

Impacts of Climate Change, Urbanization, and Water Management on Habitats and Ecology of Waterfowl & Other Waterbirds

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Pacific Flyway



CENTRAL VALLEY

- One of the most important regions for wintering waterfowl
- Many other wintering waterbird species
- Wetland, post-harvest rice & corn food habitats
- Water supplies supporting habitat are mostly managed
- Competition between habitats and other water uses, especially during drought

Research Program Goal: *Provide information to guide implementation of the Central Valley Joint Venture (CVJV) and other resource management programs*

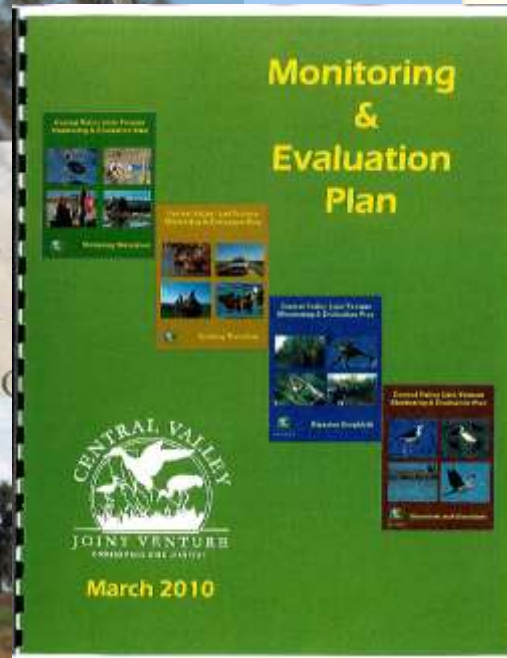
Central Valley Habitat Joint Venture Implementat



A Component

North American Waterfowl

February 199



Scenario Modeling

MODEL 1- Water Evaluation and Planning (WEAP) Model to project future water supplies, demands, and allocation

Post-process model 1 output

MODEL 2- Avian bioenergetics model

Projected Avian Food Supplies =

“Food-coma...zzzzzz.”

“No food, what an ‘awefowl’ party. I’m leaving!”

“Out of fuel...crash-landing...look-out!”

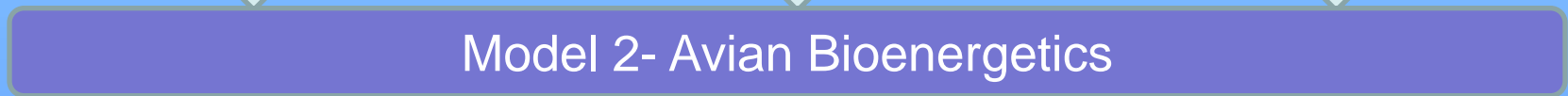
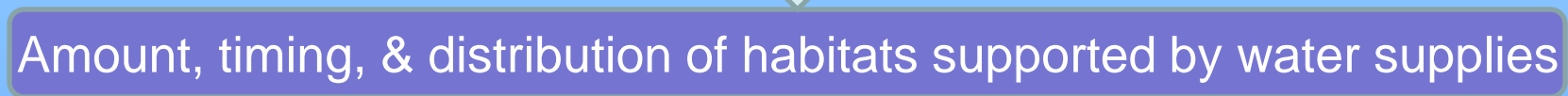
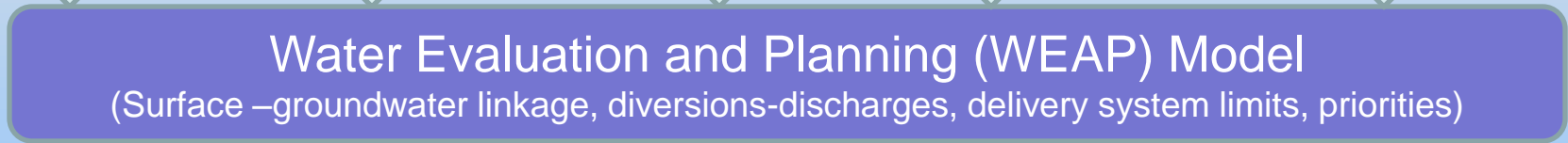


Adequate food

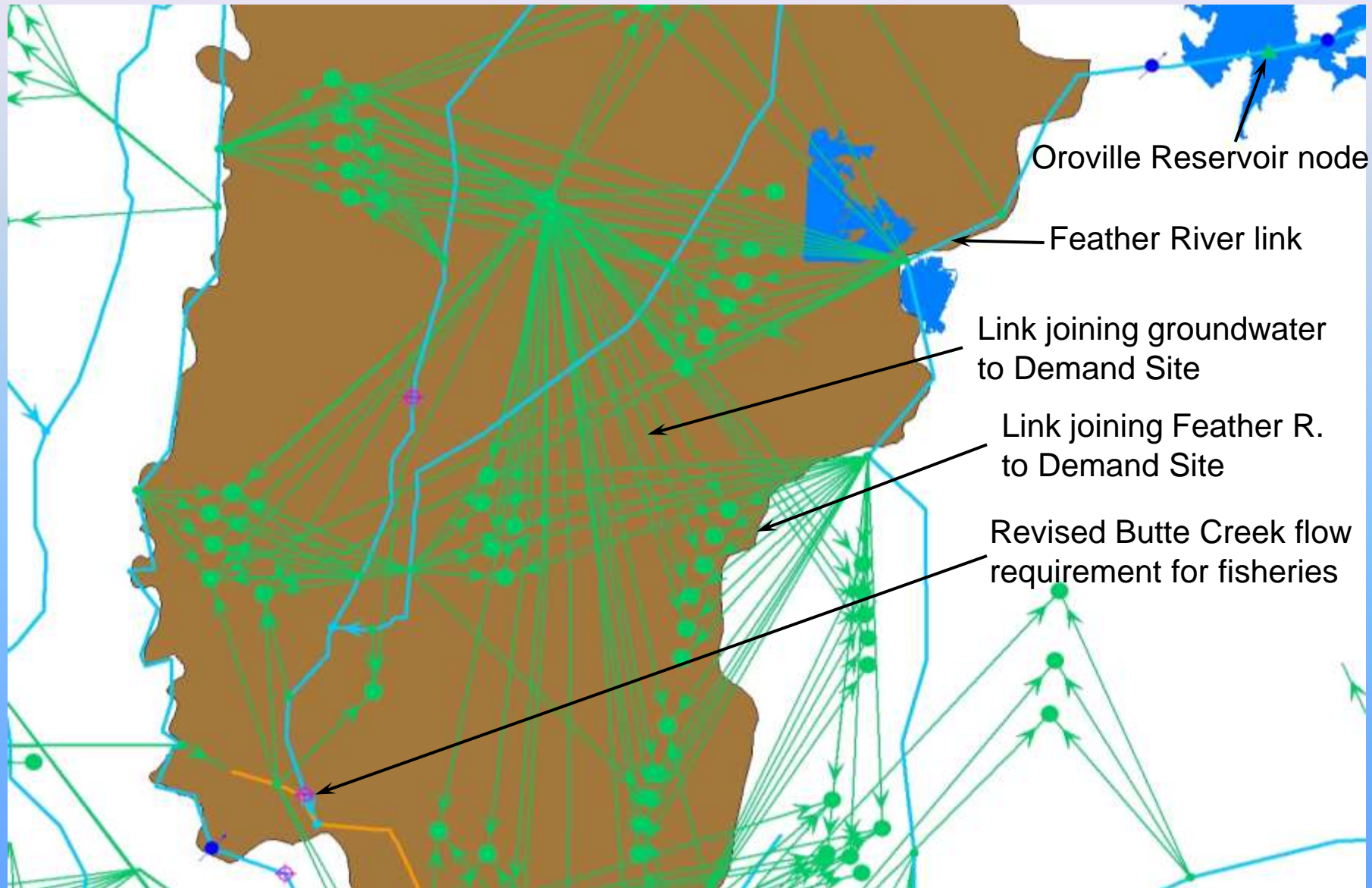


Food deficit

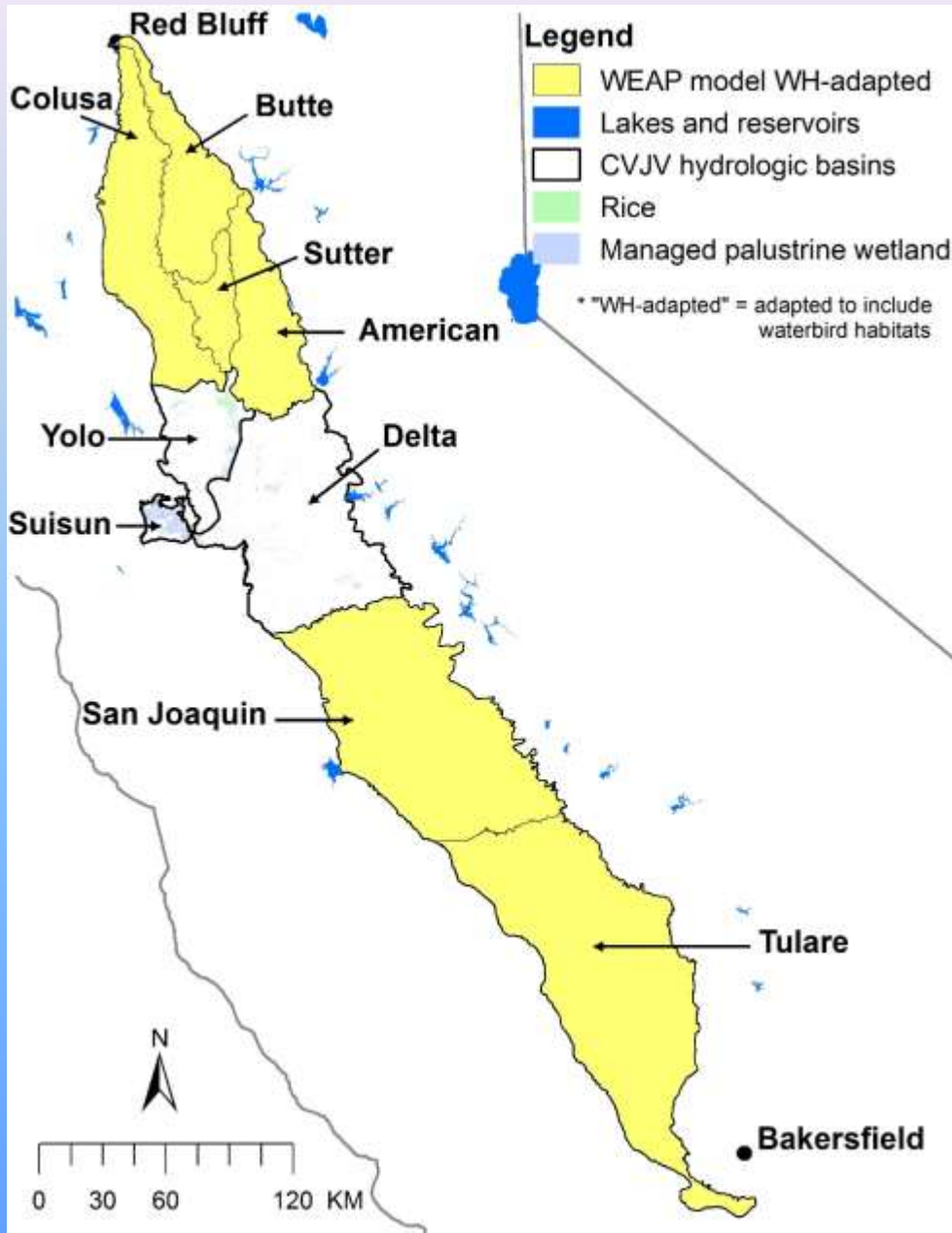
MODEL 1 – Water Evaluation and Planning (WEAP) Model



Adapted WEAP Model Representation of Water Supplies, Demands, and Delivery Connectivity in Butte Basin

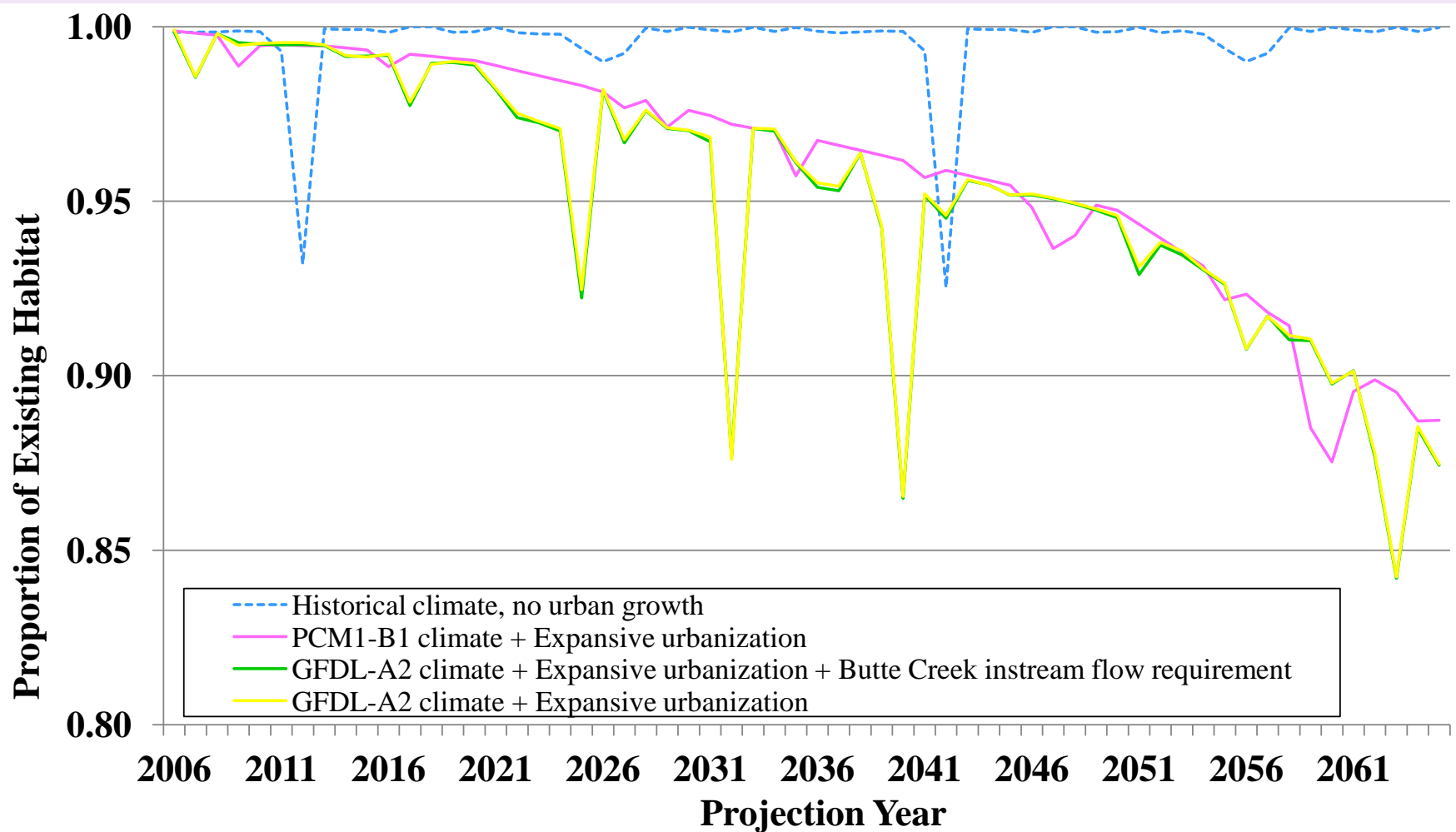


Continuing Progress in WEAP Model Adaptation



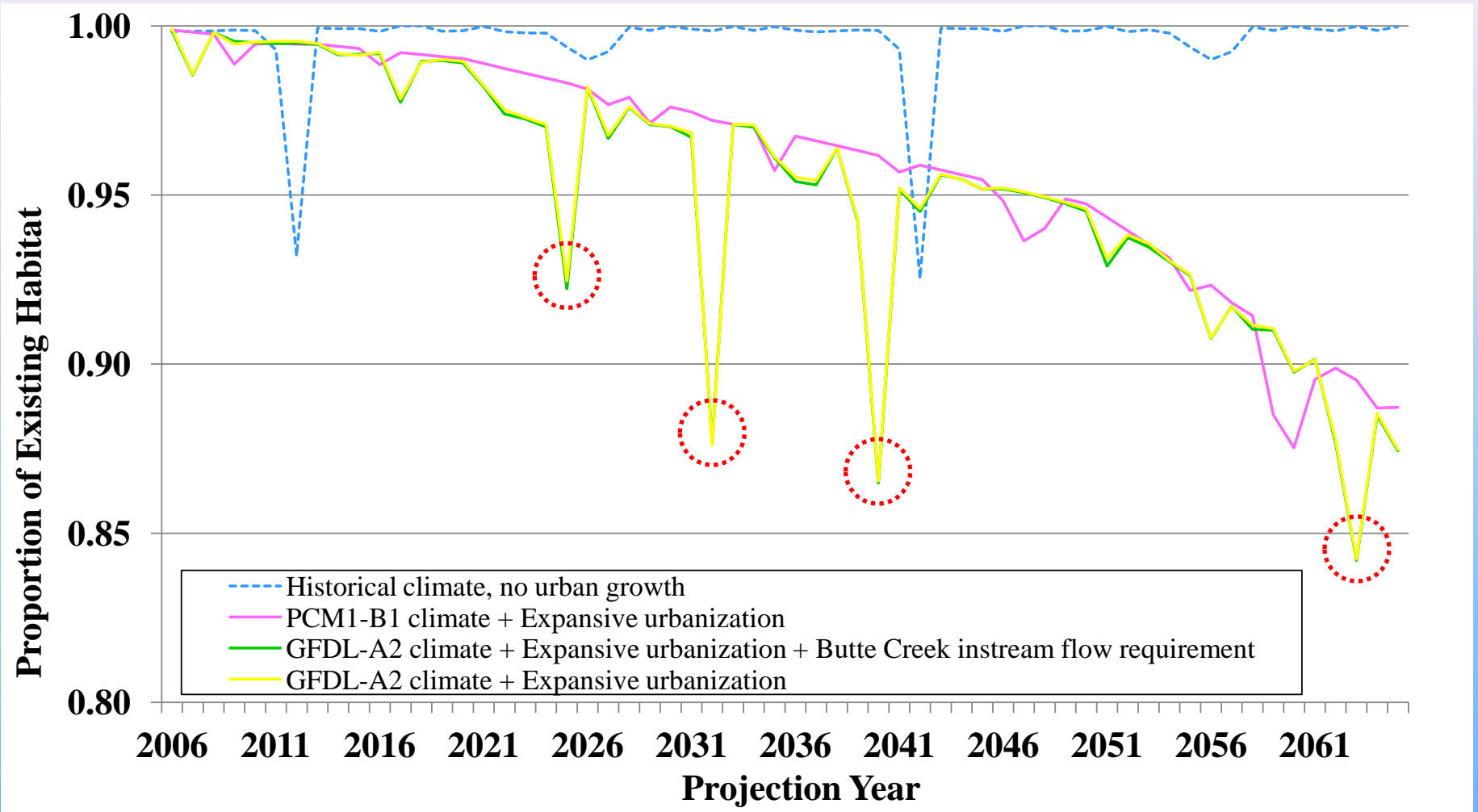
- WEAP adaptation- 6 of 9 CVJV basins nearly done (**yellow**)
- Adaptation completed and scenarios evaluated by Nov. 2015

Expansive Urbanization Resulting in Cumulative Habitat Decline



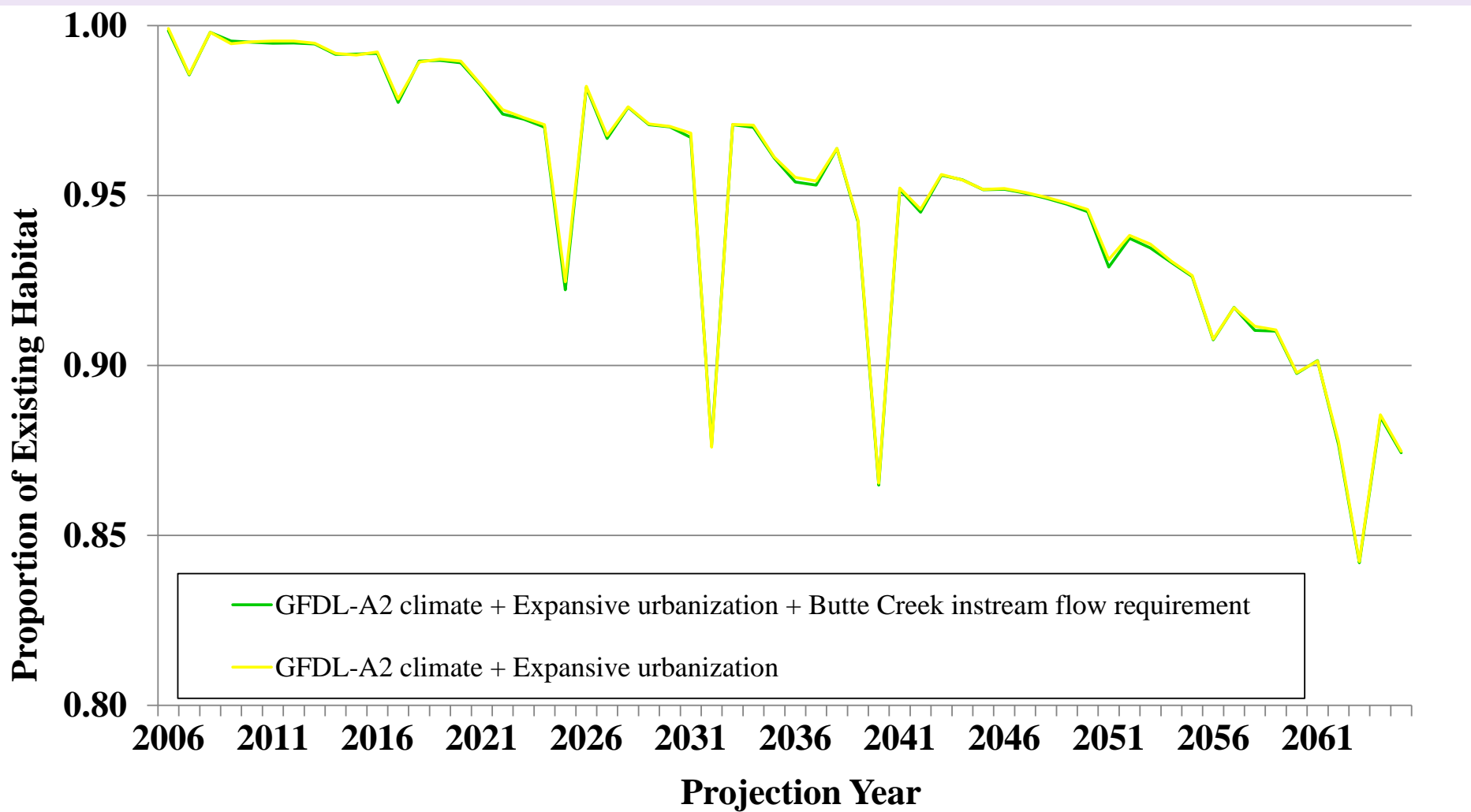
- “Expansive” urban growth resulted in a cumulative decline in total wintering habitat.

Drought Impacts Were More Frequent and Severe in GFDL-A2 Scenarios



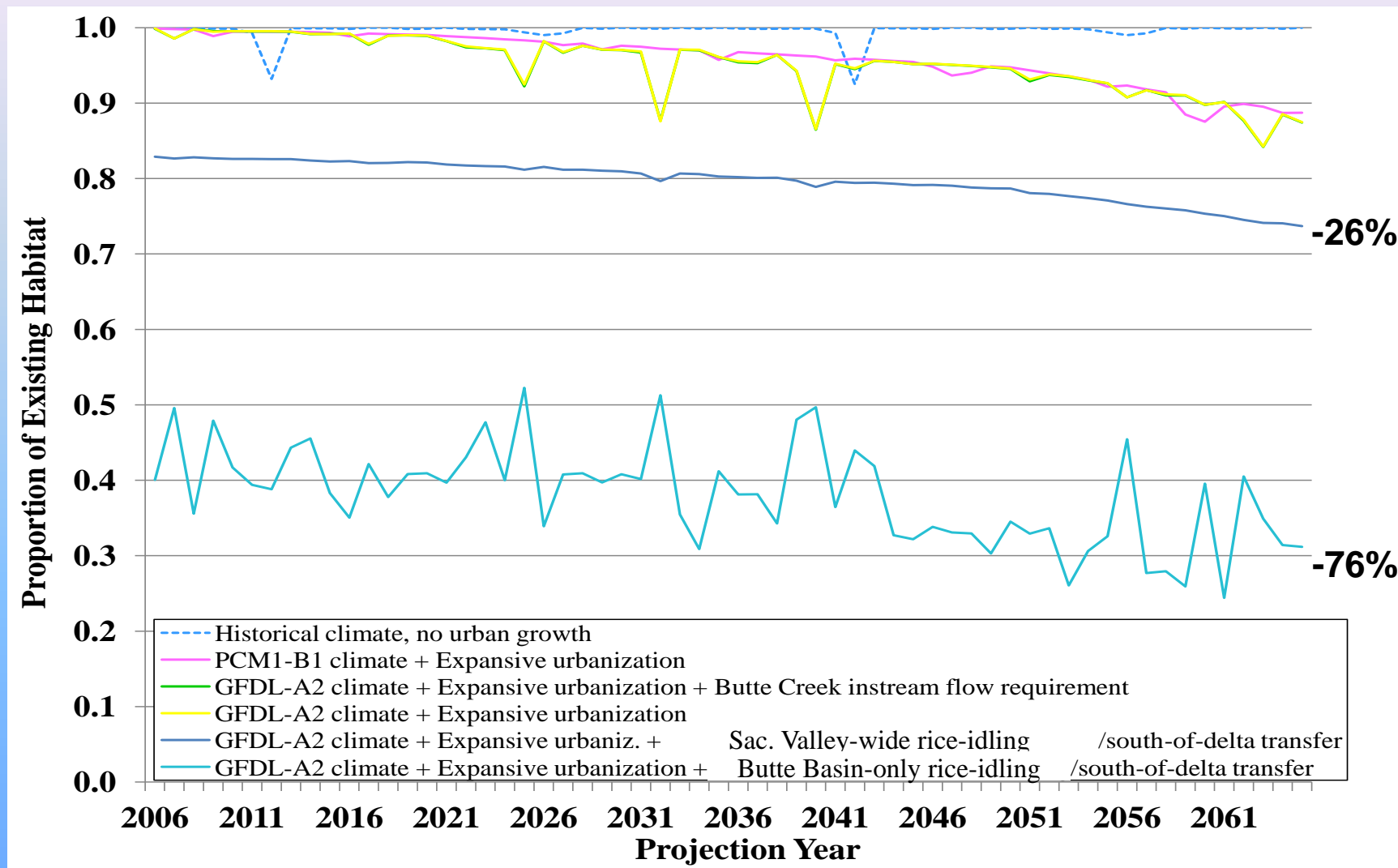
- Drought that substantially reduced habitat was most frequent in GFDL-A2 scenarios.

Revised Butte Creek Flow Requirement Causing Little Impact on Habitat



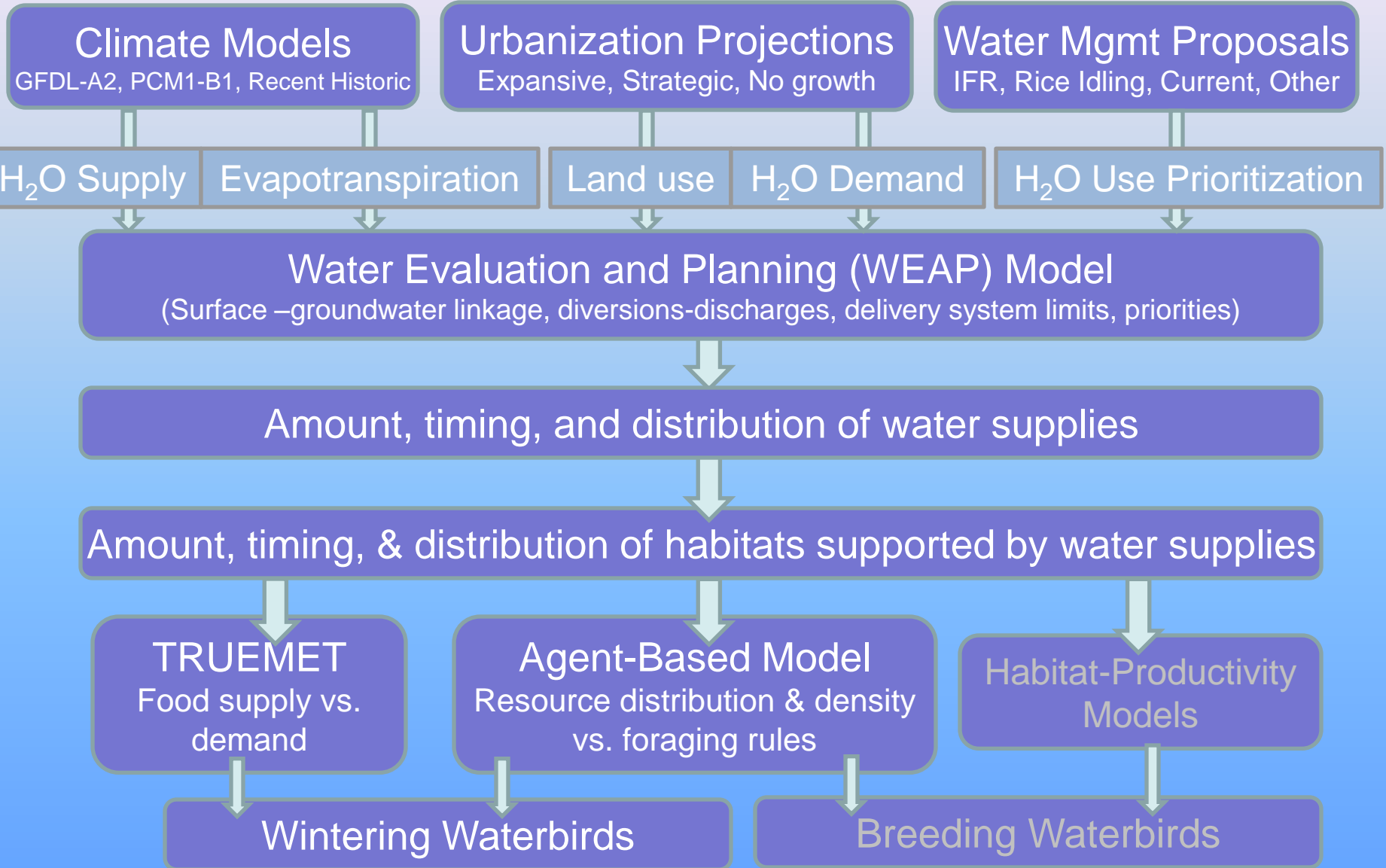
• An Oct-June instream flow requirement (IFR) of 40 cfs on Lower Butte Creek had little impact on habitat.

Idling Rice Land to Transfer Water to West San Joaquin Agriculture Caused Greatest Impacts on Habitat



Note: Rice-idling scenarios did not include “groundwater substitution”, which would reduce the need to fallow available rice habitat.

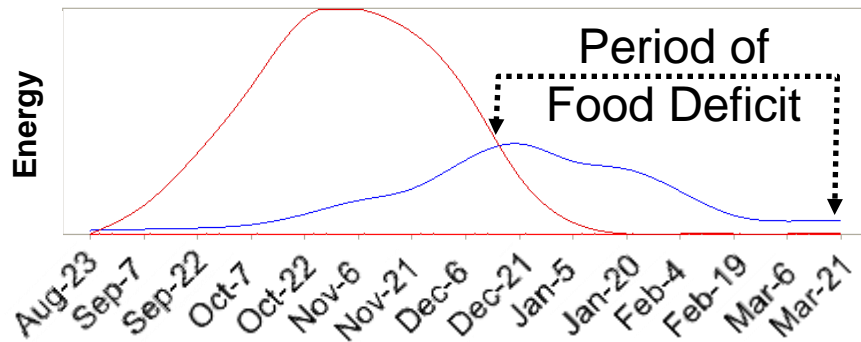
Model 2- Avian Bioenergetics



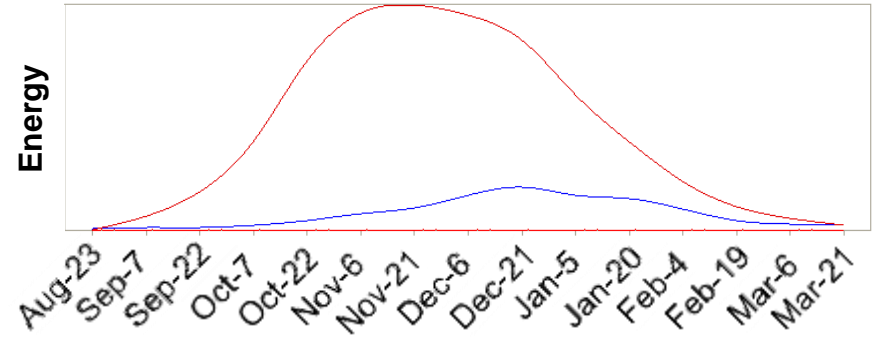
TRUEMET RESULTS for BUTTE BASIN

Some Rice-idling Scenarios Resulted in Food Deficits for Ducks

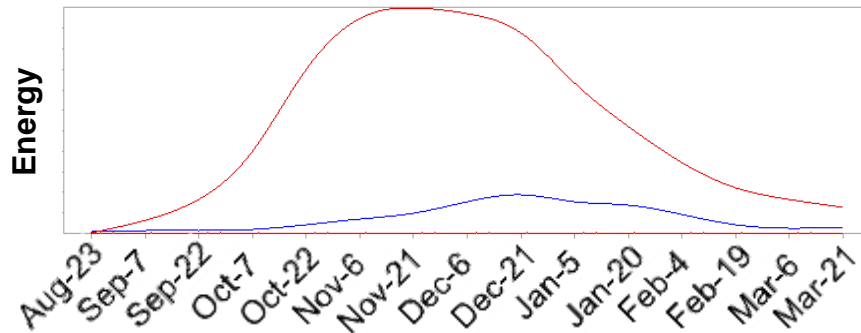
**GFDL-A2 climate + Expansive urban. +
Butte-only rice-idling/transfer**



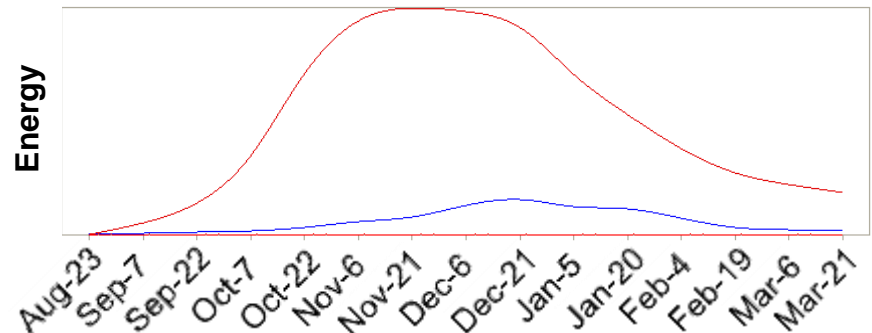
**GFDL-A2 climate + Expansive urban. +
Sac. Valley-wide rice-idling/transfer**



**GFDL-A2 climate + Expansive
urbanization**

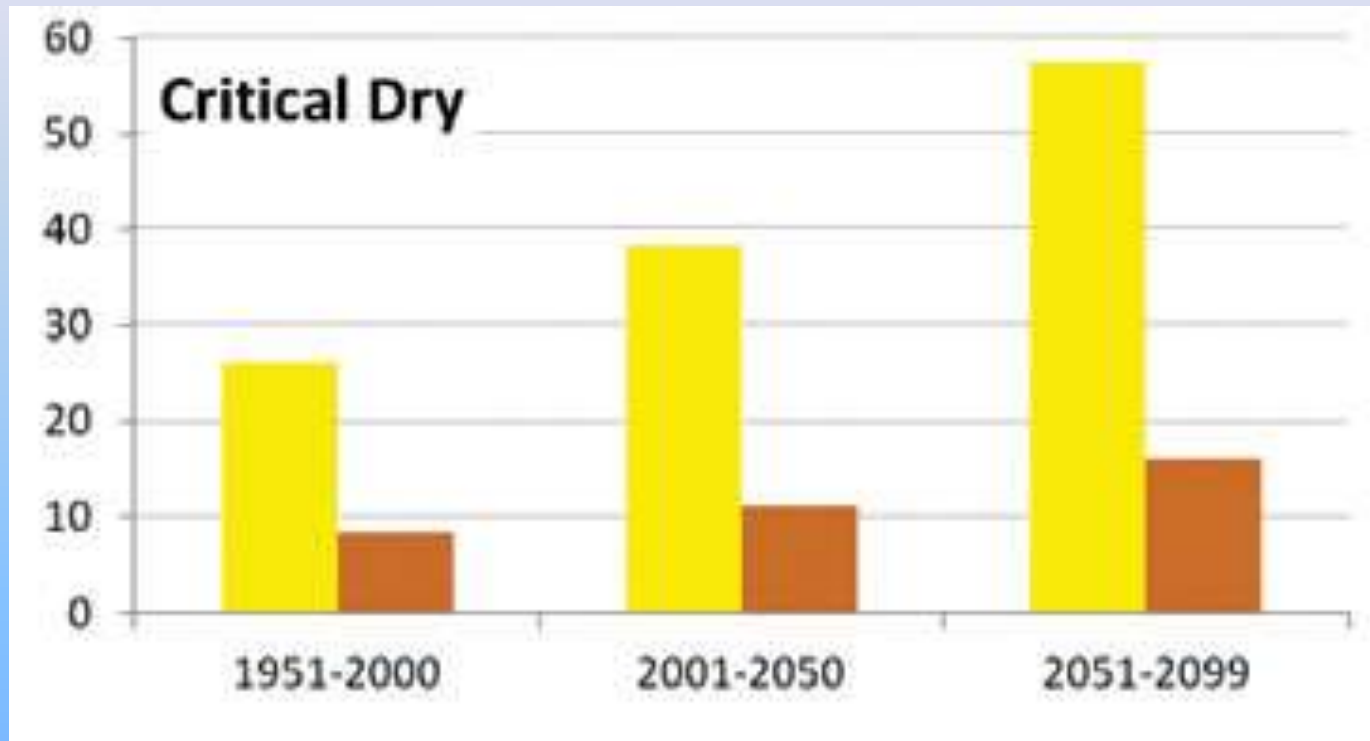


**Historical climate + no urban
growth**



- Adding major water management change = food deficit.
- Agent-based Model may project food deficits to occur earlier and more frequently.

***Projected frequency of critically dry water years in San Joaquin Valley (yellow) and Sacramento Valley (orange)**



WEAP modeling for the San Joaquin Valley and later years will likely show greater impact of climate change on habitats

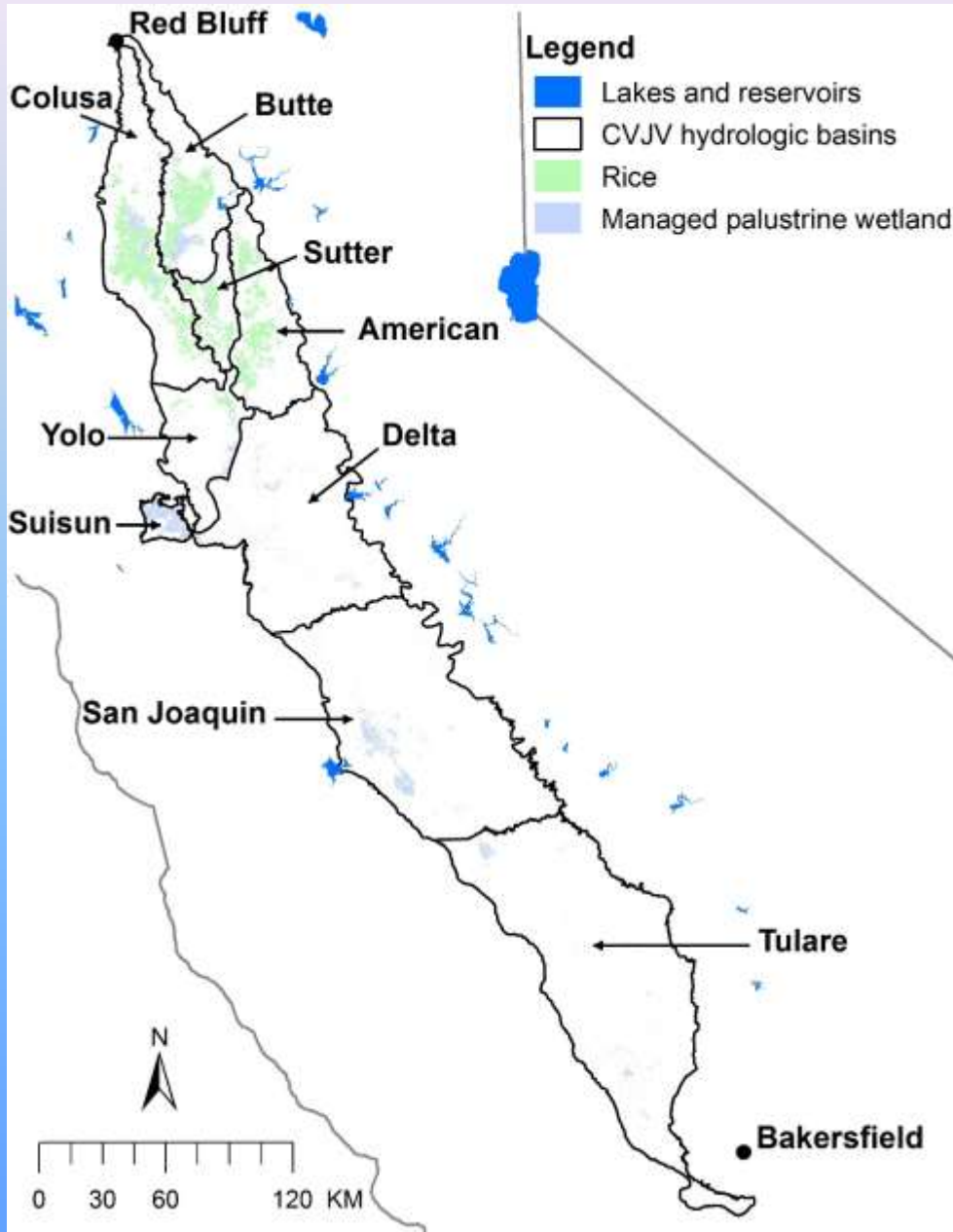
*From *Our Changing Climate 2012* available at: <http://uc-ciee.org/downloads/Our%20Changing%20Climate%202012.pdf>



Acknowledgements:

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Central Valley Joint Venture (CVJV) Hydrologic Basins



- 9 CVJV basins
- Sacramento Valley = rice provides very important foraging habitat
- Wetlands distributed throughout the Central Valley, Bay-delta, and Suisun
- Wetlands more important in some basins than others in providing critical foraging habitat