Appendix F

Spatial Summary for Methyl Parathion Uses

I. Labeled Uses for Methyl Parathion

The following use list is derived from label use information. It is used as a basis for the spatial analysis of methyl parathion. Uses of methyl parathion have been grouped into three categories: agricultural crops (represented by the cultivated crops layer), orchards (represented by the orchards and vineyards layer), and rangeland (represented by the pasture and hay layer.

Table 1. Use list from labels

Category	Use
Cultivated Crops	Barley, beans (dry), cotton, cotton (field, sweet, and pop), peas (dry), potatoes, rapeseed/canola, rice, oats, onions, sugarbeets, sunflowers, wheat
Orchards/Vineyards	Walnut
Pasture/Hay	Grass (forage, pasture, hay)

II. Initial Area of Concern

After determining which uses will be assessed from label information, an evaluation of the potential 'footprint' of use patterns is determined. The 'footprint' includes all areas within the state of California where the pesticide could be applied. The footprint of potential use represents the chemical's initial area of concern, and is typically based on available land cover data. Uses that are not represented through available land cover data are not displayed spatially, as their extent cannot be defined using existing categories of land cover classes (*e.g.* dumpsters).

A. Land Cover

Base mapping land cover layers for the initial area of concern analysis were obtained from the National Land Cover Dataset (NLCD 2001) for the majority of land use types and the California GAP data (1998) for the orchard and vineyard uses. The NLCD was released as a nationally consistent, regionally indexed dataset in January 2007. The GAP dataset is from the Biogeography Lab from UCLA-Santa Barbara. These raster files were converted to vector using simplification and majority filter routines, and used in the analysis. The rights-of-way land cover layer was derived by combining road and rail information from TeleAtlas (2006) with U.S. Department of Transportation's National Pipeline Dataset (1999). Table 2 shows the land-cover sources used for the initial area of concern analysis.

B. Land Cover by County

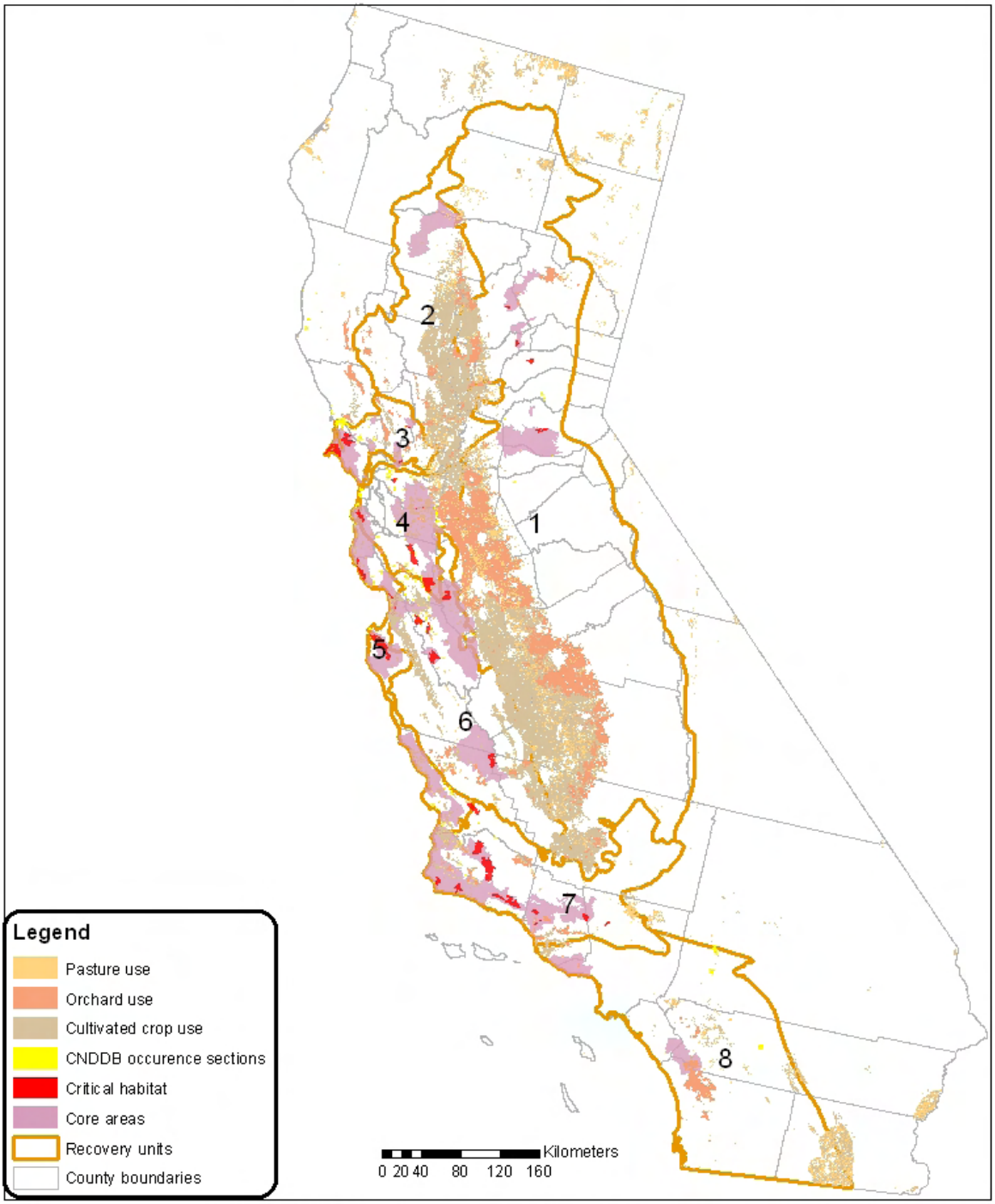
U.S. Department of Agriculture's National Agriculture Statistics Service census dataset (NASS 2002) was used to determine whether a crop was grown in a particular county. This census dataset provides survey information over five years on agricultural practices and is used mainly for cultivated or agriculture crops. For certain land cover types (cultivated crops, pasture/hay, and orchards/vineyards), chemical labeled uses were related to NASS uses, with allowance for multiple relates; an agriculture use match would result in a mapped area for one or more counties. For uses within other land cover datasets, the use is assumed to occur in every county where that particular land-cover occurs within California (*i.e.* a 'forestry' labeled use is assumed

to potentially occur in all California counties where NLCD indicates there is forest land cover). Table 2 lists the land cover classes that are used in conjunction with NASS data to determine the potential for chemical use at the county level.

Table 2. Land cover data sources.

Land Cover Data Sources			
Layer name	**Base source**	**Description**	**NASS**
Cultivated Crops	NLCD	Grid code 82: Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.	Yes
Developed, High Intensity	NLCD	Grid code 24: Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.	No
Developed, Low Intensity	NLCD	Grid code 22: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.	No
Developed, Medium Intensity	NLCD	Grid code 23: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.	No
Developed, Open Space	NLCD	Grid code 21: Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	No
Forest	NLCD	Grid codes 41,42,43: Deciduous, evergreen and mixed. Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover.	No
Open Water	NLCD	Grid code 11: All areas of open water, generally with less than 25% cover of vegetation or soil.	No
Orchards and vineyards	CA GAP	Grid codes 11210, 11211 and 11212. This is the only CA GAP reference.	Yes
Pasture/Hay	NLCD	Grid code 81: Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.	Yes
Wetlands	NLCD	Grid codes 90, 95: Woody wetlands and emergent herbaceous.	No
Turf	NLCD	A derived NLCD class based on developed classes and the impervious surface layer with corrections applied.	No
Rights-of-way	US DOT; TeleAtlas	A derived class using road, rail, and pipeline coverages.	No

Methyl parathion - Initial Area of Concern



Compiled from California County boundaries (ESRI, 2002), USDA National Agriculture Statistical Service (NASS, 2002) Gap Analysis Program Orchard/ Vineyard Landcover (GAP) National Land Cover Database (NLCD) (MRLC, 2001)

Map created by US Environmental Protection Agency, Office of Pesticides Programs, Environmental Fate and Effects Division. Projection: Albers Equal Area Conic USGS, North American Datum of 1983 (NAD 1983).

Produced: 1/28/2008

C. Initial Stream Reaches

In addition to the land cover classes described above, the initial area of concern includes the stream segments found within those land cover areas. The stream segments are obtained from the NHDPlus dataset. For each stream reach in the hydrography network, the data provide a tally of the total area in each NLCD land cover class for the upstream cumulative area contributing to the given stream reach. Using the cumulative land cover data provided by the NHDPlus (http://www.horizon-systems.com/nhdplus/), an aggregated use class is created based on the classes listed in Table 1. A cumulative percent cropped area (PCA) is calculated for each stream reach based on the aggregate use class (divided by the total upstream contribution area).

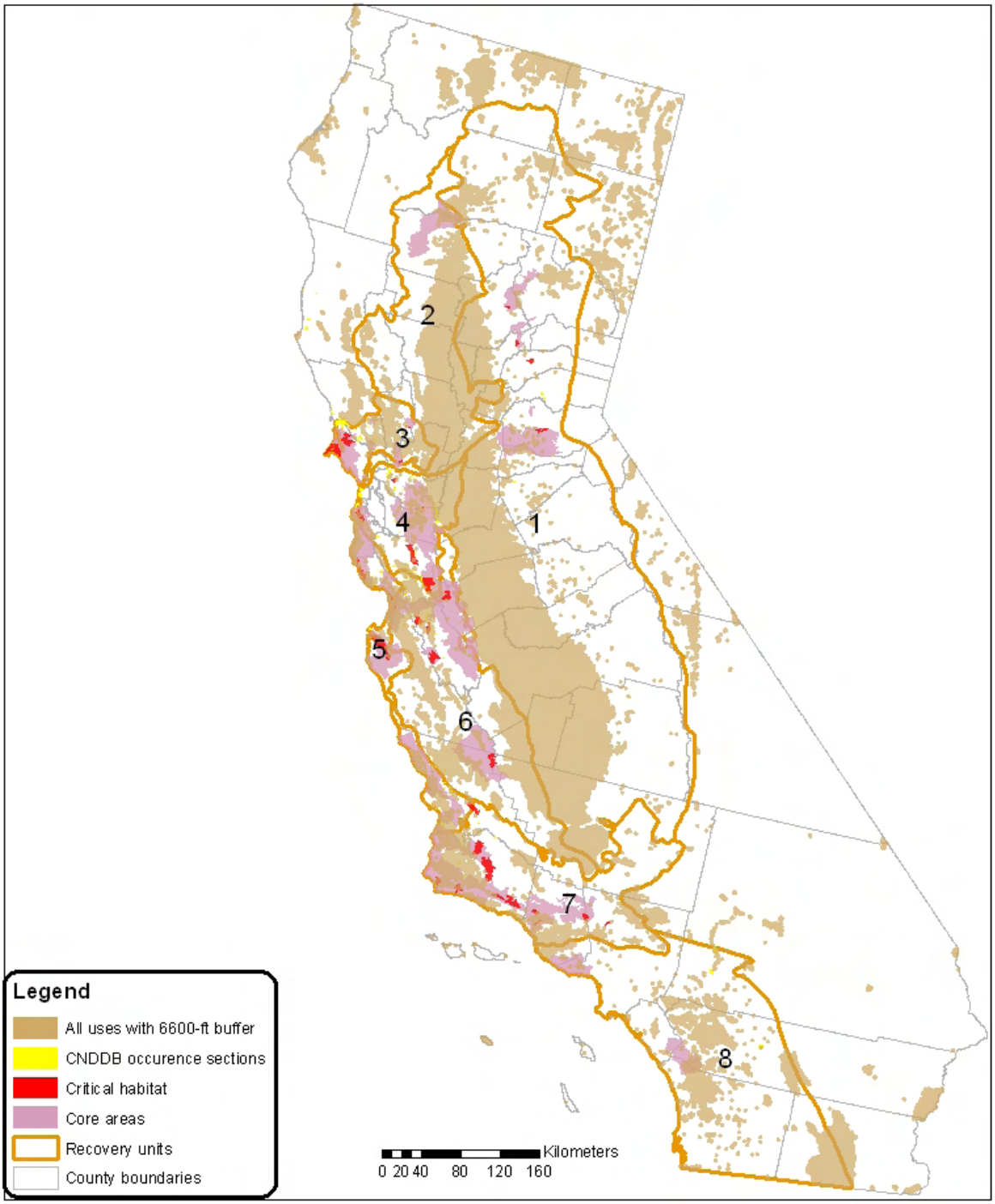
III. *Action Area Determination*

The action area is determined by extending the initial area of concern to include the toal area where the Agency's Levels of Concern (LOCs) are exceeded. It should be noted, however, that the scope of this assessment limits consideration of the overall action area to those portions that may be applicable to the protection of the CRLF and its designated critical habitat within the state of California. The action area is obtained by adding any necessary spray drift buffer distances and the downstream extent of potential runoff to flowing waterbodies. In the event that no additional buffer distances or downstream stream segments are necessary for a given chemical, the action area would be the same as the initial area of concern. The action area is determined in two ways: the spray drift action area (which includes terrestrial areas and non-flowing waterbodies) and the downstream dilution action area (which includes flowing water bodies).

A. Spray Drift Action Area

It is necessary to estimate the distance from the application site where spray drift exposures do not result in LOC exceedences for non-target animals and plants within the given initial area of concern. AgDRIFT and/or AgDISP spray drift models are used to determine the buffer distance required from the initial area of concern where no LOCs are exceeded. Land cover areas within the initial area of concern are then buffered using ArcGIS 9.2 with the distance predicted by the spray drift models. The addition of spray drift buffers expands the areal coverage of the initial area of concern, defined by land cover information corresponding to the pesticide's labeled uses. It is assumed that non-flowing waterbodies (or potential CRLF habitat) are included within the spray drift action area.

Methyl parathion - Action Area



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Map created by US Environmental Protection Agency, Office of Pesticides Programs, Environmental Fate and Effects Division. Projection: Albers Equal Area Conic USGS, North American Datum of 1983 (NAD 1983).

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B. Downstream Dilution Action Area

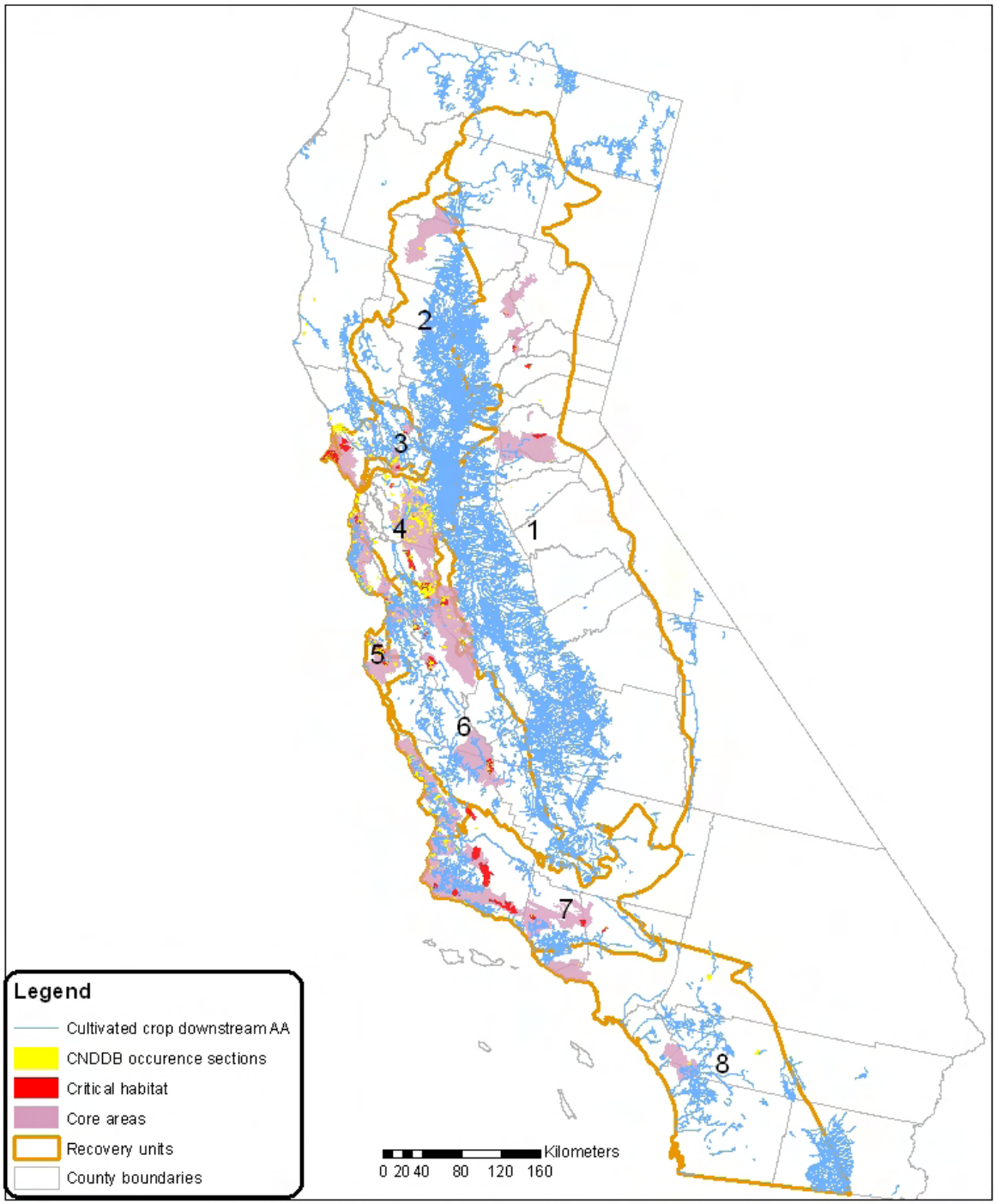
The downstream dilution model is used to determine the downstream extent of exposure in flowing streams and rivers. The downstream component, combined with the initial area of concern, define the downstream dilution action area. The downstream extent includes the area where predicted levels of exposure could potentially exceed the highest RQ (risk quotient) to LOC ratio. The model calculates two values, the dilution factor (DF) and the threshold Percent Cropped Area (PCA). The dilution factor (DF) is the maximum RQ/LOC, and the threshold PCA is the inverse value represented as a percent.

As previously noted, the dilution model uses the NHDPlus dataset for the downstream analysis. After the stream segments in the initial area of concern are identified, the dilution model traverses downstream from each stream segment. At each downstream node, the threshold PCA is compared to the aggregate cumulative PCA. If the cumulative PCA exceeds the threshold then the stream segment is included in the downstream extent. The model continues traversing downstream until the cumulative PCA no longer exceeds the threshold. The additional stream length by the downstream analysis is presented in Table 3.

Table 3. Downstream dilution spatial summary results for cultivated crop use.

Measure	**Total**
Total California stream kilometers	332,962
Cultivated crop use	
Total stream kilometers in initial area of concern	55,309
Total stream kilometers added downstream	6,498
Total stream kilometers in final action area	61,807
Orchard use	
Total stream kilometers in initial area of concern	17,926
Total stream kilometers added downstream	3,093
Total stream kilometers in final action area	21,019
Pasture use	
Total stream kilometers in initial area of concern	28,305
Total stream kilometers added downstream	9,251
Total stream kilometers in final action area	37,556

Methyl parathion - Cultivated Crop Downstream Action Area



Compiled from California County boundaries (ESRI, 2002), USDA National Agriculture Statistical Service (NASS, 2002) Gap Analysis Program Orchard/ Vineyard Landcover (GAP) National Land Cover Database (NLCD) (MRLC, 2001)

Map created by US Environmental Protection Agency, Office of Pesticides Programs, Environmental Fate and Effects Division. Projection: Albers Equal Area Conic USGS, North American Datum of 1983 (NAD 1983).

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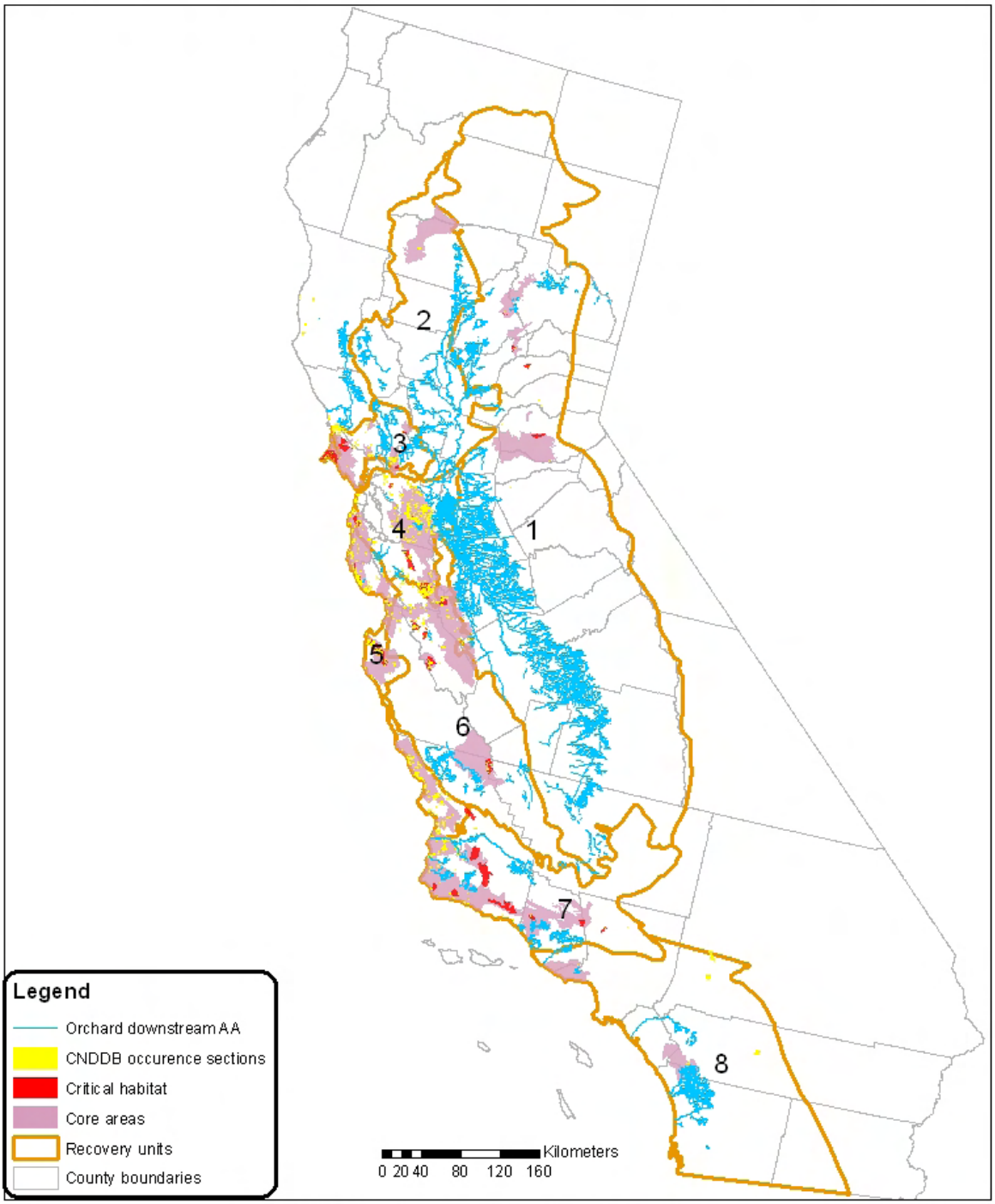
Methyl parathion - Orchard Downstream Action Area



Compiled from California County boundaries (ESRI, 2002), USDA National Agriculture Statistical Service (NASS, 2002) Gap Analysis Program Orchard/ Vineyard Landcover (GAP) National Land Cover Database (NLCD) (MRLC, 2001)

Map created by US Environmental Protection Agency, Office of Pesticides Programs, Environmental Fate and Effects Division. Projection: Albers Equal Area Conic USGS, North American Datum of 1983 (NAD 1983).

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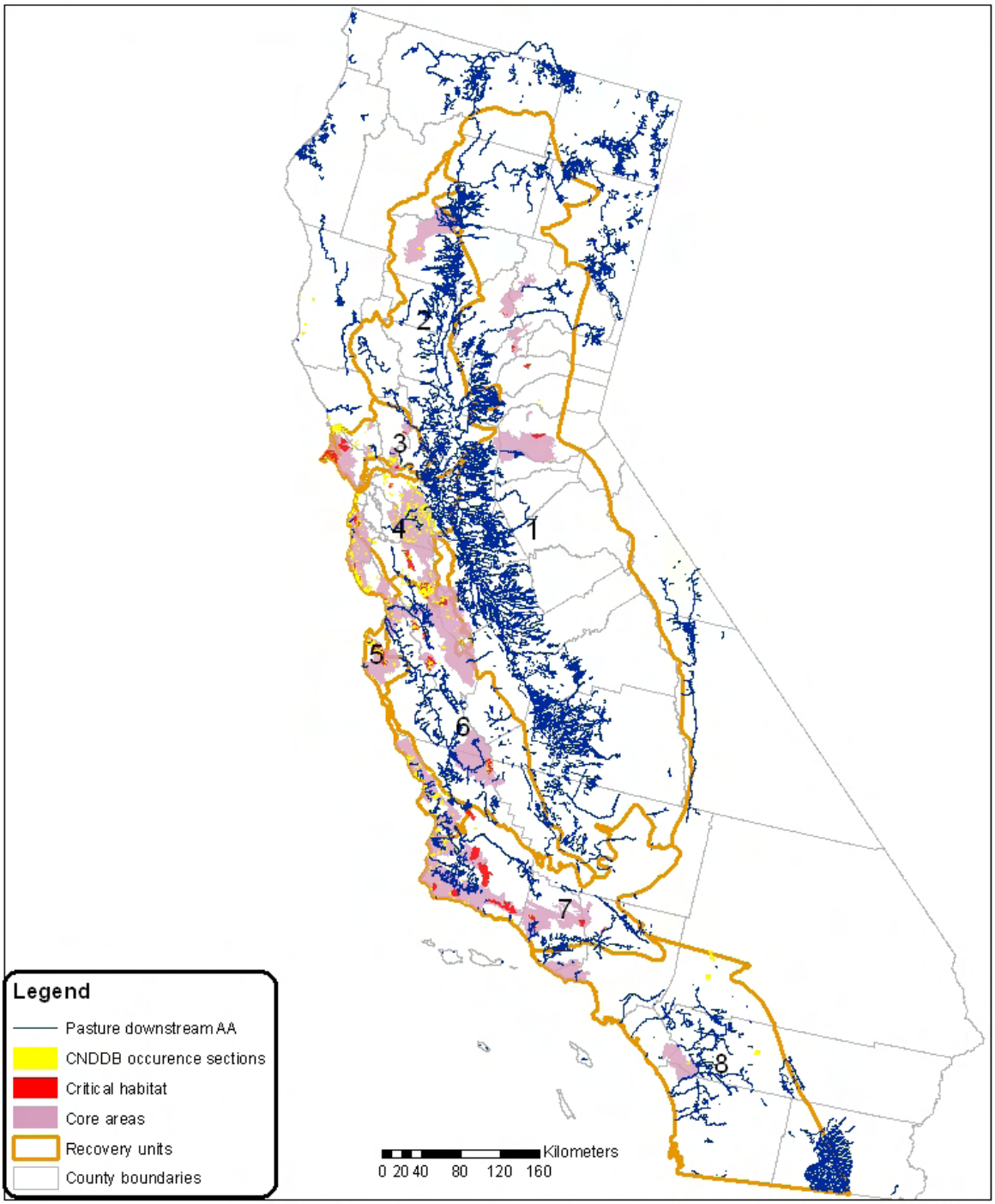
Methyl parathion - Pasture Downstream Action Area



Compiled from California County boundaries (ESRI, 2002), USDA National Agriculture Statistical Service (NASS, 2002) Gap Analysis Program Orchard/ Vineyard Landcover (GAP) National Land Cover Database (NLCD) (MRLC, 2001)

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IV. *Overlap of Action Area with CRLF habitat*

The overlap of the 'Action Area' with CRLF habitat areas is named 'Overlapping Area' and is the target of spatial analysis. The ratio of Overlapping Area to CRLF habitat area is reported for each of eight Recovery Units (RU1 to RU8).

There are three types of CRLF habitat areas considered in this assessment: critical habitat (CH), currently occupied core areas, and California Natural Diversity Database (CNDDB) occurrence sections. Recovery zones are also used to present summary habitat overlap information. Spatial data describing the recovery zones and core areas are from the U.S. Fish and Wildlife Service. Critical habitat areas were obtained from U.S. Fish and Wildlife Service's Critical Habitat Portal (http://crithab.fws.gov). Survey section data representing are from the CNDDB (http://www.dfg.ca.gov/bdb/html/cnddb.html). The occurrence sections represent habitat areas that are generalized to the Meridian Range and Township Section (MTRS) one square mile units in order to obfuscate actual habitat areas. As such, only occurrence section counts are provided and not the area potentially affected.

In order to confirm that uses of this chemical have the potential to affect the CRLF or its habitat through direct applications or through spray drift and/or runoff, an analysis of the overlap of CRLF habitat and the action area was performed. Results are presented in Table 3, below. Spatial analysis using ArcGIS 9.2 is performed to determine whether there is overlap. The results of this spatial analysis are presented below. More detailed maps of the overlap of CRLF habitat with the chemical action area are depicted in the figures that follow.

Table 4. Spray drift action area (all uses) & CRLF habitat overlap spatial summary results by recovery unit.

Measure	**RU1**	**RU2**	**RU3**	**RU4**	**RU5**	**RU6**	**RU7**	**RU8**	**Total**
Established species habitat area (CH plus core in sq km)	2894	1224	1244	3228	3712	4921	4840	1377	23,440
Overlapping habitat area (sq km)	661	304	184	1,078	1,759	1,483	2,107	465	8,041
Percent area affected	*23%*	*25%*	*15%*	*33%*	*47%*	*30%*	*44%*	*34%*	*34%*
Established occurrence sections (972 total; 30 outside recovery units)	13	3	70	328	281	122	92	33	942
# Occurrence sections affected	2	0	23	170	229	76	77	26	612**

** 9 occurrence sections affected outside of recovery units

V. A Note on Limitations and Constraints of Tabular and Geospatial Sources

The geographic data sets used in this analysis are limited with respect to their accuracy and timeliness. The NASS Census of Agriculture (NASS 2002) contains adjusted survey data collected prior to 2002. Small use sites and minor uses (e.g., specialty crops) tend to be underrepresented in this dataset. The National Land Cover Dataset (NLCD 2001) represents the most current and comprehensive collection of national land use and land cover information for the United States and represents land cover data obtained between 1994-1998. Because the NLCD does not explicitly include a class to represent orchard and vineyard landcover, California Gap Analysis Project data (CaGAP 1998) were used as a supplement to the NCLD for these areas.

Hydrographic data are from the NHDPlus dataset (http://www.horizon-systems.com/nhdplus/). NHDPlus contains the most current and accurate nationwide representation of hydrologic data. In some isolated instances, there are, however, errors in the data including missing or disconnected stream segments and incorrect assignment of flow direction.

The relatively coarse spatial scale and general classification categories of these datasets precludes use of the data for highly localized study. Tabular information quantifying areal coverage is therefore limited to the scale of individual Recovery Units. Additionally, some labeled uses are not possible to map precisely due to the lack of appropriate spatial data in NLCD on the location of these areas. To account for these uncertainties, the spatial analysis presented here is conservative, and may overestimate the real extent of actual pesticide use in California.

VI. References for GIS Maps

CNDDB Occurrence Sections – California Natural Diversity Database
http://www.dfg.ca.gov/bdb/html/cnddb.html

ESRI, 2002. Detailed Counties, ESRI data and maps. (1:24,000) www.esri.com

GAP, 1998. Gap Analysis. Orchard/vineyard land cover data. National Biological Information Infrastructure. www.nbii.gov

NASS, 2002. USDA National Agriculatural Statistics Service. www.nass.usda.gov

NHDPlus dataset (http://www.horizon-systems.com/nhdplus/)

NLCD, 2001. Multiresolution Land Characteristics (MRLC) www.mrlc.gov

TeleAtlas, 2006.

U.S. Department of Transportation's National Pipeline Dataset, 1999.

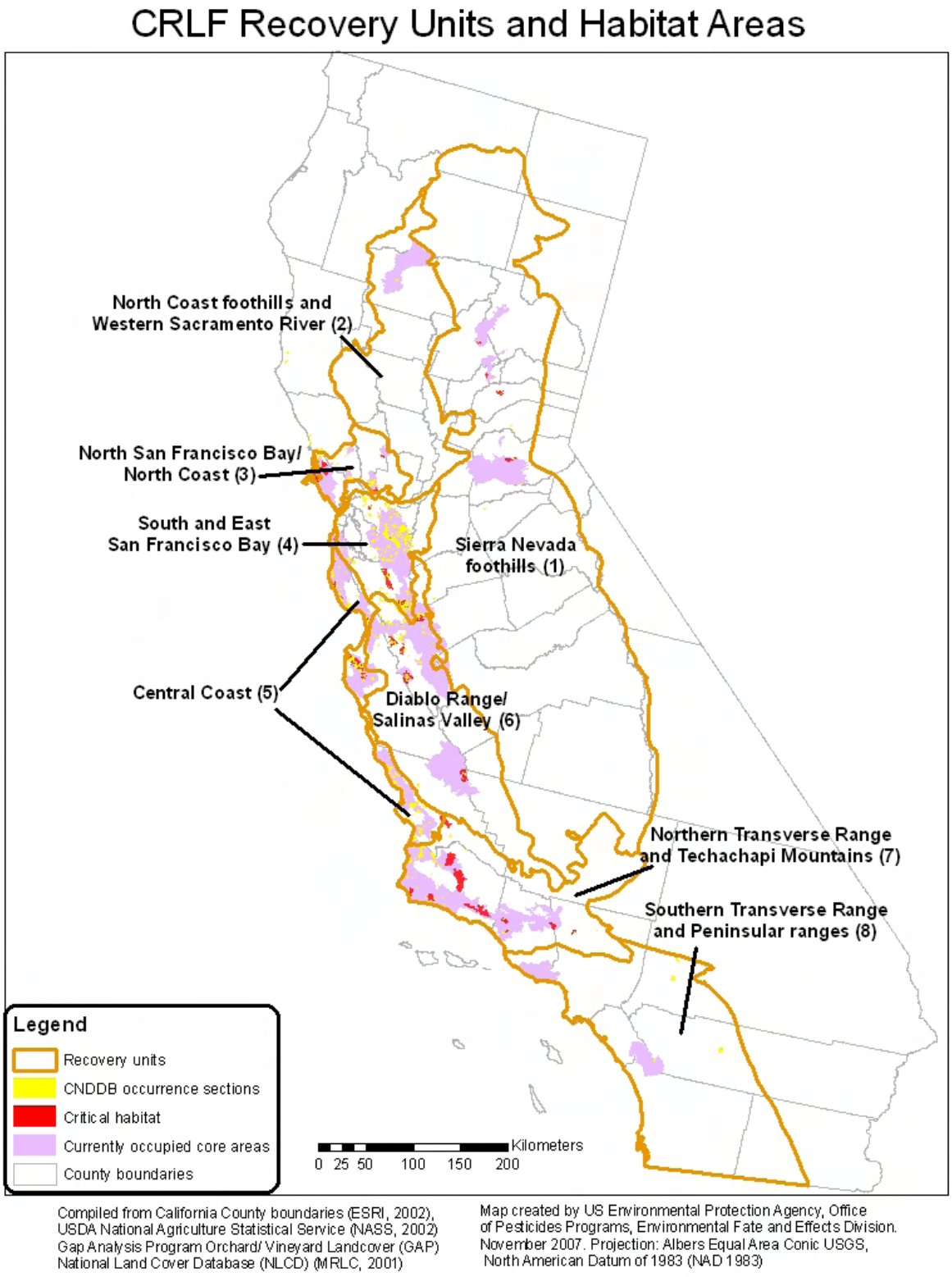
USFWS, 2006. Endangered and threatened wildlife and plants: determination of critical habitat for the California red-legged frog. 71 FR 19244-19346.

USFWS. 2002. Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*). Region 1, USFWS, Portland, Oregon. (http://ecos.fws.gov/doc/recovery_plans/2002/020528.pdf)

US FWS 2002 California red-legged frog General Recovery Zones

US FWS 2002 California red-legged frog Core Areas

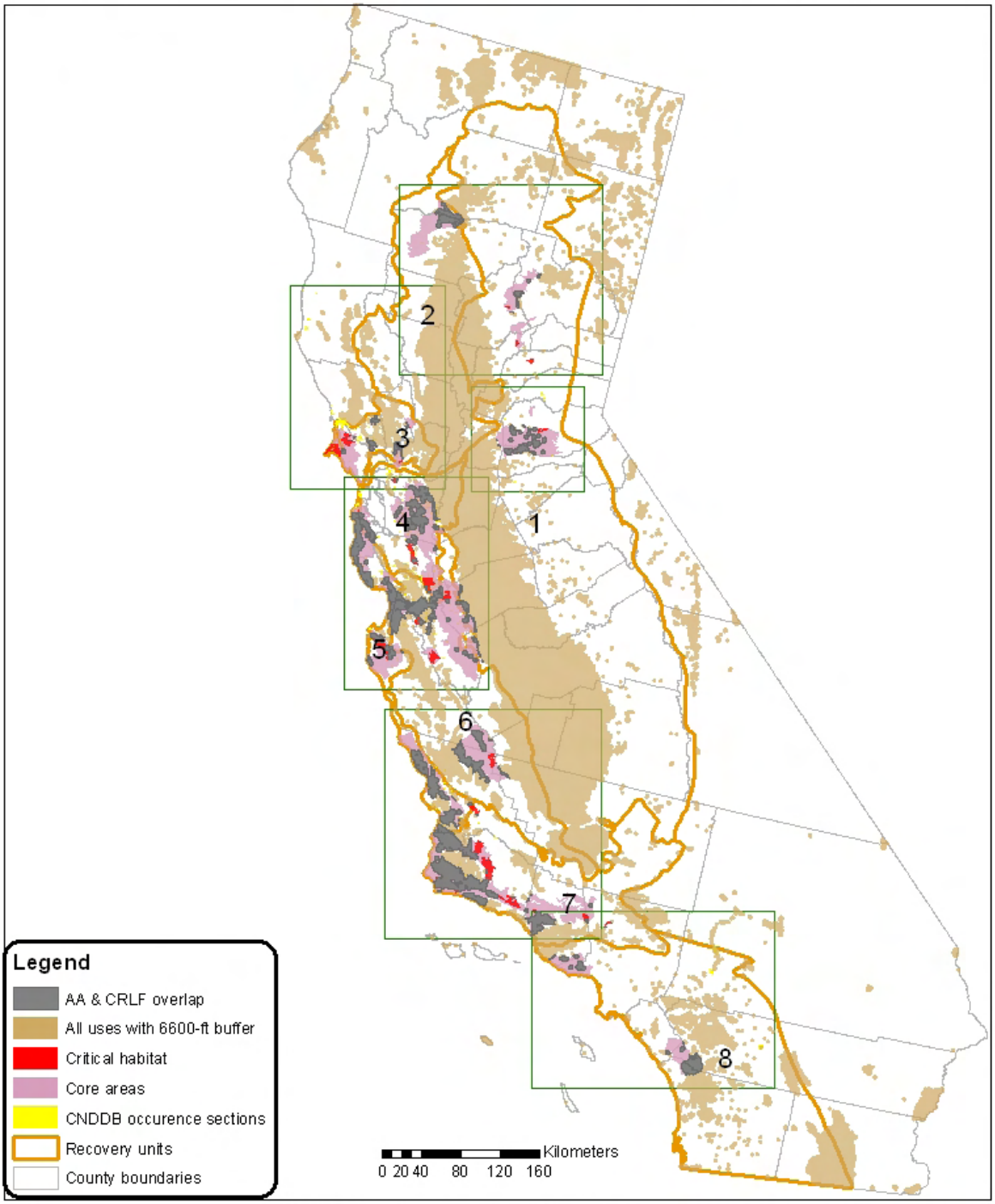
CRLF Habitat Reference Map



Compiled from California County boundaries (ESRI, 2002), USDA National Agriculture Statistical Service (NASS, 2002) Gap Analysis Program Orchard/ Vineyard Landcover (GAP) National Land Cover Database (NLCD) (MRLC, 2001)

Map created by US Environmental Protection Agency, Office of Pesticides Programs, Environmental Fate and Effects Division. November 2007. Projection: Albers Equal Area Conic USGS, North American Datum of 1983 (NAD 1983)

Methyl parathion - Action Area & CRLF overlap



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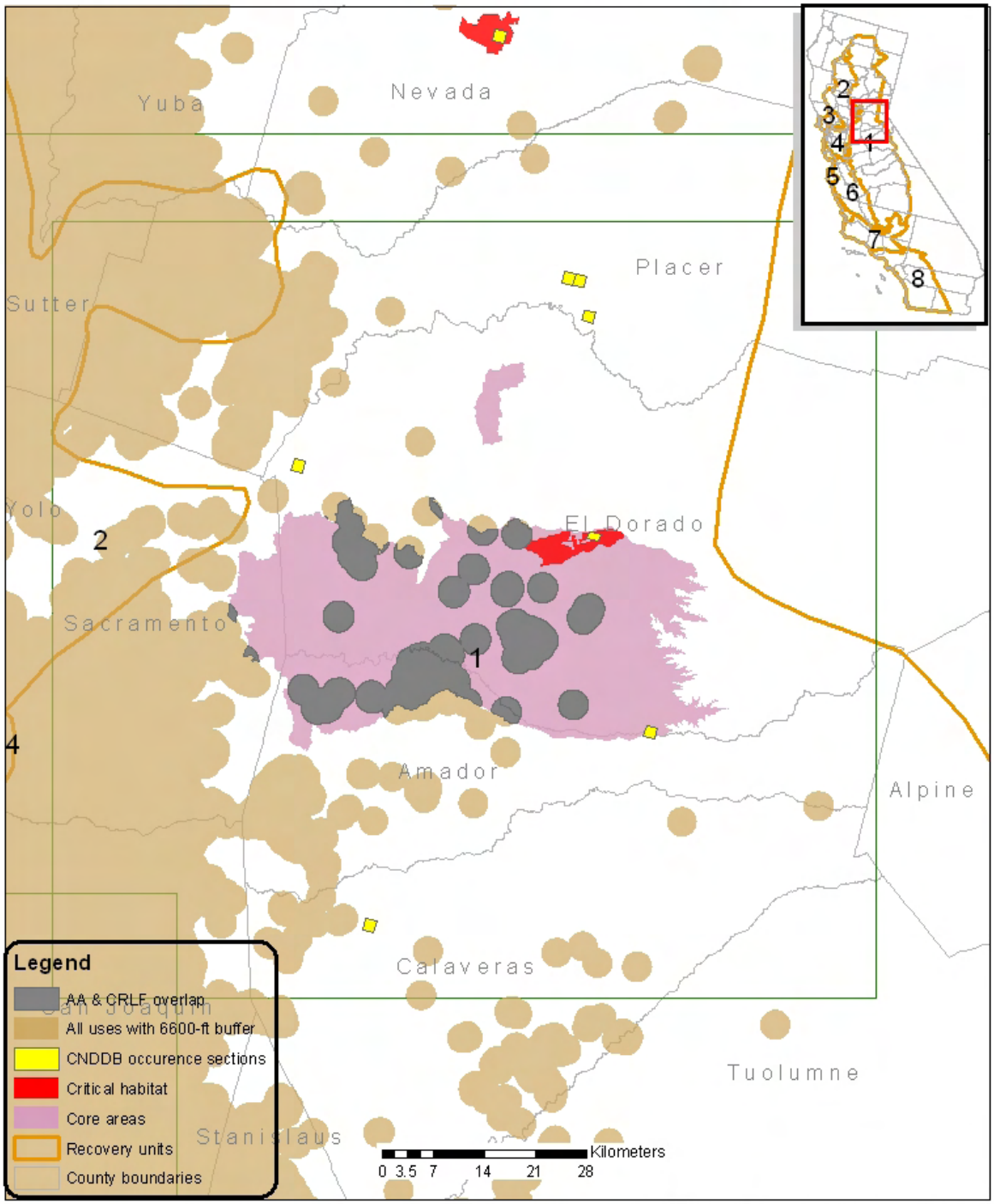
Produced: 1/28/2008

Methyl parathion - Action Area & CRLF overlap: RU 1



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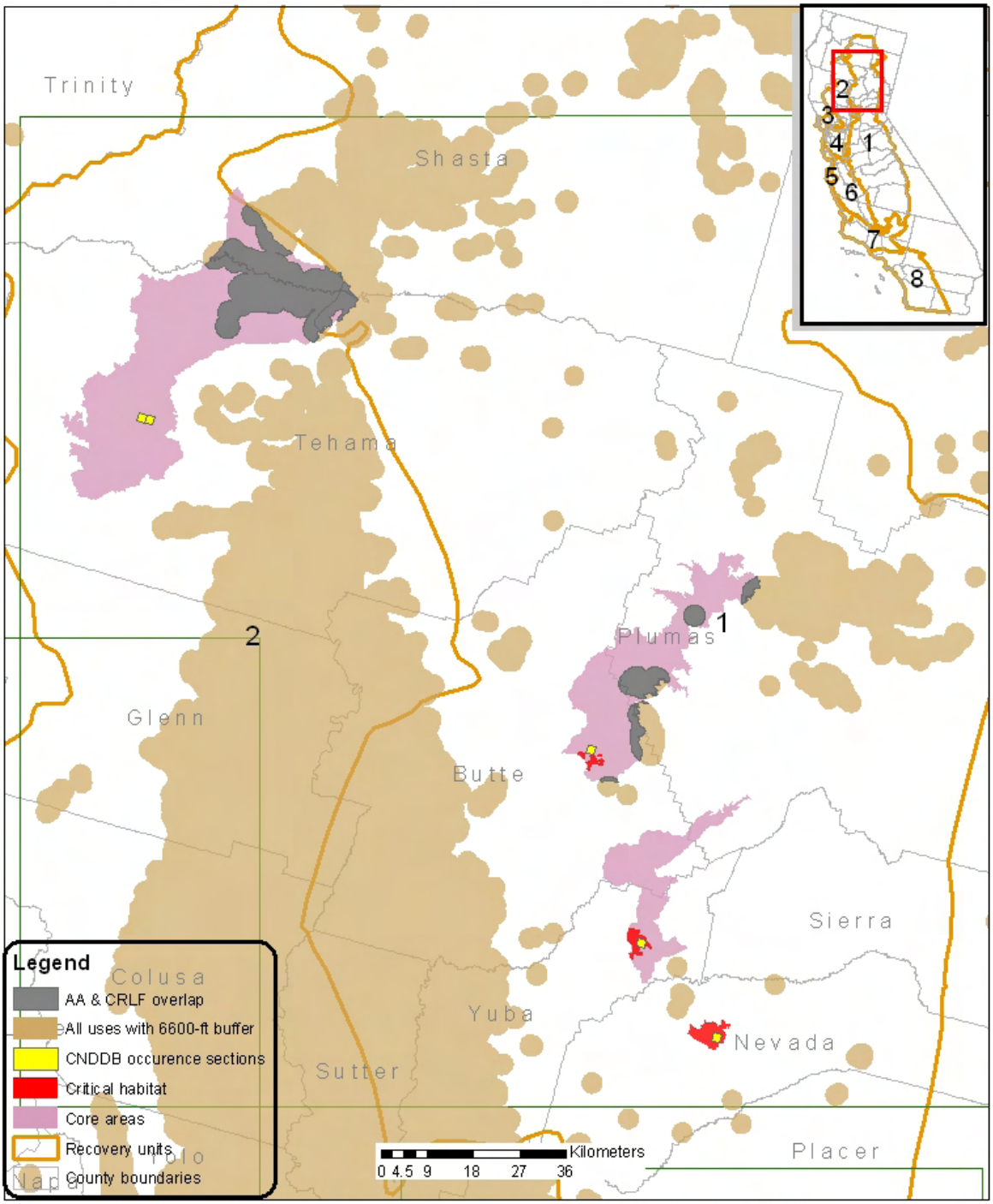
Produced: 1/28/2008

Methyl parathion - Action Area & CRLF overlap: RU 1 & 2



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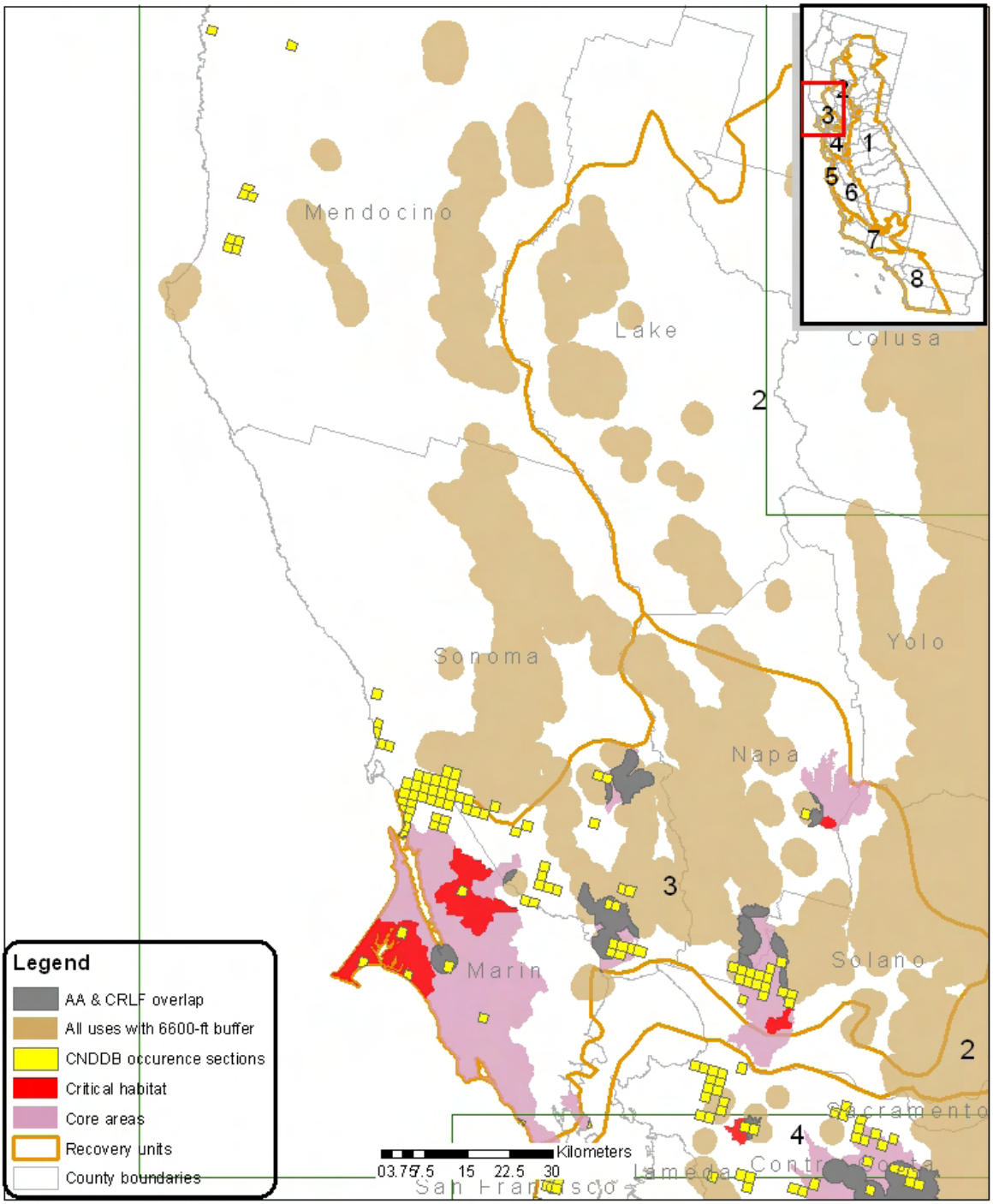
Produced: 1/28/2008

Methyl parathion - Action Area & CRLF overlap: RU 2 & 3



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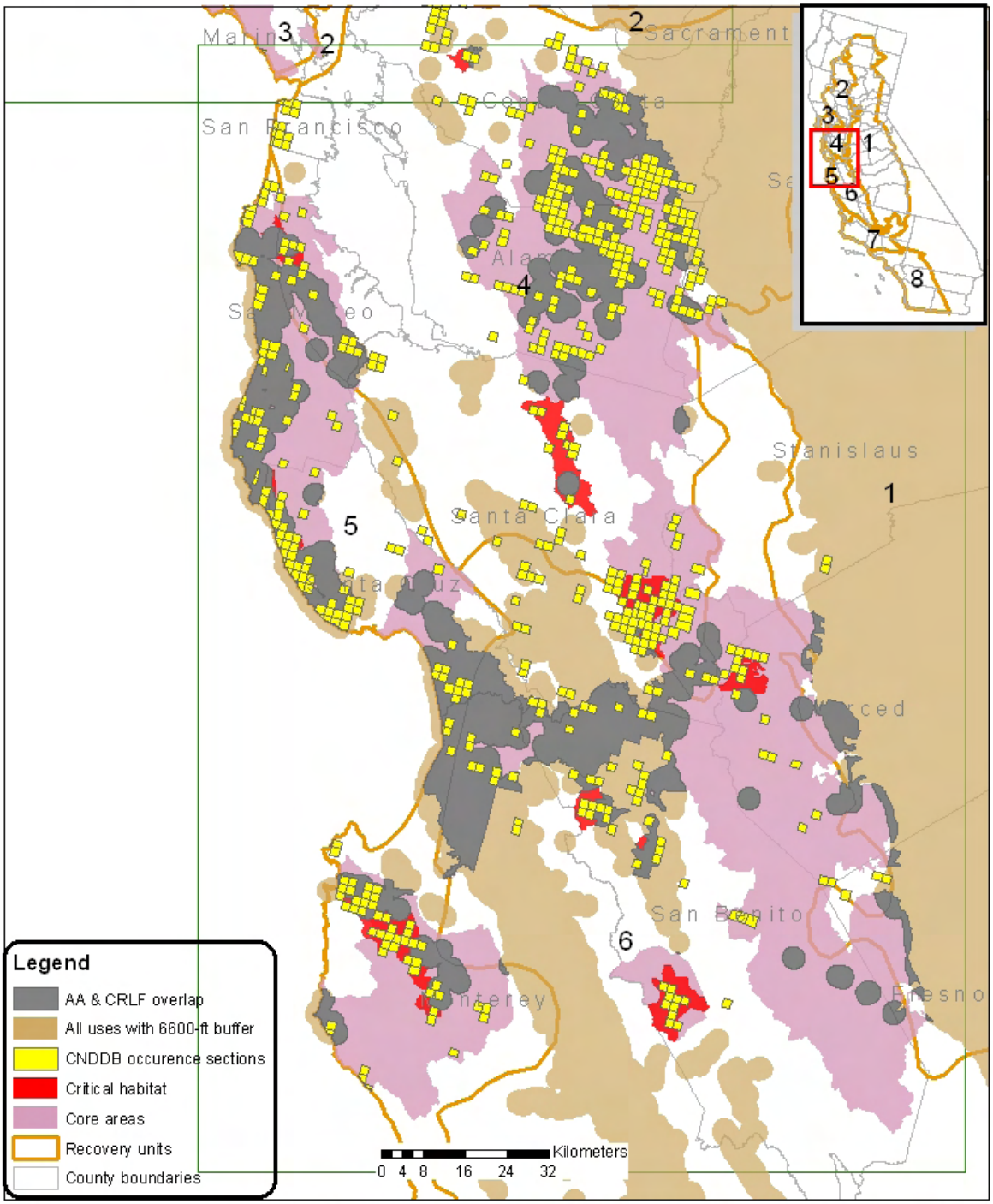
Produced: 1/28/2008

Methyl parathion - Action Area & CRLF overlap: RU 4, 5 & 6



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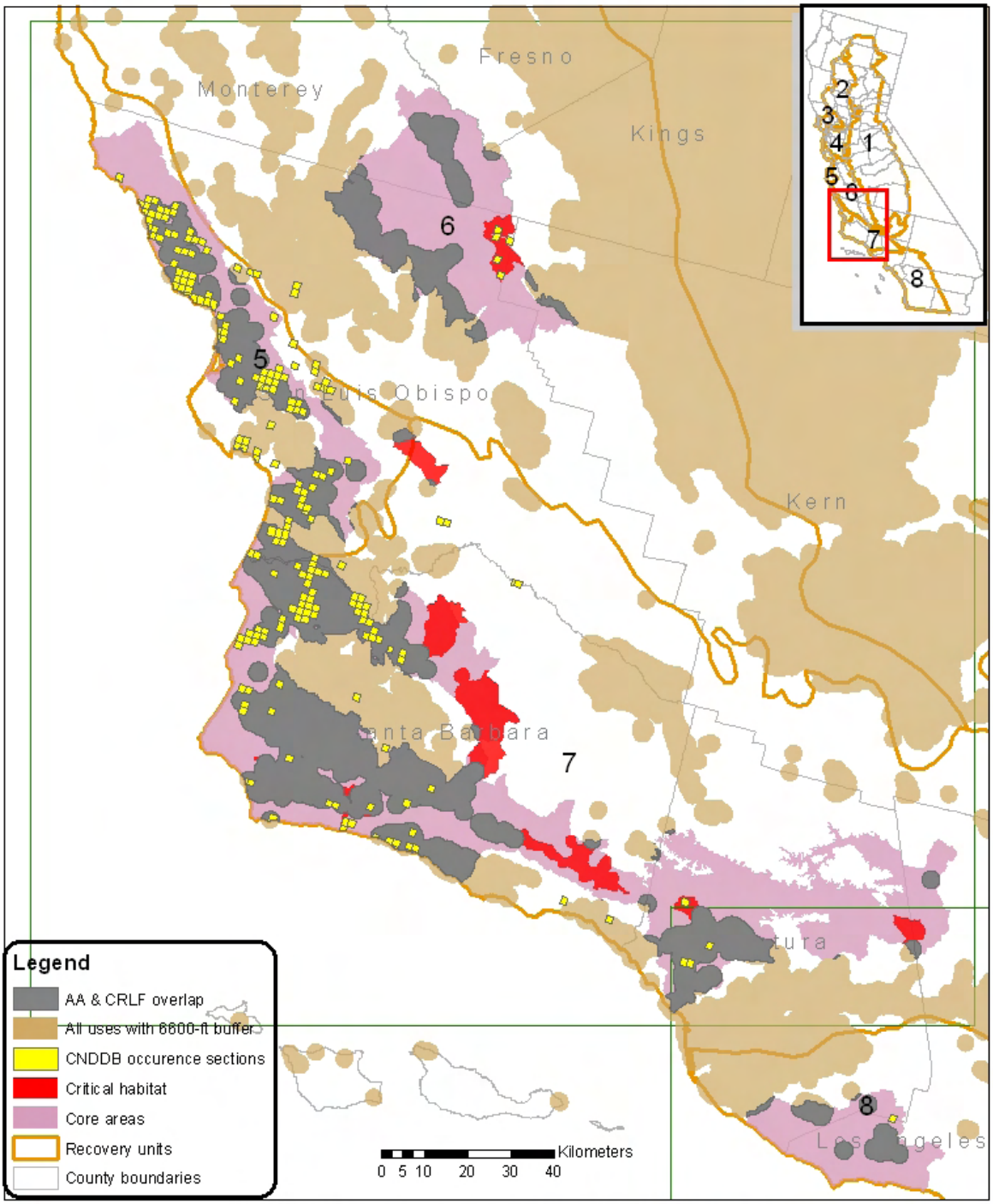
Produced: 1/28/2008

Methyl parathion - Action Area & CRLF overlap: RU 5, 6 & 7



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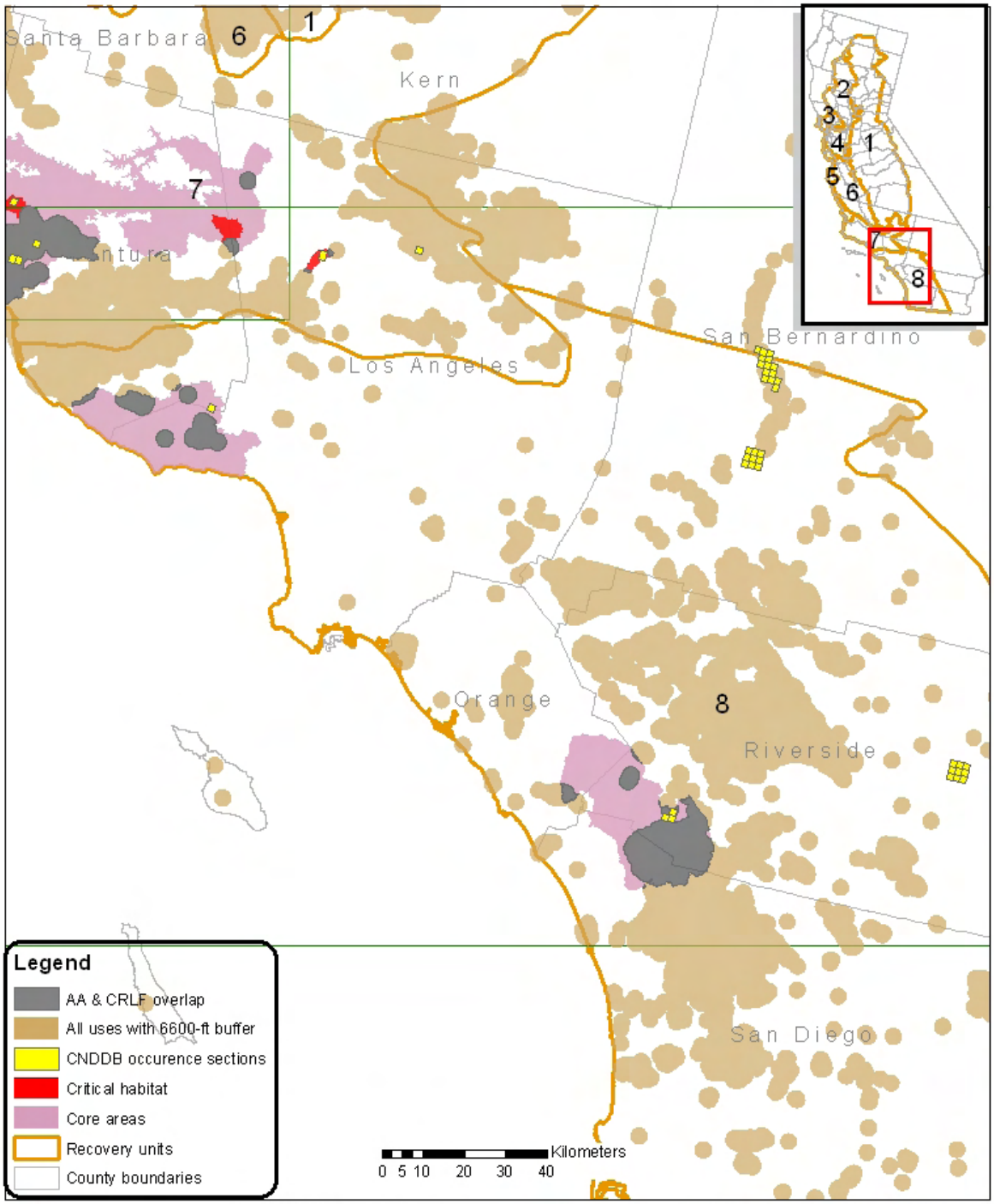
Produced: 1/28/2008

Methyl parathion - Action Area & CRLF overlap: RU 7 & 8



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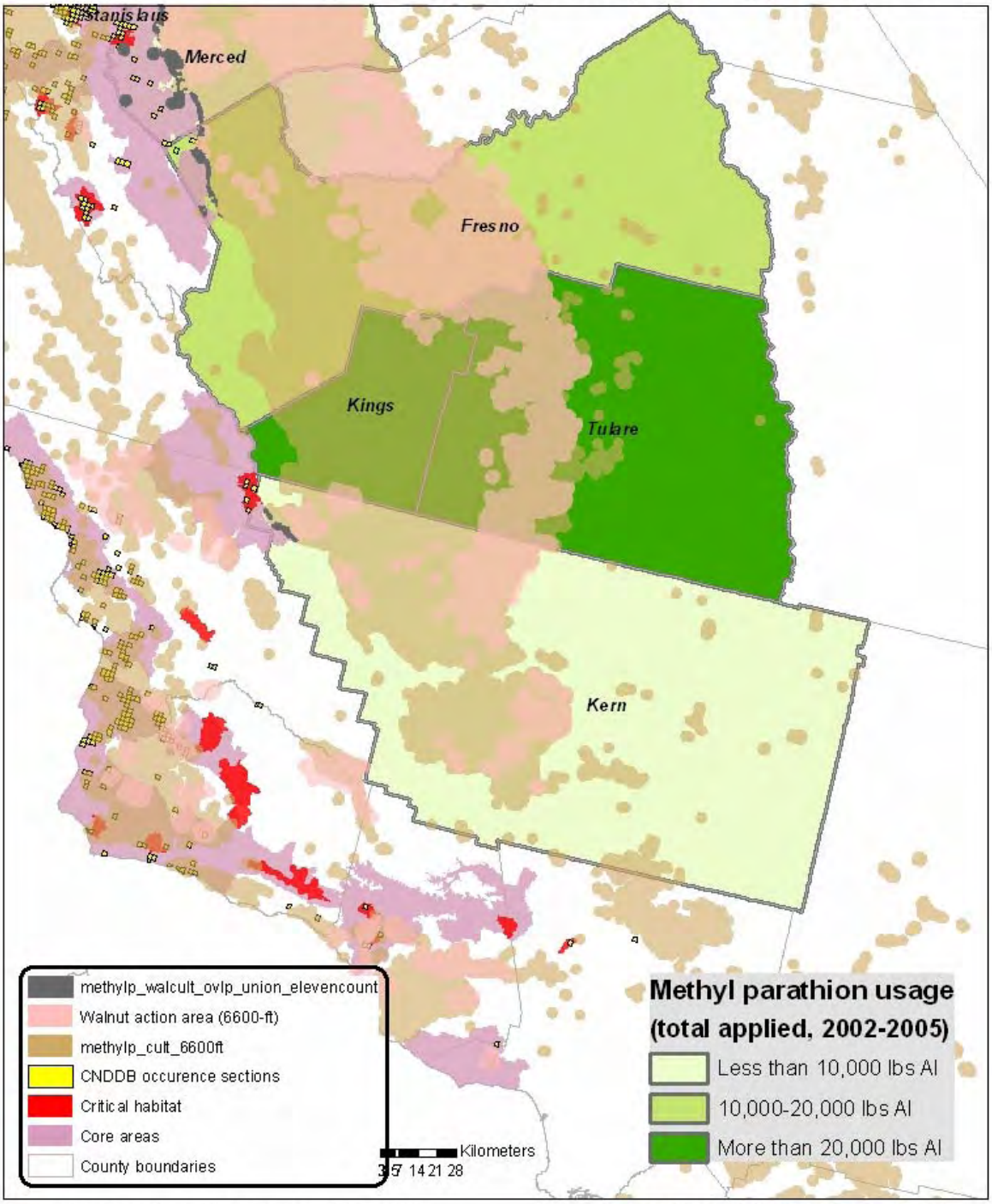
Produced: 1/28/2008

Methyl parathion - High usage counties (Total applied, 2002-05)



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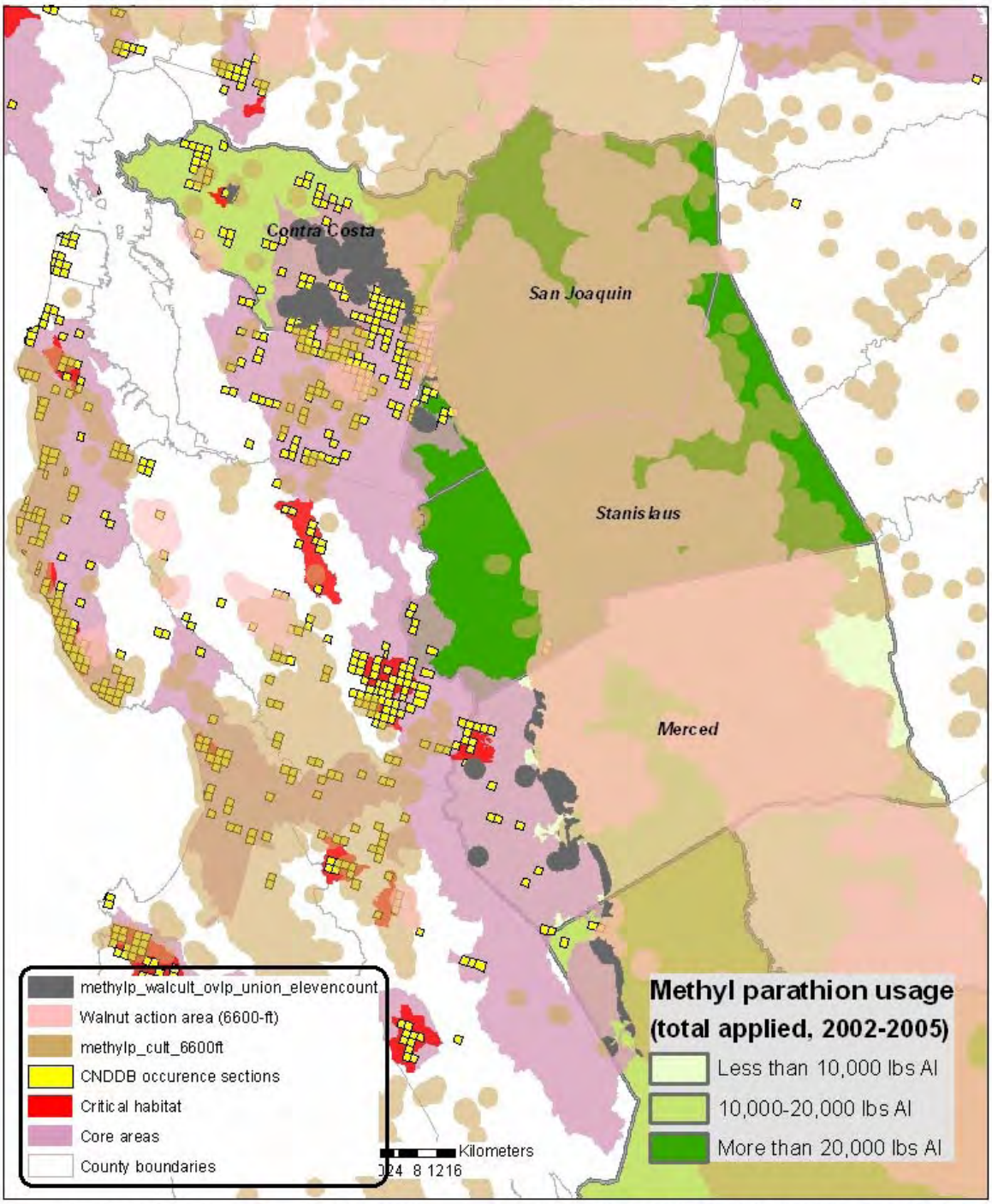

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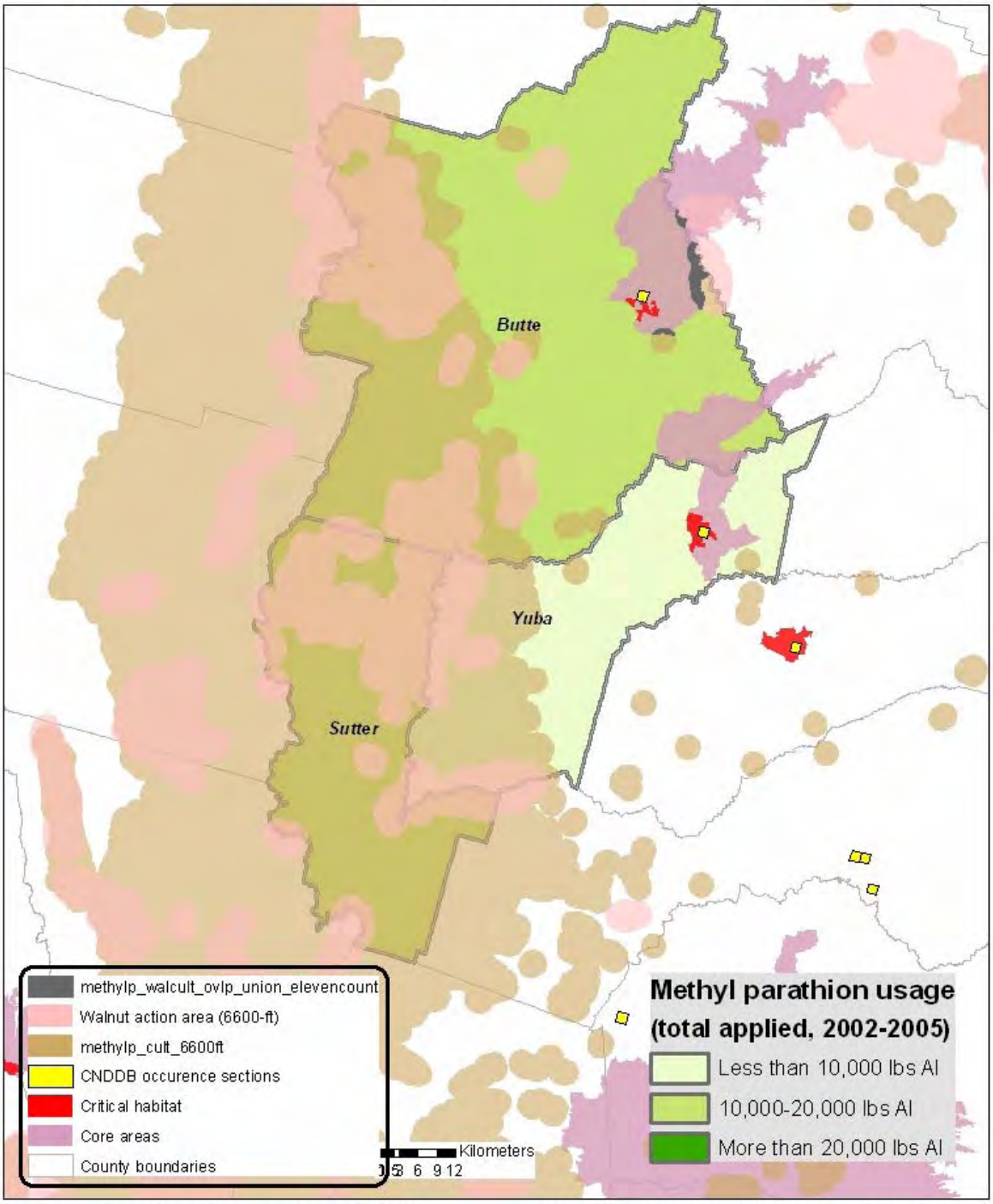

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