

### Bird Returns

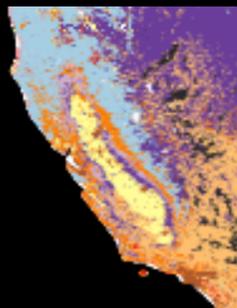
*A novel dynamic conservation framework*

Cornell Lab of Ornithology and The Nature Conservancy of California are working to dynamically provide critical habitat at the times and locations when it is most important for the survival and health of migratory birds.

The goal of this program is to provide critical wetland habitat for waterbirds in the Central Valley of California as they migrate along the Pacific Flyway. A pilot program in February and March 2014 has demonstrated that provision of wetland habitat at these times is benefitting migrating waterbirds.

### Central Valley, California

Historically, the wetlands in the California Central Valley played a critical role for waterbirds migrating along the Pacific Flyway. Today, the intensive agricultural system has left only small remnants of the wetland habitat which previously existed in this area.



- Water
- Evergreen Needleleaf
- Wooden Grassland
- Closed Shrubland
- Open Shrubland
- Grassland
- Cropland
- Urban and Built
- Bare Ground

This lack of suitable habitat has detrimental effects on the millions of migratory waterbirds which pass through the region. Many birds crowd into the small remaining areas of wetland, leading to over-crowding and spread of disease.

Land cover in California from MODIS satellite data

### Dynamic Wetland Habitat



Rice farming is prevalent in the northern part of the central valley and farmers flood the rice fields in winter to decompose the stubble. Waterbirds readily utilize these shallow artificial wetlands, which provide foraging habitat and food. However the rice fields are flooded only in January and habitat is needed by the birds for a longer period of time.

The Nature Conservancy California have developed "Bird Returns": a program to compensate rice farmers for flooding fields earlier in the winter and maintaining water on them later into the spring.

### Reverse Auction

In February 2014 a pilot program provided 10,000 additional acres of wetlands by paying rice farmers to flood their fields during a critical period when wetlands are scarce.

Rice farmers bid to receive funding for flooding fields and the lowest bids were selected, ensuring the maximum provision of habitat for the money available.

This reverse auction is being used to drive the dynamic allocation of habitat, pioneering a new framework for conservation.



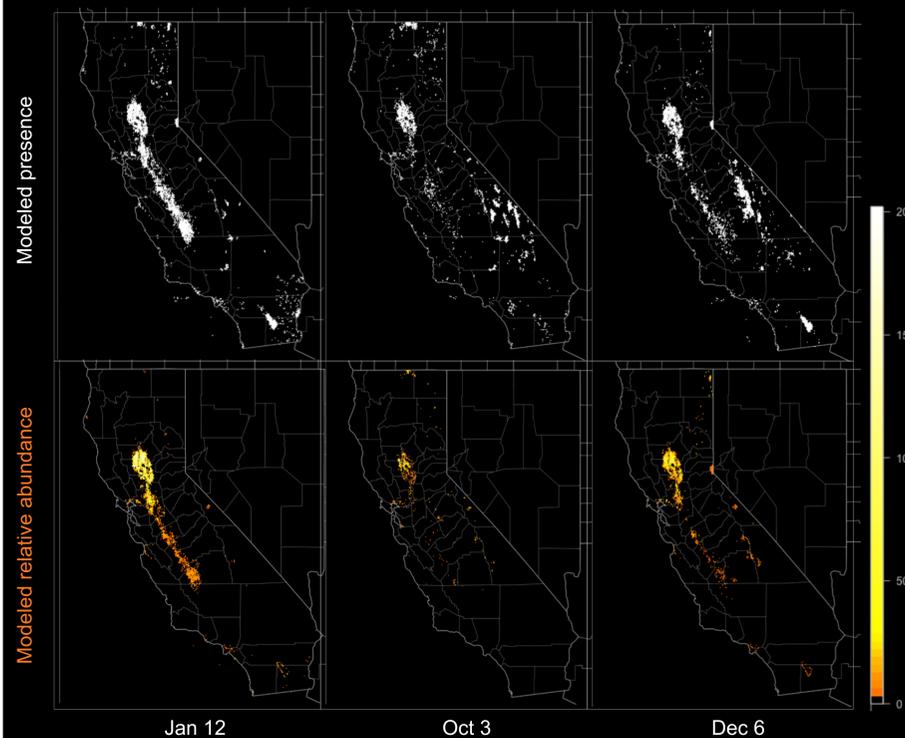
### Abundance modelling

*Optimising locations for conservation*



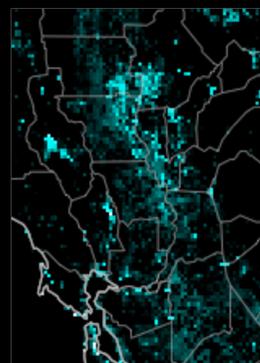
Northern Pintail (*Anas acuta*)

Estimates of Abundance provide much more information for identifying important locations and times of year for bird populations than models of occurrence.

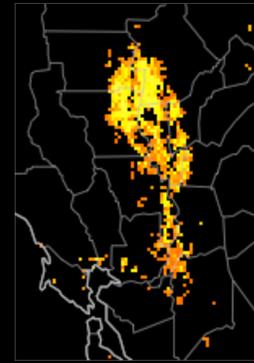


### Environmental Predictors

Surface water NDWI from MODIS



Relative abundance of Northern Pintail



The models identify strong associations between predictor variables and relative abundance.

For example, surface water is an important habitat for Pintail in the Central Valley in early December.

### Large-scale abundance modeling

*Continental migration patterns*



American Robin (*Turdus migratorius*)

Estimated probability of observing 3 or more Robins on a standard eBird checklist.

January 11

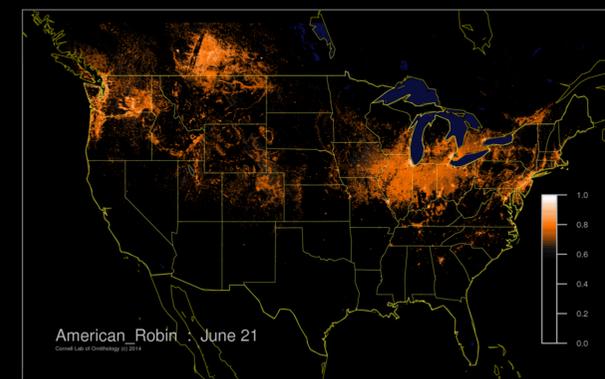
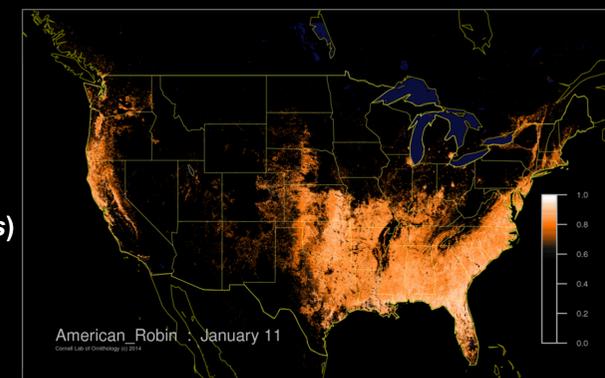
Winter distribution

Robins largely in the south and coastal areas. Higher probability of small groups occurring.

June 21

Breeding distribution

Robins further north in the US and the south of Canada. Lower occurrence of small flocks.



### Preliminary conclusions

Abundance models provide greater information than occurrence models for prioritising locations for conservation

Migratory movements and wintering and breeding aggregations of birds can be identified

Zero-inflated regression tree methods are able to identify important predictors from large suites of environmental variables

Year-round abundance models can be scaled from regional to continental extents.

### Next Steps

1. Rigorous assessment of model performance
2. Summary of important environmental and land-cover variables.
3. Model predictions under different water-rice-management scenarios

### References & Acknowledgements

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