2.1 BIOLOGICAL VALUES

2.1.1 Biological Outstandingly Remarkable Values

The Merced River and South Fork Merced River support a suite of riparian and meadow ecosystems within Yosemite National Park. Within the river corridor, these outstandingly remarkable values include alpine and subalpine meadows along the river stretches above Yosemite Valley and Wawona, as well as the meadow and riparian complex within Yosemite Valley. Dependent on these habitats are a variety of native, endemic, and/or rare plant and animal species. Sustained by periodic flooding and/or high water tables, and also influenced by periodic burning by American Indians (Anderson 1991), these habitats are river-related crossroads of life in a landscape vibrant with productive habitats.

River Segment 1 and 5: Merced River above Nevada Fall

The Merced River creates numerous, exquisite small meadows and relatively intact adjacent riparian habitats.[2]

Numerous small meadows and adjacent riparian habitats occur on these stretches of river. The meadows and rich riparian habitat within this intact riverine system support a great diversity of plant and animal species, owing their existence to the river and its annual flooding. These range from common species like mule deer (*Odocoileus hemionus*) to rare species such as the spotted bat (*Euderma maculatum*).[3]

River Segment 2: Yosemite Valley

The meadows and riparian communities of Yosemite Valley comprise one of the largest mid-elevation meadow complexes in the Sierra Nevada.

The large, moist, mid-elevation meadows and the riparian vegetation communities of Yosemite Valley owe their existence to river processes sustained by the high water table of the river and its annual flooding, as well as periodic burning by American Indians (Anderson et al., 1991) . These mid-elevation meadows (most greater than 30 acres in size), the riparian zone, and wildlife species associated with these habitats are rare and unusual at a regional and national scale.[4] Yosemite Valley meadows and riparian habitats support rare and endemic plant and wildlife species, including an exceptional diversity of both bat and sedge species. This biological diversity is a function of the variety of niches made possible by the meadows and presence of year-round water.

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2 Riparian areas are generally identified by the plant communities contiguous to and affected by surface and subsurface hydrologic features, with distinctly different vegetative species or more vigorous growth forms than those in adjacent areas, and are usually transitional between wetland and upland communities.

3 While many of these species depend primarily on the river and its fish, the adjacent and related riparian habitats provide crucial nesting or denning habitats without which the species would not be present.

4 The majority of large Sierra Nevada meadows occur between 6,500 and 8,500 feet; 62% of all Sierra meadows are smaller than 10 acres.

River Segment 4: El Portal

Valley oaks (*Quercus lobata*), a regionally rare species, occur in the El Portal area.

Valley oaks (*Q. lobata*), a keystone tree species of lowland floodplain habitats, have been eliminated from most of their range by human clearing for agriculture and other land uses. Oaks are an important cornerstone of biological communites because, in part, their acorns support a diversity of wildlife species that use the acorns as a source of food (McShea and Healy, 2002). Oak dominated forests, woodlands, and savannas in California are among the most diverse communities in North America, supporting over 300 wildlife species, thousands of insects and other invertebrates, and over 1400 species of flowering plants (Tietje et al., 2005; Oak Woodland Conservatoin Group website, 2012). Bird species were found to use oak woodlands extentively, especially as foraging habitat (Block et al., 1992) The valley oak is one of the largest species of oak in America.

There is an isolated but reproducing population of valley oak at El Portal and this remnant population is predicted to provide habitat for a diversity of wildlife species (CWHR, v8.2). Although this population is not strictly dependent on the high water table made possible by the Merced River, valley oaks are usually found in deep, well-drained soils associated with river valleys. It is in these places that valley oaks can grow tallest and most dense. Due to widespread destruction of valley oak habitat across the state (Bolsinger, 1988; Davis et al., 1998) they are a rare glimpse into former California river and valley habitats.

Although the population of valley oaks in El Portal may provide valuable habitat for wildlife, the presence of nearby development and the criss-cross network of roads may lower its potential value as habitat. An extensive body of literature on the effects of roads on wildlife behavior (e.g. Forman et al., 2003) and the usually negative effects of development would suggest that wildlife species are not using this habitat as much as they would an undisturbed location. However, no local data exists to confirm this hypothesis

River Segments 7 and 8: Wawona and South Fork Merced River below Wawona

The Sierra sweet bay (*Myrica hartwegii*) is a rare plant found along the South Fork Merced River.

In Wawona and downstream, the South Fork Merced River provides habitat for a rare plant, the Sierra sweet bay (*M. hartwegii*). This special-status shrub is found in only five Sierra Nevada counties. In Yosemite, it occurs exclusively on sand bars and riverbanks downstream from Wawona and on Big Creek, although only a portion of the Big Creek population is found within the Wild and Scenic River corridor.

2.1.2 Biological ORV Conditions

Riparian and meadow communities are a hydrological/geological/biological concept. In riparian areas, local physical features (such as river meanders) are naturally created and change through time, while the overall pattern remains constant at a larger scale. This dynamic balance in the physical system creates a corresponding dynamic balance in the biologic system (Galat et al. 1996). These dynamic systems also promote ever-changing habitats for a diverse suite of wildlife and plants, with a structural complexity that includes mosaics of sun and shade, different moisture regimes and soil types, shelter, unique microclimates for animals, and protected corridors between adjacent plant communities (Rundel et al. 1998). Meadows are driven by surface and ground water flows, which regularly saturate or inundate soils. Vegetation and wildlife (including aquatic invertebrates) have special adaptations to these environments.

In general, features that indicate the quality and character of riparian and meadow ecosystems are those that reflect the fundamental ecological processes that sustain these dynamic systems. This includes function-based, structure-based, and species-based features. An example of a function-based feature is the flow rate of the Merced River. Examples of structure-based features are the aerial extent of meadows and structural integrity. The level of species richness and the presence of focal species are also indicators of the quality and character of riparaian and meadow ecosystems.

An altered climate could lead to fundamental changes in natural plant communities, including changes to riparian and meadow complexes (Panek et al. n.d.). Warming temperatures are already causing an increase in winter precipitation as rain rather than snow (Knowles et al. 2006), earlier snowmelt, earlier stream peak flows (Mote et al. 2005; Stewart et al. 2005), and ealier blooming dates of flowering plants (Cayan et al. 2001) These changes in climate may reduce water availability, especially in the summer (Lundquist and Roche 2009), which could lead to changes in the species composition of vegetation communities, a decline in the number of large-diameter trees (Lutz et al. 2009), and increase in the frequency and intensity of wildfires, all of which could affect the biological resources of the Merced River corridor. In particular, meadow and riparian ecosystems, which are closely associated with the hydrologic regime of the Merced River, would be sensitive to alterations to the water cycle linked to climate change.

2.1.3 River Segment 1: Merced River above Nevada Fall

The upper Merced River watershed (Figures 2.1-1 and 2.1-2) is characterized by steep canyons, broad interstream areas of glacially smoothed granite, lakes and meadows, and thin, granitic soils (Photos 2.1-1 and 2.1-2). Much of the Merced River above Nevada Fall is bordered by a narrow riparian zone influenced by stream gradient, slope, sedimentation, and aspect. Riparian areas are characterized by a combination of high species diversity, species density, and productivity. Continuous interactions occur among riparian, aquatic, and upland terrestrial ecosystems through flows of energy, nutrients, and species (Mitsch and Gosselink 1986). All riparian habitats have an exceptionally high value for many wildlife species. Such areas provide water, thermal cover, migration corridors, and diverse nesting and feeding opportunities. The shape of many riparian zones – particularly the linear nature of streams – maximizes the development of ecotones (transitional areas between adjacent habitat types), which are highly productive for wildlife (Mayer and Laudenslayer 1988). Floodwater and subsequent groundwater levels are the main determinants of the type and productivity of the vegetation in riparian zones (Mitsch and Gosselink 1986).

Numerous small meadows and adjacent riparian habitat are present in the upper reaches of the Merced River corridor above Nevada Fall (NPS 1997) (Photo 2.1-3). These high-elevation meadows typically occur on fine-textured, permanently to semi-permanently wet soils generally associated with perennial streams, seeps, lake margins, or depressions. Vegetation consists of low-growing, native, tussock-forming grasses, sedges, rushes, and perennial herbs. Within the alpine zone (generally above 9,600 feet—the highest portion of the Merced River's headwaters), meadows often form thin margins around small glacial lakes (Photo 2.1-4). At lower elevations (such as Merced and Washburn Lakes), subalpine meadows (7,000 to 9,600 feet) form a distinct ecosystem linking the aquatic environment and drier coniferous forests. At these elevations, larger meadow complexes are infrequent but are present in some locations. These wetland plant communities are hydrologically driven by the groundwater and flooding regime of the Merced River (NPS 1997; Ballenger et al. 2011; Sawyer et al. 2009).

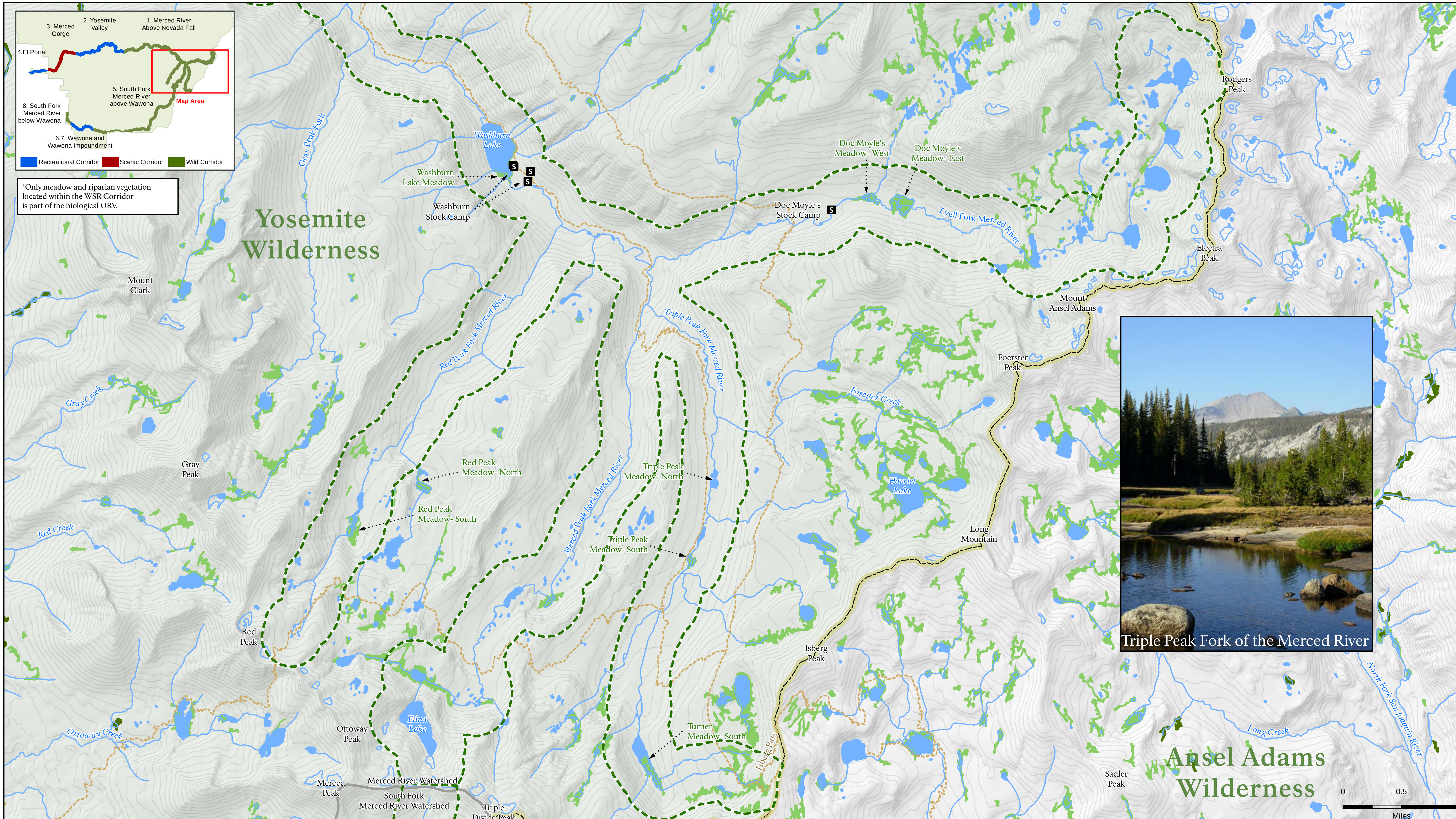

Figure 2.1-1
Biological ORV - River Segment 1. Merced River Above Nevada Fall Wild WSR Corridor

Meadow/Riparian Vegetation
Data Source: NPS, 1997

- Wild WSR Corridor Classification
- Yosemite National Park Boundary
- Lakes
- Meadow
- Riparian Vegetation
- Watershed Boundary
- Trail
- 100' Contour Line
- Stock Campsite

National Park Service U.S. Department of the Interior

Produced by: **Yosemite Planning Division**

Projection:	North American Datum 1983, UTM Zone 10
Date:	6/2/11
File:	Figure 2.1-1

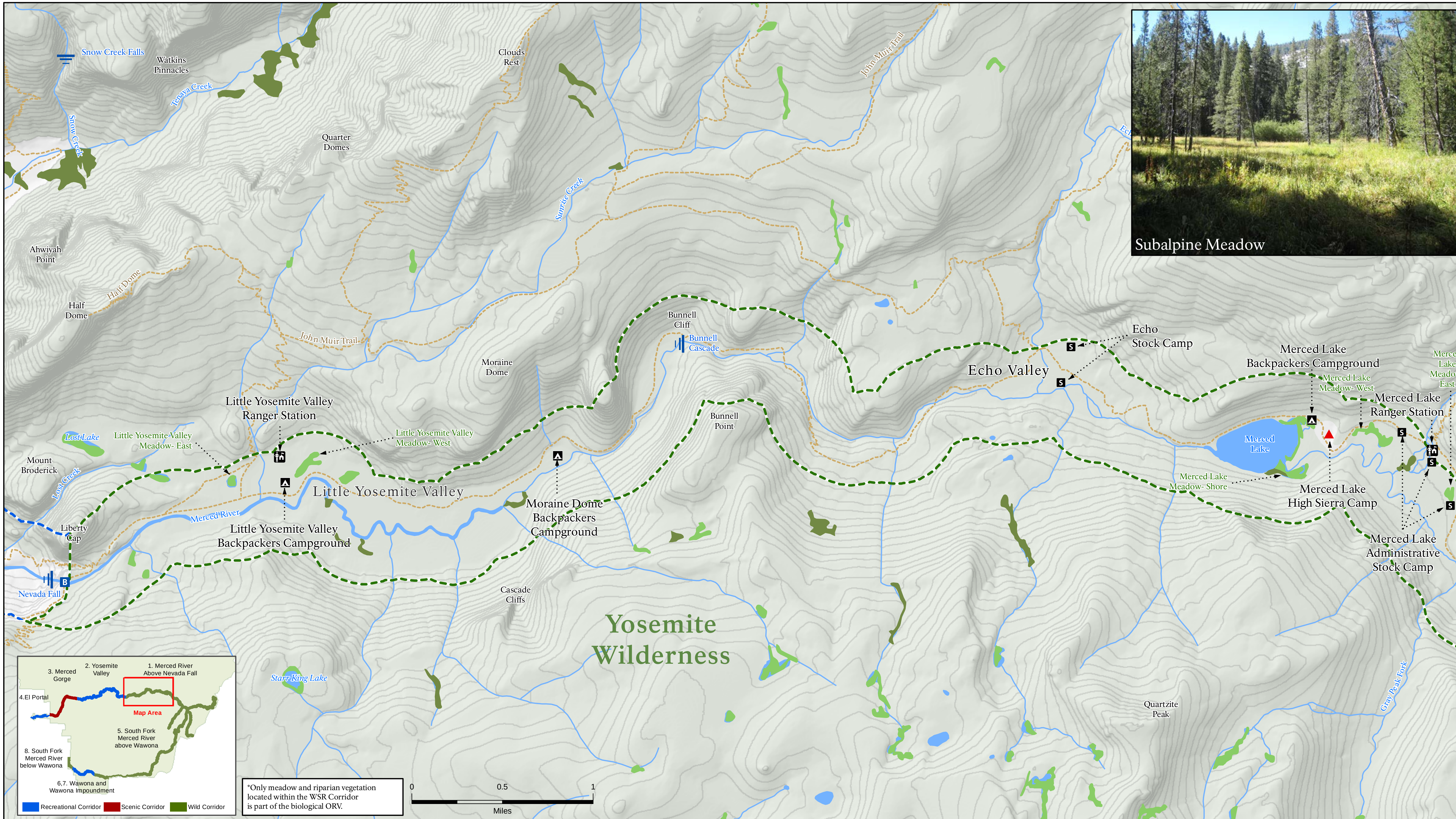

Figure 2.1-2
Biological ORV - River Segment 1. Merced River Above Nevada Fall- Little Yosemite Valley and Merced Lake High Sierra Camp Wild WSR Corridor

Meadow/Riparian Vegetation Data Source: NPS, 1997

Recreational WSR Corridor Classification
Wild WSR Corridor Classification
Lake
Meadow
Riparian Vegetation
Trail
100' Contour Line
Stream/River
Waterfall
High Sierra Camp
Ranger Station
Backpackers Campground
Stock Campsite
Footbridge

National Park Service U.S. Department of the Interior

Produced by: Yosemite Planning Division

Projection:	North American Datum 1983, UTM Zone 10
Date:	6/2/11
File:	Figure 2.1-2

Photo 2.1-1: Upper Merced River Watershed (Yochim 2010)

Photo 2.1-2: Upper Merced River Watershed (Yochim 2010)

Photo 2.1-3: Subalpine Meadow (NPS 2010)

Photo 2.1-4: Lake-margin Meadow in Alpine Zone (NPS 2010)

High-elevation tributaries to the Merced River (e.g., Merced Peak Fork and Triple Peak Fork) are sparsely vegetated with scattered patches of alpine riparian scrub and alpine willow thickets. As the river descends and the gradient becomes gentler, lodgepole pines, aspens (*Populus tremuloides*),willows (*Salix* spp.), and alders (*Alnus* spp.) become more prevalent (Photo 2.1-5). Willows often colonize where point bars form (at the margins of, or within, the river channel). Riparian species often intergrade with coniferous forest at or near the river's upper banks (NPS 1997; Sawyer et al. 2009).

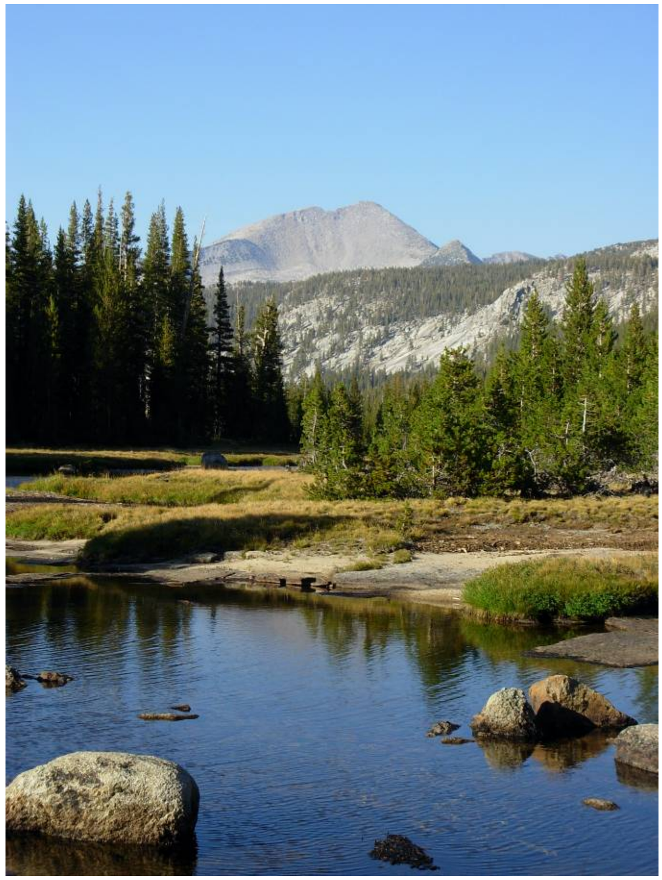

Photo 2.1-5: Triple Peak Fork (Yochim 2010)

Condition at the Time of 1987 Designation

Little information exists regarding the condition of meadows and riparian habitat along River Segment 1 at the time of designation. What information does exist is qualitative in nature and is derived from narrative accounts from that time period.

Although human use in the wilderness reaches of the Merced River has been ongoing for thousands of years, the upper reaches of the river and its associated meadow and riparian habitats remained intact and relatively free from human disturbance (NPS 2005b). Although subalpine meadows historically experienced grazing impacts, most of the meadows in this river segment have not been grazed for several decades. At the time of designation, river-dependent meadow and riparian habitats along the Merced River above Nevada Fall had recovered from many of the impacts associated with grazing in the late 19th century (Sharsmith 1961) with the exception of the meadows at Merced Lake. The meadows at Merced Lake-West and Merced Lake-Shore were grazed by NPS and concessioner stock in 1987 and showed typical grazing-related impacts such as trampling, erosion, and a decline in herbaceous production (Sharsmith 1961). Meadows in this area were closed to stock in the 1990s, with the exception of Merced Lake-East meadow, which currently serves as a holding area for National Park Service stock. The vegetation in Merced Lake-West and Merced Lake-Shore meadows appears to have recovered since they were closed to grazing (Ballenger et al. 2011).

A study by Millar et al. (2004) determined that subalpine meadows in the Sierra Nevada became more forested from 1946 to 1975. Similar findings are documented by Vale and Vale (1994). This meadow-to-forest conversion occurred during a climatic period that included warm, dry years with little annual variability (Millar et al. 2004). While the study did not specifically look at subalpine meadows along the

Merced River corridor, a correlation may be inferred since this unique climatic period likely influenced the entire region (Ballenger et al. 2011). Other studies have linked conifer invasion in meadows to historic sheep grazing (Sharsmith 1959; Dunwiddle 1977) and fire suppression (DeBenedetti and Parson 1979), and these practices may have contributed to forest invasion in the subalpine Merced River corridor (Ballenger et al. 2011).

Less is known about the impacts from recreational use on the meadows and riparian habitat of this segment at the time of designation, but conditions were likely similar to conditions of today. There is some evidence that large backcountry outings took a high toll on mountain meadows in the first half of the 20th Century (Ballenger et al. 2011). By 1987, overnight visitation in the Yosemite high country was being controlled through quotas due to the increasing popularity of outdoor recreation at Yosemite National Park.

Current Condition

The condition of river-related meadows and riparian habitat in the Merced River high country are similar to those described for conditions in 1987, exceptwhere changes in management practices and site specific restoration projects have improved meadow and riparian condition.

The recently completed *2010 Assessment of Meadows in the Merced River Corridor, Yosemite National Park* (Ballenger et al. 2011) provides details on the current condition of meadow habitats in the Merced River corridor in Yosemite National Park. The authors found that subalpine meadows in the Merced River corridor were dominated by native graminoids,[5] a potentially healthy sign because these species create dense sods that stabilize soils. Higher elevation subalpine meadows in the Red Peak Fork and Triple Peak Fork had a relatively higher proportion of subshrubs and forbs. Bladder sedge (*Carex utriculata* and *C. vesicaria*) communities dominated most subalpine zone meadows in the Little Yosemite, Merced Lake, Doc Moyle's, and Washburn Lake meadows. The dominance of these obligate wetland species indicates that these meadows stay wet later into the growing season when compared to many of the other meadows along this segment.

The extent of conifer encroachment in subalpine meadows varied widely, with some meadows (Merced Lake-East and Little Yosemite Valley-East) having no seedlings present and others (Turner Lake, Triple Peak-North and Red Peak South) having three to four times the extent of conifer encroachment relative to other subalpine meadows. With the exception of the Little Yosemite Valley area, non-native species were uncommon in meadows of the Merced River high country and were not observed in any meadows along the Merced River above Washburn Lake. Non-native Kentucky bluegrass (*Poa pratensis* ssp. *pratensis*) was found in drier areas of Little Yosemite Valley-East, while the non-native bull thistle (*Cirsium vulgare*) was mapped in the wooded area outside Merced Lake-East meadow.

The *2010 Assessment of Meadows in the Merced River Corridor, Yosemite National Park* (Ballenger et al. 2011) concluded that pack stock impacts or vulnerability to impact in subalpine meadows were a primary consideration for management of these areas. Potential issues related to pack stock use raised

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[5] Graminoids are grasses and grass-like plants, and include plants in the Poaceae (grasses), Cyperaceae (sedges), and Juncaceae (rushes) families.

in the study include levels of use, timing of use, and suitability for use. The issues are particularly important for those subalpine meadows (such as Merced Lake and Doc Moyle's) with wet soils supporting hydrophytic sedge species.

Table 2.1-1 shows the total annual number of stock-use nights within this river segment by NPS administrative and commercial operators. The majority of stock-use nights occurred at Merced Lake-East. Annual commercially guided pack trips in this river segment averaged 48 stock-use nights. The *Assessment of Meadows in the Merced River Corridor* found that pack stock impacts were absent or uncommon in most subalpine meadows, with the exception of Merced Lake-East, which had the highest levels of pack stock use of any meadow in the corridor, and Doc Moyle's-West, which had much lower levels of use. The study found that it is likely that pack stock use contributes to lower vegetation cover and higher levels of bare ground at Merced Lake-East. Interestingly, the two meadows nearest Merced Lake-East (Merced Lake-West and Merced Lake-Shore) exhibited higher vegetative cover and lower bare ground levels when compared to Merced Lake-East, even though they had the same dominant plant species. Although grazed in the past, these two meadows were closed to stock use in the 1990s due to concerns over deteriorating conditions. Ballenger et al. (2011) concluded that these two meadows appeared to have recovered from previous stock impacts, and that they could provide a comparative baseline when monitoring conditions in Merced Lake-East. The study also found that Doc Moyle's-West may be recovering from heavy use of the site as a pack camp in the mid-20th century.

Scattered signs of stock use, such as hoof punches and/or manure, were observed in five other subalpine meadows (Washburn Lake, Triple Peak, Merced Lake-Shore, Triple Peak-South, and Turner Lake). These signs are likely from stock use prior to 2010, as those meadows have no recorded 2010 stock use.

There are no formal trails present in any of the subalpine meadows surveyed for the study. Most subalpine meadows had little or no informal trails present. Five subalpine meadows did have some informal trails present, with Merced Lake-Shore having the most, likely due to its proximity to Merced Lake High Sierra Camp. The study could not differentiate between informal trailing caused by human or equine use on those sites with pack stock use (Ballenger et al. 2011). Table 2.1-2 provides details on informal trails in subalpine meadows of the Merced River corridor.

Alpine meadows in this study showed less conifer encroachment than lower elevation subalpine meadows. This is likely due to the harsh growing conditions of the alpine environment (Ballenger et al. 2011). Non-native species were not found in the alpine meadows. The meadows showed little to no impacts from visitors or pack stock use. Formal NPS-maintained trails run through some meadows in the Red Peak and Triple Peak Forks. Some sections of trail were braided and rutted, conditions which can interrupt or divert natural hydrological flows in the meadows. Pack-stock impacts were limited to formal trail corridors (Ballenger et al. 2011).

TABLE 2.1-1: STOCK-USE NIGHTS WITHIN SEGMENT 1 BY LOCATION (2004 TO 2010)[a]

Wilderness Stock Campsite Areas	2004	2005	2006	2007			2008			2009			2010			Total	2004 to 2010	High
	Commercially Guided Pack Trips	Commercially Guided Pack Trips	Commercially Guided Pack Trips	Commercially Guided Pack Trips	Administrative[b]	Total	Commercially Guided Pack Trips	Administrative[b]	Total	Commercially Guided Pack Trips	Administrative[b]	Total	Commercially Guided Pack Trips	Administrative[b]	Total		Average[c]	
Horsethief				12		12	8		8	50		50	21		21	**91**	13	50
Merced Lake-East					350	350		96	96		410	410	28	300	328	**1184**	296	410
Washburn Lake	23	36	20				28		28				28		28	**135**	19	36
Doc Moyle's	19			33		33			0				6		6	**58**	8	33
Echo		36					20		20							**56**	8	36
Total	**42**	**72**	**20**	**45**	**350**	**395**	**56**	**96**	**152**	**50**	**410**	**460**	**83**	**300**	**383**	**1524**	**344**	**460**

NOTES:

[a] Data shows the number of overnight stays by stock within the river segment. One stock-use night is equivalent to one overnight stay by one head of stock. Concessioner's stock used to supply the Merced Lake High Sierra Camp is not shown in the table.

[b] Administrative use within the Merced River corridor was not tracked by NPS staff until 2007. The stock-use night estimates do not include ranger patrols or sawyers but predominantly show stock use providing operational support for the NPS ranger operations and the backpacker campground facilities within Little Yosemite Valley and at Merced Lake.

[c] Average is for the stock use between 2007 and 2010. Although an average is presented for each wilderness stock campsite area, one caveat is necessary: year-to-year NPS administrative stock use levels can vary widely based on management and project work performed that year.

SOURCE: NPS 2011

TABLE 2.1-2: INFORMAL TRAILS IN SUBALPINE MEADOWS

Meadow Name	Informal Trails (length in meters)
Doc Moyle's-West	205.8
Doc Moyle's-East	60.6
Little Yosemite Valley-West*	0
Little Yosemite Valley-East	0
Merced Lake-Shore	1,637.5
Merced Lake-West	0
Merced Lake-East*	144.0
Red Peak-North	0
Red Peak-South	0
Triple Peak-North	0
Triple Peak-South	0
Turner Lake	0
Washburn Lake	144.2

NOTE: Includes informal trails within 50m of each meadow.

* Indicates site was largely inundated at time of survey, so detection of informal trails may not have been possible.

SOURCE: Ballenger et al. 2011

Preliminary Management Considerations

The preliminary management considerations associated with the Biological ORV in segment 1:

- The upper reaches of the Merced River and its associated meadow and riparian habitats are generally in excellent condition. The meadow east of the Merced Lake ranger station has the highest level of stock use of all the meadows in this river corridor; resulting impacts include grazed vegetation, roll pits, manure and trampled soils.
- NPS will continue to monitor conditions and manage use to protect meadows and riparian areas.

2.1.3 River Segment 2: Yosemite Valley

Although this evaluation is based on ORV conditions at the time of Wild and Scenic River designation, changes that occurred prior to 1987 are described to gain an understanding of some of the factors that attributed to conditions in 1987 and of the trends in the condition of the Biological ORV.

While seemingly natural to most, a place like Yosemite Valley, actually exists due to both natural and cultural processes. Many of the meadow and riparian species are important in the history and ongoing cultural traditions of the associated American Indian tribes and groups. Therefore while natural processes related to hydrologic function have shaped the meadow complexes of the Merced River, cultural processes including American Indian burning to promote hunting and gathering have also shaped the ecosystem. Vista clearing to maintain views of Yosemite's iconic scenery of Yosemite Valley have contributed to the landscape as well. The International Primer on Ecological Restoration

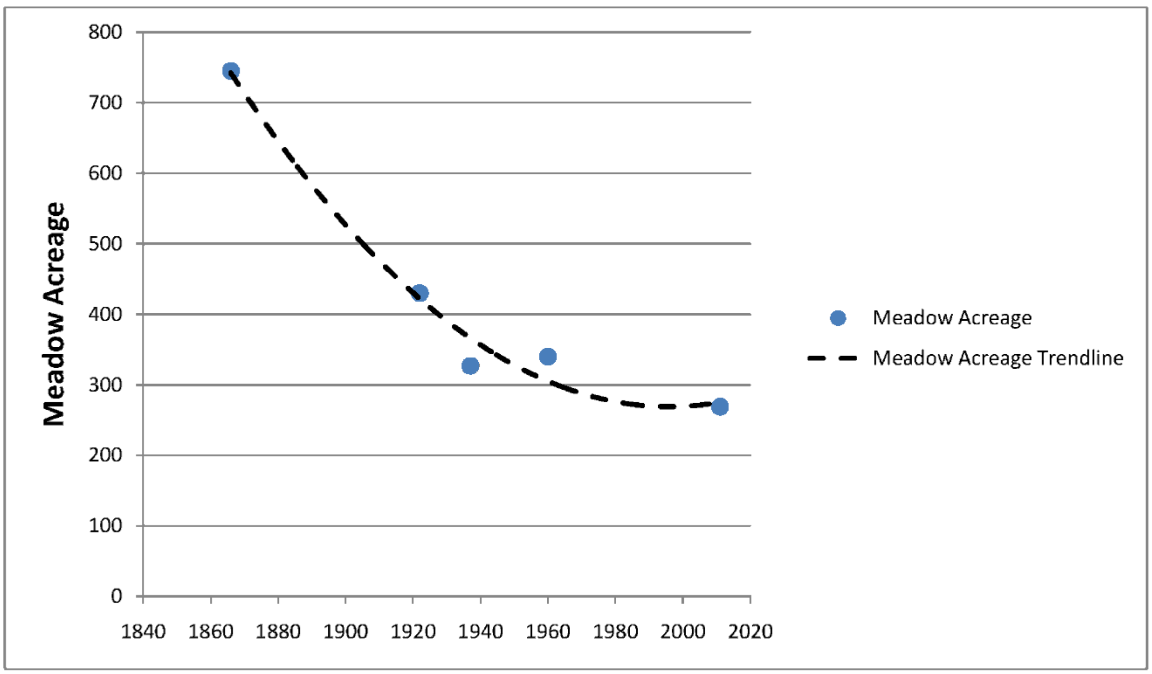
(SER 2004) acknowledges the conundrum that can take place on a landscape where natural and cultural processes have shaped the landscape, stating that "cultural landscapes or ecosystems have developed under the joint influence of natural processes and human-imposed organization". These systems are all interconnected and interrelated. Ethnographic studies have shown Yosemite Valley's original inhabitants—the Ahwahneechee—used fire to manage a landscape of sustainability (Levy 1978), and used fire intensively throughout Yosemite Valley.The use of fire as a management tool had substantial, long-term impacts on the vegetation communities of Yosemite Valley (Anderson and Moratto 1996; This type of fire management continually created openings and clearings, allowing a greater diversity of plant species and wildlife (Gassaway 2005). At the time Euro-Americans arrived in Yosemite Valley, the stretch of Merced River within Yosemite Valley was free of dams and diversions; meadows and associated riparian habitat were largely free of buildings or other infrastructure. Shortly following the arrival of visitors and Euro-American residents in Yosemite Valley in the 1850s, anthropogenic impacts became more pronounced, consisting of (but not limited to) roads and trails, fences, user-made campsites, undersized bridges, and permanent structures. For example, in 1868 John Muir noted the presence of several year-round residents and an apple orchard in Yosemite Valley (Perrottet 2008).

Over the past century, the acreage of meadows in Yosemite Valley has decreased. According to Cooper and Wolf (2008) conifer trees likely colonized meadows for several reasons: (1) the installation of drains, water diversions, and other facilities caused hydrologic changes that lowered the summer water table; (2) the cessation of burning by Native Americans allowed tree seedlings to persist; (3) disturbance caused by plowing meadows and planting hay crops and apple orchards allowed conifers to invade the bare soils after the widely-rooted, sod-forming meadow species were destroyed; and (4) placement of fill to raise the ground elevation allowed upland species to invade (Photo 2.1-6).


Photo 2.1-6: Conifer Encroachment in Yosemite Valley Meadow

The widening of the Merced River in east Yosemite Valley—attributable to human causes, such as trampling of riparian vegetation and bridges too narrow to adequately accommodate high flows (Madej et al., 1994)—may also be a factor altering groundwater hydrology, which appears to be a contributing factor to conifer colonization (Cooper and Wolf, 2008). This colonization has produced a reduction in areal coverage of meadows in Yosemite Valley due to forest encroachment (Gibbens and Heady 1964; Heady and Zinke 1978). Historic photos and accounts add perspective to the current conditions of Yosemite Valley meadows. In 1866, State Geologist J.D. Whitney (1868) mapped 745 acres of meadows in Yosemite Valley. In 1937, NPS type mapping projects calculated 327 total meadow acres in Yosemite Valley. In 2010, botanists mapped 269 total meadow acres, a 64% decrease from the 1866 Yosemite Valley survey (Ballenger et al. 2011) (Photo 2.1-7) (Figure 2.1-3 and 2.1-4).

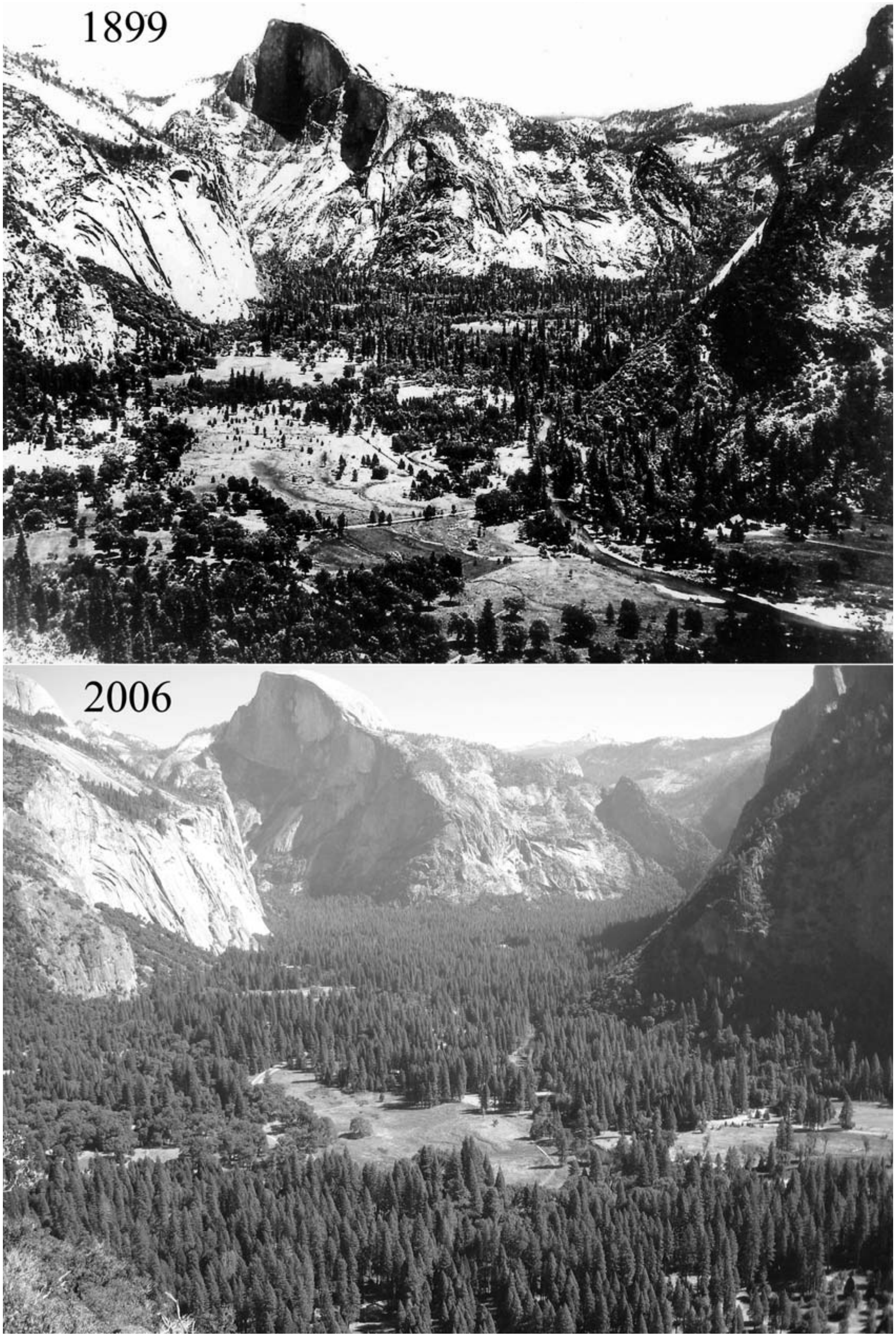
Fluvial systems behave according to the concept of "base level", which is the level which a stream or river cannot erode its bed. The ultimate base level for fluvial systems is sea level, but temporary base levels may exist locally, controlling the elevation of a river or stream immediately upstream. The El Capitan Moraine likely created a local base level for the Merced River in western Yosemite Valley (Huber, 2007). Blasting of boulders within the river channel where it crosses the El Capitan Moraine in 1879 is estimated to have lowered local base level by approximately 3-6 feet (Milestone, 1978). Local base level lowering typically creates a knickpoint, or pronounced change in river gradient, that promotes channel incision immediately upstream from the site of base level decline (Ritter et al. 2002). Knickpoints tend to migrate upstream with time, although the form of the migrating knickpoint will vary depending on the substrate. Thus, blasting of the El Capitan Moraine could have lowered groundwater table levels by a maximum localized amount of approximately 3-6 feet in western Yosemite Valley.



SOURCES: Whitney 1868; Gibbens and Heady 1964; Heady and Zinke 1978; Cooper and Wolf 2008; Ballenger et al. 2011

Figure 2.1-3

Meadow Acreage in Yosemite Valley (1866-2011)



SOURCE: Cooper and Wolf, 2008

Photo 2.1-7

Photo looking east toward Half Dome from Columbia Point, 1899 and 2006.
An increase in conifers and a decrease in oak and meadows are apparent

Despite this loss in aerial extent, meadows in Yosemite Valley are much larger than most mid-elevation meadows in the Sierra Nevada, which makes them rare and unusual at this regional scale (NPS 1997). In addition, meadows in Yosemite Valley are highly diverse, both from a structural point of view, as the meadows contain a wide variety of microhabitats, and from a species point of view, as the meadows support high numbers of different native plant and animal species. For example, Yosemite Valley harbors about 30 different sedge species (Acree 2011a). Experts consider areas with as few as 15 sedge species to be exceptional in terms of species richness. The 17 different bat species found in Yosemite Valley also illustrates the exceptional species richness of Yosemite Valley. These attributes combine to make Yosemite Valley's meadows an extraordinary example of a regionally rare ecosystem (Photos 2.1-8 and 2.1-9).

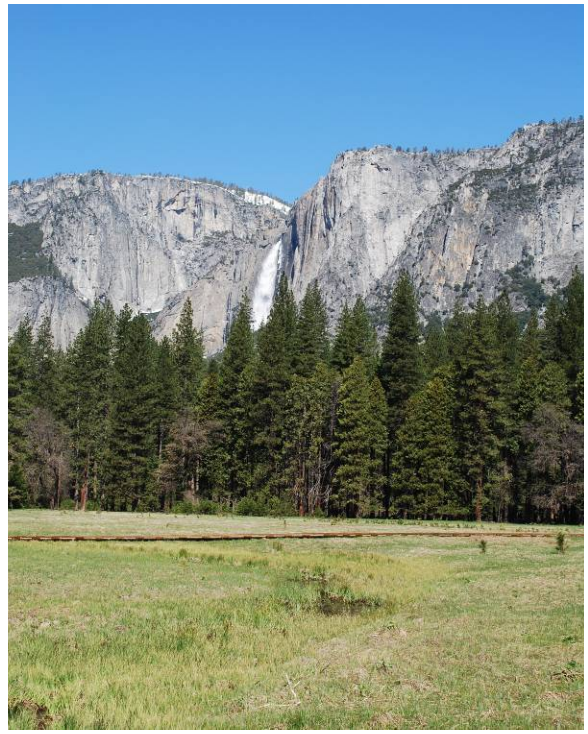


Photo 2.1-8: Yosemite Valley Meadow (NPS 2010)

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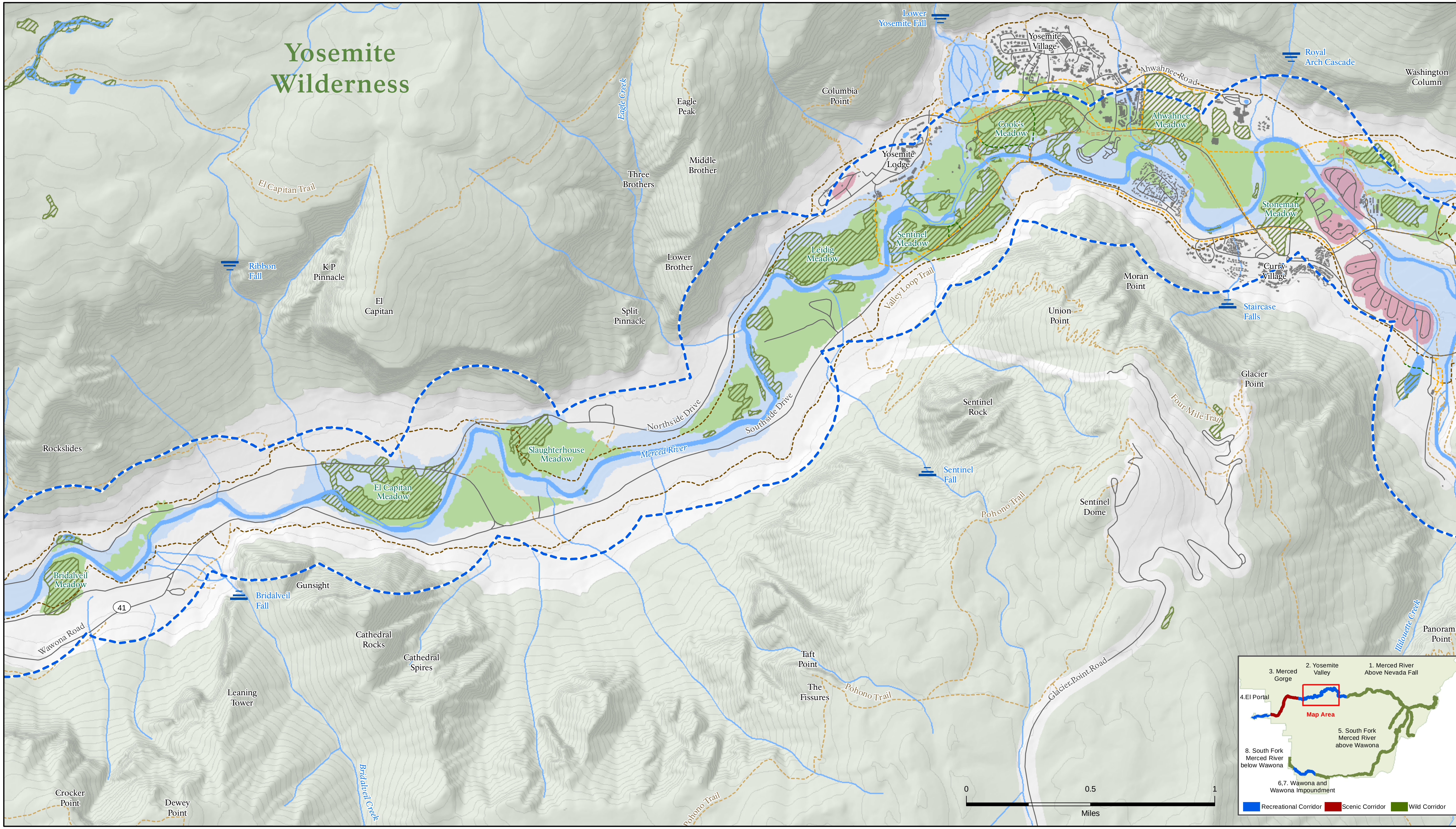

Figure 2.1-4
River Segment 2. Yosemite Valley
Yosemite Valley Meadows: Historic and Current
Recreational WSR Corridor

Source: Current Meadow Vegetation Data: NPS, 1997/2010; Historic Meadow Data: Hoffman/State Geological Survey, 1867

Recreational WSR Corridor Classification
Building
Campground
100 Year Flood Boundary
Current Meadows (1997/2010)
Historic Meadows (1867)
Road
Valley Loop Trail
Boardwalk
Bike Path
Trail
Stream/River
100' Contour Line
Waterfall

National Park Service U.S. Department of the Interior

Produced by: **Yosemite Planning Division**

Projection: North American Datum 1983, UTM Zone 10

Date: 7/22/11

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Photo 2.1-9: Yosemite Valley Meadow in Spring (Yochim 2010)

Condition at the Time of 1987 Designation

Despite the history of disturbance within Yosemite Valley's meadows and riparian habitats, by 1987 these areas had been afforded a level of protection from human disturbance through implementing a variety of restoration projects. For example, in an attempt to restore the natural fire regime and control non-native species and conifer encroachment in meadows, the NPS systematically reintroduced fire into Yosemite Valley meadows on a rotating basis starting in 1970 (Ballenger et al. 2011). Though anthropogenic impacts in the meadows and riparian areas of Yosemite Valley had been addressed by a variety of NPS projects and policies by the time of designation, in 1987 these areas were continuing to experience some human-related influences and exhibit residual effects of past management procedures.

At the time of designation, informal trails were found in most of Yosemite Valley meadows, particularlyStoneman and Sentinel meadows. Subsequent restoration projects have removed many of these informal trails (Ballenger et al. 2011). Infrastructure such as a historic roadbed, several ditches, and paved interpretive trails traversed Cook's Meadow. These features disrupted the meadow's natural hydrology, which inhibited seasonal inundations, affected the water table, and promoted the proliferation of non-native species and conifer encroachment (Cardno ENTRIX 2011). Cook's Meadow underwent a comprehensive restoration project to improve the hydrologic function of the meadow. In Sentinel Meadow, imported fill used for the foundation of Pavilion Square, a movie house and dance hall (which had been razed in 1963), was still in place in 1987. This fill area was visible from the top of Yosemite Falls but was removed and restored in 1994 (Ballenger et al. 2011).

In 1987, a number of stretches of the Merced River's banks through Yosemite Valley were suffering from substantial impacts including erosion, denuded riparian vegetation, and poorly designed riprap revetment (Tucker 1996; Cardno ENTRIX 2011). Heavily used areas of the river such as the El Capitan

Picnic Area, the Lower River Housekeeping Camp, Devil's Elbow, Lower River Campground, and the North Pines Campground exhibited extensive trampling from visitor use and a subsequent decrease in riparian vegetation (Cardno ENTRIX 2011). Since the time of designation, numerous restoration projects along the Merced River's stretch through Yosemite Valley have been implemented to mitigate these impacts (Tucker 1996; Cardno ENTRIX 2011).

Madej et al. (1991) found a strong association among levels of human use around campsites and river access points, the loss of riparian vegetation cover, and accelerated bank erosion. Trampling of soils and vegetation in developed, high-use areas in eastern Yosemite Valley (e.g., at Upper, Lower, and North Pines Campgrounds) had widened the Merced River in some reaches. Riverbanks were largely denuded along some reaches, thus affecting shading and nutrient dynamics in aquatic habitats. Potential effects include increased water temperature due to a lack of riparian cover, increased suspended sediment, and reduced dissolved oxygen levels (Madej et al. 1994).

Current Condition

Although current conditions are relatively similar to those at the time of designation, a number of restoration projects and other actions have occurred since 1987 that have improved the condition of the meadow and riparian habitat of Yosemite Valley (Figures 2.1-5 and 2.1-6).

Restoration projects have been implemented all along the Merced River corridor in Yosemite Valley since the time of designation. The projects range from removal of bank revetment to restoration of riparian and meadow vegetation. For example, tens of thousands of conifer seedlings and saplings were removed from Yosemite Valley meadows. Populations of high priority non-native species such as Himalayan blackberry (*Rubus armeniacus*), bull thistle (*Cirsium vulgare*), St. John's wort (*Hypericum perforatum*), and velvet grass (*Holcus lanatus*) were mapped and many of these populations were treated (Ballenger et al. 2011).

Riparian vegetation has been restored along a reach of the river adjacent to North Pines Campground among many other stretches (Photo 2.1-10). Park staff fenced the riverbank and planted riparian vegetation in an attempt to halt erosion and protect the banks and vegetation. Associated interpretive and educational efforts direct visitors to areas that can better accommodate heavy use without long-term impacts, such as sandy beaches and gravel bars. Similar riparian restoration efforts have occurred at Lower River Campground, El Capitan Picnic

Photo 2.1-10: Revegetated Riverbank (foreground) and Denuded, Eroding Bank (opposite side of river). (NPS)

Area, Lower River Housekeeping Camp, Devil's Elbow, Sentinel Bridge, Swinging Bridge, Housekeeping Camp, Clark's Bridge, and South Fork Bridge. These projects removed debris and riprap, improved soil conditions, and planted native plant species among other actions intended to protect and improve the riparian corridor of the Merced River through Yosemite Valley (Tucker 1996; Cardno ENTRIX 2011).

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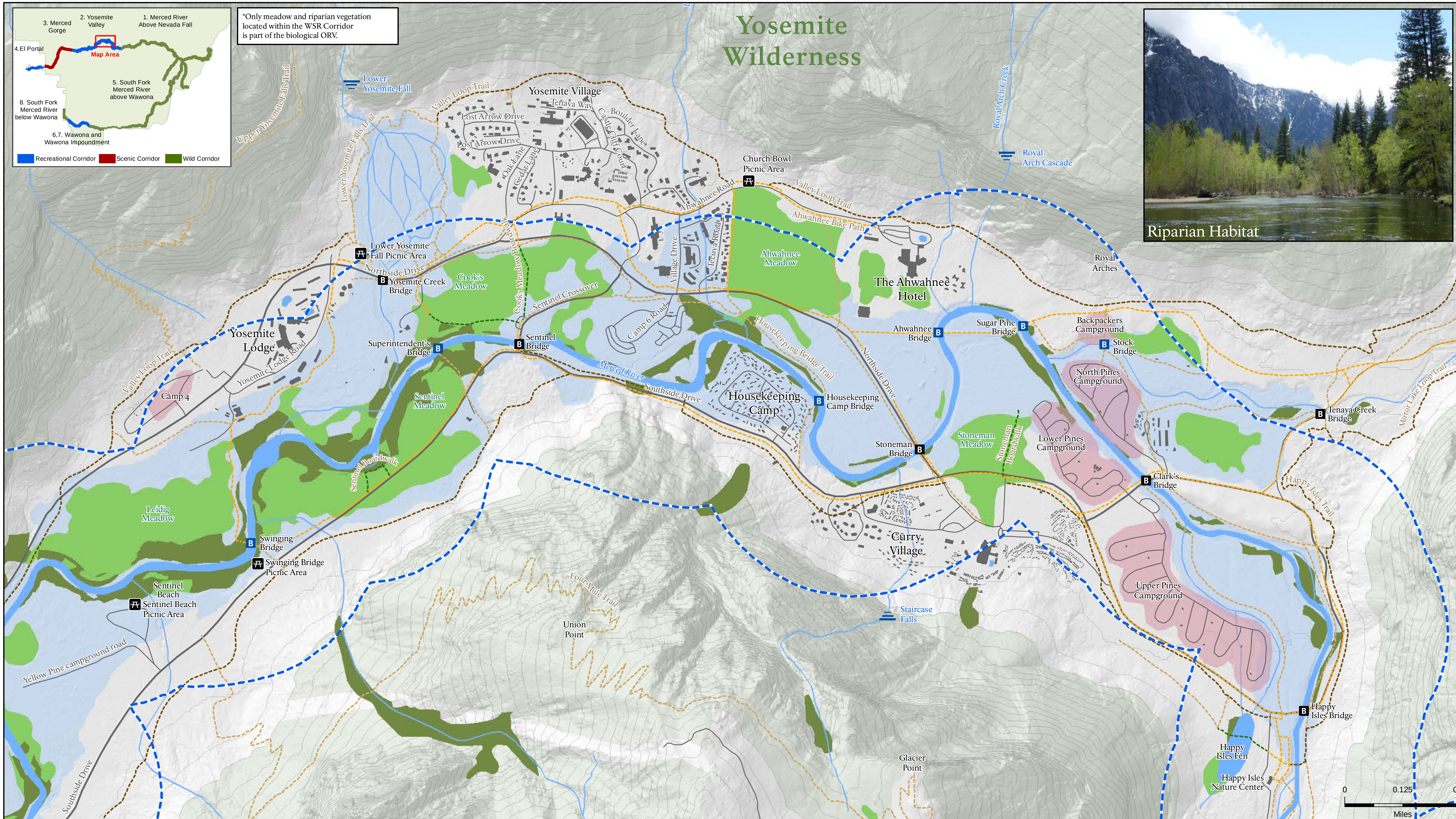

Figure 2.1-5

Biological ORV - River Segment 2. Yosemite Valley
Yosemite Lodge, Yosemite Village, and The Ahwahnee
Recreational WSR Corridor

Meadow/Riparian Vegetation
Data Source: NPS, 1997/2010

Recreational WSR Corridor Classification
Building
Campground
100 Year Flood Boundary
Meadow
Riparian Vegetation
Road
Stream/River
100' Contour Line
Valley Loop Trail
Bike path
Boardwalk
Trail
Road bridge
Footbridge
Waterfall
Picnic Area

National Park Service U.S. Department of the Interior

Produced by: **Yosemite Planning Division**

Projection:	North American Datum 1983, UTM Zone 10
Date:	6/2/11
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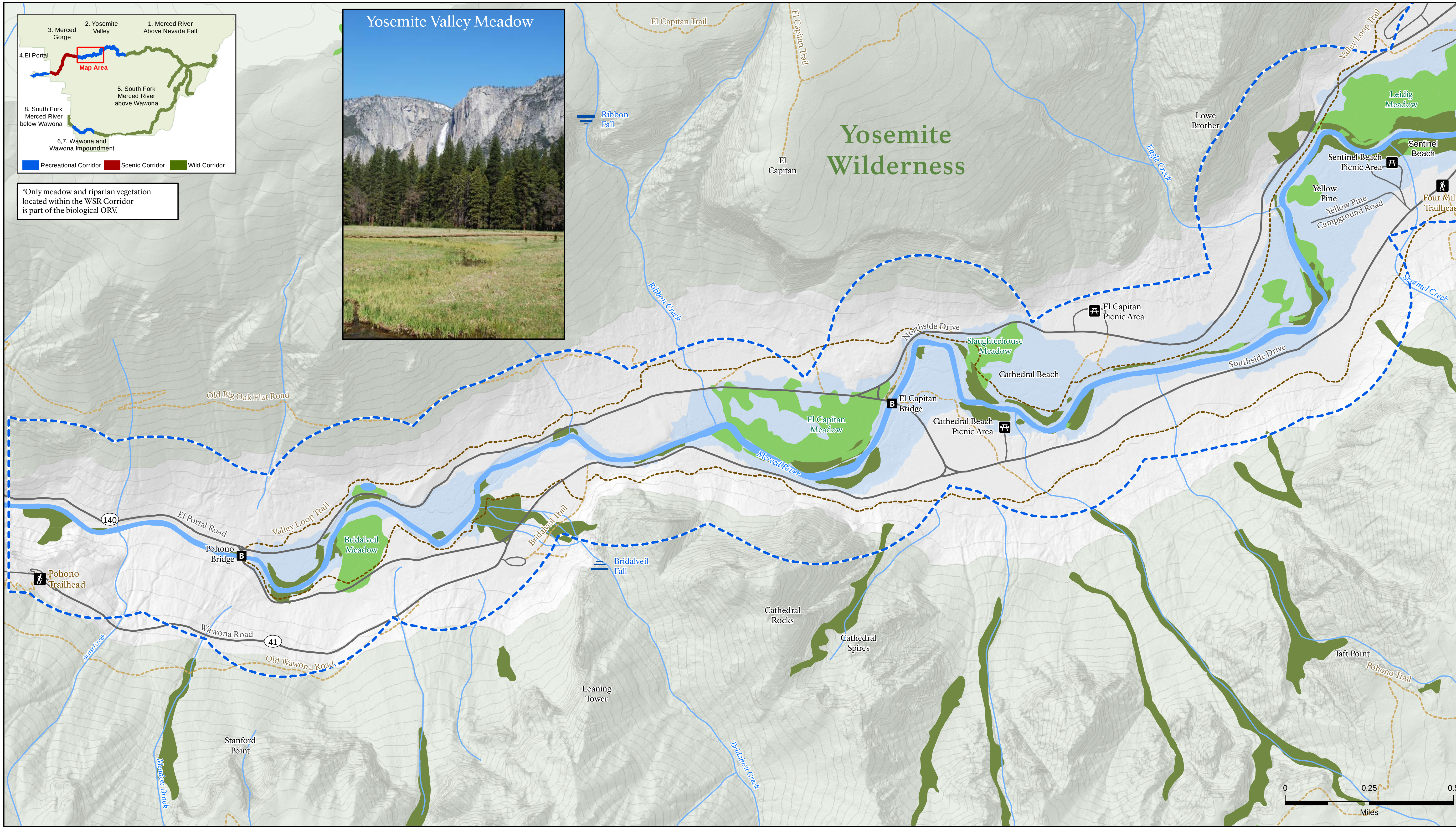

Figure 2.1-6
Biological ORV - River Segment 2. Yosemite Valley
El Capitan Meadow, Cathedral Beach, and Sentinel Beach Recreational WSR Corridor

Meadow/Riparian Vegetation
Data Source: NPS, 1997/2010

- Recreational WSR Corridor Classification
- 100 Year Flood Boundary
- Meadow
- Riparian Vegetation
- Road
- Stream/River
- Valley Loop Trail
- Bike path
- Trail
- 100' Contour Line
- Waterfall
- Trailhead
- Picnic Area

National Park Service U.S. Department of the Interior

Produced by: **Yosemite Planning Division**

Projection:	North American Datum 1983, UTM Zone 10
Date:	6/2/11
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Other examples include the Cook's Meadow Restoration Project and the Eagle Creek Restoration Project, which were specifically designed to enhance meadow and riparian habitat. These projects included actions to restore meadow hydrology (by filling ditches and replacing an abandoned roadbed) and riparian streambank integrity (by recontouring and revegetating eroded streambanks, de-compacting soils, and constructing fencing so that visitors would access the river via sandbars). In Cook's Meadow, the NPS excavated paved interpretive trails that crossed the meadow and replaced them with elevated boardwalks. In Sentinel Meadow, the NPS constructed one boardwalk and fencing along the strip parking area, reducing the extent of 29 informal trails. Similarly, in Stoneman Meadow, the NPS constructed a boardwalk across the meadow to reduce the extent of 25 social trails (Photos 2.1-11a, 2.1-11b, and 2.1-12).

Photo 2.1-11a and b: Stoneman Meadow (date unknown) with Network of Social Trails and Stoneman Meadow in 2005. These trails were restored and a boardwalk was constructed across the meadow in 1987. (NPS, Google Earth)

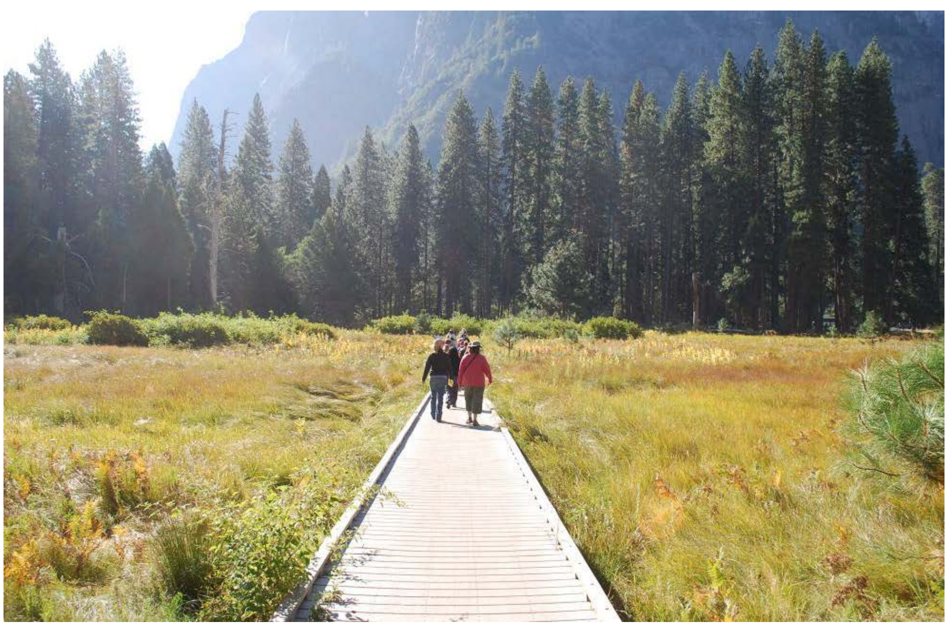


Photo 2.1-12: Pedestrian Boardwalk in Yosemite Valley Meadow

The recently completed Merced River and Riparian Vegetation Assessment (Cardno ENTRIX 2011) evaluated the current condition of eight geomorphic reaches of the Merced River and its riparian corridor in Yosemite Valley using a variety of different methods. The Merced River riparian corridor was assessed following the California Rapid Assessment Method (CRAM). The CRAM is a rapid, standardized assessment method that provides information on the overall condition and functional capacity of the riparian corridor and the stressors that may be affecting it (Collins et al. 2008). The CRAM includes the evaluation of four main attributes (Buffer and Landscape Context, Hydrology, Physical Structure, and Biotic Structure) which are broken down into fourteen metrics. For the Merced River study, these metrics were used to calculate an overall "CRAM score" for each geomorphic reach (higher scores indicate better condition). The CRAM score is an indication of the overall condition of the riparian corridor relative to the best achievable conditions for riparian corridors in California. Table 2.1-3 provides details on the CRAM scores for each geomorphic reach.

TABLE 2.1-3: CRAM SUMMARY TABLE BY GEOMORPHIC REACH

Geomorphic Reach	Buffer and Landscape Context	Hydrology	Physical Structure	Biotic Structure	Overall CRAM Score
Happy Isles	0.90	0.95	0.70	0.81	0.84
Above Tenaya	0.79	0.85	0.50	0.69	0.71
Below Tenaya	0.81	0.82	0.56	0.57	0.69
Upper Meadows	0.84	0.86	0.66	0.77	0.78
Inter-meadows	0.85	0.93	0.66	0.79	0.81
Lower Meadows	0.84	0.93	0.68	0.74	0.80
Above Pohono Bridge	0.86	0.90	0.78	0.79	0.83
Below Pohono Bridge	0.83	0.73	0.67	0.64	0.72
SOURCE: Cardno ENTRIX 2011					

Reaches with higher overall CRAM scores (Happy Isles, Inter-meadows, Lower Meadows, and above Pohono Bridge) were generally characterized by no or few locations with bank protection measures (riprap revetment), less extensive bank erosion, lower intensity visitor use, high topographic complexity, and a moderately developed vegetation community with moderate vegetation structural complexity, including some overlap of canopy layers and distinct plant layers. The riparian corridors with comparatively poorer overall CRAM scores (Above Tenaya, Below Tenaya, and Below Pohono Bridge) were generally characterized by higher intensity of human use, bank protection measures, more extensive bank erosion, low topographic complexity, and a relatively poorly developed riparian community with few co-dominant species and little canopy overlap with few distinct plant layers (Cardno ENTRIX 2011).

The study found that riparian and wildlife habitat conditions along the Merced River through Yosemite Valley varied by geomorphic reach, and that these variations were caused by responses to assorted types of human impacts. For example, the reach just below Happy Isles has wide riparian buffers with complex physical structure and provided good wildlife habitat. Conversely, the stretch just below Tenaya Creek had narrow riparian buffers and low vegetation structural complexity, providing poor wildlife habitat. The study found the primary influences affecting the riparian corridor along the Merced River riparian corridor are recreational use and the presence of infrastructure (Cardno ENTRIX 2011).

Photo 2.1-13: Riparian Habitat in Yosemite Valley

The study also found that the majority of the riparian corridor has few non-native species, while supporting a minimum of three plant layers (e.g., various heights of trees, shrubs, and herbaceous vegetation). Most of the riparian corridor through Yosemite Valley exhibits moderate horizontal zonation of species and vertical overlap among plant layers, which are generally indicative of a well-developed riparian community (Photo 2.1-13). These types of riparian communities generally have greater wildlife diversity. Stretches of the riparian corridor in the vicinity of Clarks Bridge and Stoneman Bridge and downstream of Pohono Bridge exhibit less horizontal zonation and vertical complexity compared with the majority of the corridor. This same study observed evidence of at least moderate levels of human use throughout most of the study reaches. Areas with moderate to high levels of human use were concentrated near the developed areas between Clark Bridge and Sentinel Bridge and areas easily accessible from adjacent roads. Bank erosion was observed throughout the study reaches, particularly near bridges, recreation facilities, and around some meander bends. Areas with moderate to high human use also generally had fewer co-dominant species and generally exhibited lower riparian community structure complexity (Cardno ENTRIX 2011).

The *Wildlife Condition Assessment for the Merced River Corridor in Yosemite Valley* (Espinoza et al. 2011) assessed the health of the Yosemite Valley riparian and meadow habitats in relation to wildlife focal species. In part, the study used bird survey data to assess the health of the river corridor and its riparian habitat. It examined detections of five riparian focal species (RFS) [black-headed grosbeak (*Pheucticus melanocephalus*), song sparrow (*Melospiza melodia*), spotted sandpiper (*Actitis macularia*), warbling vireo (*Vireo gilvus*), and yellow warbler (*Dendroica petechia*)], a nest brood parasite [brown-headed cowbird (*Molothrus ater*)], and two nest predators [Steller's jay (*Cyanocitta stelleri*) and common raven (*Corvus corax*)] in relation to the same eight geomorphic reaches assessed by Cardno ENTRIX (2011). Table 2.1-4 breaks down detections in each geomorphic reach by species richness (the number of RFS), relative abundance of RFS (the number of individuals averaged across point count stations), brown-headed cowbirds, Steller's jays, and common ravens.

TABLE 2.1-4: BIRD SURVEY DATA

Geomorphic Reach	No. Point Count Stations	RFS Species Richness	RFS Relative Abundance	Brown-headed Cowbird Relative Abundance	Steller's Jay Relative Abundance	Common Raven Relative Abundance
Happy Isles	2	1	1.00	0	1.50	0
Above Tenaya	2	3	4.00	0	3.50	6.50
Below Tenaya	1	3	7.00	0	2.00	1.00
Upper Meadows	7	5	14.14	1.86	2.86	0.86
Inter-meadows	4	5	12.00	1.00	1.75	0
Lower Meadows	4	5	20.75	3.75	0.75	0.50
Above Pohono Bridge	5	4	3.00	0	2.00	0.40
Below Pohono Bridge	1	3	5.00	0	5.00	0
SOURCE: Espinoza et al. 2011						

The highest relative abundance of RFS was observed in the Upper Meadows, Inter-meadows, and Lower Meadows reaches. These were the only reaches where all five RFS were present. However, these were also the only geomorphic reaches where brown-headed cowbirds were present. The relative abundance and species richness of RFS in these three reaches suggest that there is greater availability of riparian habitat in these reaches compared to the other reaches, and that the structural integrity of the riparian habitat in these three reaches may be higher (Espinoza et al. 2011).

The *2010 Assessment of Meadows in the Merced River Corridor, Yosemite National Park* (Ballenger et al. 2011) provides details on the current condition of meadow habitats in Yosemite Valley. The study examined a wide variety of attributes including vegetation, wetland extent, bare ground, non-native species, conifer encroachment, and meadow stream condition. Disturbance from small mammal burrows, informal trails, and pack stock use was also documented.

Mean vegetation cover in Yosemite Valley meadows ranged from 50-70%, with El Capitan and Leidig meadows having the lowest mean vegetation cover and Cook's Meadow having the highest. The authors found that graminoid species, which are a healthy component of meadow vegetation, dominated Yosemite Valley meadows. However, non-native plant species are common in Yosemite Valley meadows (Table 2.1-5), with the highest extent of non-natives in Stoneman and El Capitan meadows. The study also compared mean cover of non-native plants across all meadows for different surface soil moisture categories and found that non-native plant cover was lowest in saturated and inundated plots. Dry and moist plots had two to three times the cover of non-native plants as plots with early-season saturated or inundated soils. Because El Capitan and Stoneman Meadows also had the lowest proportion of wetland area of Yosemite Valley meadows, the study suggests a connection between the extent of perennially wet soils and non-native species in Yosemite Valley. Kentucky bluegrass, which outcompetes native meadow species when soil moisture is reduced, was the most common non-native recorded (Martin and Chambers 200;, Kluse and Allen-Diaz 2005). Based on the 2010 data, most non-native plants currently present in Yosemite Valley meadows are not well-adapted to outcompete native plants in the wettest portions of the meadows (an important exception to this is velvet grass— *Holcus lanatus*— which prefers wet conditions and is already established in Yosemite Valley). Close attention to early detection and eradication of non-native meadow plants will keep additional species and populations from encroaching into wetlands, and maintenance and restoration of the hydrologic regime of Yosemite Valley meadows may help sustain native meadow vegetation (Ballenger et al. 2011).

Table 2.1-5: Percent of Plots with Non-native Plants Present

Meadow	Present	>25% cover	>50% cover	>75% cover
Bridalveil	51%	0%	0%	0%
Cook's	60%	9%	5%	1%
El Capitan	96%	11%	1%	0%
Leidig	80%	11%	2%	0%
Sentinel	90%	10%	2%	0%
Stoneman	92%	29%	7%	4%
Total	81%	12%	2%	1%
SOURCE: Ballenger et al. 2011				

Across all Yosemite Valley meadows, 75% of plots were wetland. Bridalveil, Cook's, and Sentinel meadows had the highest proportion of wetland plots (87-89%). El Capitan and Stoneman meadows had the lowest proportion of wetland plots with 60% and 61% respectively. The extent of tree seedlings was highest in El Capitan and Stoneman Meadows, while Leidig and Sentinel Meadows had the lowest extent. Because El Capitan and Stoneman Meadows also had the lowest proportion of wetland area of Yosemite Valley meadows, the study suggests a connection between the extent of perennially wet soils and tree encroachment in Yosemite Valley.

Informal trailing is common in Yosemite Valley. The Visitor Use and Impact Monitoring Program has tracked informal trailing in Yosemite's meadows since 2004. For this program, beginning in 2007, infrastructure—such as formal trails, boardwalks, and roads—was used to determine meadow boundaries, and in some cases resulted in meadows being divided into sub-meadows for analytical purposes. For example, Cook's Meadow is divided into three meadow sections (Cook's Meadow A, B, and C) due to the presence of a boardwalk and a formal trail. The Visitor Use and Impact Monitoring Program uses five different indices to track informal trailing. One of the ways this program measures informal trailing is by calculating the extent, i.e. length and density, of informal trails. The *Visitor Experience and Resource Protection Monitoring Program for the Merced Wild and Scenic River Corridor--2010 Annual Monitoring Report* (NPS 2010a) surveyed seven meadows in Yosemite Valley for informal trails. Based on 2010 data, El Capitan Meadow and the portion of Sentinel Meadow north of Southside Drive have the highest extent of informal trailing, formal trailing, and disturbed areas. However, reporting on this measure does not take into account the total area of the meadow. The Visitor Use and Impact Monitoring Program also tracks the total percent of fragmentation, which is the extent of formall trailing divided by the total meadow area. The southwestern section of Cook's Meadow

(Cook's Meadow A) has a higher percentage of fragmentation. The meadows with the least informal trailing are Bridalveil and Stoneman Meadows. Overall, when looking at all five indices collectively, the 2010 study found that the three meadows of greatest concern for informal trailing were El Capitan, Cook's (Section A), and Sentinel (also Section A) (NPS 2010a).

NPS is implementing a number of management programs to improve meadow and riparian condition along the Merced River within Yosemite Valley, including prescribed burning, treatment of non-native plant populations, and restoration of native plants. Although the meadows of Yosemite Valley have experienced a variety of human-related impacts over the past 150 years, the remaining meadows are still largely intact and are some of the most ecologically valuable meadows in the Sierra Nevada.

2.1.4.3 Preliminary Management Considerations

The preliminary management considerations associated with the Biological ORV in segment 2:

- Informal trailing is common in some Yosemite Valley meadows, with the highest levels found in El Capitan, Sentinel and Bridalveil Meadows.
- Trampling of soils and riparian vegetation in developed, high-use areas in east Yosemite Valley contributed to the loss of riparian vegetation cover, accelerated bank erosion in some reaches, and has likely contributed to the widening of the Merced River.
- Invasive plant species are common in Yosemite Valley meadows, with El Capitan, Stoneman and Sentinel Meadows having the highest levels of invasive plants.
- Conifer encroachment is widespread in the meadows of Yosemite Valley.

2.1.4 River Segment 4: El Portal

Valley oaks are a keystone species[6] in the habitats they dominate throughout California. Endemic to California, valley oak populations have experienced a widespread decline throughout the state (Bolsinger, 1988; Allen-Diaz et al. 2007). The California Native Plant Society considers the valley oak plant community, or *Quercus lobata*, as rare and threatened throughout its range (Sawyer et al. 2009). Yosemite is home to one valley oak population at the El Portal Administrative Site (**Figure 2.1-7**). This population is unique as it is geographically isolated from others in the Sierra Nevada foothills. The distribution of valley oak throughout the state is fragmented, due to extensive habitat destruction. This species still remains throughout much of the Seirra Nevada foothills below approximately 3,500 feet, along protected riparian corridors in the Central Valley, and within the hills and valleys of the coast ranges.

Photo 2.1-14: Valley Oaks (Yochim 2010)

[6] A keystone species is one whose impact on its community or ecosystem is disproportionately large relative to its abundance or total biomass.

The distribution of valley oak throughout California is restricted. In the 1980s and 1990s several efforts estimated the area of valley oak dominated habiat in the state and found a range of between 228,000 and 284,000 acres (Bolsinger, 1988; Pacific Meridian Resources, 1994; GAP data from Davis et al., 1998; California FRAP, 2002), about 0.22% - 0.27% of the total state area. In addition, there has been significant reduction in valley oak habitat due to conversion to agriculture, rangeland management, and urbanization (Bolsinger, 1988). Anderson (2005) estimated that urbanization and land conversion destroyed about 90% of the valley oak stands in California that existed prior to European contact. Researchers estimate that about 1.5% of original valley oak acreage in the Sacramento River System remains (Hehnke and Stone 1979). The steadily shrinking extent of valley oak habitat in the state is exacerbated by the fact that 80%-90% of the current distribution is under private ownership (Bolsinger, 1988; Ewing et al., 1988; Greenwood et al., 1993; Davis et al., 1998).

The valley oak population in El Portal would be characterized as a woodland, with canopy cover between 20% and 60%. Although located close to the Merced River, this population is not riparian in nature. Rather, the species persists here due to the deep alluvial soils where the trees can tap into relatively shallow ground water. As stated above in section 2.1.1.3, oak dominated habitats (either woodlands, forest, or savannas) are known to be used by a wide variety of wildlife species, making these systems one of the most diverse habitat type in California (Mayer et al., 1986) and one of the most diverse in North America. The presence of human development may decrease the value of this population to wildlife, though the extent to which this may occur is unknown.

The greatest challenge facing those who manage valley oak woodlands is the apparent lack of recruitment. This pattern has been described and researched extentively (e.g. Adams et al., 1987; Muick and Bartolome, 1987; Howard 1992). In a review of published studies on the demography and recruitment of California oak species, nearly all of the valley oak inventories found valley oak seedlings and saplings to be uncommon or absent (Tyler et al., 2006).

The nucleus of the El Portal valley oak population is along El Portal Road, located next to the existing fuel storage facility and El Portal Post Office. The population expands west in the floodplain to Middle Road and east in the river cutoff channel toward the gas station.[7] (Photo 2.1-14).

Condition at the Time of 1987 Designation

The valley oak population in El Portal is an outpost or disjunct population. Only one other small population exists several miles downstream. The next closest populations are much further away in the Midpines and Jerseydale area. Due to the extreme isolation of the El Portal population, it is possible the species was introduced or dispersed here by native Americans thousands of years ago, though this is only speculation. Regardless of its origin, the population in the El Portal administrative site is offerred some degree of protection, in contrast to the large majority of the species' distribution throughout Califonria where it has experienced great loss and usually occurs on private lands. Though within the NPS system, the population had sustained some impacts from rural development at the

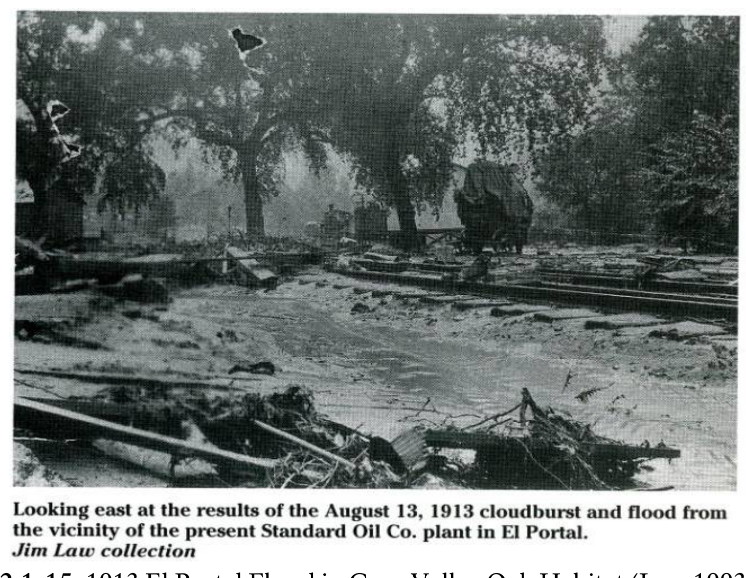
[7] Additional oaks radiate up the hillside, although botanists postulate that many oaks in drier uphill habitats may be hybrids between valley oaks and upland species. These upland oaks exhibit slight differences in morphological characteristics from the core population, such as slightly hairy terminal buds, but genetic studies have not been conducted to determine whether they are hybrids. These drier-habitat oaks are not part of the population that constitutes the ORV, as they are not strongly river-dependent or river-related.

time of designation. Development may have eliminated some individuals and the remaining ones may also experience some negative impacts, though the degree to which urbanization has impacted the individual trees and the population as a whole is unknown. Based on aerial photos and the age of existing structures, roughly 25% of potential valley oak habitat in the core floodplain of El Portal had been converted to structures and roads by the time of Merced Wild and Scenic River designation.

Another impact on the valley oak population at the time of designation was the loss of overbank flooding in the El Portal floodplain (Photo 2.1-15). Construction of the Yosemite Valley Railroad terminus in El Portal and the All Year Highway (Highway 140), and subsequent road repairs after regular flood events, effectively blocked flooding throughout the population, except during very large flood events. Flooding rejuvenates riparian systems, creating a dynamic system and depositing nutrients. However, it appears that most of the population is probabaly outside of the historic floodplain, so would not have been directly affected by flood events. However, groundwater connection and flow between the river and neighboring upland slopes may have been reduced due to the constriction of the river through El portal and the loss of area through which the river once meandered. This has probably reduced the access to groundwater somewhat, though to what extent is unknown.

Current Condition

One of the most useful tools for examining the condition and long-term viability of the El Portal valley oak population is the size distribution of existing individual trees (Tyler, et al. 2006). While the size of the oaks does not necessarily reflect their age, it is generally true that the largest individuals are the oldest, and the smallest are the youngest. The size of oaks is also generally a good predictor of their potential productivity (Tyler 2006). A healthy population would generally have higher numbers of smaller trees than larger trees.



Looking east at the results of the August 13, 1913 cloudburst and flood from the vicinity of the present Standard Oil Co. plant in El Portal.
Jim Law collection

Photo 2.1-15. 1913 El Portal Flood in Core Valley Oak Habitat (Law 1993)

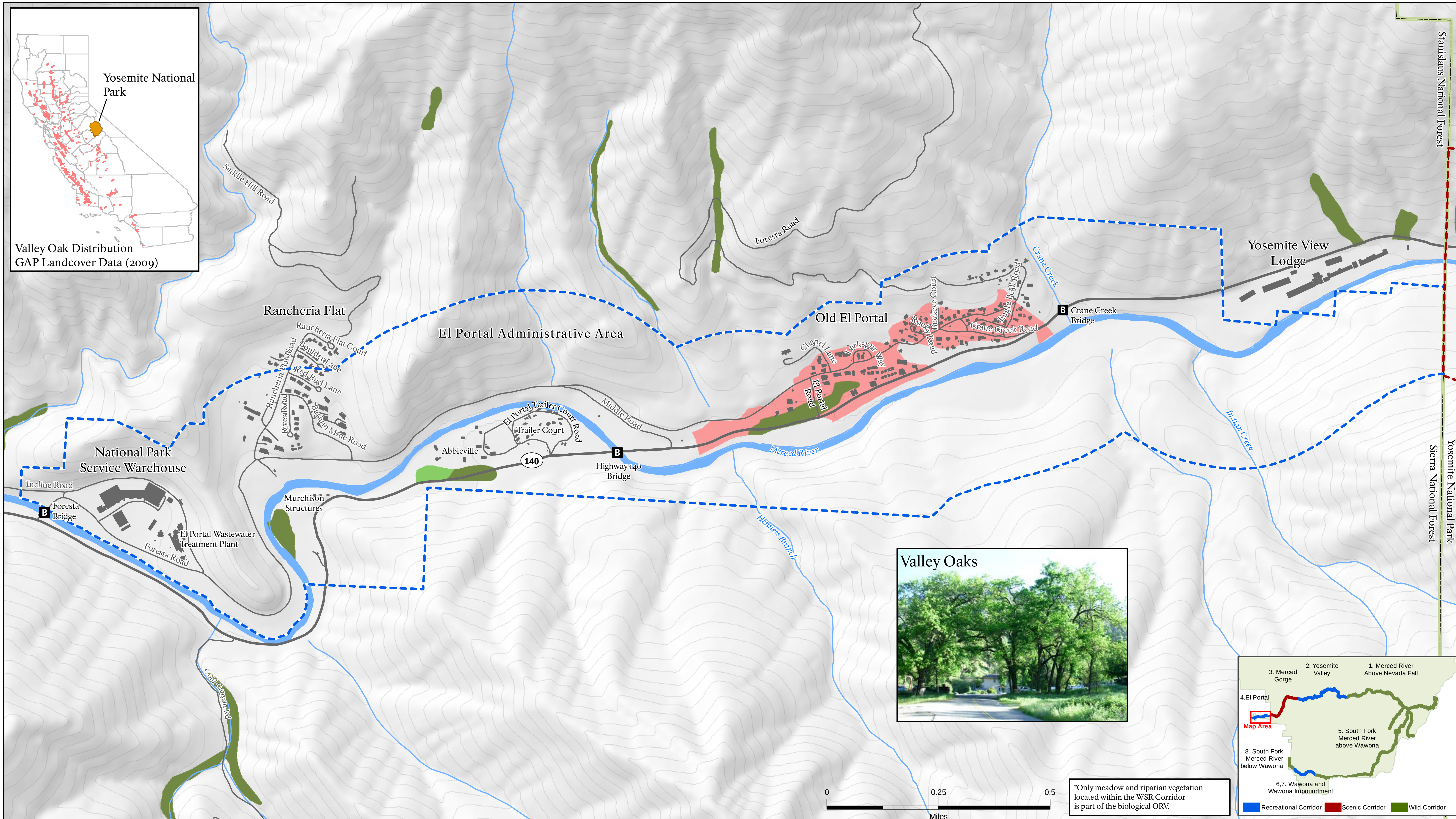


Figure 2.1-7
Biological ORV- River Segment 4. El Portal
Recreational WSR Corridor

Meadow/Riparian Vegetation
Data Source: NPS, 1997

- Recreational WSR Corridor Classification
- Scenic WSR Corridor Classification
- Building
- Yosemite National Park Boundary
- Meadow
- Riparian Vegetation
- Valley Oak Woodland Alliance
- Highway 140
- Road
- Stream/River
- 100' Contour Line
- B Road Bridge

National Park Service U.S. Department of the Interior

Produced by: **Yosemite Planning Division**

Projection:	North American Datum 1983, UTM Zone 10
Date:	6/2/11
File:	Figure 2.1-6

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The core El Portal valley oak population contains 38 individual trees with sizes ranging from small to very large trees (**Figure 2.1-8**)(Acree 2011b), though the population size in the EL Portal area including beyond the designaged ORV likely exceeds 100 individuals. Figure 2.1-8 shows the size class distribution of all 38 individuals in the ORV population greater than 1 centimeter diameter at breast height (dbh) and excludes all seedlings smaller than this size. The distribution of the El Portal valley oak population in a variety of size classes is of particular importance. As is typical of many plant species, an expected size class distribution follows a reverse-J curve, with incrementally greater numbers of individuals in the smaller size classes. The El Portal population demonstrastes this general expected distribution except for the smallest size class (1-20 cm dbh) where the numbers are muich lower than expected. An expected number in this size class would be approximately 15-20 individuals. Though the size of the population is small, an underrepresentation of trees in the smallest size class may indicate a pattern of low recruitment. Seedlings may not be surviving into the smallext adult size class at rates sufficient to maintain a stable population size..

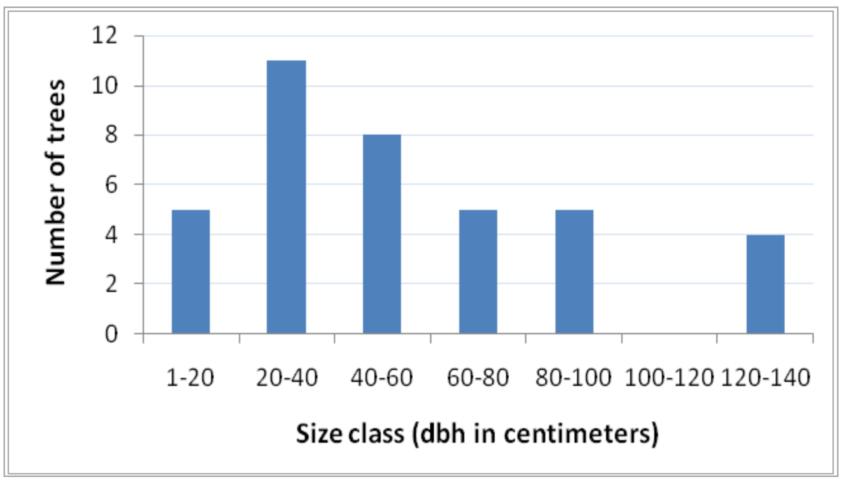

Figure 2.1-8
Size Class Distribution of Core Valley Oak Population

Several factors may be contributing to the apparent lack of recruitment into the smallest adult size class. These include rural development that limits the area available for the establishment of new valley oaks in potential habitat in El Portal. The dirt parking lots across from the Yosemite Conservancy office have expanded and cover expansive areas under the dripline of mature oaks. Repeated heavy disturbance in these areas is probably limiting new recruitment. In addition, some areas within the core population have been graded, and a few small oaks have been removed for different purposes such as the restoration of the railroad terminus. Another important factor that has received much attention is an overabundance of deer that overbrowse oak seedlings, leading to recruitment failure (Kuhn and Johnson, 2008; Ripple and Bestcha, 2008, Kuhn, 2010,) In the El Portal core area, the valley oak woodland understory is in an extensively degraded condition due to an invasion of non-native Himalayan blackberry (*Rubus armeniacus*). This thick understory is probably further limiting seedling and sapling recruitment (Williams et al., 2006). The loss of overbank flooding continues, although the root systems of mature oaks are likely still tapped in to the water table provided by the proximity to the Merced River, enhancing their growth and survival (Acree 2011b). Mature trees are sensitive to overwatering, pruning, grade changes, and asphalt covering the root system (Rossi 1980). Despite all these issues, the core population retains sufficient integrity as a vegetation community and is classified as valley oak woodland in Yosemite's parkwide vegetation map.

2.1.5.3 Preliminary Management Considerations

The preliminary management considerations associated with the Biological ORV in segment 4:

- Development in Old El Portal could affect El Portal valley oaks. Footnote: not all valley oaks in El Portal are ORVs, only those near the Post Office.
- Management of El Portal valley oaks should focus on ensuring sapling recruitment and long-term viability.

2.1.6 River Segments 7 and 8: Wawona and South Fork Merced River below Wawona

Sierra sweet bay is a small shrub endemic[8] to the Sierra Nevada and occurring at elevations from 1,000 to 5,000 feet. It is found in five Sierra Nevada counties, ranging from Yuba County in the north to Fresno County in the south (Calflora 2010; Consortium of California Herbaria 2010). In Yosemite National Park, Sierra sweet bay is found in two areas: 1) on sandbars and the lower banks of the South Fork Merced River downstream from Wawona and along Big Creek, a tributary to the South Fork, and 2) the South Fork of the Tuolumne River some miles upstream and downstream from the old Carlon Campground at the western park boundary (Colwell and Taylor 2011). Calflora, an online database of California flora, documents four observations in the park—two from Wawona Campground and two from Big Creek. Unpublished spatial data from the Yosemite National Park Geographic Information System document a larger population along an approximately two-mile reach of the South Fork in the vicinity of Wawona Campground (NPS 2010b) (Figure 2.1-9).

Photo 2.1-16: Sierra Sweet Bay Female Plant

Sierra sweet bay is a deciduous shrub with male and female flowers occurring on separate plants (Photo 2.1-16). The species ranges in height from approximately 3 to 6 feet and typically blooms from May to June. Sierra sweet bay is usually found on streambanks in pine forests or riparian habitat. Most sources characterize Sierra sweet bay as a plant that can grow in wetlands but is not restricted to them, although it prefers relatively moist environments (Calflora 2010; USDA 2010). The species has not been formally listed as rare, threatened, or endangered by the federal or state government, but is listed by the California Native Plant Society (2010) as a plant of limited distribution whose populations are not known to be under immediate threat (CNPS List 4.3). Sierra sweet bay is also listed as a sensitive species in Yosemite National Park (NPS 2002).

[8] Endemism is the ecological state of being unique to a particular geographic location. An organism endemic to a place or region is found only in that part of the world and nowhere else.

2.1.5.1. Condition at the Time of 1987 Designation

Information regarding the status of Sierra sweet bay populations in Yosemite at the time of the 1987 designation is scarce. None of the herbarium accession records contain pertinent information, such as the number of plants observed or the condition of plants and/or habitat. The species is listed in the California Natural Diversity Database, but no observations are documented in the database. In 1980, Yosemite National Park staff described the species as rare in the park since it was known to be present in only a few locations. At the same time, however, it was believed that it should not be considered threatened or endangered since the species was of sufficiently widespread distribution outside the park and occurred in minimally impacted areas (NPS 1980).

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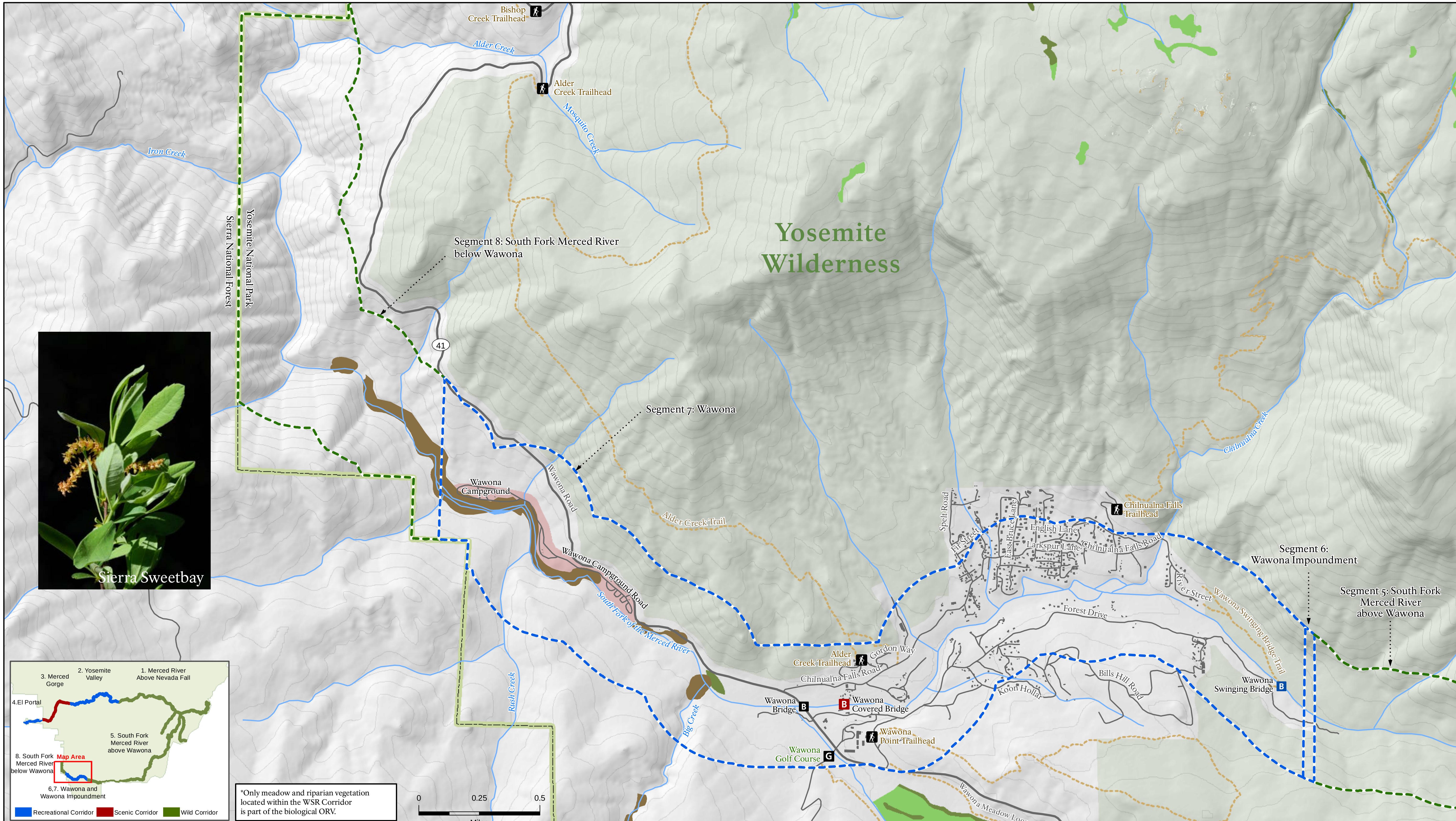

Figure 2.1-9
Biological ORV - River Segments 7 and 8.
Wawona and the South Fork Merced River Below Wawona
Recreational WSR Corridor

Meadow/Riparian Vegetation
Data Source: NPS, 1997

- Recreational WSR Corridor Classification
- Wild WSR Corridor Classification
- Campground
- Building
- Meadow
- Riparian Vegetation
- Myrica hartwegii (2010 distribution)
- Yosemite National Park Boundary
- Trailhead
- Road bridge
- Footbridge
- Covered Bridge
- Golfcourse
- Highway 41
- Road
- Stream/River
- Trail
- 100' Contour Line

National Park Service U.S. Department of the Interior

Produced by: **Yosemite Planning Division**

Projection:	North American Datum 1983, UTM Zone 10
Date:	6/2/11
File:	Figure 2.1-8

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A recently completed study by NPS investigated historic reports of Sierra sweet bay growing along the main stem of the Merced River below Yosemite Valley (Colwell and Taylor 2011). This study surveyed for the plant from the lower end of Yosemite Valley to El Portal but did not find this species. It is unclear if the species ever occurred on this reach of the river or if it has been extirpated from this section. The study found that this segment of the river did not provide preferred habitat for Sierra sweet bay (due to its high volume and fluctuating water levels).

2.1.5.2 Current Condition

Within the river corridor, the Sierra sweet bay population follows Big Creek, a tributary to the South Fork Merced River, fairly continuously from Fish Camp into the park near the south entrance and down to the junction of Big Creek with the South Fork Merced River. Sierra sweet bay is absent upstream on the South Fork from the mouth of Big Creek to the wilderness boundary above Wawona. However, Sierra sweet bay is found on both sides of the South Fork from the mouth of Big Creek downstream to below the Wawona Campground. The species is very closely associated with the river channel, occurring at the river's normal high-water mark to the five-year flood line.

Surveys of Sierra sweet bay in the vicinity of the Wawona Campground revealed a low level of affects from human impact. The most frequent and ongoing impact is foot traffic. Social trails are worn through its habitat along the river, and sandbars attract distributed foot traffic (Colwell and Taylor 2011).

2.1.5.3 Preliminary Management Considerations

The preliminary management consideration associated with the Biological ORV in segments 7 and 8:

- Visitor use may affect the riparian vegetation of the South Fork by compacting soils, reducing vegetative cover, altering streambanks, and inducing erosion, thereby impacting the Sierra sweet bay population at Wawona Campground.

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