Project Leader/Agency/Contact Information: Dr. Joseph P. Fleskes / USGS-Western Ecological Research Center / Dixon Field Station, 6924 Tremont Road, Dixon CA 95620; 707-678-0682 ext. 628; 707-678-5039 fax; joe_fleskes@usgs.gov

Title: Understanding impacts of climate change on ecology and habitats of waterfowl, shorebirds, and other waterbirds: Guidance for the California LCC and other wetland habitat conservation programs in the Pacific Flyway

Project Goals: This project will develop landscape change scenarios based upon water availability and precipitation and temperature patterns projected from downscaled models and investigate impacts of these changes on habitats and ecology of waterfowl, shorebirds, and other waterbirds in the Central Valley. Specific project goals are to:

- Develop scenarios of Central Valley landscape change based upon changes in water availability, local precipitation, temperature patterns, potential evapotranspiration, and climatic water deficits predicted from downscaled global climate models for the next century.
- Use bioenergetics modeling and ecological relationships of waterfowl, shorebirds, and other waterbirds and their habitats to investigate scenario impacts on key bird metrics (i.e., abundance, distribution, body condition, and survival) under different management scenarios in the Central Valley.
- Identify timing and locations of critical waterfowl, shorebird, and other waterbird resources that are most at risk due to climate change in the Central Valley.
- Develop adaptive management strategies to account for climate change in waterbird habitat conservation planning in the Central Valley.

Partners:

U.S. Geological Survey, Western Ecological Research Center
-Project lead, coordination and operations, GIS operations, website
U.S. Geological Survey, California Water Science Center
- Global climate model downscaling and hydrologic modeling
Ducks Unlimited Inc., Pacific Northwest Field Office
- Bioenergetics modeling
Central Valley Joint Venture
-Help develop management scenarios
PRBO Conservation Science
-Shorebird/other waterbird ecology

How project will advance LCC goals: This project will:

- Assess vulnerability of waterfowl, shorebird, and other waterbirds and their habitats
- Predict changes in waterfowl, shorebird, and other waterbird populations and their habitats
- Conduct bioenergetics modeling to guide conservation planning for waterfowl , shorebird, and other waterbirds and their habitats
- Evaluate effectiveness of management options under changing climate for waterfowl, shorebirds, and other waterbirds and their habitats

Methods: We will utilize available data on regional water supply scenarios, supplemented as needed with downscaled climate model predictions of temperature and precipitation patterns,

potential evapotranspiration and climatic water deficits, to develop realistic scenarios of possible changes in habitat quantity, quality (including food availability), distribution, and timing for major hydrological basins in the Central Valley. The downscaling of global climate projections will employ a rigorous approach to reducing uncertainty in the process and will be applied to fine-scale (270-m spatial scale) hydrologic models. Modeling will produce fine-scale climatic impacts as well as hydrologic stressors. These parameters can be used to describe potential changes in environmental conditions that can be correlated to waterbird habitats. We will then model possible changes in waterfowl, shorebird, and other waterbird ecology (migration chronology, distribution, movements, and bioenergetics) related to these habitat and climatic changes. Utilizing bioenergetics models such as TRUEMET, which the Central Valley Joint Venture (JV) relies upon to determine waterbird habitat requirements, and ecological relationships of waterbirds and their habitats, we will investigate impacts on key waterbird metrics (i.e., abundance, distribution, body condition, and survival) under different management scenarios and climatic conditions. We will work as members of JV scientific technical committees, within LCC science advisory groups, and in other ways to apply project results within the conservation community and meet the project's ultimate goal of developing adaptive management strategies that account for impacts of global climate change on conservation programs for waterfowl and other waterbirds and their habitats in the Central Valley.

Products: The project will improve planning and delivery of these programs by providing critical information and support to understand and incorporate likely impacts of climatic change in conservation planning. A successful outcome of the project will be the implementation of adaptive methods in the JV and LCC to account for effects of climate change on ecology and habitats of waterfowl shorebirds, and other waterbirds. Products from this project will include: 1) realistic set of scenarios of changes in habitat quantity, quality, distribution, and timing and bird ecology (e.g., migration chronology, movements) based on regional water supply projections, supplemented with downscaled projections of local temperature and precipitation; 2) a report of different management option impacts on habitats and key bird metrics (i.e., abundance, distribution, condition, survival) based upon bioenergetics models such as TRUEMET; 3) a website describing project goals, partners, results, and management implications; and 4) consultations with JVs and LCCs to apply project results and meet the project's ultimate goal of developing adaptive strategies that account for impacts of climate change in waterfowl, shorebird, and other waterbird habitat conservation planning. Although this work will focus waterfowl, shorebirds, and other waterbirds during the non-breeding period, because of the analysis of wetland and agricultural habitats, it will also inform, and could be expanded to specifically address other periods and wetland-dependent species, such as endangered giant garter snakes. Further, this work will provide a basis for similar evaluations in other regions. Thus, this project will help deliver and coordinate conservation planning to policy-makers, identify information still needed, and promote similar efforts in other regions.

Is the Project on-going? If so describe: This is new proposed work that will utilize a large dataset produced from numerous multi-partner studies on ecology of waterfowl, shorebirds, and other waterbirds and their habitats in the Central Valley.

Timetable for Completion (identified by each deliverable):

1 Oct 2010 – A set of realistic scenarios of changes in habitat quantity, quality (including food availability), distribution, and timing for at least one of the major hydrological basins in the Central Valley based upon available data on regional water supply scenarios, supplemented as

needed with downscaled climate model predictions of temperature and precipitation patterns, potential evapotranspiration and climatic water deficits.

An interactive project website for resource managers and others describing the project goals, partners, preliminary results, and other related information.

1 Oct 2011 – A set of realistic scenarios of changes in habitat quantity, quality (including food availability), distribution, and timing for all major hydrological basins in the Central Valley based upon available data on regional water supply scenarios, supplemented as needed with downscaled climate model predictions of temperature and precipitation patterns, potential evapotranspiration and climate water deficits.

Report summarizing changes in key waterfowl ecology metrics (i.e., abundance, distribution, body condition, and survival) for at least one of the major hydrological basins in the Central Valley based upon results of bioenergetics modeling (i.e., TRUEMET) and ecological relationships of waterfowl and their habitats under different climatic change and management scenarios.

Report summarizing changes in key shorebird ecology metrics (i.e., abundance, distribution, body condition, and survival) for at least one of the major hydrological basins in the Central Valley based upon results of bioenergetics modeling (i.e., TRUEMET) and ecological relationships of shorebirds and their habitats under different climatic change and management scenarios.

1 Oct 2012 – Report summarizing changes in key waterfowl ecology metrics (i.e., abundance, distribution, body condition, and survival) for all major hydrological basins in the Central Valley based upon results of bioenergetics modeling (i.e., TRUEMET) and ecological relationships of waterfowl and their habitats under different climatic change and management scenarios.

Report summarizing changes in key shorebird ecology metrics (i.e., abundance, distribution, body condition, and survival) for all major hydrological basins in the Central Valley based upon results of bioenergetics modeling (i.e., TRUEMET) and ecological relationships of shorebirds and their habitats under different climatic change and management scenarios.

Report summarizing changes in other waterbird key ecology metrics (i.e., abundance, distribution, body condition, and survival) for at least one major hydrological basin in the Central Valley based upon results of bioenergetics modeling (i.e., TRUEMET) and ecological relationships of waterbirds and their habitats under different climatic change and management scenarios.

Report summarizing the timing and locations of critical resources for waterfowl and shorebirds that are most at risk due to climate change in the Central Valley.

Report summarizing and consultations on possible adaptive strategies and critical information gaps to account for climate change in habitat conservation planning for shorebirds and waterfowl in the Central Valley.

1 Oct 2013 – Report summarizing changes in other waterbird key ecology metrics (i.e., abundance, distribution, body condition, and survival) for all major hydrological basins in the Central Valley based upon results of bioenergetics modeling (i.e., TRUEMET) and ecological relationships of waterbirds and their habitats under different climatic change and management scenarios.

Report summarizing the timing and locations of critical resources for all waterbirds that are most at risk due to climate change in the Central Valley.

Report summarizing and consultations on possible adaptive strategies and critical information gaps to account for climate change in habitat conservation planning for all waterbirds in the Central Valley.

Performance Metrics with Timeline for each: See above for products and timeline.

Conservation Outcomes:

Realistic scenarios of changes in Central Valley waterbird habitat
Summary of changes in key waterfowl ecology metrics
Summary of changes in key shorebird ecology metrics
Summary of changes key ecology metrics of other waterbirds
Summary of critical waterbird resources most at risk
Summary of the adaptive strategies for waterbird habitat conservation planning

Budget- (by outcomes):

FY2010

Outcome: Realistic scenarios of changes in Central Valley waterbird habitat

	Request from	Value of in-kind Services		
Budget Item	**LCC**	PRBO	CVJV	USGS
Permanent Salaries w/benefits				
Project Leader (USGS-WERC)	-	-	-	12,000
GIS/IT Specialist (USGS-WERC)	**10,000**	-	-	-
Hydrologic Modeler (USGS-CWSC)	**10,000**	-	-	18,000
Shorebird Ecologist (PRBO)	**10,000**	30,000	-	-
CVJV Science Coordinator (FWS)	-	-	15,000	-
Non-Permanent Salaries w/benefits				
Ecological Modeler (USGS-WERC)	**32,800**	-	-	-
Equipment (Computing, network)	**7,000**	10,000	-	15,000
Supplies (Software, miscellaneous)	**2,500**	-	-	5,000
Travel (Partner meetings, conferences)	**1,500**	-	-	-
Services				
Statistical support (USGS-WERC)	-	-	-	5,500
Printing and publication costs	**200**	-	-	-
Bioenergetics modeling	**10,000**	-	-	-
Total Direct Costs	**84,000**	40,000	15,000	55,500
Indirect Costs	**15,450**	-	-	-
FY10 Total	***99,450***	*40,000*	*15,000*	*55,500*

FY2011 and FY2012

Outcome: [a] *Realistic scenarios of changes in Central Valley waterbird habitat*
[b] *Summary of changes in key waterfowl ecology metrics*
[c] *Summary of changes in key shorebird ecology metrics*
[d] *Summary of critical waterfowl and shorebird resources most at risk*
[e] *Summary of the adaptive strategies for waterfowl/shorebird habitat conservation*

	Request from	Value of in-kind Services		
Budget Item	**LCC**	PRBO	CVJV	USGS
Permanent Salaries w/benefits				
Project Leader (USGS-WERC)	-	-	-	30,000[abcde]

GIS/IT Specialist (USGS-WERC)	**4,000**[abcde]	-	-	-
Hydrological Modeler(USGS-CWSC)	**10,000**[a]	-	-	12,000[a]
Shorebird Ecologist (PRBO)	**10,000** [cde]	20,000	-	-
CVJV Science Coordinator (FWS)	-	-	17,000[ae]	-
Non-Permanent Salaries w/benefits				
Ecological Modeler (USGS-WERC)	**82,500** [abcde]	-	-	-
Equipment (Computing, network)	-	10,000[c]	-	15,000[abcde]
Supplies (Software, miscellaneous)	**1,000** [abcde]	-	-	5,000[abcde]
Travel (Partner meetings, conferences)	**2,500** [abcde]	-	-	-
Services				
Statistical support (USGS-WERC)	-	-	-	7,000[abcde]
Printing and publication costs	**1,500** [abcde]	-	-	-
Bioenergetics modeling	**15,000** [abcde]	-	-	-
Total Direct Costs	**126,500**	10,000	17,000	69,000
Indirect Costs	**23,300**	-	-	-
FY11 and FY12 Totals	***149,800***	*30,000*	*17,000*	*69,000*

FY2013

Outcome: [a]*Realistic scenarios of changes in Central Valley other waterbird habitat*
[f]*Summary of critical other waterbird resources most at risk*
[g]*Summary of the adaptive strategies for other waterbird habitat conservation*

Budget Item	**Request from LCC**	Value of in-kind Services PRBO	CVJV	USGS
Permanent Salaries w/benefits				
Project Leader (USGS-WERC)	-	-	-	36,000[a]
GIS/IT Specialist (USGS-WERC)	**5,000** [afg]	-	-	-
Hydrological Modeler(USGS-CWSC)	**5,000**[a]	-	-	12,000[a]
"Other" Waterbird Ecologist (PRBO)	**10,000**[afg]	20,000	-	-
CVJV Science Coordinator (FWS)	-	-	18,000[g]	-
Non-Permanent Salaries w/benefits				
Ecological Modeler (USGS-WERC)	**85,500** [afg]	-	-	-
Equipment (Computing, network)	-	10,000[fg]	-	15,000[afg]
Supplies (Software, miscellaneous)	**1,000** [afg]	-	-	5,000[afg]
Travel (Partner meetings, conferences)	**3,000** [afg]	-	-	-
Services				
Statistical support (USGS-WERC)	-	-	-	8,000[afg]
Printing and publication costs	**2,000** [afg]	-	-	-
Bioenergetics modeling	**15,000** [afg]	-	-	-
Total Direct Costs	**126,500**	30,000	18,000	76,000
Indirect Costs	**23,300**	-	-	-
FY 13 Total	***149,800***	*30,000*	*18,000*	*76,000*

Matching Funds: In addition to the value of in-kind support listed above (110% match in FY10, >75% match in FY11-13) the amount requested from LCC during FY11-13 may be reduced if pending funding is provided by the National Climate Change and Wildlife Science Center, NASA, PRBO Conservation Science partners, or other sources.

Letters of Support: See attached from the Central Valley Joint Venture, California Waterfowl Association, and U.S. Fish and Wildlife Service.

CENTRAL VALLEY JOINT VENTURE

Conserving Migratory Bird Habitat

May 19, 2010

To: California Landscape Conservation Cooperative
From: Bob Shaffer, Joint Venture Coordinator
Subject: Support for LCC Science Proposal: "*Understanding impacts of climate change on ecology and habitats of waterfowl, shorebirds, and other waterbirds: Guidance for the California LCC and other wetland habitat conservation programs in the Pacific Flyway"*

Dear Madam or Sir:

I am writing to express the strong endorsement of the Central Valley Joint Venture (CVJV) for the research proposal ***"Understanding impacts of climate change on ecology and habitats of waterfowl, shorebirds, and other waterbirds: Guidance for the California LCC and other wetland habitat conservation programs in the Pacific Flyway"*** that has been submitted by **Dr. Joseph Fleskes** for consideration of funding through the California Landscape Conservation Cooperative. The proposed project would provide information that is critical to achieving the CVJV's conservation objectives, and I urge your organization to consider full funding for it.

The CVJV is a self-directed coalition which includes nine conservation organizations, 11 state and federal agencies and one corporation. This partnership directs its efforts toward the common goal of providing for the habitat needs of migrating and resident birds in the Central Valley of California.

The CVJV has recently recognized a very critical need to better understand, and incorporate into our conservation planning, potential impacts of climate change on water supplies, habitats, and avian ecology. We feel strongly that the study proposed by Dr. Fleskes would help our JV meet this information need and help ensure the continued success that our program has enjoyed during its more than two decades in existence.

Our JV has worked with Dr. Fleskes and his colleagues in the past and we have full confidence that if funded the proposed work will be accomplished. I fully endorse the proposal.

Sincerely,

Robert D. Shaffer

Robert D. Shaffer, Coordinator

19 May 2010

California Landscape Conservation Cooperative

Dear Madam or Sir:

I am writing to express the strong endorsement of *California Waterfowl Association* for the research proposal "***Understanding impacts of climate change on ecology and habitats of waterfowl, shorebirds, and other waterbirds: Guidance for the California LCC and other wetland habitat conservation programs in the Pacific Flyway***" that has been submitted by **Dr. Joseph Fleskes** for consideration of funding through the California Landscape Conservation Cooperative. The proposed project would provide information critical to the successful management of waterfowl populations and their habitats in California and I urge your organization to consider full funding.

California Waterfowl Association is a statewide nonprofit organization, whose principal objectives are the preservation, protection, and enhancement of California's waterfowl resources, wetlands, and associated hunting heritage. We were established in 1945 and are now the largest single-state organization in the nation focused on conservation of waterfowl and their habitats. Our programs incorporate various aspects of public policy, waterfowl management, habitat enhancement, and education. *California Waterfowl* works closely with government agencies and private landowners to improve habitats and manage for healthy waterfowl populations in California. Wetland restoration and enhancement projects focus on breeding and migratory waterfowl habitat and work to increase public hunting opportunity.

California Waterfowl Association recognizes the importance of understanding all important factors that may impact water supplies, wetland habitats, and waterfowl ecology. We feel strongly that the study proposed by Dr. Fleskes would provide this critical information and aid us in our conservation efforts.

California Waterfowl Association staff have worked with Dr. Fleskes and his colleagues on a variety of successful projects, many of which have resulted in publications in peer-reviewed journals. I have full confidence that, if funded, the proposed work will be accomplished and we fully endorse the proposal.

Sincerely,

Gregory S. Yarris
Vice President, Policy and Communications

4630 Northgate Blvd., Suite 150, Sacramento, CA 95834
916.648.1406 • www.calwaterfowl.org

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Southwest Region
2800 Cottage Way, Room W-2606
Sacramento, California 95825-1846

In reply refer to:

R8/CCSA

MAY 26 2010

To Whom It May Concern:

I wish to express the support of the U.S. Fish and Wildlife Service (Service) for the proposal being submitted by Dr. Joseph Fleskes, USGS Western Ecological Research Center, entitled ***"Understanding the impacts of climate change on the ecology and habitats of waterfowl, shorebirds, and other migratory birds: Guidance for the California LCC and other wetland habitat conservation programs in the Pacific Flyway"*** for consideration of funding through the California Landscape Conservation Cooperative.

Existing climate models project changes in temperature and precipitation patterns in watersheds that supply water used to manage wetlands and agricultural habitats in the Central Valley. These projected changes are likely to impact habitat availability and quality through altered evapotranspiration rates and timing of rainwater flooding, plant phenology, and development of invertebrate communities. The changes could have significant impacts on the ecology and habitats of migratory waterfowl in the Pacific Flyway by altering where and when critical resources are available.

The current lack of detailed information is impairing the ability of Service conservation programs to consider the effects of climate change in our planning efforts. This information is urgently needed to identify conservation priorities and effectively direct limited conservation resources.

The Service has worked previously with Dr. Fleskes on a number of important conservation issues. We have had nothing but positive experiences and look forward to the opportunity to develop even closer ties.

If you have questions, please contact the undersigned at (916) 978-6160.

Sincerely,

Richard F. Kearney
Assistant Regional Director
Climate Change and Science Applications

TAKE PRIDE IN AMERICA