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Tracking Landscape Change in the Central Valley:

Developing critical capability, strategies, and data to guide conservation and management of birds and their habitats

Progress Update
18 Feb 2011

Data Summary

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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Developing critical capability, strategies, and data to guide conservation and management of birds and their habitats

Project Update
18 Feb 2011

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18 Feb 2011 Data Summary

Prepared for:

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U.S. DEPARTMENT OF THE INTERIOR
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U.S. GEOLOGICAL SURVEY
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Summary: The collaborative project *"Tracking Landscape Change in the Central Valley: Developing critical capability, strategies, and data to guide conservation and management of birds and their habitats"* is comprised of two parts: 1) an effort led by USGS-Western Ecological Research Center (WERC) to develop a strategy for tracking key avian habitats in the Central Valley on an operational basis, and 2) an analysis led by Ducks Unlimited, Inc. (DU) to update spatial representation and tabular database of wintering waterfowl habitat in the Central Valley. This update summarizes data collected and describes progress made during the first 6 months (Sep 2010-Feb 2011) for the USGS-led portion of the project and expands upon the update provided in Oct 2010. The project study plan calls for two goals addressing the development of a landscape change tracking strategy to be accomplished by April 2011. These goals are to: 1) determine types and timing of key habitats to track for wintering waterfowl, breeding waterfowl, shorebirds, other waterbirds, and riparian songbirds in the Central Valley, and 2) identify existing data and types of new data that are necessary to track key habitats. This update reports on progress made on those two goals. (The DU-led part of the project is progressing as planned as described in their Oct 2010 update).

BACKGROUND

The Central Valley of California (Fig. 1) provides critical habitat for many bird species. In 1988, the Central Valley Joint Venture (CVJV) was formed as part of North American Waterfowl Management Plan, with the goal to restore and enhance Central Valley habitats necessary to support abundance and distribution of waterfowl similar to the 1970s (Central Valley Habitat Joint Venture Implementation Board 1990). The CVJV focus on wintering and breeding waterfowl has since been expanded to also include shorebirds, other waterbirds, and riparian songbirds.

CVJV planners use a bio-energetic modeling approach for wintering waterbirds and other methods for other bird groups to estimate the area of key habitats necessary to support goal bird populations. These habitat goals are determined for each Central Valley basin. The CVJV then works with partners to accomplish these goals through acquisition, restoration and enhancement. The CVJV maintains an online project database to track habitat acreage goals by habitat category (palustrine, riverine, upland, agriculture, etc.), habitat type (emergent shrub-scrub, forested, etc.), and water regime (perennial, seasonal, tidal/non-tidal, etc.). This online system allows CVJV partners to update and track project information and provides JV staff and partners with up-to-date information on habitat gains made through CVJV programs. However, urban development, changing cropping patterns, changing agricultural practices and other factors (e.g., climate) beyond the control of the CVJV are also occurring. The current system was not designed to track these changes which can greatly impact the types and amounts of habitats available to birds.

Tracking net habitat change (i.e. both gains and losses) at a landscape scale is key to conservation planning for wildlife species. The CVJV currently lacks this capability and has identified that tracking net landscape change is one of the primary issues that affects its ability to effectively monitor and evaluate habitats essential for healthy populations of the bird species upon which their conservation program focuses. This project was designed to address this need and is comprised of two parts 1) an effort led by USGS-Western Ecological Research Center (WERC) to develop a strategy for tracking key avian habitats in the Central Valley on an operational basis and 2) an analysis led by Ducks Unlimited, Inc. (DU) to update spatial representation and tabular database of wintering waterfowl habitat in the Central Valley.

Specific project goals are to:
1) Determine types and timing of key habitats for which tracking data are required
2) Identify existing data and types of new data that are necessary to track key habitats
3) Develop cost estimates for the collection and interpretation of each data source
4) Develop a feasible strategy to track key habitats on an operational basis
5) Collect and analyze new data to track change in availability of key bird habitats

This update summarizes data collected and describes progress made during about the first 6 months (Sep 2010-Feb 2011) for the WERC-led portion of the project (Goals 1-4) and expands upon the earlier update provided in Oct 2010. Regarding the development of a landscape change tracking strategy, the project study plan calls for addressing goals 1 and 2 by April 2011. This update reports on progress made addressing those two goals. (Progress on the DU-led part of the project [Goal 5] was provided in an Oct 2010 update).

ACCOMPLISHMENTS

Goal 1: Determine types and timing of key habitats for which tracking data are required.

The project team worked with the CVJV science coordinator, the CVJV Waterfowl Working Group, Shorebird and Waterbird Working Group, and Riparian Songbird Working Group members, and habitat managers to identify types and timing of key habitats needed to be tracked for breeding waterfowl, wintering waterfowl, shorebirds, waterbirds, and breeding riparian songbirds. The types and timing of habitats that were important to track were identified by each CVJV bird group based upon existing reports (see literature cited) and expert opinion. Habitat tracking needs were summarized into tables by each bird group (attached for reference; Appendix A, B, C). Initial habitat tracking tables developed for each bird group were expanded and refined through discussions with working group members that included a series of meetings and conference calls. To facilitate development of a feasible strategy to track key bird habitats in the Central Valley on an operational basis, tracking needs for individual bird groups were coalesced into a common table (Table 1) in order to better identify common and unique key habitats and more clearly detail and specify habitat tracking needs. This coalesced table was then used to develop a draft summary of tracking goals and possible tracking methods (Table 2).

The types and timing of key habitats and level of detail provided varied among bird groups (Appendix A, B, C). Bird ecology (e.g., seed vs. invert eaters), season (e.g., breeding vs. wintering), use of the information (monitoring vs. research), and other factors influenced habitat tracking needs. However, coalescing into a single table with a common format (Table 1) revealed significant overlap among bird groups in types, timing, and locations of habitats that needed tracking. Not surprisingly, due to their reliance on wetlands and flooded agricultural habitats, waterfowl, shorebirds, and waterbirds had the greatest overlap in tracking needs; importance of trees and shrub habitats was mostly unique to riparian songbirds. To aid pricing and prioritization, tracking goals were defined by habitat type and season, and include additional information on regional needs and methods (Table 2).

Goal 2: Identify existing data sources and types of data that are necessary to track key habitats.

A search of the literature, web, and personal contacts revealed a large number of often inter-related completed and on-going local, regional, or national landscape mapping projects (Table 3) that could serve as example of the type of projects that could be conducted in the future as well as provide baseline data for comparison with new data in a landscape change analysis. Availability of data and project details, classification precision, classes, attributes, and geographic scope varied greatly among projects.

FUTURE PLANS

We will further refine habitat tracking goals and methods, gather additional information on completed and on-going landscape mapping projects, and add information on habitat quality evaluation projects (e.g., food density evaluations, nesting cover quality evaluations), through additional consultation with CVJV bird working groups, habitat managers, remote sensing specialists, GIS project leaders, and wildlife habitat researchers. We will then develop cost estimates for each set of habitat tracking data and work with CVJV bird groups and others to prioritize data sets based on importance for each bird group and cost. We will then develop one

or more suggested options to track landscape change that will include information on suggested tracking frequency, estimated costs, and potential data sources.

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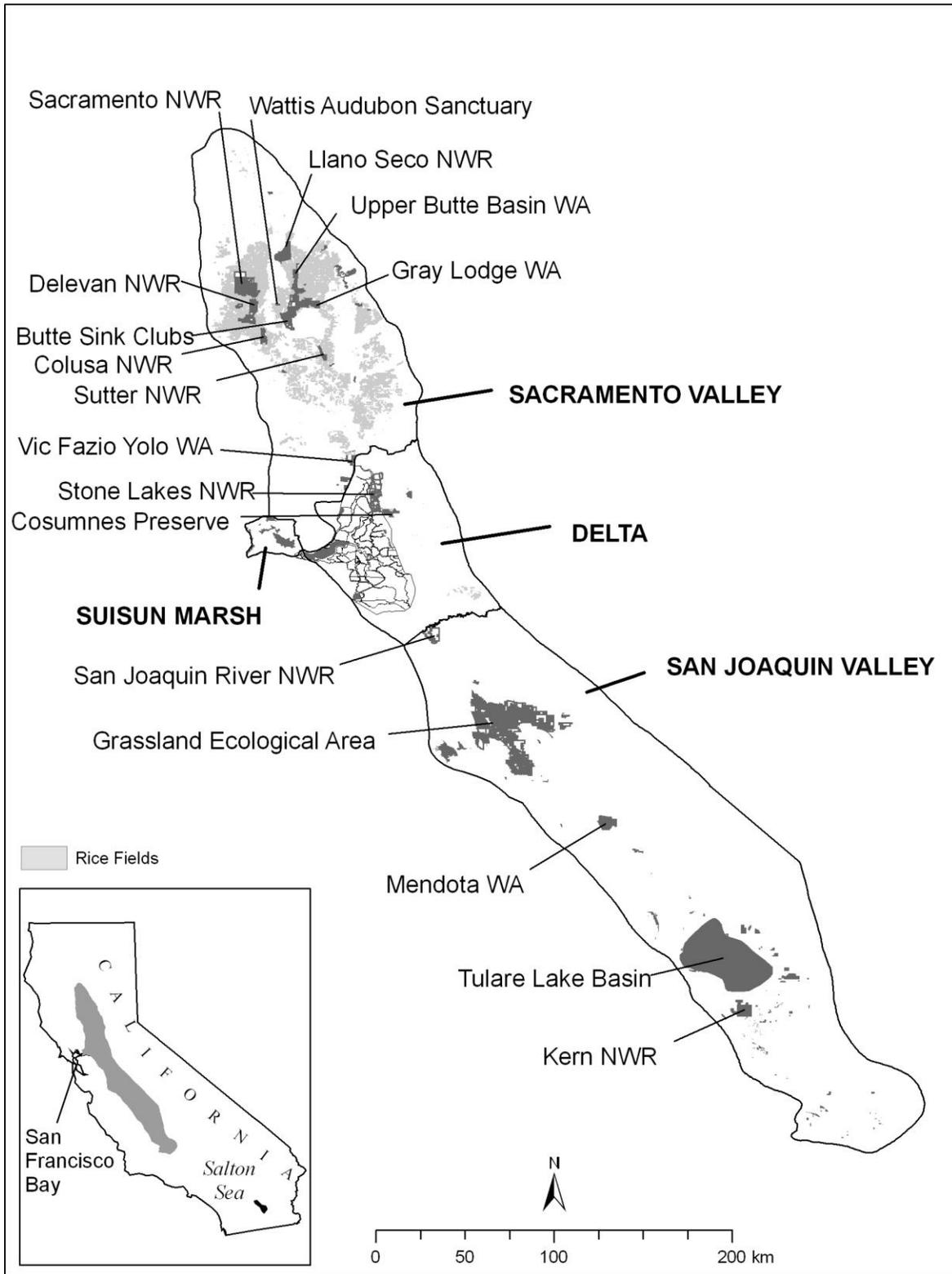
Figure 1. Central Valley Study Area

Table 1. Consolidated and expanded table of habitat tracking needs for waterfowl, shorebirds, waterbirds, and riparian songbirds.

Region	Habitat Type	Spring	Summer	Fall	Winter	Timing of use	Suggested timing of survey	Info Description
	WATERFOWL							
CV	Managed Seasonal Wetlands	Pair/Mig	-	Feed/Roost	Feed/Roost	Aug – Apr	Feb, Aug, Dec	Acres, flooded/not flooded
CV	Managed Semi-perm/Perm Wetlands	Pair/Mig	Brood/Molt	Feed/Roost	Feed/Roost	Year-round	Feb, Jun, Aug, Dec	Acres, flooded/not flooded
CV	Unmanaged Seasonal Wetlands[1]	Pair/Mig	Brood/Molt	Feed/Roost	Feed/Roost	Feb – May	Feb, Apr, Dec	Acres, flooded/not flooded
CV	Unmanaged Semi/Perm Wetlands	Pair/Mig	Brood/Molt	Feed/Roost	Feed/Roost	Year-round	Feb, Jun, Aug, Dec	Acres, flooded/not flooded
SJ,TB	Evaporation/Sewage Ponds	Pair/Mig	Brood	Feed/Roost	Feed/Roost	Year-round	Jun	Acres, flooded
CV	Riparian Habitat	Nest	Nest				Jun	Cavities, Boxes
CV	Canals/Ditches							
CV	Oak Woodland							
SA(CV)	Rice-Planted	Pair	Brood	Feed/Roost	Feed/Roost	Year-round	County Ag. Records	Acres
SA	Rice-Harvested			Feed	Feed	Sep-Mar	Sep, Oct, Nov, Dec	Acres/% of All Rice
SA	Rice-Har-Disked			Feed	Feed	Sep-Mar	Sep, Oct, Nov, Dec	Acres/% of All Rice
SA	Rice-Har-Plowed			Feed	Feed	Sep-Mar	Sep, Oct, Nov, Dec	Acres/% of All Rice
SA	Rice-Har-Burned			Feed	Feed	Sep-Mar	Sep, Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-Disk-MgmFlooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-Plow-MgmFlooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-Burn-McmFlooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-MgmFlooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-AllTrt-AllFlooded/Puddled			Feed/Roost	Feed/Roost	Sep-Mar	Feb Sep, Oct, Nov, Dec, Jan	Acres/% of All Rice
DE(CV)	Corn-Planted			Feed	Feed	Sep-Mar	County Ag Records	Acres
DE(CV)	Corn-Harvested			Feed	Feed	Sep-Mar	Oct, Nov, Dec	Acres
DE(CV)	Corn-Harvested-Plowed			Feed	Feed	Sep-Mar	Oct, Nov, Dec	Acres
DE(CV)	Corn-Harvested-Plowed-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Oct, Nov, Dec	Acres
DE(CV)	Corn-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Oct, Nov, Dec	Acres
DE(CV)	Corn-Har-AllTrt-AllFlooded/Puddled			Feed/Roost	Feed/Roost	Sep-Mar	Feb Sep, Oct, Nov, Dec, Jan	Acres
SA(CV)	Spring Wheat-Planted	Nest				Sep-Mar	County Ag. Records	Acres
DE,TB	Spring Wheat-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
SA(CV)	Winter Wheat-Planted	Nest/Browse				Sep-Mar	County Ag. Records	Acres
DE,TB	Winter Wheat-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
TB	Safflower-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
TB	Tomato- Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
TB	Cotton-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
TB	OtherCrop-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
CV	Idle Grass	Nest	Nest			Mar-Jun	County Ag. Records	Acres
CV	Irrigated Pasture/Hay	Nest	Nest			Mar-Jun	County Ag. Records	Acres
CV	Alfalfa	Nest	Nest			Mar-Jun	County Ag. Records	Acres
CV	Rangeland (grazed)	Nest/Browse	Nest			Mar-Jun	County Ag. Records	Acres
CV	Grass/Pasture/Hay-Flooded	Feed/Browse			Feed/Roost	Jan-May	Feb,Mar,Apr,May Jan	Acres

Region	Habitat Type	Spring	Summer	Fall	Winter	Timing of use	Suggested timing of survey	Info Description
	SHOREBIRDS							
CV	Managed Seasonal Wetlands	Mig	Breed	Feed/Roost	Feed/Roost	Aug – Apr	Apr Aug, Dec	Acres, flooded/not flooded
CV	Managed Semi-perm/Perm Wetlands	Mig	Breed	Feed/Roost	Feed/Roost	Year-round	Apr Jun, Aug, Dec	Acres, flooded/not flooded
CV	Unmanaged Seasonal Wetlands[1]	Mig	Breed		Feed/Roost	Feb – May	Feb, Apr,	Acres, flooded/not flooded
CV	Unmanaged Semi/Perm Wetlands	Mig	Breed	Feed/Roost	Feed/Roost	Year-round	Apr Aug, Dec	Acres, flooded/not flooded
SJ,TB	Evaporation/Sewage Ponds	Mig	Breed	Feed/Roost	Feed/Roost	Year-round	Jun	Acres, flooded
CV	Riparian Habitat							
CV	Canals/Ditches							
CV	Oak Woodland							
SA(CV)	Rice-Planted	Mig	Breed	Feed/Roost	Feed/Roost	Year-round	County Ag. Records	Acres
SA	Rice-Harvested							
SA	Rice-Har-Disked							
SA	Rice-Har-Plowed							
SA	Rice-Har-Burned							
SA(CV)	Rice-Har-Disk-MgmFlooded			Feed/Roost	Feed/Roost	Oct-Apr	Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-Plow-MgmFlooded			Feed/Roost	Feed/Roost	Oct-Apr	Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-Burn-McmFlooded			Feed/Roost	Feed/Roost	Oct-Apr	Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-MgmFlooded			Feed/Roost	Feed/Roost	Oct-Apr	Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-AllTrt-AllFlooded/Puddled			Feed/Roost	Feed/Roost	Oct-Apr	Feb,Mar Oct, Nov, Dec, Jan	Acres/% of All Rice
DE(CV)	Corn-Planted							
DE(CV)	Corn-Harvested							
DE(CV)	Corn-Harvested-Plowed							
DE(CV)	Corn-Harvested-Plowed-Flooded			Feed/Roost	Feed/Roost		Oct, Nov, Dec	Acres
DE(CV)	Corn-Harvested-Flooded			Feed/Roost	Feed/Roost		Oct, Nov, Dec	Acres
DE(CV)	Corn-Har-AllTrt-AllFlooded/Puddled			Feed/Roost	Feed/Roost	Aug-Mar	Feb Oct, Nov, Dec, Jan	Acres
SA(CV)	Spring Wheat-Planted							
DE,TB	Spring Wheat-Harvested-Flooded			Feed/Roost	Feed/Roost	Aug-Mar	Aug Oct, Nov, Dec Jan	Acres
SA(CV)	Winter Wheat-Planted							
DE,TB	Winter Wheat-Harvested-Flooded			Feed/Roost	Feed/Roost	Aug-Mar	Aug Oct, Nov, Dec Jan	Acres
TB	Safflower-Harvested-Flooded			Feed/Roost	Feed/Roost	Aug-Mar	Aug Oct, Nov, Dec,Jan	Acres
TB	Tomato- Harvested-Flooded			Feed/Roost	Feed/Roost	Aug-Mar	Aug Oct, Nov, Dec Jan	Acres
TB	Cotton-Harvested-Flooded			Feed/Roost	Feed/Roost	Aug-Mar	Aug Oct, Nov, Dec,Jan	Acres
TB	OtherCrop-Harvested-Flooded			Feed/Roost	Feed/Roost	Aug-Mar	Aug Oct, Nov, Dec Jan	Acres
CV	Idle Grass							
CV	Irrigated Pasture/Hay	Mig		Feed/Roost	Feed/Roost	Year-round	County Ag. Records	Acres
CV	Alfalfa	Mig		Feed/Roost	Feed/Roost	Year-round	County Ag. Records	Acres
CV	Rangeland (grazed)	Mig		Feed/Roost	Feed/Roost	Year-round	County Ag. Records	Acres
CV	Grass/Pasture/Hay-Flooded	Mig		Feed/Roost	Feed/Roost	Dec-May	Feb,Mar,Apr,May Jan	Acres Flooded
Region	*Habitat Type*	*Spring*	*Summer*	*Fall*	*Winter*	*Timing of use*	*Suggested timing of survey*	*Info Description*

	WATERBIRDS							
CV	Managed Seasonal Wetlands	Feed/Roost		Feed/Roost	Feed/Roost	Aug – Apr	Apr Aug, Dec	Acres, flooded/not flooded
CV	Managed Semi-perm/Perm Wetlands	Feed/Roost	Breed	Feed/Roost	Feed/Roost	Year-round	Apr Jun, Aug, Dec	Acres, flooded/not flooded
CV	Unmanaged Seasonal Wetlands[1]	Feed/Roost	Breed		Feed/Roost	Feb – May	Feb, Apr,	Acres, flooded/not flooded
CV	Unmanaged Semi/Perm Wetlands	Feed/Roost	Breed	Feed/Roost	Feed/Roost	Year-round	Apr Aug, Dec	Acres, flooded/not flooded
SJ,TB	Evaporation/Sewage Ponds							
CV	Riparian Habitat	Feed/Roost	Breed	Feed/Roost	Feed/Roost	Year-round	Jun	Acres
CV	Canals/Ditches	Feed/Roost	Breed	Feed/Roost	Feed/Roost	Year-round	Feb Jun	Acres
CV	Oak Woodland							
SA(CV)	Rice-Planted	Feed/Roost	Breed	Feed/Roost	Feed/Roost	Oct-July	County Ag. Records	Acres
SA	Rice-Harvested			Feed	Feed	Oct-Apr	Dec	Acres/% of All Rice
SA	Rice-Har-Disked			Feed	Feed	Oct-Apr	Dec	Acres/% of All Rice
SA	Rice-Har-Plowed			Feed	Feed	Oct-Apr	Dec	Acres/% of All Rice
SA	Rice-Har-Burned			Feed	Feed	Oct-Apr	Dec	Acres/% of All Rice
SA(CV)	Rice-Har-Disk-MgmFlooded			Feed/Roost	Feed/Roost	Oct-Apr	Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-Plow-MgmFlooded			Feed/Roost	Feed/Roost	Oct-Apr	Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-Burn-McmFlooded			Feed/Roost	Feed/Roost	Oct-Apr	Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-MgmFlooded			Feed/Roost	Feed/Roost	Oct-Apr	Oct, Nov, Dec	Acres/% of All Rice
SA(CV)	Rice-Har-AllTrt-AllFlooded/Puddled			Feed/Roost	Feed/Roost	Oct-Apr	Feb,Mar Oct, Nov, Dec, Jan	Acres/% of All Rice
DE(CV)	Corn-Planted			Feed	Feed	Oct-Jan	County Ag Records	Acres
DE(CV)	Corn-Harvested			Feed	Feed	Oct-Jan	Oct, Nov, Dec	Acres
DE(CV)	Corn-Harvested-Plowed			Feed	Feed	Oct-Jan	Oct, Nov, Dec	Acres
DE(CV)	Corn-Harvested-Plowed-Flooded			Feed/Roost	Feed/Roost	Oct-Jan	Oct, Nov, Dec	Acres
DE(CV)	Corn-Harvested-Flooded			Feed/Roost	Feed/Roost	Oct-Jan	Oct, Nov, Dec	Acres
DE(CV)	Corn-Har-AllTrt-AllFlooded/Puddled			Feed/Roost	Feed/Roost	Sep-Mar	Feb Sep, Oct, Nov, Dec, Jan	Acres
SA(CV)	Spring Wheat-Planted							
DE,TB	Spring Wheat-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
SA(CV)	Winter Wheat-Planted							
DE,TB	Winter Wheat-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
TB	Safflower-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
TB	Tomato- Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
TB	Cotton-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
TB	OtherCrop-Harvested-Flooded			Feed/Roost	Feed/Roost	Sep-Mar	Sep, Oct, Nov, Dec, Jan	Acres
CV	Idle Grass							
CV	Irrigated Pasture/Hay	Feed/Roost		Feed/Roost	Feed/Roost	Year-round	County Ag Records	Acres
CV	Alfalfa	Feed/Roost		Feed/Roost	Feed/Roost	Year-round	County Ag. Records	Acres
CV	Rangeland (grazed)	Feed/Roost		Feed/Roost	Feed/Roost	Year-round	County Ag. Records	Acres
CV	Grass/Pasture/Hay-Flooded	Feed/Roost	Feed/Roost	Feed/Roost	Feed/Roost	Jan-May	Feb,Mar,Apr,MayJun,July,Aug,Sep Jan	Acres Flooded

Region	Habitat Type	Spring	Summer	Fall	Winter	Timing of Use	Suggested timing of survey	Info Description
	BREEDING RIPARIAN SONGBIRDS							
CV	Managed Seasonal Wetlands		Breed			Aug-Apr	Apr	Acres, flooded/not flooded
CV	Managed Semi-perm/Perm Wetlands		Breed			Year-round	Apr	Acres, flooded/not flooded
CV	Unmanaged Seasonal Wetlands[1]		Breed			Feb-May	Apr	Acres, flooded/not flooded
CV	Unmanaged Semi/Perm Wetlands		Breed			Year-round	Apr	Acres, flooded/not flooded
SJ,TB	Evaporation/Sewage Ponds							
CV	Riparian Habitat	Mig	Breed	Mig	Feed/Roost	Year-round	Jun	Acres Forest and Scrub
CV	Canals/Ditches							
CV	Oak Woodland	Mig	Breed	Mig	Feed/Roost	Year-round	Jun	Acres
SA(CV)	Rice-Planted							
SA	Rice-Harvested							
SA	Rice-Har-Disked							
SA	Rice-Har-Plowed							
SA	Rice-Har-Burned							
SA(CV)	Rice-Har-Disk-MgmFlooded							
SA(CV)	Rice-Har-Plow-MgmFlooded							
SA(CV)	Rice-Har-Burn-McmFlooded							
SA(CV)	Rice-Har-MgmFlooded							
SA(CV)	Rice-Har-AllTrt-AllFlooded/Puddled							
DE(CV)	Corn-Planted							
DE(CV)	Corn-Harvested							
DE(CV)	Corn-Harvested-Plowed							
DE(CV)	Corn-Harvested-Plowed-Flooded							
DE(CV)	Corn-Harvested-Flooded							
DE(CV)	Corn-Har-AllTrt-AllFlooded/Puddled							
SA(CV)	Spring Wheat-Planted							
DE,TB	Spring Wheat-Harvested-Flooded							
SA(CV)	Winter Wheat-Planted							
DE,TB	Winter Wheat-Harvested-Flooded							
TB	Safflower-Harvested-Flooded							
TB	Tomato- Harvested-Flooded							
TB	Cotton-Harvested-Flooded							
TB	OtherCrop-Harvested-Flooded							
CV	Idle Grass		Breed			Year-round	County Ag. Records	Acres
CV	Irrigated Pasture/Hay		Breed			Year-round	County Ag. Records	Acres
CV	Alfalfa						County Ag. Records	Acres
CV	Rangeland (grazed)		Breed			Year-round	County Ag. Records	Acres
CV	Grass/Pasture/Hay-Flooded							

[1] Vernal pools, alkali meadows, seasonally-flooded depressional and riverine wetlands

[2] Ponds, canals, streams, oxbows, backwaters, etc.

CV = Valley Wide, SA = Sacramento Valley, DE = Delta, SM = Suisun Marsh, SJ = N San Joaquin Valley, TB = Tulare Basin.

Table 2. Landscape Tracking and Habitat Quality Evaluation Goals and Methods.

1) Goal: Track trend in area of landscape types important to waterfowl, shorebirds, waterbirds, and riparian songbirds
a) Use landsat image classification to map area of the following:
      seasonal wetlands
      semiperm/perm wetlands
      evap ponds
      sewage ponds
      lakes
      canals/ditches
      rivers/streams
      rice
      other crops
      hay/pasture
      idle grasslands
      riparian forest/forest-shrub
      oak woodland
      groves/woodlots
b) for additional info on specific crop types (corn, wheat, safflower, tomato, cotton, other) use:
      i) County Ag records to estimate acreage, or
      ii) California Augmented Multisource Landcover (CAML) data for crop type map
      (CWHR classes pasture, dry grain, irr grain, irr hay, irr row&field,, rice, orchard, etc.)
      iii) Pre-harvest ground/ aerial surveys to map crops

2) Goal: Track trend in peak managed flooding of winter (Oct-Jan) habitats for waterfowl, shorebirds, and waterbirds
Use most recent landscape map (same-year only for rice & other crops) produced above and map water on each type using ≥1 landsat image in the Tulare Basin (early Oct for Ag flooding; Nov/Dec for wetlands) and other regions (late Nov/early Dec usually late enough for most Ag and wetland flooding but avoid dates soon after [<7 days?] significant rainfall). Use radar data to fill gaps due to fog or clouds.

3) Goal: Track trend in average availability (managed and natural flooding) of winter (Oct-Jan) habitats for waterfowl, shorebirds, and waterbirds
Use most recent landscape map (same-year only for rice & other crops) produced above and map water on each type using landsat images in Oct, Nov, Dec, and Jan. Use radar data to fill gaps due to fog or clouds.

4) Goal: Track trend in peak managed flooding of spring (Feb-Apr) migration and pairing habitats for waterfowl, shorebirds, and waterbirds
Use most recent landscape map (same-year only for rice & other crops) produced above and map water on each type using ≥1 landsat image in Feb and ≥1 image in April (avoid dates <7 days after a significant rainfall). Use radar data to fill gaps due to fog or clouds.

5) Goal: Track trend in average availability (managed and natural flooding) of spring (Feb-Apr) migration and pairing habitats for waterfowl, shorebirds, and waterbirds
Use most recent landscape map (same-year only for rice & other crops) produced above and map water on each type using landsat images in Feb, March, and April. Use radar data to fill gaps due to fog or clouds.

6) Goal: Track trend in availability of summer (May-July) breeding habitats for waterfowl, shorebirds, and waterbirds
Use most recent landscape map (same-year only for rice & other crops) produced above and map water on each type using landsat images in May and July.

7) Goal: Track trend in availability of late summer/early fall (Aug-Sep) habitats for migrating shorebirds and waterbirds and molting and migrating waterfowl.
Use most recent landscape map (same-year only for rice & other crops) produced above and map water on each type using landsat images in Aug and Sep.

Information needed for nesting habitats in addition to that provided above:
8) Goal: Track trend in availability of nesting habitats for waterbirds
a) Use landsat imagery in July to map emergent vegetation in semiperm/perm wetlands
b) Use landsat imagery to map oak woodlands, groves/woodlots $\leq$ __ km from feeding habitats (i.e., wetland habitats, key ag habitats (rice, flood-irrigated alfalfa and pastures) (or map and quantify by distance-to-water and key ag habitats?)

9) Goal: Track trend in availability of nesting habitats for ground-nesting ducks
a) Use landsat imagery to map hay/pastures & idle grassland $\leq$ _ km from water & rice (or map & quantify by distance-to-water & rice?)
b) Use landsat imagery to map winter wheat and spring wheat area $\leq$ __ km from water & rice (or map and quantify by distance-to-water & rice?)

10) Goal: Track trend in availability of nesting habitats for cavity-nesting ducks
a) Use landsat to map oak woodlands & groves/woodlots are $\leq$ __ km from water & rice (or map and quantify by distance-to-water & rice?)
b) Survey riparian forest, oak woodlands, groves/woodlots <__km from water for cavities
c) Develop database to track wood duck box numbers and locations

11) Goal: Track trend in availability of nesting habitats for riparian song birds
a) Use LIDAR to measure veg height to classify riparian areas into forest, shrub, etc.
b) Conduct vegetation mapping from aerial photo interpretation and site visits to classify riparian habitat quality (CALVEG or other)

Information needed on wintering habitats in addition to that provided above:
12) Goal: Track trend in ag field food value for waterfowl, shorebirds and other waterbirds
Mostly in Sacramento Valley
a) Survey % of rice fields by post-harvest field treatment (Harvest only, Disked, Plowed,

Chisleplowed, Burned, Other; HarvFlooded, DiskFld, PlowFld ChisleplowFld,BurnedFld, OtherFld)

b) Sample harvested rice fields of each type immediately after flooding to estimate rice seed density

c) Sample flooded rice fields of each post-harvest treatment every __ weeks to estimate invert production

d) Sample flooded rice fields of each post-harvest treatment every __ weeks during Aug – Apr to estimate water depth (especially important to shorebirds)

In Delta (& SacValley?)
e) Survey % of corn fields by post-harvest field treatment (Harvest only, Disked, Plowed, Chisleplowed, Burned, Other; HarvFlooded, DiskFld, PlowFld ChisleplowFld,BurnedFld, OtherFld)

f) Sample harvest corn fields of each type immediately after flood to estimate corn seed density

g) Sample flooded corn of each post-harvest treatment every __ weeks to est. invert production

h) Sample flooded corn fields of each post-harvest treatment during Aug – Apr to estimate water depth (especially important to shorebirds)

In Tulare Basin
j) Sample other crop fields that are flooded to estimate seed density

k) Sample flooded fields of each other crop every __ weeks to est. invert production

l) Sample flooded fields of each other crop during Aug – Apr to estimate water depth (especially important to shorebirds).

Additional Notes:-Classify water status of year (dry, average, wet, etc.) to calibrate comparison of habitat availability among years.

Table 3. Completed or Ongoing Landscape Tracking Projects

1) The Department of Fish and Game's Vegetation Classification and Mapping Program (VegCAMP) is charged with the development of a complete, fine-scale, attribute-rich Statewide Vegetation map and corresponding digital GIS layer.
-Ongoing vegetation mapping effort largely conducted by Chico State University Geographic Information Center (GIC) in collaboration and via funding from a variety of sources including DFG/ DWR/RHJV/ & others
-Completed a fine-scale vegetation map for the northern Sierra Nevada foothills and began mapping of the greater San Joaquin Valley,
-Detailed Vegetation Mapping in the Sacramento Valley will be conducted Jan 2011-Dec 2014
    http://www.sgc.ca.gov/council_meetings.html
    (see Mar 17 2010 and Sep 1 2010 meeting materials for details)
    http://www.sgc.ca.gov/meetings/20100317/
    http://www.sgc.ca.gov/meetings/20100901/
    Butte, Yuba, Sutter, Placer, Sacramento Counties
    Approved for $510,000 funding on March 17, 2010 by The Strategic Growth Council
(sgc.ca.gov)
-DWR's Central Valley Flood Protection Program (CVFPP) project area is 2.8 mil ac (Note: total area of the Central Valley is about 14.4 mil ac).
-more than just a "riparian mapping effort"
-"Thematic resolution" (i.e. categorical veg type or attribute) approximates and adds clarity to National Vegetation Classification System (NVCS) group-level to produce framework for second pass which will delineate fine scale "Alliance-level" mapping aligned with the Manual of California Vegetation (CALVEG) classification.
-Focus so far on natural veg while also capturing ag and urban
-aerial photo interpretation used to capture difficult to access areas
-minimum mapping unit (MMU) 1 acre w min. avg width 10 meters
-will provide a finer scale complement to National Gap Analysis Program's (GAP) Calif. data.
-will cover greater area than Sacramento Riparian Mapping project (that contained some of the most complex habitat) http://www.sacramentoriver.org/sacmon/index.php
-John Hunt (jhunt@gic.csuchico.edu)

2) CAML (California Augmented Multisource Landcover Map)
http://cain.ice.ucdavis.edu/caml/camlmeta.html
100 m resolution, 2002 Multisource Land Cover data, 2006 urban, DWR
Supplements existing landcover maps to provide addl. Info on ag land types and urban.
CWHR classes including Pasture, Dry grain, Irr grain, Irr Hay, Irrg row&field, Rice, orchard, vineyard, flooded riparian, wetland, water
1. Alpine-Dwarf Shrub
3. Annual Grassland
4. Alkali Desert Scrub
5. Aspen
6. Barren
7. Bitterbrush

8. Blue Oak-Foothill Pine
9. Blue Oak Woodland
10. Coastal Oak Woodland
11. Closed-Cone Pine-Cypress
12. Chamise-Redshank Chaparral
13. Coastal Scrub
14. Douglas-Fir
15. Desert Riparian
17. Desert Scrub
18. Desert Succulent Shrub
19. Desert Wash
20. Eastside Pine
21. Estuarine
22. Freshwater Emergent Wetland
24. Jeffrey Pine
25. Joshua Tree
26. Juniper
27. Klamath Mixed Conifer
 28. Lacustrine
29. Lodgepole Pine
30. Low Sage
31. Marine
 32. Mixed Chaparral
34. Montane Chaparral
35. Montane Hardwood-Conifer
36. Montane Hardwood
37. Montane Riparian
39. Perennial Grassland
40. Pinyon-Juniper
41. Palm Oasis
42. Ponderosa Pine
43. Riverine
44. Redwood
45. Red Fir
48. Subalpine Conifer
49. Saline Emergent Wetland
50. Sagebrush
51. Sierran Mixed Conifer
53. Urban
55. Valley Oak Woodland
56. Valley Foothill Riparian
57. Water
58. White Fir
59. Wet Meadow
62. Unknown Shrub Type

63. Unknown Conifer Type
72. Pasture
77. Eucalyptus
101. Dryland Grain Crops
102. Irrigated Grain Crops
103. Irrigated Hayfield
104. Irrigated Row and Field Crops
105. Rice
106. Deciduous Orchard
107. Evergreen Orchard
108. Vineyard

3) USBR Central Valley Land Cover Mapping project
- Barbara Simpson, David Hansen, Chris Curlis, Chuck Johnson USBR Sacramento
-Lansat 7 TM, compared1993, 2000 and 2005 land cover
-Ability to mask out ag areas to focus on change in other cover types
http://proceedings.esri.com/library/userconf/proc01/professional/papers/pap272/p272.htm
Used DU, GAP, NLCD, many other coverages for 1993 base map.
http://proceedings.esri.com/library/userconf/proc01/professional/papers/pap260/p260.htm
-Combined the six datasets into one land cover dataset
-Additional details needed.

4) Central Valley Wetlands and Riparian Areas GIS database
-CDFG 1997 (DU, Pacific Meridian Resources, DFG, WCB, BOR, USGS)
-Landsat Thematic Mapping
-3 habitat categories (wetlands, ag, uplands)
-Specific projects include comparing area of dry and flooded rice
(1988-89, 1993-94, 1999-00 Fleskes et al. 2005, Spell et al 1995)
http://proceedings.esri.com/library/userconf/proc96/TO300/PAP262/P262.HTM

5) PRBO Conservation Science LIDAR mapping
-Nat Seavy
LIDAR analysis to map riparian veg height (shrub, forest, etc.)
http://www-csgc.ucsd.edu/NEWSROOM/NEWSRELEASES/2008/MappingBirdHabitats.html
http://sonic.net/~sfbayjv/pdfs/PRBO-Using%20Lasers%20to%20Map%20Bird%20Habitat.pdf
http://www.esajournals.org/doi/pdf/10.1890/08-1124.1

6) VegCAMP
http://www.dfg.ca.gov/biogeodata/vegcamp/
The Vegetation Classification and Mapping Program (VegCAMP) develops and maintains
California's expression of the National Vegetation Classification System.
-Delta: veg mapping from 2002 (& a few 2005) aerial photos & site visits
nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18211

(Delta Veg Report.pdf)

Five main ecological groupings of vegetation assemblages:
1) valley oak
2) black willow
3) red-osier dogwood
4) fresh-to-brackish water emergent wetland herbaceous vegetation
5) upland annual

Final Vegetation and Land Use map for the Delta
Map
Code Definition
1000 Urban or built-up Land
1100 Residential
1200 Commercial and Services
1271 Military – Built Up
1272 Military – Not Built Up
1300 Industrial
1400 Transportation, Communications, and Utilities
1410 Transportation Corridor
1500 Industrial and Commercial Complexes
1700 Other Urban or Built-up Land
2000 Agricultural Land
2100 Cropland and Pasture
2110 Flooded Agriculture
2200 Land
Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural
2210 Nurseries and Ornamental Horticultural Land
2220 Deciduous Orchards
2230 Evergreen Orchards
2240 Vineyards
2300 Confined Feeding Operations
2400 Other Agricultural Land
3000 Natural Vegetation
3100 Vacant
5000 Water
5100 Streams – Rivers

7) <u>Suisun Marsh veg map from aerial photos</u> (1999, 2003, 2006) & site visits; change detection
(Department of Fish and Game datasets Diana Hickson dhickson@dfg.ca.gov; 916-327-5956)
N SacVal, SanJVal (currently being mapped) and other areas.
-map of existing vegetation species/genus and/or landscape types (mapping units [mu])
Suisun Marsh Vegetation Mapping Change Detection 2003. DFG
Compared existing 1999 digital vegetation map and classification and compares it to 2003
classification from aerial photos. Field data was collected to strengthen the existing classification
and improve accuracy. VegMappingRpt_Suisun_Marsh_Change_Detection[1].pdf

8) FRAP Wildlife Habitat Maps http://frap.cdf.ca.gov/projects/frap_veg/index.asp
-California Department of Forestry and Fire Protection website
-County maps of wildlife habitat classifications
-2002 data
-utilized a variety of data coverages

9) California Wildlife Habitat Relationships, CWHR)
http://www.dfg.ca.gov/biogeodata/cwhr/wildlife_habitats.asp
At present, there are 59 wildlife habitats in the CWHR System: 27 tree, 12 shrub, 6 herbaceous, 4 aquatic, 8 agricultural, 1 developed, and 1 non-vegetated.

10) CALVEG
http://www.fs.fed.us/r5/rsl/projects

- Minimum Mapping Size

    o 2.5 acres for contrasting vegetation conditions based on cover type, vegetation type, tree cover from above classes and overstory tree diameter classes

    o No minimum mapping unit for lakes and conifer plantations

- Life Forms are initially generated from classification of Landsat Thematic Mapper imagery into the following hierarchical classes:

    o Conifer - greater than 10 percent conifer cover as the dominant type

    o Mix - greater than 10 percent tree cover and 20 to 90 percent hardwood cover

    o Hardwood - greater than 10 percent hardwood cover as the dominant type

    o Shrub - greater than 10 percent shrub cover as the dominant type

    o Grass - greater than 10 percent grass cover as the dominant type

    o Barren - less than 10 percent cover of any natural vegetation

    o Agriculture

    o Urban

    o Ice/snow

    o Water

11) GIC's Sacramento Riparian Mapping project
-Josh Viers
http://www.sacramentoriver.org/sacmon/index.php
-change detection of riparian coverage 2007 vs 1999 vs 1991-98
- The Central Valley Riparian Mapping Project was initiated in 1978 by the California Department of Fish and Game. Maps showing the occurrence of riparian vegetation on the depositional flatland or floor of the Central Valley were compiled from existing aerial

photographs (Nelson and Nelson CSU)

    Value Definition   2007 Riparian Coverage
    BS Blackberry Scrub - Rubus armeniacus (R. discolor) Semi-Natural Stands
    CW Cottonwood Series - Fremont Cottonwood Series
    CA California Annuals - California Annual Grassland Series
    VO Valley Oak (Quercus lobata) - Valley Oak Series
    GB Gravel and Sand Bars - These appear as open, unvegetated areas in air photos, but may have up to 50% annual and short-lived perennials.
    OW Open Water. This mapping unit constitutes water, either standing or moving.
    GR Giant Reed. - Arundo donax. - Giant Reed Series
    BE Box Elder - Acer negundo Forest Aliance
    BW Black Walnut - Juglans hindsii x - California Walnut Series
    GW Goodding's Willow - Salix gooddingii - Black Willow Series
    CS California Sycamore - Platanus racemosa aliance
    MW Mixed Willow Series
    RS Riparian Scrub
    PG Introduced Perennial Grassland Series
    CB Cattail - Bulrush
    LP Ludwigia peploides
    FL Floating -Leaved plants

12) GIC's Central Valley Historic Vegetation Mapping project
-created and compared pre-1900, 1945, 1960, and 1995 veg maps
hardwood, chaparral, grassland, riparian, alkali desert scrub, wetlands, aquatic, other floodplain
http://www.gic.csuchico.edu/pdf/summary_rpt.pdf

Table 5 – Valley wide Land Cover Changes

LAND COVER	1900 acres	1945 acres	1960 acres	PRESENT acres
urban\agriculture	0	6346459	8169169	9690262
riparian	1021584	368989	246429	132586
wetlands	2040766	793907	544645	133261
aquatic	241168	141974	89627	261683
grassland	7085483	3946049	3283692	3198301
valley/foothill hardwood	1165114	873315	805828	852767
alkali desert scrub	1755724	1545084	1120461	431196
chaparral	3469	3467	3293	11254
other floodplain habitat	1424137	718201	474355	-
TOTAL	**14737445**	**14737445**	**14737499**	**14711310**

13) Landscape Change in the San Joaquin Valley project
 (1885, 1912, 1945, 1977, 2000[4])
sphillips@esrp.csustan.edu CSU-Stanislaus
Phillips, S.E., P.A. Kelly, and D.F. Williams. 2005. Landscape Change in the San Joaquin Valley of California. Pre-European Settlement to
2000.http://www.esrp.org/projects/lrdp/restdata/SERCAL_05/page_4.htm
(Slides of landscape change, retired farmland in SJV, restored wetlands s of Mendota WA).

14) GAP
Davis et al. 1998
http://www.biogeog.ucsb.edu/projects/gap/gap_rep.html
Statewide map based on 1990 relatively coarse classification National Vegetation Classification System (NVCS) classes. Uses WHR Types. Major wetland areas mapped using 40 Ha mmu.

15) Sac-SJV Delta Habitat Delineation
DWR 1993; Non digital habitat maps based on ~1987 data on 1:24,000 orthophotoquads
CDFG 2007; Digitized 52 veg alliances from 2002 (& some 2005) photos (see VEGCAMP)
nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18211. See classification under VEGCAMP

16) USGS-EROS
Free satellite and other data
http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/Satellite_Products
-Multi-Resolution Land Characteristics Consortium (MRLC) http://www.mrlc.gov/
-National Land Cover Database (NLCD)
http://eros.usgs.gov/#Science/Landscape_Dynamics/Land_Cover-
Land_Use/National_Land_Cover
-1992, 2001 landsat classification (also 2006 update for some areas but not Central Valley)
-Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+), 30 m resolution
Land Cover Trends (1973 vs 2000) completed in Central Valley (11 general land cover classes)
http://landcovertrends.usgs.gov/west/eco7Report.html#_ftn1
Sleeter, B. M., T. Wilson, C. Soulard, and J. Liu, 2010, Estimation of Late 20th Century
Landscape change in California, Environmental Monitoring and Assessment, DOI
10.1007/s10661-010-1385-8
Sleeter, B. M., 2008, Late 20th century land change in the Central California Valley Ecoregion,
The California Geographer, Vol. 48 pp. 27-60.
Sleeter, B. M., and J. P. Calzia, 2008, Contemporary land cover change in the Klamath
Mountains Ecoregion in Acevedo, W. eds., Status and Trends of Western United States Land
Cover, U.S. Geological Survey Professional Paper.
SPOT 4 and SPOT 5- Free 1986-1998 satellite data with either 10 m, 5 m, or 2.5 m resolution
http://www.pnamp.org/node/2975
http://landsat.usgs.gov/documents/Jan_2010_Quirk_1-19_10_LST.pdf
GeoEye contacted the USGS about their intention to purge OrbView-3 archive, per NOAA license USGS, in partnership with NASA and the USDA, have contracted to receive satellite data over North America.The USGS recently awarded a contract to SPOT Image Corporation for moderate-resolution optical satellitedata. This data buy includes all collections of SPOT 4 and SPOT 5 data for the next 12 months over the conterminous U.S. and parts of Canada and Mexico. Data will be made available at no cost to U.S. Federal Civil Agencies and U.S. State and Local Government users, per the licensing arrangements. SPOT data will be directly downlinked to the USGS at the EROS Center following the installation of a SPOT ground

processing capability.
• The satellite was launched June 26, 2003 and was considered inoperable in March 2007
• The collection is comprised of 530,424 images
• Over 80% of the collection is made up of panchromatic, 1-m imagery; ms is 4-m, 4 band
• Approximately 50% of total has 10% or less cloud cover

17) USDI
New global inititative to track land cover and use changes
30 m resolution, urban, ag, forest, grass, shrub, water, wetlands, snow/ice, barren

18) EPA
Landscape Sciences Program
www.epa.gov/esd/land-sci/pdf/157leb00.pdf
-The 10-year goal of the Landscape Sciences Program is to conduct a national assessment of
landscape change between the early 1970s and the early 2000s.
-California analysis was slated for FY05 and FY06
- Completed Atlantic and N-NW California but not Central Valley
-K. Bruce Jones, EPA
North American Landscape Characterization Project (NALC)
http://www.epa.gov/nerlesd1/land-sci/north-am.htm
Dan Heggem and Ricardo Lopez
-Environmental Monitoring and Assessment Program (EMAP)
http://www.epa.gov/esd/land-sci/wildlife.htm

19) North American Waterfowl Management Plan Science Support Team (NSST-NAWMP)
Proposed work plan to map net landscape change
Proposal to charge JVs for analysis

20) Google Earth
Various capabilities for imagery analysis

Appendix A
BREEDING WATERFOWL

Spatial habitat database and tracking needs for **breeding waterfowl** as identified in Issue #1 of CVJV Breeding Waterfowl M&E Plan. Assumes inventory to be updated every 5 years and includes habitat type, timing of inventory, and associated life-cycle event.

Habitat Type	*Waterfowl Use*			*Peak timing of use by breeding ducks*	*Timing of survey*
Wetland Habitats	*Pairing Habitat*	*Nesting Habitat*	*Brood-rearing Habitat*		
Managed Seasonal Wetlands	X			January- March	February
Managed Permanent &Semi-perm Wetlands	X		X	Jan-Mar; May - Aug	Feb; June
Rice			X	May-August	June
Unmanaged Seasonal Wetlands[1]	X		X	February	February
Unmanaged Permanent Water[2]	X		X	Jan-Mar; May-Aug	Feb; June
Upland Habitats					
Managed Upland Nesting Cover		X		March-June	April
Native Grassland		X		March-June	April
Pasture/Rangeland		X		March-June	April
Hay		X		March-June	April
Fallow/Set-aside Lands		X		March-June	April
Winter Wheat		X		March-June	April
Other Crops ???		X		March-June	April
Unmanaged "edge" habitats[3]		X		March-June	April

[1] Vernal pools, alkali meadows, seasonally-flooded depressional and riparian associated wetlands, etc.

[2] Ponds, canals, streams, oxbows, backwaters, etc.

[3] Vegetated areas bordering fields, ditches, canals, riparian habitat, etc.

Appendix B
SHOREBIRDS & WATERBIRDS

Spatial habitat database and tracking needs for shorebirds and waterbirds as indentified in the CVJV Shorebird/Waterbird M&E Plan. Assumes inventory to be updated every 5 years and includes habitat type, timing of use, timing of availability, and suggestions for survey timing to determine presence/absence of habitat and quantity of habitat.

Habitat Type		Shorebird Use			Habitat availability/timing	Suggested timing of survey
	Spring Migration Habitat	Breeding Habitat	Fall Migration Habitat	Wintering Habitat		
Seasonal Wetlands	X	-	X	X	Aug – Apr	Apr, Aug, Dec
Semi-permanent/Permanent Wetlands	X	X	X	X	Year-round	Apr, Jun, Aug, Dec
Rice	X	X	-	X	Oct – July	Apr, Jun, Dec
Unmanaged Seasonal Wetlands[1]	X	X	-	X	Feb – May	Feb, Apr
Evaporation/Sewage Ponds	X	X	X	X	Year-round	Apr, Aug, Dec
Pre-irrigation/Cropland (Tulare Basin)	-	-	X	-	Aug - Oct	Aug
Irrigated Pasture/Hay	X	-	X	X	Year-round	Use County Ag. Records
Alfalfa	X	-	X	X	Year-round	Use County Ag. Records
Rangeland (grazed)	X	-	X	X	Year-round	Use County Ag. Records
Habitat Type		**Waterbird Use**			**Habitat availability/timing**	**Suggested timing of survey**
Wetland Habitats	Spring Habitat	Breeding Habitat	Fall Habitat	Wintering Habitat		
Seasonal Wetlands	X	-	X	X	Aug – Apr	Apr, Aug, Dec
Semi-permanent/Permanent Wetlands	X	X	X	X	Year-round	Apr, Jun, Aug, Dec
Rice	X	X	X (dry)	X	Oct – July	Apr, Jun, Dec
Unmanaged Seasonal Wetlands[1]	X	X	-	X	Feb – May	Feb, Apr
Canals/Ditches	X	X	X	X	Year-round	Feb, Jun
Riparian Habitat	X	X	X	X	Year-round	Jun
Corn	-	-	X (dry)	X	Oct – Jan	Dec
Irrigated Pasture/Hay	X	-	X	X	Year-round	Use County Ag. Records
Alfalfa	X	-	X	X	Year-round	Use County Ag. Records
Rangeland (grazed)	X	-	X	X	Year-round	Use County Ag. Records

[1] Vernal pools, alkali meadows, seasonally-flooded depressional and riverine wetlands

Appendix C
BREEDING RIPARIAN SONGBIRDS

Spatial habitat database and tracking needs for breeding riparian songbirds as indentified in the CVJV 2006 Implementation Plan and CVJV Riparian Songbird M&E Plan. Assumes inventory to be updated every 5 years and includes habitat type, timing of use, timing of availability, and suggestions for survey timing to determine presence/absence of habitat and quantity of habitat.

Habitat Type	*Riparian songbird and other landbird use*				*Habitat availability/timing*	*Suggested timing of survey*
	Spring Migration Habitat	*Breeding Habitat*	*Fall Migration Habitat*	*Wintering Habitat*		
Seasonal wetlands		X			Aug – Apr	Apr
Semi-permanent/permanent wetlands		X			Year-round	Apr
Unmanaged seasonal wetlands[1]		X			Feb – May	Apr
Riparian vegetation (forest and scrub)[2]	X	X	X	X	Year-round	Jun
Oak woodland[3]	X	X	X	X	Year-round	Jun
Grasslands/rangeland (grazed)[3]		X		X	Year-round	Use County Ag. Records

[1] Vernal pools, alkali meadows, seasonally-flooded depressional and riverine wetlands

[2] Any tracking of Central Valley riparian vegetation should be conducted in concert with current efforts by Riparian Habitat Joint Venture and Chico State GIS group.

[3] While not addressed in the 2006 Implementation Plan, tracking these habitats would allow us to expand our efforts to upland songbirds that are important conservation targets in the CVJV region.