Attachment C

# CONSERVATION PLANNING CONSIDERATIONS

## YOLO COUNTY PARKS MASTER PLAN

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There has been a general recognition during the process of developing the Parks Master Plan that the Yolo County Parks units should serve a role in protecting or conserving regional biological diversity. Appropriate conservation planning for the parks requires that the Parks Master Plan consider issues that transcend the scale of individual park units, and in fact that the Parks Master Plan consider conservation planning at regional scales that are larger than the County as a whole.

Yolo County is currently pursuing an update of many of its General Plan elements, and at the same time it (jointly with the cities in the County) is pursuing the development of a Natural Community Conservation Plan/Habitat Conservation Plan (NCCP). Presumably the plan development processes for these two efforts will be pursued collaboratively. It is reasonable that some of the County Parks units may be called upon to provide important habitat elements for the NCCP and the County's General Plan focus on Conservation. The considerations in this section are important in this context.

## C-1 Biological Diversity at Regional Scales

A basic conservation question pertains to the natural biological diversity patterns in the landscape: in a general sense, where in the County are the natural highs and lows of species richness, or of habitat structural diversity, or of other measures of biological richness? One answer to this question would be suggested by the occurrences of "sensitive" species in Yolo County; however, there is reason to believe that observer sampling patterns for such "heritage" species have not been particularly thorough, so that the observed occurrences of "heritage" species may not reflect the actual distribution patterns or abundances of those species in Yolo County (that is, knowledge about the distributions of those species may be incomplete). In addition, while uncommon species are an important element of the native biodiversity in Yolo County, such "heritage" data are not an unbiased estimate of the distribution of most plant and wildlife species. For valid ecological reasons, the vast majority of species are <u>not</u> "uncommon" throughout most of their ecological distributions. Biodiversity protection is increasingly recognized as requiring a second, complementary approach to identifying and protecting species and their habitats, an approach that relies on maintaining the ecological patterns that support a broad range of plant and wildlife

species, in addition to an approach that addresses measures of "rarity." [1] Applying this approach begins with a consideration of existing patterns of species commonness; that is, this approach begins by looking at the "normal" distribution of abundances of species.

In 2003 the California Department of Fish and Game (CDFG) published a summary of biological diversity information for the State of California that illuminates the relative importance of various parts of the state for biodiversity (CDFG 2003), based on an abstraction of data compiled by the Jepson Herbarium, the California Native Plant Society, CDFG's Natural Diversity Data Base, and the Wildlife Habitat Relationships database regarding the geographical occurrences of plants and wildlife. Selected results for Yolo County are abstracted in the Table C-1.

**Table C-1. Comparison of Biological Diversity Elements between Western Yolo County and Eastern Yolo County. [A]**

| Group | Blue Ridge/Rocky Ridge and Terraces | Bajada and Basins |
|---|---|---|
| Plant Species | 1409 - 1705 | 719-838 |
| Amphibian Species | 11 - 17 | 4 - 6 |
| Reptile Species | 19 - 25 | 6 - 11 |
| Bird Species (Summer) | 109 - 127 | 91 - 108 |
| Bird Species (Winter) | 118 - 143 | 144 - 187 |
| Mammal Species | 40 - 47 | 22 - 39 |

Notes

A It is unstated in CDFG (2003) whether these data include species associated with the riparian corridors immediately adjacent to the Sacramento River, Cache Creek, Putah Creek, and other streams in Yolo County. For reasons summarized below this assessment presumes that riparian-associated species are aggregated with non-riparian species in the regional CDFG data.

The patterns of species occurrence data were aggregated by CDFG according to the report authors' interpretations of landscape-level biological processes in California; the authors' interpretations reflect their perceptions of natural landforms and biogeographic regions in the state, including Yolo County. The center column in Table C-1 reflects the species numbers occurring in the western mountain and foothill regions in Yolo County, including the Blue Ridge/Rocky Ridge crest, the front ranges farther east in the County, and the Tehama Formation terraces and the Dunnigan Hills. The right column reflects the species numbers occurring in the flatter, agriculturally dense lands east of the mountains, including the bajada[2] east of the

1 Landscape-scale conservation planning is focused on maintaining ecosystem processes, or on maintaining ecological functions at a landscape scale. An underlying presumption in conservation biology is that maintaining the ecological processes that support the majority of species can prevent their becoming "rare" and thus a potential subject for the laws that protect "heritage" species. Maintaining ecosystem functions is also a key requirement for maintaining viable populations of the "heritage" species in habitat areas set aside for their protection. See Meffe and Carroll 1994 and Noss and others 1997 for additional considerations.

2 A "bajada" is a coalesced alluvial fan at the base of a mountain range. For Yolo County, the

foothills as well as the wetland basins and the Yolo Bypass near the Sacramento River.[3]

The basic species richness in the western mountains is substantially greater, across taxa, than the species richness in the eastern part of the County. The primary exception occurs with wintering bird species, which are considered further below. Except for birds, the observed species richness in the western foothills and mountains is two or three times the species richness in the eastern basins. This result is quite important from a regional conservation planning perspective; it suggests strongly that conservation planning in Yolo County (and in the Central Valley and in the Coast Range) should be focused preferentially on these mountainous western regions, because that is where the majority of the native species richness occurs.

There is a biologically coherent explanation for this pattern. Western Yolo County is included in the CDFG (2003) maps for oak woodlands and chaparral (the entire mountainous west) and native grasslands (the Dunnigan Hills), but none of these important natural community or habitat types is mapped in the eastern part of the County. Oak woodlands are widely identified as being among the most important habitat types for wildlife in California (see, for instance, CalPIF 2002), and chaparral and grassland habitats are also considered to be important in preserving the state's native flora and fauna (CalPIF 2000, 2004). Two of the generally accepted relationships from the past 50 years of ecological studies indicate that species richness is positively correlated with both the range of habitat conditions available and habitat structural complexity (Mayer and Laudenslayer 1988, many others), although a complete explication of these relationships is beyond the scope of work for this project. The structural complexity of the woodland and chaparral habitats in the western part of the County, as well as the range of habitat conditions there, are substantially greater than in the eastern two-thirds of the County.

The "flatlands" in the central and eastern parts of the County are not without important habitat values. These lands include mapped vernal pool complexes, for example, which are absent from the mountainous areas to the west [interestingly, CDFG mapped vernal pools north of Winters and west of Woodland, in an area identified in JSA (1996) as having potential natural vegetation that included seasonal wetlands]. The wetland areas in the eastern part of the County, in particular, also provide important habitat values for wintering waterfowl, shorebirds, and cranes, part of a regionally significant wintertime concentration area for wetland-related birds (CalFed 2000).

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bajada is the interwoven alluvial fans of Cache Creek, Cottonwood Creek, Chickahominy Slough, and Putah Creek, as well as the sediment deltas of smaller streams at the eastern base of the Coast Range. See JSA (1996) for mapping results that confirm this determination.

3 The Atlas is ambiguous about the inclusion of species associated with riparian corridors along major rivers and streams; the presence of riparian habitats can substantially increase the species richness present in an area with respect to the richness that would be present without the riparian habitat. Presumably riparian-associated species are included in the diversities identified in the table above. The association of riparian-related bird species with habitats that were historically more common in the eastern part of Yolo County appears to be a partial exception to the general pattern described by these data, as discussed further in this section.

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One important pattern that does not fit very well within the contrast set up in Table C-1 is the pattern of native fish diversity associated with watercourses. The Sacramento River and the east-west oriented Cache Creek watershed were mapped by CDFG (2003) as regionally important native fish habitats (with 15–21 species and 11–14 species, respectively). Moyle (1999; also see the regional habitat-based discussion in Moyle 1996) described the Cache Creek basin as "including most of the fish that inhabit Central California;" the basin lacks large impoundments between Clear Lake and the Sacramento Delta, which may have allowed many native fish populations in the basin to persist, even given the hydrological alterations associated with agricultural water uses in Yolo County. From a conservation perspective, the native fish species richness in the Cache Creek basin is one of the more significant region-scale facts about Yolo County; no other tributary stream basin in the Central Valley shows such a high diversity of native fish species.

The CDFG (2003) map portraying riparian habitat areas includes narrow corridors along the Sacramento River, Putah Creek, and Cache Creek; the map also includes smaller areas of mapped riparian habitat along the eastern margins of the Yolo County foothills at the inland edge of the Coast Range, including Enos Creek, Chickahominy Slough, Cottonwood Creek, Buckeye Creek, and other foothill streams in the western part of the County. The map does not include the existing narrow riparian corridors along Willow Slough, Dry Slough, and other creeks in the central and eastern parts of the County. All of this riparian habitat is classified by the Department as "Valley Foothill Riparian," which is the habitat type designation used in the CWHR classification (CDFG 2002) for all Central Valley riparian habitats. In a sense, while this designation indicates the general importance of this habitat type, it does not adequately indicate whether the habitat values vary geographically (which they do, substantially). CDFG's (2003) existing mapping indicates that this habitat type is distributed throughout Yolo County, and that its value as habitat is also broadly distributed throughout the County.

Riparian habitat is well established as a significant habitat for wildlife species of many varieties:

> "More than 225 species of birds, mammals, reptiles, and amphibians depend on California's riparian habitats. Riparian ecosystems harbor the most diverse bird communities in the arid and semiarid portions of the western United States (references omitted). Riparian vegetation is critical to the quality of in-stream habitat and aids significantly in maintaining aquatic life by providing shade, food, and nutrients that form the basis of the food chain (references omitted). Riparian vegetation also supplies in-stream habitat when downed trees and willow mats scour pools and form logjams important for fish, amphibians, and aquatic insects. The National Research Council (2002) concluded that riparian areas perform a disproportionate number of biological and physical functions on a unit area basis and that the restoration of riparian function along America's waterbodies should be a national goal.
>
> "Riparian vegetation in California makes up less than 0.5% of the total land area, an estimated 145,000 hectares (reference omitted). Yet, studies of riparian habitats indicate that they are important to ecosystem integrity and function across landscapes (references omitted). Consequently, they may also be the most important habitat for landbird species in California (reference omitted). Despite its importance, riparian

habitat has been decimated over the past 150 years. Today, depending on bioregion, riparian habitat covers 2% to 15% of its historic range in California (references omitted).

"Due to their biological wealth and severe degradation, riparian areas are the most critical habitat for conservation of Neotropical migrants and resident birds in the West (references omitted). California's riparian habitat provides important breeding and over wintering grounds, migration stopover areas, and corridors for dispersal (references omitted). The loss of riparian habitats may be the most important cause of population decline among landbird species in western North America (reference omitted)." – RHJV (2004)

It should be noted with respect to bird use of riparian habitats that there is a well known change in use by "migrant" species between the breeding season in spring and summer and in the winter. Most of the "Neotropical migrants" that are present during the breeding season are absent in the winter, and a different complement of "winter migrant" bird species is encountered then (in addition to resident species that are present in all seasons). Studies in the Central Valley (e.g., Hehnke and Stone 1979, Motroni 1979, Gaines 1980) have indicated that the absolute numbers of wintering riparian birds may equal or even exceed the numbers present in the breeding season. The combination of this seasonal exchange in the avifaunal use of riparian habitats and the wintertime appearance of shorebirds and waterfowl in wetlands in the Yolo Bypass appears likely to be the underlying ecological reason for the relative importance of the central and eastern parts of Yolo County for wintering birds shown in Table C-1 above.

## C-2 Landscape-Scale Conservation Planning

While many conservation programs (including the NCCP process now underway in Yolo County) have focused to a significant degree on sensitive species, conservation biologists have developed an understanding of certain potential (and real) disadvantages in such approaches, which are identified in a general sense as "heritage programs" (including the CNPS and CNDDB database programs). Heritage programs have inherent limitations for biodiversity planning: they are often focused on rarity and on small, mappable locations rather than large occurrence areas. This focus cannot adequately deal with elements that are not limited to small, mappable locations, such as habitat areas for large carnivores, or other elements that have large-area requirements (Noss and Cooperrider 1994). Also, as noted by Noss and Cooperrider, such programs work through "successive approximations," which supposes that surveys are being conducted in various parts of the landscape over time, so that, eventually, the entire landscape will get adequate coverage. The intermittent coverage of sensitive species in the USGS quadrangles that include the Yolo County park units suggests that the limitation of the "heritage program" approach described by Noss and Cooperrider is operating in Yolo County.

The alternative to the heritage planning approach is a "landscape-level" conservation planning approach. This approach has evolved from a relatively recent scientific innovation called "landscape ecology" (Forman and Godron 1986, Forman 1997), which addresses "landscape-scale" ecological processes. Included among these would be questions concerning the conservation of environmental resources that are only noticeable at scales larger than small, mappable occurrences, such as the use of the landscape by mountain lions or bears, or the sub-population interactions of patchily

distributed sensitive plant or butterfly species. Landscape ecology is concerned with the *spatial distribution of the ecological elements* that have conservation interest, as well as with the maintenance of *spatially based ecological processes* that support the elements of conservation interest. While a complete explication of the application of landscape ecology to conservation in Yolo County is beyond the scope of this report, the elements of a possible landscape-scale application to Yolo County conservation planning can be summarized relatively easily.

The basic element in a landscape-scale conservation approach is a "network" of land elements that are managed for conservation purposes. The central features of these conservation networks are "core areas," generally known as "reserves," which are often areas with high value in protecting biodiversity; such areas might demonstrate locally high densities of several sensitive species, or they might be areas with the highest regional densities of a variety of species, such as the mountains in western Yolo County. The core reserve areas are buffered from adverse effects by having additional areas adjacent to the reserves in which land uses may be authorized that have more intense effects on the protected resources; these areas are often identified in conservation plans as "multiple-use areas," or sometimes as "buffer areas." The landscape generally also includes areas that are not protected for biodiversity-maintenance purposes; these areas are often identified as the "matrix" in which the conservation network is embedded.

Conservation planning at a landscape level needs both "reserves" and "multiple-use areas." These areas work in concert in a landscape perspective, with the reserve areas providing habitat and the multiple-use areas providing buffering as well as other uses of the land. A widely known landscape-scale conservation model begins with "Multiple Use Modules," or MUMs (Noss and Harris 1986). This model uses core reserves to encompass "biodiversity hotspots." Core areas are linked by corridors. Core areas and linkages are protected with layers of multiple-use buffers in which the intensity of potentially damaging land uses increases with distance away from the core, and protection of ecological processes decreases with distance away from the core. The buffers are embedded in a "matrix" of general-use lands (Figure C-1).

"Core reserve" selection is an important step in designing landscape-level conservation networks. Noss and Cooperrider (1994) offered the following "empirical generalizations for reserve design:"

"1. Species well distributed across their native range are less susceptible to extinction than are species confined to small portions of their range.

"2. Large blocks of habitat containing large populations of a target species are superior to small blocks of habitat containing small populations.

"3. Blocks of habitat close together are better than blocks far apart.

"4. Habitat in continuous blocks is better than fragmented habitat.

"5. Interconnected blocks of habitat are better than isolated blocks, and dispersing individuals travel more easily through habitat resembling that preferred by the species in question.

"6. Blocks of habitat that are roadless or otherwise inaccessible to humans are better than roaded and accessible habitat blocks."

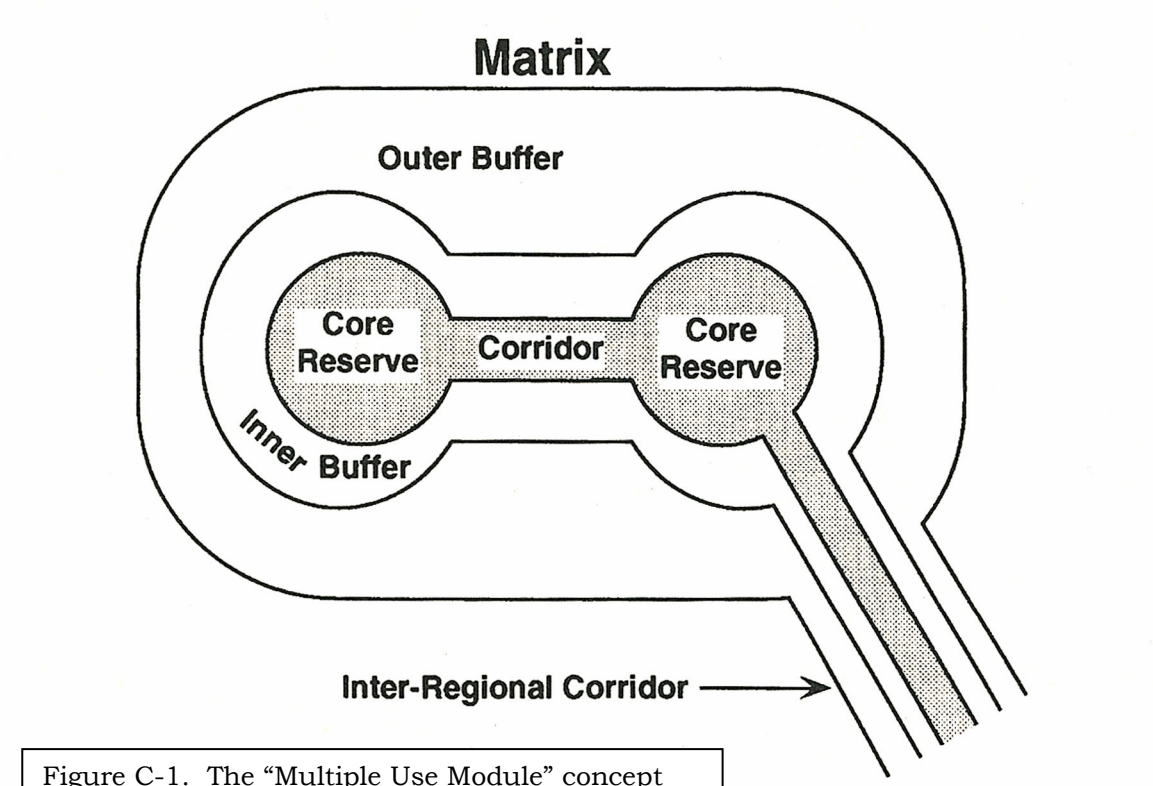


Figure C-1. The "Multiple Use Module" concept pioneered by Reed Noss and Larry Harris for building conservation networks in landscapes that have areas with high conservation value in a "working landscape matrix." See text for additional discussion and Noss and Harris (1986) for a complete explanation.

An important concept in the landscape-level approach is "connectivity," which involves the ability of the landscape to support the movement and interchange of individuals among population segments of species of conservation interest. In some ways this is more a function of matrix permeability than it is of discrete corridors or linkages, although conservation plans usually include corridors or linkages. Linkages, or "connectivity," on a landscape scale is an important conservation topic, since linkages may be associated with adverse effects (e.g., because of enhanced disease transmission) as well as positive effects. Part of the importance of considering landscape linkages is that it leads to identifying natural connections across landscape elements.

At a conference held in San Diego, CA, in 2000, conservation biologists from around the state identified known or expected biological or conservation linkages in areas in which they worked.[4] An excerpt from the resulting statewide linkages map is shown in Figure C-2 (on following page). The general opinion among conservation biologists was (and remains) that Putah Creek and Cache Creek are important east-west landscape linkages. A north-south linkage corridor was identified along the Blue Ridge/Rocky

4 The resulting publication, with maps that can be downloaded as JPG files, is located at URL: http://www.calwild.org/resources/pubs/linkages/.

Ridge crest. An additional north-south linkage was identified in the lower foothills/terraces, at the margin of the Central Valley flatlands.

The linkages illustrated in Figure C-2 serve two broad purposes. First, the linkages were selected, in part, to interconnect relatively large areas of publicly owned land, such as the BLM lands in western Yolo County. The second purpose was to illustrate and support migration routes among important wildland habitats regardless of ownership. The mountainous regions of western Yolo County were recognized as significant wildland habitats which also served to link similar habitats to the north and south. Putah Creek and Cache Creek were recognized as important connections from the Coast Range to the Sacramento River corridor, and additional linkages were identified between the Sacramento River and the Sierra Nevada foothills. In any landscape-level conservation model for Yolo County these linkages would need serious consideration, together with a designated corridor along the Sacramento River.

The "linkages" provided by riparian habitat corridors along major streams are considered by many landscape ecologists to be among the most important elements in landscape-level conservation plans. For example, a major USDA Forest Service study addressing wildlife habitat values in the Blue Mountains of Oregon (Thomas 1979) included the following conclusions: "riparian zones are the most critical wildlife habitats in the Blue Mountains;" "riparian zones are the most critical zones for multiple use planning in the Blue Mountains;" and "riparian habitat alterations will affect wildlife far more than indicated by the proportion of the total area." The Blue Mountains report noted that 285 of the 378 terrestrial wildlife species (75 percent) in the Blue Mountains either depended on riparian zones or used them more than other habitats. Similar results have been reported from numerous other studies of riparian ecosystems.

Riparian ecosystems are sensitive to the hydrological dynamics of the adjacent streams or rivers, because riparian habitat is functionally affected by inadequate streamflow (Winter and others 1998, NRC 2002). Landscape-level conservation plans typically include considerations about watershed management [such as the Willow Slough Watershed IRMP (JSA 1996)]; in Yolo County such a plan would also need to include water-supply considerations, inasmuch as both Cache Creek and Putah Creek are hydrologically affected by water-supply management requirements. For the Cache Creek linkage corridor, the linkage elements in the conservation plan would also need to address other hydrologically focused questions, such as floodplain management.

The size of the area that is necessary for landscape-level conservation planning is an important consideration for any planning effort, including Yolo County's Parks Master Plan. The minimum scale for landscape-level conservation planning is conceptually related to "the smallest area in which all of the processes that affect the landscape recur" with a frequency that maintains the elements; this is functionally the "minimum dynamic area" of Pickett and Thompson (1978) and Pickett and White (1985), which includes disturbance regimes (such as fire) as well as the landscape areas through which matter and energy cycle (such as watersheds). Typically the area that is needed is much larger than the average disturbance patch; an appropriate focus of the landscape-scale conservation plan is to perpetuate the natural disturbance regime (Baker 1992), and the minimum dynamic area may be larger than the 40,000± acres that burned in the Rumsey Fire in October 2004.

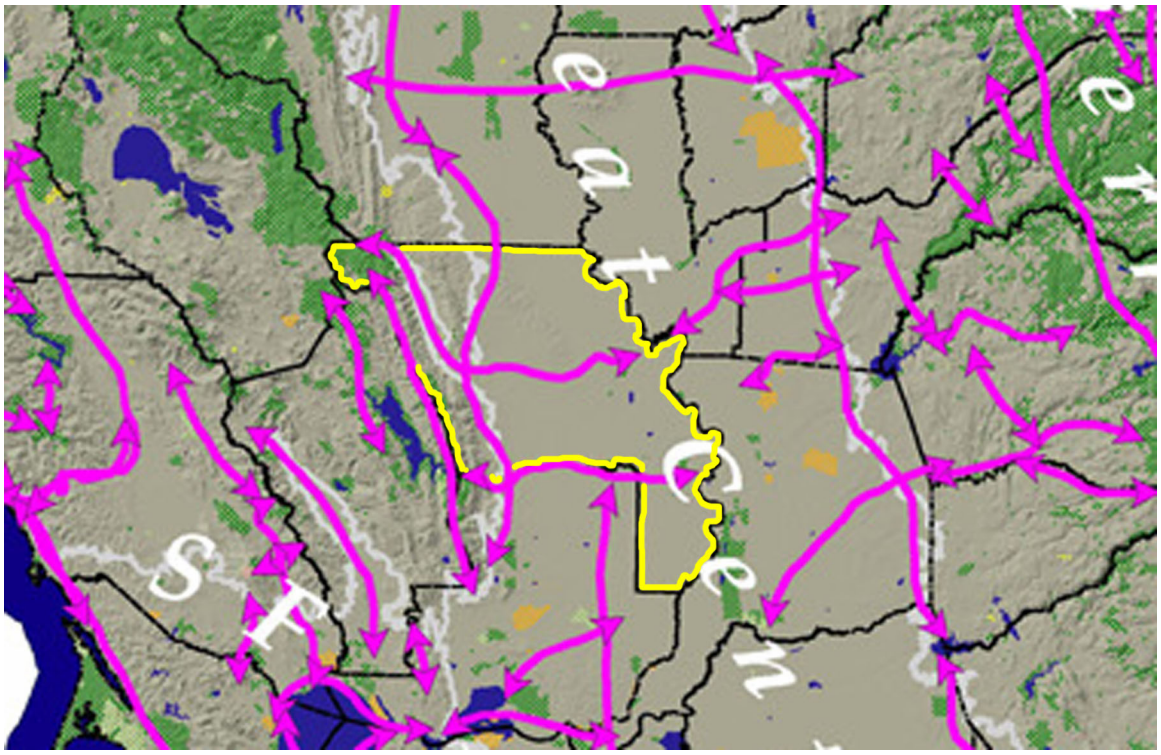

Figure C-2. This excerpt from the "Statewide Linkages Map" shows Yolo County (yellow boundary) and the landscape-scale linkages (pink arrows) that exist in and near the county. Mapped county linkages include Putah Creek, Cache Creek, the Blue Ridge / Rocky Ridge axis, and a foothill woodland corridor. An additional corridor (not mapped) is the Sacramento River and its riparian corridor.

In landscape-level conservation planning, suitable management elements for the core reserves and the multiple-use buffer areas must be identified that accomplish the plan's goals (often some consideration will be given, as well, to "matrix" areas near the buffers). Table C-2 provides an example of a set of management guidelines (modified from Noss 1993) for a conceptual conservation plan that could, for example, be located in the mountainous region in western Yolo County. Core reserve areas might include public lands in the Berryessa Peak region. Buffer lands could include the surrounding ridges and foothills. The landscape matrix, for this plan, might include the agricultural lands in the bajada region and farther east.

**Table C-2. Landscape-Level Conservation Plan Guidelines for Yolo County.** [A]

| **Core Reserves:** |
|---|
| No new road construction or reconstruction. |
| Close all pre-existing roads other than major highways; restore roadbeds to prior conditions. Reduce overall road density under 0.5 miles road / square mile of reserve. |
| No off-highway vehicles (including bicycles). |
| No horses (they introduce exotic species). |

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| No grazing or agricultural activities. |
| No logging or other commercial extraction of plants or biological materials. |
| No commercial extraction of other natural objects. |
| No mineral or energy leasing. |
| Eliminate exotic species. |
| Limit fire suppression. |
| Recreational activities such as hiking, primitive camping, nature study, environmental education, non-motorized restoration of degraded areas, and non-manipulative research are encouraged. |
| Eliminate inholdings. |
| **Multiple-use Buffer:** |
| Limit new road construction to those consistent with protecting core reserve environmental resource values. Reduce or maintain overall road density under 1.0 miles road / square mile of buffer land. |
| No motorized off-highway vehicles on public land. |
| Protect environmentally sensitive resources, particularly riparian areas, oak woodlands, and habitats for sensitive species. |
| Vegetation manipulation, including grazing, logging, or other extractive activities, must be consistent with restoration and management goals for protecting core reserve environmental resource values. |
| Restore degraded areas. |
| Eliminate exotic species. |
| Manage fire suppression to be consistent with protecting core reserve environmental resource values. |
| Recreational activities, including hiking, low-impact camping, nature study, environmental education, non-motorized restoration of degraded areas, and non-manipulative research are encouraged. |
| Eliminate inholdings, or establish easement restraints over inholdings. |
| **Matrix Near Buffer:** |
| Require sustainable resource management approaches, including those for agricultural and timberland management. |
| Protect environmentally sensitive resources, particularly riparian areas, oak woodlands, and habitats for sensitive species. |
| Restore degraded areas. |
| Eliminate exotic species. |

A Modified from Noss (1993).

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