

APPENDIX C

Species Habitat Models

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This appendix describes the species habitat modeling (also referred to as species distribution modeling) methods for the Desert Renewable Energy Conservation Plan (DRECP) and presents the species habitat model results. The description below provides an overview of the species habitat modeling method that was used to develop the habitat models for each of the proposed Covered Species. Detailed technical information on methods, data, and processing is provided at <http://databasin.org/>.

C.1.0 BACKGROUND

Species habitat modeling (i.e., species distribution modeling) is a necessary component of the planning process for DRECP because of the following factors:

- Need for extrapolating species and habitat distribution across areas lacking adequate data due to lack of comprehensive survey results across the Plan Area;
- Need to obtain information that will supplement existing surveys as part of the planning process;
- Need to transcend the limitations of the “snapshot in time” that survey data represents when using existing field data alone;
- Need for synthesis and analysis of multiple data sources across the entire Plan Area;
- Need to identify and rank biological values between areas; and
- Need to establish baseline conditions to compare alternate conservation strategies.

Given these factors, the DRECP Independent Science Advisors (ISA) “recommend careful use of habitat suitability models or species distribution models” (DRECP ISA 2010). Species habitat modeling can provide an objective, transparent, and repeatable means of assessing species habitat distribution where the species distribution or distribution of suitable habitat for a species is not well known. For these reasons, species habitat modeling results provide additional biological information to be used in the following components of the DRECP: conservation strategy, impact analysis, and monitoring and adaptive management. The approaches to assess the potential effects of climate change on species habitat and distribution for the DRECP are being developed and are not addressed in this document. Additionally, the approaches to address reference states for the purposes of monitoring and adaptive management for the DRECP are being developed and are not addressed in this document.

APPENDIX C (Continued)

Generally, two types of models were used for the DRECP: expert-based models and statistically based models. **Expert-based models** identify species-specific habitat distribution based on scientific literature, habitat characteristics, location of documented occurrences, and expert opinion related to the physical and biological habitat parameters associated with species occurrence. As the ISA stated, expert-based models are appropriate where species occurrence data are not sufficient (i.e., too few data points to build a model) to conduct more rigorous modeling, where species occurrence data are strongly biased spatially across a plan area, or during the initial, exploratory analyses of environmental factors associated with species occurrence. **Statistically based models** specify suitable habitat and may even predict the likelihood of species occurrence based on correlations between presence/absence data and physical and biological habitat parameters. The ISA indicated that empirical, statistically based models are preferred over expert-based models (such models better control for subjective or biased input). Both expert-based models and statistically based models were developed for proposed Covered Species for the DRECP depending on species-specific considerations, including the availability of data.

The output from statistically based models is a continuous probability value ranging from 0 to 1 corresponding to range from unsuitable conditions for the species to high likelihood of species presence. The output from expert-based models is a binary result indicating suitable habitat or not. In order to use the statistically based models in conjunction with the expert-based models in developing the DRECP, a threshold value was developed for each statistically based model to convert the continuous result into a binary result.

The use of models in the DRECP conservation planning process focused on identifying areas of suitable conditions for a species (i.e., species habitat) within the Plan Area. The statistically based (i.e., Maxent) species distribution models were used in conjunction with the expert-based models to assist in the identification of potential high-priority conservation areas for the DRECP conservation strategy. Models were also used as one measure of quantification of expected conservation and effects for evaluation of conservation strategy alternatives.

C.2.0 SPECIES HABITAT MODEL DEVELOPMENT

Species habitat models have been developed for the 37 proposed Covered Species under the DRECP. The following summarizes the process for developing the DRECP species habitat models.

Early in the DRECP planning process, existing published species distribution models for proposed Covered Species were gathered and evaluated. Additionally, early versions of expert-based and Maxent models were developed for the DRECP. These early model versions were used to support the initial DRECP planning process and were

APPENDIX C (Continued)

documented in previous versions of the draft Baseline Biology Report (Dudek and ICF 2012) and the Description and Comparative Evaluation of the Draft DRECP Alternatives (DRECP REAT 2012).

In order to continue to refine and improve the species habitat models, the models documented in Dudek and ICF 2012 went through the following review process:

1. Outside Expert Review (Winter–Spring 2012). This involved the individual review of species profiles and species habitat models by outside scientists and species experts. Comments on profiles have been integrated in the profiles in Appendix B of this document. Comments on species habitat models were used to refine the species habitat models.
2. Independent Science Panel Review (Summer 2012). This involved a panel review of the science used in the DRECP. Comments on species habitat models were used to refine the species habitat models.
3. DRECP Species Modeling Forum (January 2013). Researchers and modelers with expertise in species distribution modeling were gathered with REAT agency biologists to review existing species habitat models and provide species-by-species recommendations on data sources and modeling approaches, as well as address issues common to species modeling in general (including technical issues, such as thresholds, raised in DRECP independent science reviews). For taxa with multiple available models, this forum allowed selection of the one most relevant to the DRECP's purposes and discussion of the differences among the various models for a given taxon. Experts from the Conservation Biology Institute (CBI), University of California Berkeley (UCB), University of California Davis (UCD), University of California Santa Barbara (UCSB), and the United States Geological Survey (USGS) collaborated to develop the recommendations. These scientists also provided recommendations and advice on specific technical issues arising during the DRECP species model development work but subsequent to the forum.

This comprehensive input gathering process provided robust input from species experts, agency specialists, and modelers, and was used to scientifically vet, refine, and improve the DRECP species habitat models for all proposed Covered Species. Statistically based Maxent models were used for a majority of the DRECP Covered Species. Where statistically based models were not recommended due to data limitation or species-specific considerations, expert-based models were developed. Species habitat models used for DRECP were developed by several entities, including CBI, Dudek, UCB, UCD, UCSB, and USGS.

APPENDIX C (Continued)

The model results for each species are provided in this appendix. Supporting documentation with detailed information on methods, data, and processing is provided on <http://databasin.org/>.

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APPENDIX C (Continued)

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APPENDIX C (Continued)

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