Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

Project Information

1. **Proposal Title:**

   Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

2. **Proposal applicants:**

   Oscar Wambuguh, California State University, Hayward

3. **Corresponding Contact Person:**

   Oscar Wambuguh
   California State University, Hayward
   Dept. of Biological Sciences 25800 Carlos Bee Blvd. Hayward, CA 94542
   510 885-3471
   owambugu@dvc.edu

4. **Project Keywords:**

   Habitat Restoration, Upland
   Habitat Restoration, Wetland
   Wildlife-friendly Agriculture

5. **Type of project:**

   Research

6. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

7. **Topic Area**:

   Uplands and Wildlife Friendly Agriculture

8. **Type of applicant:**

   University

9. **Location - GIS coordinates:**

   Latitude: 37.942

   Longitude: -121.385

   Datum:

Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.

The project will be based in the Sacramento-San Joaquin Delta Region & East Tributaries Region of California. It is located within 40 miles North, 50 miles south and 45 miles NE and SE of the city of Antioch; and within a 50 mile radius of the city of Stockton.

10. **Location - Ecozone:**

    1.1 North Delta, 1.2 East Delta, 1.3 South Delta, 1.4 Central and West Delta, 11.1 Cosumnes River, 11.2 Mokelumne River, 11.3 Calaveras River

11. **Location - County:**

    Alameda, Contra Costa, Sacramento, San Joaquin

12. **Location - City:**

    Does your project fall within a city jurisdiction?

    Yes

    If yes, please list the city: part of Stockton

13. **Location - Tribal Lands:**

    Does your project fall on or adjacent to tribal lands?

    No

14. **Location - Congressional District:**

    10 th

15. **Location:**

    California State Senate District Number: 5 & 11

    California Assembly District Number: 5

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?

       Yes

       If yes, list the different overhead rates and total requested funds:

State Overhead Rate: 25% of total direct costs

Total State Funds: $156,935

Federal Overhead Rate: 47% of salaries, wages and benefits

Total Federal Funds: $165,479

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?**

No

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

No

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?

No

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)

Reginald Barrett UC Berkeley 510-643-2626 rbarrett@nature.berkely.edu

Chris Kitting Cal State University, Hayward 510-885-3471 ckitting@csuhayward.edu

Mike Moser UC Berkeley 510-642-8123 mmoser@uclink4.berkeley.edu

21. **Comments:**

    None

Environmental Compliance Checklist

Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

1. **CEQA or NEPA Compliance**
   a) Will this project require compliance with CEQA?

      No
   b) Will this project require compliance with NEPA?

      No
   c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

      Work on proposal does not require anything covered by the Acts

2. **If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies).** *If not applicable, put "None".*

   CEQA Lead Agency:
   NEPA Lead Agency (or co-lead:)
   NEPA Co-Lead Agency (if applicable):

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

   CEQA
   -Categorical Exemption
   -Negative Declaration or Mitigated Negative Declaration
   -EIR
   Xnone

   NEPA
   -Categorical Exclusion
   -Environmental Assessment/FONSI
   -EIS
   Xnone

   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?

      Not Applicable

   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	Required
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	
Coastal Development Permit	
Reclamation Board Approval	
Notification of DPC or BCDC	
Other	Required

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:

Permission to access state land.
Agency Name:

Permission to access federal land.
Agency Name:

Permission to access private land.
Landowner Name: Several landholdings involved — Required

6. **Comments.**

There will be several landholdings involved in this project - not all known at this moment - permission will be sought from all of them.

Land Use Checklist

Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

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?

      varies but not more than 20 acres

   b) Describe what changes will occur on the land involved in the proposal.

      The project will evaluate how landholders can use conservation tillage practices, use of fencerows, agroforestry, streamside vegetation, woodlots, wetlands like veranal pools, ditchbanks, windbreaks and hedgerows in their farming.

   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	**agricultural crops/dairy farming**	**Habitat Improvement for wildlife**
Zoning	**agricultural**	**none**
General Plan Designation	**Agricultural**	**modified agricultural**

   d) Is the land currently under a Williamson Act contract?

      No

   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:

Prime farmland & farmland of Statewide Importance

f) **Describe what entity or organization will manage the property and provide operations and maintenance services.**

Landholders - owners & private operators; Institutions (local & private)

4. **Comments.**

Most of the project will takje place in prime farmland areas and others of statewide importance

Conflict of Interest Checklist

Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

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):

Oscar Wambuguh, California State University, Hayward

Subcontractor(s):

Are specific subcontractors identified in this proposal? No

Helped with proposal development:

Are there persons who helped with proposal development?

Yes

If yes, please list the name(s) and organization(s):

Chris Kitting Cal-State Hayward

Comments:

Budget Summary

Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

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.

Federal Funds

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	Field reconnaisance surveys & site selection (GIS/Topo. maps)	20	665	33	86	0	0	0	0	784.0	328	1112.00
2	Vegetation & animal life assessments	256	5794	289	1380	3500	0	0	0	10963.0	2859	13822.00
3	Interviews - administration & follow-up	192	4346	218	604	2500	0	0	0	7668.0	2145	9813.00
4	Appraisals & consultations	40	1331	66	69	750	1000	0	0	3216.0	657	3873.00
5	Data analysis/adaptive management processing	240	7985	400	52	1750	0	5500	0	15687.0	3941	19628.00
6	Monitoring farmlands for new farming methods	240	5432	272	432	0	0	0	0	6136.0	2680	8816.00
7	Workshops & conferences	56	1863	93	138	1000	0	0	0	3094.0	919	4013.00
		1044	27416.00	1371.00	2761.00	9500.00	1000.00	5500.00	0.00	47548.00	13529.00	61077.00

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	**Vegetation & animal life assessments**	**256**	**5794**	**289**	**1380**	**3500**	**0**	**0**	**0**	**10963.0**	**2859**	**13822.00**
2	**Interviews - administration & follow-up**	**192**	**4346**	**218**	**604**	**2500**	**0**	**0**	**0**	**7668.0**	**2145**	**9813.00**
3	**Appraisals & consultations**	**40**	**1331**	**66**	**69**	**750**	**500**	**0**	**0**	**2716.0**	**657**	**3373.00**
4	**Data analysis/adaptive management processing**	**240**	**7985**	**400**	**52**	**1750**	**0**	**750**	**0**	**10937.0**	**3941**	**14878.00**
5	**Monitoring farmlands for new farming methods**	**240**	**5432**	**272**	**43**	**0**	**0**	**0**	**0**	**5747.0**	**2680**	**8427.00**
6	**Workshops & conferences**	**56**	**1863**	**93**	**138**	**1000**	**0**	**0**	**0**	**3094.0**	**919**	**4013.00**
		1024	**26751.00**	**1338.00**	**2286.00**	**9500.00**	**500.00**	**750.00**	**0.00**	**41125.00**	**13201.00**	**54326.00**

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	Vegetation & animal life assessments	256	5794	289	1380	750	0	0	0	8213.0	2859	11072.00
2	Interviews - follow-up	192	4346	218	604	1500	0	0	0	6668.0	2145	8813.00
3	Appraisals & consultations	40	1331	66	69	500	500	0	0	2466.0	657	3123.00
4	Data analysis/adaptive management processing	240	7985	400	52	1500	0	750	0	10687.0	3941	14628.00
5	Monitoring farmlands for new farming methods	240	5432	272	43	0	0	0	0	5747.0	2680	8427.00
6	Workshops & conferences	56	1863	93	138	1000	0	0	0	3094.0	919	4013.00
		1024	26751.00	1338.00	2286.00	5250.00	500.00	750.00	0.00	36875.00	13201.00	50076.00

Grand Total=165479.00

Comments.
A more detailed justification of this budget is included in the Justification form. The overhead rate included here is the 47% Federal Indirect Cost (for salaries & benefits). The State Indirect Cost (which is 25% of total direct costs)is not included here but it is included in the Project Information Form Qs 17a. Thanks

Budget Justification

Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

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

PI = 2060 hrs (for 3 years) - the PI will do the reconnaissance surveys to select study sites including the GIS work, plant/animal life assessments, interviews, appraisals & consultations, data analysis/adaptive management processing, monitoring farmlands & participate in workshops/conferences/writing reports. Assistant = 1032 (for 3 years) - a student assistant will assist in plant/animal life assessments, interview administration & follow-up, and monitoring agricultural areas for incorporation of recommended methods

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

PI = $33.27/hr Assistant = $12.00/hr

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

PI - 5% of the hourly rate Asst. - 5% of the hourly rate

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

The University rate is: $0.345/mile and this was used for all estimated distances of this project.

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

Office = $1250.00 Laboratory = & 2250.00 Field = $ 6000.00 Computing = $ 5500.00 These are per year rates - some of these costs recur every year and an additional $ 8000 for each of years 2 & 3 is included in the budget

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.

Sociologists & Agricultural scientists = $1000.00 These experts will be contacted by PI for more information when doing incentive & institutional appraisals

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 presentatons, reponse to project specific questions and necessary costs directly associated with specific project oversight.

5. Project Management - please see hours, miles & costs on budget sheet a) Field reconnaissance surveys & site selections (GIS/Topographical Maps)- these costs include the initial surveys in the research areas to select sampling sites - mainly travel costs & salaries b) Vegetation & animal life assessments - these costs include costs of field equipment (mist nets, traps, binoculars, tape measures, rulers, poles, etc.), travel costs, hours spent and some expendable supplies (e.g. note books, pencils, pens, etc.) c) Interviews - administration & follow-up - these costs include travel costs, hours spent & supplies like stationery & stamps d) Appraisals/consultations - these costs include local travel, photocopying, hours spent, consultation charges and expendable supplies e) Data analysis/Adaptive management processing/Report preparation - these costs include computer equipment (including floppy/zip diskettes, software & printer) photocopying, stationery, hours spent & local travel f) Monitoring farmlands for incorporation of new farming methods - these costs include travel and hours spent g) Workshops & Conferences - these costs include presentation preparation costs, travel, hours spent, stationery, photocopying, etc. h) Laboratory costs - these costs include local travel, plant/animal identification guides & materials and the hours spent i) General Project Management - these includes costs of time associated with miscellaneous tasks, e.g. project question responses, validation of costs, etc.

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

None

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.

None

Executive Summary

Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California Executive Summary The agricultural ecosystems of many farming areas of the United States in the east, west and north-central regions present complex decision making environments for farmers who have to cope with volatile commodity markets, complicated, ever-changing farm programs, adoption of new farming technologies, escalating public concern over the effects of pesticide pollution, soil erosion, water quality and increasing intervention by governments with their rules, regulations and incentives (Warner and Brady 1995). Wildlife and habitat considerations then are not high on their list of priorities, and the perception that wildlife is a by-product of agriculture remains widespread even today (Rodgers and Wooley 1983). In recent years however, various conservation tillage practices have become increasingly popular among farmers because they reduce farm preparation costs and because herbicides are available that lessen the need for mechanical weed control (Romander 1982). Recent studies on conservation tillage have shown that dramatic increases in wildlife abundance and species richness from invertebrates to small mammals, occur in farmlands incorporating such farming techniques both on temporal and spatial scales. The proposed project is a research and restoration effort focusing on the Delta and East Tributaries Region to find out what wildlife-friendly agricultural methods are (or can be) used in this region and to compare the effectiveness as a basis for further refinement or expansion in the agricultural areas. This project will also look at human issues focusing on understanding landholder psychological, socio-economic and ecological factors that may influence how landholders make decisions on what to do on their lands. Further, the project will also identify what incentives work (or need to be incorporated) in this agricultural area to encourage farmers to practice farming methods favourable to wildlife. To assess wildlife species composition, distribution and abundance in both agricultural areas and nearby "reference" areas, several techniques will be used. To gather data on landholder needs, what wildlife-friendly farming methods are acceptable, prospects, attitudes and socio-economic conditions interview questionnaires will be used. Information about farming activities that reduce runoff, landholder incentives that will encourage inception of wildlife-friendly agriculture methods by landholders, and an evaluation of the institution needs of landholders that will help and support wildlife-friendly farming methods will be appraised from the literature, interviews and from discussions with experienced workers in this field. The outcomes of the proposed project will include: biotic assessments which will provide performance measures allowing us to improve our approaches and incorporate adaptive management; understanding what motivates landholders, their needs, their attitudes towards what we are proposing, how they perceive their roles in this process, how they can help and above all, their participation and co-operation; information on the incentives necessary in this region and the institutional needs that would help to engage landholders in habitat conservation matters. This project will provide information that spans several ERP goals: enhancement and conservation of native biota; enhancement of populations of waterfowl and upland game; gather data on connectivity between habitats, identification of high quality major habitat types, and management of agricultural areas in ways that support wildlife; reduce the impact of non-native mammals on native birds, mammals and other organisms; reduction of fine sediment loading from human activities into waterways.

Proposal

California State University, Hayward

Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California

Oscar Wambuguh, California State University, Hayward

Strategies for incorporating wildlife-friendly agriculture in the Delta and Tributaries Region of California

The importance of using wildlife-friendly farming practices to biodiversity conservation
Biodiversity refers to the variety and variability among living organisms, biota, and the ecological complexes in which they occur. It encompasses species diversity (diversity among species), genetic diversity (diversity within species) and diversity among the ecological systems within a given area (NRC 1992, Panayotou 1994). As we head for the twenty-first century, much is still unknown about the diversity of species on the planet. Even less is known about the rate at which biological diversity is being lost, the role of biodiversity in the functioning of ecosystems now or in the future, and the implications this has for the resilience of the biosphere (Perrings *et al.* 1994, Pimentel *et al.* 1997). A level of biodiversity that will guarantee the ability of ecosystems on which human production and consumption depends needs to be maintained, a level that will assure the capacity of ecosystems subject to stress from economic activity to continue to evolve creatively in an uncertain world (Pearce and Perrings 1994). The primary value of biodiversity is believed to lie in the value of the 'ecological services' supported by the interaction between organisms, populations and communities in the natural environment (Ehrlich 1988, Pimentel *et al.* 1997). There appears to be a threshold of biodiversity below which most ecosystems cannot function properly; a threshold that assures that the diversity present is able to capture solar energy, and develop the cyclic relationships of fundamental compounds between producers, consumers and decomposers on which biological productivity depends (McNeely 1988, Wilson 1993).

The conservation of biodiversity ultimately means conservation of entire ecosystems or landscapes rather than just individual species of flora and fauna (Wilson 1988, Whitmore 1990, Terborgh 1992). Healthy and well functioning ecosystems are vital to the protection of our nation's biodiversity, to the achievement of quality of life objectives, and to the support of economies and communities. The ecosystem approach recognises the interrelationship between healthy ecosystems and sustainable economies (EPA 1997). A critical problem with modern agriculture is the loss of biodiversity which reaches an extreme form in agricultural monocultures that depend on a handful of varieties for their major crops (Altieri 1995). To maintain agricultural sustainability, restoration of agricultural diversity is a necessity. In its early stages, farming benefited many native wildlife species because it increased the food base and diversified existing habitats. Farming also set the stage for successful introductions of exotic game species like the grey partridge and ring-necked pheasant. Despite favourable responses to farming initially most native wildlife species declined as expansion of cultivation and overgrazing reduced habitat. Many wildlife species that once thrived in farmland settings have declined with intensification of agriculture since World war II (Warner and Brady 1994). Others species that sufficiently adapted to those conditions are collectively now called "farm wildlife" (Rodgers and Wooley 1983). As most of those "farm wildlife" form the basis of complex food webs that span local and regional boundaries, enhancing their conservation is central

to the maintenance of holistic and naturally functioning ecosystems. Over the years, the concept of clean farming, development of large farm machinery, increasing field sizes, intensified farming which eliminated weeds, residue, fencerows and odd areas spelled trouble for even "farm wildlife".

Complex agricultural environments and wildlife declines

The agricultural ecosystems of many farming areas of the United States in the east, west and north-central regions present complex decision making environments for farmers who have to cope with volatile commodity markets, complicated, ever-changing farm programs, adoption of new farming technologies, escalating public concern over the effects of pesticide pollution, soil erosion, water quality and increasing intervention by governments with their rules, regulations and incentives (Warner and Brady 1995). Wildlife and habitat considerations then are not high on their list of priorities, and the perception that wildlife is a by-product of agriculture remains widespread even today (Rodgers and Wooley 1983). Nearly all farmland is privately owned, while the wildlife resources from agricultural land historically and legally, are public property. States have been given primary responsibility for managing wildlife under the U.S. Constitution, but in most of them wildlife and its resource use are subordinate to other resource interests (Miranowski and Bender 1982). Long-term declines in wildlife populations have been associated with changing agricultural land use practises and loss of habitats in many farming areas (Jahn 1988). In Illinois for example, populations of key grassland species of birds like savannah sparrow, bobolink, dickcissel and grasshopper sparrow declined more than 95% from 1957 to 1983 (Jahn 1988). Other species like ring-necked pheasants, cottontail rabbits, bobwhite quail, breeding waterfowl and other wetland species have also been drastically affected in many farming areas (Best 1986).

The "source-sink" conceptual model

The "source/sink" model for wildlife habitat (Best 1986) is suggested as a way of conceptualising the impacts of farming on wildlife and how habitat interventions can mitigate negative impacts. The paradigm holds that in some patches of habitat, wildlife will typically produce enough young to account for average annual mortality (a source). Other patches due to factors like predation, interspecific competition and farming practices (that affect vegetation structure and cover juxtaposition) and other farming disturbances do not allow wildlife to reproduce enough young to compensate for annual mortality (a sink). This model therefore suggests that habitat management in farmlands should be directed toward increasing numbers of patches attractive to wildlife, and increasing the portion of attractive patches that afford high rates of reproduction and survival (source habitats). Many farm operations usually coincide with critical periods of wildlife reproduction, maturation and dispersal rendering potential source habitats as sinks unless conservation oriented agencies provide guidance and incentives to encourage farmers to minimise field disturbances (e.g. planting and tillage practices, timing of hay harvest, timing and intensity of livestock grazing, mowing of edge habitats and use of pesticides) during such critical periods (Warner and Brady 1995). On the other hand,

disturbances appear to be necessary to maintain vegetation in early to mid-successional stages but timing is the key (Warner and Etter 1988).

The effects on soil and water quality

The use of chemical fertilisers eliminated the need for crop rotations that include the planting of nitrogen-fixing legumes to maintain soil fertility as the production of row crops, especially soybeans expanded. Row-crop systems are also attractive to farmers because synthetic fertilisers and availability of hybrids and pesticides have increased production per unit of land. Soil erosion and sedimentation have further increased farm pesticide loadings in the environment. Some of these pesticides and their metabolites have entered aquatic and terrestrial ecosystems thereby reducing target and non-target plants and insects of value to wildlife (Pimentel et al 1987). Future strategies for enhancing wildlife habitat in agricultural areas should be linked with efforts to improve soil and water quality. To reduce soil erosion, several tillage and planting practices have come into practice since the 1980s (Gebhardt et al 1985). These practices have been accompanied by intensive chemical disturbances (Castrale 1987) resulting in high variation from field to field in crop residues available to wildlife on fall and winter landscapes (Brady 1985).

Conservation tillage practices

Today, various conservation tillage practices are becoming increasingly popular among farmers because they reduce farm preparation costs and because herbicides are available that lessen the need for mechanical weed control (Romander 1982). Conservation tillage encompasses a variety of techniques designed to leave protective amounts of crop residue on the soil service, thereby decreasing soil erosion (Mannering and Fenster 1983). The most extreme form of conservation tillage is “no tillage” or “slot planting” in which the current years crop is planted directly through crop residue from the previous season without tilling the soil (Best 1986). Recent studies (for example Best 1986, Jahn 1988, Rodgers and Wooley 1983, Nowak and Korsching 1985, Warburton and Klimstra 1984 among others) on conservation tillage have shown that dramatic increases in wildlife abundance and species richness from invertebrates to small mammals, occur in farmlands incorporating such farming techniques both on temporal and spatial scales. In 1986 a record 97.6 million acres (32%) of all U.S. cropland were managed using some form of conservation tillage (Harmon and Nelson 1988). Informing farmers about low-input farming and other conservation tillage practices appears to be a key step in achieving nation-wide integrated resource management goals. More farmers are discovering that sustained-yield agriculture can reduce annual costs, increase profits, reduce soil erosion, improve water quality and benefit wildlife resources including soil organisms (Harmon and Nelson 1988). Opportunities for enhancing fish and wildlife on private farmlands have increased from support programs like the federal Conservation Resource Program (CRP), Environmental Protection Agency’s Community-Based Environmental Program (CBEP), past federal programs like the Soil Bank program of the 1950s, U.S. Department of Agriculture conservation programs and many state and local initiatives (Nowak and

Korsching 1985). Some private institutions are also increasingly helping farmers supplement their incomes by marketing recreational opportunities resulting from improved wildlife and fish habitats and populations (Harmon and Nelson 1988).

The importance of landholder partnerships

The ultimate success of those programs depends upon the strong interest, participation and support of private landowners and operators, the co-operation of state government agencies, and effective administration of the conservation and commodity provisions of the USDA agencies, conservation districts, county committees and the various private groups (Jahn 1988). An effective teamwork of all players involved in new integrated agricultural and conservation programs allows everyone to gain from the sustained, multiple-benefits system of agriculture - farmers, communities, states and the nation (Warner and Brady 1995). The role of landowners in the success of habitat conservation and enhancement programs cannot be underestimated. Skills in communicating, marketing and salesmanship appear to be essential to success and must be backed by the technical know-how that demonstrates to farmers a knowledge of wildlife management and an understanding of agribusiness and the complex world in which a farmer must make a living (Warner and Brady 1995).

More than a good idea and good intentions are needed to make an impact on privately-owned land and assumptions cannot be made that landowners are willing to manage their land for public benefits at personal expense. The management goals of landowner, not those of managing agencies are likely the ones to be applied and maintained over the years. Scientists must therefore find out from landowners and farm operators what they want accomplished on their lands, help farmers interpret the local landscape providing information about soils, water, plant and animal communities that with management can be transformed to benefits both to the landowners and the nation (Magleby et al 1985). It must be recognised that landowners and farm operators require a time commitment to incorporate new farming plans together with other obligations to lending institutions, farm programs, adherence to other "farm plans" for soil conservation, financial management, marketing and forestry plus other social and economic liabilities (Warner and Brady 1995). It is easy to see why the frequency of farmers in today's economy who will forego a profit to dedicate productive land to wildlife, is low.

Rural sociologists have documented how new practices are evaluated by farmer operators and landowners (Pampel et al 1977). Innovative approaches are accepted or rejected by farmers in an awareness-interest-trial and evaluation process. Farmers will look at advantages of the new practices over the current methods, compatibility with existing methods, degree of difficulty in understanding the new approach and opportunity to try it without significant social or economic costs (Warner and Brady 1995). Of particular importance is the time it requires before new benefits are seen especially because plants

and animals require years to respond to conservation practices and direct economic return may not necessarily be forthcoming. To increase wildlife value of agricultural lands each patch of annual or perennial vegetation must be optimised for wildlife. Streamside vegetation, woodlots, wetlands, ditchbanks, and other odd areas represent habitat patches useful to wildlife. Completing these patches of vegetation are with windbreaks, hedgerows, grassy and woody fencerows and roadsides. To maximise landholder participation in wildlife-friendly agriculture, a variety of strategies have been used including incentives, sustained aggressive promotion campaigns, education and outreach activities plus participation by volunteer groups like Ducks Unlimited, Pheasants Forever and Quail Unlimited. The challenge to scientists and conservation-minded participants is to find a compatible mix of strategies that will work in the complex agricultural holdings that characterise different U.S. farming areas.

The role of incentives

With the assumption that resource exploitation is governed by perceived self-interest of landholders, behaviour affecting the incorporation of wildlife-friendly agriculture can best be changed by providing new approaches. These approaches must alter people's perceptions of what behaviour is in their self-interest, and since the latter is defined largely in economic terms, the need to promote conservation with economic incentives, among others, arises (McNeely 1988, Wells 1994). An incentive for conservation is any inducement that is specifically intended to incite or motivate governments, local people and non-profit organisations to conserve biodiversity. Incentives may be direct or indirect. Although studies have shown that only about 50% of the farmers would consider monetary programs developed to encourage establishment of wildlife habitat (Warner and Brady 1995), today's commodity economies may skew this finding to more acceptance among land operators. Incentives involving use of cash directly include the following. First, cash rewards plus special recognition plaques can be given to local farmers showing exemplary behaviour toward implementing wildlife-friendly practices. Two, grants can be provided for specific community activities (e.g. promotion of local tourism). Three, subsidies from the government to support activities operating at a loss, possibly due to a short-term market failure, or granted for avoiding activities that are detrimental to biological resources, e.g. sustained pesticide use. Fourth, land banks could be very effective in small-scale ownerships where the objective is to reduce the amount of land under agriculture, thereby increasing amount of land available for biodiversity conservation. Fifth, land retirement programs, an earlier federal concept, can be very effective (Harmon and Nelson 1973). Sixth, loans or credit facilities through financial institutions with easy terms to expand landowner options for wildlife-friendly farming practices. Seven, daily wages could be paid to individuals or community organisations in return for activities contributing to the implementation of farming practices useful to wildlife.

Indirect incentives have potential for providing landholders with the means to develop their own capacity to benefit from wildlife-friendly farming may include some of the

following suggestions. 1) Fiscal incentives of tax exemptions, security guarantees and insurance, especially in bad economic times. 2) Service incentives that encourage communities to reduce their dependence on external inputs like fertilisers and pesticides and build self-reliance. These activities build community spirit and provide context for ensuring that the linkage between assistance and expected change in behaviour is reinforced. Agricultural practices that help rehabilitate soils, and promote diverse and sustainable agroecosystems like trees, perennial crop species (e.g. fruit trees), improved seeds and wildlife friendly fencing could be good incentives. Education and training, especially for children and short-term training incentives for adults could provide a ready forum for promoting a conservation ethic within the community. 3) Social incentives include community-based organisations that can encourage the establishment of strong community-level institutions. Information can then be delivered through such institutions which allow farmers know what incentives are available, the long-term consequences of their actions, and the value locally, regionally and nationally of the biodiversity they are helping to conserve. 4) Zoning and easements - areas important for specific purposes (e.g. threatened wildlife conservation in remnant vegetation patches) can be zoned-off for those land uses by legislation. Also important are easements where landowners can be compensated for the acquisition of areas in their jurisdiction, important for specific purposes (e.g. setting up corridors or preserving remnant patches of riparian vegetation important for endemic species conservation).

Incentives can be used to divert land, capital and labour towards conserving biodiversity and promoting broader participation in work that will benefit those resources (McNeely 1988, Perrings *et al.* 1994). They can smooth the uneven distribution of costs and benefits of encouraging wildlife-friendly farming practices, mitigate anticipated negative impacts on landholders by regulations controlling exploitation, compensate people for losses suffered through such controls, and reward farmers who assume responsibilities through which the larger public benefits. However, to function effectively, incentives require some degree of regulation, enforcement and monitoring, and must be used with considerable sensitivity, if they are to attain their objectives and be adaptive to changing conditions. Challenges abound as farmers are encouraged to adopt the diversity of approaches (which must remain sufficiently coherent to allow consistent implementation and achievement) for diverse biodiversity conservation goals in the long-term.

Proposed project goals, hypothesis and objectives

Using the above information as a baseline, the proposed project will find out what wildlife-friendly agricultural methods are (or can be) used in this region and compare the effectiveness as a basis for further refinement or expansion in the agricultural areas. This project will also look at human issues focusing on understanding landholder psychological, socio-economic and ecological factors that may influence how landholders make decisions on what to do on their lands. Further, the project will also identify what incentives work (or need to be incorporated) in this agricultural area to encourage farmers to practice methods favourable to wildlife. The proposed project is based on the

hypothesis that farmers in general are motivated, first and foremost, by economic benefits that they can derive from their lands and any other activity that deviates, complicates, frustrates, or delays the realisation of this goal is marginally important to farmers' operations. It follows then that for farmers to incorporate farming strategies that are beneficial to wildlife, they must perceive those strategies as of economic gain to them. Although this hypothesis can be trivialised, the management implications bearing on it are huge and wide-ranging. For example, if farmers are viewed as partners interested in habitat conservation for wildlife with good soil and water usage intentions, the strategies for implementation of those strategies will be different from the perception that farmers have to be encouraged, directed, motivated or perhaps be coerced (by rules and regulation for instance) into wildlife-friendly farming practices. As the implications for habitat, soil, water and wildlife conservation on private lands strongly hinges on support from, and participation of landholders in those areas, there should must be no doubts on that assumption.

The study will specifically address these objectives:
1) carry out vegetation and animal sampling in areas where wildlife-friendly agriculture has been practised to assess species composition, richness and abundance as indicators of their effectiveness for at least three years; this information will be compared to data collected in nearby reference (natural) areas with no agricultural activity;
2) identify what farming practices have improved (or can improve) agricultural land's value for at risk and other wildlife species;
3) identify landholders' needs, prospects, attitudes toward habitat improvements and other socio-economic factors that may affect landholder involvement and participation;
4) appraise what farming activities minimise (or would minimise) polluted runoff into nearby waterways
5) appraise and identify the incentive programs that landholders need to incorporate wildlife-friendly farming practices and assess the adaptability into this area any other incentives that have been used effectively here or elsewhere;
6) evaluate the existing institutional framework for providing assistance to landholders as they incorporate wildlife-friendly farming practices and identify what mechanisms can be used to make them more effective.

Justification of the proposed study
One of the most important reasons for maintaining, restoring and/or enhancing biodiversity in agroecosystems is that it performs a variety of ecological functions including nutrient recycling, control of local micro-climates, regulation of local hydrological processes, regulation of the abundance of undesirable species and detoxification of noxious chemicals (Altieri 1995). As these renewal processes and ecological services are largely biological, their persistence depends on the maintenance of biological diversity. Even with perfect compliance with all rules and regulations a lot of environmental issues cannot be addressed by federal agencies alone. This is primarily due to the multitude of dispersed sources that bring about environmental stress, for example,

the polluted runoff from rain and snow-melt in cities, suburbs and farmland that affect soil, air, water and living resources (EPA 1997). Fortunately, environmental issues as they pertain to farming have come to the forefront during the last two decades with a strong mandate by society to address these issues. There are movements within agriculture to diversify farm commodities, reduce energy-intensive farming practices, protect natural resources and in general ensure agricultural systems are sustainable (NRC 1989). These movements have created significant opportunities for federal, state, local and public agencies to promote farm practices relatively beneficial to wildlife that are also compatible with other goals in agriculture (Pimental et al 1989). Successful farmland habitat programs are often associated with how well agency managers are able to accommodate the ecological, political, economic and social contexts in which habitat initiatives must occur (McConnell 1981). New programs to improve and establish wildlife habitat in intensively farmed areas have increased in recent years (Vander Zouwen 1990). However, these attempts dwindle after a few years with benefits to wildlife typically short-lived and highly localised (Warner and Brady 1995). Agricultural policies and programs, changing farming needs and practices, competing land uses, and limited agency resources all contribute to this failure. Therefore, those pursuing wildlife friendly agriculture must rely on more than ecological theory, soil and water conservation techniques, and habitat development skills; they must become familiar with land use practices, the politics of conservation and rural sociology.

Conceptually, information coming from research will affect the environment and landholder as follows:
Research findings (appropriate wildlife and soil-friendly farming techniques, types of incentives and socio-economic information about landholders themselves including their attitudes, needs and prospects) ⇨ Institutional framework (federal, state, local and private) ⇨ Landholders ⇨ New techniques for soil, water, and wildlife applied ⇨ Habitat improves/biodiversity increases ⇨ Foodweb ramifications ⇨ Assessments and evaluations ⇨ Adaptive management process[1] ⇨ Improved or better strategies ⇨ Habitat improves/biodiversity increases ⇨ Landholders multiple benefits.

Unless time is spent gathering the information outlined in the objectives above, the effectiveness of past approaches, the appropriate incentives for landholders in this region, the types of wildlife-friendly farming practices to be encouraged, and the critical role of landholders to the maintenance of these agroecosystems will largely remain obscure. With the need to restore ecosystems for many at risk species and improve habitats for other species that high on our agendas, investments for generating this kind of information must be greatly encouraged. This is what the proposed research work hopes to achieve. The study hopes to continue monitoring the agricultural areas for at least three or more years and using the information generated to feed into the adaptive management process outlined in Chapter 2 of the Draft Stage 1 Implementation Plan.

[1] See Figure 1 in Chapter 2 Draft Stage 1 Implementation Plan

Study Design and Methods

Although the actual results of any restoration endeavour takes a long time to realise, this project is initially designed to take three years. During most of the first year (but also during the second and third years), time will spent carrying out of vegetation and animal assessments in areas where wildlife-friendly farming techniques have been implemented in the Delta/Tributaries Region. Absolutely natural areas with minimal or no human influence are limited in this region. However, similar assessment data will be gathered for comparison in "reference" areas where habitats/habitat patches are in such a condition that they can be regarded as "minimally-to-moderately influenced" by human activity thereby "near natural". Such habitats may be located adjacent or (depending on type of land-holding), within agricultural areas. This done, information about which farming practices have made a difference to habitat improvement for at risk and other wildlife species will be gathered. Information about attitudes, needs and prospects of landholders will also be gathered during the first year. During the latter part of the first year and the second year, information will be gathered on the last three objectives including identifying appropriate incentives, evaluating existing institutional framework and appraising farming techniques that reduce pollution in existing waterways. During the latter part of the second year, information that can be used to modify or initiate techniques that are landholder supported, wildlife-friendly, and reduce water pollution will be available, as generated through the adaptive management process depicted in Chapter 2 (pg. 8) of the CALFED Draft Stage 1 Implementation Plan. After this process, the implementation by landholders (with support from institutions) of the various recommended techniques will be initiated following guidelines that will come from the adaptive management process of year two. Time will be spent monitoring the implementation plans by landholders and follow-up evaluations of objectives 1, 2 and 4. It is believed that more monitoring and evaluation of restoration effectiveness incorporated in Year 3 plus the process of adaptive management will proceed even longer.

Due to the spatial simplicity of intensively managed human agroecosystems, an effort will be made to chose study sites preferentially after the initial area surveys are completed in the various land-holdings. Prior information gathered from grid maps of the region will also help in the selection of study sites especially "reference" sites adjacent to the agricultural areas. The use of a Geographical Information System (GIS) for this region will also be evaluated, and if feasible, will be used in the selection of study sites both in the agricultural areas and "reference" areas.

Vegetation sampling (Objective 1) will involve quantitative and qualitative measurements of the following aspects as outlined by Bookhout (1995): frequency of occurrence and species composition of various plant, vegetation density, cover, plant height and vegetation visual obscurity. To measure frequency of occurrence (Bonham 1989), 3 small $1m^2$ plots per patch will be sampled in specific areas of the agricultural landscape including the adjacent "reference" areas mentioned above. The types of species in each

plot will be assesses and how many times each species occurs in each of the three plots will be counted and averaged. Plant species densities will be measured in the same $1m^2$ plots as frequency. Vegetation cover will be measured using the line intercept method (Higgins et al 1995; Hanley 1978) where a line or tape measure is stretched between two sticks and the basal width of all plants touching the line is measured. To measure plant heights, a calibrated ruler will be used as explained by Higgins and Barker (1982). Visual obscurity is a parameter functionally important to wildlife as hiding and thermal cover (Nudds 1977). A 2.5m x 30 cm "cover pole" as reported by Griffith and Youtie (1988) will be used. Here, the cover pole is painted with alternating 10 cm black and white bands and three red bands divide the pole into 50 cm zones. Visual obstruction in each zone is measured by viewing the board from 15m in a randomly chosen direction. The percentage of each interval concealed by vegetation is recorded as a single digit score ranging from 1-5 corresponding to 0-20, 21-40, 41-60, 61-80 and 81-100% estimated concealment. Simple and multiple regression analysis (Zar 1993) will be used to find out how much vegetation parameters explain animal species composition, abundance and species richness. Correlation analysis will be used to analyse vegetation data and relationships between various animal data, e.g. how animal abundance correlates with species richness in specific sites. Student t-test and analysis of variance (ANOVA) will be used to determine how habitat characteristics in different habitat patches vary. Chi-square analysis will be used for analysis of data generated from the interviews about differences or similarities between landholders in the many aspects covered in the interviews.

These vegetation parameters combined with animal sampling data (described below) are useful indicators of the degree of usage by wildlife of different habitats, why some habitats are more useful to wildlife than others, wildlife habitat preferences. This information will then be incorporated in the adaptive management process. To assess wildlife species composition, distribution and abundance in both agricultural areas and "reference" areas (Objective 1) several techniques will be used. For bigger avian species like waterfowl and ground nesting birds three sampling 100 m transects will be established in each study site (Schemnitz 1995) where an observer will walk along the transects after sunrise twice a month for all seasons and all birds using the area will be identified and counted. Adjacent "reference" areas will also be sampled. Mist nets will be used for smaller passerine bird species as discussed by Keyes and Grue (1982). This will be done monthly over the four seasons in the agricultural and "reference" areas. Small mammals will be sampled monthly using baited Sherman live traps (5 x 6 x 16 cm) placed at 30 m intervals along 200 m line transects in the agricultural and "reference" areas as described by Warburton and Klimstra (1984). Other small mammals like squirrels will be counted along 100 m transects used for ground-nesting birds above. Above-ground invertebrates will be sampled using linear pitfall traps (Murkin et al 1995) in each study site placed at 15 - 25 m intervals. Two traps will be placed in the middle of each study site and invertebrate samples collected and analysed each month during the four seasons.

The information gathered in the above vegetation and animal sampling will be used to find out what farming practices improve agricultural land's value to wildlife (Objective 2). To gather data on landholder needs, prospects, attitudes and socio-economic conditions a interview questionnaire (attached) will be used for all landholders. Interviews with landholders will be conducted by the principal investigator in most (if not all) of the agricultural areas in the Delta/Tributaries Region. Information about farming activities that reduce pollution runoff (Objective 4), landholder incentives that will encourage inception of wildlife-friendly agriculture methods by landholders (Objective 5) and an evaluation of the institution needs of landholders that will help and support wildlife-friendly farming methods (Objective 6) will be appraised in the literature and from discussions with experienced workers in this field. The methods that have worked elsewhere and any new or novel strategies that can be incorporated in this region, will be evaluated and incorporated in the adaptive management process. Information derived from Objective 3 will allow assessments be made on how accurate the original hypothesis of the study reflects landholder motivations and needs. For example, the proportion of landowners found supporting a specific habitat conservation objective, or performing a certain action that enhances wildlife habitat can be used as a guide to evaluating landholder intentions and attitudes towards habitat improvement.

Data from all these biotic and human measurements and assessments will be used as performance measures of how effective various wildlife-friendly farming techniques affect animal and plant populations. This information will then be compiled as reports that will be published and presented in meetings, workshops or conferences. This opportunity will provide critical evaluations to be made of the proposed project's performance by other workers. Important feedback obtained in these meetings will then be used in the adaptive management process to further improve the project output. When all data from this project is available, I believe (together with data from other projects in the region) it will close crucial information gaps that decision makers definitely need to formulate appropriate plans that will enhance local and regional maintenance of biodiversity.

Data handling, storage and work schedule

All data collected in this project will be compiled, analysed and organised for workshops, seminars, etc. at the Biology Department of the California State University, Hayward campus where all administrative, operations and equipment for this project will be based. Assuming funding for this project will not be a problem, work is scheduled to proceed as follows:

May 2002	*Funds from CALFED become available to researchers
June 2002	*Acquiring required project equipment
	*Initial Delta Region field reconnaissance surveys are made
	*Areas incorporating wildlife-friendly practices are identified and mapped
	*Study sites (using a GIS or topographic maps) identified in the

	agricultural and neighbouring areas
July-June 2003	*Vegetation and animal assessments - agricultural/"reference" areas for all four seasons
Aug.-Dec. 2002	*Landholder interviews on attitudes, needs, prospects, actions, etc.
Jan.-April 2003	*Literature appraisal/discussions with other scientists about landholder incentives, institutional framework assessments, and identification of farming techniques that facilitate soil and water conservation
July-Aug. 2003	*Analysis of data obtained, adaptive management process evaluation - workshops & conferences; publications
Sept.-Oct. 2003	*Landholder and institutional consultation/meetings to prepare incorporation by farmers of recommended habitat improvement techniques.
Nov.-June 2004	*Incorporation by farmers of wildlife-friendly farming practices (institutions help?) *Monitoring incorporation in agricultural areas
July-March 2005	*Annual vegetation and animal assessments - agricultural/"reference" areas
April-June 2005	*Analysis of data obtained; presentations/workshops/conferences; preparation of final report and publications

Please note: Separation (e.g. by funding) of the above tasks will not generate all the information required. For instance, we need data generated in the first year for the adaptive management process performed at end of Year 2; results of which we need for incorporation in mid-Year 2. Biotic assessments performed in Year 1 and Year 3 are inseparable because they will allow assessments of the effectiveness of the approaches used before and during this project. Another example: we cannot separate assessments of landholder attitudes, needs, aspirations, suggestions, etc. from the rest because we need not only their support but their participation in the revised or new wildlife-friendly approaches. Assessments of the appropriate incentives and institutional framework that can be incorporated in the Delta Region are also needed as part of the incorporation done in mid-Year 2.

However, the project can also be conducted in stages if separation is inevitable. Biotic assessments can be performed and incorporated into a future stage. Assessments of the appropriate incentives and institutional framework for landholder wildlife-friendly farming methods can be done as a stand alone objective and incorporated in a future stage. Assessments of landholder attitudes, needs, aspirations, suggestions, etc. can also be done as a stand alone objective to be incorporated in a future stage.

System-wide ecosystem benefits and ERP priorities

The information generated by the proposed project will be crucial to regional biodiversity maintenance of both at risk and non-risk biota in the following ways:

a) biotic assessments provide performance measures that allow us to improve our approaches and incorporate adaptive management;
b) understanding what motivates landholders, their needs, their attitudes towards what we are proposing, how they perceive their roles in this process, how they can help, and above all, their participation and co-operation is the only way we will realise our biodiversity conservation objectives locally and regionally; and finally
c) finding out what incentives can be incorporated in this region and what institutional needs there are, is the only way we can engage landholders (especially the least motivated ones) in habitat conservation matters.

This project will provide information that spans several ERP goals as listed in Attachment 2 Draft Stage 1 Implementation Plan.
a) Goal 1, objective 3: enhance and conserve native biotic communities including neo-tropical migratory birds, wading birds, waterfowl and other species associated with wetland habitats;
b) Goal 3, objective 3: enhance populations of waterfowl and upland game for harvest and non-consumptive recreation;
c) Goal 4, objectives 1, 2, 3 and 4 that deal with connectivity between habitats, identification of high quality major habitat types, and management of agricultural areas in ways that support wildlife;
d) Goal 5, objective 6: reduce the impact of non-native mammals on native birds, mammals and other organisms. By enhancing habitats for wildlife in farming areas, some of these effects will be greatly minimised;
e) Goal 6, objective 3: reduction of fine sediment loading from human activities into waterways - practising soil and water conservation farming methods (addressed by this project) will greatly reduce soil erosion and sedimentation in waterways;
f) multiple goals/objectives - there are other goals and objectives that data from this proposal will partially support throughout the 6 goals outlined in Attachment 2. Of the Draft Stage 1 Implementation Plan.

Local involvement
Initial landholder surveys in the Delta Region farming community by myself indicate that landholders are interested in farming methods that are environment friendly - strategies that will encourage protection or provision of wildlife habitat, but those that will augment (not compromise) their main objective, which is farming. Some farmers felt stressed out by requirements of federal and state agencies that appear to yield no benefits to the landowner in the long term; regulations that curtail them from operating independently in their private lands in farming matters; and what looks like too much involvement of outsiders in their operations. Some farmers indicated site specific habitat needs that they require, but cannot obtain, because they are either too expensive to operate, or severely compromises their farming operations. This initial survey indicates that taking the time it requires to understand critical landholder issues is as crucial to success as is everything else we do to encourage wildlife-friendly farming practices.

Qualifications

The principal investigator has a doctor's degree in Natural Resource Management from the University of California at Berkeley and a Masters degree in Biology of Conservation. I currently teach Environmental Science and Biology/Ecology primarily at California State University, Hayward. I have conducted research in various fields including ecology, animal behaviour, land use and more recently, community-based biodiversity conservation. Currently, I am paying more attention to developing biosocial approaches that enhance sustained habitat protection and conservation in multiple interest semi-urban and rural areas with competing land uses particularly in developing countries.

Planned Reports/Outcomes

The following reports are initially expected to come from the proposed project:

1. Wildlife restoration in agricultural areas: comparing the effectiveness of different approaches
2. What farming approaches can landholders incorporate in their lands that enhance wildlife habitat without significantly compromising their economic objectives?
3. Slide presentation of different farming techniques in the Delta Region of California.
4. Wildlife species composition, abundance and distribution in agricultural areas.
5. How critical are agricultural habitat patches to migratory wildlife? A Delta Region case study
6. What do landholders in the Delta Region of California think about habitat enhancement projects that restore and conserve wildlife in their lands?
7. Incentives that make a difference in restoring wildlife in agricultural areas: The Delta Region of California study
8. What agricultural land management approaches conserve soils and minimise pollution in our waterways?
9. What institutional mechanisms work best to encourage wildlife-friendly farming practices: the experience from the Delta Region of California.
10. Restoring wildlife in agricultural areas: the crucial role of landholders.

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Strategies for incorporating wildlife-friendly agriculture in the Delta and East Tributaries Region of California: *Listening to the farmers*

Landholder Questionnaire

Delta/Tributaries Zone Number: _____
Farm Number: _____

Both the Federal and State Government, County and local authorities plus other interest groups would like you to share your opinions in this survey conducted by ourselves (California State University researchers). We are all interested in enhancing and restoring biodiversity of both at-risk and other species that use your land as their primary or substitute habitat, by incorporating wildlife-friendly agricultural techniques.

We know we can only do this if we have your absolute support and participation. We want to know your feelings about this, your farming and other needs, your problems, your future prospects and expectations and what incentives you would want used to encourage you incorporate such farming techniques. We can only succeed in our habitat improvement endeavours if we take the time to gather and evaluate information about those very important issues about landholders in the Delta Region of California.

This will allow us understand what kind of partnerships can be designed between you, the landholder, and the institutions that will provide assistance and work with you to accomplish the above objectives. We truly appreciate your time and effort in this task.

Please fill the questionnaire as completely as you can for each item. Writing additional information on the margins or back page is all right.

1. Landholder gender & Age: 1. Male____ 2. Female____ 3. Below 50____ 4. Over 50____

2. When did you settle here? Year: _____

3. Do you own or operate this farm? 1. Own_____ 2. Operate_____

4. What is the size of this farm? Size _____acres

5. What agricultural activities occur on your farm? *(check)*
    1. Crop_____
    2. Livestock_____
    3. Both_____
    4. Others_____ Please list here:_____

6. What problems do you encounter in your farming operations? *(Please check)*
    1. Tillage operations_____ Which ones?_____
    2. Seed availability_____ Which ones?_____
    3. Planting____ Which ones?_____
    4. Not enough farm workers_____ Why?_____
    5. Wildlife problems_____ Which ones?_____
    6. Lack of information on better farming practices_____
    7. Harvesting operations_____ Which ones?_____
    8. Marketing issues_____ Which ones?_____
    9. Too much government regulation_____ In what ways?_____
    10. Others:_____

Please use the space below to write more (or to say more on any of the above) problems.

7. What do you feel you most need to make your operations on this farm better and more productive?

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____

8. Do you like wildlife? Yes_____ No_____ Not Sure_____

9. If you like wildlife, what wildlife species do you like?

1._____ Why?_____
2._____ Why?_____
3._____ Why?_____
4._____ Why?_____
5._____ Why?_____

10. Do you like nature? Yes_____ No_____

11. What aspects of nature do you like?

1._____ Reason?_____
2._____ Reason?_____
3._____ Reason?_____
4._____ Reason?_____
5._____ Reason?_____

12. Do you practice farming methods that encourage natural habitats in your farm?

1. Yes_____ 2. No_____

13. If so, what farming methods?

1._____
2._____
3._____
4._____
5._____

13. Do you see any wildlife in your farm? 1. Yes_____ 2. No_____

14. What kinds of wildlife do you see on your farm throughout the year?

1._____
2._____
3._____
4._____
5._____

15. Are there any particular wildlife you would like to encourage on your farm?

1. Yes_____ 2. No_____ Reason?_____

16. What kinds of wildlife would you like on your farm?

1._____
2._____
3._____
4._____
5._____

17. Would you then like to use farming methods that would encourage wildlife on your farm?
1. Yes_____ 2. No_____

18. Would you support those farming methods if they require you to reduce:
1. Your crop acreage? 1. Yes_____ 2. No_____
2. Livestock space or numbers? 1. Yes_____ 2. No_____
3. Your farm profitability? 1. Yes_____ 2. No_____
4. Dependence on chemicals/pesticides or herbicides? 1. Yes_____ 2. No_____
5. Farming methods that increase soil erosion? 1. Yes_____ 2. No_____
6. Other unforeseen events? 1. Yes_____ 2. No_____

19. Would you support those farming methods if they require you to:
1. Plant specific crops in addition to yours? 1. Yes_____ 2. No_____
2. Reduce acreage of some crops in favour of others? 1. Yes_____ 2. No_____
3. Invest time and money? 1. Yes_____ 2. No_____
4. Allow your farm be used for demonstration purposes? 1. Yes_____ 2. No_____
5. Use new farming methods that will enhance wildlife habitat on your farm?
1. Yes_____ 2. No_____
6. Adjust your farming schedules a little to accommodate them?
1. Yes_____ 2. No_____
7. Other unforeseen events? 1. Yes_____ 2. No_____

20. Are there any incentives you get from any federal, state, local or private groups in your farming operations? 1. Yes_____ 2. No_____

21. What kinds of incentives? *Please write below*
1._____
2._____
3._____
4._____
5._____

22. Who provides those incentives?_____

23. Are you happy with those incentives? 1. Yes_____ 2. No_____

24. In what ways do they help your farming operations?
1._____
2._____
3._____
4._____
5._____

25. Would you like incentives that encourage you to use wildlife-friendly farming techniques?
1. Yes_____ 2. No_____

26. What kinds of incentives do you think would help you accomplish this?
1._____

2._____
3._____
4._____
5._____

27. What institutions do you interact with in your farming activities - federal, state, local or private?
1._____
2._____
3._____
4._____
5._____
6._____

28. Do you think they are doing enough to address your farming needs?
1. Yes_____ 2. No_____

29a. If not, what needs are not addressed that you feel are important to you?
1._____
2._____
3._____
4._____
5._____
6._____

29b. Are there issues you think institutions over-address or over-emphasise in this area?
1._____
2._____
3._____
4._____
5._____
6._____

30. Do you think the number of those institutions is enough or you would want to see more institutional help? 1. Enough_____ 2. Need More_____ 3. Reduce them_____

31. What more institutions (kinds) would you like to see more of?
1. Federal_____
2. State_____
3. Local_____
4. Private_____

32a. Have you benefited from any past research activities on your farm or neighbourhood?
1. Yes_____ 2. No_____

32b. In what ways?
1._____
2._____
3._____
4._____
5._____

32c. Do you support research activities on private farms by outsiders?
1. Yes_____ 2. No_____

33. If yes, what kind of research questions/activities do you think outsiders should focus on?
1._____
2._____
3._____

4._____
5._____
6._____

34. Do plan to continue with your farming operations here for a long time?
1. Yes_____ 2. No_____

35. If yes, how much longer? Less than 5 years_____ More than 5 years_____ Forever_____

36. If not, why will you stop farming operations here?_____
_____

37. What kinds of crops will you focus on in the future? Same_____ Different_____

38. If different, which crops?
1._____
2._____
3._____
4._____
5._____
6._____

39. Why change crops types?_____

40. If someone offered to lease or buy all or a portion of your land today, would you agree?
1. Yes_____ 2. No_____

41. If yes, why would you agree?_____

42. Are there any social, cultural, economic, political or psychological factors that affect your farming operations here? (e.g. family tradition, neighbourhood psychology, regulations, etc.)
1. Yes_____ 2. No_____

43. If so, what factors are those?
1._____ 7._____
2._____ 8._____
3._____ 9._____
4._____ 10. _____
5._____ 11. _____
6._____ 12. _____

44. In general, what best do you like about your farming operations here?
_____
Why?_____
_____
_____

45. On the contrary, what don't you like about your farming operations here?
_____
Why?_____
_____
_____

46. Generally speaking, what are your future expectations or prospects as a farmer in this area?
_____
_____
_____

_____
_____
_____
_____

47. Are there any other issues you think we should know that we have not addressed above?
(Please use this space to tell us about them)

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____

We sincerely wish to thank you profusely for all the time you have taken to provide us with a picture of how you operate here. This information will be very helpful to agencies that are involved in agriculture and soil, water and wildlife conservation. It will allow the design of policies and incentives that will strengthen partnerships between landholders and agencies that operate in this area for sustained benefits of us all.

Thank you.

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