Ecosystem Restoration Program - 2002 Proposal Solicitation Package (PSP)

Form 1 - Project Information

1. Proposal Title:
Sacramento River Restoration: Chico Landing Sub-Reach (RM 178-206)

2. Proposal applicants:
Ryan Luster, The Nature Conservancy

3. Corresponding Contact Person:
Wendie Duron
The Nature Conservancy
Sacramento River Project
500 Main St.
Chico, CA 95928
(530) 897-6376
wduron@tnc.org

4. Project Keywords:
Habitat Restoration, Riparian
Restoration Ecology
Revegetation

5. Type of project:
Implementation_Full

6. Does the project involve land acquisition, either in fee or through a conservation easement? No

7. Topic Area:
Riparian Habitat

8. Type of applicant:
Private non-profit

9. **Location - GIS coordinates:**
Latitude: 39.701
Longitude: -121.961
Datum:

Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.
Sunset Ranch (RM 199, east bank) 25 acres
RX Ranch (RM 194, west bank) 243 acres

Capay (RM 194, west bank) 550 acres
Dead Man Reach (RM 186, east bank) 238 acres

10. Location - Ecozone:
3.2 Red Bluff Diversion Dam to Chico Landing, 3.3 Chico Landing to Colusa

11. Location - County:
Butte, Glenn

12. Location - City:
Does your project fall within a city jurisdiction? No

13. Location - Tribal Lands:
Does your project fall on or adjacent to tribal lands? No

14. Location - Congressional District: 2 & 3

15. Location:
California State Senate District Number: 1 & 4
California Assembly District Number: 2 & 3

16. How many years of funding are you requesting? 3

17. Requested Funds:
a) Are your overhead rates different depending on whether funds are state or federal? No
If no, list single overhead rate and total requested funds: 25%
Total Requested Funds: $5,010,960
b) Do you have cost share partners already identified? No

c) Do you have potential cost share partners? No

d) Are you specifically seeking non-federal cost share funds through this solicitation? No

If the total non-federal cost share funds requested above does not match the total state funds requested in 17a, please explain the difference:

18. Is this proposal for next-phase funding of an ongoing project funded by CALFED? Yes

If yes, identify project number(s), title(s) and CALFED program (e.g., ERP, Watershed, WUE, Drinking Water):
97 NO-2 Ecosystem and natural process restoration on the Sacramento River: floodplain acquisition and management. ERP

Have you previously received funding from CALFED for other projects not listed above?

Yes

If yes, identify project number(s), title(s) and CALFED program.
97 NO-3 Ecosystem and natural process restoration on the Sacramento River: Active restoration of riparian forest, ERP.

97 NO-4 Ecosystem and natural process restoration on the Sacramento River: A meander belt implementation project, ERP.

98 F-18 Floodplain acquisition, management, and monitoring on the Sacramento River, ERP.

2000 FO-3 Floodplain acquisition and sub-reach/site-specific management: Sacramento River (Red Bluff to Colusa), ERP.

19. Is this proposal for next-phase funding of an ongoing project funded by CVPIA?
No

Have you previously received funding from CVPIA for other projects not listed above?
Yes

If yes, identify project number(s), title(s) and CVPIA program.
#00FG200173 Acquisition of Southam Orchard Properties for Preservation of Riparian Habitat, AFRP.

#1448-11332-7-G017 Hartley Island Acquisition, AFRP.

#11332-0-G014 Singh Walnut Orchard, AFRP.

#02FG20021 Sunset Ranch Restoration Grant

20. Is this proposal for next-phase funding of an ongoing project funded by an entity other than CALFED or CVPIA? No

Please list suggested reviewers for your proposal. (optional)

21. Comments:
none

Form 2 - Executive Summary

The Nature Conservancy's (TNC) Sacramento River Project requests $5,010,960 to restore native riparian communities within the Sacramento Rivers Chico Landing sub-reach (RM 178-206). Project goals are: 1) Develop tract-specific restoration plans using information generated from studies conducted during the development of the CALFED 97 NO-2 funded Chico Landing Management Plan, 2) Replace 1,056 acres of flood-prone agricultural land with native riparian communities that will benefit important at-risk wildlife species, 3)Determine the effectiveness of using cover crops as a method to control non-native invasive species (NIS) vegetation and decrease the use of herbicides prior to planting native understory vegetation in restoration tracts, 4) Advance our understanding of the factors that most strongly influence recruitment, growth and survival of native understory and woody species in restored tracts.

Hypotheses to be tested are: 1) Planting cover crops (bell beans and peas) offers an effective alternative to the application of herbicides for controlling problematic NIS vegetation during restoration, 2) Controlling NIS vegetation and providing an overstory canopy enhances recruitment and cover of native species, 3) Colonization and establishment of native understory plant species is higher in sites closer to remnant forest, and 4) A statistically significant relationship exists between environmental factors and vegetation growth and development on restoration sites.

The expected outcome is to add 1,056 acres of self-sustaining riparian habitat to the Chico Landing sub-reach for approximately 4,863 acres of nearly contiguous protection in this area. This project addresses the following CALFED ERP goals: 1) at-risk species, 2) ecosystem processes and biotic communities, 4) habitats, 5) non-native invasive species, and 6) sediment and water quality. CVPIA goals addressed include: 1) protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley of California, 2) improve habitat for all life stages of anadromous fish, and 3) involve partners in the implementation and evaluation of restoration actions.

Form 3 - Environmental Compliance Checklist

1. CEQA or NEPA Compliance
a) Will this project require compliance with CEQA? Yes
b) Will this project require compliance with NEPA? Yes
c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

2. If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies). *If not applicable, put "None".*
CEQA Lead Agency: to be determined
NEPA Lead Agency (or co-lead:) to be determined
NEPA Co-Lead Agency (if applicable):

3. Please check which type of CEQA/NEPA documentation is anticipated.
CEQA
-EIR

NEPA
-Environmental Assessment/FONSI

If you anticipate relying on either the Categorical Exemption or Categorical Exclusion for this project, please specifically identify the exemption and/or exclusion that you believe covers this project.

4. CEQA/NEPA Process

a) Is the CEQA/NEPA process complete? No

If the CEQA/NEPA process is not complete, please describe the dates for completing draft and/or final CEQA/NEPA documents.
This process will not be initiated until CALFED funding has been approved.

b) If the CEQA/NEPA document has been completed, please list document name(s):

5. Environmental Permitting and Approvals (*If a permit is not required, leave both Required? and Obtained? check boxes blank.*)

LOCAL PERMITS AND APPROVALS
Conditional use permit
Variance
Subdivision Map Act
Grading Permit
General Plan Amendment
Specific Plan Approval
Rezone

Williamson Act Contract Cancellation
Other

STATE PERMITS AND APPROVALS
Scientific Collecting Permit
CESA Compliance: 2081
CESA Compliance: NCCP
1601/03
CWA 401 certification **Required**
Coastal Development Permit
Reclamation Board Approval **Required**
Notification of DPC or BCDC
Other

FEDERAL PERMITS AND APPROVALS
ESA Compliance Section 7 Consultation
ESA Compliance Section 10 Permit
Rivers and Harbors Act
CWA 404
Other

PERMISSION TO ACCESS PROPERTY
Permission to access city, county or other local agency land.
Agency Name: none required

Permission to access state land.
Agency Name: none required

Permission to access federal land.
Agency Name: U.S. Fish and Wildlife Service **Required**

Permission to access private land.
Landowner Name: none required

6. **Comments.**

Form 4 - Land Use Checklist

1. Does the project involve land acquisition, either in fee or through a conservation easement? No

2. Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal? Yes

3. Do the actions in the proposal involve physical changes in the land use?
Yes

If you answered yes to #3, please answer the following questions:
a) How many acres of land will be subject to a land use change under the proposal?
1,056 acres

b) Describe what changes will occur on the land involved in the proposal.
Conversion of agricultural land to restored riparian communities.

c) List current and proposed land use, zoning and general plan designations of the area subject to a land use change under the proposal.

Category	**Current**	**Proposed (if no change, specify "none")**
Land Use	Sunset Ranch - fallow Rx Ranch - orchard Dead Man Reach - orchard Capay - fallow	All will be converted to riparian habitat.
Zoning	Sunset Ranch: A-160 Rx Ranch: AE-40 Dead Man Reach: AP-80 Capay: A-40	No Changes in the Zoning
General Plan Designation	Sunset Ranch - Orchard/Field Crop Rx Ranch - Intensive Agriculture Dead Man Reach - Orchard/Field Crop, Capay - Intensive Agriculture	No changes in the General Plan Designations

d) Is the land currently under a Williamson Act contract?
Sunset Ranch (25 acres) is subject to a Williamson Act contract.

e) Is the land mapped as Prime Farmland, Farmland of Statewide Importance, Unique Farmland or Farmland of Local Importance under the California Department of Conservation's Farmland Mapping and Monitoring Program?
Yes

If yes, please list classification:
See comments below

f) Describe what entity or organization will manage the property and provide operations and maintenance services.
Sunset Ranch and RX Ranch: The Nature Conservancy.
Dead Man Reach and Capay: The Nature Conservancy and U.S. Fish and Wildlife Service

4. Comments.
Question 3d: Sunset Ranch is subject to the Williamson Act. None of the other parcels are subject to the Williamson Act. Question 3e: The parcels Sunset Ranch and Dead Man Reach are designated under the Butte County FMMP as Irrigated Farmland. The Properties in Glenn County (Rx Ranch and Capay) are mapped in the FMMP as the following: Rx Ranch- Prime Farmland and Farmland of Statewide Importance; Capay- Prime Farmland, Farmland of Statewide Importance, and Farmland of Local Importance.

Form 5 - Conflict of Interest Checklist

Please list below the full names and organizations of all individuals in the following categories:
Applicants listed in the proposal who wrote the proposal, will be performing the tasks listed in the proposal or who will benefit financially if the proposal is funded. Subcontractors listed in the proposal who will perform some tasks listed in the proposal and will benefit financially if the proposal is funded. Individuals not listed in the proposal who helped with proposal development, for example by reviewing drafts, or by providing critical suggestions or ideas contained within the proposal. The information provided on this form will be used to select appropriate and unbiased reviewers for your proposal.

Applicant(s):
Ryan Luster, The Nature Conservancy

Subcontractor(s):
Are specific subcontractors identified in this proposal? Yes
If yes, please list the name(s) and organization(s):
Germain Boivin, Floral Native Nursery
Mark Leigh, Chico State Farms
John Anderson, Hedgerow Farms
Fred Thomas, CERUS Consulting
Dr. Karen Holl, UC Santa Cruz
Dr. David Wood, California State University, Chico

Helped with proposal development:
Are there persons who helped with proposal development? Yes
If yes, please list the name(s) and organization(s):
Daryl Peterson, The Nature Conservancy
Greg Golet, The Nature Conservancy
Wendie Duron, The Nature Conservancy
Amy Hoss, The Nature Conservancy
Carol Wong, The Nature Conservancy
Sam Lawson, The Nature Conservancy
Marlyce Myers, The Nature Conservancy
Mike Roberts, The Nature Conservancy

Comments:

Form 6: Budget Summary

Please provide a detailed budget for each year of requested funds, indicating on the form whether the indirect costs are based on the Federal overhead rate, State overhead rate, or are independent of fund source.
Budget is independent of fund source

Year 1

Task No.	Task Description	Direct Labor Hours	Salary *(per year)*	Benefits *(per year)*	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Planning	334	6,349	2,445	0	100	30,000	0	50	38,944	9,736	**48,680**
2	Implementation	698	9,124	3,513	0	300	2,341,615	0	0	2,354,551	588,638	**2,943,189**
3	Research	472	10,796	4,156	0	0	331,851	0	0	346,803	86,701	**433,504**
Proj Mgmt	Proj Mgmt	237	6,985	2,689	0	0	0	0	0	9,674	2,419	**12,093**
		1,741	**33,254**	**12,803**	**0**	**400**	**2,703,466**	**0**	**50**	**2,749,973**	**687,493**	**3,437,466**

Year 2

Task No.	Task Description	Direct Labor Hours	Salary *(per year)*	Benefits *(per year)*	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Planning	112	2,326	895	0	100	0	0	0	3,321	830	**4,151**
2	Implementation	258	4,000	1,540	0	100	796,135	0	0	801,775	200,444	**1,002,219**
3	Research	465	11,069	4,262	0	0	19,400	0	0	34,731	8,683	**43,413**
Proj Mgmt	Proj Mgmt	237	7,337	2,825	0	0	0	0	0	10,161	2,540	**12,702**
		1,072	**24,731**	**9,522**	**0**	**200**	**815,535**	**0**	**0**	**849,988**	**212,497**	**1,062,485**

Year 3

Task No.	Task Description	Direct Labor Hours	Salary *(per year)*	Benefits *(per year)*	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Planning	70	1,406	541	0	100	0	0	0	2,047	512	**2,559**
2	Implementation	408	6,627	2,551	0	100	367,995	0	0	377,273	94,318	**471,590**
3	Research	423	10,459	4,027	0	0	6,800	0	0	21,286	5,321	**26,607**
Proj Mgmt	Proj Mgmt	202	5,921	2,280	0	0	0	0	0	8,201	2,050	**10,251**
		1,103	**24,413**	**9,399**	**0**	**200**	**374,795**	**0**	**0**	**408,807**	**102,201**	**511,009**

Grand Total = **5,010,960**

Form VII - Budget Justification

Budget Form Instructions

Direct Labor Hours. Provide estimated hours proposed for each individual.

Position Hours: Conservation Planner-1,183 hrs; Preserve Assistant I-640 hrs; Preserve Assistant I-640 hrs; Program Assistant II-490 hrs; Science Specialist II-294 hrs; Program Director I-266 hrs; Operations Manager-192; Program Director II-175 hrs; Operations Assistant - 35 hrs

Salary. Provide estimated rate of compensation proposed for each individual.

Position Hourly Rate: Conservation Planner $22; Preserve Assistant I $13; Program Assistant II $17; Science Specialist II $30; Program Director I $34; Operations Manager $26; Program Director II $46; Operations Assistant $17

Benefits. Provide the overall benefit rate applicable to each category of employee proposed in the project.

38.5% for all categories

Travel. Provide purpose and estimate costs for all non-local travel.

None

Supplies & Expendables. Indicate separately the amounts proposed for office, laboratory, computing, and field supplies.

$800 field supplies

Services or Consultants. Identify the specific tasks for which these services would be used. Estimate amount of time required and the hourly or daily rate.

Estimates for Task 1 – Restoration Planning
CEQA/NEPA documentation & permitting - $30,000

Estimates for Task 2 – Restoration Implementation
Orchard Removal - $193,600
Plant Propagation - $554,730 (contracts with CSUC Farm, Floral Native Nursery, Hedgerow Farms)
Seed Collection - $147,750
Irrigation - $635,400
Grass Seed - $462,550 (Hedgerow Farms)
Pre-Treatment - $158,850
Planting & Maintenance - $1,270,800
Land Management - $37,065 (CERUS Consulting)

Estimate for Task 3 – Monitoring
Sub-task 1 - $49,500 (CERUS Consulting)
Sub-task 2 - $171,623 (UC Santa Cruz)
Sub-task 3 - $136,928 (CSU Chico)

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than $5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items.

None

Project Management. Describe the specific costs associated with insuring accomplishment of a specific project, such as inspection of work in progress, validation of costs, report preparation, giving presentations, response to project specific questions and necessary costs directly associated with specific project oversight.

Project management activities will include contract management, report preparation, accounting, and inspection of work in progress. Direct labor hours have been budgeted for these activities by Conservation Planner (308 hrs), Operations Manager (192 hrs) and Program Director II (175 hrs), equaling $35,046 in salaries/benefits and indirect costs.

Other Direct Costs. Provide any other direct costs not already covered.

Minimal postage costs of $50

Indirect Costs. Explain what is encompassed in the overhead rate (indirect costs). Overhead should include costs associated with general office requirements such as rent, phones, furniture, general office staff, etc., generally distributed by a predetermined percentage (or surcharge) of specific costs. *[CORRECTION: If overhead costs are different for State and Federal funds, note the different overhead rates and corresponding total requested funds on Form I - Project Information, Question 17a. On Form VI - Budget Summary, fill out one detailed budget for each year of requested funds, indicating on the form whether you are presenting the indirect costs based on the Federal overhead rate or State overhead rate. Our assumption is that line items other than indirect costs will remain the same whether funds come from State or Federal sources. If this assumption is not true for your budget, provide an explanation on the Budget Justification form.]* Agencies should include any internal costs associated with the management of project funds.

The Nature Conservancy (TNC) has a Negotiated Indirect Cost Rate (NICRA) of 25% that was negotiated and approved by TNC's cognizant agency, USAID, and calculated in compliance with the requirements of OMB Circular A-122. TNC's indirect cost per the NICRA includes salaries, fringe benefits, fees and charges, supplies and communication, travel, occupancy, and equipment for general and administrative regional and home office staff. These costs are reflected in the Indirect Costs category of this proposal and are not reflected anywhere else in the proposal budget. Direct staff costs are reflected in the salary and benefits categories of the proposal budget. Indirect costs are not assessed on the estimated cost to acquire any real property, which cost is included in other direct costs.

Section A: Project Description: Project Goals and Scope of Work

A.1. Problem

Since settlement of the Central Valley began in the 1850's, the Sacramento River has been drastically altered. Originally there were an estimated 800,000 acres of riparian forest along the main stem of the Sacramento River (Katibah 1984). The entire valley floor, including major tributaries to the Sacramento River, probably contained 900,000 to 1,600,000 acres of riparian habitat, with the riparian forest band at times stretching ten miles across. Riparian forests and associated aquatic habitats were once common within the meander belt and on alluvial terraces of the Sacramento River; however, 95% has been destroyed by firewood collection, agriculture, flood control projects, urban development, and hydropower development. Cumulatively, these changes have drastically reduced high-quality habitat and placed a high level of stress on the Sacramento River and its associated species.

Draining 24,000 square miles of the northern Central Valley and typically supplying 80% of freshwater flowing into the Bay-Delta, the Sacramento River is a fundamental state water resource (California State Lands Commission 1993). Even in its present degraded condition, the Sacramento River is the most diverse and extensive river ecosystem in California, capturing a a rich mosaic of aquatic habitats, oxbow lakes, sloughs, seasonal wetlands, riparian forests, valley oak woodlands, and grasslands. Riparian communities are sustained by ecological processes that drive changes in geomorphology and vegetation succession (Gregory et al. 1991, Baker and Walford 1995). Variations in soils, water availability, and disturbance level create microhabitats that are differentially utilized by a vast array of species (California State Lands Commission 1993, California Resources Agency 2000). In addition to providing critical breeding and migratory habitat for a host of important flora and fauna, riparian corridors play important roles in moderating stream temperature and reducing sediments and nutrients emanating from upland agriculture (Castelle et al. 1994, Altier et al. 2001).

An effective strategy improving the ecological condition of the Sacramento River ecosystem is active riparian restoration. Restoring riparian communities is critical for improving the degraded quality of habitat for threatened, endangered, and common species (RJHV 2000). Restoration creates new habitat to connect remnant riparian patches thereby improving migration and dispersal corridors for fish, birds, and other important wildlife species. Declining fish species whose future depends upon successful restoration of the Sacramento River include four races of Chinook salmon (*Oncorhynchus tshawytscha*), Sacramento splittail (*Pogonichthys macrolepidotus)*, steelhead trout (*Oncorhynchus mykiss*), and green sturgeon (*Acipenser medirostris*) (Moyle and Yoshiyama 1994, Yoshiyama et al. 1998, Sacramento River Advisory Council 2000). Winter-run Chinook are classified as a federally endangered species, while spring-run Chinook and Sacramento Splittail are listed as threatened. Additional special-status species associated with Sacramento River riparian communities include the bald eagle (*Haliaeetus leucocephalus*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), Swainson's hawk (*Buteo swainsoni*), bank swallow (*Riparia riparia)*, giant garter snake (*Thamnophis couchi gigas*), and valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). The proposed project will promote the recovery of these declining species by providing much-needed habitat.

In the absence of active river processes we have demonstrated that a number of dominant plant species can be successfully established through horticultural restoration (e.g., *Rosa californica, Populus fremontii, Salix* spp., *Quercus lobata, Fraxinus latifolia*) within one to four years of planting (Alpert et al. 1999, Griggs and Golet 2002). Accompanying research has demonstrated that within ten years of planting, these restoration sites may be colonized by important native species including the yellow-billed cuckoo and the valley elderberry longhorn

beetle (Small et al. 2000, TNC unpublished data). Based on these observations we believe that immediate, active restoration presents an effective solution to the problem of insufficient high-quality habitat in the project area.

Project Location: This project seeks funding for implementing restoration on four tracts within the Chico Landing Sub-reach (RM 178-206), a portion of the Sacramento River Conservation Area (SRCA) that has been the focus of several CALFED-funded acquisitions, modeling, and restoration planning studies (Figure 1, p. 35). Two of the tracts, Capay (formerly known as Kaiser) and Dead Man Reach (formerly known as Koehnen), are part of the U.S. Fish and Wildlife Service (USFWS) Sacramento National Wildlife Refuge Complex. The other tracts (RX Ranch and Sunset Ranch) are private conservation lands, currently owned by The Nature Conservancy (TNC). TNC expects that Sunset Ranch and RX Ranch will be transferred to public ownership once restoration is completed. Three of the tracts were acquired with CALFED funding (Capay, Dead Man Reach, and RX Ranch). Dead Man Reach and Sunset Ranch are located in Butte County; Capay and RX Ranch are located in Glenn County.

We requested funding for restoration of the 186-acre Sunset Ranch tract in our original (October 2001) Ecosystem Restoration Program (ERP) proposal, however, since then, we received funds from the Bureau of Reclamation's Central Valley Improvement Act (CVPIA) (b) (1) "other" program to restore 161 acres of this property. Thus, we are now only seeking funds to restore the remaining 25 acres of this tract that will not be covered by the CVPIA grant. All four restoration tracts are located within the Inner River Zone of the Sacramento River Conservation Area (Sacramento River Advisory Council 2000).

Study sites for the research and monitoring tasks of this proposal include the four restoration tracts described above as well as a set of reference sites that were restored by TNC 5-13 years ago. The specific reference sites that we propose to study are Ryan, Kopta Slough, Rio Vista, Sam Slough, River Unit, Lohman, Flynn, and Princeton Ferry (Figure 2, p. 36).

Project Goal: This project has two primary goals: 1. Implement active restoration to improve the ecological health and long-term viability of at-risk species and biological communities of the Sacramento River, while simultaneously increasing the benefits (e.g., improved water quality, flood damage reduction) that the river provides to humans; and 2. Conduct research and monitoring to advance the science that guides the restoration of riparian habitats in the Great Central Valley and beyond.

Project Objectives:

1. Develop tract-specific restoration plans using information generated from studies conducted during the development of the CALFED 97 NO-2 funded Chico Landing Sub-reach Management Plan.
2. Replace 1,056 acres of flood-prone agricultural land with native riparian communities that will benefit important at-risk wildlife species.
3. Determine the effectiveness of using cover crops as a method to control non-native invasive species (NIS) vegetation and decrease the use of herbicides prior to planting native understory vegetation in restoration tracts.
4. Advance our understanding of the factors that most strongly influence recruitment, growth and survival of native understory and woody species in restored tracts.

Project Hypotheses:

1. Planting cover crops (bell beans and peas) offers an effective alternative to the application of herbicides for controlling problematic NIS vegetation during restoration.

2. Controlling NIS vegetation and providing an overstory canopy enhances recruitment and cover of native species.
3. Colonization and establishment of native understory plant species is higher in sites closer to remnant forest.
4. A statistically significant relationship exists between environmental factors and vegetation growth and development on restoration sites.

A.2. Justification

Project Type: This is a full-implementation project. TNC's extensive past experiences in planning, implementing, and evaluating restoration on the Sacramento River leads us to believe the scale of this project is appropriate. We are continually refining our restoration planning methodologies by incorporating information from our earlier projects and a variety of other perspectives. While our knowledge of how vegetation communities respond to horticultural restoration efforts is incomplete, there has been sufficient demonstration that these techniques are effective to merit their application to new tracts (Griggs and Peterson 1997, Alpert et al. 1999, Griggs and Golet 2002).

Active horticultural restoration is often an important component of ecosystem restoration where natural regeneration is slow to occur or NIS vegetation threatens to dominate a site (Whisenant 1999). In addition, active horticultural restoration can aid in the rehabilitation of riparian communities where natural recruitment of riparian vegetation is impeded by diminished erosional and depositional processes (Friedman et al. 1995), and other alterations to the natural hydrograph (Mahoney and Rood 1998, Andersson et al. 2000, Tu 2000). By restoring key areas along the Sacramento River we can provide important, high-quality habitat to flora and fauna dependent upon this vital system (Moyle and Yoshiyama 1994, Point Reyes Bird Observatory 2000).

In addition to benefiting riparian-associated species, riparian corridors provide numerous benefits to the growing human population of the Central Valley. These benefits include improved water quality (Osborne and Kovacic 1993), reduced rates of bank erosion (Brice 1977, Micheli et al. in review), flood damage reduction, recreational opportunities, and aesthetics. By transferring restored properties to appropriate land stewards whose objectives include providing beneficial uses to the public, such as the U.S. Fish and Wildlife Service and the California Department of Fish and Game, these benefits will be further enhanced.

The Chico Landing Sub-reach (River Mile 178-206) includes a corridor of protected lands on both banks of the river making this sub-reach an ideal portion of the SRCA to conduct landscape-scale conservation and restoration. Located at the top of the Butte Basin flow split and the top of the non-levied portion of the Sacramento River, the Chico Landing Sub-reach encompasses a relatively unconfined section of the Sacramento River floodplain (Figure 1). In addition, the restoration tracts in the Chico Landing Sub-reach experience regular flooding and have variable soils, two factors that create an adverse environment for farming but an ideal environment for habitat restoration. Three of these restoration tracts were purchased under a CALFED 97 NO-2 grant (RX Ranch, Capay, Dead Man Reach) adding to over 3,800 acres of land already in conservation ownership within this sub-reach.

This project also contains a research component that will provide critical information for refining future riparian restoration work. We propose to conduct a set of small-scale experiments in the context of the planned restoration activities to test specific hypotheses that will advance riparian restoration techniques. Additionally we propose to conduct surveys of tracts that were planted in the past to assess the effect of a number of factors on long-term vegetation establishment. Gathering information on how the vegetation communities have developed following the cessation of restoration maintenance activities (e.g., irrigation, NIS control) is

critical to furthering our ability to calibrate our planting design model (Figure 3, p. 37) to local and landscape-scale conditions. This planting design model was developed by TNC to guide restoration activities within the Chico Landing Sub-reach. To bring a high caliber of science to the project we will work with research ecologists at the University of California, Santa Cruz, and California State University, Chico.

Conceptual Models:

A common theme has emerged among studies of ecosystem response to restoration; namely, that there is a great deal of variability in how different tracts within an ecosystem respond to the same management actions depending on both tract-specific and landscape-scale factors (Parker & Pickett 1997). Variable outcomes in restoration may be attributable to fundamental differences in the landscape matrices within which projects are embedded (Hansson et al. 1995), but may also represent unmeasured environmental differences on-site. Furthermore, many ecological processes are highly responsive to the scale and location at which habitat and processes are altered (Wiens 1989). Despite the difficulty in predicting restoration outcomes, ecologists are increasingly called upon in restoration projects to engineer specified "desired future conditions."

As first steps toward meeting this challenge, we propose to conduct a small set of integrated research and monitoring studies to resolve key ecological uncertainties, and to use the information gathered therein to construct empirical models of ecosystem function. Although models appropriate to a few species in riparian systems in the semi-arid west have previously been developed (e.g., Mahoney & Rood 1998), they have not been adequately tested to determine the generality and range of conditions over which they apply.

Our project is designed to test whether the success of restoration efforts at particular sites can be predicted based upon analyses of local site characteristics and landscape-scale factors (Attachment 1, p.21). As noted by Ehrenfeld & Toth (1997), there is a need for process-level ecosystem research in restoration projects that includes a variety of taxa and processes. Our proposal embraces this notion.

Our research approach combines experiments and monitoring with modeling. We will monitor native and NIS vegetation, and measure a range of local and regional physical and biotic variables thought to influence their distribution and abundance. Our ecological conceptual model (Figure 4, p. 38) illustrates how the relative distribution, abundance and biological performance of native vs. NIS vegetation at individual tracts can be predicted based upon tract characteristics, the surrounding landscape matrix (including the proximity of remnant natural habitats), previous land use, and the degree to which natural physical processes (flooding, sediment deposition, etc.) are maintained. This project will investigate the vegetation and the factors that affect its dynamics and it will inform studies that are currently underway which are focusing on higher order taxa (i.e., insects, fish, birds, bats).

Adaptive Management:

Our programmatic conceptual model (Figure 5, p. 39) demonstrates how restoration activities are organized within an adaptive management framework. In this project, we will rigorously analyze our past restoration efforts and incorporate these results into future restoration designs (see Section A.3., Task 3, Sub-task 3). The restoration designs that are developed by TNC are the products of an integrative process. This process draws from extensive past experiences in planning, implementing, and evaluating restoration on the Sacramento River since 1989 and from two decades of earlier work on the Colorado River. To bring these perspectives to the planning process TNC conducts evaluations of both ecosystem and societal response to restoration activities.

To date, TNC has primarily focused on bird and fish response to evaluate restoration success. Point Reyes Bird Observatory (PRBO) has devised tract-specific restoration and adaptive management recommendations for TNC and the USFWS. These recommendations are based on TNC and USFWS monitoring results and the Riparian Bird Conservation Plan (PIF & RJHV 2000). Since 1993 PRBO has been annually monitoring riparian restoration tracts in cooperation with TNC, USFWS, and California Partners in Flight (Small et al. 2000). PRBO's recommendations have focused on improving nesting habitat for open-cup nesters, with an emphasis on increasing understory structural and compositional diversity, a primary focus of this proposal. Overall, research suggests that riparian bird diversity increases significantly in the restoration tracts that have complex vegetation structure (Small et al. 2000), but some of the older tracts are limited in terms of the degree to which there has been natural recruitment of native plant species. To address this shortcoming, we propose to study factors affecting recruitment of native understory and woody species into both new and older restoration tracts (Section A.3. Task 3, Sub-task 2).

TNC has also partnered with Dr. Michael Marchetti of California State University, Chico to study habitat utilization patterns of fish on the Sacramento River. The results of these research efforts are feeding into TNC's adaptive management program by providing information on the importance of floodplain and aquatic habitats to native anadromous and resident fishes.

Ecosystem response data from adjacent revegetation tracts provides information on how plants and communities interact with different edaphic factors, hydrology, and management techniques (Sacramento River Project 1999, 2000). TNC's short-term monitoring has shown that, in general, grassland and savanna communities do best on tracts with low water tables, and also on more well drained tracts characterized by larger particle size soils (cobble, gravel). In contrast, forest communities tend to occur on tracts with high water tables and finer particle size soils (sand, silt). Vegetation monitoring at restored tracts has thus far been limited to monitoring survival and growth of planted trees (Alpert et al. 1999, Griggs and Golet 2002), except for preliminary efforts to monitor native woody recruitment and understory plants in the Beehive Bend Sub-reach (USFWS-TNC Cooperative Agreement #114201J1001) and preliminary surveys of understory vegetation in restored tracts (USCS faculty grant to K. Holl).

TNC has implemented a sub-reach planning program that gathers stakeholder feedback and evaluates restoration management actions from the standpoint of their impacts on important human services (e.g., flood damage reduction, water quality) and infrastructure (e.g., bridges and water-conveyance facilities). It is through the sub-reach planning process that we collect information to help us adaptively manage this aspect of our restoration work. We will meet directly with landowners adjacent to the restoration tracts through public meetings and private consultation to incorporate their considerations into plant designs prior to developing final restoration plans. For example, under guidelines of the USFWS, TNC does not plant elderberry (*Sambucus mexicana*) within 200 feet of private property to help prevent migration of the federally threatened valley elderberry longhorn beetle on to private lands. TNC has funded studies of the impacts of habitat restoration on the local economy, public access, cultural resources, and flood water conveyance (Attachment 2, p. 25).

Hypothesis Testing:

Please refer to Attachment 1 (p. 21) for hypotheses testing details.

1. *Planting cover crops offers an effective alternative to the application of herbicides for controlling problematic NIS vegetation during restoration.* To test this hypothesis we will compare experimental plots treated with cover crops to those treated with herbicides.
2. *Controlling NIS vegetation and providing an overstory canopy enhances recruitment and cover of native species.* To test this hypothesis we will have plots in which six native

understory species are introduced and we will compare those to others that are not seeded or planted and that have or lack aggressive NIS control. Plots will be established in the four tracts proposed for restoration in this proposal as well as eight older restored tracts in areas with and without dense overstory.

3. *Colonization and establishment of native understory plant species is higher in sites closer to remnant forest.* To test this hypothesis we will compare colonization and establishment of native understory plant species in plots monitored under (2) above, and (4) below.
4. *A statistically significant relationship exists between environmental factors and vegetation growth and development on restoration sites.* To test this hypothesis, we will relate cover and diversity of native species to various parameters (see Table 2, p.24) to determine which have the strongest effect on community composition through a combination of multivariate ordination and regression techniques. Particular attention will be paid to determining the effects that flooding and, more generally, hydrologic connection to the river have in shaping vegetation dynamics.

A.3. Approach

TNC will use horticultural restoration techniques to restore appropriate tract-specific vegetation communities as determined through the Chico Landing Sub-reach planning process. The SRCAF delineates fluvial geomorphic reaches and sub-reaches on the Sacramento River. TNC added criteria such as county boundaries, as a further division, in order to include socio-political management information. This combination of information resulted in roughly 15 to 20 mile long management units, also called sub-reaches. Planning at this scale can be summarized as a shift from small-scale, parcel-size planning to large, floodplain-scale planning. This scale facilitates an evaluation of restoration actions in the context of other land uses and infrastructure along the river, and also in the context of larger scale physical and biological.

In this project we will use a combination of experimentation, monitoring, and empirical modeling to evaluate the effectiveness of cover crops to control NIS vegetation, evaluate factors influencing the recruitment of native species into restoration tracts, and evaluate landscape factors that determine community structure on restoration tracts.

<u>Tasks 1-3: Restoration of 1,056 acres in the Chico Landing Sub-reach and restoration monitoring and research.</u>

The following three tasks are to be implemented on all four restoration tracts, Task 3 also includes experimental plots that will be located on previously restored tracts.

<u>Task 1: Restoration planning.</u>

Restoration plans will be based on the Chico Landing Long-term Management Plan being developed under CALFED 97 NO-2. The Chico Landing Sub-reach Planning process is an integral part of the management planning discussed in Attachment 1: CALFED 97 NO-2 Status Report for Next-Phase Funding. The restoration planning process in this proposal will utilize large-scale information collected in the Sub-Reach Planning process; this information will then be used to develop a tract-specific Restoration Plan for each proposed restoration tract. Information in the Restoration Plan will include location, background information, objectives including ecological and management goals, a three year detailed schedule of activities, planning (a summary of the baseline assessment activities and findings, the planting design, and nursery propagation activities), identifying compliance issues (permits, contracts, monitoring, and reporting), fieldwork to be accomplished (tract preparation, irrigation installation, planting), maintenance (NIS control and irrigation), and figures (topographic, flood recurrence, plant

design maps, and aerial photographs). The USFWS Sacramento National Wildlife Refuge, prior to implementing restoration, will approve restoration plans for Capay and Dead Man Reach.

Task 2: Seed collection, plant propagation, tract preparation, planting, maintenance, monitoring, and well abandonment.

The tracts currently have a NIS dominated herbaceous cover that will require repeated tilling and herbicide (glyphosphate, "Round-Up") applications prior to planting to decrease NIS density (Griggs and Peterson 1997). After planting, aisles will be mowed and herbicide sprayed around planted vegetation in the rows as a pre-emergent to deter NIS from setting seed. Irrigation systems are already in place at all four tracts, but these will need to be repaired and modified to support the proposed restoration. Tracts will be irrigated, generally, at low frequencies and for long-durations depending on tract conditions.

Planting and tract maintenance will be contracted out through a competitive bidding process to local farmers and overseen by TNC. Plant materials collection will be conducted by TNC staff while plant materials propagation will be contracted out to local nurseries: California State University Farms, Chico; Floral Native Nursery, Chico; Hedgerow Farms, Winters. Planting will occur in three phases: 1) potted stock, acorns, and cover crops will be planted in fall 2003, 2) willow and cottonwood cuttings will be planted in spring 2004, and 3) understory herbaceous layer will be drilled in fall 2004. The contracted farmers, using their own equipment, could begin preparations in summer 2003 depending upon the availability of funds. Farmers will be responsible for tract preparation, planting, and maintenance.

Based on preliminary baseline assessment data collected to date and to be completed by spring 2003, TNC will determine one of three general plant communities to revegetate a tract: forest, savanna, or grassland (Sawyer and Keeler-Wolf 1995). The four proposed restoration tracts described below are illustrated in Figure 1 (p 35). Table 1, below, identifies the mix of communities to be planted per tract.

Table 1. Community composition per tract (in acres) to be restored.

Tract Name & Acres	Sunset Ranch (25 acres)	RX Ranch (246 acres)	Capay (661 acres)	Dead Man Reach (553 acres)	Total
Forest	25	10	155	55	245
Savannah	0	202	355	100	657
Grassland	0	31	40	83	154
Total acres	25	243	550	238	**1,056**

At the end of all restoration activities, TNC will contract out with a certified well abandonment company to properly fill and cap wells on the restoration tracts according to county requirements. This is an important component of the restoration process that will ensure floodwaters do not contaminate groundwater supplies in Butte and Glenn Counties.

Task 3: Riparian restoration monitoring and research.

We propose to conduct science-based sampling and experimentation to modify and improve our current restoration practices. These scientific studies will address the four hypotheses listed above. We briefly summarize the experiments below and provide detailed experimental designs in Attachment 1 (p.21).

Sub-task 1: Cover crop NIS suppression trials.

We will use a randomized strip plot design with three replications to test the effectiveness of using cover crops (bell bean and pea mixture) as a pre-understory seeding NIS vegetation

suppression technique. Native grasses will then be no-till drilled into the plots with and without cover crops. Sub-task 1 will be conducted on three restoration tracts and replicated in the grassland community at RX Ranch, Capay, and Dead Man Reach (Sunset Ranch does not have a grassland restoration component in this proposal). The goal of this trial is to determine the effectiveness of using cover crops as a competitive biological control method for NIS control in lieu of herbicide application. Effective NIS control is essential for establishment of overstory and understory species and to ensure long-term native vegetation diversity at the restoration tract.

Sub-task 2: Manipulative experiments in new and old restoration tracts.

Experiments will be conducted at six tracts, the four that will be restored as part of this proposal, as well as two tracts restored by TNC over 10 years ago (Kopta Slough and River Unit). It is necessary to conduct the experiments at two older tracts in order to be able to test the hypothesis regarding overstory cover, since sufficient overstory cover will not establish in the newer tracts during the course of the study period. These experiments will test important questions of both basic ecological and management concerns. These experiments will enhance our understanding of the scale at which ecosystem recovery is implemented and the role of competition in this ecosystem.

From a management perspective, determining the effect of proximity of forest is important in prioritizing lands for restoration and deciding how to allocate scarce resources (i.e. if natural recovery is slower farther from a forest edge then it may be more important to plant additional species in these areas). By ascertaining the importance of overstory cover to competition between native and non-native species, we will learn whether it would be wiser to wait 5-10 years for the establishment of overstory cover before introducing other understory native plant species. Planting native understory species will help us to determine their effects on NIS vegetation control and aid in selection of species for restoration.

Sub-task 3: Vegetation-environment relationships on previously restored tracts.

We will collect data on colonization and establishment of native plant species (both herbaceous and woody), survival and growth of planted species at eight TNC restoration tracts planted between 1989 and 1997, four of which already have existing TNC long-term monitoring plots (Kopta Slough, Rio Vista, Sam Slough, River Unit). Additional sampling will be conducted at the Lohman, Flynn, Princeton Ferry, and Ryan tracts (Figure 2, p. 36). A minimum of ten plots will be established on each tract. We will also measure a variety of environmental variables including edaphic, hydrologic and landscape parameters.

We propose to carefully analyze established vegetation on restoration tracts with respect to survival and growth, community structure, and colonization of new native species (i.e. those not planted) and simultaneously relate current vegetation diversity and structure to a suite of environmental variables. Our goal is to build statistical and/or conceptual models that will enable managers to predict the success and type of ecological community at a given tract using a relatively small number of environmental predictors. Knowledge gained from this monitoring and analysis can then feed directly into future restoration designs (adaptive management) as well as aid in large-scale conservation planning.

Criteria for Hypothesis Testing:

Hypothesis 1: Under Task 3, Sub-task 1 we will evaluate the establishment of NIS vegetation in plots receiving cover crop treatment and adjacent plots receiving standard herbicide and mowing techniques. If NIS establishment is lower in plots receiving the cover crop treatments we will conclude that cover crops are more effective for controlling NIS than standard herbicide and mowing NIS control methods.

Hypotheses 2 and 3: Under Task 3, Sub-task 2 we will monitor natural recruitment of native understory and woody species, and the growth and survival of six planted native understory species in sites with differing levels of overstory cover, understory NIS cover, and proximity to the forest edge. If cover of naturally-recruiting native species is higher closer to the forest edge then we will conclude that recruitment is limited by sources of seed. If cover of native species is higher in plots where overstory cover is higher we will conclude that overstory cover is important to enhance seed dispersal and provide favorable growth conditions for native species. Higher diversity and cover of native species in NIS removal plots will indicate that NIS limit establishment of native species.

Hypothesis 4: Under Task 3, Sub-task 3 we will evaluate the extent to which we can predict community type from a subset of potential environmental measurements. Through a combination of multivariate ordination and regression techniques, we will relate cover and diversity of native species to various parameters to determine which have the strongest effect on community composition.

Information Richness and Value for Decision Makers:

Previous work has demonstrated that parameters such as edaphic factors, hydrology, and geology play an important role in affecting restoration success (Griggs and Peterson 1997, Alpert et al. 1999, Sacramento River Project 1999, 2000) though it is uncertain how these parameters specifically affect species success in this sub-reach. Research in other systems suggests that proximity to forest and reducing competition with non-native species should enhance establishment of native species, but the relative importance of these factors has not been experimentally tested in this system. The short-term monitoring program outlined in this proposal (see Performance Measures, p. 10) combined with baseline assessments will provide information on the relative effects of these parameters on species responses, thereby helping to prioritize management actions necessary to enhance restoration of both overstory and understory vegetation.

A.4. Feasibility

TNC has access rights and permission to carry out the activities of this proposal on all tracts included in this request for funding. Capay and Dead Man Reach are owned by USFWS, and managed by TNC under a Cooperative Land Management Agreement with the USFWS. As part of this Agreement, TNC is obligated to restore riparian habitat on Capay and Dead Man Reach. Although RX Ranch and Sunset Ranch are owned by TNC, TNC anticipates it will transfer Sunset Ranch to an appropriate public agency by fall 2003; a transfer date for RX Ranch to the Department of Fish and Game's Pine Creek Unit or other appropriate conservation agency or land trust has yet to be determined. An Environmental Assessment (EA) was conducted for the restoration of several units of the Sacramento National Wildlife Refuge, including Capay, Dead Man Reach, in addition to the TNC-owned Sunset Ranch (Jones and Stokes 2001). A finding of no significant impact (FONSI) was issued by the USFWS for proposed restoration on Capay, Dead Man Reach, and Sunset Ranch in 2002. Environmental compliance actions for RX Ranch are included within this proposal and will be conducted prior to restoration implementation. TNC will contract with an appropriate consulting firm to complete the environmental compliance.

TNC has been restoring native riparian habitat on the Sacramento River since 1989 on properties owned by TNC, USFWS, and the Department of Fish and Game (Griggs and Peterson 1997). To date, TNC and its partners have secured over 15,000 acres for conservation within the

100-year floodplain between Red Bluff and Colusa. TNC staff and seven contracted local farmers have planted over 3,000 acres of riparian habitat on twelve different tracts. These planting methods have been continually refined since 1989 by TNC staff through adaptive management (Sheehan and Griggs 1994, Hujik and Griggs 1995a, Hujik and Griggs 1995b). TNC's experience demonstrates the feasibility of restoring self-sustaining riparian communities within 1 to 4 years after planting (Alpert et al. 1999).

Timing of the restoration activities is flexible; planting can begin as early as October and can be completed as late as June. This wide planting window accounts for weather and flooding events, the ability to irrigate affords a large degree of flexibility in timing planting schedules. This work will be completed within the three-year grant period.

A.5. Performance Measures

Tract-specific measurements of the establishment, survival, and growth of plantings provides a first and most basic measure of project success or failure. Measurements at restoration tracts determine if planting has met design specifications, indicate initial success, and encourage the development of better restoration techniques. Performance measures will consist of three monitoring phases for each of the four tracts during the three-year life of the project. These monitoring phases will include: 1) 30-day post-planting evaluation, 2) end of growing season monitoring, and 3) project completion monitoring.

The 30-day post-planting monitoring will be conducted one month after all riparian species have been planted. Based on previous monitoring results, a census conducted on 10% of each community type planted adequately captures survival per species per community (Sacramento River Project 1999, 2000). Results from the 30-day post-planting monitoring will provide baseline establishment and survival data against which end of growing season and project completion monitoring will be compared. End of growing season monitoring will be conducted in December for the three year life of the project while project completion data will be collected once in final fall of the project. In addition, TNC will measure average height of all planted species (potted stock and cuttings) at each monitoring phase. This will permit comparisons of species growth across different restoration tracts.

TNC will require the contracted farmers to meet an 80% survival rate averaged across all potted stock trees and shrubs, acorns, and cuttings as well as 80% frequency for understory forb and grass species. The 80% survival and frequency requirements must be met at the end of each growing season and project completion monitoring phases in order for contracted farmers to be paid for their restoration activities. TNC uses an 80% survival rate because, to date, this has been the minimum survival rate monitored at TNC restoration tracts and therefore this has been an easy goal for contracted farmers to meet. If a farmer does not meet the 80% requirement, TNC will conduct a more in-depth census to determine if factors outside the control of the farmer were responsible for poor species performance.

TNC is also engaged in longer-term studies of ecosystem response. For example, under Task 2 of TNC's CALFED 97 NO-3 agreement, a monitoring plan is being developed and implemented. In addition, TNC has been working with PRBO (see Section A.2. Justification, Adaptive Management) and California State University, Chico to monitor tract-based ecological function including monitoring groundwater quality, soil development, and nutrient cycling (C and N dynamics) as functions of restoration age (Brown and Wood 2002).

A.6. Data Handling and Storage

TNC will archive all data collected in this project. Data will be stored electronically in ArcView GIS, and Microsoft Excel, Access, or Word formats.

A.7. Expected Products and Outcomes

Task 1 deliverable: Restoration plans for each of the four tracts will be provided to CALFED upon completion of all final plans.

Task 2 deliverables: TNC will provide CALFED with quarterly programmatic and financial reports, and annual reports that will include progress to date and monitoring results. TNC will provide restoration activity updates to the Sacramento River Conservation Area Forum's Technical Advisory Committee and Board. In addition, TNC will complete all necessary environmental compliance requirements prior to restoration implementation for RX Ranch. TNC will contract out to a certified well abandonment company to permanently seal wells in accordance with county regulations at the end of the restoration process at each of the proposed restoration tracts. Tasks, sub-tasks, deliverables, and deliverable dates are listed in Table 2 below.

Task 3 deliverables: See Table 2.

Table 2: Tasks, sub-tasks, deliverables, and deliverable dates for Sunset Ranch, Dead Man's Reach, Capay, and RX Ranch.

Task	**Sub-tasks**	**Deliverable**	**Deliverable Date**
1. Restoration planning.	none	Restoration plans	Upon completion of all final plans.
2. Restoration implementation	Sub-task 1: Seed collection, propagation, tract preparation, planting, maintenance, and contract compliance monitoring.	Quarterly reports. Annual reports.	1/10, 4/10, 7/10, and 10/10 of each year 1/30 of each year
	Sub-task 2: Well abandonment	Certificates of well abandonment.	upon project completion
3. Monitoring and restoration science (as outlined in Appendix 1, p. 21)	Sub-task 1: NIS control experiment. Sub-task 2: Recruitment experiment. Sub-task 3: Monitoring and vegetation-environment relationships.	Annual reports. Scientific papers. Presentations at. CALFED and other scientific conferences	1/30 of each year

Project Management

Project management will include contract management and writing quarterly and annual reports to CALFED. Project management has been allocated for and delineated in the Budget Summary form (Form VI) and Budget Justification form (Form VII).

A.8. Work Schedule Please see attached Table 3 (p.28) for a detailed work schedule.

Section B: Applicability to CALFED Ecosystem Restoration Program (ERP) and Science Program Goals and Implementation Plan and Central Valley Project Improvement Act (CVPIA) Priorities.

B.1. ERP, Science Program, and CVPIA Priorities

The primary focus of TNC's Sacramento River Project is to restore and sustain the diversity of riparian, wetland, and aquatic species and habitats between Red Bluff and Colusa in collaboration with local, state, and federal agencies and local landowners. This is aligned with CALFED's Sacramento Region goal 1 (SR-1): "develop and implement management and restoration actions in collaboration with local groups such as the Sacramento River Conservation Area Forum Non-Profit Organization." Although this project is designed to stand-alone it complements a set of additional projects past and present that TNC and its partners are working on. Collectively these projects accomplish habitat protection, habitat restoration, ecosystem processes, coordinated floodplain management, and habitat restoration monitoring thereby addressing many of CALFED's Implementation Plan goals and CVPIA priorities (PSP Sacramento Region Priorities 1, 3, 4, 7, ERP Goals 1, 2, 4, 5, and 6, Key CALFED Science Program Goals and CVPIA Goals).

This restoration proposal specifically addresses many of the ERP Science Program goals, and CVPIA priorities. TNC has worked closely with the SRCAF Non-Profit within the guidelines of the Sacramento River Conservation Area handbook (Sacramento River Advisory Council 2000) to develop the restoration activities outlined in this proposal. By increasing riparian habitat in the Sacramento River Conservation Area, this proposed project is designed to help protect and restore the stream meander corridor between Red Bluff and Colusa (PSP SR-1). The proposed project adds 1,218 acres of riparian habitat to the Chico Landing Sub-reach for a total of approximately 4,863 acres of nearly contiguous protection (restored plus conservation lands) to ameliorate habitat loss and fragmentation. At-risk riparian species, as well as common riparian species, will benefit from protection and restoration of large expanses of habitat along the main stem of the Sacramento River (ERP Goals 1 and 4).

RX Ranch is an unproductive almond orchard with missing trees and damage from frequent flooding and deposition. Capay Ranch has been fallow and dominated by NIS vegetation for several years while NIS vegetation has been the primary component of the understory at Sunset Ranch. Successfully establishing native understory and overstory vegetation in the four parcels proposed for restoration will help control and reduce the number of NIS-dominated acres along the Sacramento River thereby reducing their negative biological and economic impacts (MR-1, ERP Goal 5).

Restoration of the proposed tracts will allow natural processes such as erosion and deposition (channel meander) to occur in select areas along these tracts. This will help to increase spawning gravel to the channel in this area, an important factor in anadromous fish restoration. Additionally, a long-term benefit of restoring these tracts will be to help provide in-stream complexity in the form of large woody debris that falls into the river as the tracts erode (PSP SR-2 and SR-4, ERP Goal 2).

Restoration of flood-prone land along the Sacramento River will help improve water and sediment quality in the river. Replacing flood-prone agriculture with riparian habitat decreases pesticide and herbicide use on land adjacent to the river, thereby contributing to improved water quality. Additionally, riparian forests act as a buffer and filter for toxic runoff of anthropogenic sources of organic matter that originate further away from the river, thereby helping to improve water and sediment quality (ERP Goal 6).

The proposed project addresses the following specific CVPIA goals and Anadromous Fish Restoration Program (AFRP) objectives:

1. Protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California;
2. Improve habitat for all life stages of anadromous fish by providing flows of suitable quality, quantity, and timing, and improved physical habitat; and
3. Involve partners in the implementation and evaluation of restoration actions.

Restoring complex riparian habitat along the Sacramento River will improve habitat for fish and wildlife. Fish benefit from complex riparian areas that become flooded at high flows, slow floodwaters down, and provide refugia for young and juvenile fish (Sommer et al. 2001).

B.2. Relationship to Other Ecosystem Restoration Projects

TNC's Sacramento River project is part of a collaboration of public and private partners whose goal is to establish a riparian corridor within approximately 30,000 acres of the Sacramento River Conservation Area (SRCA). Over the last decade, TNC has worked with local governments and organizations to protect and restore habitat and establish a limited meander along the Sacramento River between Red Bluff and Colusa. This partnership is formalized under a Memorandum of Agreement with local, state, and federal agencies and coordinated through the SRCAF Non-Profit. Projects and organizations working in partnership toward this goal include the USFWS' Sacramento National Wildlife Refuge Complex, California Department of Fish and Game, Department of Parks and Recreation, Department of Water Resources, Army Corps of Engineer's Comprehensive Study, Riparian Habitat Joint Venture, Sacramento River Preservation Trust, and Sacramento River Partners. Numerous programs, including CALFED, CVPIA, and state and federal agencies such as California Wildlife Conservation Board, U.S. Environmental Protection Agency, and many private foundations and individuals have supported these efforts.

This proposal builds on over 3,000 acres of habitat restoration that has occurred along the Sacramento River between Red Bluff and Colusa. The Chico Landing Sub-reach is the site of recent acquisitions and subsequent management planning to address ecosystem restoration funded by CALFED (97 NO-2). Hydraulic and geomorphic modeling, Hamilton City hydraulic modeling and foundation investigation, baseline assessments, and restoration plant designs have been funded through the 97 NO-2 grant agreement. These projects have been conducted to identify and address potential third party impacts that may result from ecosystem restoration efforts. Capay and RX Ranch are also within the subject area of the potential J Levee relocation - an ecosystem/flood damage reduction project that includes collaboration between Hamilton City Community Services District, Army Corps of Engineers Comprehensive Study, SRCAF, local landowners, Ayers Associates, and the Hamilton City Working Group (including CALTRANS, state legislative representatives, Glenn County supervisors, and the Family Water Alliance).

By implementing this project and addressing the hypotheses put forward in Section A.2., TNC seeks to enhance the body of scientific knowledge regarding the best available ecosystem restoration science. This proposal builds on experience gained from horticultural restoration efforts to revegetate the Sacramento River floodplain conducted since the late 1980s. Research and monitoring programs have begun to demonstrate the positive effects of horticultural restoration to the Sacramento River ecosystem. In recent years state and federally-listed species such as the yellow-billed cuckoo, and the valley elderberry longhorn beetle have been observed breeding on TNC restoration sites (Small et al. 2000, TNC *unpublished data*). The activities that we propose in this project are well integrated with the research and monitoring studies that are currently underway on the Sacramento River. See Golet et al. (*in press)* for an overview of these studies.

It is unknown how alterations in flow regimes would affect actively restored tracts and/or create new habitat through process restoration. Therefore, it is necessary to evaluate how alterations to the flow regime would both create new natural habitat, and subject restoration tracts to river processes that may enhance their ecological function. This is being addressed through a CALFED 2002 proposal led by TNC titled "Implementing a Collaborative Approach to Quantifying Ecosystem Flow Regime Needs for the Sacramento River."

Lastly, TNC is spearheading a CALFED 2001 submitted and accepted proposal to address sub-reach planning in the Colusa Sub-reach titled "Sub-reach Planning for the Sacramento River: River Miles 144-164." Information gathered through this sub-reach planning process will provide the basis for which restoration activities will be implemented and further refined.

B.3. Request for Next-Phase Funding

This proposal is a request for next-phase funding to implement the restoration of properties acquired in the Chico Landing Sub-reach under a previously awarded CALFED agreement (97 NO-2). Under the 97 NO-2 agreement, acquisition of Capay, RX Ranch and Dead Man Reach is complete, and start-up stewardship activities are being conducted and a Long-term Management and Monitoring Plan developed. Attachment 2 (p.25), "CALFED 97 NO-2 Status Report for Next-Phase Funding," describes the accomplishments to date and status of this ongoing project.

B.4. Previous Recipients of CALFED Program or CVPIA Funding

To date, The Nature Conservancy's Sacramento River Project (TNC) has been awarded 5 CALFED and 4 CVPIA grants to further the goals of protection and restoration within the Sacramento River Conservation Area. Two grants focused on restoration planning, and the remaining seven grants have been used to plan and implement protection and restoration actions on approximately 3,114 acres. Project titles and numbers, specific accomplishments, and progress to date are summarized in Table 4 (p.29).

B.5. System-Wide Ecosystem Benefits

TNC's Sacramento River Project works with public agencies and private organizations to restore a riparian corridor and limited river meander within the Sacramento River Conservation Area. Four programmatic phases comprise TNC's Sacramento River Project synergistic approach to ecosystem restoration in an adaptive management framework (Figure 5, p. 39):

1. cooperative integrative floodplain management planning;
2. habitat acquisition and baseline assessment;
3. horticultural and process restoration; and
4. ecosystem response monitoring and research.

This framework furthers the goals of the following programs: SRCAF Non-Profit, Central Valley Project Improvement Act, Central Valley Habitat Joint Venture, Sacramento River National Wildlife Refuge, Department of Fish and Game's Sacramento River Wildlife Area, California Riparian Habitat Conservation Program, Riparian Habitat Joint Venture (Partners in Flight), and the Army Corps of Engineers Comprehensive Study.

Through our work with partners and stakeholders, this approach offers substantial system-wide ecosystem benefits. By using both horticultural and natural-process restoration in an adaptive management framework, these collective efforts are successfully restoring the viability of native species and reducing the proliferation and adverse impacts of non-native invasive species. Specifically, the effort to establish a continuous riparian corridor along the Sacramento River is already improving the health of local wildlife populations by promoting the recolonization of areas where local extirpations have taken place. Several taxa, including the

state threatened yellow-billed cuckoo and the federally threatened valley elderberry longhorn beetle, have colonized and successfully bred on restoration tracts (Small et al. 2000).

The ecological benefits of our restoration activities extend far beyond the reaches of the project area. For many species the main stem of the Sacramento River is a migratory pathway. By making the habitat in this region more supportive of migratory species this project will bolster breeding and wintering populations in areas physically removed, but ecologically linked to the Sacramento River. Examples include the habitat benefits to neotropical migratory birds and anadromous fish. Additionally, improvements in water quality as a result of restoration efforts have positive impacts all the way down the Sacramento River into the Bay-Delta.

B.6. Additional Information for Proposals Containing Land Acquisition

n/a

Section C: Qualifications

The project will be conducted under the guidance and management of TNC's Sacramento River Project.

The Nature Conservancy (TNC) is an international non-profit organization; our mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. Founded in 1951, TNC and its one million members have safeguarded more than 11.6 million acres in the United States. TNC of California, headquartered in San Francisco, has 110,000 members and has protected over one million acres in the state.

TNC employs an integrated conservation framework called "Conservation By Design" to fulfill its long-term vision and achieve its goals (Conservation by Design 2001). Conservation by Design directs the organization to systematically identify the array of places around the globe that embrace the full spectrum of the Earth's natural diversity; to develop the most effective strategies to achieve tangible, lasting results; and to work collaboratively to catalyze action at a scale great enough to ensure the survival of entire ecosystems.

TNC's strength and reputation are built on the policy and practice of applying the best conservation science available and of building partnerships to achieve mutual conservation goals. We respect the needs of local communities by pursuing strategies that conserve biological diversity while at the same time enabling humans to live productively and sustainably on the landscape. We know that lasting conservation success requires the active involvement of individuals from diverse backgrounds and beliefs, and we value the participation of individuals in the conservation of their communities and environments.

The Nature Conservancy's Sacramento River Project is headquartered in Chico, CA. For more than ten years the Sacramento River Project has worked to protect more than 18,000 acres of riparian land within the Sacramento River Conservation Area. In addition we have restored more than 3,000 of marginal agricultural land along the Sacramento River to riparian habitats. An active participant in the SB 1086 process and now the Sacramento River Conservation Area Forum non-profit, TNC is collaborating with federal and state agencies, local government, landowners, and other stakeholders and non-profit organizations to achieve the SRCAF's goal of restoring a continuous riparian corridor with limited river meander between Red Bluff and Colusa.

The Sacramento River Project is organized into teams focused on planning, science (research and restoration), acquisition, government relations and outreach, and administration. Legal, finance, and government contracting are overseen by TNC's regional office in San

Francisco. Overall project management is the responsibility of TNC's Sacramento River Project Director, Dawit Zeleke, with more than ten years experience in organic farming, project management, and community relations. Dr. Gregory Golet, Senior Ecologist; manages the planning, science, and restoration teams. The project lead for this proposal is Ryan Luster, Restoration Coordinator.

Gregory Golet, The Nature Conservancy, has degrees from Bates College (B.S. Biology 1987), and the University of California, Santa Cruz (M.S. Marine Sciences 1994, Ph.D. Biology 1999). Dr. Golet was a wildlife biologist for the U.S. Fish and Wildlife Service before joining TNC's Sacramento River Project as senior ecologist. He provides scientific input for the design of conservation strategies and studies ecosystem responses to management actions. He has 11 refereed publications, and has extensive experience coordinating and conducting research in California and Alaska.

Ryan Luster, The Nature Conservancy, has degrees from Beloit College (B.A. Environmental Biology 1994) and Utah State University (M.S. Range Science 2002). Ryan has worked on native ecosystem restoration projects in the U.S. and West Africa since 1994. Ryan first joined TNC as a Restoration Specialist in 1997 at Dye Creek Preserve, CA, where he supervised riparian restoration projects. As Restoration Program Manager Ryan oversees the development of conservation management planning and all phases of riparian restoration activities for TNC's Sacramento River Project.

Contractors

Karen Holl, University of California, Santa Cruz, has degrees from Stanford (B.S. Biology 1989) and Virginia Polytechnic Institute and State University (Ph.D. 1994). She was a postdoctoral fellow at Stanford University and joined the faculty at UC Santa Cruz in 1996 where she is now an associate professor and holds the Pepper-Giberson endowed chair. Her research interests are broadly based in restoration ecology with a specific interest in the spatial scale at which ecosystem recovery is regulated. Dr. Holl has done research on restoration and management of a range of ecosystems including eastern hardwood forest, tropical forest, and chaparral, grassland, and riparian ecosystems in California. She has 23 refereed publications and has managed a number of federal grants, including a recent NSF Biocomplexity Incubation Grant modeling linkages between hydrology, vegetation, and birds on the Sacramento River.

Fred Thomas, CERUS Consulting, has a degree from California State University, Chico (B.S. Agriculture 1975). Fred is a Pest Control Advisor (PCA) who specializes in cover crops, sustainable and organic agriculture, and he has owned CERUS Consulting for eight years. His experience includes almond farm management, wholesale seed marketing, germplasm research and development, cover crop technology, pasture and rangeland seeds, and biological farming systems.

Dave Wood, California State University, Chico, has degrees from U.C. Davis (B.A. Zoology 1975), California State University Fresno (M.A. Biology 1982) and the University of Washington (Ph.D. Botany 1987). He was a postdoctoral research associate at the Institute of Ecosystem Studies in Millbrook, NY from 1987 to 1988. He then joined the faculty of Wheaton College in Norton, MA as an assistant professor in 1988. In 1990 he joined the faculty at California State University Chico where he is now a full professor. Dr. Wood's research interests are centered in community and ecosystem ecology, with special interests in ecological succession and ecosystem recovery from disturbance. Dr. Wood has conducted field research on

Mount St. Helens, on eastern deciduous forest in New York, and on the Sacramento River. He has 14 refereed publications. Dr. Wood has received grants from several organizations including the NSF TNC and has been a subcontractor under TNC.

Potential Conflicts of Interest or Problems with Availability. The Sacramento River Project does not have any conflicts of interest or any potential problems with availability to do the proposed work within the proposed timeline.

Section D: Cost

D.1. Budget. See Forms VI (Budget Summary) and VII (Budget Justification).

D. 2. Cost-Sharing

There are no formal cost-share agreements associated with this proposal. However, TNC has contributed $178,679 in private funds to initiate this restoration program, including baseline assessments for the four properties, preliminary studies on native understory recruitment, and environmental documentation (Sunset Ranch, Capay, and Dead Man Reach). Preliminary studies of native understory species recruitment were funded by a grant from University of Santa Cruz to Dr. Karen Holl for $5,600. TNC has received $257,000 from the Bureau of Reclamation's Central Valley Improvement Act (CVPIA) (b)(1) "other" program to restore 161 acres of the 186-acre Sunset Ranch property.

Section E: Local Involvement

TNC has introduced this proposal to interested parties and will continue to do so after proposal submission. TNC will work with local landowners and stakeholders to address their concerns over restoration activities.

SRCAF: The proposal was presented at the August 23, 2001 SRCAF Board of Directors meeting, at the SRCAF's Technical Advisory Committee meeting on August 16, 2001, May 16, 2002, and September 19, 2002. In addition, TNC provided an update in the "SRCAF Notes," which is distributed to 650 SRCAF stakeholders regarding the preparation of this proposal. TNC regularly attends SRCAF Board and sub-committee meetings and will continue to give regular updates to the SRCAF at meetings and through the "SRCAF Notes."

Glenn County: TNC has coordinated its past activities in Glenn County with local government and will continue to keep the County informed and updated regarding restoration activities. Glenn County Supervisor and SRCAF Board member, Denny Bungarz, was contacted and updated regarding this proposed restoration, as was Glenn County Supervisor Keith Hansen. Project staff plan to invite both supervisors and interested county staff to the tracts to discuss restoration plans. A meeting was conducted on August 13, 2001 in Hamilton City with the Hamilton City Community Service District (HCCSD) working group. Glenn County staff, landowners, and the HCCSD members attended this meeting. Activities on two of the four proposed tracts (Capay and RX Ranch) have been coordinated through and compliment the work of the HCCSD working group in their efforts to realign the Hamilton City J Levee for ecosystem and flood damage reduction benefit.

Butte County: TNC works to coordinate their activities with local government in Butte County and will continue to keep the county informed and updated concerning this proposal. County Supervisor and SRCAF Board member, Jane Dolan, has been notified regarding this proposal. TNC will notify other Butte County officials and staff when the proposal is submitted and set-up meetings to discuss the restoration plans.

Two meetings have been held to discuss TNC's proposed restoration activities. On August 10, 2001, the Sacramento River Reclamation District Board of Directors met, in attendance were local landowners and Michael Madden, Butte County Emergency Services Officer. In addition, a meeting was held on August 24, 2001 with the Sacramento River Reclamation Board in Chico and was attended by Butte County landowners.

Restoration Tract Neighbors: TNC places a high priority on establishing good working relationships with all neighboring landowners. TNC has initiated efforts to contact landowners directly adjacent to the restoration tracts and will continue these efforts to discuss restoration planning with them. A landowner adjacent to Dead Man Reach has voiced interest in providing input into the final restoration plan; TNC will continue this coordination with landowners as restoration plans are further developed. RX Ranch is surrounded by conservation lands while Capay has one neighbor. TNC is currently working on setting up meetings with this neighbor to inform him of our planned activities.

TNC is aware of potential third party impacts resulting from the conversion of agricultural lands to riparian habitat and is addressing these issues through several studies. TNC is currently engaged in a socioeconomic assessment to examine the potential costs and benefits associated with the acquisition and restoration of land along the Sacramento River between Red Bluff and Colusa. In addition, start-up stewardship activities conducted for these properties under the CALFED 97-NO2 grant were designed to specifically address potential third party impacts (e.g., potential flooding). Hydraulic modeling of the area has been conducted and final restoration designs will incorporate this information to avoid any potential flood damage to neighboring properties. These reports can be viewed at:
http://www.sacramentoriverportal.org/projects/index.htm

TNC will hold two additional on-site public meetings during the summer of 2003 prior to implementing restoration activities in order to discuss the tract-specific restoration plans. To date, there has not been direct opposition to the restoration activities; however, TNC will work with landowners to address concerns that are raised through the outreach process.

Section F: Compliance with Standard Terms and Conditions See Table 5 (p.32).

Section G: Literature Cited

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Attachment 1: Task 3 Experimental Designs.

Sub-task 1: Cover crop NIS suppression trials

Tracts – This experiment will be conducted on the grassland portion of RX Ranch, Capay, and Dead Man Reach. Sunset Ranch does not have a grassland component as part of this proposal.

Plot design – We will establish one plot (45 m x 100 m) at RX, Capay, and Dead Man Reach restoration tracts. Each plot will contain nine treatment strips 5 m x 100 m with 1 m buffer strips between each treatment strip. There will be three treatments randomly assigned to three strips each for a total or nine strips per plot.

Treatments – Three treatments will be used in this experiment: 1) a cover crop of bell beans and peas, 2) a standard mowing and herbicide application using glyphosphate (trade name Round-Up), and 3) a control treatment where only mowing will be conducted. It would not be a productive use of resources to have a non-NIS control treatment since all sites are completely dominated by NIS vegetation. TNC has used non-NIS control methods in the past and all such restoration tracts receiving this treatment have failed to meet USFWS standards for successful restoration (TNC 1996, 2000, Peterson 2002).

Monitoring - The four replications will be monitored using a random transect line with 10 locations per line each 5 m apart. The number of established native grasses will be counted and recorded using a 20-cm^2 ring. The monitoring will be conducted three times a year (in February, May, and October) for two years. The data will be analyzed and compared for total number of established grasses in the cover crop treatment, standard treatment, and control.

Statistical Analysis – We will use analysis of variance (ANOVA) to explore how the treatments may affect native grass establishment.

Sub-task 2: Manipulative experiments in new and old restoration tracts.

Tracts – Experiments will be conducted at six tracts, the four that will be restored as part of this proposal, as well as two tracts restored by TNC over 10 years ago: Kopta Slough and River Unit. It is necessary to conduct the experiments at two older tracts in order to be able to test the hypothesis regarding overstory cover, since sufficient overstory cover will not establish in the newer tracts during the course of the study period.

Plot design – All manipulations will be conducted on 10 x 10 m plots, which will be divided to test different hypotheses. There will be a 1 m buffer around the edge of the plots within which no measurements will be taken. There will be no introduction of species in a 3 x 8 m strip on one half of the plot where natural vegetation dynamics will be monitored. The other half of the plot will be subdivided into six 2 x 2 m plots with 1 m buffers separating them. One of each of the six focal species will be planted into each of these plots.

Focal species – We will introduce six focal species, which are common in the remnant riparian forests and could be potentially used for restoration. We have chosen focal species that represent a range of growth forms and dispersal mechanisms that represent important wildlife bird habitat and/or food resources. These are pipevine (*Aristolochia californica*, gravity-dispersed vine),

Santa Barbara sedge (*Carex barbarae,* gravity-dispersed herb), California Blackberry (*Rubus ursinus,* animal-dispersed shrub), California grape (*Vitis californicus,* animal-dispersed vine), *mugwort (Artemisia douglasiana,* wind-dispersed herb), and clematis (*Clematis ligusticifolia,* wind-dispersed vine). Plants for which it is possible to collect sufficient seed and are known to have moderately high germination rates (e.g., *Artemisia*) will be seeded, whereas species for which the germination ecology is not well understood (e.g., *Carex*) will be planted.

Treatments – At all tracts treatments will be set up with high competition from NIS vegetation and reduced competition from NIS vegetation (it is impossible to completely eradicate NIS vegetation). In the reduced competition experiment all exotic species will be herbicided and removed in fall 2003. The soil will then be irrigated and solarized to reduce NIS seed bank. During the experiment a grass-specific herbicide will be used to control NIS vegetation in combination with hand weeding of particularly problematic non-grass species. It is recognized that this level of NIS control is not practical on a large scale, but Sub-task 1 will test which strategy (herbicide or cover crops) is most effective for NIS control.

In order to assess the effect of proximity of forest on colonization and establishment of non-tree native species, plots will be set up at two distances from the edge of a remnant forest (near: <50 m, far >250 m) at four tracts (Kopta, Phelan Island, Rx Ranch, Capay). These distances were selected based on the overall range of distances from forest observed in these sites, as well as species distribution and dispersal patterns documented in preliminary surveys in this system and Dr. Holl's research elsewhere. The other two new tracts (Sunset Ranch and Dead Man Reach) do not have sufficient remnant forest close by.

At Kopta and Phelan Island, treatments will be repeated both in open areas and areas with overstory cover of riparian tree species (e.g., *Acer negundo, Populus fremontii*) to test the effects of overstory cover on competition.

All treatment combinations will be replicated three times within each tract. Replication within each tract is necessary given the high between tract variation. Each of the tracts has a varied management history and, therefore, the tracts themselves cannot be considered as replicates. It is important to repeat these experiments across tracts to assess the generalizability of the effects of different management strategies. In total there will be 84 plots: Kopta and River Vista (24 each), Capay and Rx Ranch (12 each), Sunset Ranch and Ord Ferry (6 each).

Environmental Measurements – Clearly, competition between native and NIS vegetation will be affected by a number of abiotic factors, such as soil nutrients and texture, floodplain position, and groundwater depth. It is impossible to replicate the outlined treatments across replicated combinations of each of these abiotic factors, but it is important to quantify them to explain potential variations in responses across tracts and we will study their effects in more detail in Task 3, sub-task 3. We will collect surface soil samples (0-10 cm) in all plots and have them analyzed for texture, pH, and basic nutrients at the University of California, Davis Analytical Laboratory. In each of the locations where there are plots, we will drill one soil core to quantify soil stratigraphy and to determine depth to groundwater. We will also determine relative position on the floodplain of each plot by GPSing the location and overlaying them with detailed elevational models being developed by Dr. Steve Greco (UC Davis).

Monitoring - Plants will be seeded in fall and planted in winter of the first year and reseeded and planted the following year if high mortality rates prevent continuation of the study. We will

monitor germination of seeded species in February, 2004 and tag or record cover (depending on abundance) of all naturally establishing seedlings in the non-seeded subplots. To parallel the surveys described in Task 3, sub-task 3, woody species recruitment will be monitored in five, 1 x 1 m plots. We will survey the entire strip for the presence of focal species. We will monitor survival and growth of planted seedlings and cover of native and exotic species at the end of the rainy season (late-April/early May), mid-summer (July) and again at the end of the dry season (September) in the first year and at the end of the rainy and dry seasons in the following years. In addition to monitoring planted and naturally establishing vegetation, we will also monitor seed dispersal by air and water in the second and third years of the study (once the plots are set up). This information will help to determine whether lack of establishment of certain native species is due to lack of colonization or by inappropriate conditions for establishment. It will also provide information regarding the seed rain of NIS vegetation to separate out the role of the seed bank vs. ongoing input of seeds from surrounding areas.

Statistical Analysis – The data will be analyzed using multi-way ANOVA with site, distance to forest, overstory cover, and NIS cover as independent variables, and survival and growth of planted species and cover of naturally establishing species as dependent variables.

Sub-task 3: Surveys of previously restored tracts.

Tracts - Sampling will be conducted at eight TNC restoration tracts established between 1989 and 1997, four of which already have existing TNC long-term plots (Kopta Slough, Rio Vista, Sam Slough, Phelan Island River Unit). Additional sampling will be conducted at the Lohman, Flynn, Princeton Ferry, and Ryan tracts. Ten plots will be established on each tract.

Sampling design – We will sample according to protocols that are currently being followed in the task 1 studies of CALFED project 99-B126, directed by Dr. David Wood. This project is focusing on remnant riparian forests on the Sacramento River, and will provide data that allow comparisons to be drawn restoration and natural forest sites.

Sample plots will be 20 x 50m, located either at an existing TNC long-term plot (see above) or randomly within a restoration site. For trees, we will measure dbh (diameter breast height, = 1.3 m) of all woody stems >2 m; count all other woody stems <2 m and record their height; and estimate canopy coverage by species. For shrubs, percent cover will be measured along three randomly placed line transects of 10m length (line intercept method). For herbs, percent cover will be estimated in five 1 x 1 m plots. In addition the entire plot will be searched for native herbaceous species and their abundance will be recorded on a Braun-Blanquet scale. Special attention will be paid to the six focal species being used in Sub-task 2 above. The percent cover of these six species will be estimated on a plot-wide basis.

Environmental Measurements - Detailed data will be collected on a suite of parameters thought to influence vegetation community structure. Table 1 lists these variables and the methodology to be used. The TNC long-term plots already have detailed information on soil stratigraphy and water table depth; therefore, these measurements will only be collected at some tracts. Information on initial planting density, species composition, and early restoration management (irrigation and NIS control) are available for all tracts from pre- and post-project reports. A key hydraulic parameter that will be assessed to address hypothesis four is flooding frequency. This will be determined by developing stage-discharge relationships for the areas surveyed.

Complete topographic cross sections of the river channel and floodplain will not be measured due to funding constraints; however, we will record the extent of flooding (stage) at multiple locations during high water events, and relate this to available discharge records. Flow gauges are sufficiently numerous and adequately positioned to provide the necessary discharge data. We will also quantify elevation of site above river baseflow using a map recently developed by Steve Greco at UC Davis with funding from the California Department of Water Resources.

Table 2. Site-specific and landscape-scale parameters that will be measured to test for factors affecting vegetation community structure at previously restored tracts.

Parameter	**Assessment Methodology**
Flooding frequency	stage-discharge relationships
Depth of water table	Soil auger
Soil moisture	Time-Domain Reflectometry
Soil stratigraphy and texture	Soil auger; texture-by-feel
Distance to river	DWR GIS coverage
Elevation above baseflow	Steve Greco GIS coverage
Soil nutrients	Soil Analysis
Land age	Steve Greco GIS coverage
Stand age	Steve Greco GIS coverage
Overstory cover	Fish-eye plant canopy analyzer
Surrounding land use	DWR GIS coverage
Area of remnant forest	DWR GIS coverage
Distance to remnant forest	DWR GIS coverage

Statistical Analysis - We will regress individual plant parameters (e.g. cover and diversity of native understory species) on the physical parameters measured. We will use multivariate techniques, primarily Non-metric Multidimensional Scaling (NMS) and Canonical Correspondence Analysis (CCA) to analyze plant composition data. NMS is a relatively robust procedure but does not explicitly relate vegetation to environmental parameters (regression analysis is used after NMS). CCA does explicitly relate the two but only if several assumptions are met. When the data are in hand statistical assumptions can be assessed, we will choose the particular techniques to be used.

Attachment 2: CALFED 97 NO-2 Status Report for Next-Phase Funding
Ecosystem and Natural Process Restoration on the Sacramento River: Floodplain Acquisition and Management. CALFED Grant 97-NO2, ERP Program (Term: 1/1/98-12/31/01).

Project Description

In 1997, TNC, the California Wildlife Conservation Board (California Department of Fish and Game), and the USFWS requested funds for the acquisition of fee title on 1,500 acres within the Sacramento River Conservation Area of the Sacramento River between Keswick and Verona. Funds were also requested for start-up stewardship and development of short and long-term management and monitoring plans for these lands. These acquisitions were a means to facilitate the recovery of ecological processes within the floodplain, including the revegetation of native riparian habitat. The primary ecological objectives of the project were:

1. Protect and increase quality and quantity of an essential spawning, rearing, and migratory pathway for a host of aquatic and terrestrial species.
2. Protect large continuous blocks of existing and restorable aquatic riparian habitat for the benefit of these species.
3. Protect and allow for the restoration of ecological processes in the 150-year meander belt.

Under this block grant, four properties totaling approximately 1,628 acres have been purchased along the Sacramento River (Capay, Dead Man Reach, Gunnhill, RX Ranch) within the Chico Landing sub-reach. The restoration of three of these properties - Capay, RX Ranch, and Dead Man Reach (Figure 1, p. 35) is the subject of this proposal. TNC is not seeking funds to restore the Gunnhill property at this time.

Property	Location	Appx. Acres	Acquisition Date
Capay (Kaiser)	Glenn County, RM 194	661	2/26/99
RX Ranch	Glenn County, RM 194	246	2/29/00
Dead Man Reach (Koehnen)	Butte County, RM 186	503	8/12/99

Scientific Merit of the Project

In September 1999, TNC developed and CALFED approved "A monitoring framework for riparian habitat restoration on the Sacramento River and Lassen Foothill tributaries." This document includes TNC's approach to monitoring and the conceptual models that have guided TNC's work to date. We followed the framework of this approved document for development of the science-related workscope for 97 NO-2. Approaches and tools developed under 97 NO-2 serve to leverage future sub-reach management actions, including habitat restoration.

Current Status of the Project

Progress and Accomplishments: Four properties, Capay (Kaiser), RX Ranch, Dead Man Reach (Koehnen), and Gunnhill, have been purchased. Task orders were approved to fund acquisition of two additional properties: the 238-acre Ward property (purchased April, 2001), and the 77-acre Clendenning property (purchased October, 2001). This will complete the acquisition terms of this grant (Tasks 1 & 2). Start-up stewardship activities to assess restoration potential, and guide large-scale conservation strategies, are either underway or completed. These activities include hydraulic and geomorphic modeling, a riparian vegetation recruitment study, a geotechnical investigation, development of additional GIS information layers, ortho-rectification of aerial photography, an assessment of potential third party impacts associated with restoration

actions, a cultural resource study, a study to further develop biological indicators of ecosystem health, and fencing/road/gate construction (Task 3).

Status: Task 1: Acquisition Administrative Costs and Task 2: Acquisition Capital Costs will be complete once the Clendenning and Ward acquisition packages are approved.

Task 3: Start-up Stewardship Activities are in progress and approximately 75% complete. The 97 NO-2 grant funded start-up stewardship activities, which TNC has termed the "Chico Landing Sub-reach Planning" process. The goal of this process was to identify the necessary components needed to conduct landscape-scale riparian conservation and restoration within the Chico Landing Sub-reach. This task includes activities such as initial clean-up, fencing, preparation for restoration, and preparation of short and long-term management and monitoring plans for the acquired properties. To date, tasks in support of management and monitoring plans include:

Geo-technical investigation: A final geo-technical investigation report is complete for the J-levee area near Hamilton City. The report was distributed to the ACOE for incorporation into their Comprehensive Study "initial projects" data collection efforts and to Hamilton City stakeholders.

Large-scale planting design model: TNC initiated the development of a model which uses tract characteristics (soils and elevation) to develop large-scale plant designs and serve as input to large-scale hydraulic models. This allows TNC to evaluate interactions of conservation strategies and infrastructure such as bridges and levees.

Cultural resources study: TNC is contracting with California State University, Chico to inventory sites with significant cultural resources within the floodplain of the Middle Sacramento River. Identification of sites with historical significance is important in land use planning activities such as restoration.

Public access and recreation study: TNC is contracting with EDAW to conduct this study which focuses on 1) inventorying and assessing the condition of existing public access sites on the Middle Sacramento River, 2) identifying concerns of the public and private landowners, and 3) evaluating opportunities for coordinated management of publicly owned lands.

Hydraulic modeling: Ayres Associates constructed the topographic information necessary for a 2-dimensional model within the Hamilton City area (RM 194-202). The model evaluates ecosystem restoration and flood damage reduction benefits of a hypothetical setback levee, re-vegetation, and potential removal of small private levees which are located within conservation ownership parcels.

Channel meander modeling: Eric Larsen (UC Davis) built a meander model for sections within the Chico Landing Sub-reach. The modeling allows stakeholders to evaluate changes in meander patterns that result from placing and or removing bank protection. This model will inform management issues such as protecting infrastructure.

Cottonwood regeneration pilot study: TNC conducted an initial investigation into regeneration of the riparian forest at river mile 192.5. River regulation effects on the riparian forest are not fully quantified. However, we sought to calibrate an ecological model which other river managers have used to re-generate riparian forest, meeting both resource and human water needs. A final report is near completion and this information will be evaluated for the long-term management plan.

Biological indicators project: Investigations into macroinvertabrate foodweb structure, isotope analysis of carbon to nitrogen ratios, and bat utilization of different habitats is in progress. These

indicators have proven useful on other Central Valley rivers such as the Tuolomne. Replicating these same studies on the Sacramento River places the health of the Sacramento River into the context of the rest of the Central Valley.

Management and monitoring data collection and development: TNC conducted a large-scale analysis of conservation parcel physical characteristics with respect to flooding, soil types, erosion predictions, and surficial geology. TNC initiated collection of GPS data on parcels in conservation ownership within the sub-reach; data collection includes crop type and variety, infrastructure, land use, and occurrence of young stands of riparian recruitment. All information will be referred to for development of the management and monitoring plan.

Information from all of the above tasks will be incorporated into short- and long-term management and monitoring plans by February 2003. Final reports from this contract can be found at: http://www.sacramentoriverportal.org/projects/index.htm

Table 3: Restoration Proposal Schedule of Activities.

Activities & Tasks	Responsible Party	2002				2003				2004				2005				2006			
		W	SP	SU	F	W	SP	SU	F *	W	SP	SU	F	W	SP	SU	F	W	SP	SU	F**
PLANNING																					
Subreach planning	TNC																				
Baseline assessments	TNC																				
RX Ranch EA	EDAW, Inc.																				
Restoration plan	TNC																				
PROPOGATION																					
Seed Collection	TNC																				
Nursery propagation	contractor																				
Cutting Collection	TNC																				
FIELDWORK																					
Field Preparation	Contractor																				
Layout	Contractor																				
Irrigation system	Contractor																				
Planting	Contractor																				
Replant (if necessary)	Contractor																				
MAINTENANCE																					
NIS Control	Contractor																				
Irrigation	Contractor																				
MONITORING																					
30 day post-planting	TNC																				
End of growing season	TNC																				
Project completion	TNC																				
Regular check-in	TNC																				
PROJECT MNGMT.																					
Annual reports	TNC																				
Quarterly reports	TNC																				
Contract management	TNC																				

* project implementation, ** project completion

Table 4: B.4. Previous Recipients of CALFED Program or CVPIA funding.

Project Title	CALFED Program/ CVPIA Project	Term	Progress and Accomplishments	Status
Ecosystem and Natural Process Restoration on the Sacramento River: Floodplain Acquisition and Management	CALFED 97-NO2	1/1/98-12/31/01	Four properties along the Sacramento River totaling approximately 1,628 acres have been purchased (Kaiser, Dead Man's Reach, Gunnhill, RX Ranch). Task orders were approved to fund portions of the purchase of two additional properties: 238-acre Ward property purchased in April 2001, and 77-acre Clendenning property purchased in October 2001. Start up stewardship activities are underway, including hydrologic and geomorphic modeling that will help identify short and long-term conservation and management actions for these properties.	The acquisition terms of this grant have been completed. Restoration of 3 of the purchased properties is the subject of a 2002 CALFED proposal. A request was approved by CALFED for an extension of the term date and the shifting of funds under the agreement from Task 1 (direct acquisition costs) to Task 3 (Startup Stewardship) in order to complete the management and monitoring plans called for under Task 3.
Ecosystem and Natural Process Restoration on the Sacramento River: Active Restoration of Riparian Forest	CALFED 97-NO3 ERP	12/1/98-6/30/02	Site preparation and planting of two sites (River Vista and Flynn) to riparian habitat totaling 264 acres, as well as maintenance and monitoring activities, are complete.	Completed.
Ecosystem and Natural Process Restoration on the Sacramento River: A Meander Belt Implementation Project	CALFED 97-NO4 ERP	2/25/98-12/1/01	The 94-acre Flynn property and adjacent levee were purchased in December 1998. The levee was subsequently removed; as a result this site now supports one of the largest bank swallow colonies recorded on the Sacramento River. Restoration was implemented under CALFED 97-NO3 and 97-NO4 and is complete.	Completed.
Floodplain Acquisition, Management and Monitoring on the Sacramento River	CALFED 98-F18, FWS Agreement #11420-9-J074 ERP	7/20/99-6/30/02	Funding was awarded for the acquisition portion of this grant. The 104-acre Jensen property was purchased in July 2000, the 54-acre Hays property was purchased in May 2001, and partial funding was provided for the 129-acre Boeger	Completed.

			property purchased in April 2002.	
Floodplain Acquisition and Sub-Reach/Site Specific Management Planning: Sacramento River (Red Bluff to Colusa)	CALFED 2000-F03, FWS Agreement #11420-1-J001 ERP	6/1/01-5/31/03	Funding was awarded to implement the Sub-reach/Site Specific Planning portion of this proposal. Four tasks were identified to develop comprehensive conservation and management strategies for multiple benefits and uses of the river floodplain. Under Task 1, the Beehive Bend hydraulic analysis has been completed for RM 167-172. Under Task 2, a socioeconomic assessment for the riparian corridor of the SRCA between Red Bluff and Colusa has been drafted with involvement from SRCA, stakeholders and local governments, and will be sent out for public comment. Under Task 3, the final in a series of newsletters went out to all stakeholders; stakeholder meetings have been conducted; updates are regularly provided to the SRCA. Under Task 4, a report will be developed to inform future conservation and management actions for the Beehive Bend sub-reach based on information developed within Tasks 1 – 3.	During the first year of this 3-year grant, all tasks were initiated. Task 1 has been completed and other tasks are making good progress.
Acquisition of Southam Orchard Properties for Preservation of Riparian Habitat	CVPIA grant, BuRec Agreement #00FG200173 (b)(1)"other"	9/12/00-9/30/02	A portion of the grant was applied to the purchase of the 76-acre Southam property, purchased in July 2000. The remainder of the funding was applied to the purchase of the 238-acre Ward property purchased in April 2001.	Completed.
Hartley Island Acquisition	CVPIA grant, FWS Agreement #1448-11332-7-G017 AFRP	8/14/97-9/30/01	Funding was used toward the purchase of two parcels on Hartley Island, including the 321-acre Sandgren parcel. The remaining funds available were applied to the purchase of the 76-acre Southam parcel.	Completed.
Singh Walnut Orchard	CVPIA grant, FWS Agreement #11332-0-	9/18/00-12/31/01	All tasks were completed for this pre-acquisition and planning grant including: pre-acquisition due diligence and signed option for Singh property, baseline assessment, and local	Completed. A report dated December, 2001 was submitted that outlined baseline and ecological considerations with restoration alternatives. Restoration of this property is the subject of a 2002 CALFED

	G014 AFRP		stakeholder meeting to discuss restoration plans.	proposal.
Acquisition of Boeger and Ward Properties	CVPIA grant, FWS Agreement #114201J114 (b)(1)"other"	9/27/01-12/31/03	Funding was used toward the purchase of the 238-acre Ward property (purchased in April 2001) and the 129-acre Boeger property (purchased April 2002).	Acquisition activities under this grant have been completed. Sub-reach planning and baseline assessment activities, as well as draft restoration plans for both parcels will be completed and provided to USFWS and Bureau of Reclamation.

Table 5. Section F, Compliance with Standard Terms and Conditions.

Attachment D, Section 4 *Expenditure of Funds*	TNC requests the following language which was negotiated and approved for the CALFED 2001 agreements with TNC: "Contractor shall expend funds in the manner described in the approved Budget. As long as the total contract amount does not increase, the Contractor may (1) decrease the Budget for any individual tasks by no more than 10% of the total task amount, on a cumulative basis, and increase the Budget for one or more task(s) by an equal dollar amount and (2) adjust the Budget between individual line items within a task by no more than 10% of the total task amount, for such task. Any other variance in the budgeted amount among tasks, or between line items within a task, requires approval in writing by CALFED or NFWF. All cumulative variances to approved Budget must be reported with each invoice submitted to NFWF for payment. The total amount to be funded to Contractor under this Agreement may not be increased except by amendment of this Agreement. Any increase in the funding for any particular Budget item shall mean a decrease in the funding for one or more other Budget items unless there is a written amendment to this Agreement."
Attachment D, Section 5 Subcontracts	TNC requests the following language which was negotiated and approved for the CALFED 2001 agreements with TNC: "Contractor is responsible for all subcontracted work. Subcontracts must include all applicable terms and conditions as presented herein. An approved sample subcontract is attached as [an exhibit]. Contractor must obtain NFWF's approval prior to entering into any subcontract that will be funded under this Agreement, which approval shall not be unreasonably withheld if (1) contracted work is consistent with the Scope of Services and the Budget; and (2) the subcontract is in writing and in the form attached to this Agreement as [an exhibit]. Contractor must subsequently provide NFWF with a copy of the signed subcontract. Contractor must (a) obtain at least 3 competitive bids for all subcontracted work, or (b) provide a written justification explaining how the services are being obtained at a competitive price and submit such justification to NFWF with copy of the signed subcontract. Notwithstanding the foregoing, the CALFED Program has acknowledged that the Contractor generally does not use a subcontract for routine land appraisals, surveys, and hazardous materials reports. For these one-time services, Contractor uses a group of vendors on a regular basis and pays no more than fair market value for such services by one-time invoice rather than written contract. Contractor will not be required to obtain competitive bidding for such services or to provide any further justification to NFWF."
Attachment D, Section 9 Rights in Data	TNC requests the following language which was negotiated and approved for the CALFED 2001 agreements with TNC: "All data and information obtained and/or received under this Agreement shall be publicly disclosed only in accordance with California law. All appraisals, purchase and sale agreements and other information regarding pending transactions shall be treated as confidential and proprietary until the transaction is closed. Contractor shall not sell or grant rights to a third party who intends to sell such data or information as a profit-making venture. Contractor shall have the right to disclose, disseminate and use, in whole or in part, any final form of data and

	information received, collected, and/or developed under this Agreement, subject to inclusion of appropriate acknowledgment of credit to the State, NFWF, to the CALFED Program, and to all cost-sharing partners for their financial support. Contractor must obtain prior approval from CALFED to use draft data. Permission to use draft data will not be unreasonably withheld. CALFED will not disseminate draft data, but may make draft data available to the public upon request with an explanation that the data has not been finalized."
Attachment D, Section 11 Indemnification	TNC requests the following language which was negotiated and approved for the CALFED 2001 agreements with TNC be added to the end of Section 11: ",provided, that Contractor shall have no indemnification obligations under this paragraph to the extent that any claim or loss is caused by the gross negligence or willful misconduct of the party seeking indemnification.
Attachment D, Section 13 Termination Clause	TNC requests the following language which was negotiated and approved for the CALFED 2001 agreements with TNC: "Default and Remedies. In the event of Contractor's breach of any of Contractor's obligations under this Agreement, NFWF shall deliver to Contractor written notice which shall describe the nature of such breach (the "Default Notice"). If Contractor has not cured the breach described in a Default Notice prior to the expiration of the twenty (20) day period immediately following Contractor's receipt of such Default Notice, or, in the event the breach is not curable within such twenty (20) day period, Contractor fails to commence and diligently proceed with such cure within such twenty (20) day period, then Contractor shall be deemed to be in default under this Agreement, and NFWF shall have the right, after receiving approval from CALFED, to terminate this Agreement by delivering to Contractor a written notice of termination, which shall be effective immediately upon receipt by Contractor (the "Termination Date"). Upon and following the Termination Date, NFWF shall be relieved of the obligation under this Agreement to process any payments to Contractor for any work that has been performed prior to the Termination Date; however, NFWF shall continue to be obligated to process any payments to Contractor for work properly performed and invoiced in accordance with the terms and conditions of this Agreement prior to the Termination Date. In no event shall Contractor be required to refund to NFWF, CALFED, the Agency or DWR any of the funds that have been forwarded to Contractor under this Agreement, except as provided below: 1) If Contractor transfers any fee simple real property interest acquired by Contractor with funds provided under this Agreement without having obtained prior approval by the Agency, which approval shall not be unreasonably withheld, Contractor shall reimburse the Agency the sum received by Contractor for such fee simple real property interest, together with interest compounded semiannually starting from the date funds were disbursed by DWR pursuant to this Agreement, and including the date of default, at a rate equivalent to that which is being earned at the time of default on deposits in the State of California's Pooled Money Investment Account. 2) In the event of Contractor's default under Section Eleven, the Agency shall be entitled to receive one of the following remedies, at the Agency's election:

	a) reimbursement pursuant to the terms in Section Ten.I.(1); or b) conveyance by Contractor of a conservation easement to an entity that is authorized to acquire and hold conservation easements under Section 815.3 of the California Civil Code and is selected by the Agency (the "Easement"), together with a sum to CALFED which, when combined with the fair market value of the Easement, equals the sum granted to Grantee pursuant to this Agreement, together with interest compounded semi-annually starting from the date funds for the real property interest purchase were disbursed pursuant to this agreement, and including the date of default, at a rate equivalent to that which is being earned at the time of default on deposits in the State of California's Pooled Money Investment Account. The value of the Easement shall be determined by a fair market value appraisal approved by CALFED.
Attachment D, Section 16 Consideration	TNC requests the following language which was negotiated and approved for the CALFED 2001 agreements with TNC: "Consideration. The consideration to be paid Contractor as provided in this Agreement, shall be in compensation for the performance by Contractor of Contractor's obligations under this Agreement.

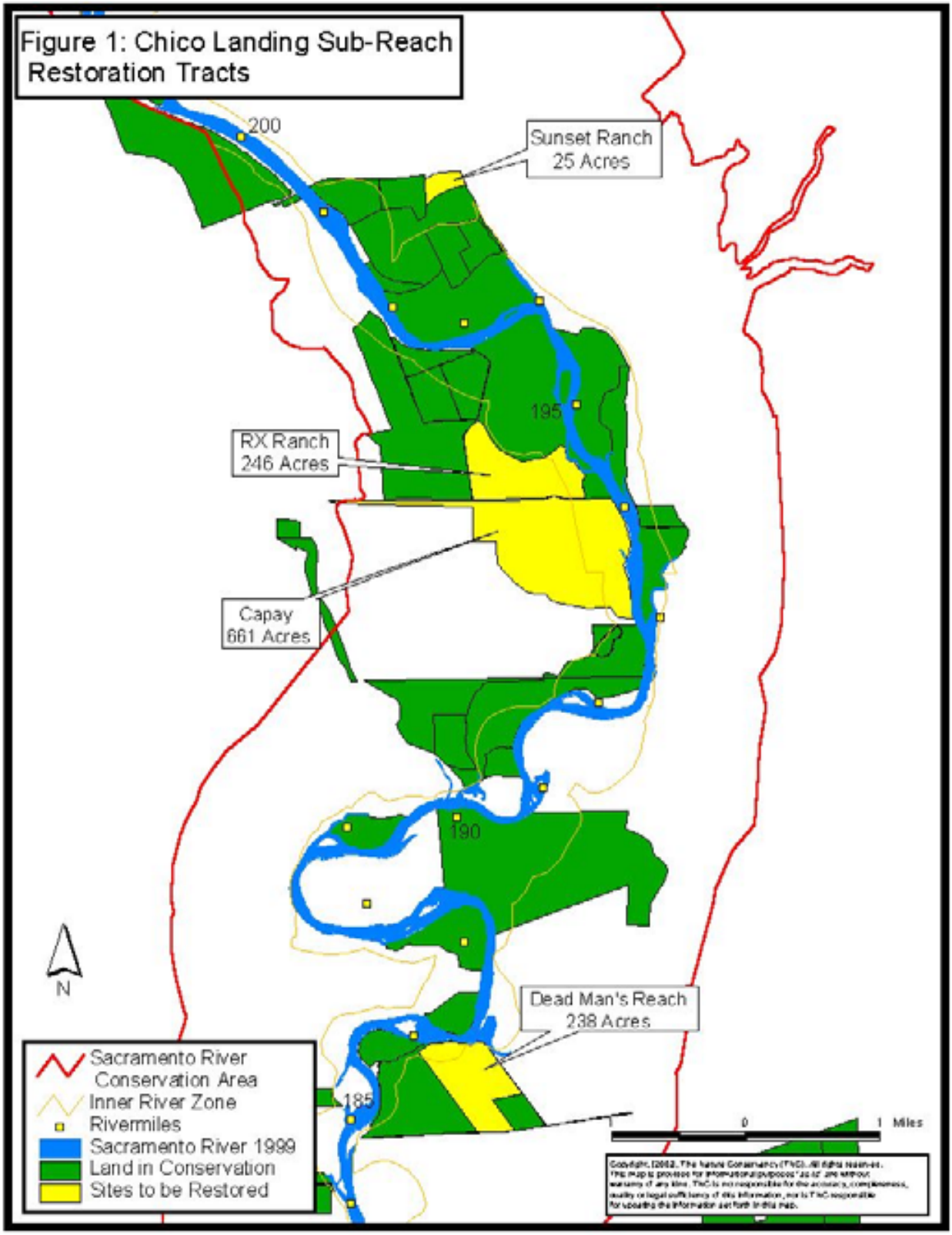
Figure 1: Chico Landing Sub-Reach Restoration Tracts
200
Sunset Ranch
25 Acres
195
RX Ranch
246 Acres
Capay
661 Acres
190
Dead Man's Reach
238 Acres
185
N
Sacramento River Conservation Area
Inner River Zone
Rivermiles
Sacramento River 1999
Land in Conservation
Sites to be Restored
0
1 Miles

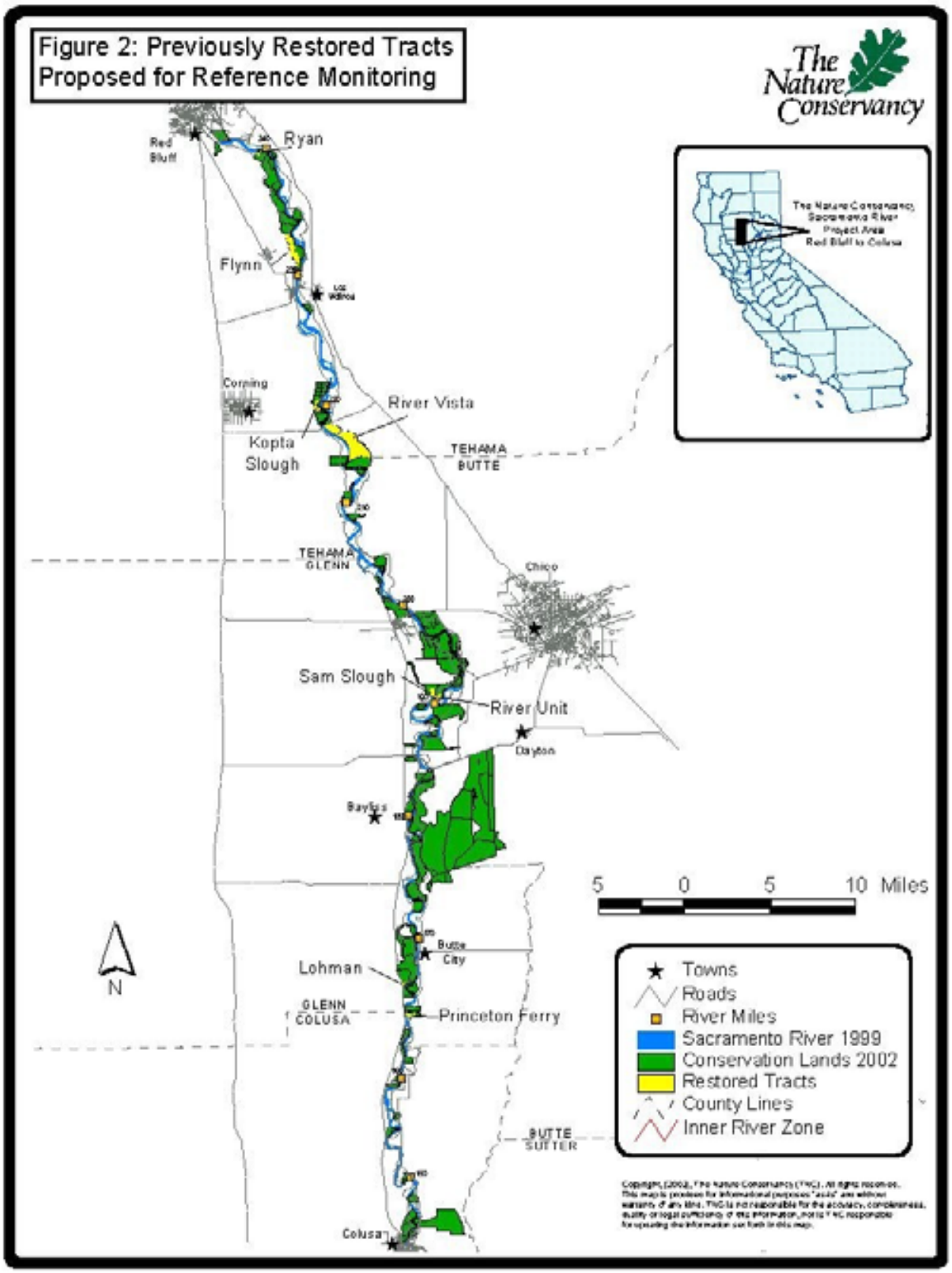
Figure 2: Previously Restored Tracts
Proposed for Reference Monitoring
The Nature Conservancy
Red Bluff
Ryan
Flynn
Los Molinos
Corning
River Vista
Kopta Slough
TEHAMA
BUTTE
TEHAMA
GLENN
Chico
Sam Slough
River Unit
Dayton
Bayliss
5 0 5 10 Miles
N
Butte City
Lohman
GLENN
COLUSA
Princeton Ferry
BUTTE
SUTTER
Colusa
Towns
Roads
River Miles
Sacramento River 1999
Conservation Lands 2002
Restored Tracts
County Lines
Inner River Zone

Figure 3. Restoration Communities model for the Chico Landing Sub-reach

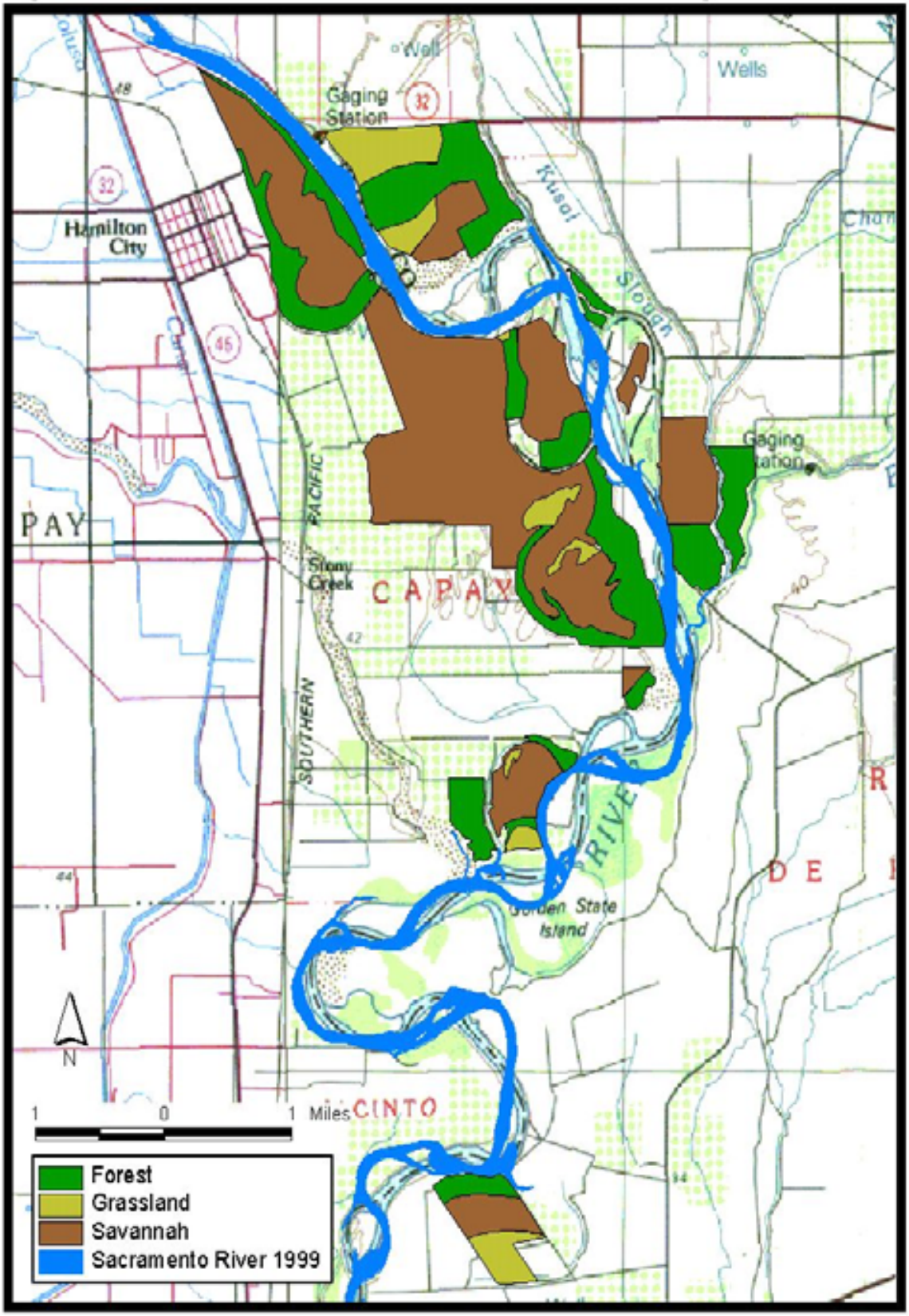

Figure 4. Conceptual ecological model which combines monitoring of key ecological uncertainties with empirical modeling. Bold portions refer to parameters addressed in this proposal.

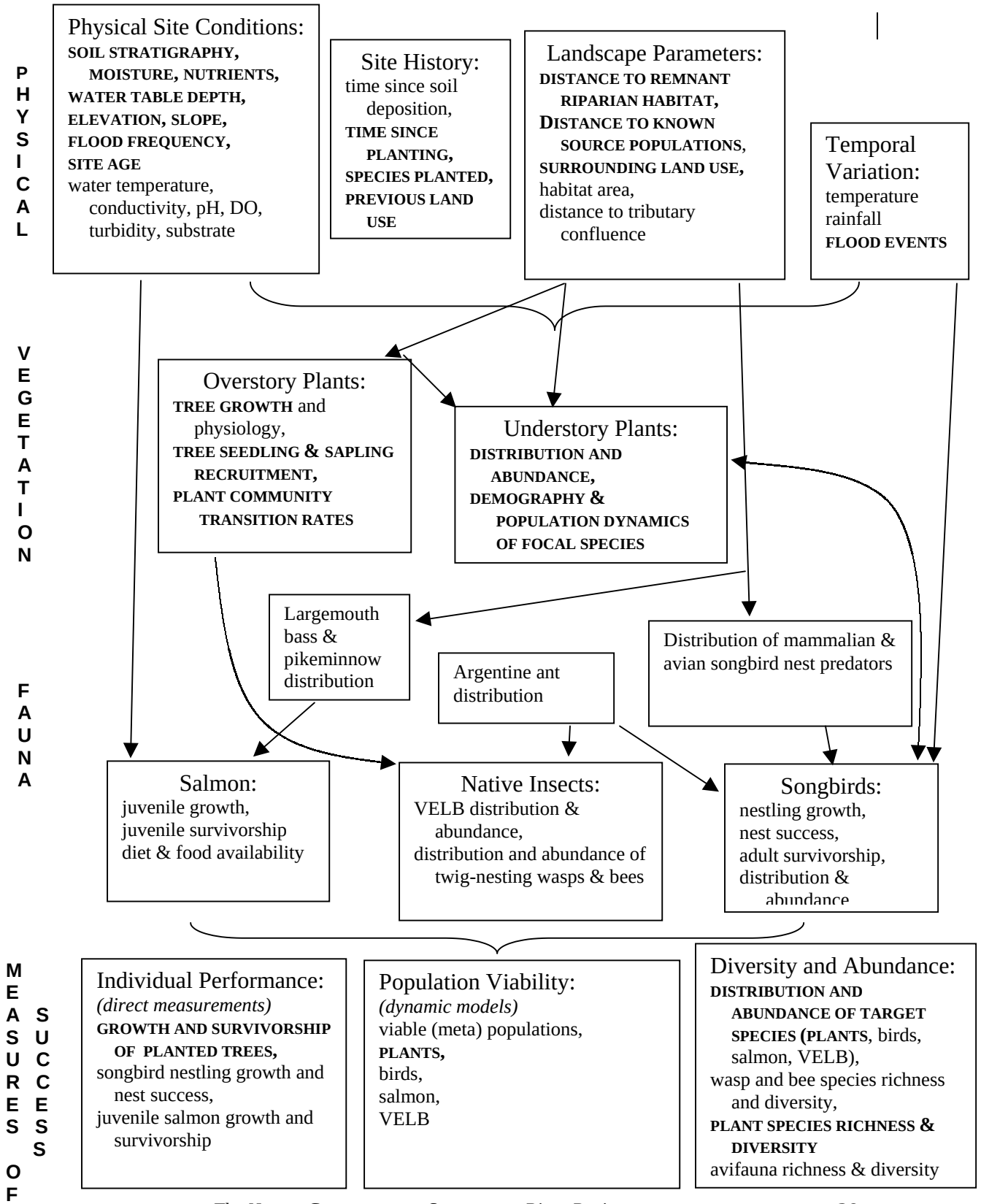

Figure 5. Conceptual model of the Sacramento River Project's programmatic structure.