture Exclusive” or “Mountain Preserve” by Mariposa County has a minimum 160-acre parcel size and a maximum of two single-family residences per parcel. In addition, these zones reserve land primarily for the production of agricultural crops, cattle, and timber.

Publicly owned land and land with conservation easements may be considered permanently protected from major development, but Williamson Act and TPZ designations expire if not renewed, zoning regulations can be changed, and recognition of historic parcels can override zoning regulations and permit wildcat development. As discussed below, the number of acres enrolled in Williamson Act contracts is declining due to state policy changes. Currently, however, less than 14% of all land in the county is zoned to allow lot sizes below 160 acres.

Figure 3 shows that of the approximately 930,000 acres of land in Mariposa County, only 23% is private land available for subdivision and development.

Figure 3. Mariposa County land ownership and development potential



Sources: Mariposa County Planning Department, California Rangeland Trust, Sierra Foothill Conservancy

Most of the public land is in the eastern part of the county, while most of the Williamson Act parcels are in the western part of the county (Figure 4). The major public land managers in Mariposa County include the USDI National Park Service and Bureau of Land Management, and the USDA Forest Service.

Figure 4. Land Conservation Act contracts, as of January 2010

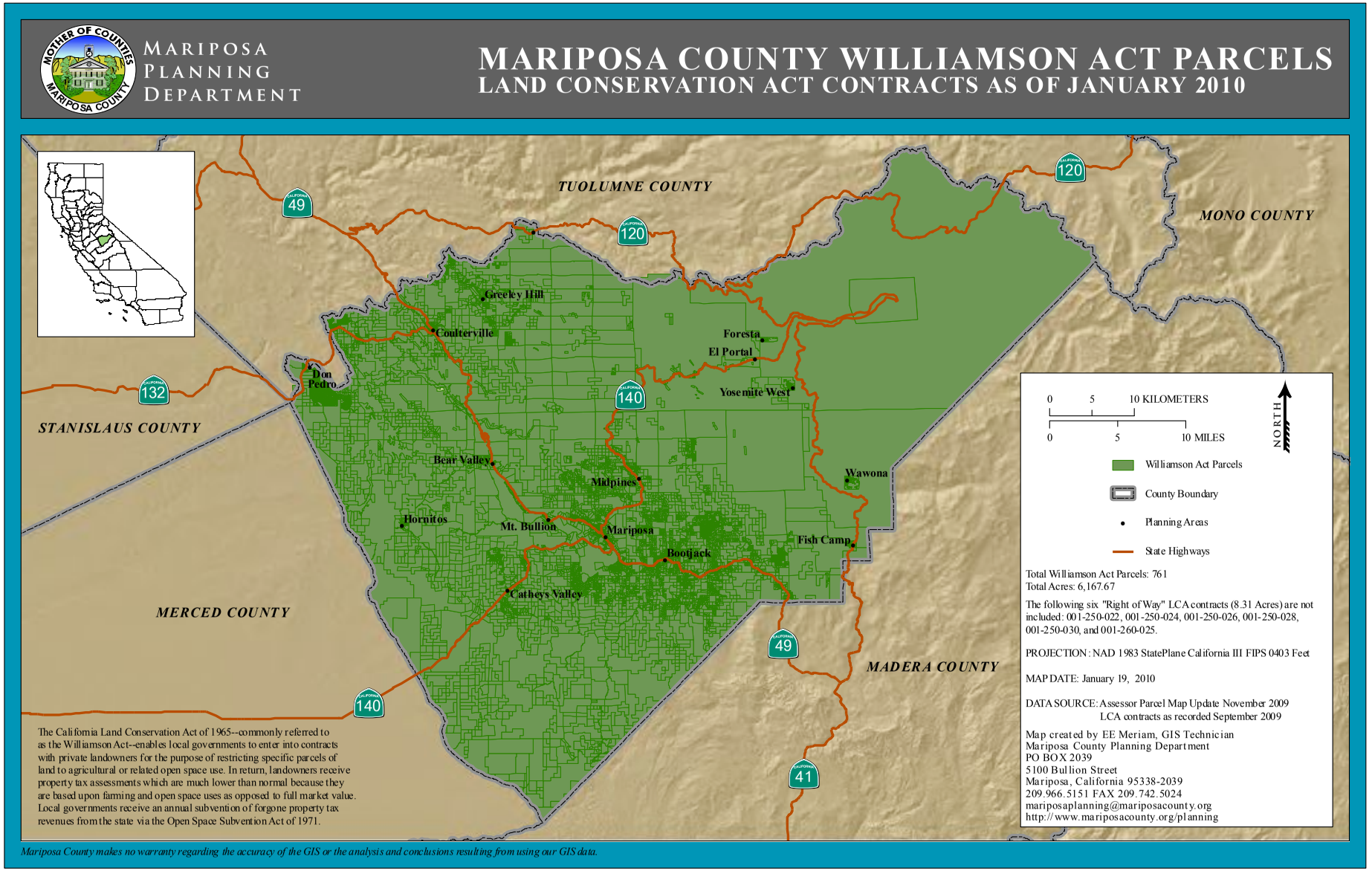
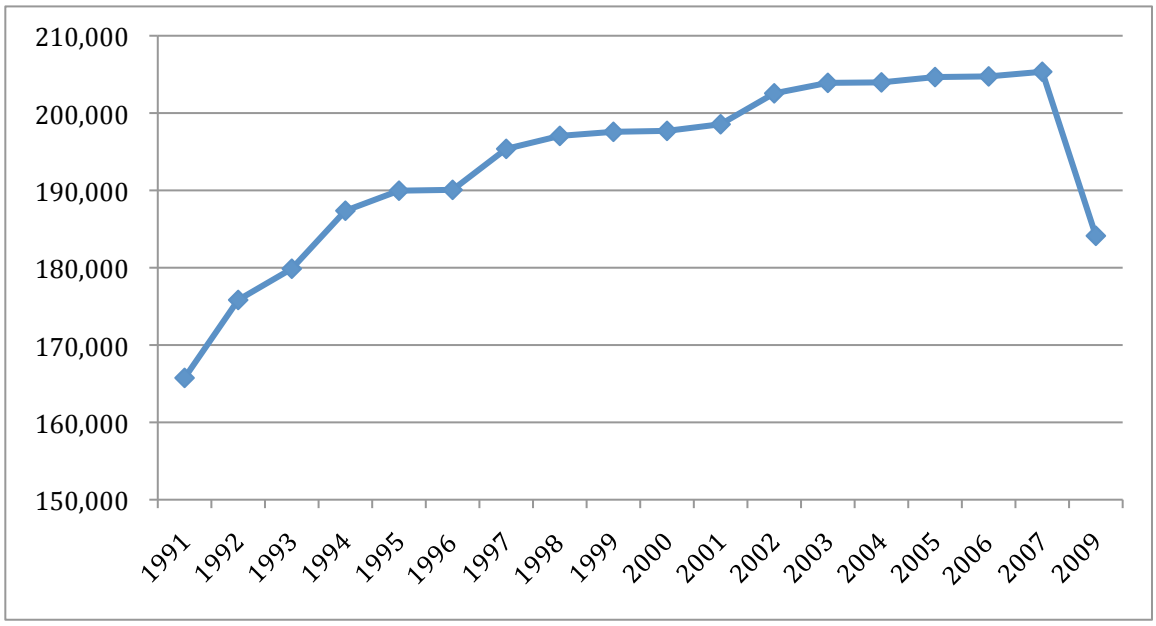


Figure 5 shows that Williamson Act enrollments in Mariposa County steadily increased between 1991 and 2007. As a new program, the Williamson Act was quickly accepted, and a large number of landowners enrolled in the program in the first ten years. Acres enrolled remained relatively steady after 2001, until the recent precipitous drop beginning in 2007, when landowners began withdrawing from the program. In many cases, non-renewals are filed due to the increased restrictions of AB1492, a 2005 state assembly bill that establishes a framework for material breach of contract, specifically limiting the types of residential and other uses that can exist on Williamson Act contract lands.

Figure 5. Mariposa County Williamson Act enrollment



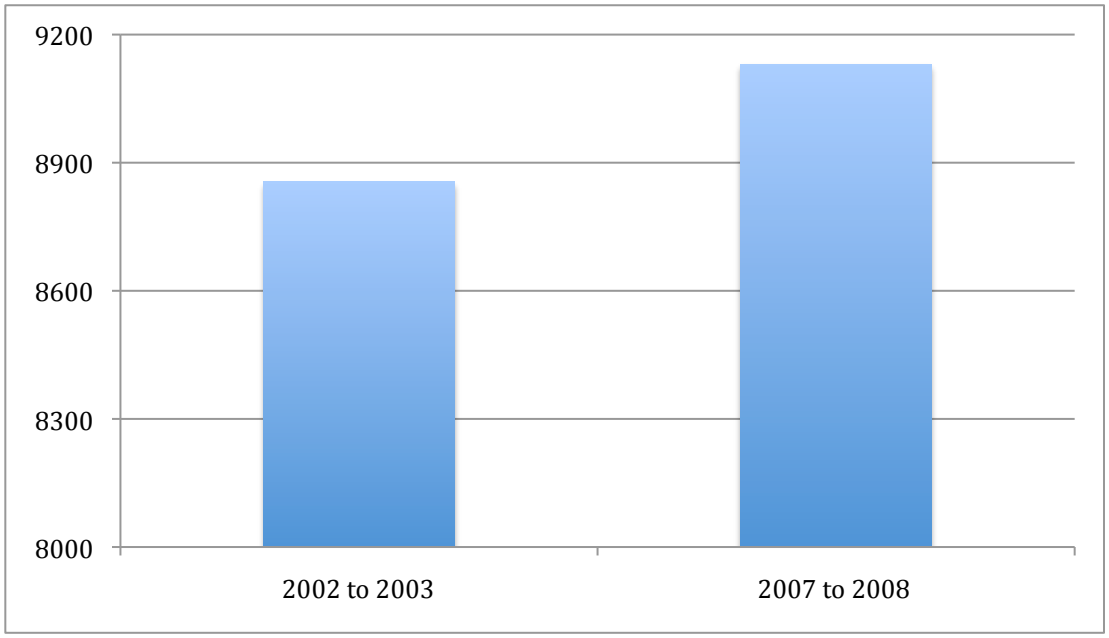
Sources: California Department of Conservation, Division of Land Resource Protection (1991-2007), Mariposa County Planning Department (2009)

Beginning in 2005, nine contracts totaling over 21,000 acres went into non-renewal or partial enrollment status, and are a major contributor to the enrollment decline. Non-renewal status establishes a 19-year wind-down process with taxes increasing incrementally each year, reaching full tax status in the last few years of the contract.

The recent decline in non-renewals may continue. Until 2009, Mariposa County received what is called an annual subvention of forgone property tax revenues from the state, which is a direct payment from the state to the county to offset lost property taxes for land enrolled under the Williamson Act. With budget crises statewide, the State virtually eliminated this in 2009. Instead of the $185,000 it was due from the state FY 2009, Mariposa County received a check for $5.27. While some counties are choosing not to continue Williamson Act contracts, as of spring 2010 the Mariposa Board of Supervisors indicated it will continue to support Williamson Act contracts. Continuing county fiscal challenges and the cost of this program shifted to the county may yet force Mariposa County supervisors to drop their support for the program.

Figure 6 shows that TPZ enrollment increased by 3% between 2002 and 2007, from 8,855 to 9,132 acres.

Figure 6. Acres enrolled in timberland production zones, Mariposa County



Source: California State Board of Equalization, Mariposa County Assessment Practices Surveys, 2003 and 2008

Table 2 lists acres of land enrolled in privately held conservation easements and private land preserves. As of May 2010, there were 14 privately held conservation easements in Mariposa County, totaling 864 acres: a total of 13 of these easements are held by Sierra Foothill Conservancy and one by California Rangeland Trust. Sierra Foothill Conservancy owns a 40-acre preserve on Feliciana Mountain, above the Merced River Canyon. California Rangeland Trust has 9,037 acres pending (soon to be covered by easements).

Table 2. Private land preserves and conservation easements in Mariposa County

	Acres in private land preserves	Acres in private conservation easements	Acres of conservation easements pending
Sierra Foothill Conservancy	40	740	0
California Rangeland Trust	0	124	9,037

Sources: Sierra Foothill Conservancy, California Rangeland Trust, 2010

Table 3 shows that, as of June 2010, there are over 304,000 acres of private land in Mariposa County zoned Agricultural Exclusive, Timber Exclusive, or Mountain Preserve. Both Agricultural Exclusive and Mountain Preserve Zones require a minimum 160-acre parcel size, with no more than two single-family residences per 160 acres. Because many of the Williamson Act contract

lands are zoned Agricultural Exclusive, the decline in Williamson Act non-renewals may be reduced. The Timber Exclusive Zone limits subdivision of land to 40-acre parcels, with no more than two residences per parcel. In addition, both the Agricultural Exclusive and Timber Exclusive Zones are intended to protect working landscapes. The Timber Exclusive Zone restricts land use to growing and harvesting timber for a minimum of ten years. The Agriculture Exclusive Zone allows a broader range of uses compatible with preserving a viable agricultural industry in Mariposa County.

Table 3. Total acres zoned agriculture exclusive, timber exclusive, or mountain preserve

	2004	2005	2006	2008	2009	2010*
Agriculture Exclusive	267,509	266,283	269,490	272,467	275,659	276,393
Timber Exclusive	2,558	2,558	2,558	2,558	2,649	2,649
Mountain Preserve[4]	14,897	21,276	18,803	20,333	24,029	25,193
Total	284,964	290,117	290,850	295,358	302,337	304,235

*As of June 2010
Source: Mariposa County Planning Department

In 2008, Mariposa County Planning Department began mapping parcels available for subdivision and development under existing zoning regulations. These data are useful because they provide a visual representation of areas where development can occur under existing zoning and could be compared to maps of agricultural, scenic, and recreational areas. This mapping effort is incomplete, but, when complete, it will offer a useful overview of the extent and location of developable land that is developable.

Figure 7 shows number of new parcels created per year through minor land divisions (creating one to four new parcels), major subdivisions (creating five or more new parcels), and certification of historic parcels. Recognition of historic parcels warrants special attention, because the patents that underlie these parcels were established prior to local planning and zoning laws and therefore allow recognition of sub-standard parcels unrestricted by current county zoning.

Historic land parcels are based on land patents issued by the federal government prior to 1893. These parcels can be fractions of the minimum parcel size required for subdivided parcels in this zone. Although property with these patents may always have been owned and managed as a single large holding, landowners can apply to the county for a "certificate of compliance" recognizing their patents. Once the certificate has been issued, the property owner can sell or finance the historic parcels separately without any further local government zoning or subdivision review. Recognizing parcel boundaries this way does not require landowners to follow the state's key legislation governing land subdivision, such as the Subdivision Map Act

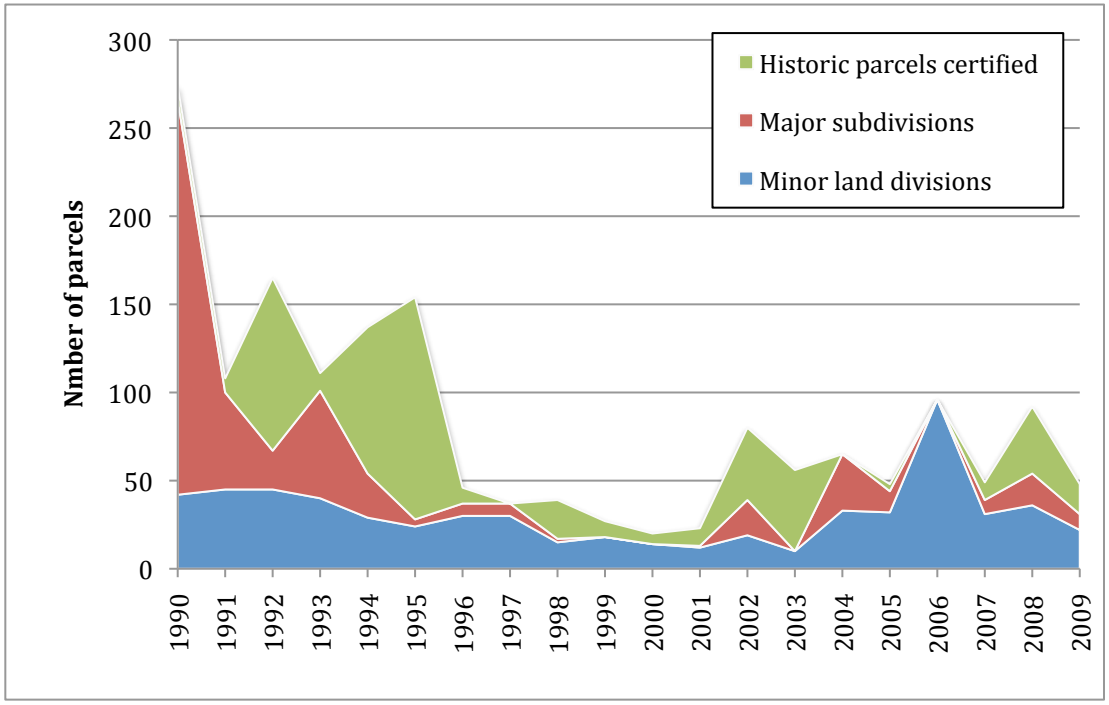
[4] The Mariposa County Planning Department reported that the 2004 and 2005 Mountain Preserve data are unreliable due to inconsistent use of use codes. The decline of Mountain Preserve acreage in 2006 may be the result of adoption of a new County General Plan (communication with Planning Department staff September 28, 2010).

and the California Environmental Quality Act, nor follow current local planning and zoning laws. Property owners can also use a procedure known as a "lot line adjustment" to rearrange the historic parcels like puzzle pieces to form a more marketable layout of parcels.

Subdividing land based on historic parcels greatly increases property value for large property owners, but also allows development that is inconsistent with county general plans and zoning aimed at preserving agriculture and discouraging urban sprawl. Several large ranches have been broken up in Mariposa County have been subdivided based on certificates of compliance, and additional recognition of sub-standard A-E parcels based on historic patents could lead to development of considerably more land in the county than is classified developable under current zoning.

In 1990 there were two large subdivisions, one in Mariposa and one in Lake Don Pedro, which created 160 small parcels. From 2000 to 2009, the county certified an average of 58 new parcels each year. Of these, most are developable. Of the parcels certified from historic patents in the last 20 years, about half are enrolled in Williamson Act and are not developable as long as that land remains under Williamson Act.

Figure 7. New parcels certified, per year

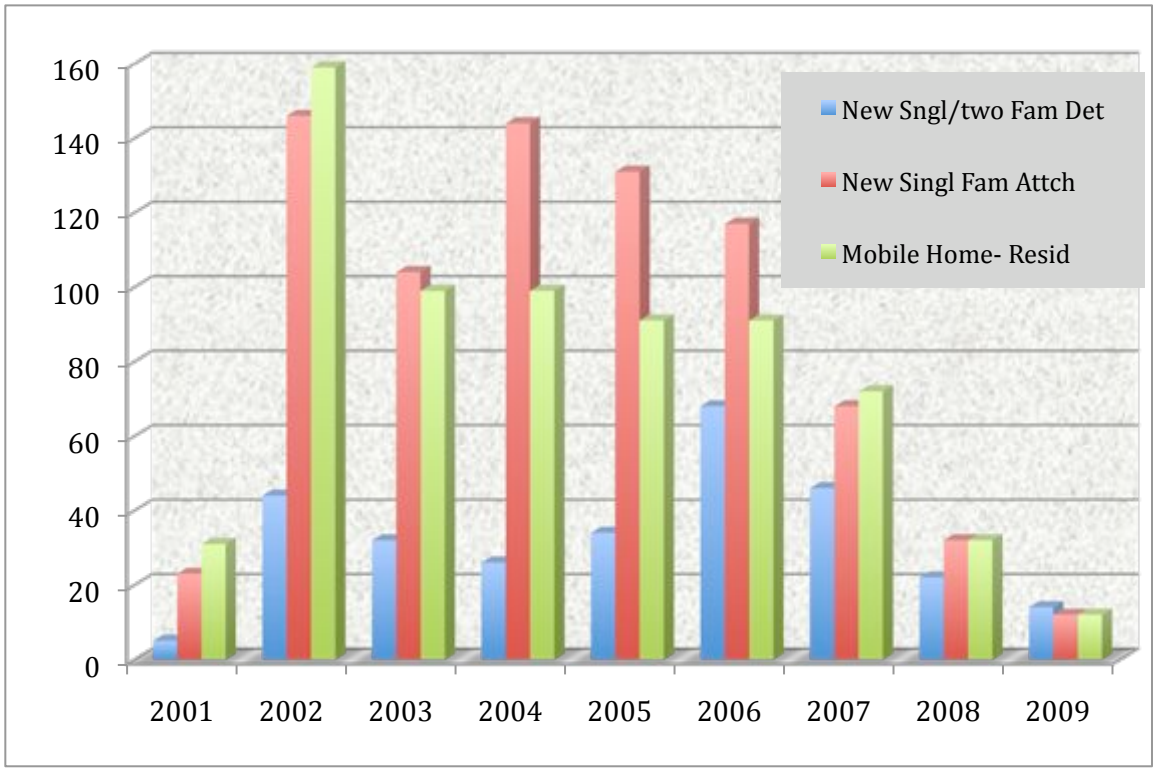


Sources: Mariposa County Planning Department, Mariposa County Assessor's Office

Figure 8 shows number of building permits issued for new single and two family detached homes and new single family attached and mobile home for the past 9 years. The high number of building permits during 2002-2006 could have been in anticipation of the opening of UC Merced in 2005. Although time constraints did not allow for identifying and mapping locations of existing and permitted building development, in future, it would be useful to collect

information from the Mariposa County Planning Department and Assessor's Office regarding the type of buildings constructed and where they are located, to create maps of changing development densities. In particular, it would be useful to know whether development is occurring within town planning areas or more rural parts of the watersheds.

Figure 8. Number of building permits issued for new homes and mobile units



Source: California State Board of Equalization, Mariposa County Assessment Practices Surveys

Historical and Cultural Character

Table 4 shows numbers of sites in the county that, as of May 2010, have been recognized by the state as having historic or cultural significance, and those that have been given federal, state, or local protection. The sites include historic districts and structures and other notable landmarks, including trees and groves, rocks, and caves. A few are historic Indian sites. Historic districts on the National Register include Coulterville, Mariposa, Yosemite Village, Yosemite Village Archeological District, and Camp Curry. Areas and districts designated State Historical Landmarks include Coulterville, Hornitos, Agua Fria, and Yosemite Valley. In 1988, the Mariposa County Board of Supervisors passed a resolution recognizing 160 buildings, structures, and natural features with special historical or architectural significance.

Table 4. Total number of identified and designated historic sites

	National Register (individual property)	National Register (contributing to historic district)	California Register*	Determined eligible for National or California Register	Appears eligible for National or California Register	Local designation or appears eligible for local designation	Needs re-evaluation
Bear Valley	0	0	0	0	20	0	4
Briceburg	0	0	1	0	0	0	1
Catheys Valley	0	0	0	0	2	7	9
Coulterville	4	24	28	3	5	21	5
El Portal	8	0	8	4	0	13	16
Fish Camp	0	0	0	0	0	6	4
Greeley Hill	0	0	0	0	2	15	1
Hornitos	2	0	2	0	0	6	7
Mariposa	5	62	67	0	41	79	16
Midpines	0	0	0	0	0	3	7
Mt. Bullion	0	0	0	0	1	12	2
Wawona	0	0	0	38	0	33	0
Yosemite National Park	33	14	48	73	3	4	6

**All National Register sites are also included on the California Register*
Source: California Office of Historic Preservation, accessed May 18, 2010[5]

It is more difficult to gather data on archeological sites, as their locations and most survey data are protected and restricted from public review. However, a list of federally and state-recognized prehistoric and historic Native American sites in the county can be purchased from the State Office of Historic Preservation. In May 2010, there were 274 prehistoric archeological sites in Mariposa County listed on California's Archeological Determination of Eligibility list. These include sites identified and listed by the National Park Service, the Forest Service, Army Corps of Engineers, Bureau of Land Management, and the State of California. As with historical sites, this list includes sites that have received special designation and those that have been deemed eligible for designation or worthy of further study.

Protection of historical and archeological character of the county could also be tracked by evaluating the number of subdivisions that have been required to mitigate impacts on archeological sites. This information is available from the County Planning Department but is time consuming to compile. Other ways to measure the extent to which the county's archeological character is recognized and protected would be to track the number and availability of educational materials and interpretive displays or to consult local tribes or Native

[5] These data have to be purchased from the California Office of Historic Preservation. The database was accessed on this date by staff at the Central California Information Center and provided for this report.

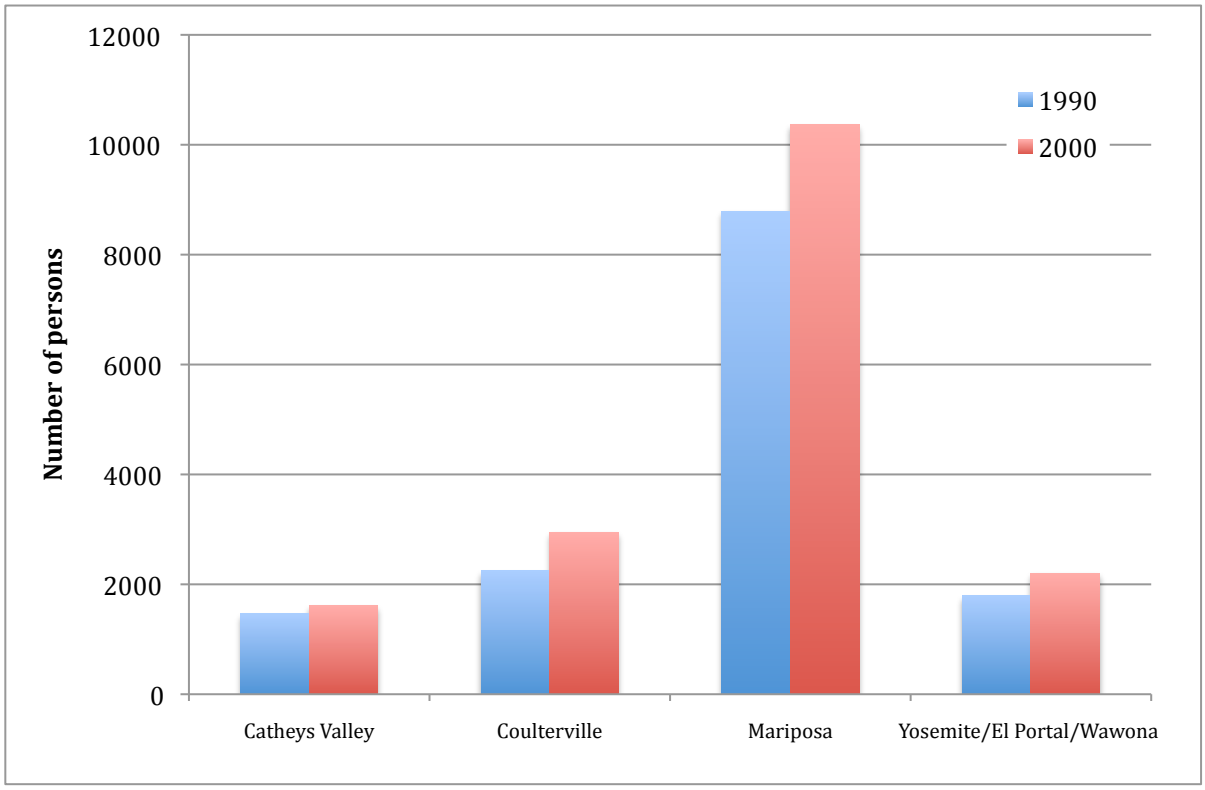
Americans whose ancestors lived in or utilized resources from the watersheds. A study of historic Native American fisheries in the Merced River watershed is incomplete at the time of this writing, but may be available in the near future.

Demographics

This section reports data on population and demographic trends, including age and school enrollment trends, and race. Population trends are useful for interpreting other changes in the county, such as development. Demographic trends involve not only whether a population is increasing or decreasing, but also how a population is changing, such as whether it is growing older or younger as a result of the increase or decrease of older residents, younger residents, and households with children.

Population in Mariposa County increased rapidly from 1990 to 2000, grew slowly from 2000 to 2008, and appears to have decreased since 2008. The county population increased 20% from 1990 to 2000, from 14,300 to 17,130 people (Figure 9). The population increase was greatest in the Coulterville Area, which for this report includes Lake Don Pedro (for a map of the community boundaries see Figure 2), and least in the Catheys Valley Area, comprising the county's largest ranching area.

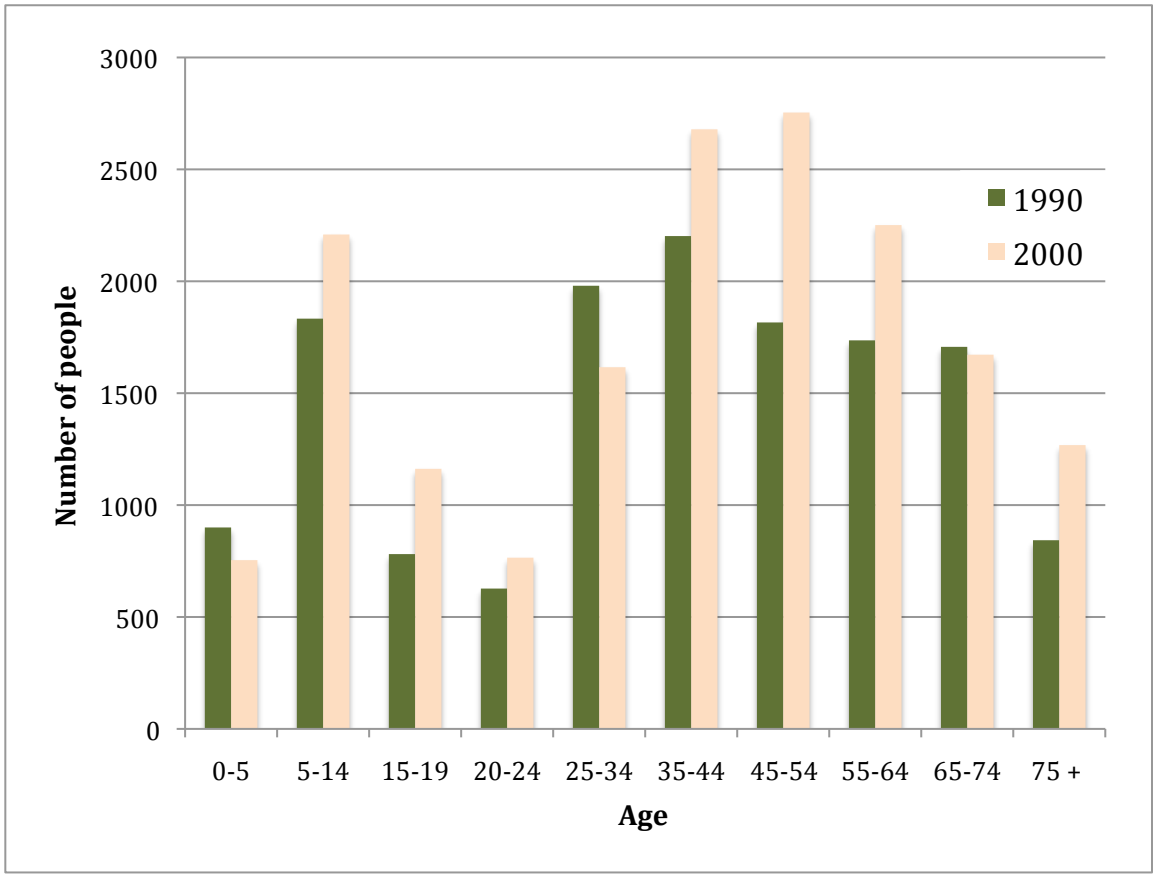
Figure 9. Population change, 1990-2000



Source: U.S. Census Bureau

Demographic trends from 1990 to 2000, shown in Figure 10, show an aging population, with the greatest increase in the 35-64 year old range and decreases in the 0-5 and 25-34 age ranges. The 35 to 64 year-olds increased the most.

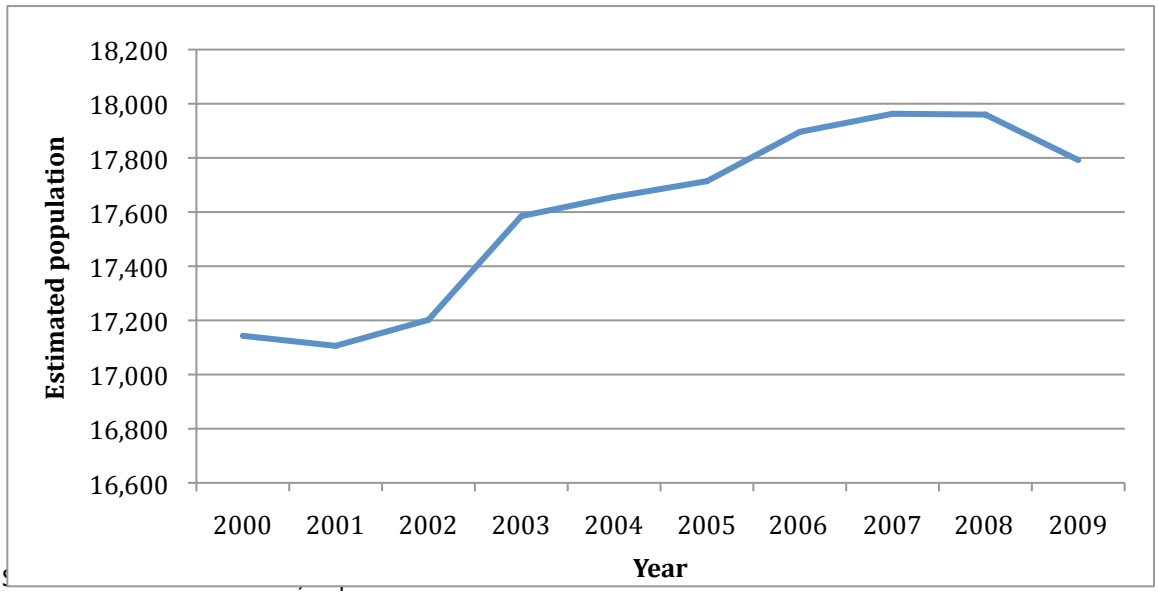
Figure 10. Population by age group, Mariposa County, 1990 and 2000



Source: U.S. Census Bureau

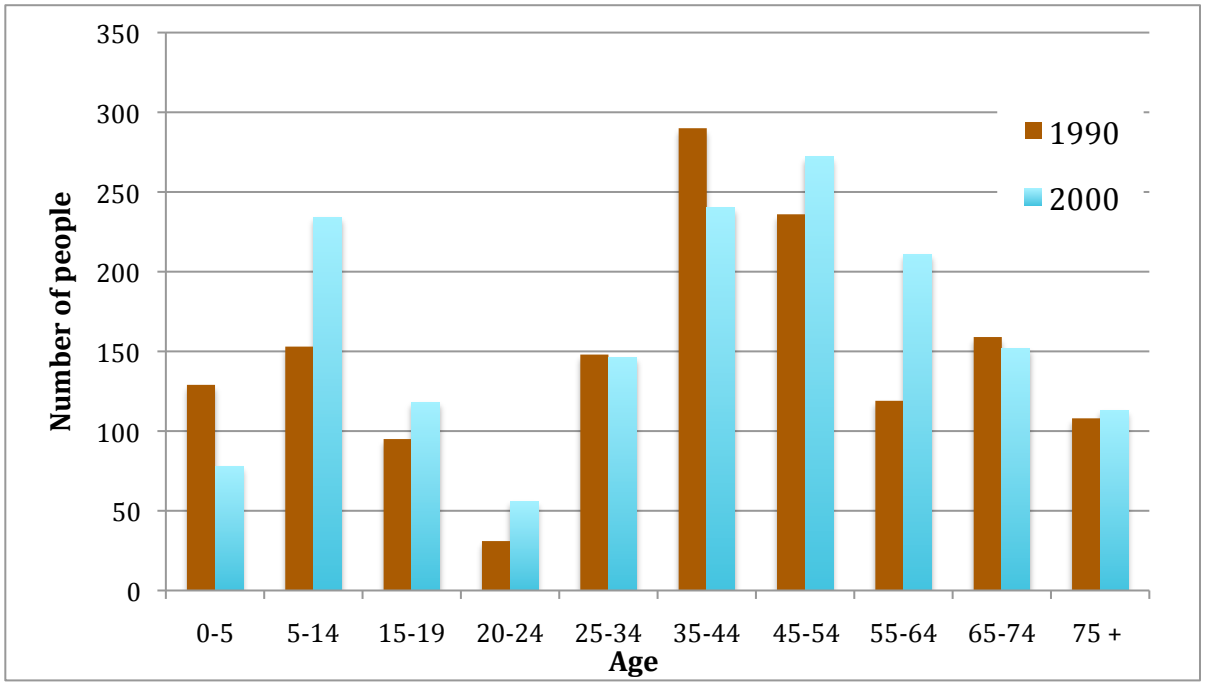
From 2000 to 2009, U.S. Census Bureau population estimates suggest the county population increased by less than four percent. This is shown in Figure 11. Since the recession in 2008, the county population is estimated to have dropped by one percent. A fairly dramatic reduction in school enrollment since 2000 suggests that the county continues to lose young families. The U.S. Census Bureau population estimates for the county are lower than state estimates. The California Department of Finance estimated the county population at 18,242 for January of 2009. They estimated the January 2010 population total to have declined by 0.3% from 2009, to 18,192.

Figure 11. County population estimates, 2000-2009



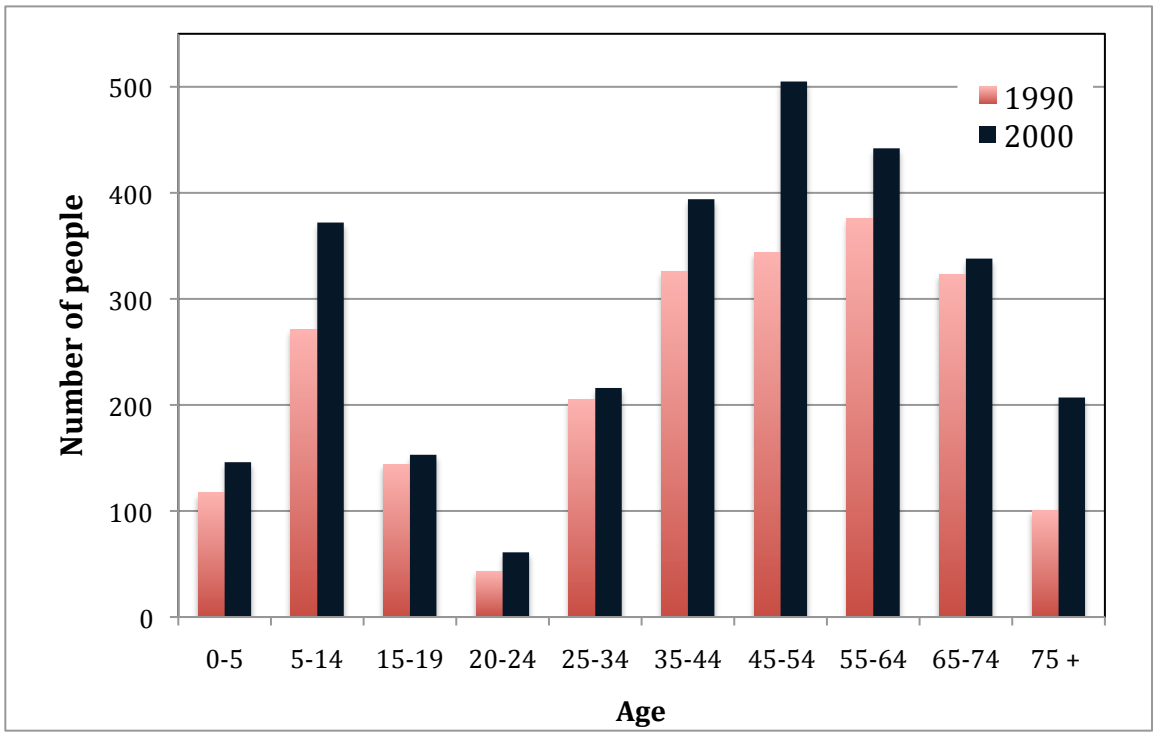
Figures 12-15 show age trends in the four community areas from 1990 to 2000. Coulterville is the only community in which population increased in all age groups. In Mariposa, the largest population area of the county, those 35 to 64 years old as a group increased considerably more than other age groups during the decade of the 1990s. Unlike the other three communities, the Yosemite/El Portal/Wawona area has proportionally fewer residents 55 and over.

Figure 12. Population by age group, Catheys Valley area, 1990 and 2000



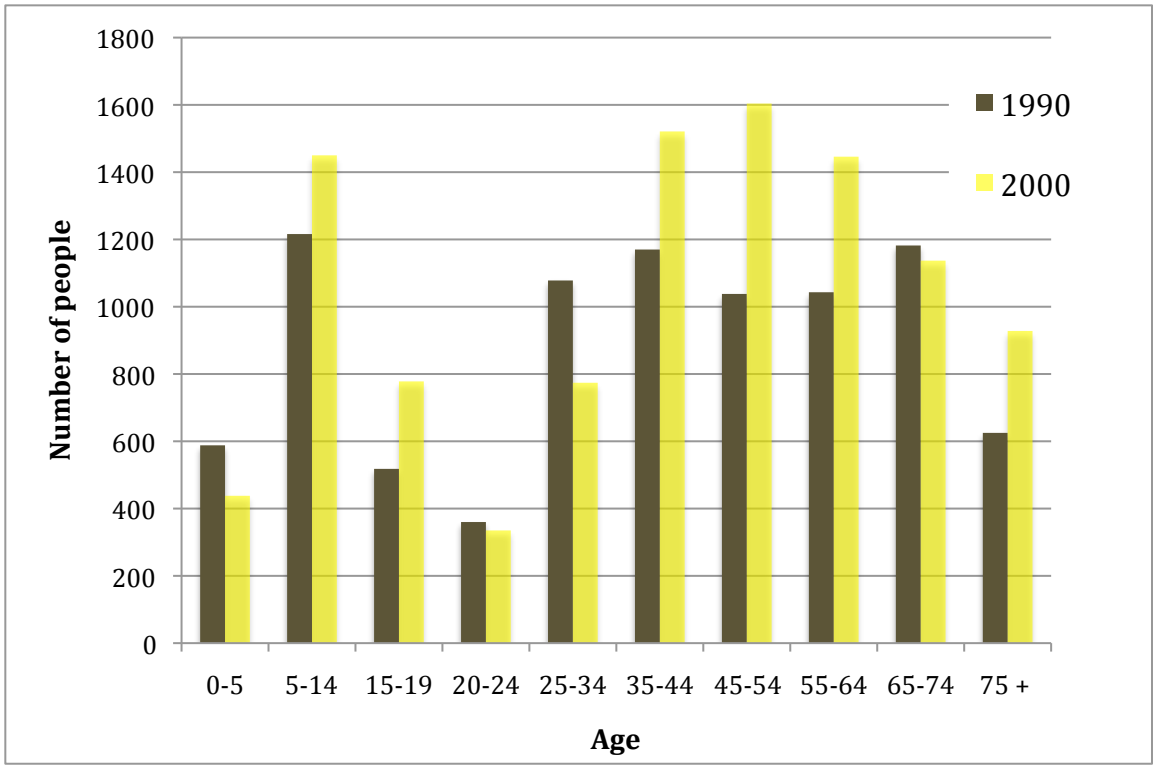
Source: U.S. Census Bureau

Figure 13. Population by age group, Coulterville area, 1990 and 2000



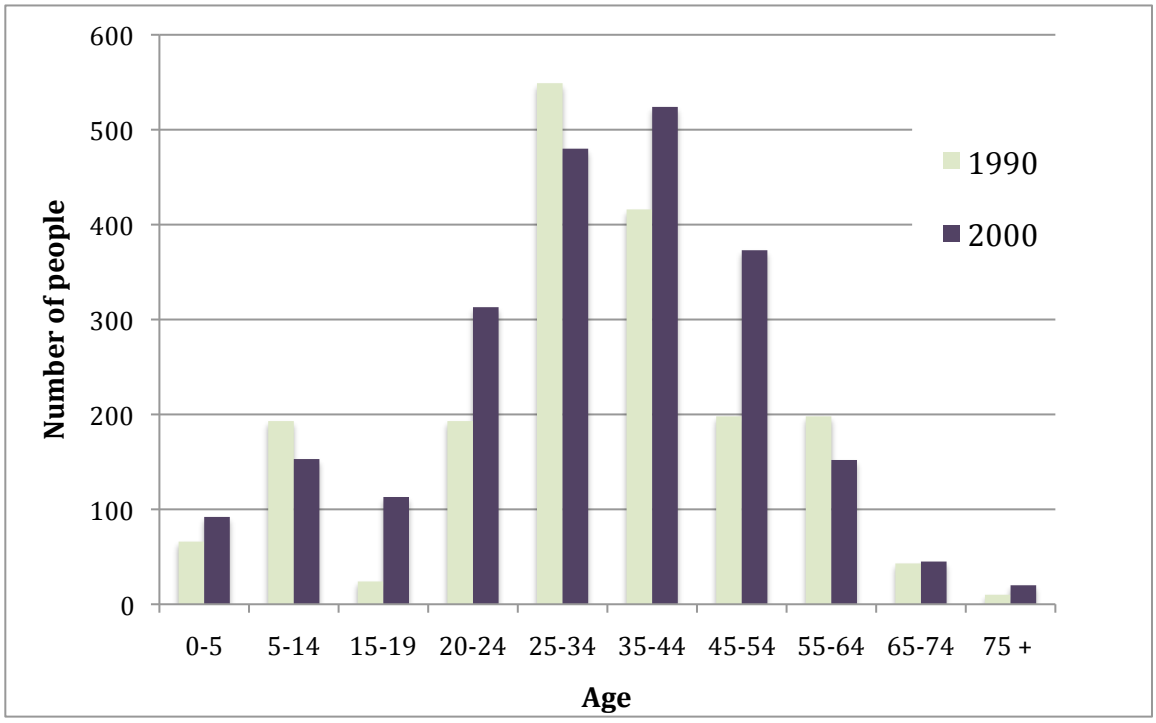
Source: U.S. Census Bureau

Figure 14. Population by age group, Mariposa area, 1990 and 2000



Source: U.S. Census Bureau

Figure 15. Population by age group, Yosemite/El Portal/Wawona area, 1990 and 2000

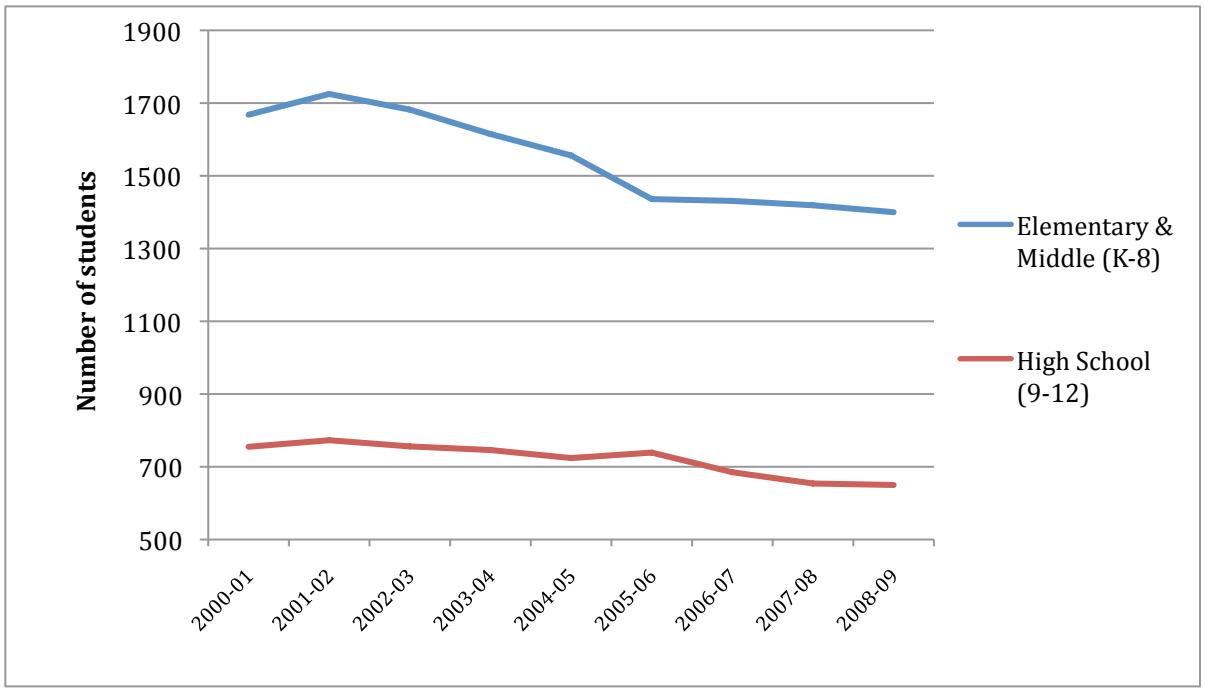


Source: U.S. Census Bureau

School enrollment in Mariposa declined by 12% from 2000 through 2009. See Figures 16 and 17. Enrollment in traditional elementary, middle, and high schools dropped by 15.4%, while enrollment in alternative schools increased. The greatest decline was in the town of Mariposa.

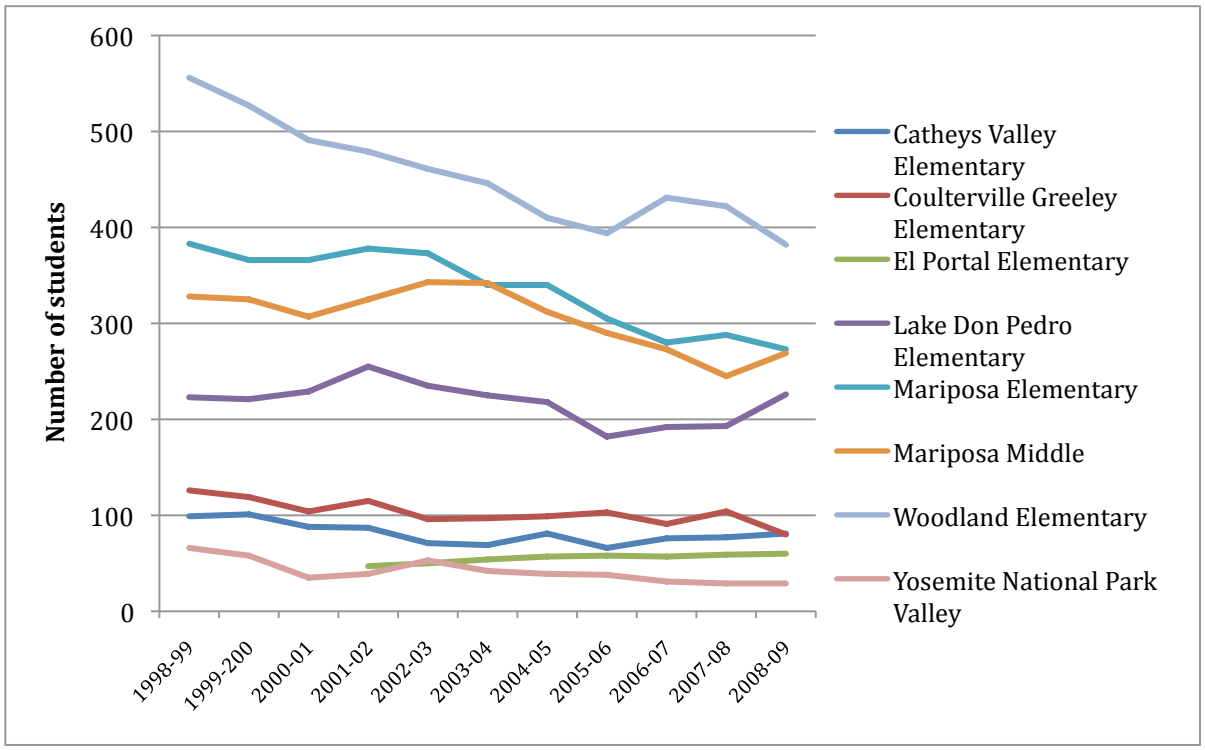
School enrollment steadily declined even while county population increased in the 2000s. This is due to a combination of an increase in retirees and older residents and the departure of families with school-age children. An increase in home schooling can of course affect this pattern, but Mariposa has not been immune to the impact of the changed welfare laws of the late 1990s and the loss of jobs in rural areas that began long before the recent recession. Over the last decade, rural counties in the Sierra and across the West have experienced continuing population declines as families with children move in search of work.

Figure 16. School enrollment trends, 2000-2009



Source: California Department of Education, Education Data Partnership

Figure 17. Elementary and middle school enrollment trends, 1998-2010



Sources: California Department of Education, Mariposa County Unified School District

Table 5 reports data on race, Hispanic or Latino origin, and foreign-born origin from the 2000 U.S. Census. 1990 Census data are not comparable, because data collection methods and categories changed in 1997. For the 2000 Census, approximately 89% of Mariposa County residents reported their race as "white"; 3.5% said they were Native American or Alaskan Native; and 6.1% of people in Mariposa County reported their race as "other" or "more than one race." A total of 7.8% said they were of Hispanic or Latino origin, and 2.8% were foreign-born. According to 2008 Census estimates, the proportion of Hispanics in the county had increased to 10.5%.

Table 5. Population by race

	Percent of population
White alone	88.9%
Black or African American alone	0.7%
American Indian and Alaska Native alone	3.5%
Asian alone	0.7%
Native Hawaiian and Other Pacific Islander alone	0.1%
Some other race alone	2.7%
Population of two or more races:	3.4%
Hispanic or Latino	7.8%
Foreign born	2.8%

Source: U.S. Census Bureau, 2000 Census

Public Health

This section briefly discusses water availability, what is known and not known; water quality, through discussion of water quality violations and factors that can affect it such as leaking underground storage tanks; and air quality, focusing on the number and type of reported air quality violations. Others measures, such as incidence of disease, infant mortality rates, access to health care, and percent of population covered by health insurance, to mention just a few, might be considered elsewhere.

Water Availability

The majority of households in Mariposa County draw their water from the ground and through private wells. Determining the amount of available groundwater or the extent to which it is being withdrawn is difficult if not impossible due to the following factors:

1. Geologic Conditions: Groundwater in the county is trapped in granitic hard rock fissures and these fissures are inconsistent in depth or water availability. Therefore, water levels tend to fluctuate greatly on both a spatial and temporal scale and it would be extremely expensive to accurately measure water availability across such a fractured rock landscape.
2. Well Log Reports: Private well information is for the most part proprietary and unavailable to the public. However, when a new well is completed a well driller provides

a report to the county, including an estimate of well productivity. Although the county cannot share location information, it is possible to examine data on the number of new wells drilled every year. Currently, methods for estimating well productivity, particularly in fractured rock areas, are not very reliable. In the future they may become more useful.

Water Quality

The State of California does not regulate water quality in private domestic wells. Past reports have indicated nitrate and other contaminants have entered the groundwater within the county, however no groundwater-monitoring program exists to track this issue. Two state programs evaluate groundwater, but neither includes Mariposa County. The closest groundwater well consistently monitored for water quality is located in the town of Merced. Available data are reported, but caution should be used in extrapolating these findings to the rest of the county and assuming these data are sufficiently comprehensive of Mariposa County water quality.

In terms of water contamination, there are three sources of data that track (1) sanitary sewer overflows, (2) public water supply contaminant exceedances, and (3) leaking underground storage tanks. These data cannot be extrapolated to areas beyond the sampling sites.

Public sewage spill incidents

The State Water Resources Control Board Public Sewage Spill Incident Map tracks all sewage spills from 2007 until present, whether spills have overflowed into a receiving body, and if so, when and how much. Category 1 spills represent a greater threat to public health. They include (1) a discharge of sewage, which equals or exceeds 1000 gallons, or (2) a discharge of sewage to a surface water and/or drainage channel, or (3) a discharge of sewage to a storm drain that was not fully captured and returned to the sanitary sewer system. Category 2 spills include any discharge of sewage, which does not meet the criteria for Category 1. Category 2 spills represent a lesser threat to public health.

A search of all records since 2007 revealed one Category 1 and two Category 2 spills within the town of Mariposa. The Category 1 spill occurred on February 2010 and involved a plugged manhole overflow of 4,000 gallons that reached Mariposa Creek.

Public water supply contaminants

California Environmental Protection Agency's Groundwater Ambient Monitoring and Assessment Program collects water from public water supply wells serving 25 or more residents and analyzes it for naturally-occurring and man-made chemicals. Since there are national limits on contaminant levels in drinking water, suppliers of public water are required to notify the California Department of Public Health and those they serve if they exceed these limits for coliform bacteria, inorganic chemicals, radioactivity, and others. Table 6 lists public well water sites that have results above limits for naturally occurring and man-made chemicals.

Table 6. Reported public well water contaminant exceedances in Mariposa County

	Nitrate (limit 45 ml/l)	Arsenic (limit 10 ug/l)	Chloride (limit 500mg/l)	Hexavalent Chromium (limit 1 ug/l)	Fluoride (limit 2 mg/l)
1994		Yosemite View Lodge	Yosemite View Lodge		
1999		Ponderosa Basin Mutual Water			
2002					Ponderosa Basin Mutual Water
2004				California Department of Forestry Camp Bullion	
2005	Mariposa County Fairgrounds	Catheys Valley Elementary School			
2008		Mariposa Junior High School, Ahwanee Resorts, Cedar Lodge Resort			
2009		Cedar Lodge Resort, Indian Flat RV Campground			

Source: California Department of Public Health, GeoTrackerGAMA[6]

Leaking underground storage tanks

The State also tracks water quality in monitoring wells located around identified leaking underground storage tanks in Mariposa County. Table 7 shows the 13 leaking tanks in Mariposa County: seven in and around Mariposa, one near the north fork of the Merced River, two near the south fork of the Merced River, and one in Coulterville.

Table 7. Leaking underground storage tanks in Mariposa County

Leaking Underground Storage Tanks
Badger Pass Ski Area
Bartlett Petroleum
Ben Hur Yard
Chase's Foothill Petroleum
Coulterville General Store
Mariposa Airport
Mariposa CHP
Mariposa County Landfill
Mariposa Quick Stop
Mariposa Ranger Unit Headquarters
Midpines Maintenance Station
Wawona Quad, South Force Merced

Source: California State Water Resources Control Board, http://geotracker.waterboards.ca.gov/sites_by_watershed.asp

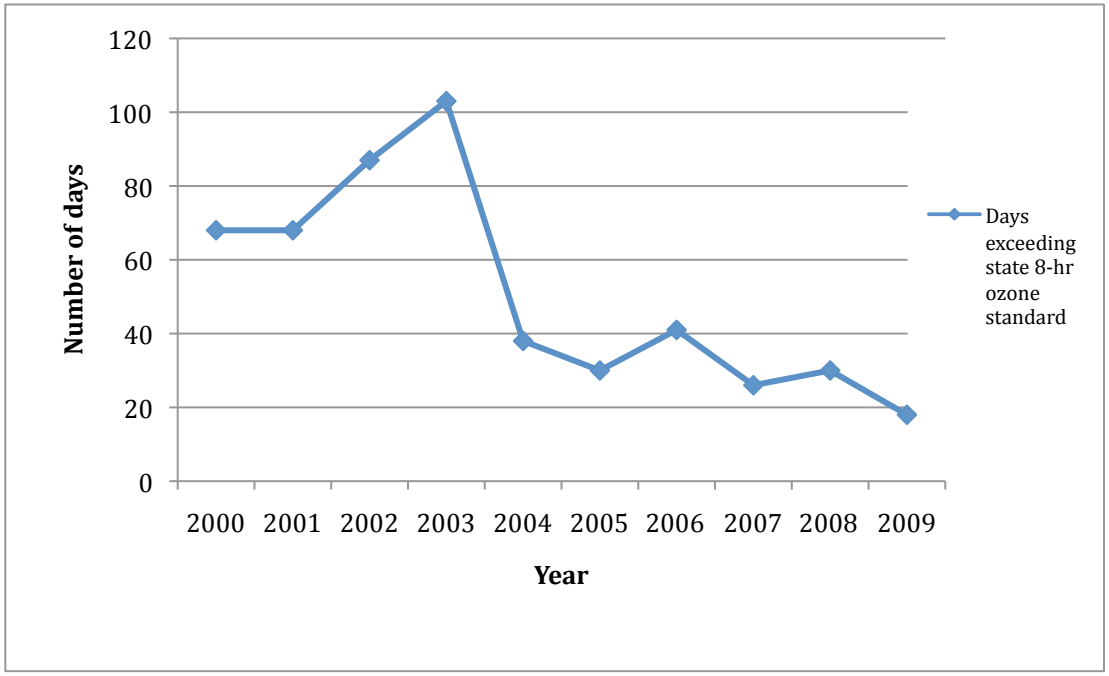
[6] Data in this table are collected from reports furnished to the state. One entry error was discovered and was removed.

Given the limits of existing data but importance of water quality and quantity data to residents and for planning development, implementing a groundwater and well study would be valuable for assessing both the quality and quantity of groundwater to safely support resident needs.

Air Quality

There is only one air quality monitoring station in the county outside of Yosemite National Park. The Jerseydale monitoring site is in an undeveloped area east of Midpines, and reports only on ozone levels. There are two other monitoring stations in the county, in Yosemite Village and at Turtleback Dome in Yosemite National Park. The Yosemite Village site has only very occasional records of particulate matter levels.

Figure 18. Ozone exceedances at Jerseydale monitoring site



Source: California Air Resources Board

Additional air quality measurement may be desirable, particularly to measure particulates from automobiles and forest fires. However, the usefulness of these data should be balanced against the cost to measure them.

Income and Impoverishment

Income

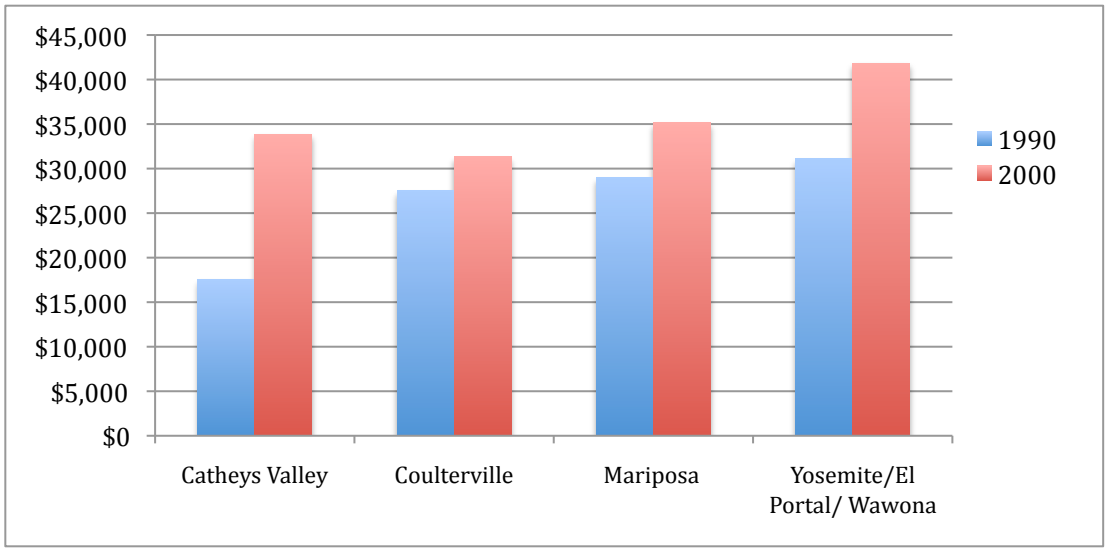
Measures of household income, unemployment, and the percent of households receiving public assistance are used to describe income and impoverishment in Mariposa.

In 2000, the Yosemite/El Portal/Wawona Area had the highest median income in the county, exceeding the others by roughly 25%, as shown in Figure 19. Catheys Valley showed the

greatest increase in median income from 1990 to 2000. This may be due to the disproportional increase in typically more affluent 45-64 year olds during the same period.

Figure 19. Median household income, by community area

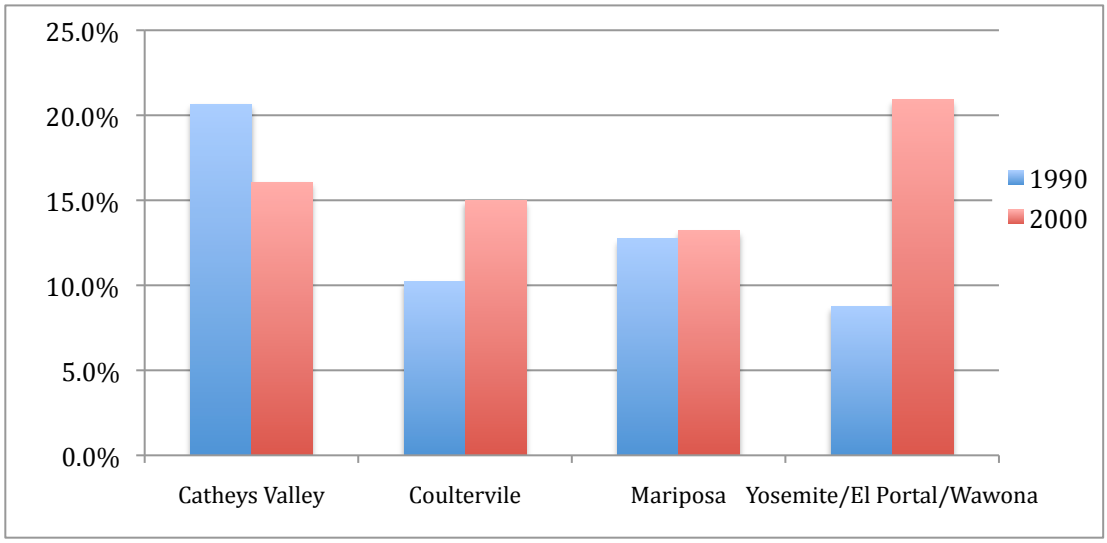
Source: U.S. Census Bureau



Impoverishment

Notably, unemployment and percent of the population with an income below poverty level increased dramatically in the Yosemite/El Portal/Wawona area during the 1990s. See figures 20 and 21. The percent of population with incomes below poverty level increased by roughly 12% in the Yosemite/El Portal/Wawona area, while Coulterville increased 5%, Mariposa stayed the same, and Catheys Valley decreased by almost 5%.

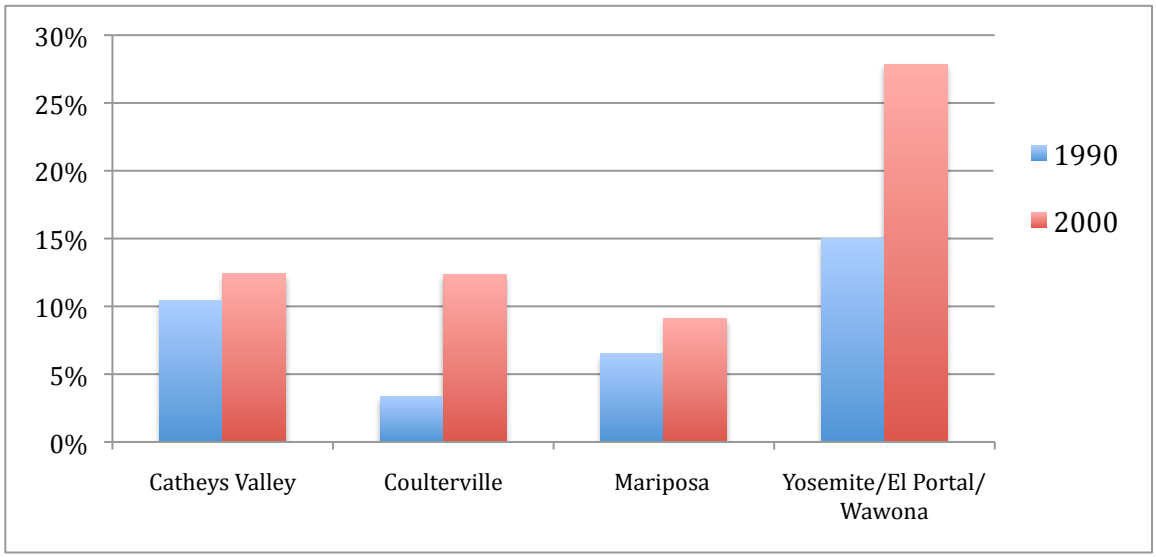
Figure 20. Percent of population with income below poverty level, by community area



Source: U.S. Census Bureau

In all communities the percentage of unemployed increased during the decade of the 1990s, as shown in Figure 21. Catheys Valley had the smallest increase, while the largest increase was in Yosemite/El Portal/Wawona. In this area unemployment reached almost 28%. On a relative basis, Coulterville's unemployment increased the most, tripling to just over 12%. Additional analysis is needed to determine the reasons for the different relative changes and the strikingly different unemployment totals.

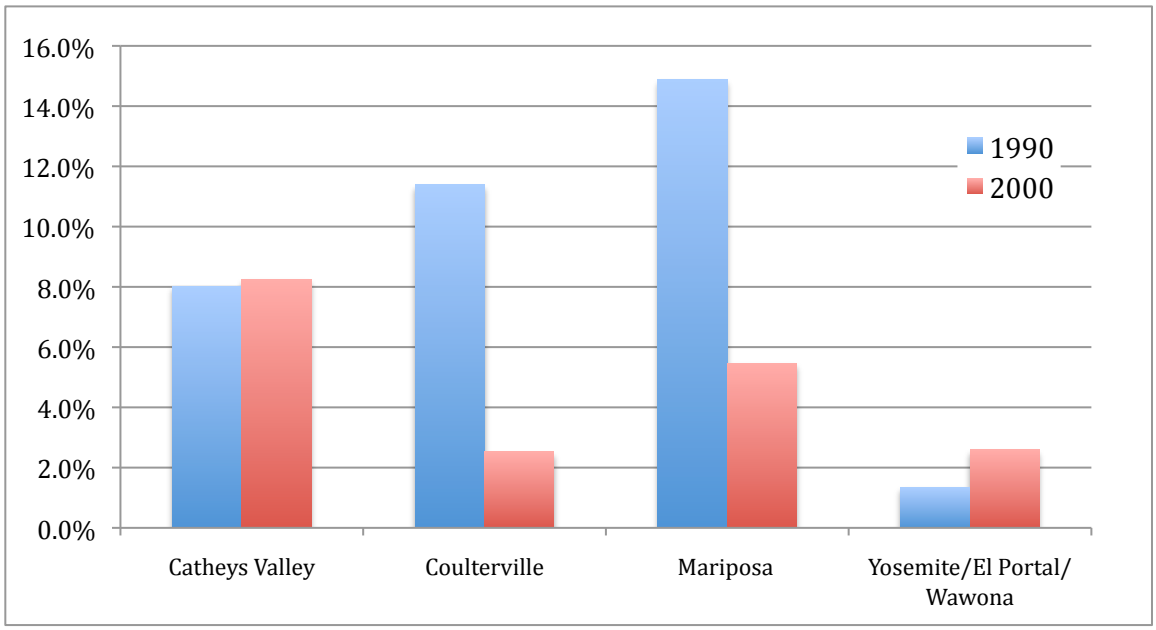
Figure 21. Percent of labor force unemployed, by community area



Source: U.S. Census Bureau

The percent of households receiving public assistance, shown in Figure 22, reveals a different pattern from some of the other measures of impoverishment. Coulterville and Mariposa showed dramatic declines, while the Yosemite/El Portal/Wawona area and Catheys Valley increased only slightly. It is important to point out that there was a significant change in the federal welfare program in the 1990s that could have played a prominent role in the declines. The percentage of households receiving public assistance in Yosemite/El Portal/Wawona and Coulterville in 2000 is extremely low, with Coulterville showing over a threefold decrease from 1990. One reason for the dramatic change in the Coulterville area may be the rapid growth of the Lake Don Pedro community, which is believed to have a significantly higher household income level than other communities in the area. Further disaggregation of data to isolate Lake Don Pedro, Coulterville, and other communities would be needed to determine community-specific changes.

Figure 22. Percent of households receiving public assistance



Source: U.S. Census Bureau

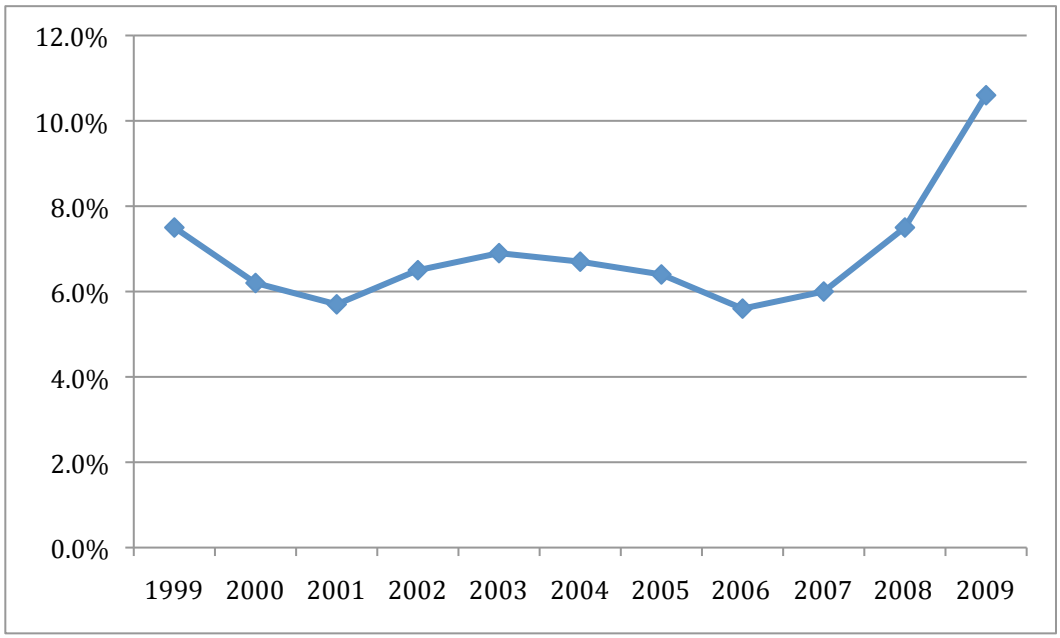
It is worth mentioning that Yosemite/El Portal/Wawona has what appears to be the anomaly of high unemployment and poverty, but few people receiving public assistance and high median income in 2000. Based on previous study of communities in the Sierra,[7] and a separate study of Mariposa in the late 1990s,[8] this pattern is likely attributable to several factors, notably that the area is home to a proportionately high number of young seasonal workers who work as guides and in recreational and retail sectors. Many of these workers are not highly paid and often are unemployed during the winter and early spring when the Census is conducted. Many of these same people do not have children, accounting for low rates of households receiving public assistance. Higher reported income may also be the result of using a median income measure, which is a problematic statistic in an area where there are many people with high incomes as well as many with incomes below the poverty level, or a bi-modal income distribution. Finally, it is important to mention that these data and discussion are based on data that are now 10 and 20 years old. More recent countywide unemployment rates and enrollment in the free and reduced school lunch program, shown in Figures 23 and 24, suggest that as the recession has taken hold economic conditions and impoverishment have indeed worsened.

[7] Sierra Nevada Ecosystem Project Report; Wildland Resources Center Report No. 39 9ISBN 1-887673-03-2

[8] Doak, Sam and Jonathan Kusel. 1997. A Social Assessment of the Highwater Incident, Yosemite National Park, prepared for the supervisor of Yosemite National Park. 37p.

As shown in Figure 23, from 2000 through 2007, Mariposa County's unemployment rate fluctuated between 5.7-6.9% (California Employment Development Department). In 2008 it was 7.5%, and by 2009 the county's recession-driven unemployment rate was 10.6%, slightly lower than the statewide average of 11.4%.

Figure 23. Mariposa County unemployment rate, 1999-2009



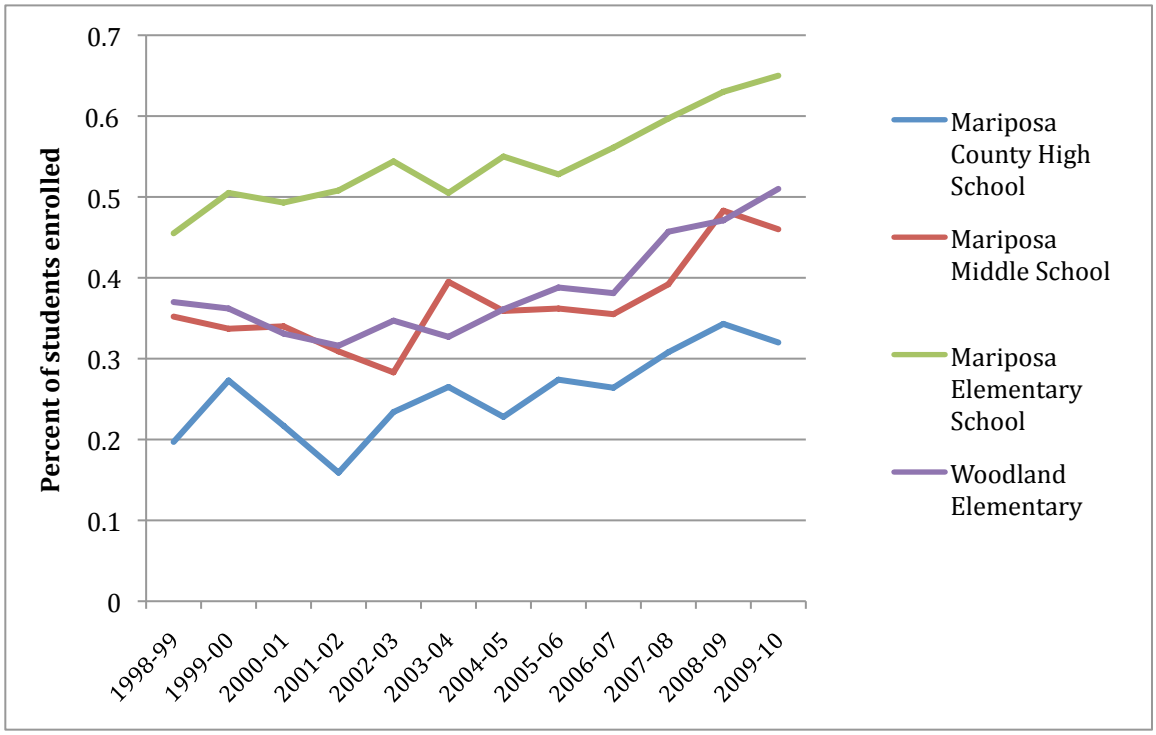
Source: California Employment Development Department, Labor Market Information Division

In the beginning of 2010, reflecting typically higher winter unemployment rates, Mariposa unemployment stood at 14.8% in January. This rate has steadily declined in the ensuing months; the June 2010 unemployment rate is at 9.8%. This is still under the statewide monthly rate of 12.2%.

Figure 24 shows trends in free and reduced lunch enrollment in schools in Mariposa town, the largest schools in the county. Figure 25, looking at all schools across the county, enrollment in the free and reduced lunch program, shows an overall increase from 43% in 2006-2007 to 50% in 2007-2008 and 57% in 2008-2009.

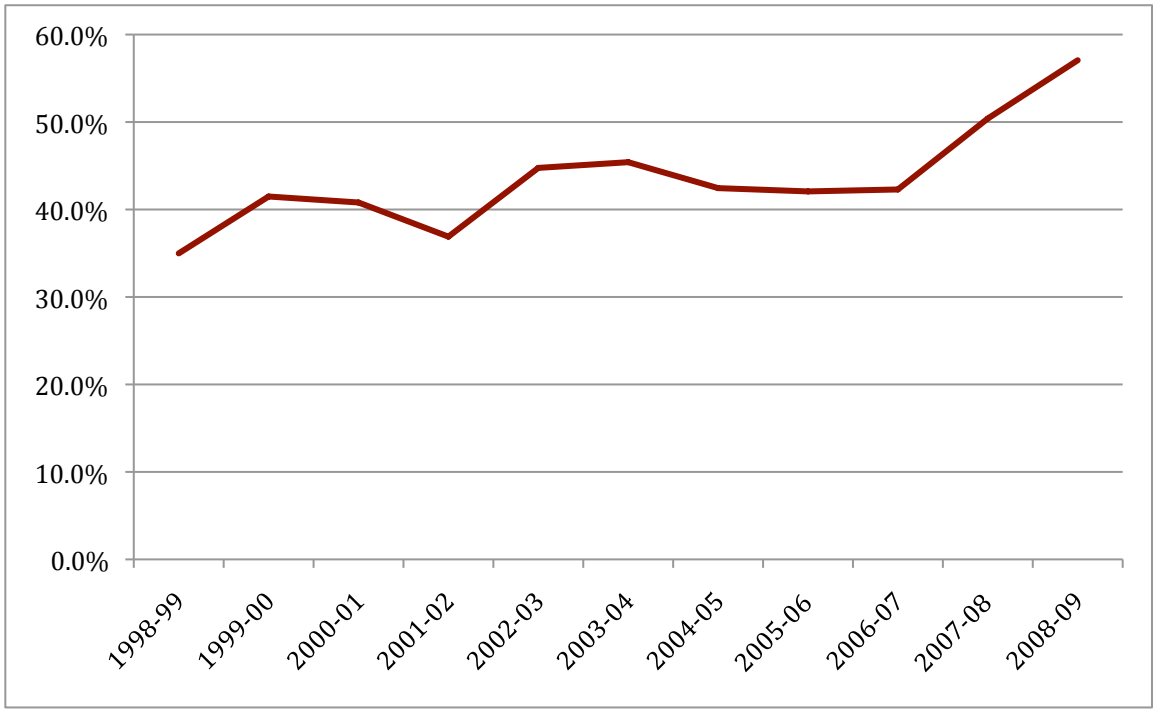
Additional analysis of trends affecting the county, such as the 1997 flood, the 2006 Ferguson Rock Slide, and the current recession, would be helpful for more detailed interpretation of these data. However, additional data collection and analysis on at this level is beyond the scope of this report.

Figure 24. Free and reduced lunch enrollment program, Mariposa town schools



Sources: California Department of Education, Mariposa Unified School District, 2010

Figure 25. Free and reduced lunch program enrollment, Mariposa County schools



Source: California Department of Education, 2010

Economic Vitality

Economic vitality is reflected in personal income, business diversity and earnings, and employment in key economic sectors. According to people who live and work in Mariposa County, the health of the tourism and agricultural sectors are of most concern. Tourism (hospitality and leisure) provides the most jobs in the area and transient occupancy taxes, which account for close to half of the county's discretionary budget. Hence, the health of the tourism sector not only affects jobs, but it directly affects dollars available for county-funded watershed projects as well as other county functions. The health of the agricultural sector is of interest to maintaining a way of life and the rural, agricultural character of the county, but employment in agriculture pales in comparison to employment in other sectors.

Business Diversity

Economic diversity is often considered a measure of economic health, because a variety of businesses are considered to be better able to weather an economic downturn. In Mariposa County, however, approximately 80% of all jobs are in either government or leisure and hospitality (accommodations and food services). This is shown in Figures 26 and 27. There are relatively few jobs in retail trade, construction, manufacturing, and other industries.

Figure 26 shows that workers in Mariposa County are dependent on a healthy tourism and recreation economy. With the exception of the two government sectors (State and Local Government workers and Federal Government workers), the Leisure and Hospitality industry exceeds other sectors by a factor of at least four. The number of workers employed in the Leisure and Hospitality industry has fluctuated considerably throughout the 1990 to 2009 period. The dramatic decline of 1997 is linked to Yosemite National Park's almost three-month closure during a damaging flood at the beginning of the year that destroyed roughly half of its campsites, and closure of Highway 140 until Memorial Day of that year. Throughout the 19-year period the number of state and local government jobs steadily increased until 2008. Federal government jobs fluctuated more, but also increased over the last 19 years.

In Figure 27, which shows the major industries with less than 500 employees, Retail Trade and Professional & Business Services industries are the largest. Retail Trade steadily declined during the 19-year period, while Professional & Business Services dramatically spiked and dropped during the 2000-2003 period. Foreshadowing the recession, the number of construction workers peaked in 2006 and has since declined dramatically.

Figure 26: Employment by Industry, more than 500 employees, 1990-2009

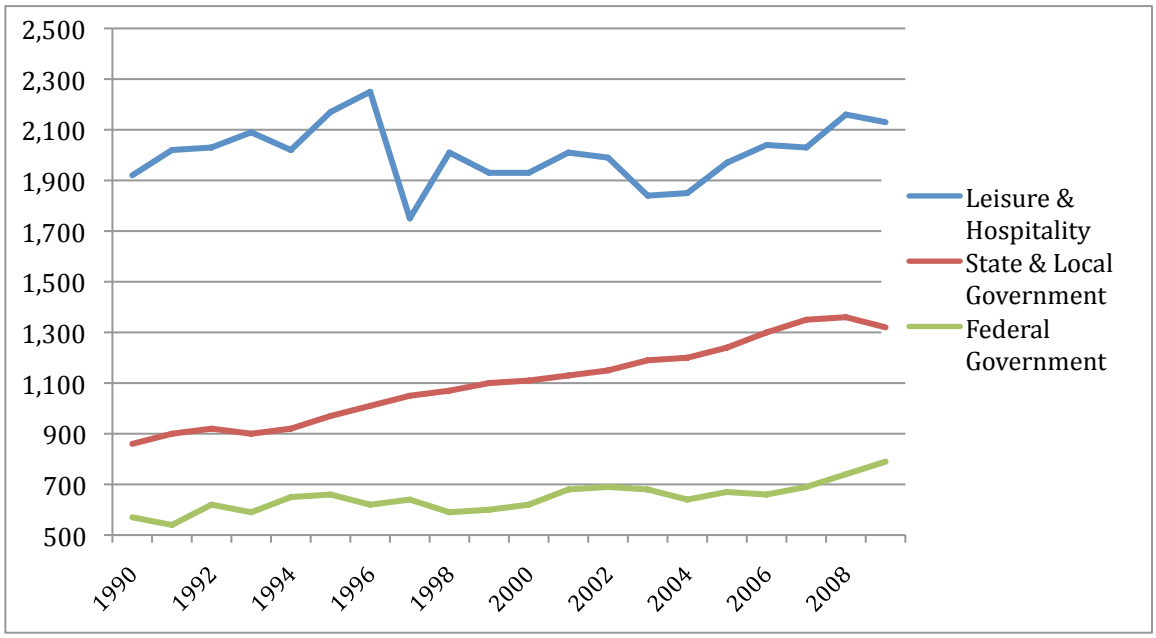
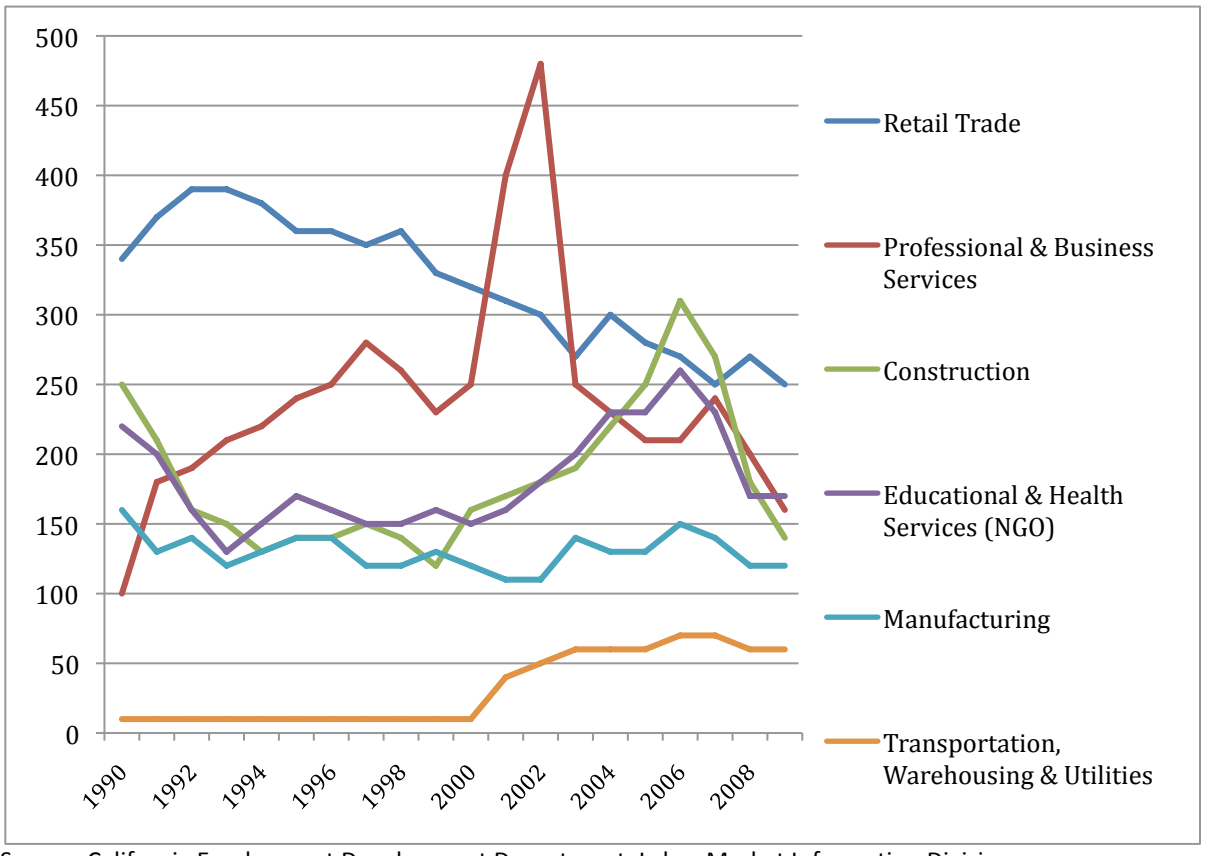


Figure 27: Employment by Industry, less than 500 employees, 1990-2009



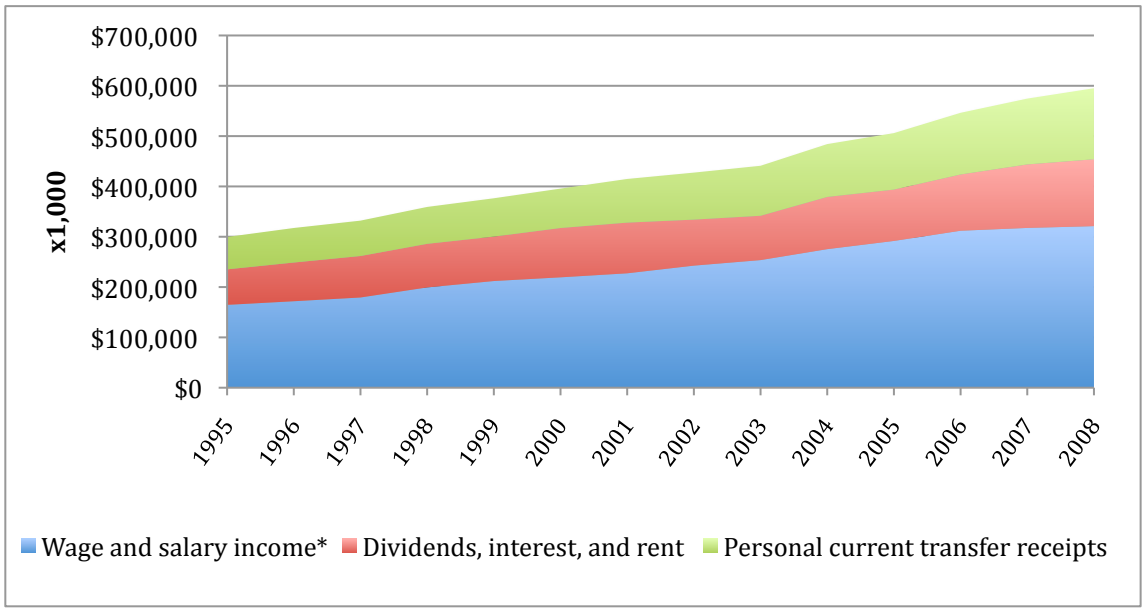
Source: California Employment Development Department, Labor Market Information Division

We have so far relied on California Employment Development Department for employment data rather than federal employment or other data. Employment Development Department (EDD) data are most frequently used in reporting employment in the state. It is important to note that other sources of employment data, such as the U.S. Census Bureau's Economic Census, Bureau of Economic Analysis, and Bureau of Labor Statistics report numbers, and some of these data differ from California Employment Development Department statistics, sometimes markedly. Rather than display and discuss differences in data, which is beyond the scope of this report, we utilize these other data where appropriate to report socioeconomic relationships and patterns that help to explain socioeconomic conditions in Mariposa County. In all cases where data are based on estimates and projections they may fail to accurately reflect local conditions. It is important to make clear, especially in light of employment numbers, that the hard-hitting impact of the 2008 recession has reduced the accuracy of normally sound numbers generated by both state and federal formulas and estimations.

Income

Figure 28 shows the components of personal income for Mariposa County residents over the last 14 years, expressed in hundreds of millions of dollars (unadjusted for inflation). Typically, an aging population derives a higher proportion of its income from sources other than wage and salary income. In the aggregate, from 1995 to 2008, Mariposa residents derived $0.54-$0.58 of the income dollar from wage and salary income.

Figure 28. Total personal income by source, 1995-2008



*Wage and salary is earnings by place of work, including proprietors' income, minus contributions for social insurance and adjusted for residence; Source: Bureau of Economic Analysis, Regional Economic Accounts

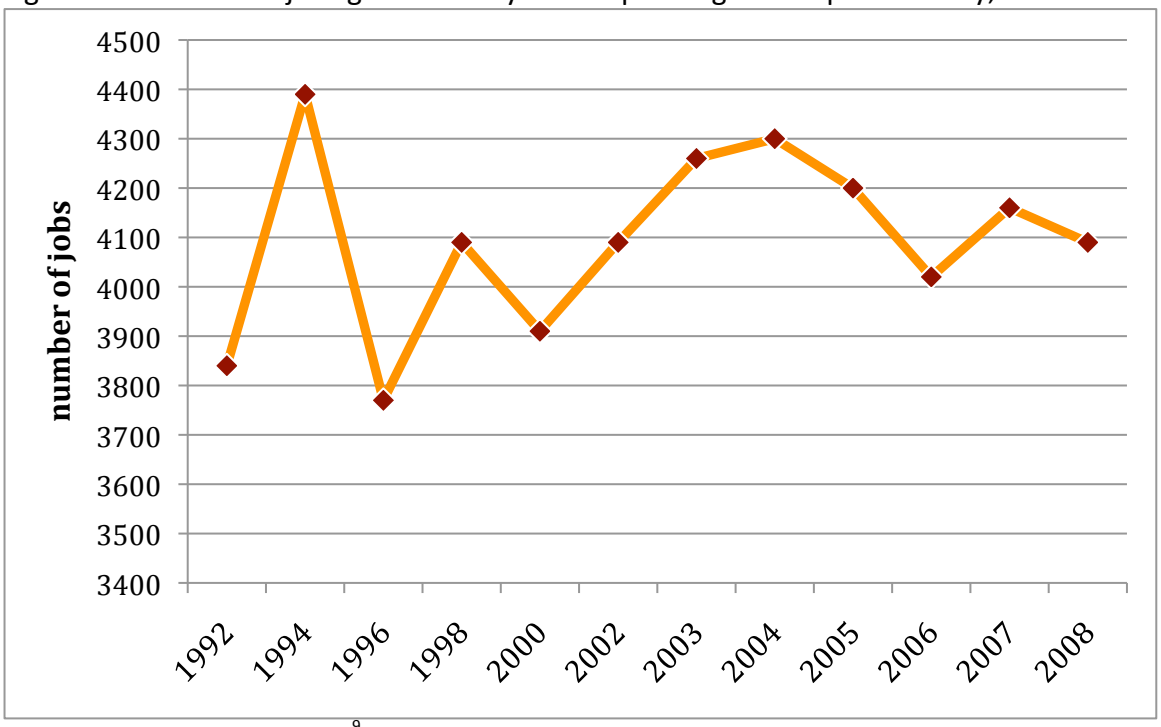
The low is 2008 and the high is in 2003 and 2005. In 2008, wage and salary income for the state of California totaled two-thirds of all personal income, or $0.67 for one dollar of income. Personal income from transfer receipts in Mariposa County totaled $.24 on the dollar, which

was almost double the statewide average of $.13. The proportion of the income dollar in Mariposa and California derived from dividends, interest, and rent in 2008 was the same. With the recent dramatic decline of the stock market and the economy, the percentage of income from dividends and interest is likely to decline in 2009 and 2010.

Travel and Tourism

Accommodations, food and beverage services, recreation, and retail industries are by far and away the single largest employment sector and generate the most business income in Mariposa County. Travel and tourism spending generates approximately 4,000 full and part-time jobs in Mariposa County, or between 40% and 50% of the total employment in the county. Figure 30, displays data are from a travel impact study conducted by Dean Runyan Associates for the California Travel & Tourism Commission, showing the number of jobs created in the largest service industries.

Figure 29. Number of jobs generated by travel spending in Mariposa County, 1992-2008

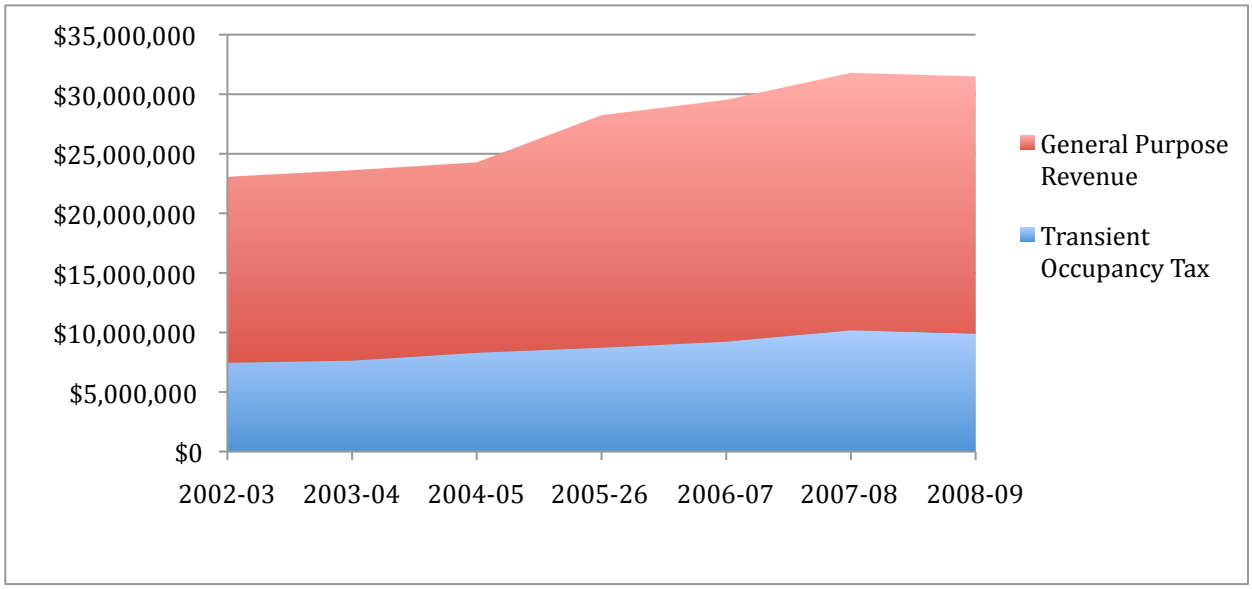


Source: Dean Runyan Associates[9]

The travel and tourism sector also provides a critical portion of the tax revenue that is used to run the county. A measure of this is transient occupancy tax (TOT) receipts—the taxes paid by visitors who stay overnight in the county that sometimes referred to a bed tax. It is derived from local hotels, motels, and bed and breakfast establishments. As shown in Figure 30, TOT accounts for between 45% and 52% of the County General Fund, the county's discretionary budget.

[9] Dean Runyan Associates, 2010 California Travel Impacts by County, 1992-2008, with 2009 Preliminary State & Regional Estimates. California Travel & Tourism Commission.

Figure 30. Transient occupancy tax as a portion of annual county general fund revenues

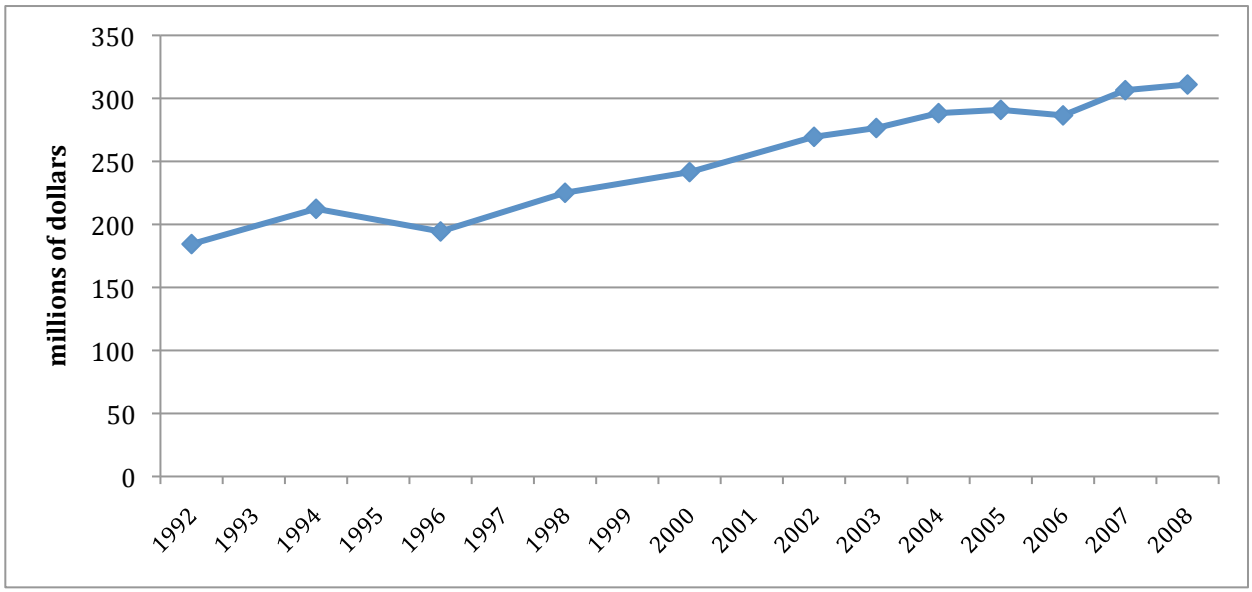


Source: Mariposa County

Figures 31 through 33 show estimates of numbers of travel spending and jobs generated by tourism in Mariposa County through 2008. The data are derived from a model that uses data from several sources, including sales and industry receipts; local and state tax receipts; visitor surveys; and employment and earnings reports from the U.S. Census Bureau, the Bureau of Labor Statistics, and the Bureau of Economic Affairs.

Total direct spending by visitors to the county is over $300 million in 2007 and 2008 and is shown in Figure 31.

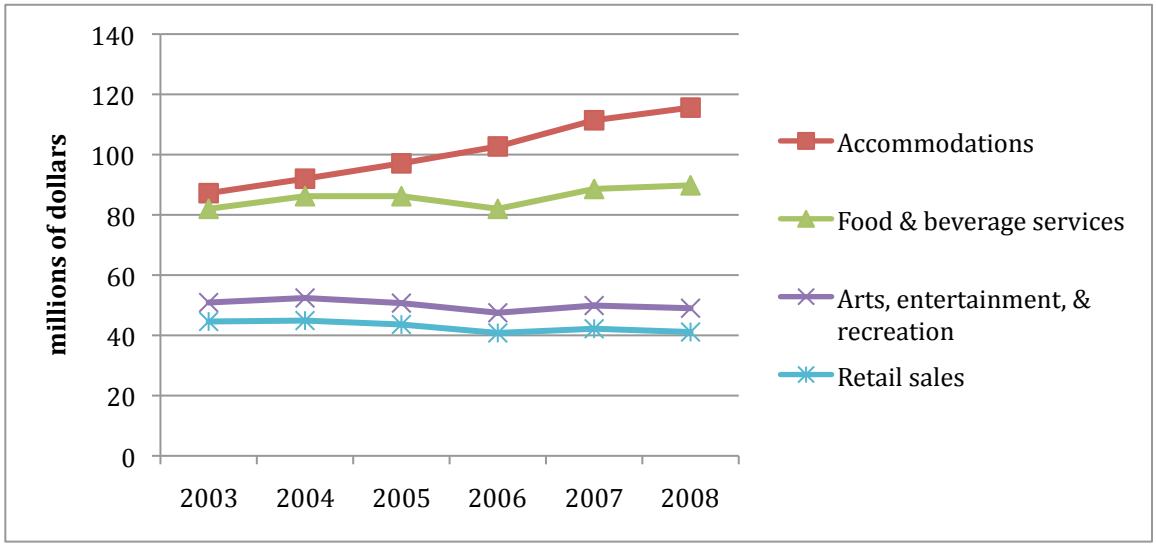
Figure 31. Total direct travel spending, 1992-2008



Source: Dean Runyan Associates

Figure 32 shows the majority of the spending is in accommodations, food and beverage services, recreation, and retail sales. Many of the purchases shown in Figure 33 are transacted in Yosemite National Park and with a primary Concessionaire that has a corporate office outside of Mariposa County. While this concessionaire provides considerable local employment, company profits go out of county.

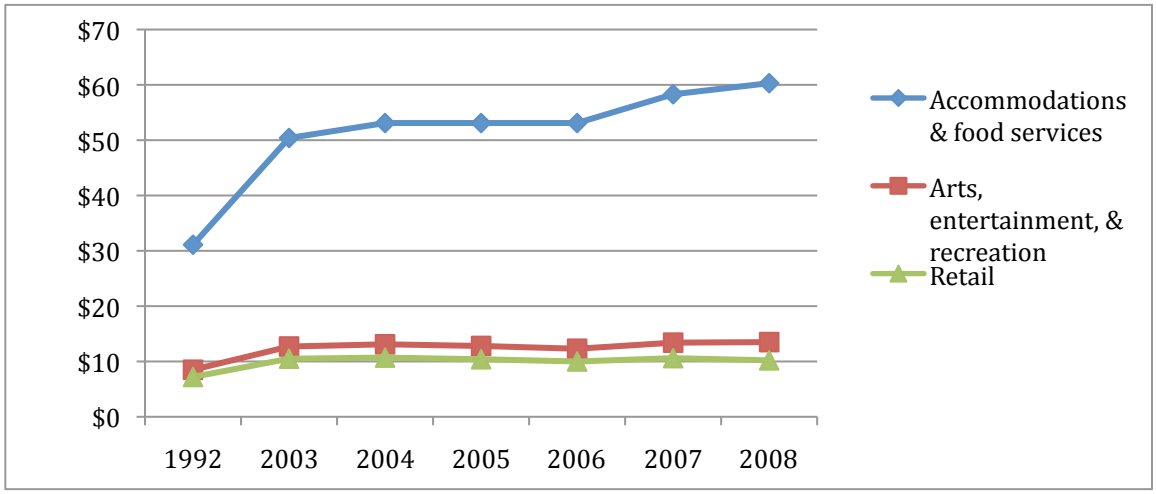
Figure 32. Visitor spending by commodity purchased, 2003-2008



Source: Dean Runyan Associates

Actual earnings by industry, or travel spending minus business expenses, amounts to approximately 24-29% of total spending, or close to $5,000 per capita in the county. In 2008, total industry earnings for accommodations and food services are approximately $60.3 million, and recreation and retail generated approximately $13.5 million and $10 million, respectively. This is shown in Figure 33.

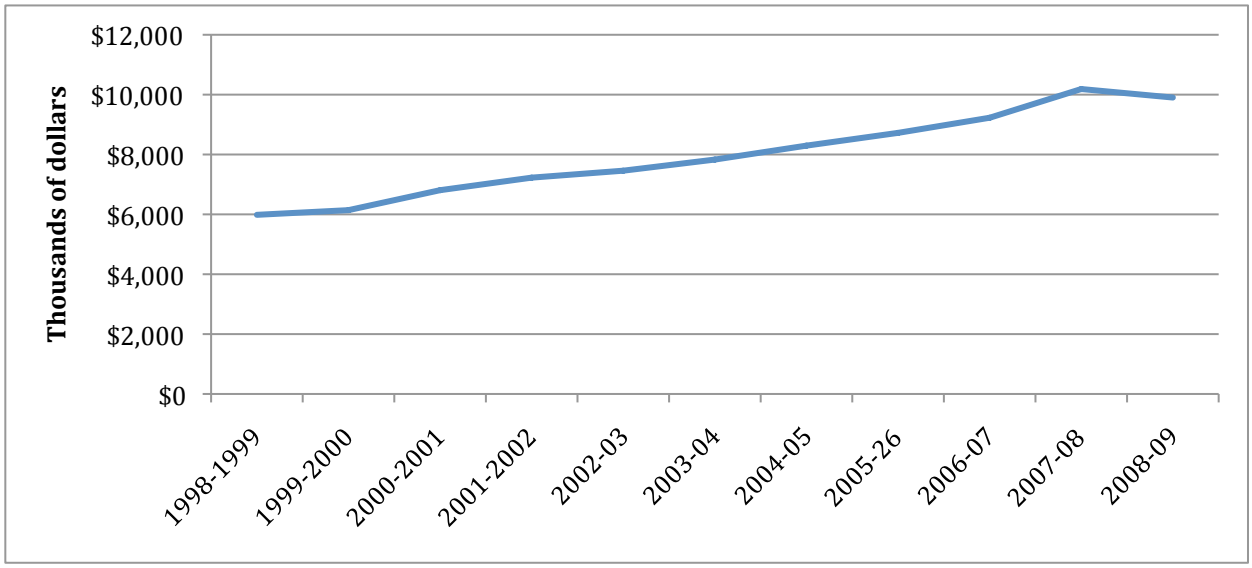
Figure 33. Industry earnings from travel spending



Source: Dean Runyan Associates

Figure 34 shows that after a steady increase of (on average) 6% per year for 10 years, the transient occupancy tax dropped for the first time in the 2008-2009 fiscal year, reflecting the impact of the recession. Income and employment across all travel-related industries are likely to have similarly declined since 2008. In their statewide study, Dean Runyan Associates found an estimated 10% decrease in travel spending and a 5% decrease in number of jobs generated by travel spending from 2008 to 2009.

Figure 34. Mariposa County transit occupancy tax receipts, 1999-2009



Sources: California State Controller's Office and Mariposa County

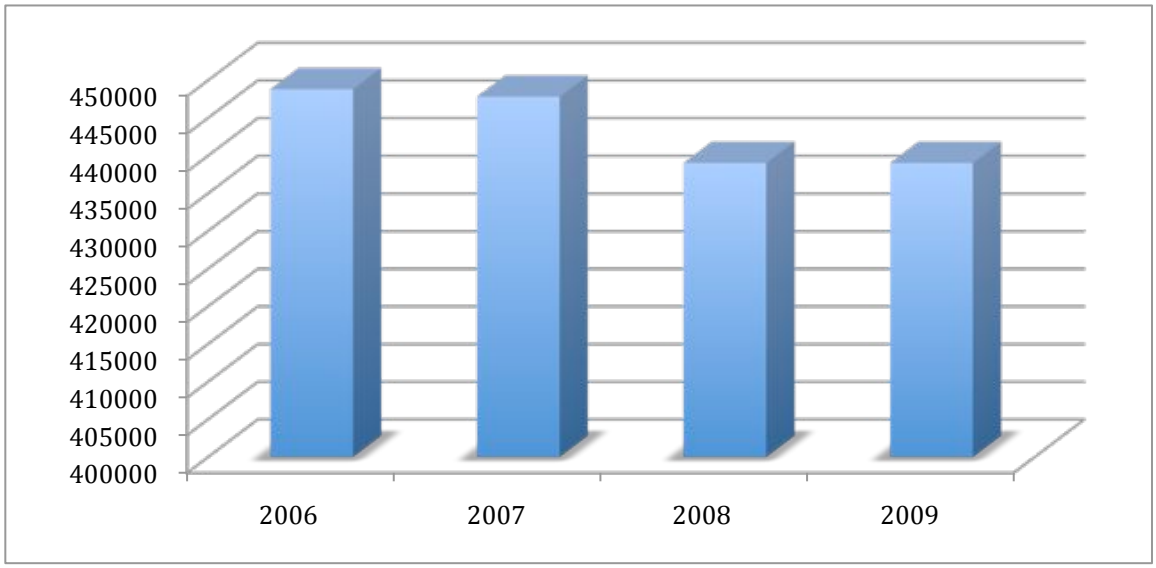
Local stakeholders encouraged similar research into specific recreation and tourism industries, such as rafting and fishing, to determine how much these are contributing to overall tourism spending and economic vitality in the watersheds.[10] These data would be useful for future planning, but gathering them would require original research.

Agriculture

Agriculture is visible throughout much of the county and remains culturally important and indirectly important to the tourism industry. Though it pales in direct economic importance and employment to other industries, there are over 440,000 acres of land in agriculture in the county. The vast majority of this land is rangeland. This land blends a pastoral element to the forests and high country of the Sierra that make for a powerful tourist draw to the county. Shown in Figure 35, rangeland has declined somewhat over the last four years. Irrigated pasture and miscellaneous field crops, utilizing roughly 600 and 800 acres respectively, are the next highest crop acreage totals. Wine grapes and miscellaneous fruit and nut crops each occupy only 100 acres in the county.

[10] Martin, M. 2008. Upper Merced River Anadromous Salmonid Restoration: Report on Species Status, Threats, Assessment, Recovery Actions, Nexus to FERC, Relicensing, Restoration Concept, Economics of a Restoration Project, Upper Merced River California. Unpublished report available from the author: Michael Martin, Ph.D., PO Box 2216, Mariposa, CA 95338

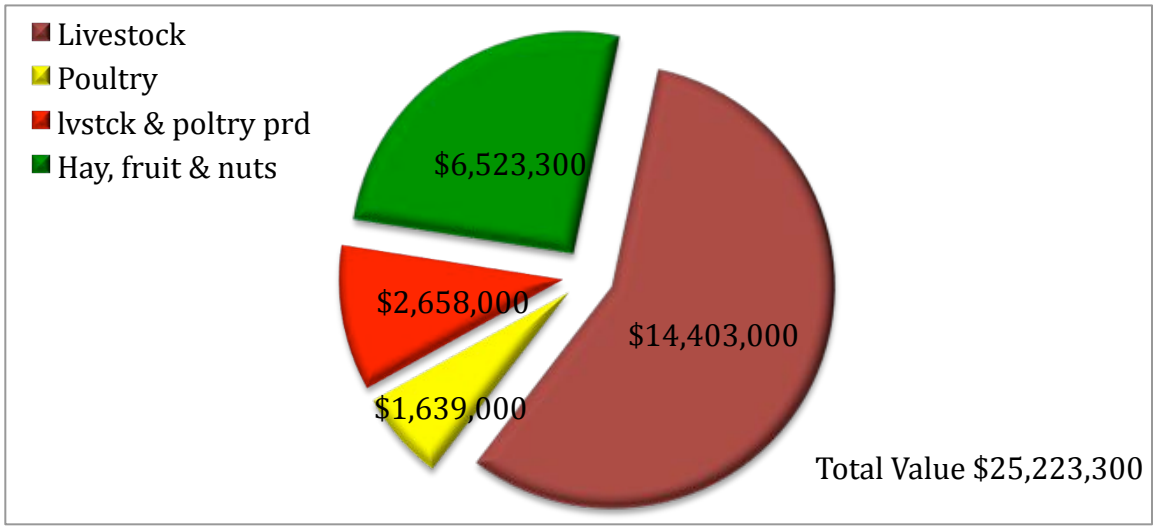
Figure 35. Acres of Rangeland in Mariposa County, 2006-2009



Source: Agricultural Crop and Livestock Report for Mariposa County from 2007, 2008, and 2009

Livestock, consisting of cattle and calves, sheep and lambs, and some miscellaneous livestock, totaled $14.4 million in 2009, exceeding the value of other agricultural products in the county by a considerable margin. See Figure 36. Hay, fruits, and nuts comprise the second largest group of agricultural products, totaling $6.5 million. The value of rangeland products, primarily forage for cattle, makes up 90% of this total. At $2.7 million, livestock and poultry products—mostly turkey eggs—is the next largest group of agricultural products. With a value of $1.6 million, poultry production is the fourth largest group of products.

Figure 36: Market Value of Agricultural Products, 2009



Source: 2009 Agricultural Crop and Livestock Report for Mariposa County

The federal calculation of Mariposa County's agricultural production in 2009 totals roughly half of the 25.2 million dollars Mariposa County reported. The county agricultural commissioner reported that the two million dollar turkey egg farm is not included in the federal total. Other reasons for the discrepancy are not clear, although sampling methodology and the Mariposa County report based on gross production values may contribute to the difference.

The number of farms in Mariposa has fluctuated between 250 and 300 since 1997. Based on these data, there is no clear pattern of change associated with farm size.

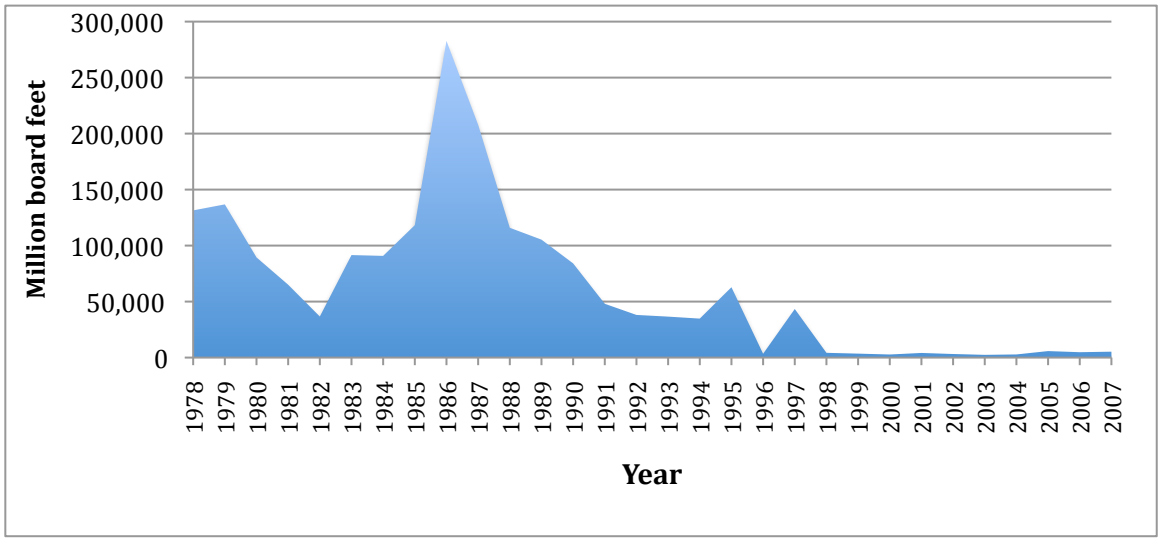
Table 8. Farms in Mariposa by Size by Year for 1997, 2002, & 2007

Acres / Year	1997	2002	2007
1-9	46	22	43
10-49	52	86	93
50-179	46	73	55
180-499	38	44	46
500-999	14	23	22
>1000	56	36	43
Total farms	252	284	302

Source: USDA National Agricultural Statistics Service, Census of Agriculture: 1997, 2002, 2007

Timber production was once significant in the northern part of the county, but has drastically dropped since the 1980s as shown in Figure 37. The mid-1980s were a period of some of the highest harvests ever in the state—many would say beyond sustained-yield levels. Since then, forest management for other priorities and environmental restrictions trumped harvesting, leading to the dramatically reduced levels. While the debate over harvesting is inevitable, these data make clear that annual sustainable timber harvest has not taken place.

Figure 37. Timber production, 1978-2007

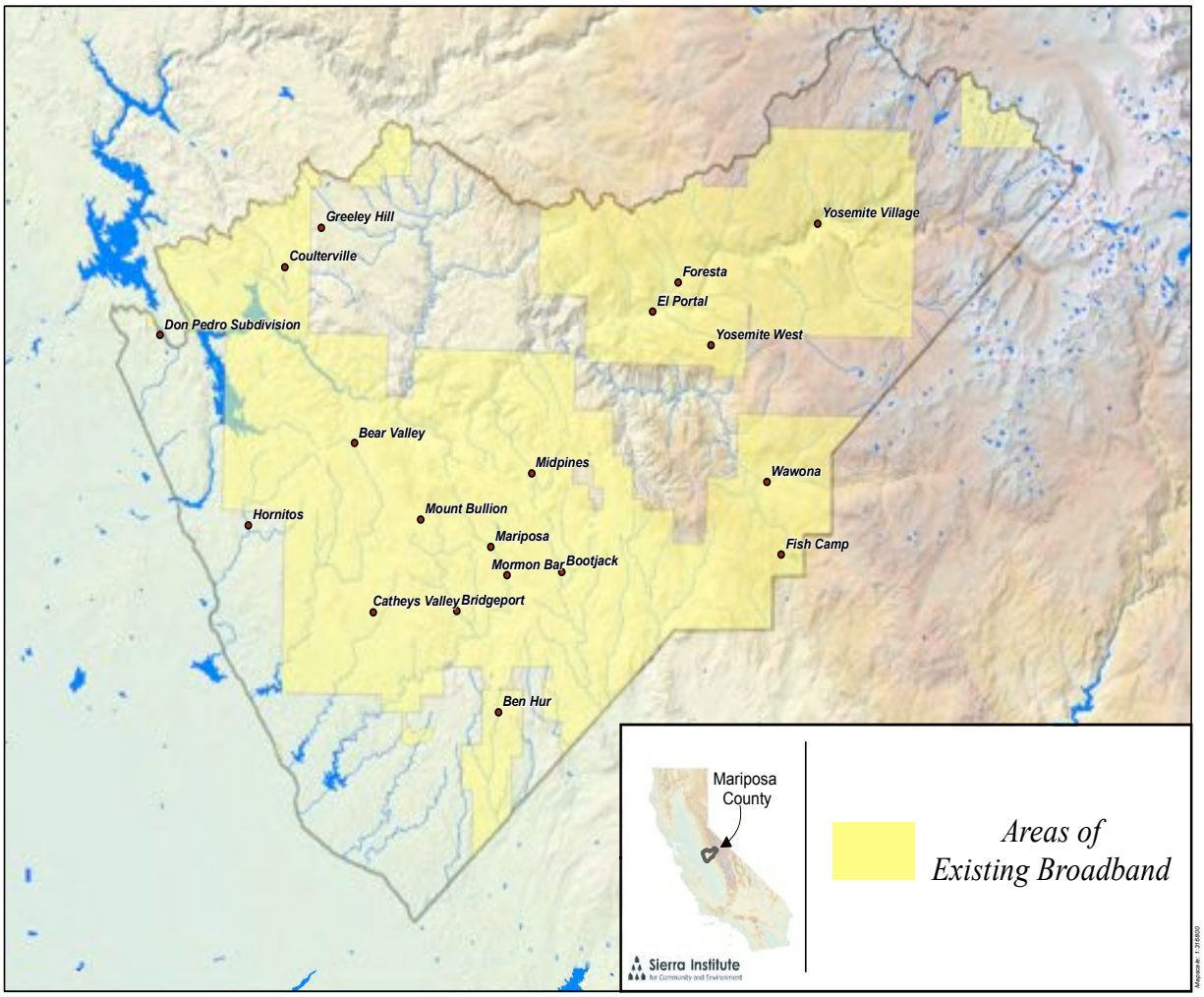


Source: California State Board of Equalization, Research and Statistics Section

Access to Technology

Currently, 59% of the County (869 square miles) has broadband coverage. Another 24% (357 square miles) is approved for coverage and 16% (239 square miles) is not yet approved. Figure 38 shows most populated parts of the County have coverage. Broadband coverage is often cited as critical for encouraging businesses to locate to the county and a cornerstone of current and future competitiveness.

Figure 38. Existing broadband coverage



Map Created by Sierra Institute GIS; June 2010

Capacity to Address Watershed Goals

When discussing challenges to achieving watershed goals and strategies for achieving those goals, stakeholders who participated in interviews and public meetings for this project emphasized the importance of capacity-related issues like public understanding of watershed issues and the extent that government laws and policies are funded, implemented, and enforced. Community and government capacity include not only physical and financial resources but also the ability and willingness of people and agencies to address issues of

concern and work toward goals. Past research and experience have shown that community and government capacity are often the factors that determine the success or failure of watershed planning and management.

To assess capacity in the three watersheds in Mariposa County, we examined five indicators, shown in Table 9, that collectively comprise capacity as it relates to watersheds.

Table 9. Indicators of capacity

Indicators	Definition
Financial capital	Dollars available and allocated to watershed issues
Physical capital	The condition of the built environment and how well it contributes to or detracts from watershed health
Human capital	Watershed-related skills, education, experiences, and general abilities (including having both time and energy) of people who live and work in the watershed.
Organizational capital	The existence of watershed-related organizations, programs, plans, and projects and the extent to which they are being implemented.
Social capital	The ability and willingness of people, agencies, and organizations to work together on watershed goals and projects.

To assess these measures we convened a group of experienced and knowledgeable experts who were asked to individually and then collectively rank the status of each form of capital, in terms of how well it meets existing needs, and the overall capacity to address issues of concern in each watershed. Capitals and capacity were ranked using a 1-7 scale, with 1-very low; 2-low; 3-medium low; 4-medium; 5-medium high; 6-high; and 7-very high.

As Table 10 shows, the assembled expert panel agreed that the Upper Merced River Watershed had the highest capacity of the three watersheds, and the Mariposa Stream Groups had the lowest capacity. The primary reason for the Upper Merced River Watershed's higher capacity is the presence of high levels of organizational, financial, physical, and human capitals stemming largely from government and private interest in and expertise from Yosemite National Park. The expert panel noted that in general residents and people who work in the Upper Chowchilla River Watershed have necessary skills that would allow planning and management to move forward fairly readily given adequate funding and attention to physical capital needs. These characteristics resulted in a "medium" rating for human and organizational capital. But lower overall capacity of the Upper Chowchilla, compared to the Upper Merced, resulted from a lack of financial capital and limited physical infrastructure to address watershed needs.

Table 10. Expert panel assessment of watershed capitals and capacity

	Upper Chowchilla	Mariposa Stream Groups	Upper Merced
Physical capital	Low	Low	Medium high
Organizational capital	Medium low	Low	Medium high
Financial capital	Low	Low	Medium high
Human capital	Medium low	Medium	Medium high
Social capital	Medium low	Low	Medium low
OVERALL CAPACITY	*Medium low*	*Low*	*Medium*

Source: Expert Panel group held June 2, 2010.

The Mariposa Stream Groups Watershed is considered to have the lowest capacity of the three watersheds. The strength of this watershed is the skill set and knowledge of residents, but overall capacity suffers from a limited physical infrastructure, along with limited funds for work and organizations, and a small, dispersed, and less engaged population. Expert panelists agreed that all three watersheds have knowledgeable people who are spread very thin while working with multiple community groups, and more education of the general public regarding watershed issues is needed.

Upper Merced River Watershed

Organizational and human capital

Much of the Upper Merced River Watershed is publicly owned land managed by Yosemite National Park, the Sierra National Forest, the Stanislaus National Forest, and the Bureau of Land Management. Much of the watershed lies in Yosemite National Park, where considerable capacity already exists. The expertise of the Park Service employees, along with the expertise in other agencies and the many laypeople who can knowledgeably speak to watershed issues, are the primary reasons the expert panel rated both organizational and human capital "medium high." The federal agencies have staff specializing in hydrology, vegetation management, recreation, and other resource management disciplines that directly relate to planning and management in the watershed.

Despite the relatively high agency organizational capital, however, agencies do not always work together effectively. Many felt that Yosemite was administratively and statutorily focused on the watershed within Park boundaries, resulting in reduced attention to important downstream issues. Even after several starts, Yosemite National Park still lacks a river plan. In addition to the agencies, there are many private and nonprofit organizations and interest groups that work directly in the watershed, addressing watershed issues such as water quality, open space, and wilderness protection, and recreational opportunities. However, the local Forest Service and Bureau of Land Management offices, and county departments were recognized by panelists as understaffed and underfunded.

There are a number of existing and incipient programs and plans that address watershed conditions. The 2006 Mariposa County General Plan and the 2007 Economic Vitality Strategy and Implementation Plan for Mariposa County addresses most of the watershed conditions and stressors discussed in this report, and the public land management agencies and private

organizations have plans and programs to address biophysical conditions and recreational goals on public land. The National Park Service is continuing in its efforts to develop a Merced River Plan to address recreational carrying capacity and use in the sections of the watershed in Yosemite National Park. Mariposa County is in the early stages of developing a Central Sierra Integrated Regional Water Management Plan that would include the Upper Merced River Watershed and, it is hoped, coordinated efforts across the watershed.

Financial capital

Financial capital in the watershed is anomalous: Yosemite National Park has considerable resources to address areas within the park, but funding to address downstream and watershed issues of concern outside the park is limited. One example is the Forest Service lacking the resources to reduce the extremely high risk of catastrophic wildfire in the South Fork of the Merced area. Because the majority of the watershed is within the jurisdiction of the Park Service, the panel rated financial capital "medium high," but they recognized that county and federal agencies outside of the park are understaffed, and nongovernmental organizations' funding is project-specific.

Physical capital

Physical capital is rated "medium high" in the watershed, primarily because of the water and wastewater infrastructure in Yosemite National Park and associated communities. In addition, the downstream Merced Irrigation District facilities can address water quality issues, and provide well-developed and maintained recreational facilities. Overall, recreational facilities are considered excellent and water and sewage treatment adequate, but experts recognized that a major highway and campgrounds next to the river pose threats.

Social capital

Social capital was ranked "medium low" because the myriad agencies and organizations in the watershed typically work independently and do not coordinate their efforts. It was also ranked lower than the other capitals because there are ongoing and deep-seated conflicts over water management primarily between conservation groups and development interests, along with miscommunication and misunderstanding between other parties, including the agencies themselves and the agencies and the public. Expert panelists stated that government plans were frequently not implemented. The Integrated Regional Water Management Plan has been prone to controversy and this has delayed funding to finalize the plan. As in the Upper Chowchilla River and Mariposa Stream Groups Watersheds, downstream users hold rights to water and do not work with upstream landowners, agencies, or the county.

Nongovernmental organizations such as the Mariposa County Resource Conservation District and the Upper Merced River Watershed Council may be in a position to combine the results of federal and local government planning and research into coordinated watershed management in the near future, particularly if an Integrated Regional Water Management Plan is completed and implemented. Due to changing Forest Service policy, future projects on the Sierra National Forest and the Stanislaus may be landscape-scale, watershed-based, and conducted with increasing coordination with adjacent landowners.

Summary Capacity Rating

The reduced social capital score resulting from the current lack of coordination and high levels of conflict in this watershed led the expert panel to rate capacity in the watershed as "medium," even though other capitals were all rated "medium high."

Upper Chowchilla River Watershed

Organizational and human capital

Expert panelists agreed that the basic structure existed to address watershed issues. For instance, there are several organizations directly or indirectly addressing management issues in the watershed. These include the Sierra National Forest, Central Sierra Watershed Committee, Mariposa and Madera County departments, Mariposa County Resource Conservation District, and the Chowchilla Red Top Resource Conservation District, which hosts a Chowchilla Watershed Coordinator. A small portion of the Eastman Lake National Recreation Area, managed by the Corps of Engineers, lies within the Mariposa County portion of this watershed. Madera County maintains an interest in water management in the Upper Chowchilla as it affects downstream users.

The Madera County Integrated Regional Water Management Plan for the Upper Chowchilla and Upper Fresno River watersheds includes existing and recommended projects addressing water supply, flood control, and watershed management in the Madera County portion of the Chowchilla River Watershed. The many watershed implementation measures in the Mariposa County General Plan and Economic Vitality Strategy and Implementation Plan apply to the Mariposa County section of this watershed as well as the rest of Mariposa County.

Despite the presence of these groups, the panel rated organizational capital as "medium low" primarily because organizations needed to work together more and because the Forest Service, which a manages a portion of the watershed, lacks a watershed management plan and has a land management plan that is out of date.

Human capital was rated "medium low" for several key reasons. The Upper Chowchilla River watershed in Mariposa County is a sparsely populated area with no central core. This challenges the ability of people to come together. Despite being generally interested in environmental issues and involved in reducing the risk of fire and the threats to homes, panelists observed that residents of the watershed are less engaged in watershed planning and management activities. Panelists suggested better marketing to expand concerns about fire and forest to other watershed issues.

Financial capital

Financial capital was rated "low" because there is limited money relative to the overall need associated with fire risk and poor road conditions. The Sierra National Forest has little funding to address serious road and fuels problems. Most funding for the Chowchilla River system goes to work in the lower watershed, in Madera County.

Physical capital

Physical capital is "low" because infrastructure in the watershed is limited or in very poor condition. Poor road conditions were noted to be contributing to stream turbidity. Most residents rely on private wells and septic systems, although Ponderosa Basin has a private water treatment system that serves that community. The one developed recreational facility is private and available only to people in the Lushmeadows community.

Social capital

Social capital in this watershed was rated "medium low" by the expert panel because they felt that most private landowners do not understand or take ownership in the watershed. They noted there is a tendency among residents to expect the government to take care of watershed issues. Panelists felt that the organizations and residents of the watershed are poised to work on watershed issues, given a rallying point and funding. The debate between Mariposa and Madera Counties over who should be responsible for the Integrated Regional Water Management Plan may represent an opportunity to bring residents together in the watershed, or it could further fragmentation of the area.

Summary Capacity Rating

Largely due to social capital and organizational limitations, the lack of a central watershed focus, and resident commitment to a watershed, the panel rated the capacity of the watershed "medium low."

Mariposa Stream Groups Watershed

Organizational and human capital

The primary governmental entity working on watershed issues in this watershed is Mariposa County, particularly the County Planning Department and the Environmental Health Department. The Mariposa Public Utility District is also an important player in the watershed, and is regulated by state agencies that influence water management in the public utility district's service area. Other agencies involved include Mariposa County Resource Conservation District and the Natural Resource Conservation Service. The Army Corps of Engineers manages four dams in the watershed on the Burns, Bear, Owens, and Mariposa Creeks. One nongovernmental organization, Mariposans for the Environment and Responsible Government, is actively addressing land use, water quality, and water supply issues in this watershed.

The major plans covering this watershed are the Mariposa County General Plan and Economic Vitality Strategy and Implementation Plan. In addition, a Mariposa Town Planning Area Specific Plan, completed in 1992, addresses some physical capital issues. A draft Catheys Valley Community Plan addresses land use, development pressures, and agricultural uses in that community, as well as infrastructure and water quality concerns.

In general, expert panelists rated human capital "medium" because residents have a good understanding of water supply limitations, but rated organizational capital as "low" because there are considerable suspicions about government restrictions, and a general distrust of

organizational efforts. Because it runs through the town of Mariposa, with many more people than the sparsely populated lower stretch, the upper stretch appears to have more activity and information, but communication is still lacking.

Financial capital

Expert panelists rated financial capital as "low." They indicated that Mariposa County lacks the funding to address watershed issues discussed in this report. Federal, state, and nongovernmental funding entities tend to fund projects in the town of Mariposa, yet the Mariposa Public Utility District lacks the needed funding to bring it in line with new regulations. There is less money available for stream needs in the lower, agricultural portion of the watershed.

Physical capital

Panelists rated physical capital as "low" because the Mariposa Stream Groups is largely an agricultural and sparsely developed watershed. Aside from the Mariposa Public Utility District, residential water supply and water treatment is private and consists of private wells and septic systems. The Army Corps of Engineers has flood control dams and reservoirs on each of the four major creeks. There is the potential for considerable residential growth in this watershed, particularly in the areas near Merced County and the University of California campus, and there are concerns about infrastructure and water supply available for this development.

Social capital

With a history of mistrust and water and land use conflicts in the watershed, the panel rated social capital as "low." The agricultural community, while interested in better information on water supply and water quality, is suspicious of government and of how research data might be used. There is a long-standing fear of increased controls over water use. Panelists felt any meaningful change and improvements will be tied directly to organizing people and being able to engage in meaningful discussions with the Merced Irrigation District, because they own water rights to the streams group. The panelists agreed that this watershed is lacking the organization or structure that could meaningfully bring residents, water users, and water management agencies together around watershed planning and management.

Summary Capacity Rating

Relying on the low financial and physical, organizational, and social capital, the panel rated the capacity of the Mariposa Stream Groups Watershed as "low." This is the lowest capacity rating of the three watersheds. The outside control of the water rights, the fear of governmental intrusion, limited resources, and lack of organization all contributed to the low capacity score.

III. Conclusion

The purpose of this project is to identify key watershed *conditions* and select and test socioeconomic *indicators* and *measures* that could be used to monitor and evaluate selected conditions in a watershed. In some instances, when the "ideal" measure was not available, a measure was selected because data were readily available and it sufficiently informed an indicator or key condition of interest. Indicators and measures were generally selected and measured to assess their usefulness, along with the time and cost required to collect quality data. In other instances, time and money constraints and lack of relevant secondary data restricted indicator and measure options. Some desired measures, such as recreational supply and demand, were not included because good data were not available.

What follows first, in Table 11, is a list of the conditions and indicators that were used to guide this pilot project and assessment in Mariposa County watersheds. Measures from the pilot project along with some additional ones that may be important for other watersheds are included. Secondly, key lessons learned from this pilot project are presented to help advance this work in Mariposa County watersheds in the future, as well as in watersheds elsewhere.

Table 11. Conditions, indicators, and examples of measures

Conditions	Indicators	Example measures
Watershed character	Land use	Total acres/percent of watershed dedicated to various uses, such as agricultural production, residential development, open space, etc.; total acres or percent of watershed covered by conservation easements or other protections, and/or zoned for special uses; location and density of residential development; number, size, and location of subdivision, industrial, and commercial developments
	Demographics	Age distribution; racial/language distribution; in- and out-migration; length of tenure in the watershed; percentage of population who live in developments versus dispersed/large-acre lots
	Unique characteristics	Number of historic/cultural sites; number and type of interpretive programs, docents per capita, etc.
Public health	Amount of water available for human use	Number of water shortage incidents per year; number of days or annual percentage of the year with restricted water use
	Water quality	Number of fishing and/or swimming advisories per year; percent of population without access to drinking water that meets health-based standards; number, type, and impact of surface water impairments
	Air quality	Ozone and particulate matter levels at specific locations; numbers of days state standards for ozone and particulate matter are exceeded
	Disease rates and access to medical services	Rates of diseases specifically linked to suspected pollutants (e.g., asthma, methaemoglobinaemia, or cryptosporidiosis); percent of population with health benefits; availability and use of telehealth technology; number of doctors per capita

Income and impoverishment	Income	Median household and per capita income; mean salary and wage rates
	Impoverishment	Unemployment rate; percent of families receiving public assistance; percent of families below poverty level
	Leisure opportunities	Commute to work times; hours worked; hours per week spent with family or recreating
Economic vitality	Personal income sources	Proportion of personal income from salaries and wages, dividends, and transfer receipts
	Business diversity	Number and size of businesses, by industry; employment, by industry
	Employment and production rates in key industries	Product volumes and sales; annual earnings, by industry, market values for key products
	Access to technology	Percent of area with high-speed internet access; percent of population with internet access
Capacity	Institutional capital	Number and type of related organizations, programs, and plans; existence of performance measures in plans and extent to which they have been met; number and size of initiatives linked to a watershed plan
	Financial capital	Dollars allocated to watershed planning and management; percent of local government expenditures that go to watershed management
	Physical capital	Existence of and plans for roads, commercial or industrial sites, residential development, high-intensity recreational areas, etc.
	Human capital	Number and type of educational opportunities; number of staff allocated to watershed planning and management; experience of local agencies, organizations, and businesses to conduct watershed restoration and remediation work; number, size, and activities of conservation and watershed focused groups in the watershed
	Social capital	Citizen willingness to work on community issues, and with other community members and groups; average number of volunteer hours per week; organizational involvement in and work on community and watershed issues; citizen trust of government services (e.g., percent who say they trust watershed planning and management agencies/organizations); extent that different perspectives are represented in watershed planning and management

Lessons and Recommendations

1. *Do not rely on pre-determined lists of indicators and measures*. It is important that watershed planners and government agencies develop indicators and measures that are appropriate and responsive to local watershed conditions. Using "canned" or pre-determined sets of indicators and measures may result in ignoring important conditions. Even where there is agreement about conditions, there may be disagreement about whether indicators accurately describe conditions and whether measures are appropriate.

Sets of indicators and measures used in this project represent a good starting point for consideration, not a list that should be blindly adhered to without review.

2. *Involve people who live and work in the watershed in the selection of conditions, indicators, and measures*. Local knowledge is critical to identify conditions and indicators of concern in a watershed. It can also be valuable for identifying measures to evaluate indicator condition and trends. Local stakeholders can provide invaluable help with identifying local data sources and with interpretation of results. Productive involvement in stakeholders also dramatically increases the likelihood that indicator and measurement data are used and that data-driven decisions become the norm.

3. *Carefully select conditions, indicators, and measures.* Indicators should be chosen judiciously, after carefully assessing their relevance in the watershed, usefulness for watershed planning and management, availability of good data, and time and dollars required to gather data. Time and dollars are often most critical, because too often secondary data needed for good measures and sound measurement are unavailable.

4. *Be sensitive to scale when selecting indicators and measures.* Measurement data will need to be reported at the community watershed scale to be useful for watershed planning and management. However, data at this scale are rarely available. Appropriately scaled data often require de-aggregating and re-aggregating secondary data, or collecting primary data, which can be time consuming and expensive.

   In this pilot effort, it took well over 350 hours to find and compile data on the selected indicators, and more time to analyze and organize them in a report so they could be digested and useful to others.

5. *Not all data are created equal.* Some secondary data are unreliable, especially when based on samples that are small or on questionnaires that could be biased. Similarly, two data sets that sound the same may in fact be different based on data are collected, organized, and reported. It is important to understand and critically review methodologies used to collect measurement data, especially when reported numbers are estimates based on historical trends, trends in an area larger than a focus watershed, or sample surveys. Any recent estimate-derived data that are based on extrapolation of trends over the last ten or twenty years should be questioned and examined further. The recession that started in 2008 has had profound effects in Mariposa and other rural areas, and these impacts will not be captured using pre-2008 data and standard estimation methodologies. There were a number of data sets evaluated for this project containing recent estimates of employment, income, etc., that contained questionable assumptions and measurements, and were not used.

   It is helpful to compare different data sets when possible. Assessing the quality of secondary data can be time consuming, but is necessary to ensure that data are reliable and accurately reflect indicators and measures of interest. This same effort is needed to answer the question of whether to rely on locally collected data versus that which is collected by state or

federal agencies. Beyond data quality, the purpose for which data will be used, data clarity, along with future availability will drive data selection.

6. *Community and governmental capacity to address watershed goals is important to assess in order to understand the potential for successful watershed planning and management*. In this project capacity was assessed using indicators of institutional, financial, physical, human, and social capitals. Because there are no data collected that comprehensively inform these indicators, primary data collection is essential. Interviews can be used to frame issues and a local expert panel convened to assess these indicators to determine the overall capacity of a watershed.

   Expert panel assessment of capacity conducted for this project could be compared to future panel assessments to evaluate progress toward improving watershed capacity and achieving watershed goals.

7. *Some primary data collection may be needed to understand critical issues and conditions.* Similar to indicators of capacity, in some cases, primary (new) data collection may needed to assess locally important community and watershed issues and conditions. This may also be needed because secondary data are collected either at different scales or address different questions.

   Most employment data is reported only at the county scale and does not reflect conditions at community or watershed scale. it also does not reflect the number of jobs that are part-time or seasonal. Typically, state and federal agencies do not report the number of jobs and business earnings in sectors with small numbers of businesses. There are also differing economic production and employment statistics, suggesting that primary data collection would be required to obtain reliable data. For some watersheds, it may also desirable to know rates of production for specific resource-based commodities and number of jobs in specific sub-industries, such as watershed restoration.

8. *New research is sometimes needed.* When conducting a watershed assessment, answering important questions or assessing critical conditions may require development of new research. For example, the travel and tourism data used in this report was based on research and models developed by a consulting firm. Similar economic data specific to recreational activities, such as fishing, rafting, and birding, will require careful sampling design and perhaps model development to accurately assess. With most residents relying on wells, drinking water quality and quantity data are time consuming and expensive to gather, and require primary research.

9. *Effective data interpretation may require consideration of influences beyond the watershed.* It is important to think broadly and consider influences beyond the data, such as the influence of regional, national, and global markets or management constraints imposed by distant state and federal regulatory agencies. For this assessment, it was important to consider Mariposa watershed impacts by downstream dam management agencies and

downstream water users and rights holders outside of Mariposa County. Similarly, the recession had profound effects on recent local economic trends.

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Appendix I

A Stakeholder-Guided Approach to Identifying Socioeconomic Indicators and Measures

Monitoring and evaluation are most effective when grounded in real-world experience and informed by the best available science. Engaging local stakeholders helps assure indicators and measures are informed by local knowledge, address local conditions, and, equally important, that they are used to inform local watershed planning and management.

From the start, this project was a collaborative effort among researchers specializing in applied social science and local watershed and planning groups. Three local partners, the Upper Merced River Watershed Council, Mariposans for the Environment and Responsible Government, and Chowchilla Red Top Resource Conservation District, led community outreach activities, which included identifying key stakeholders and informing communities and diverse stakeholders throughout the county about the project. This latter work involved publicizing meetings and making arrangements for local workshops, and helping with distribution of project material to inform others and obtain feedback.

The process of developing indicators and measures for this project drew on the best available science in social and economic monitoring and evaluation. Sierra Institute staff reviewed indicator and evaluation literature and interviewed people with expertise in watershed monitoring evaluation. At the same time, it substantively engaged local stakeholders through stakeholder interviews and community meetings in the development of useful and appropriate social and economic indicators and measures of conditions, stressors, and management actions. Data from the literature review, interviews, and community meetings were combined to develop the initial list of socioeconomic indicators and measures.

Identifying priority stakeholders

The three local partner groups each drew up lists of priority contacts representing a range of interests including: local government; state and federal resource management; business and economic development; environmental and conservation; agriculture; recreation; realty and land development; community service; and utilities and water management. The combined list included over 80 individuals, which was then prioritized to identify those from each category with in-depth knowledge of watershed conditions and issues. All of the people on the list were invited to community meetings, and eight key informants were selected for in-depth interviews. Using a "snowball sampling" process, informants were asked to identify additional individuals who should be contacted and included in the project. The initial community meetings were also advertised locally to invite any others interested in participating.

Key informant interviews

Eight individuals representing local government, local watershed and conservation groups, water utilities, the ranching and farming community, and land management agencies were interviewed to obtain detailed information about locally important socioeconomic conditions and issues, along with their perspectives on watershed planning and management in the three

watersheds. A semi-structured interview script shown in Table 12 was used to guide interviews. Responses were coded, or organized by topic, for analysis. Semi-structured means that interviews did not necessarily follow the order of the questions in Table 11 or rely exclusively on them. Interviews were tailored to the answers and expertise of the individual being interviewed and regularly involved additional questions and sometimes widely varying discussions.

Table 12. Interview script

1. Thinking broadly about Mariposa County, what would you say are the environmental, economic, and social qualities of this area that people who live and work there value most?
    a. Are there other qualities or conditions that *you yourself* particularly value?
2. What are the most significant threats to these values?
3. What specific qualities or conditions are the *most* threatened?
    a. Are there other things that are not currently threatened but need the most protection to be maintained?
4. What has or is currently being done to maintain and improve these conditions?
    a. Have there been any local planning efforts or other processes that have involved local people?
5. Increasingly, people are recognizing a connection between environmental health and individual and community health. Can you think of examples of this in your area?
6. Are you familiar with the watersheds within Mariposa County?
    a. Which of the three watersheds are you most familiar with? [Upper Merced, Upper Chowchilla, Mariposa stream groups]
7. What in your mind are the priority goals local communities have for their watersheds?
    a. What are the social and economic goals?
    b. What do *you* think are the priority watershed goals?
8. What specific actions or changes would you like to see in place to achieve these goals?
9. What gets in the way of achieving your goals for your watershed(s)?
10. How will you and others know you are making progress toward your goals [Identify benchmarks or milestones if available.]
11. Do you think the priority watershed goals will be different in five years? If so, how?
12. Who else should we be talking to about this project?

Community workshops

Three different sets of community workshops were held during the project. The first set, launched at the outset of the project, was designed to share objectives of the project, and collect general information from participants about conditions and stressors in communities and watersheds to help identify conditions, indicators, and measures of importance. The second set of workshops, held in March of 2010, involved the presentation, discussion, and ranking of proposed indicators and measures based on their appropriateness and comprehensiveness for assessing local community and watershed conditions. The third set of workshops, held in late July of 2010, shared results of the project and solicited feedback,

including interpretation of findings, reflection on the comprehensiveness of work, as well as identification of key assessment and data gaps.

Thirty-five people attended first set of two community workshops focused on sharing the project objectives and discussing socioeconomic conditions in the watersheds. Participants included: representatives from environmental, conservation, agriculture, and recreation groups; resource management agencies; local community and economic development groups; academic and other research groups; law enforcement; local businesses; and the general public. Participants worked in small groups to identify and prioritize desired conditions in Mariposa County watersheds, stressors on those conditions, and strategies and actions that could be used to reduce stressors and maintain or improve conditions.

Nearly 20 people attended the second set of three community workshops, which was focused on valuing indicators and measures based on their clarity, relevance, and responsiveness to local conditions, data availability, reliability, and time and cost of collection. In addition to members from the local partner groups, participants included local government, representatives from state and federal agencies, environmental group representatives, staff from public utility districts, and other local stakeholders. Participants provided feedback on a set of proposed indicators and measures and identified data sources. They also identified some additional measures they felt would be most useful for future planning and management, some of which were included in the final list of indicators and measures included in the study.

More than 35 people attended the final two workshops in which the results of the project were shared. A wide variety of organizations and interest groups were represented, including: local, state, and federal government officials; environmental, recreation, and conservation groups; agricultural interests; economic developers; local business owners; retirees; and others. Participants provided comments that were helpful for interpreting findings. Participants agreed that the discussions advanced understanding of social and economic conditions in their watersheds.

Focus group meeting

Key stakeholders were invited to participate in a focus group meeting to assess community and government capacity to advance watershed planning and management and work toward common goals. Six local experts, who were identified with the help of local partner groups, participated in a meeting that focused on five different indicators of capacity for each watershed in Mariposa County. First, participants filled out worksheets on the status of the financial, physical, human, social, organizational, and social capital for each watershed. This worksheet is shown in Figure 39. Second, using the completed worksheets as a starting point, a facilitator from the Sierra Institute led the group through a discussion resulting in a consensus-based rating for each of the five capitals by watershed. This discussion was important as much for establishing the ratings as well for identifying factors that determined the ratings. Third, the group compared and discussed their rating for each capital and the overall capacity rating by watershed, and developed a consensus rating of capacity for each of the three watersheds. Participants identified the process as extremely illuminating.

Figure 39. Capitals and Capacity worksheet used by local experts

Socioeconomic Indicators for Watersheds
Mariposa County Watershed Capacity Assessment

Sierra Institute for Community Environment

Watershed_____

1. Financial capital includes dollars available and dollars allocated to watershed issues.

Please describe components of financial capital that exist in this watershed, and how well they meet existing needs. *(Use the reverse side if you need more space.)*

NUMERICAL RATING OF FINANCIAL CAPITAL IN THIS WATERSHED *(Please circle one number)*

1	2	3	4	5	6	7
very low	low	medium low	medium (neither low nor high)	medium high	high	very high

2. Physical capital includes the built environment or infrastructure (e.g., water treatment and sewer systems, recreational facilities, etc.).

Please describe the condition of existing physical capital in this watershed, and how well it contributes to or detracts from watershed health. *(Use the reverse side if you need more space.)*

NUMERICAL RATING OF PHYSICAL CAPITAL IN THIS WATERSHED *(Please circle one number)*

1	2	3	4	5	6	7
very low	low	medium low	medium (neither low nor high)	medium high	high	very high

3. Human capital includes watershed-related skills, education, experiences, and general abilities of people who live and work in the watershed.

Please describe components of human capital that exist in this watershed, and identify gaps in human capital. *(Use the reverse side if you need more space.)*

NUMERICAL RATING OF HUMAN CAPITAL IN THIS WATERSHED *(Please circle one number)*

1	2	3	4	5	6	7
very low	low	medium low	medium (neither low nor high)	medium high	high	very high

1

Figure 39. Capacity worksheet used by local experts (cont.)

4. Organizational capital includes the existence of watershed-related organizations, programs, and plans, and projects and the extent to which plans and projects are being implemented.

Please describe components of organizational capital that exist in this watershed, and identify gaps in organizational capacity. *(Use the reverse side if you need more space.)*

NUMERICAL RATING OF ORGANIZATIONAL CAPITAL IN THIS WATERSHED *(Please circle one number)*

1	2	3	4	5	6	7
very low	low	medium low	medium (neither low nor high)	medium high	high	very high

5. Social capital includes the ability and willingness of people to work together for watershed goals and projects.

Please describe components of social capital (both positive and negative) that exist in this watershed. *(Use the reverse side if you need more space.)*

NUMERICAL RATING OF SOCIAL CAPITAL IN THIS WATERSHED *(Please circle one number)*

1	2	3	4	5	6	7
very low	low	medium low	medium (neither low nor high)	medium high	high	very high

6. Please discuss the overall capacity to address issues of concern in this watershed, and identify the most critical aspects of capacity, both positive and negative**.** *(Use the reverse side if you need more space.)*

NUMERICAL RATING OF FINANCIAL CAPACITY IN THIS WATERSHED *(Please circle one number)*

1	2	3	4	5	6	7
very low	low	medium low	medium (neither low nor high)	medium high	high	very high

2

Written feedback

In addition to the community workshops, local stakeholders were invited to review and provide written feedback on draft lists of indicators. A number of individuals provided detailed comments and recommendations. The same process was used for review of the final report. Members of the three local partner groups took the lead in providing comment, and helped distribute report drafts to others from whom additional comments were received. In a few instances, questions were raised about data quality or the efficacy of selected measures, which required additional work. The value of involving a variety of stakeholders in the final review was similar to that obtained from the numerous community workshops: although it added time to the overall project, the value gained in the improved product vastly outweighed not doing so. Involving stakeholders in review of the two drafts of the report also resulted in a final product that took slightly longer to complete, but it was significantly improved as a result of numerous thoughtful and, at times, challenging comments. Most importantly, it resulted in a report that is more likely to be used and updated in the future.