Appendix C.

Spatial Summary for Disulfoton Uses

I. Labeled Uses for Disulfoton

The following use list is derived from label use information. It is used as a basis for the spatial analysis of Disulfoton.

Table 1. Use list from labels	
Category	**Use**
Cultivated crops	Asparagus, beans, broccoli, Brussels sprouts, cabbage, cauliflower, Christmas trees, cotton, Easter lilies, lettuce
Developed (low, medium, and high density	Residential flowers, shrubs, and vegetables

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 (Figure 1). The footprint of potential use represents the chemical's initial area of concern, and is typically based on available land cover data. The initial area of concern represents the starting point from which the action area is defined.

A. Land Cover

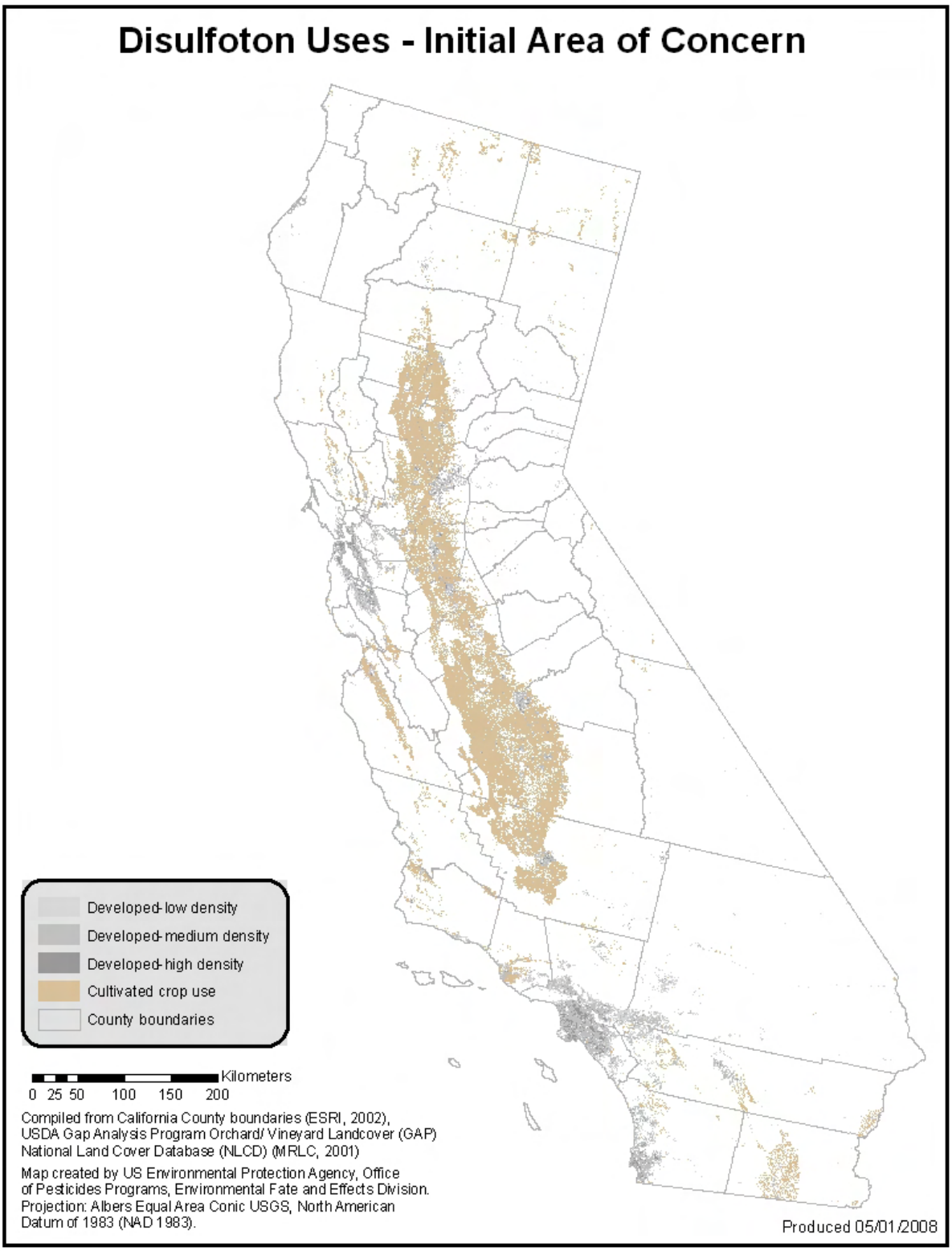
Base mapping land cover layers for the initial area of concern analysis were obtained from the National Land Cover Dataset (NLCD 2001) for the majority of land use types. The NLCD was released as a nationally consistent, regionally indexed dataset in January 2007. California GAP data from the Biogeography Lab from UCLA-Santa Barbara (1998) were obtained for the orchard and vineyard uses. These raster files were converted to vectors 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 (2007) with U.S. Department of Transportation's National Pipeline Mapping System (1999). Table 2 shows the land-cover sources used for the initial area of concern analysis.

Table 2. Land Cover Data Sources		
Layer name	**Base source**	**Description**
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.
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.
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.
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.
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.
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.
Open Water	NLCD	Grid code 11: All areas of open water, generally with less than 25% cover of vegetation or soil.
Orchards and vineyards	CA GAP	Grid codes 11210, 11211 and 11212. This is the only CA GAP reference.
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.
Wetlands	NLCD	Grid codes 90, 95: Woody wetlands and emergent herbaceous.
Turf	NLCD	A derived NLCD class based on developed classes and the impervious surface layer with corrections applied.
Rights-of-way	US DOT; TeleAtlas	A derived class using road, rail, and pipeline coverages.

B. 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). Pesticide exposures in the streams within the initial area of concern are conservatively assumed to be represented by the estimated environmental concentrations used in RQ calculation.

Figure 1.


Disulfoton Uses - Initial Area of Concern
Developed-low density
Developed-medium density
Developed-high density
Cultivated crop use
County boundaries
Kilometers
0 25 50 100 150 200
Compiled from California County boundaries (ESRI, 2002),
USDA 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 05/01/2008

III. *Spatial Extent of the Effects Determination*

Based on the results of the Agency's endangered species risk assessment for disulfoton, a Likely to Adversely Affect (LAA) and modification to critical habitat determination was concluded for the CRLF. The spatial extent of the effects determination is based on the initial area of concern for application of disulfoton on cultivated crops, and developed high, medium, and low density residential areas, and expanded to include the total area where there is potential for direct or indirect effects to occur via off-site transport mechanisms. The extent of potential off-site transport is determined by deriving the spray drift area and the run-off area based on downstream dilution. The identified direct and indirect effects are anticipated to occur only for those currently occupied core areas, CNDDB occurrence sections, and areas of designated critical habitat for the CRLF that are located **8336 ft** from legal use sites where disulfoton is applied to cultivated crops, and developed high, medium, and low density residential areas. Downstream extent analysis shows that **257 km** is the furthest distance that could be added downstream. This distance is representative of the maximum continuous downstream dilution from the edge of the initial area of concern where direct/indirect effects and/or critical habitat modification may occur. Lotic (*i.e.*, flowing) waterbodies that overlap with the CRLF habitat potentially contain concentrations of disulfoton sufficient to result in LAA determination and modification of critical habitat.

There are three types of CRLF habitat areas: critical habitat, currently occupied core areas, and California Natural Diversity Database (CNDDB) occurrence sections (Figure 2). The overlap of land cover corresponding to disulfoton use patterns that result in an LAA determination and CRLF habitat for the entire state of California is shown in Figure 3. Figures 4 through 9 provide a similar depiction of this overlap at a county-level scale. The overlap maps shown here provide a depiction of land cover that corresponds to "LAA" disulfoton use patterns areas overlapped with habitat; however, the actual area of overlap is expected to be greater when off-site transport via spray drift and run-off are included for each land cover type. The buffers and runoff may be different for each land cover type due to varying application rates and/or methods for different use patterns. Further analysis of the extent of drift and run-off for each land cover type and the overlap with habitat can be included as part of the consultation process, if needed.

A. Spray Drift Area

AgDRIFT and/or AgDISP spray drift models are used to determine the distance from the initial area of concern where no direct or indirect effects are expected to occur. It is assumed that lentic (*i.e.*, non-flowing) waterbodies (or potential CRLF habitat) are included within the spray drift area.

B. Downstream Dilution

The downstream dilution approach is used to determine the downstream extent of exposure in flowing streams and rivers where direct/indirect effects and/or habitat modification may occur. The downstream component, combined with the initial area of concern, define the downstream dilution area. The downstream extent includes the area where predicted levels of exposure could potentially exceed the highest RQ (risk quotient) to LOC ratio. The approach calculates two

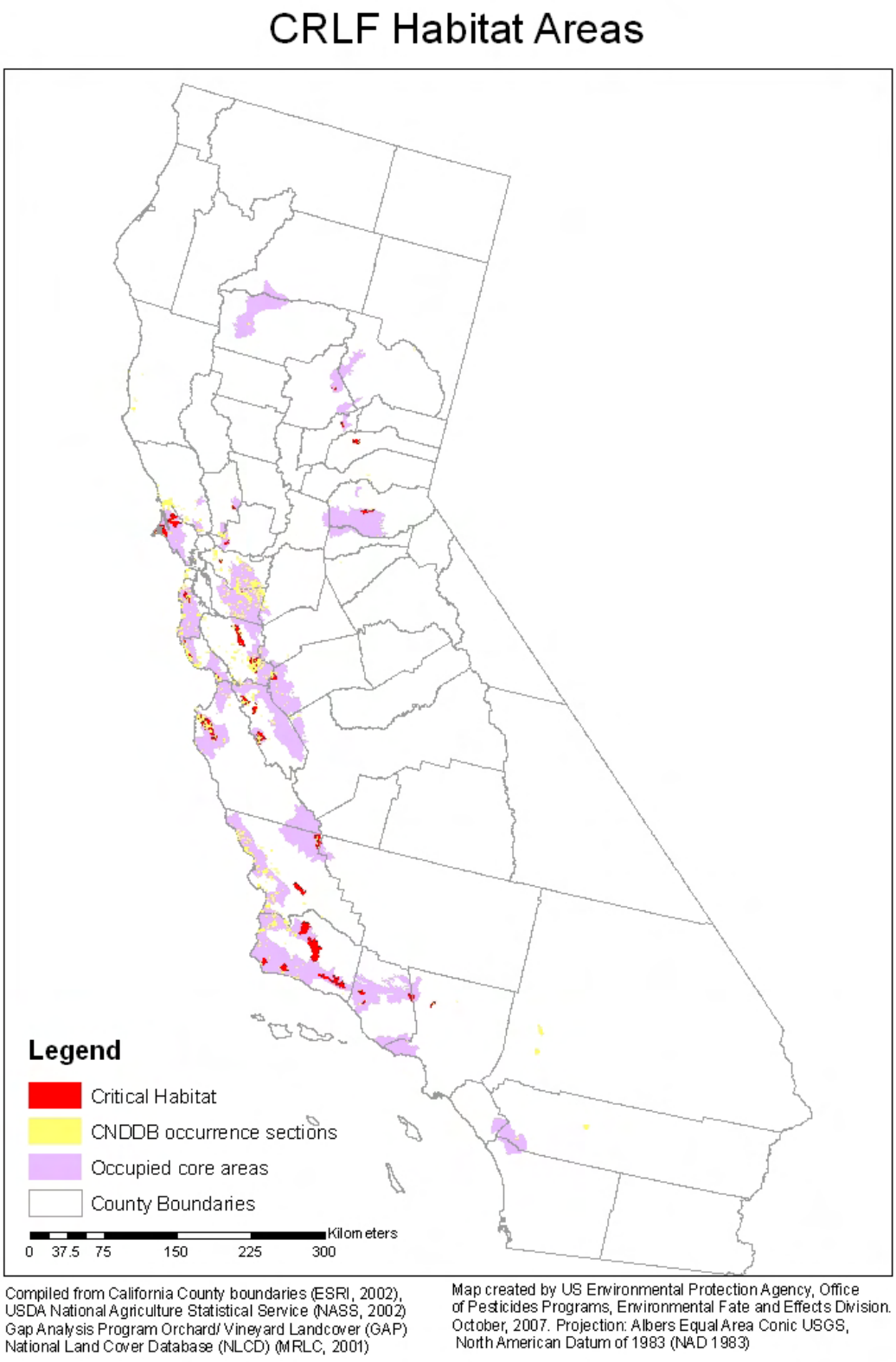
values, the dilution factor (DF) and the threshold Percent Cropped Area (PCA). The dilution factor (DF) is the maximum RQ/LOC, and the threshold PCA is the inverse value represented as a percent.

As previously noted, the dilution approach 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 for that segment exceeds the threshold, the stream segment is included in the downstream extent. This continues traversing downstream until the cumulative PCA no longer exceeds the threshold.

The extent of downstream dilution is derived by identifying the stream segment that represents the maximum continuous length of stream miles downstream from the outer boundary of the initial area of concern.

In order to determine the downstream extent of the entire "LAA" area, a conservative assumption is made that all streams exiting the boundary of the initial area of concern are the same length as the identified longest stream reach and extend the maximum distance. For example, if the analysis indicates that 100 streams exiting the initial area of concern have concentrations above the LOC and the average length of these streams is 200 feet but the maximum length for any one stream is 1,000 feet; the analysis will conservatively assume that all streams exiting the initial area of concern have concentrations above the LOC for 1,000 feet downstream. It is likely, however, that this conservative assumption will result in an overestimation of stream reaches that are identified as "LAA". Although the maximum continuous downstream distance is reported, the overlap of potentially impacted stream reaches with CRLF habitat is not depicted. However, shapefiles of the downstream analysis are available for further consideration as part of the consultation process, if needed.

Figure 2.


CRLF Habitat Areas
Legend
Critical Habitat
CNDDB occurrence sections
Occupied core areas
County Boundaries
Kilometers
0 37.5 75 150 225 300
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. October, 2007. Projection: Albers Equal Area Conic USGS, North American Datum of 1983 (NAD 1983)

IV. 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 National Land Cover Data Set (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. Two additional data sets were included to account for uses not clearly defined by the NLCD. These supplemental data include orchard and vineyard land cover data from the California Gap Analysis Project data (CaGAP 1998), and rights-of-way data derived from the Teleatlas (2007).

Hydrographic data are from the NHDPlus data set (http://www.horizon-systems.com/nhdplus/). NHDPlus contains the most current and accurate nationwide representation of hydrologic data. At a spatial scale of 1:100,000, the NHDPlus might omit the smallest streams and waterbodies. In addition, in some isolated instances, there are 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 data sets preclude use of the data for highly localized study. 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.

OPP will continue to endeavor to identify and incorporate (as appropriate) additional land cover data sets for other land classes not captured in this assessment. In addition, as new updates to existing data occur, these will also be evaluated and incorporated as appropriate.

Figure 3.

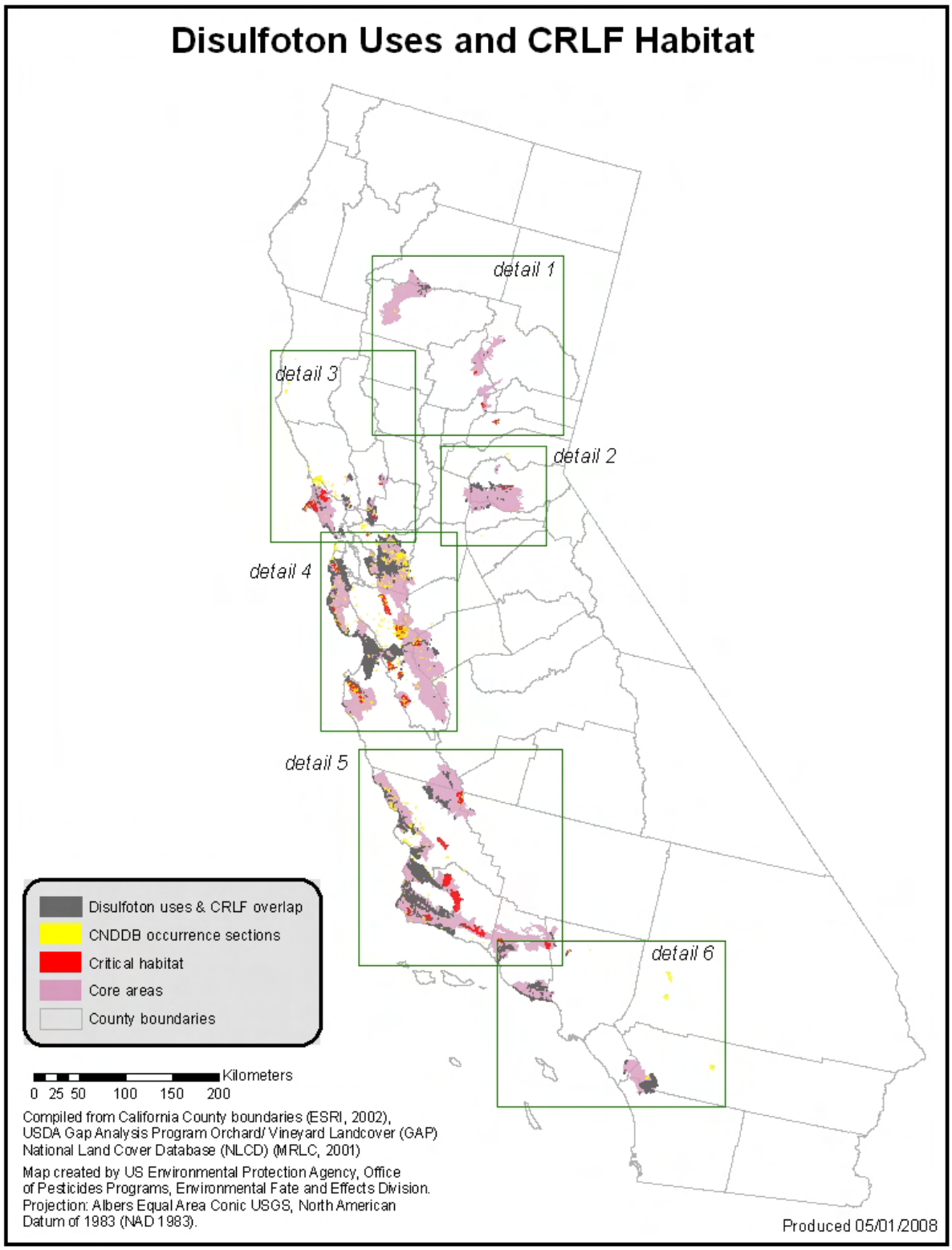
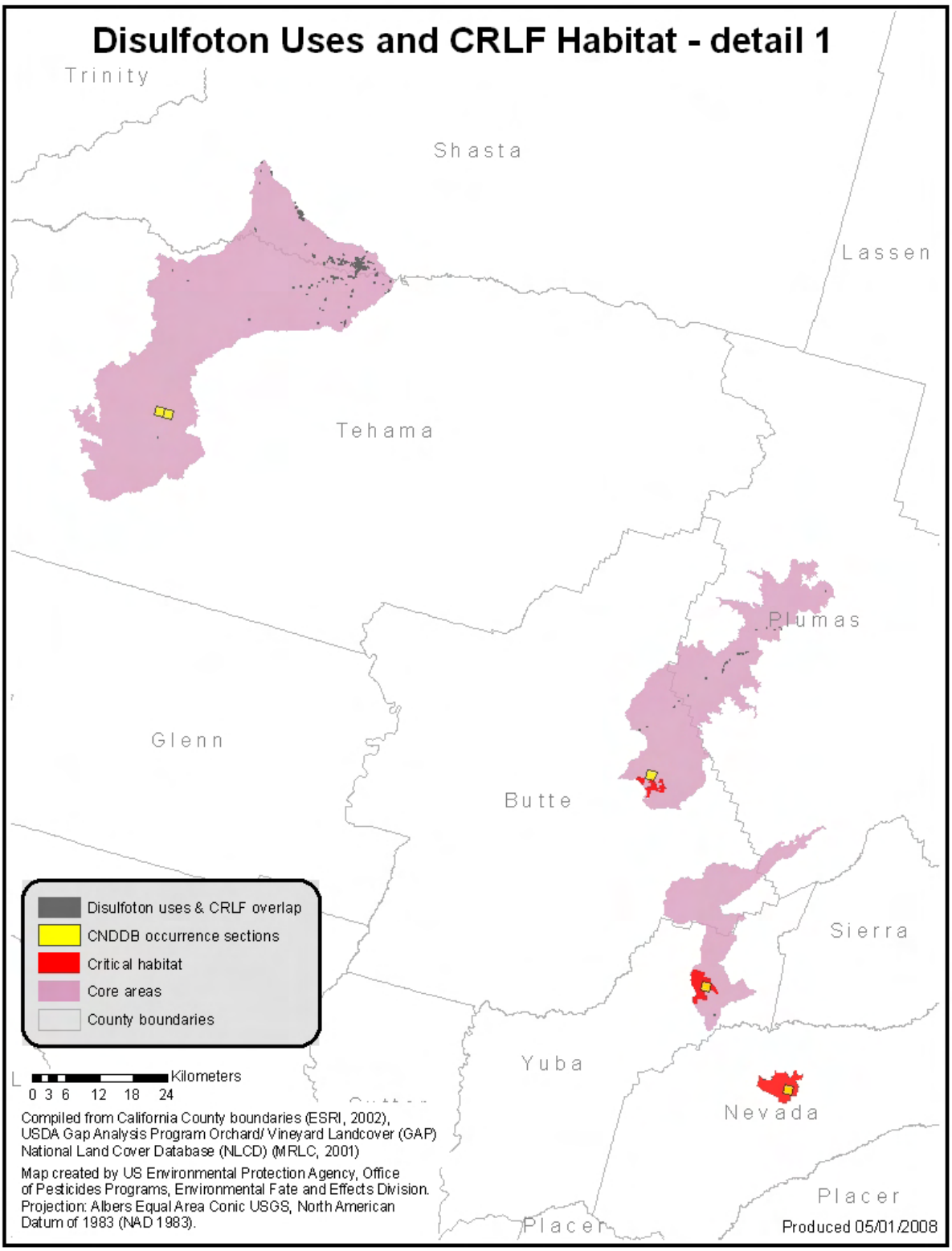

Disulfoton Uses and CRLF Habitat
detail 1
detail 3
detail 2
detail 4
detail 5
detail 6
Disulfoton uses & CRLF overlap
CNDDB occurrence sections
Critical habitat
Core areas
County boundaries
Kilometers
0 25 50 100 150 200
Compiled from California County boundaries (ESRI, 2002),
USDA Gap Analysis Program 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 05/01/2008

Figure 4.


Disulfoton Uses and CRLF Habitat - detail 1
Trinity
Shasta
Lassen
Tehama
Plumas
Glenn
Butte
Sierra
Yuba
Nevada
Placer
Placer
Disulfoton uses & CRLF overlap
CNDDB occurrence sections
Critical habitat
Core areas
County boundaries
Kilometers
0 3 6 12 18 24
Compiled from California County boundaries (ESRI, 2002),
USDA Gap Analysis Program Orchard/ Vineyard Landcover (GAP)
National Land Cover Database (NLCD) (MRLC, 2001)
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Projection: Albers Equal Area Conic USGS, North American
Datum of 1983 (NAD 1983).
Produced 05/01/2008

Figure 5.

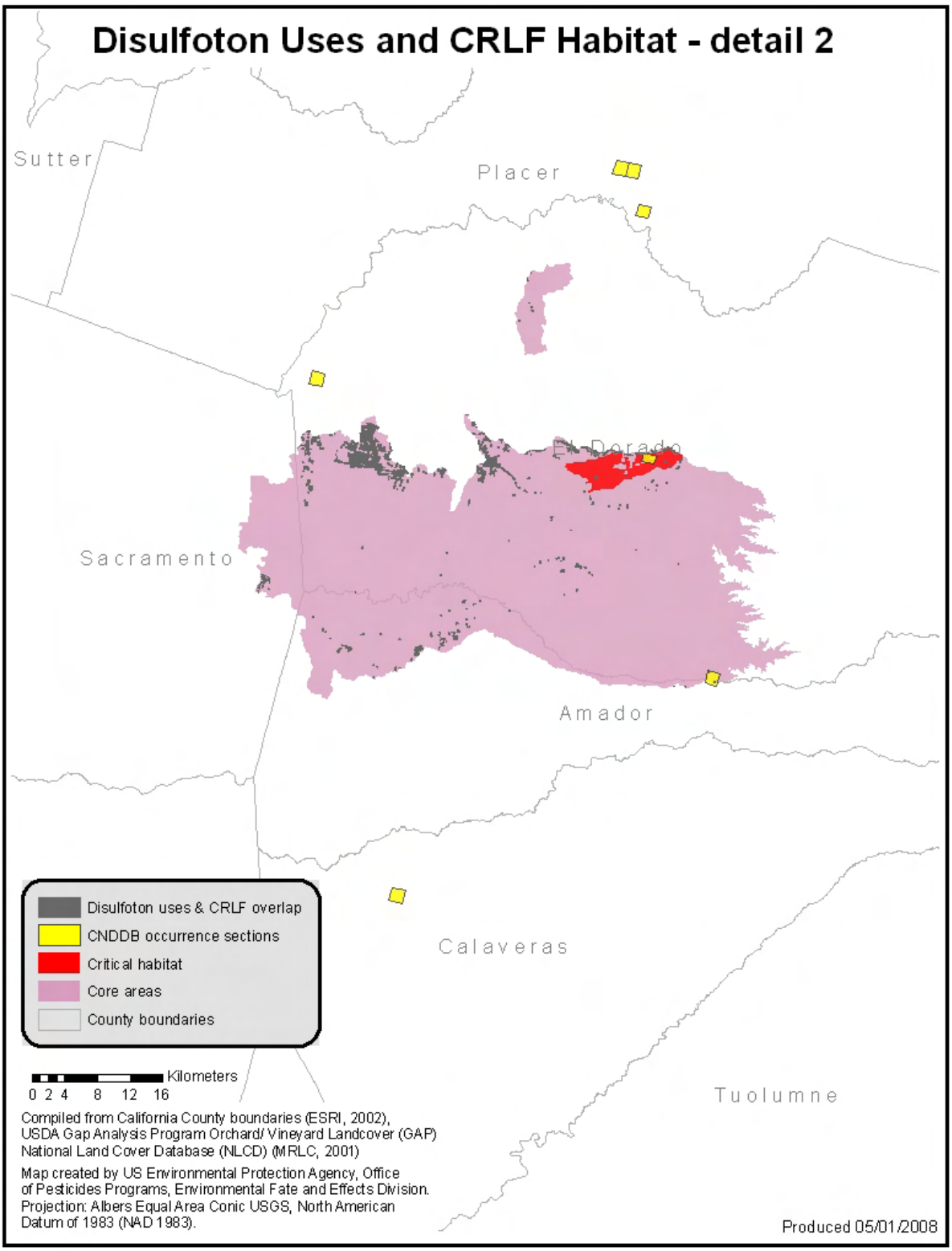
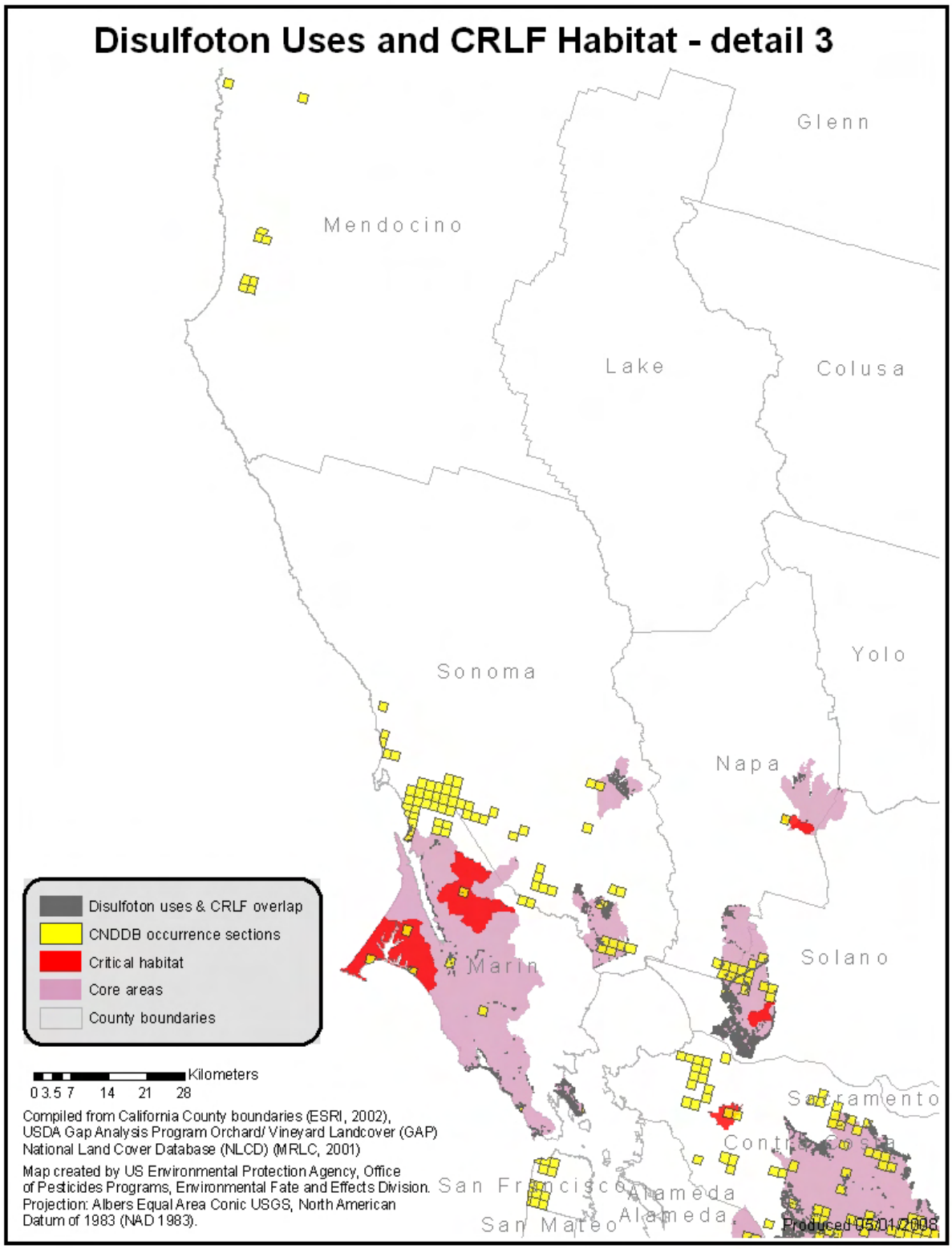

Disulfoton Uses and CRLF Habitat - detail 2
Sutter
Placer
El Dorado
Sacramento
Amador
Calaveras
Tuolumne
Disulfoton uses & CRLF overlap
CNDDB occurrence sections
Critical habitat
Core areas
County boundaries
Kilometers
0 2 4 8 12 16
Compiled from California County boundaries (ESRI, 2002),
USDA Gap Analysis 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 05/01/2008

Figure 6.


Disulfoton Uses and CRLF Habitat - detail 3
Glenn
Mendocino
Lake
Colusa
Sonoma
Yolo
Napa
Solano
Marin
Sacramento
Contra Costa
San Francisco
Alameda
San Mateo
Disulfoton uses & CRLF overlap
CNDDB occurrence sections
Critical habitat
Core areas
County boundaries
Kilometers
0 3.5 7 14 21 28
Compiled from California County boundaries (ESRI, 2002),
USDA Gap Analysis Program Orchard/ Vineyard Landcover (GAP)
National Land Cover Database (NLCD) (MRLC, 2001)
Map created by US Environmental Protection Agency, Office
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Datum of 1983 (NAD 1983).
Produced 05/01/2008

Figure 7.

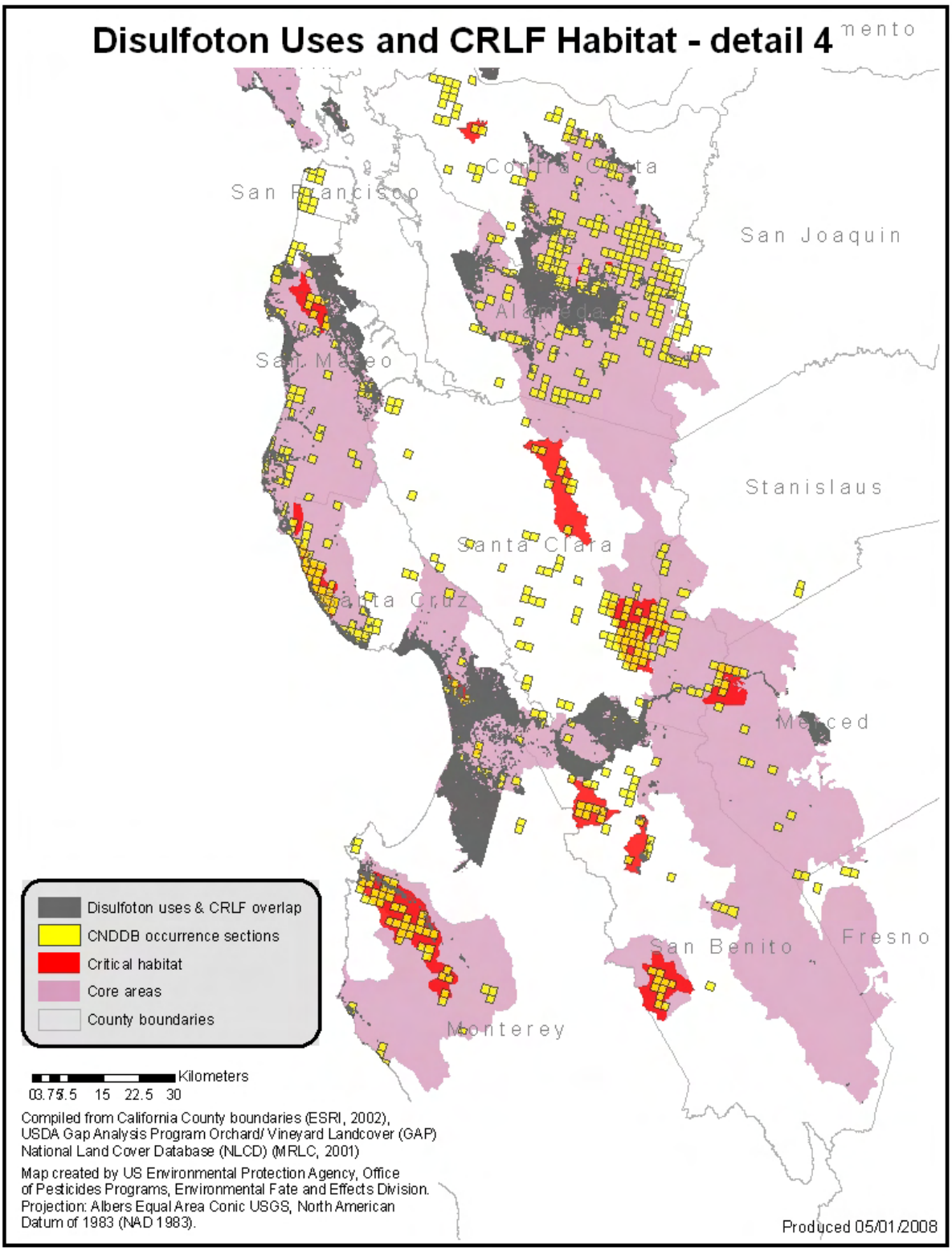
Disulfoton Uses and CRLF Habitat - detail 4
San Francisco
San Joaquin
Stanislaus
Santa Clara
Merced
San Benito
Fresno
Monterey
Disulfoton uses & CRLF overlap
CNDDB occurrence sections
Critical habitat
Core areas
County boundaries
Kilometers
0 3.75 7.5 15 22.5 30
Compiled from California County boundaries (ESRI, 2002),
USDA 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 05/01/2008

Figure 8.

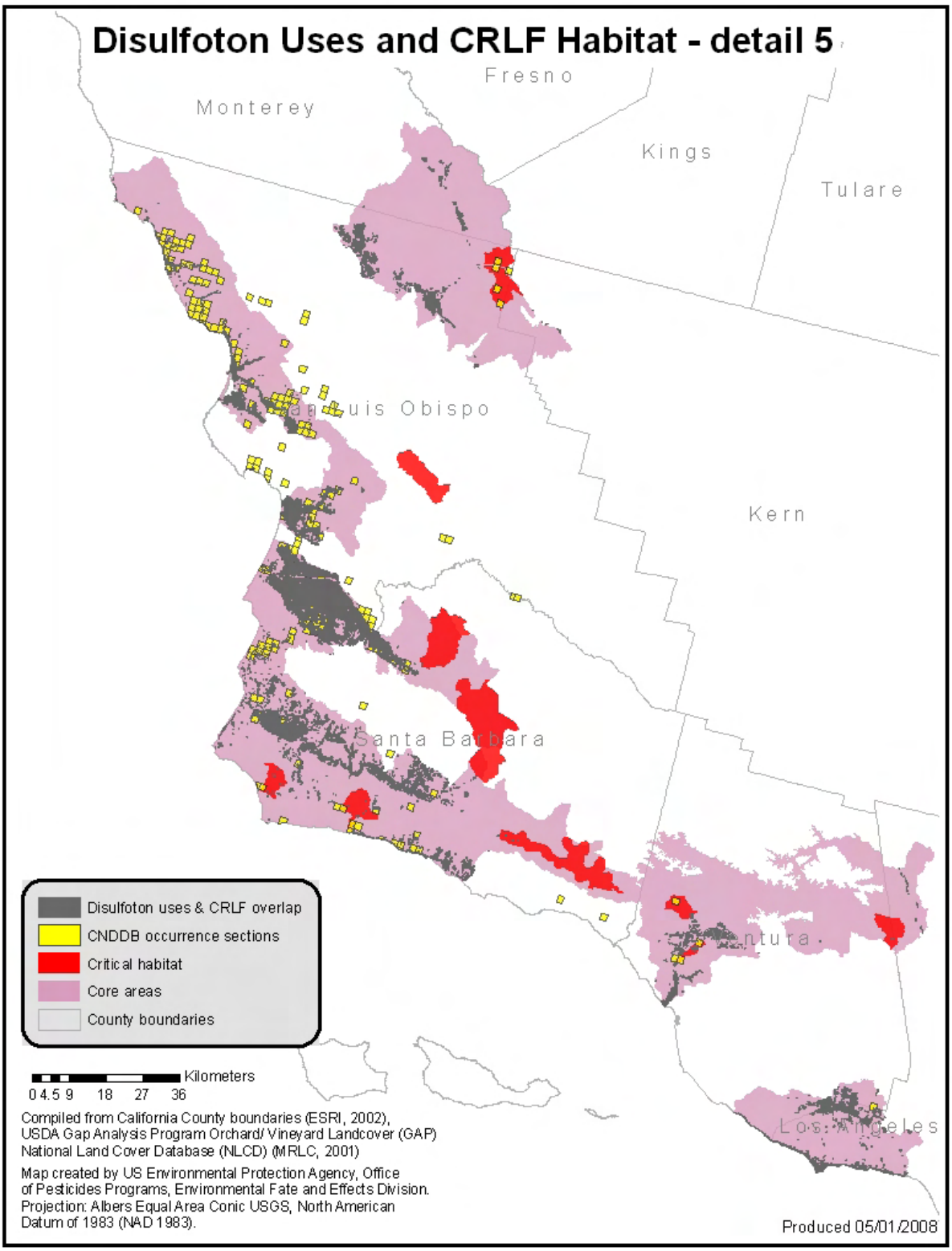
Disulfoton Uses and CRLF Habitat - detail 5
Fresno
Monterey
Kings
Tulare
San Luis Obispo
Kern
Santa Barbara
Ventura
Los Angeles
Disulfoton uses & CRLF overlap
CNDDB occurrence sections
Critical habitat
Core areas
County boundaries
Kilometers
0 4.5 9 18 27 36
Compiled from California County boundaries (ESRI, 2002),
USDA 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
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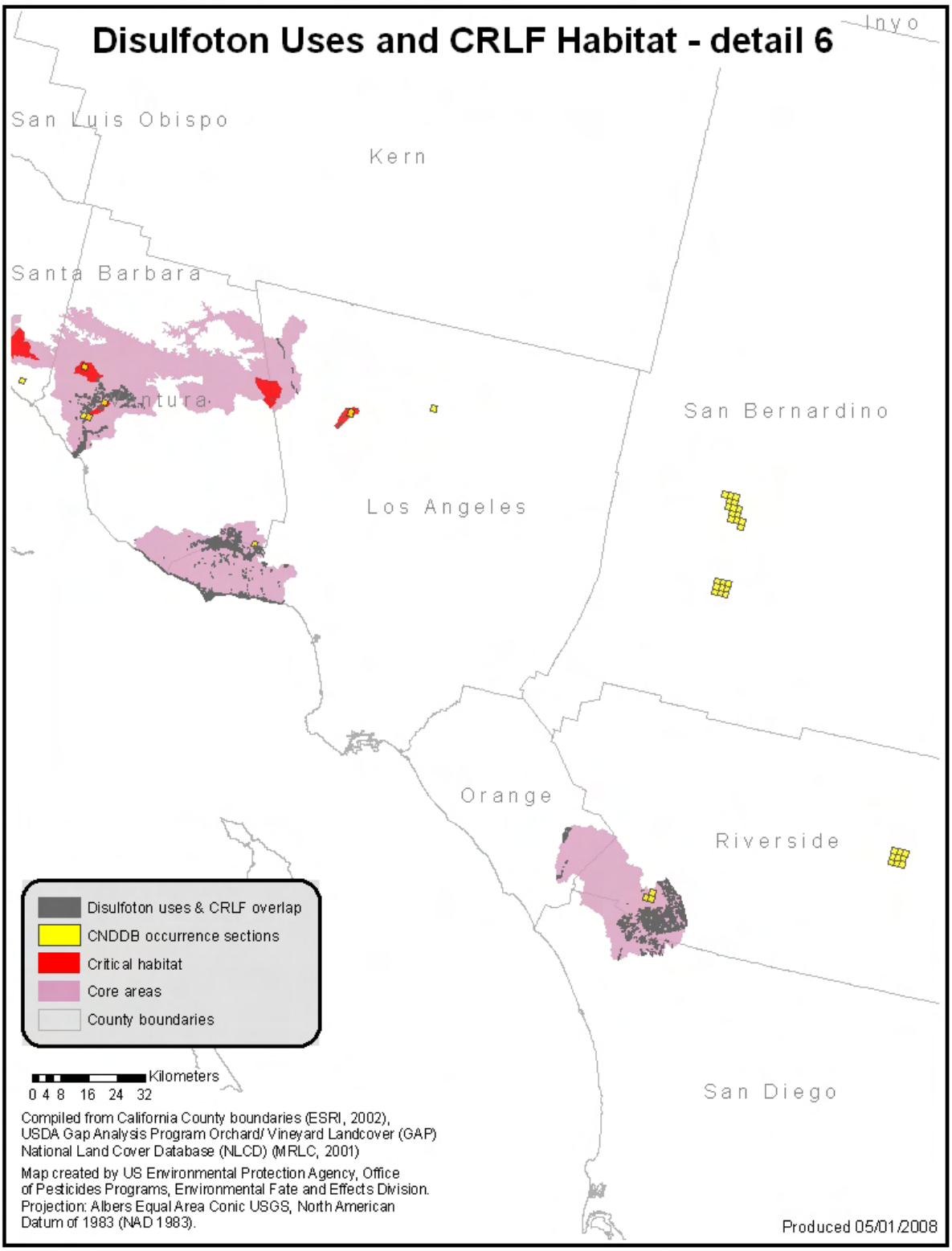
Figure 9.


Disulfoton Uses and CRLF Habitat - detail 6
Inyo
San Luis Obispo
Kern
Santa Barbara
Ventura
San Bernardino
Los Angeles
Orange
Riverside
San Diego
Disulfoton uses & CRLF overlap
CNDDB occurrence sections
Critical habitat
Core areas
County boundaries
Kilometers
0 4 8 16 24 32
Compiled from California County boundaries (ESRI, 2002),
USDA 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 05/01/2008

V. 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

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US FWS 2002 California Red-legged frog Core Areas.