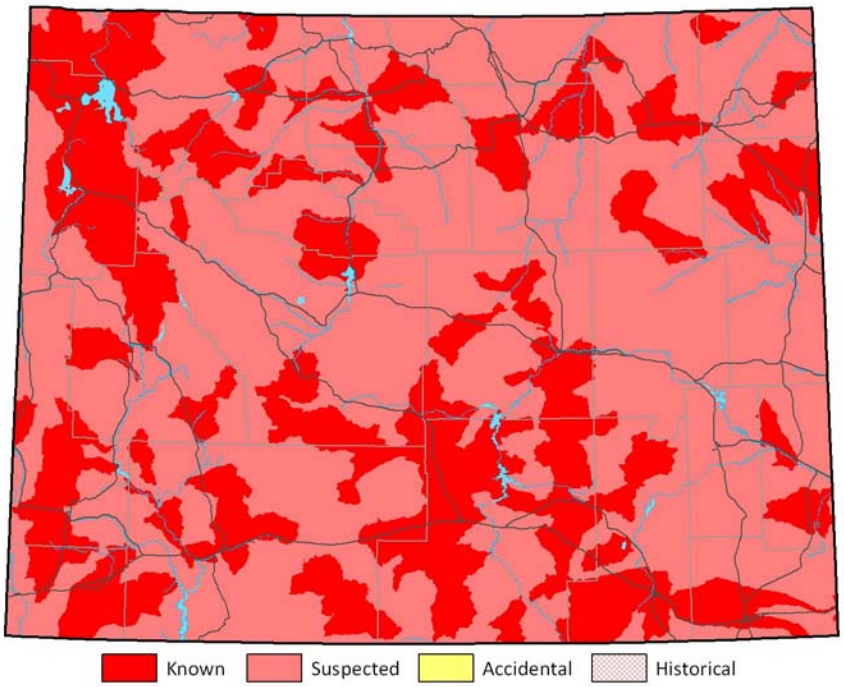
Tiger Salamander (*Ambystoma mavortium*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Tiger Salamander (AAAAA01140) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

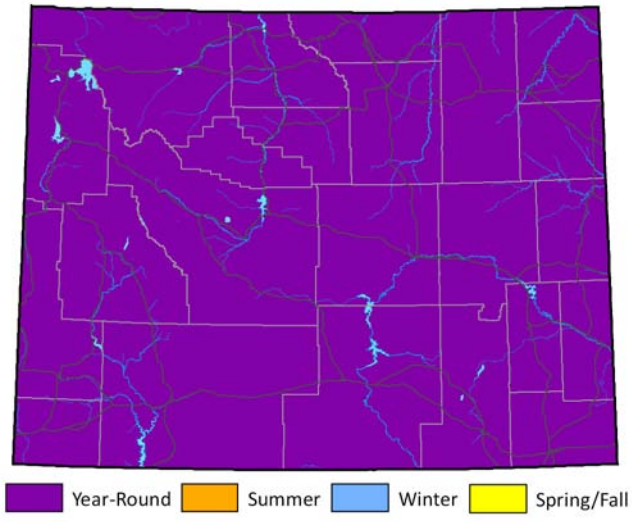
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.277
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



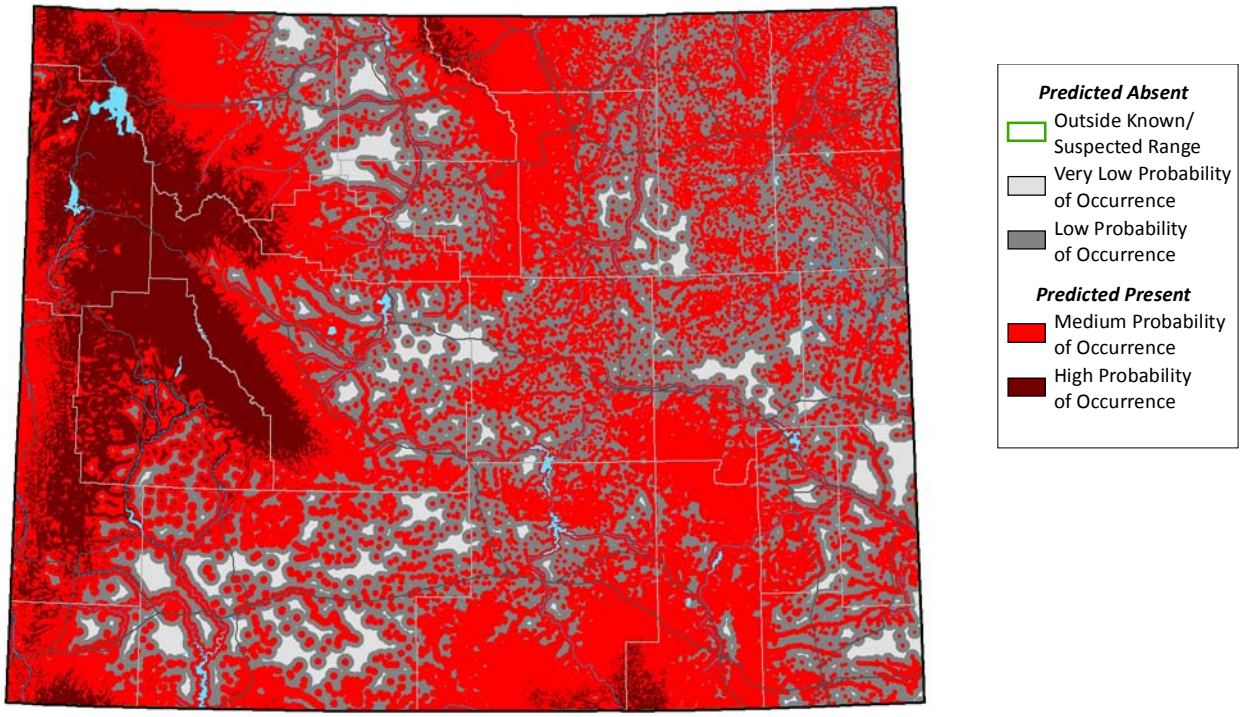
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Tue Apr 13 15:32:41 MDT 2010)

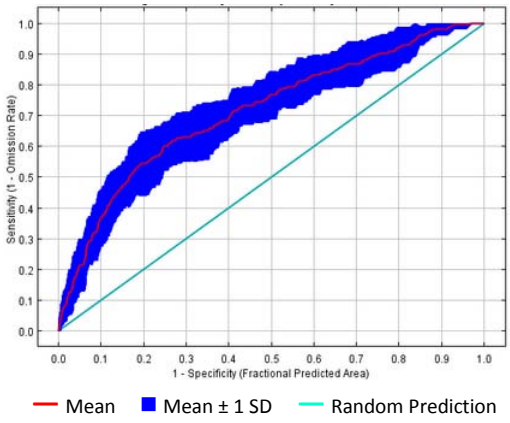
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear
- Binary Threshold Rule: 10 percentile training presence
- Binary Threshold Value: 0.2314270
- High-Probability Threshold Value: 0.5422827
- Low-Probability Threshold Value: 0.0506449

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

Expert Assessment: Low
Occurrence Sample Size: High
Quality of Occurrences: High
Positive Success Rate: Low
Test AUC and Model Gain: Low

Model Evaluation Statistics

Final Model Statistics

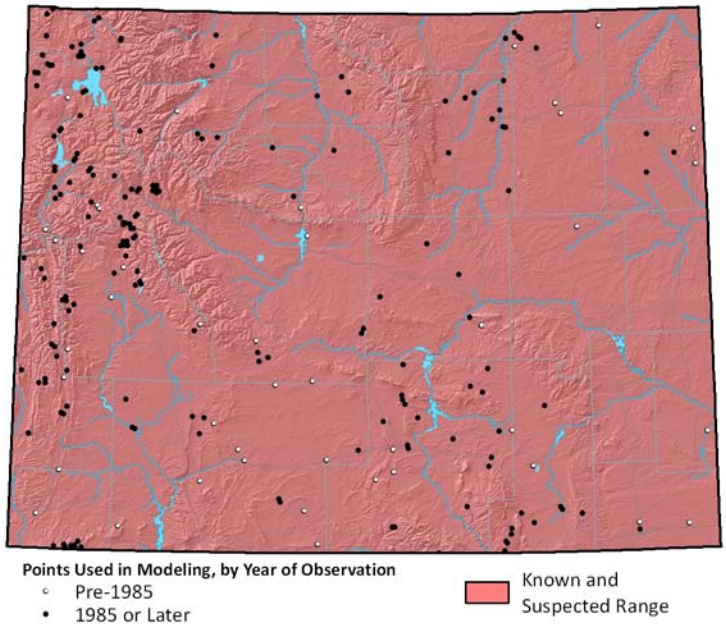
Training AUC: 0.717
Regularized Training Gain: 0.338

Cross-Validation Statistics

- Average Test AUC: 0.715 ± 0.043
- Upper Bound on Test AUC: 0.723
- Average Test Gain: 0.329 ± 0.141
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.35± 0.12

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 829
- Number of Occurrences used to create distribution model: 228
- Average Point Quality Index (highest quality is 12.00): 9.55 ± 2.94
- Most recent occurrence used: 2008
- Oldest occurrence used: 1899
- Occurrence File: DRAFT_3_SAGE_WATER_RERUNS.csv

Comments

This species is ubiquitous in Wyoming and occurs within a variety of habitat types. It is therefore difficult to develop an uniformly-accurate environmental niche model that can be effectively applied across the state. This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

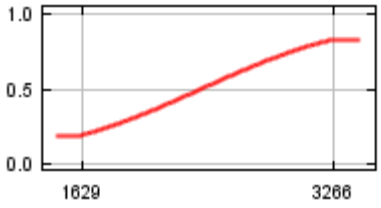
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Annual number of Frost Days	65
Distance to Permanent Water	31
Mean diurnal temperature range	4
Elevation	0

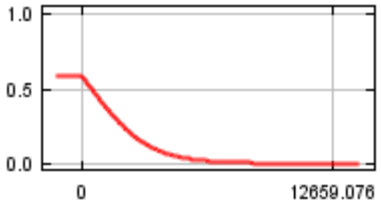
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

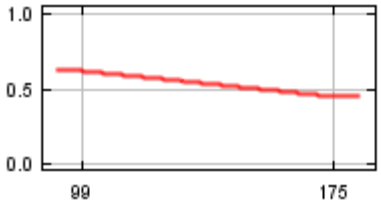
Annual number of Frost Days



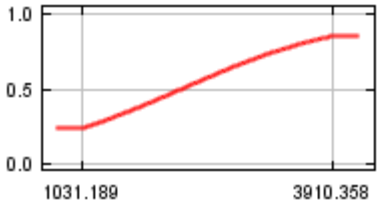
Distance to Permanent Water



Mean diurnal temperature range



Elevation

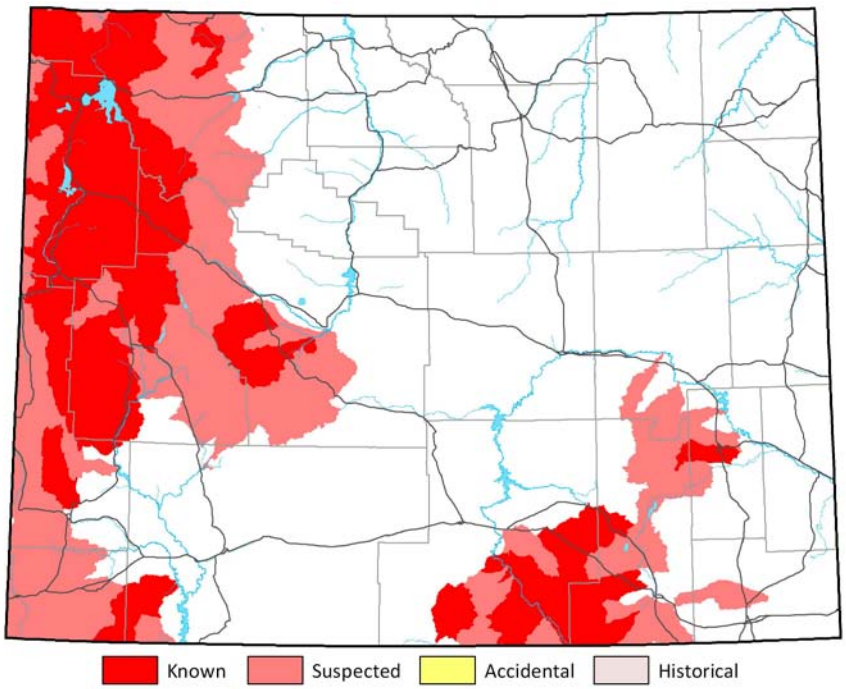


Boreal Toad (*Anaxyrus boreas boreas*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Boreal Toad (AAABB01031) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

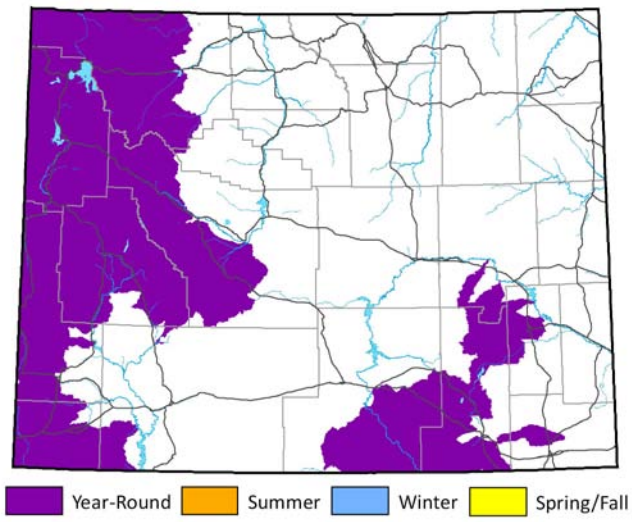
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.406
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



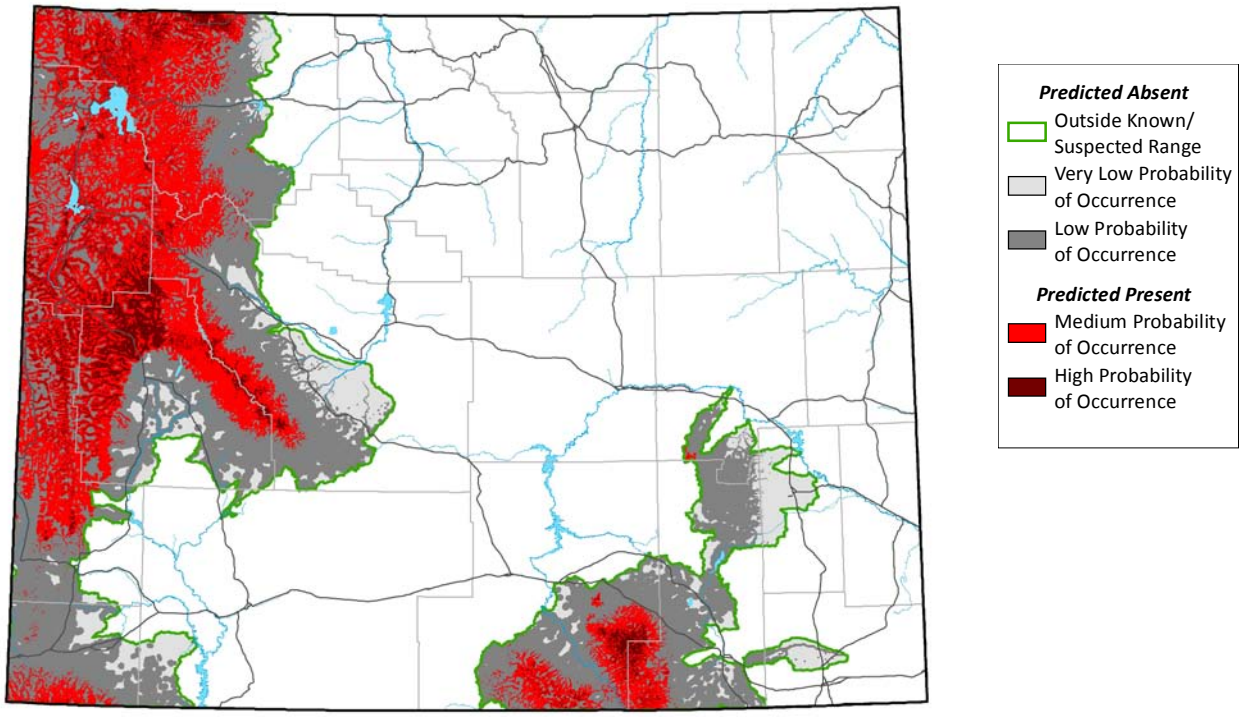
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Wed Mar 17 08:05:42 MDT 2010)

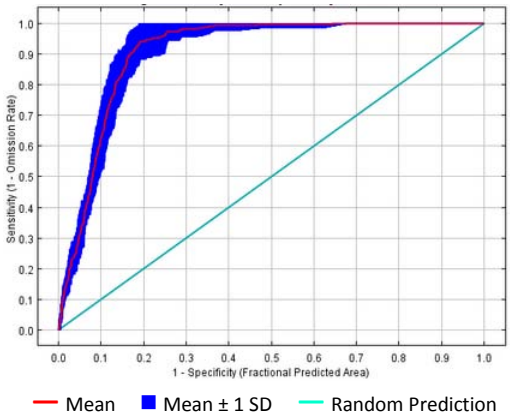
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2772690
- High-Probability Threshold Value: 0.5574093
- Low-Probability Threshold Value: 0.0024045

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

Expert Assessment: High
Occurrence Sample Size: High
Quality of Occurrences: High
Positive Success Rate: Very High
Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

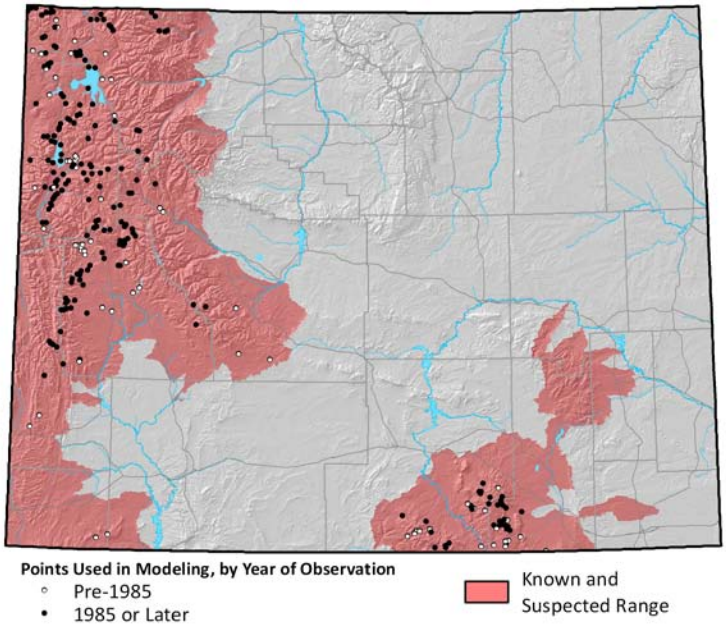
Training AUC: 0.916
Regularized Training Gain: 1.477

Cross-Validation Statistics

- Average Test AUC: 0.909 ± 0.016
- Upper Bound on Test AUC: 0.913
- Average Test Gain: 1.430 ± 0.219
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.03± 0.03

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,690
- Number of Occurrences used to create distribution model: 256
- Average Point Quality Index (highest quality is 12.00): 8.97 ± 3.00
- Most recent occurrence used: 2008
- Oldest occurrence used: 1940
- Occurrence File: LOCAL_SAMPLE_POINTS_W_PDOG_2.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

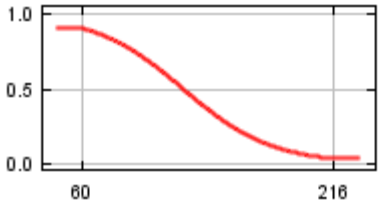
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Warmest quarter mean temperature	41
Wettest quarter mean temperature	35
Distance to Permanent Water	7
Annual Relative Humidity Range	7
Precipitation of the driest month	6
Precipitation of the coldest quarter	4

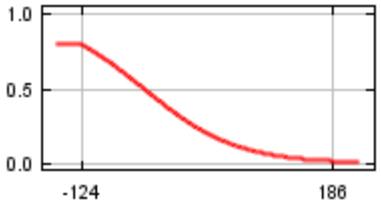
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

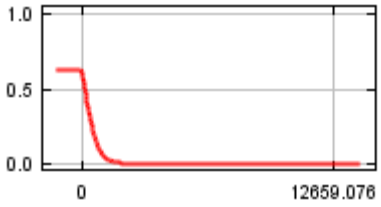
Warmest quarter mean temperature



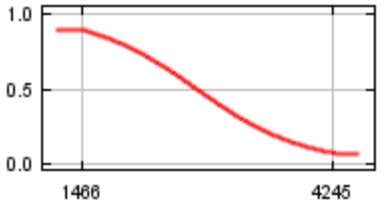
Wettest quarter mean temperature



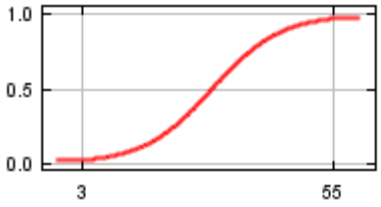
Distance to Permanent Water



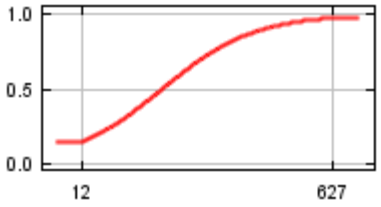
Annual Relative Humidity Range



Precipitation of the driest month



Precipitation of the coldest quarter

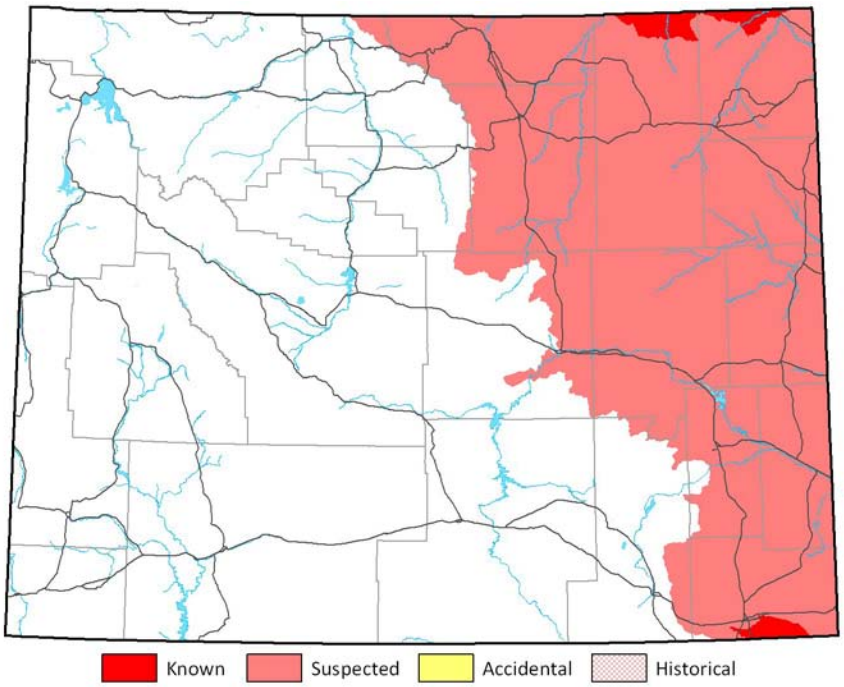


Great Plains Toad (*Anaxyrus cognatus*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Great Plains Toad (AAABB01050) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

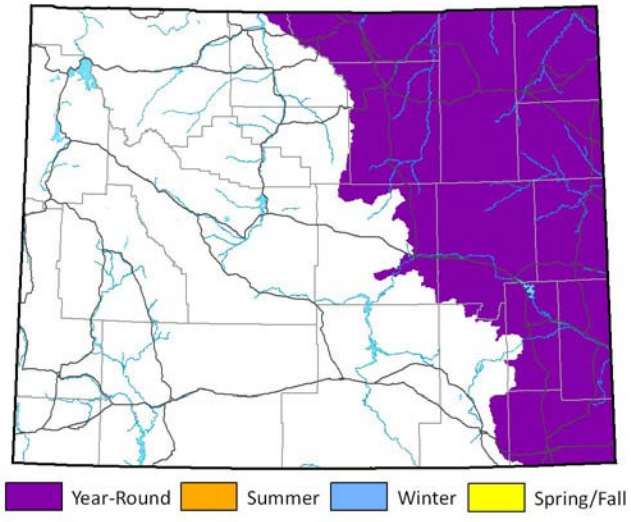
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.049
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



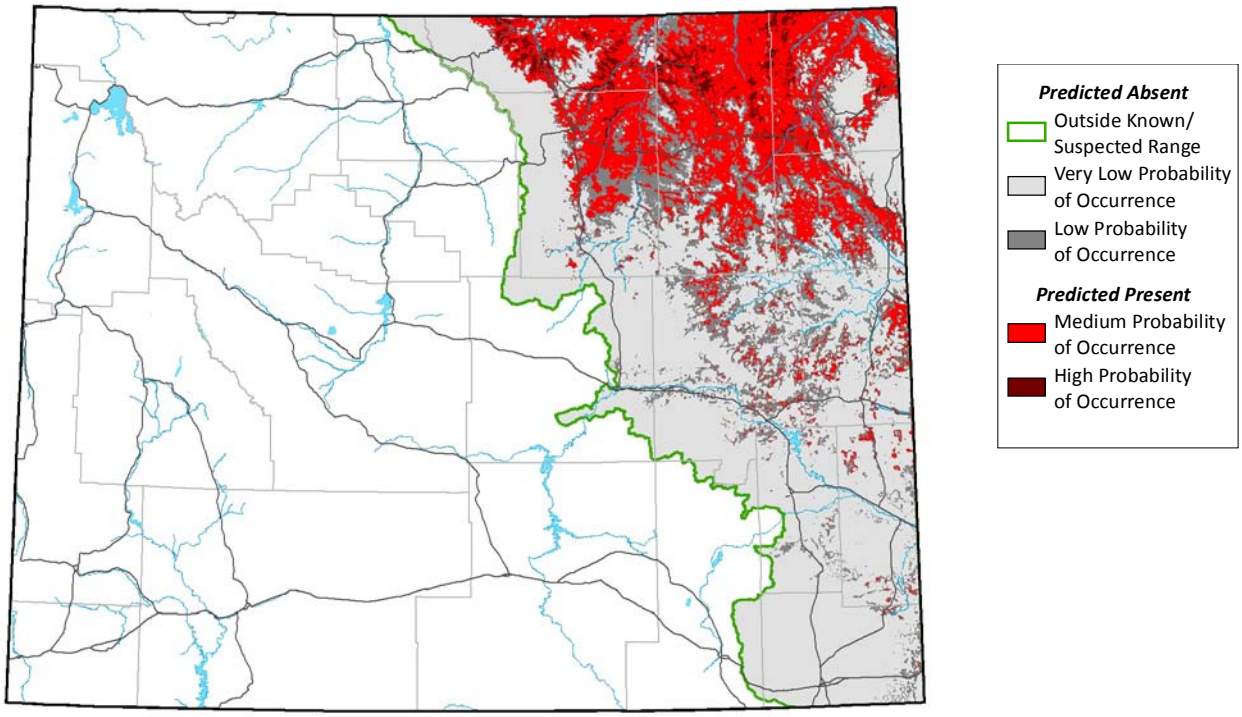
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Wed Apr 21 14:25:14 MDT 2010)

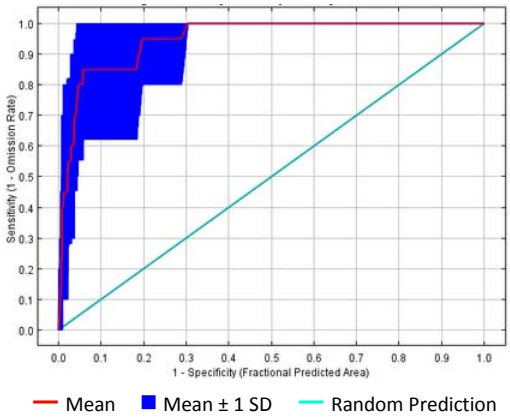
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1931160
- High-Probability Threshold Value: 0.6607317
- Low-Probability Threshold Value: 0.0900393

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

Expert Assessment: Medium
Occurrence Sample Size: Low
Quality of Occurrences: High
Positive Success Rate: High
Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

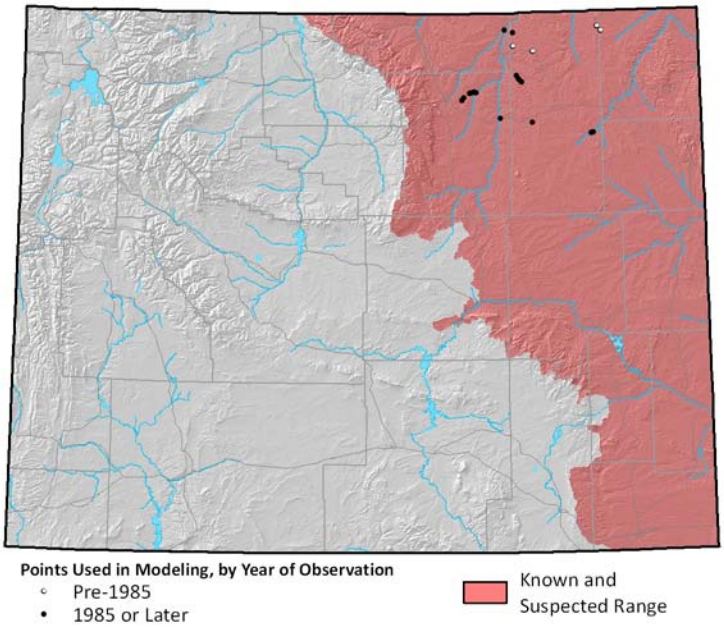
Training AUC: 0.968
Regularized Training Gain: 2.031

Cross-Validation Statistics

- Average Test AUC: 0.949 ± 0.053
- Upper Bound on Test AUC: 0.950
- Average Test Gain: 1.990 ± 1.128
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.15± 0.24

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 55
- Number of Occurrences used to create distribution model: 20
- Average Point Quality Index (highest quality is 12.00): 9.65 ± 2.83
- Most recent occurrence used: 2008
- Oldest occurrence used: 1949
- Occurrence File: LOCAL_SAMPLE_POINTS.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

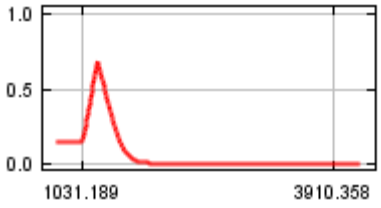
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Elevation	29
Herbaceous Cover Index	25
Pinon-Juniper Index	17
Radiation of the lightest month	11
Variation in monthly radiation	9
Hottest month mean maximum temperature	9

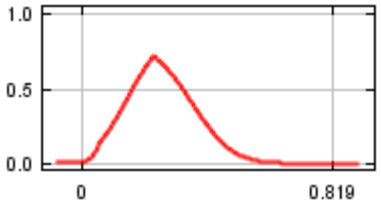
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

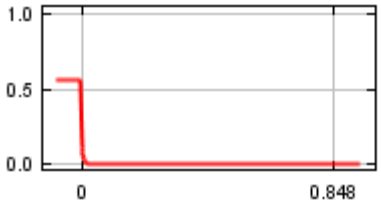
Elevation



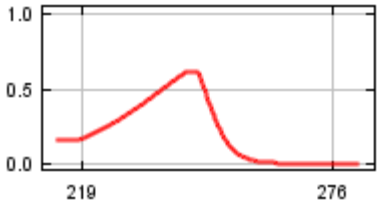
Herbaceous Cover Index



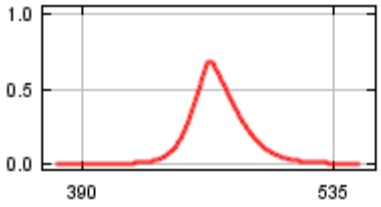
Pinon-Juniper Index



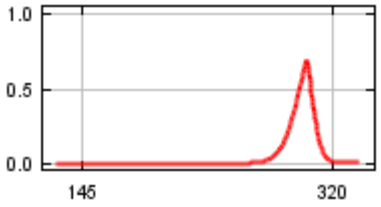
Radiation of the lightest month



Variation in monthly radiation



Hottest month mean maximum temperature

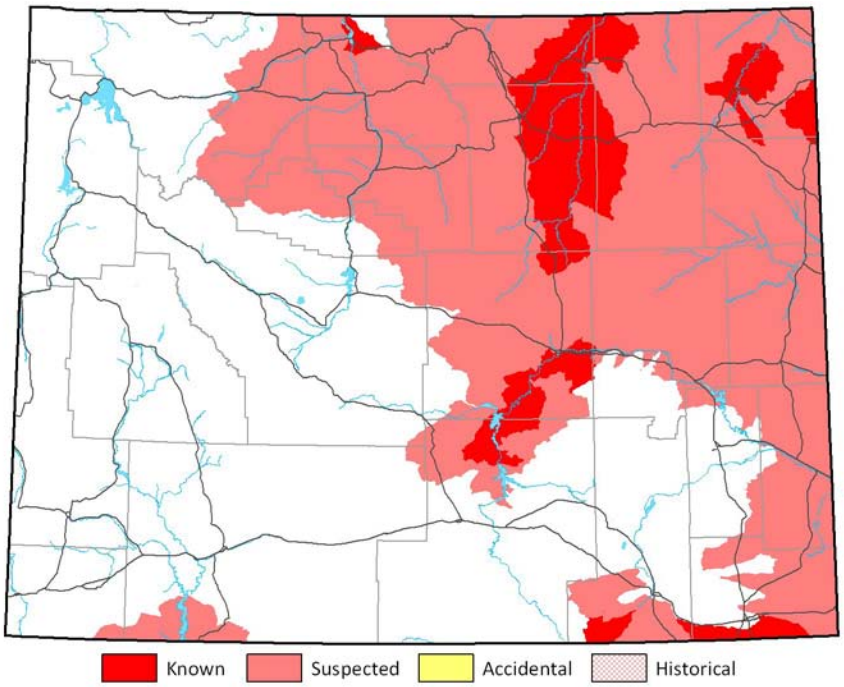


Rocky Mountain Toad (*Anaxyrus woodhousii woodhousii*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Rocky Mountain Toad (AAABB01180) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

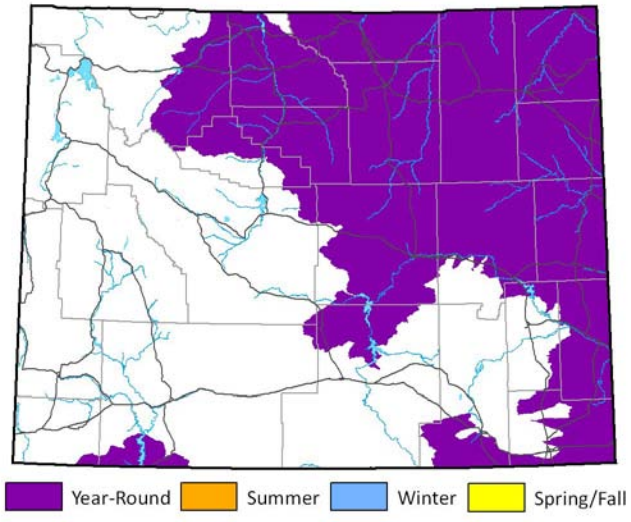
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.141
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



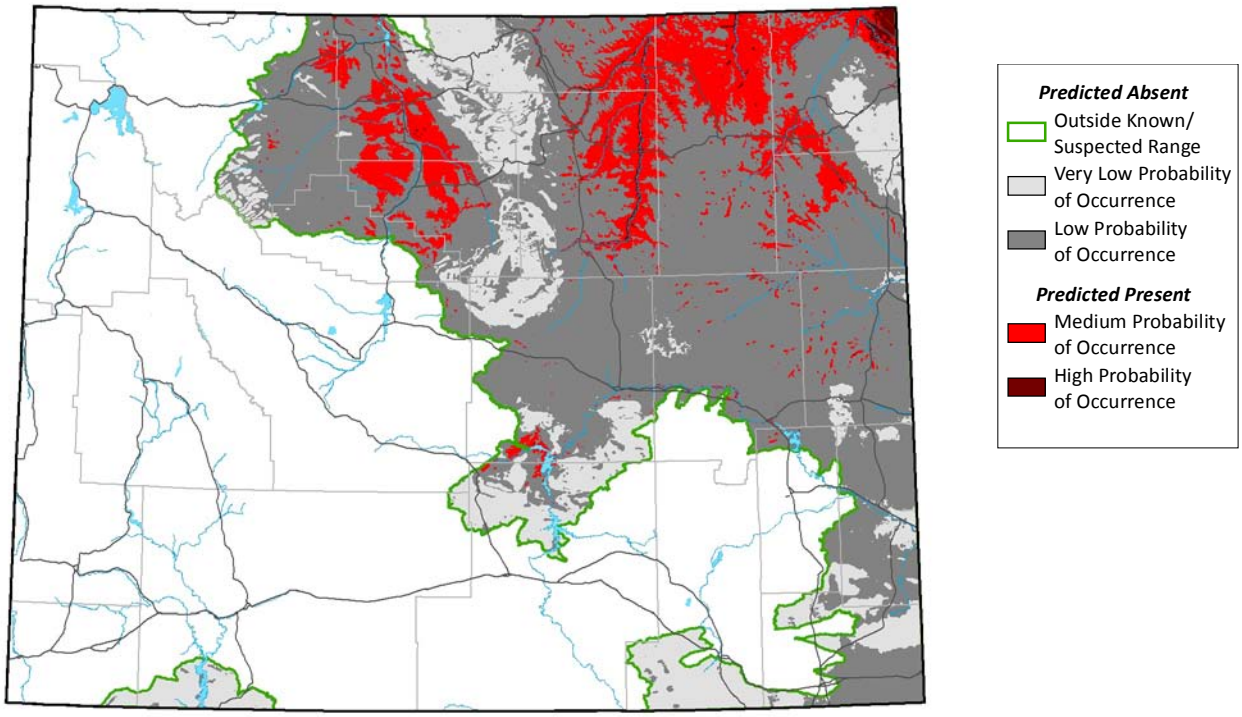
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Fri Dec 04 22:03:17 MST 2009)

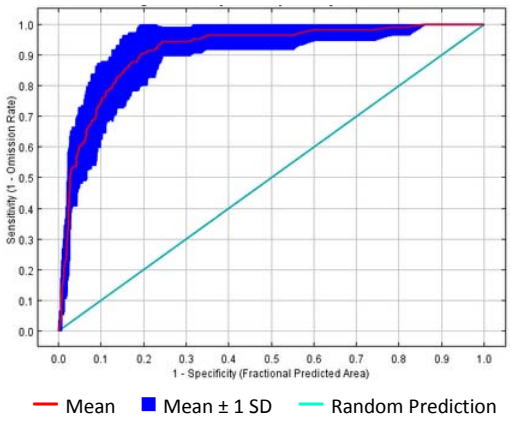
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3089790
- High-Probability Threshold Value: 0.6768350
- Low-Probability Threshold Value: 0.0158477

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

Expert Assessment: Medium
Occurrence Sample Size: High
Quality of Occurrences: High
Positive Success Rate: High
Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

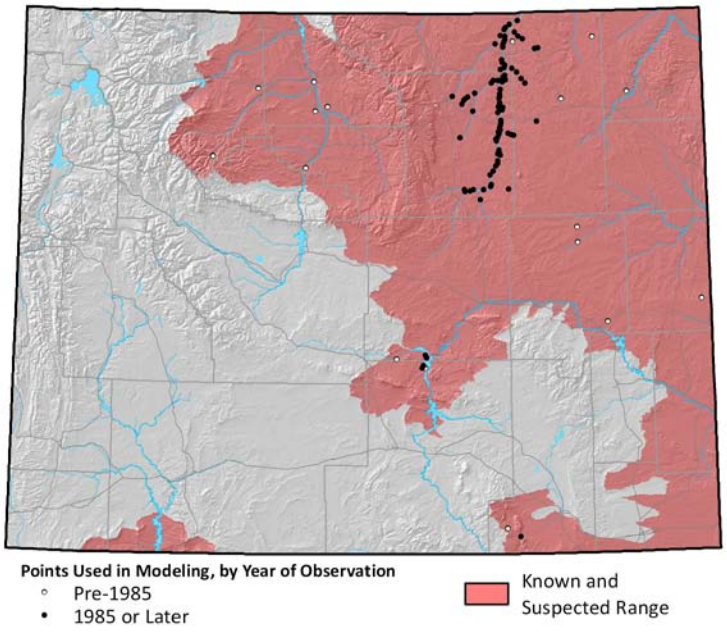
Training AUC: 0.942
Regularized Training Gain: 1.613

Cross-Validation Statistics

- Average Test AUC: 0.914 ± 0.033
- Upper Bound on Test AUC: 0.918
- Average Test Gain: 1.541 ± 0.370
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.14± 0.10

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 671
- Number of Occurrences used to create distribution model: 106
- Average Point Quality Index (highest quality is 12.00): 10.36 ± 2.87
- Most recent occurrence used: 2008
- Oldest occurrence used: 1910
- Occurrence File: LOCAL_SAMPLE_POINTS.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

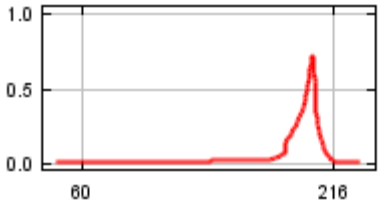
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Warmest quarter mean temperature	25
Variation in monthly radiation	18
Elevation	18
Cottonwood Index	15
Variation of monthly precipitation	13
Precipitation of the coldest quarter	11

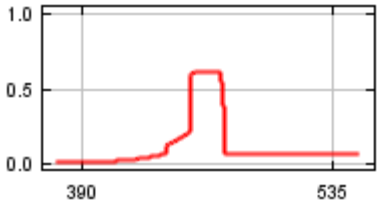
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

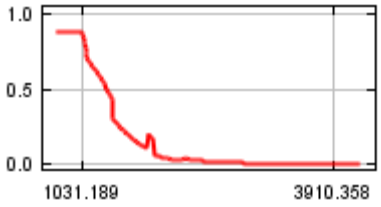
Warmest quarter mean temperature



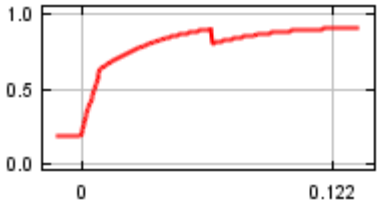
Variation in monthly radiation



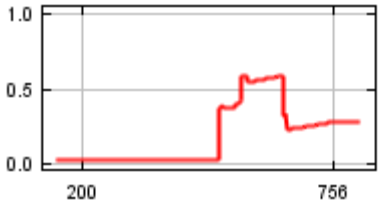
Elevation



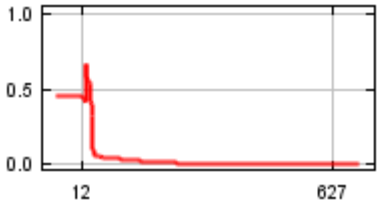
Cottonwood Index



Variation of monthly precipitation



Precipitation of the coldest quarter

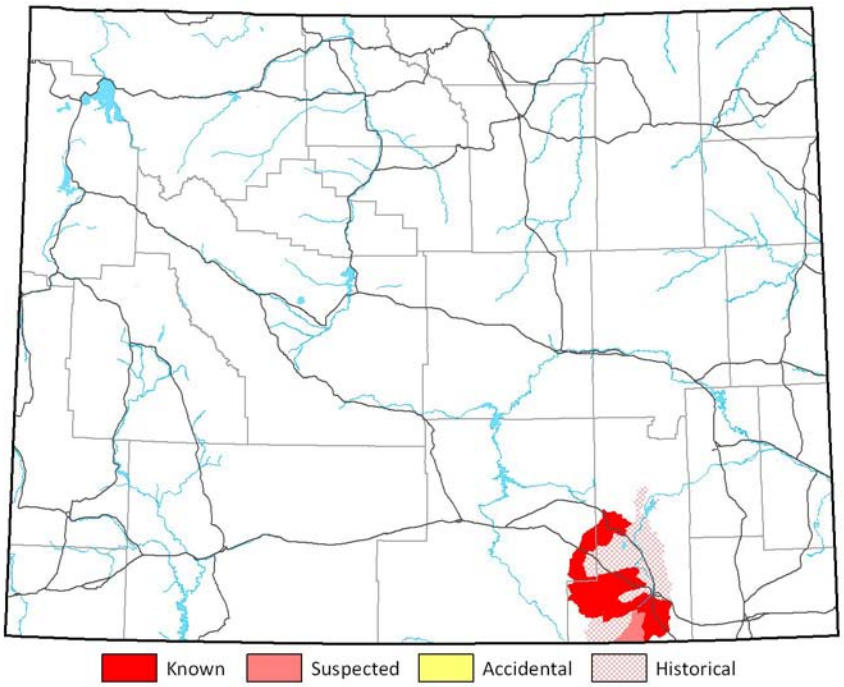


Wyoming Toad (*Anaxyrus baxteri*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Wyoming Toad (AAABB01220) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

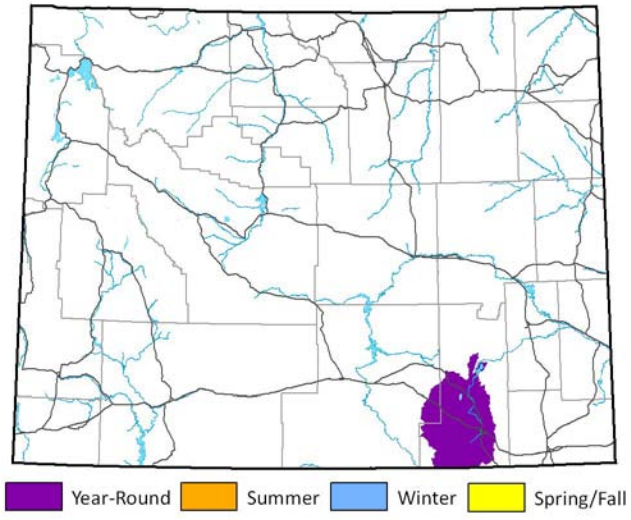
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.750
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



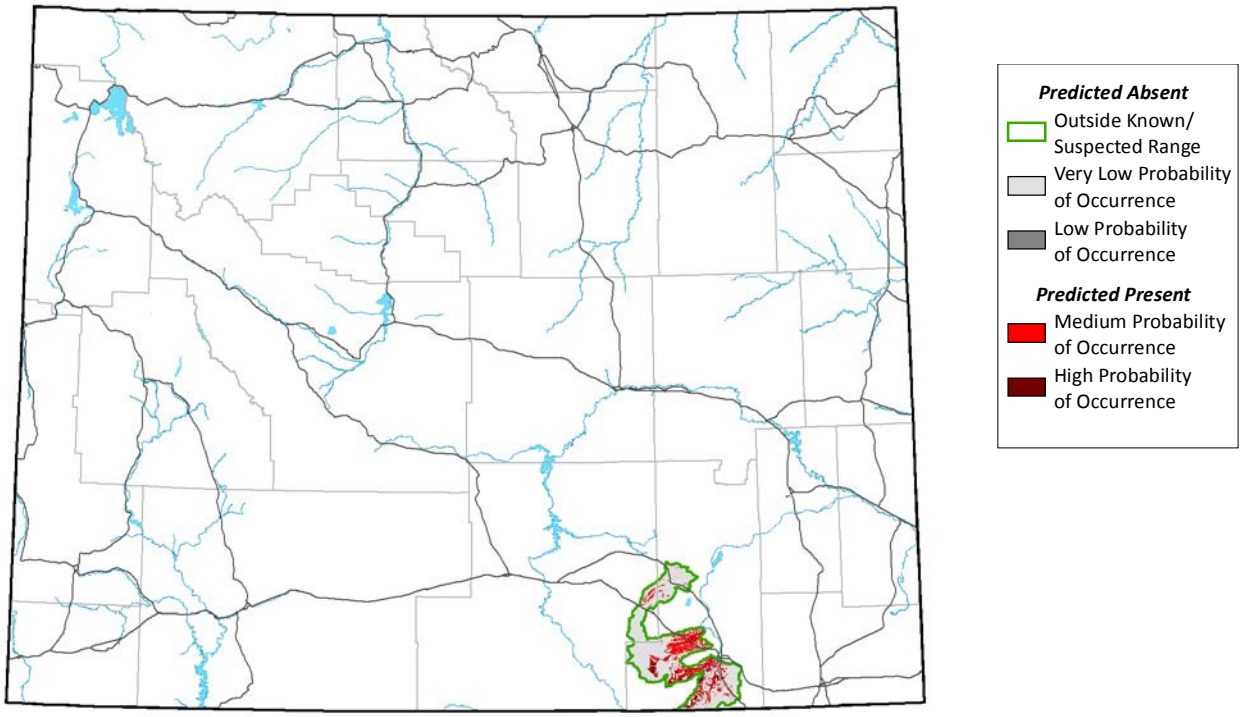
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Sat Dec 05 02:27:23 MST 2009)

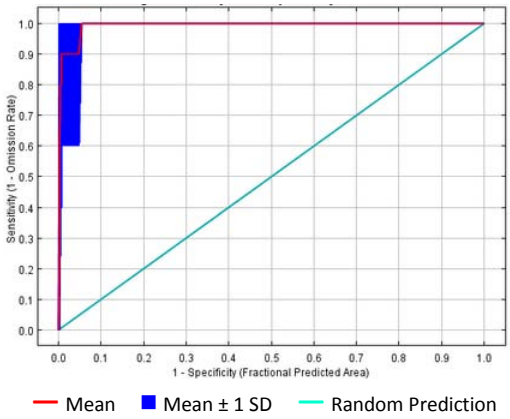
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2238890
- High-Probability Threshold Value: 0.6466638
- Low-Probability Threshold Value: 0.2238890

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: MEDIUM

Expert Assessment: Medium
Occurrence Sample Size: Low
Quality of Occurrences: Medium
Positive Success Rate: High
Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

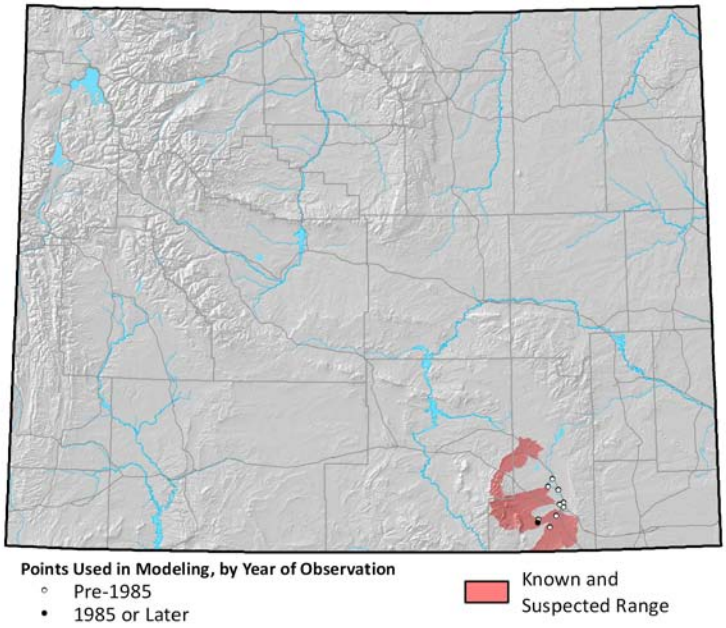
Training AUC: 0.998
Regularized Training Gain: 4.631

Cross-Validation Statistics

- Average Test AUC: 0.993 ± 0.016
- Upper Bound on Test AUC: 0.994
- Average Test Gain: 4.325 ± 2.282
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.20± 0.42

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 133
- Number of Occurrences used to create distribution model: 10
- Average Point Quality Index (highest quality is 12.00): 6.10 ± 2.56
- Most recent occurrence used: 1990
- Oldest occurrence used: 1946
- Occurrence File: LOCAL_SAMPLE_POINTS.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

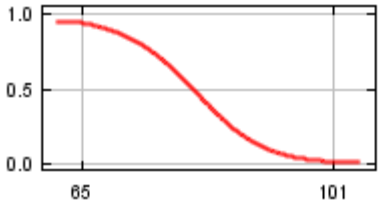
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Standard deviation of monthly temperature	43
Interannual variation in annual frost days	17
Vector Ruggedness Measure	15
Degree Slope	11
Conifer Index	9
Distance to Water Shoreline	4

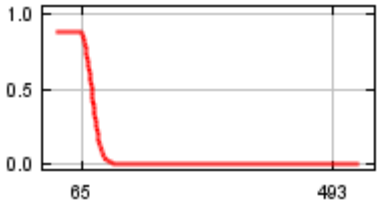
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

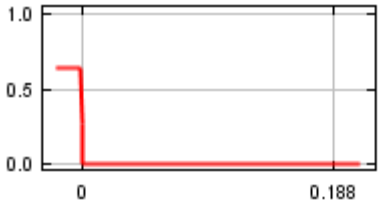
Standard deviation of monthly temperature



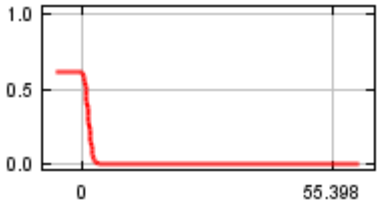
Interannual variation in annual frost days



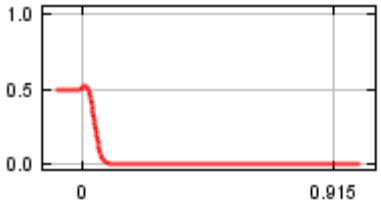
Vector Ruggedness Measure



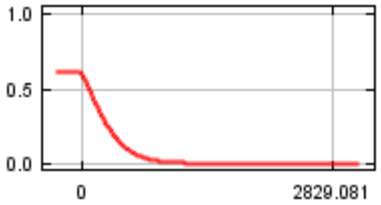
Degree Slope



Conifer Index



Distance to Water Shoreline

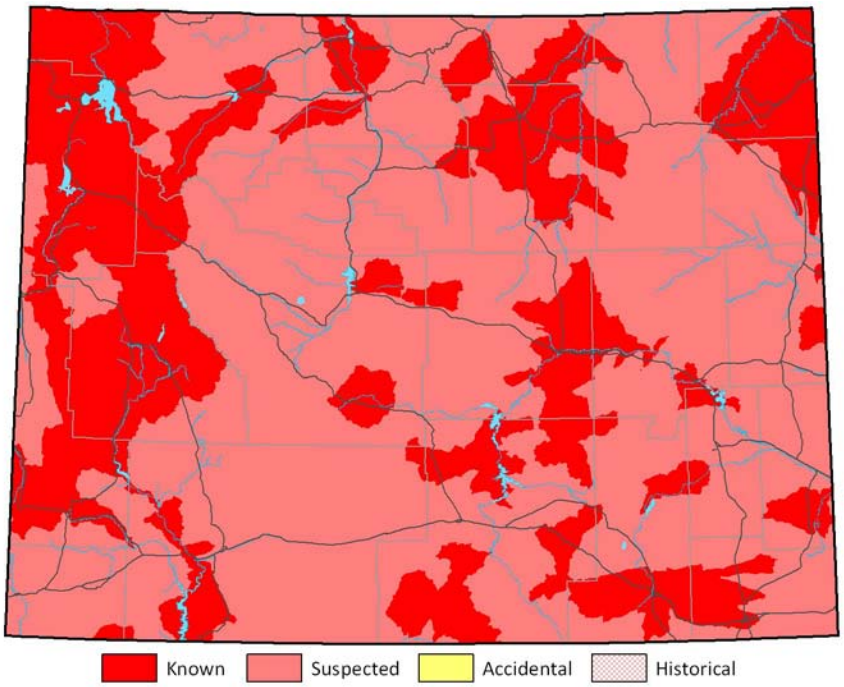


Boreal Chorus Frog (*Pseudacris maculata*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Boreal Chorus Frog (AAABC05130) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

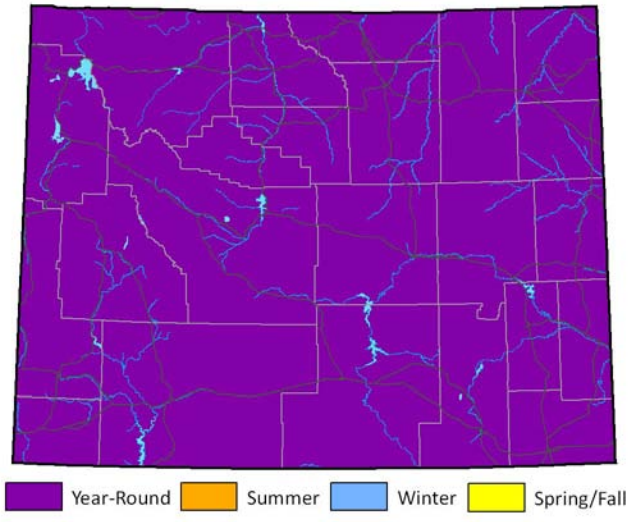
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.298
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



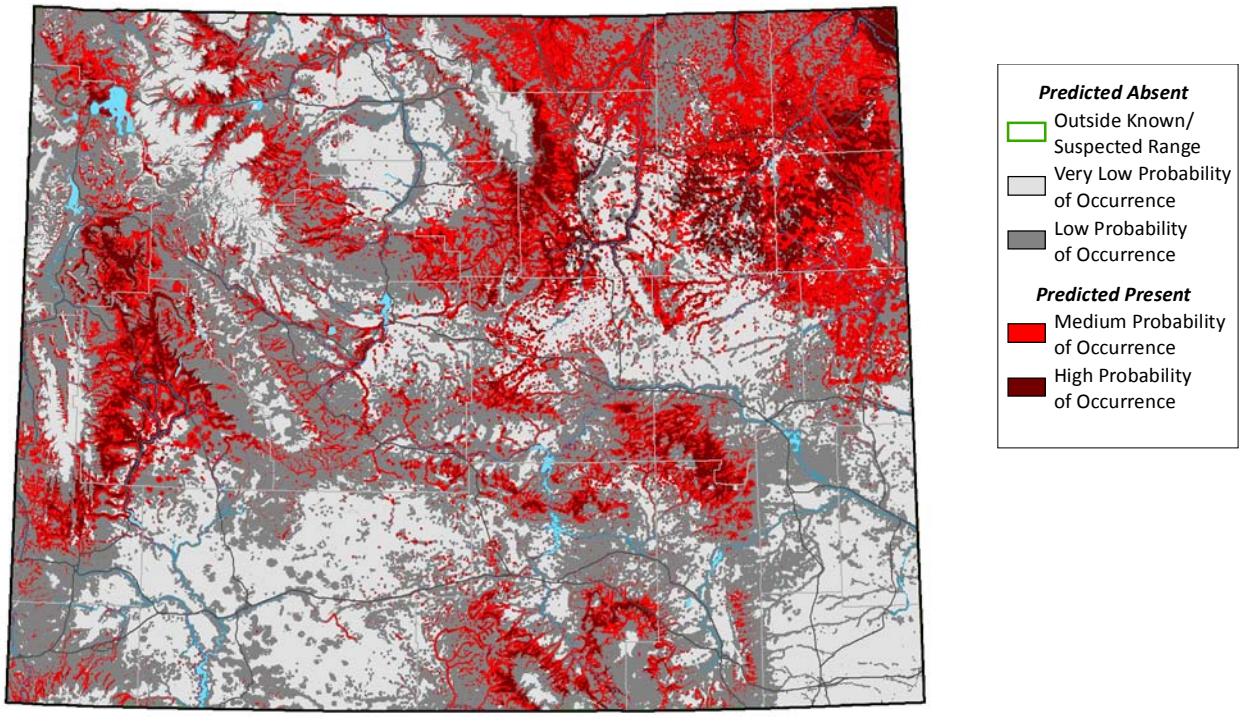
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Fri Apr 09 11:24:22 MDT 2010)

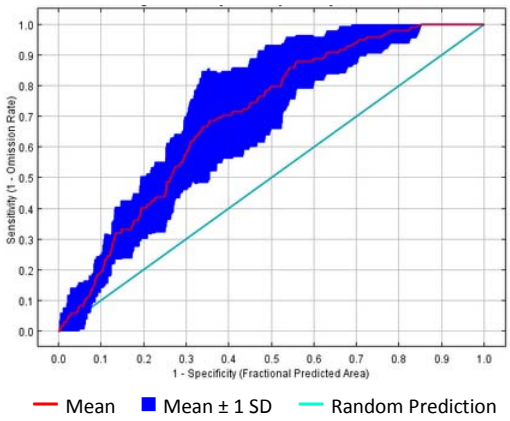
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4407440
- High-Probability Threshold Value: 0.5880334
- Low-Probability Threshold Value: 0.1500802

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

Expert Assessment: Low
Occurrence Sample Size: Medium-High
Quality of Occurrences: High
Positive Success Rate: Low
Test AUC and Model Gain: Low

Model Evaluation Statistics

Final Model Statistics

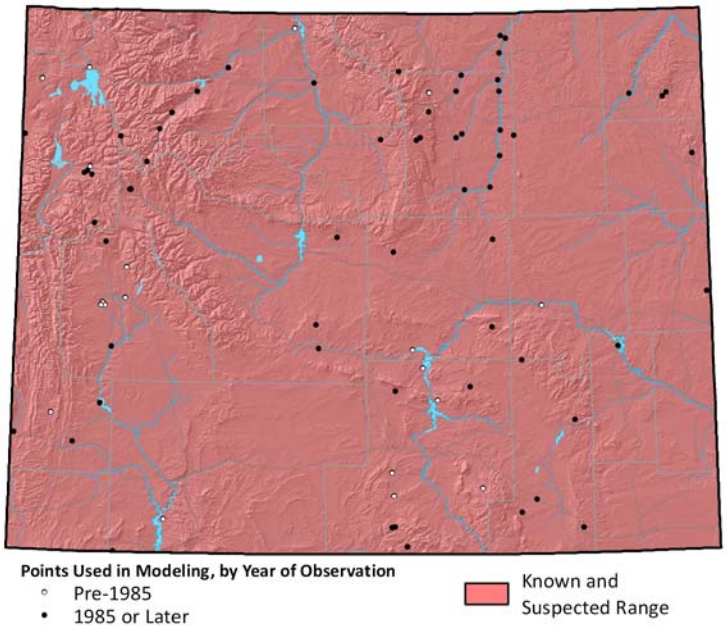
Training AUC: 0.822
Regularized Training Gain: 0.400

Cross-Validation Statistics

- Average Test AUC: 0.699 ± 0.055
- Upper Bound on Test AUC: 0.742
- Average Test Gain: 0.230 ± 0.165
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.42± 0.19

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 353
- Number of Occurrences used to create distribution model: 97
- Average Point Quality Index (highest quality is 12.00): 7.88 ± 2.78
- Most recent occurrence used: 2008
- Oldest occurrence used: 1950
- Occurrence File: DRAFT_3_SAGE_WATER_RERUNS.csv

Comments

This species is ubiquitous in Wyoming and occurs within a variety of habitat types. It is therefore difficult to develop an uniformly-accurate environmental niche model that can be effectively applied across the state. This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

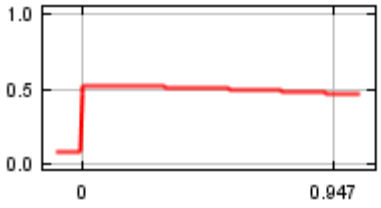
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Forest Cover Index	32
Variation in monthly radiation	18
Coldest month mean minimum temperature	18
Distance to Permanent Water	16
Elevation	12
Annual precipitation range (P3 – P2)	4

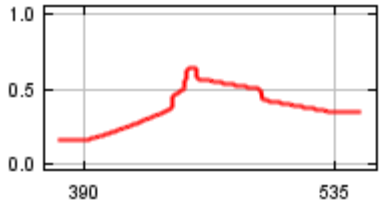
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

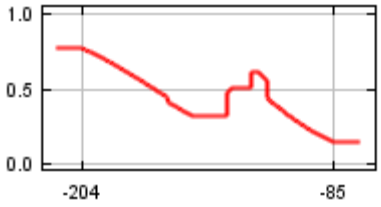
Forest Cover Index



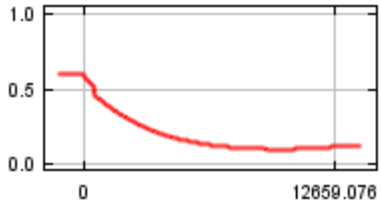
Variation in monthly radiation



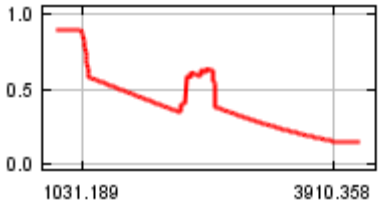
Coldest month mean minimum temperature



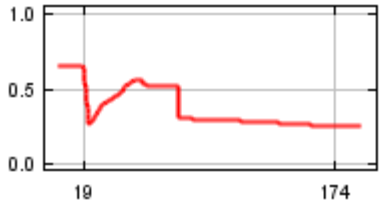
Distance to Permanent Water



Elevation



Annual precipitation range (P3 – P2)

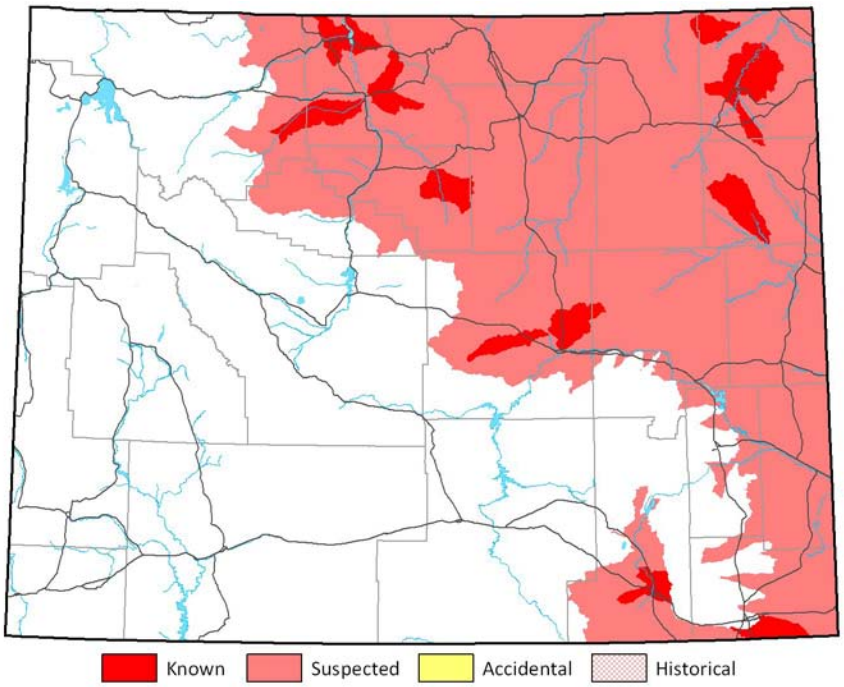


Plains Spadefoot (*Spea bombifrons*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Plains Spadefoot (AAABF02010) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

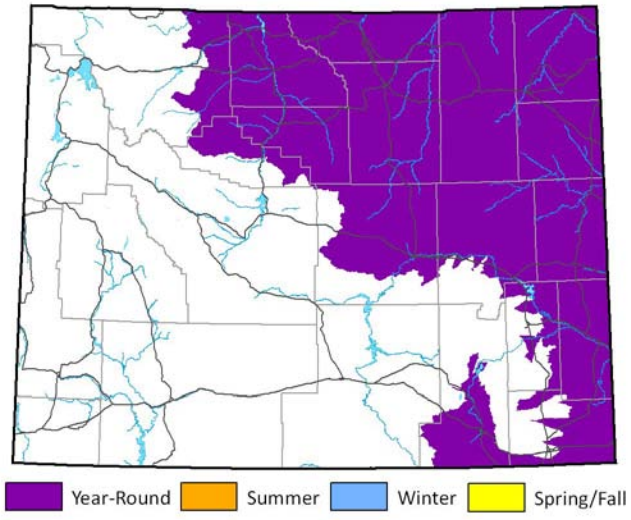
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.085
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



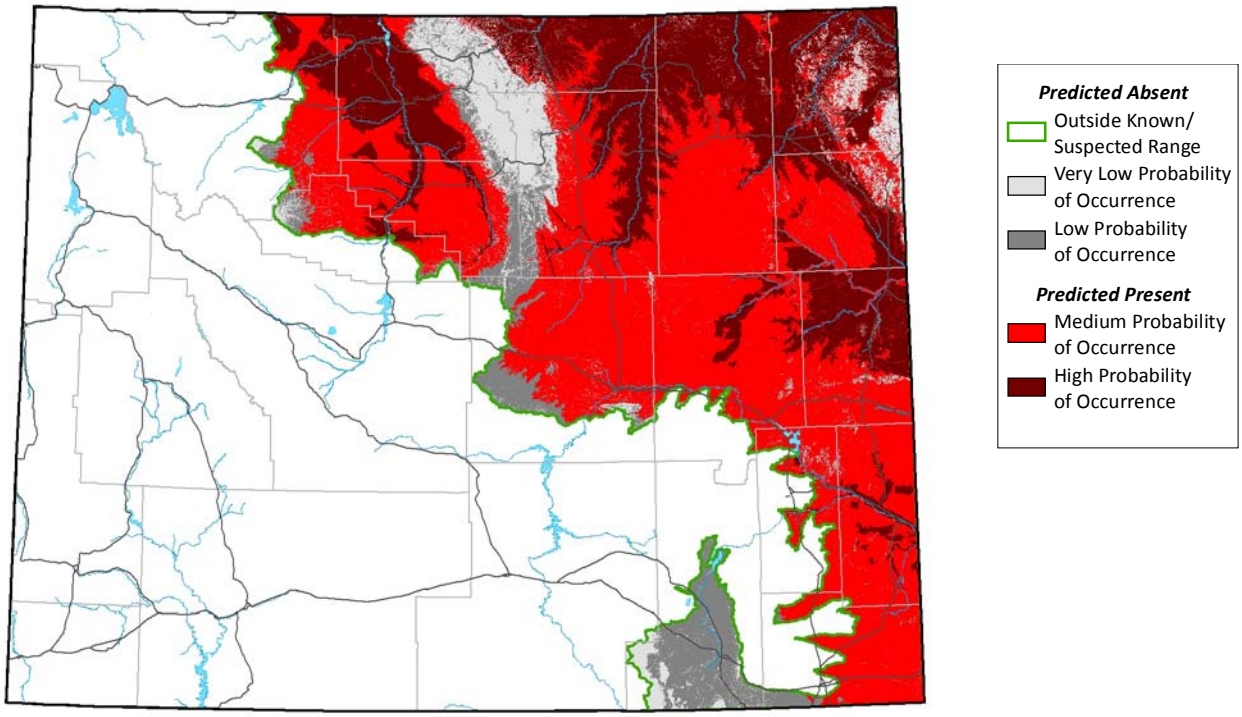
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Wed Apr 21 13:34:26 MDT 2010)

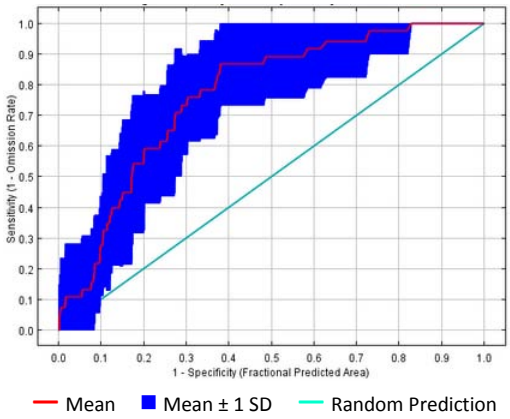
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3328540
- High-Probability Threshold Value: 0.5650452
- Low-Probability Threshold Value: 0.1037380

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

Expert Assessment: Low
Occurrence Sample Size: Medium
Quality of Occurrences: Medium
Positive Success Rate: Medium
Test AUC and Model Gain: Medium

Model Evaluation Statistics

Final Model Statistics

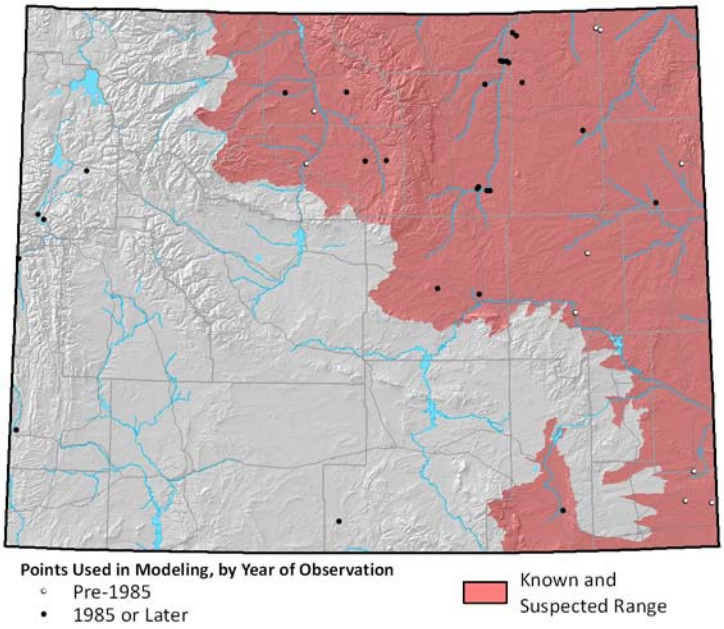
Training AUC: 0.804
Regularized Training Gain: 0.596

Cross-Validation Statistics

- Average Test AUC: 0.766 ± 0.085
- Upper Bound on Test AUC: 0.787
- Average Test Gain: 0.371 ± 0.580
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.29± 0.15

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 79
- Number of Occurrences used to create distribution model: 37
- Average Point Quality Index (highest quality is 12.00): 7.84 ± 2.73
- Most recent occurrence used: 2008
- Oldest occurrence used: 1949
- Occurrence File: LOCAL_SAMPLE_POINTS.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps. Qualitative expert review of this model suggests that the binary version may over-predict the distribution of this species in Wyoming.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

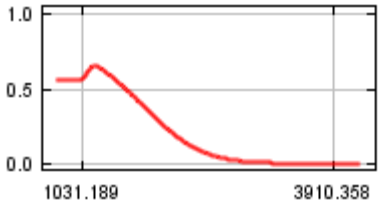
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Elevation	52
Percent Forest Cover	21
Radiation of the lightest month	16
Standard deviation of monthly temperature	6
Soil texture	5

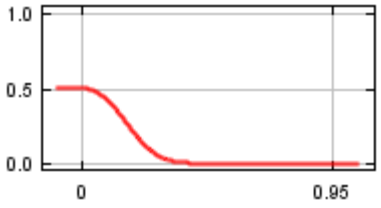
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

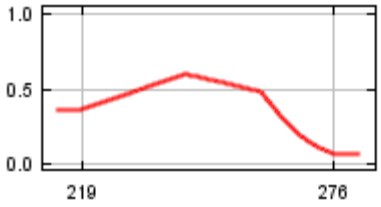
Elevation



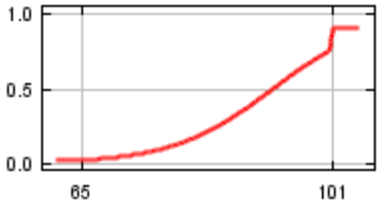
Percent Forest Cover



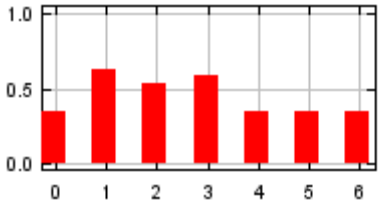
Radiation of the lightest month



Standard deviation of monthly temperature



Soil texture

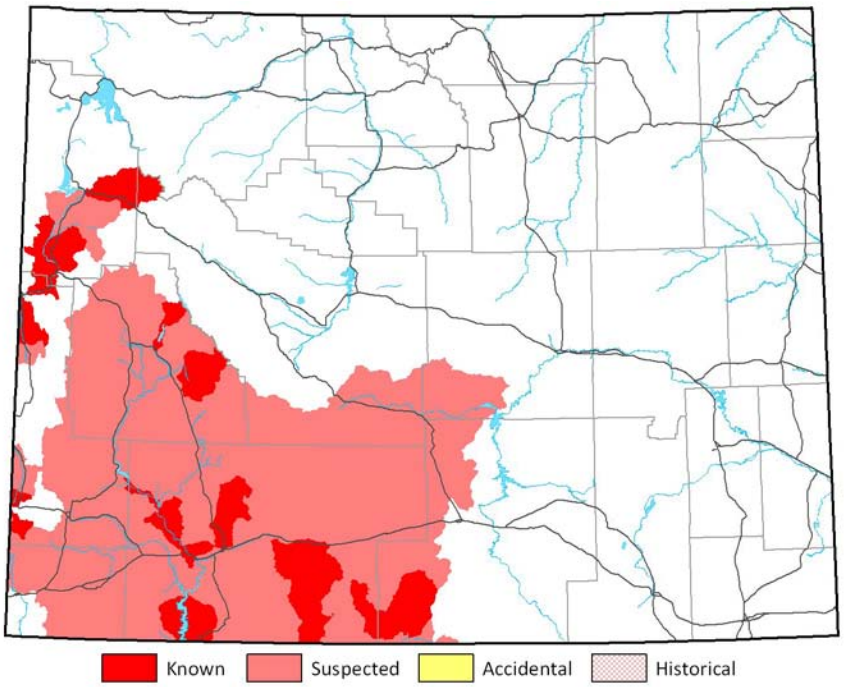


Great Basin Spadefoot (*Spea intermontana*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Great Basin Spadefoot (AAABF02030) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

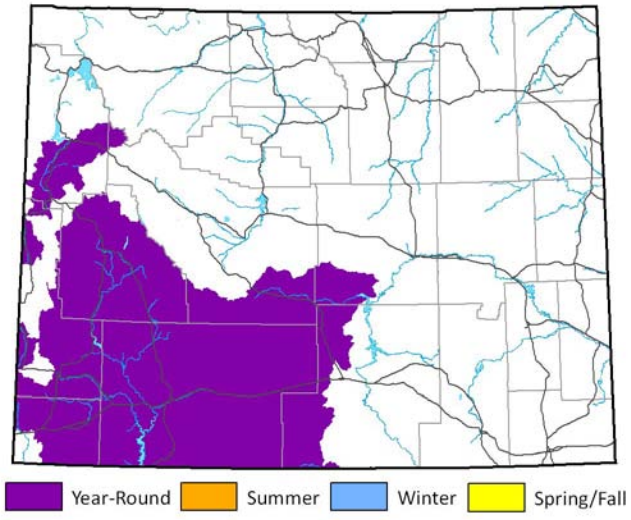
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.151
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



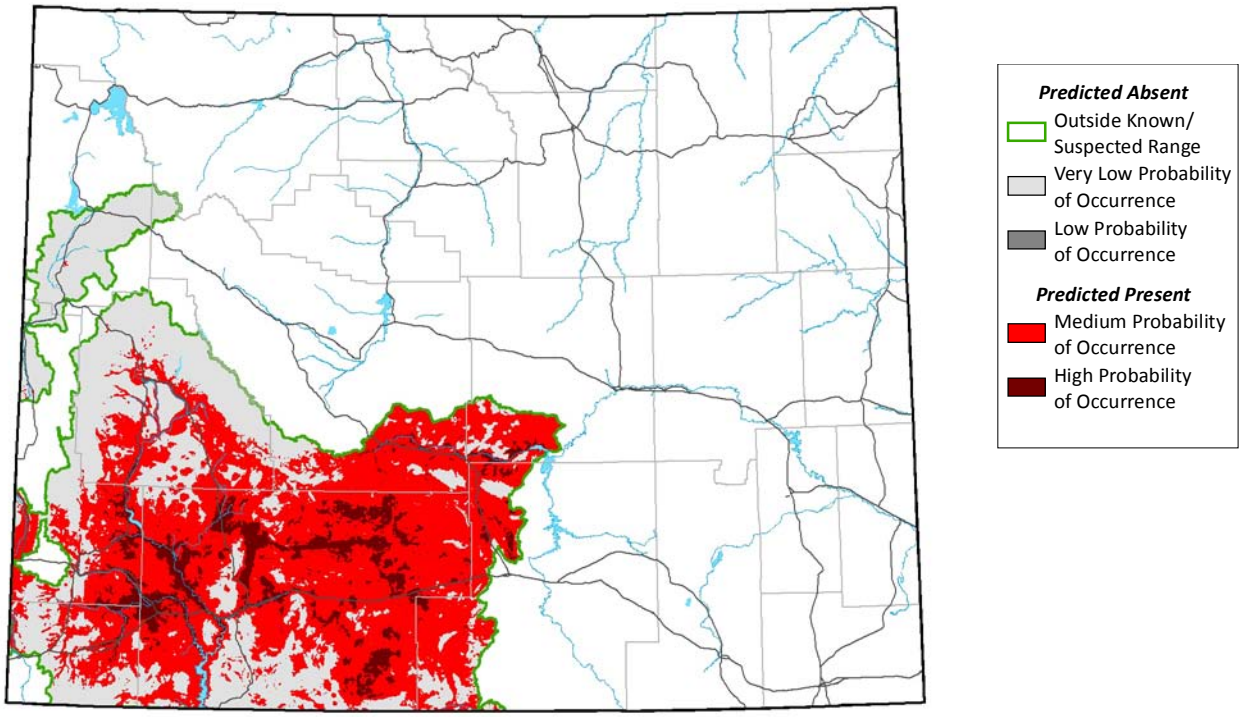
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Wed Mar 17 21:12:54 MDT 2010)

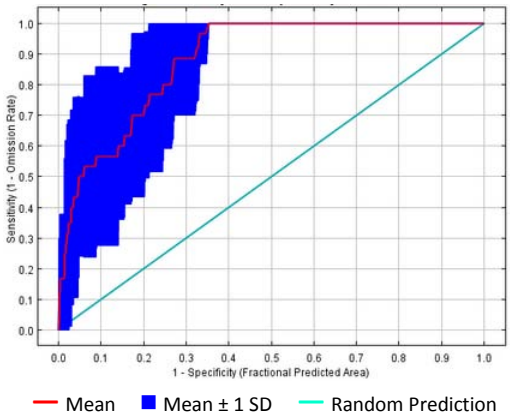
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1534280
- High-Probability Threshold Value: 0.5893315
- Low-Probability Threshold Value: 0.1534277

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: MEDIUM

Expert Assessment: Medium
Occurrence Sample Size: Medium
Quality of Occurrences: High
Positive Success Rate: High
Test AUC and Model Gain: Medium

Model Evaluation Statistics

Final Model Statistics

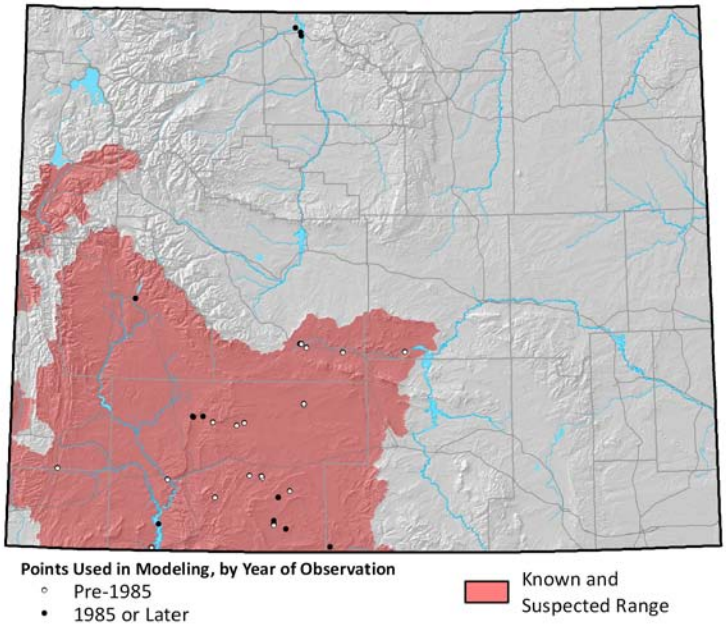
Training AUC: 0.903
Regularized Training Gain: 1.245

Cross-Validation Statistics

- Average Test AUC: 0.882 ± 0.070
- Upper Bound on Test AUC: 0.889
- Average Test Gain: 1.238 ± 0.726
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.12± 0.19

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 63
- Number of Occurrences used to create distribution model: 27
- Average Point Quality Index (highest quality is 12.00): 7.96 ± 2.36
- Most recent occurrence used: 2005
- Oldest occurrence used: 1950
- Occurrence File: LOCAL_SAMPLE_POINTS_W_PDOG_2.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

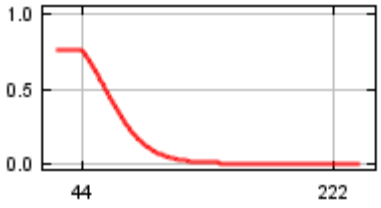
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Precipitation of the warmest quarter	68
Conifer Index	13
Soil - Fraction Sand	7
Depth to Shallowest Restrictive Layer	7
Distance to Permanent Water	3
Contagion Index	3

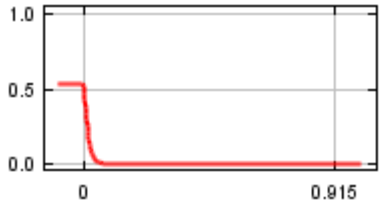
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

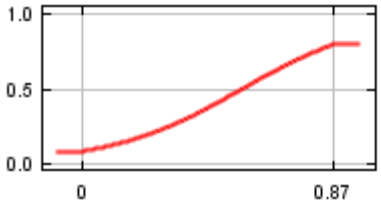
Precipitation of the warmest quarter



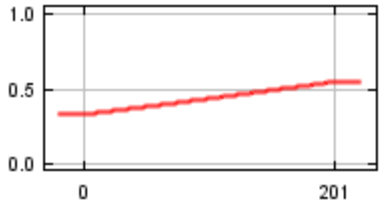
Conifer Index



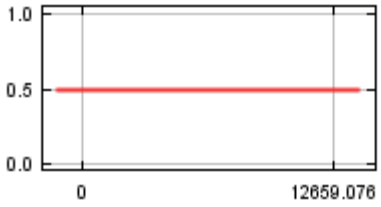
Soil - Fraction Sand



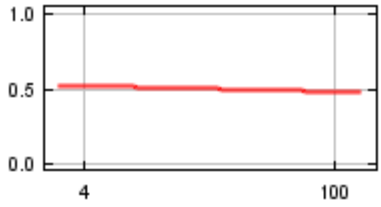
Depth to Shallowest Restrictive Layer



Distance to Permanent Water



Contagion Index

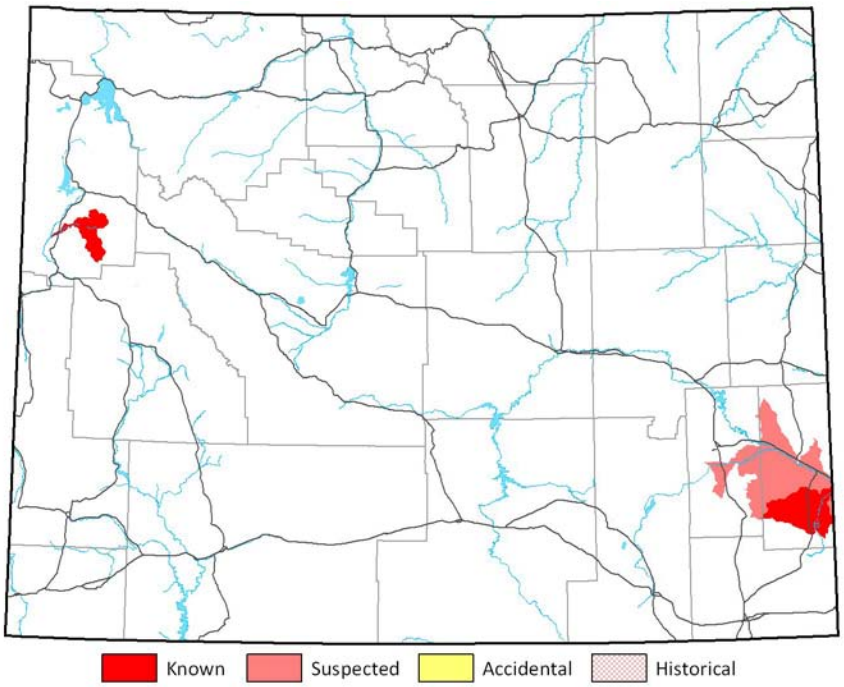


American Bullfrog (*Lithobates catesbieanus*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of American Bullfrog (AAABH01070) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

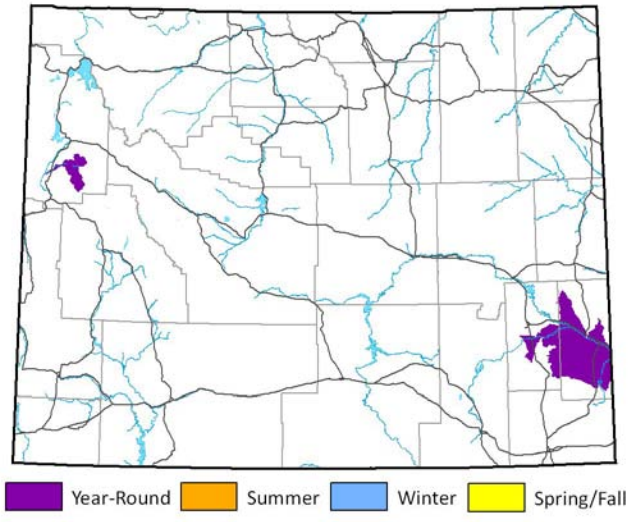
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.286
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



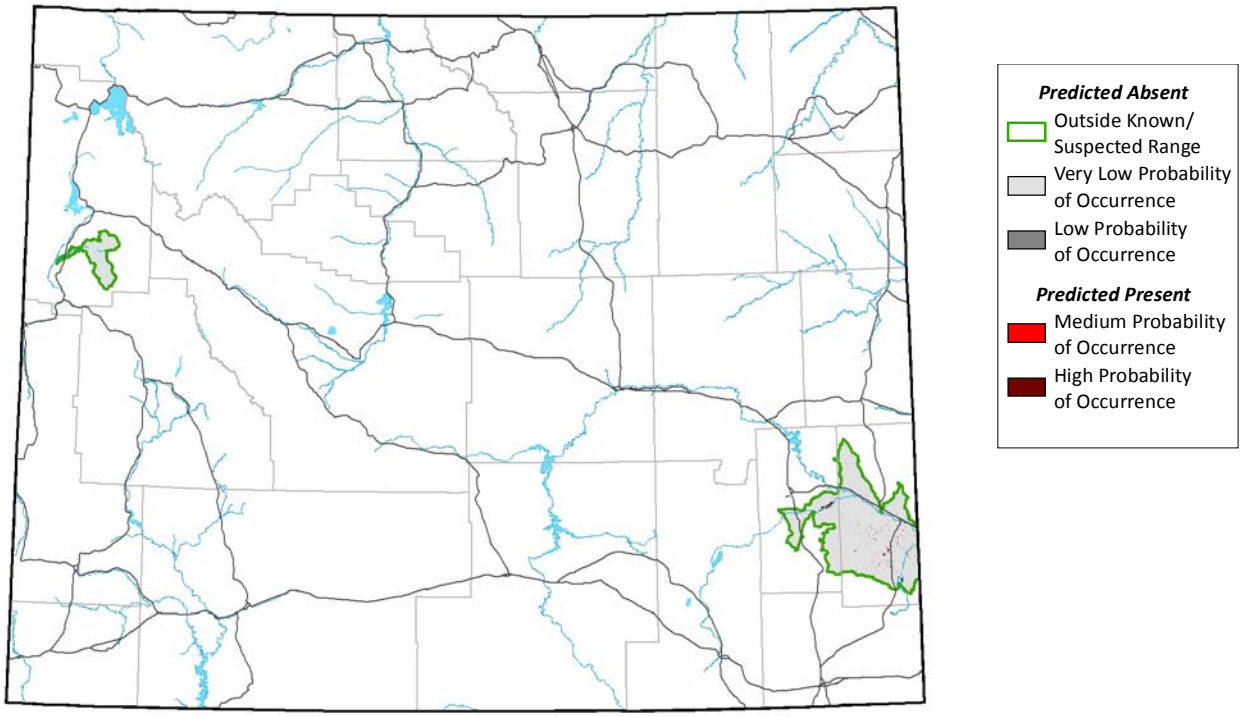
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Sat Dec 05 23:23:57 MST 2009)

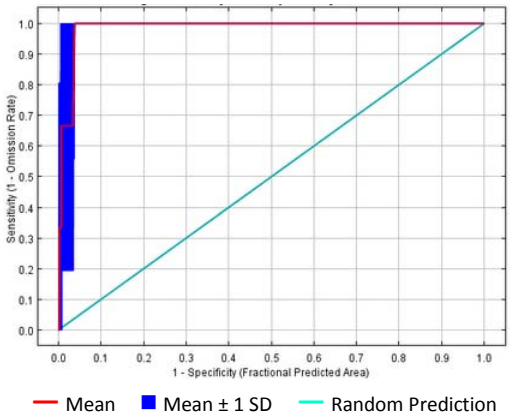
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.5363030
- High-Probability Threshold Value: 0.6150528
- Low-Probability Threshold Value: 0.5363030

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

Expert Assessment: Low
Occurrence Sample Size: Very Low
Quality of Occurrences: Low
Positive Success Rate: Low
Test AUC and Model Gain: Low

Model Evaluation Statistics

Final Model Statistics

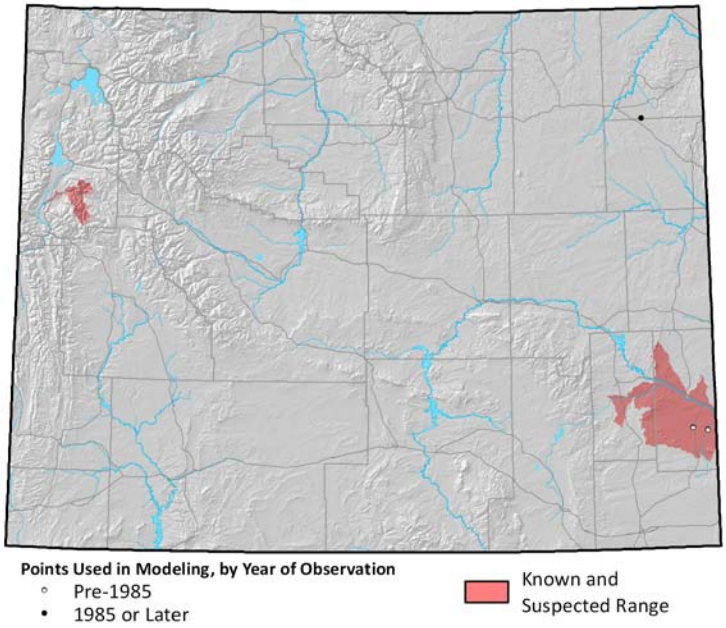
Training AUC: 0.999
Regularized Training Gain: 4.643

Cross-Validation Statistics

- Average Test AUC: 0.296 ± 0.476
- Upper Bound on Test AUC: 0.996
- Average Test Gain: -0.483 ± 3.993
- Omission Error (fraction of test points omitted during 3-fold cross validation): 0.67± 0.58

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 5
- Number of Occurrences used to create distribution model: 3
- Average Point Quality Index (highest quality is 12.00): 4.67 ± 0.58
- Most recent occurrence used: 1987
- Oldest occurrence used: 1985
- Occurrence File: LOCAL_SAMPLE_POINTS.csv

Comments

The model for this species is based on a small sample size of occurrence locations, which often results in low model quality. Collection of additional, high-quality occurrence locations could greatly improve the modeled distribution for this species. This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

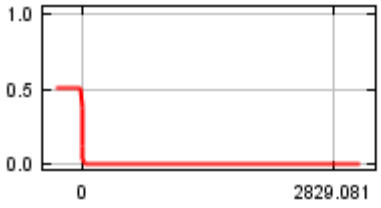
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Distance to Water	42
Warmest quarter mean temperature	19
Depth to Shallowest Restrictive Layer	13
Radiation Load	11
Degree Slope	10
Elevation	5

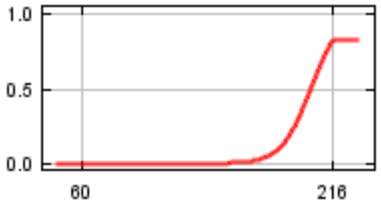
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

Distance to Water

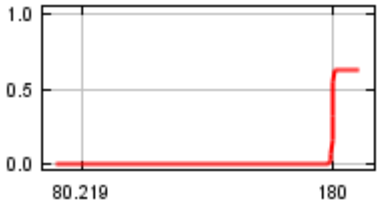


Warmest quarter mean temperature

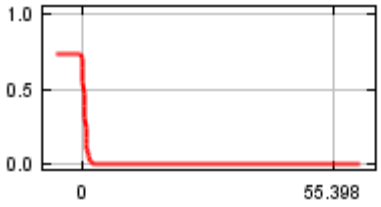


Depth to Shallowest Restrictive Layer

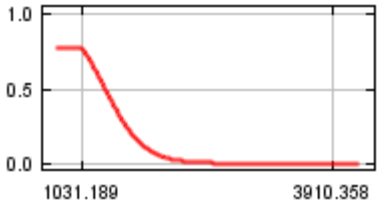
Radiation Load



Degree Slope



Elevation

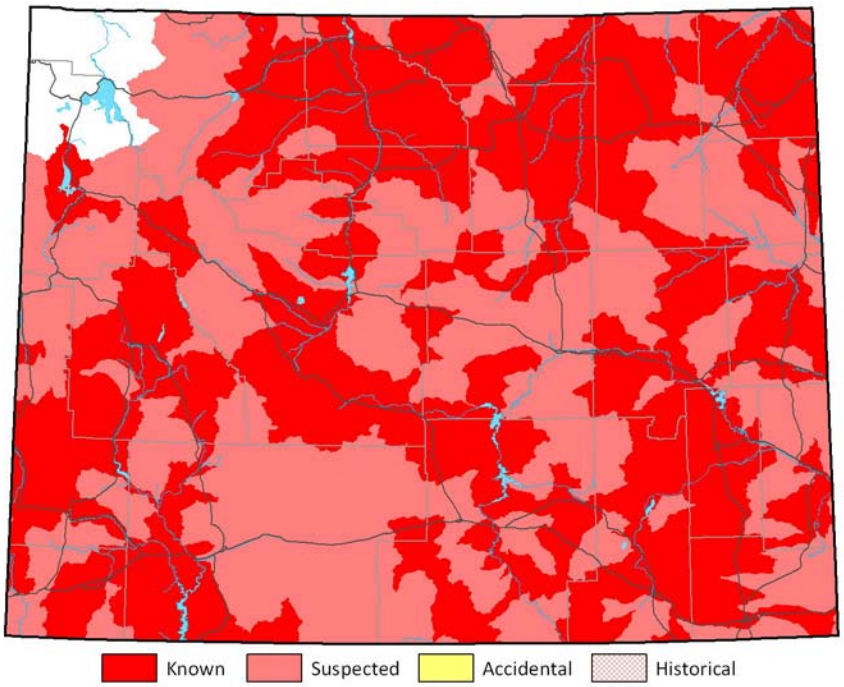


Northern Leopard Frog (*Lithobates pipiens*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Northern Leopard Frog (AAABH01170) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

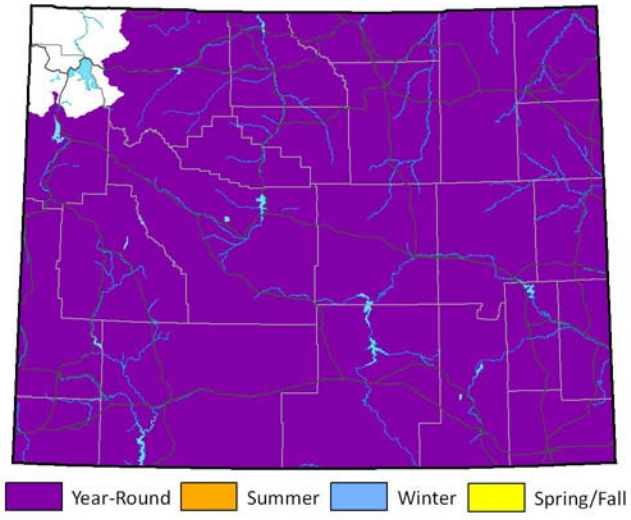
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.458
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



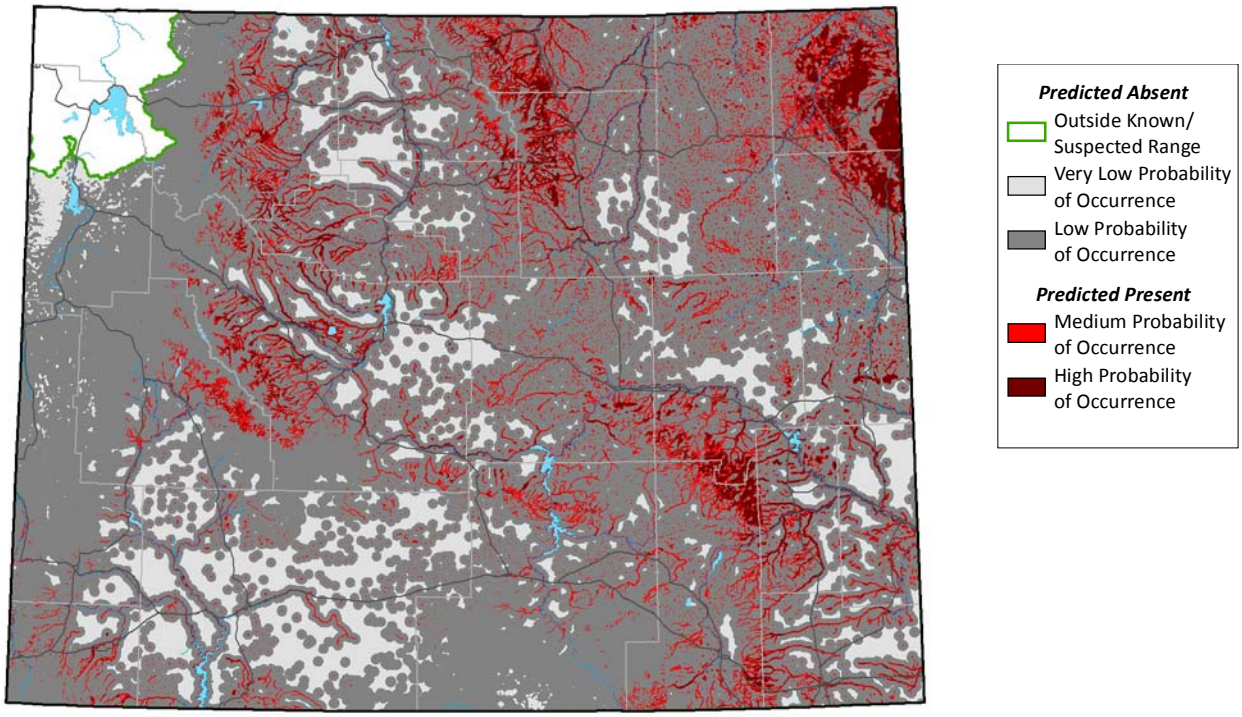
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Wed Mar 17 08:09:32 MDT 2010)

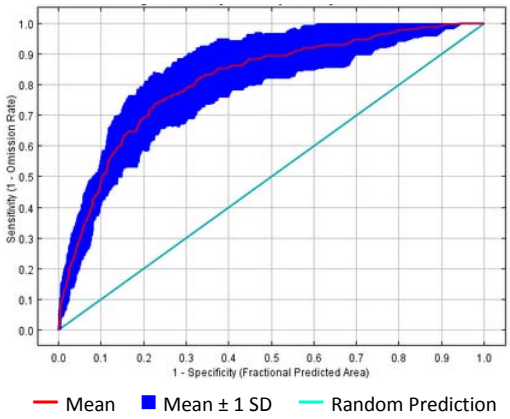
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4196310
- High-Probability Threshold Value: 0.5416970
- Low-Probability Threshold Value: 0.0122484

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: MEDIUM

Expert Assessment: Medium
Occurrence Sample Size: High
Quality of Occurrences: High
Positive Success Rate: Medium
Test AUC and Model Gain: Medium

Model Evaluation Statistics

Final Model Statistics

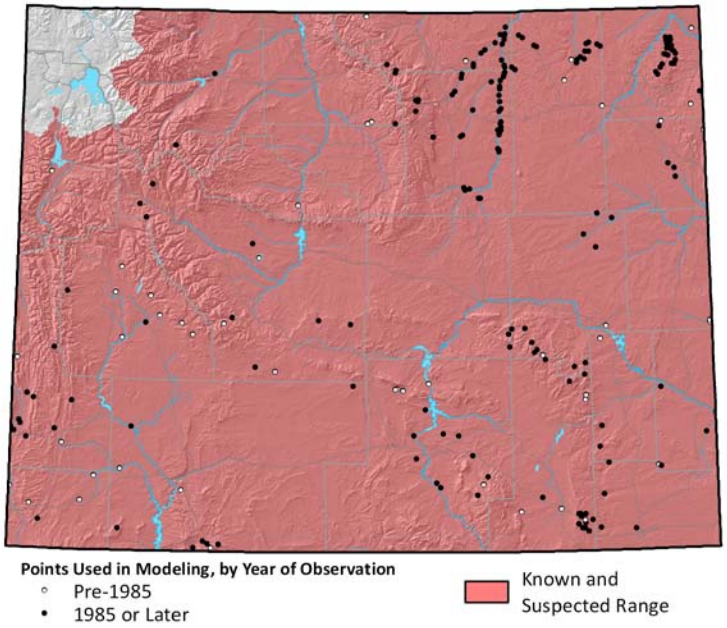
Training AUC: 0.819
Regularized Training Gain: 0.728

Cross-Validation Statistics

- Average Test AUC: 0.812 ± 0.062
- Upper Bound on Test AUC: 0.806
- Average Test Gain: 0.677 ± 0.376
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.29± 0.13

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,099
- Number of Occurrences used to create distribution model: 225
- Average Point Quality Index (highest quality is 12.00): 9.80 ± 2.84
- Most recent occurrence used: 2008
- Oldest occurrence used: 1950
- Occurrence File: LOCAL_SAMPLE_POINTS_W_PDOG_2.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

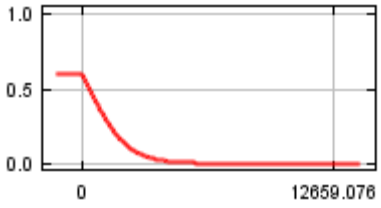
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Distance to Permanent Water	36
Deciduous Forest Index	18
Precipitation of the coldest quarter	16
Variation in monthly radiation	16
Annual Radiation range	13
Forest Cover Index	2

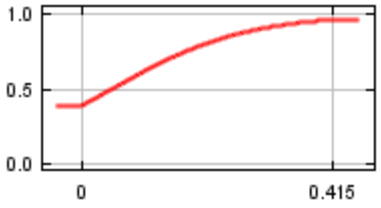
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

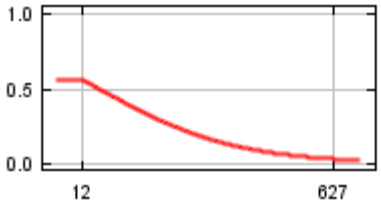
Distance to Permanent Water



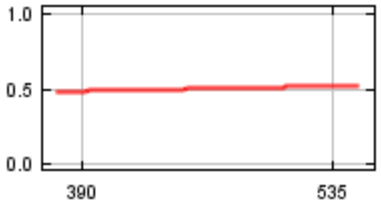
Deciduous Forest Index



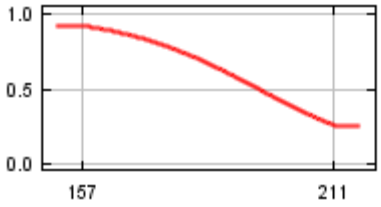
Precipitation of the coldest quarter



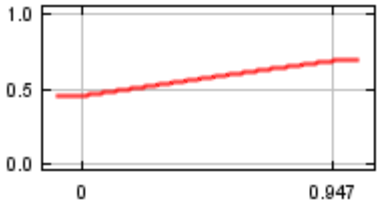
Variation in monthly radiation



Annual Radiation range



Forest Cover Index

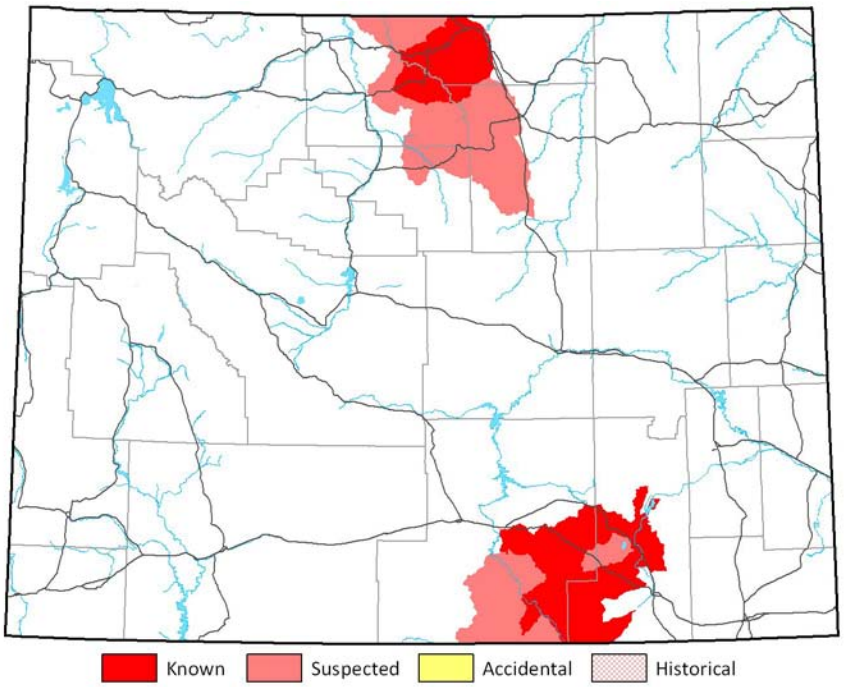


Wood Frog (*Lithobates sylvaticus*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Wood Frog (AAABH01200) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

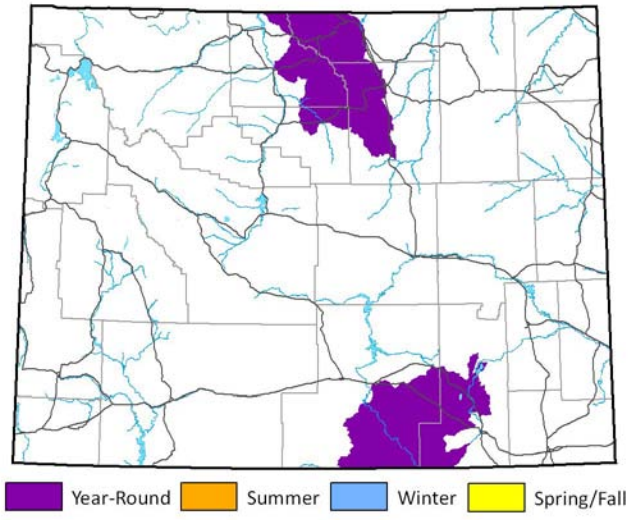
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.375
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



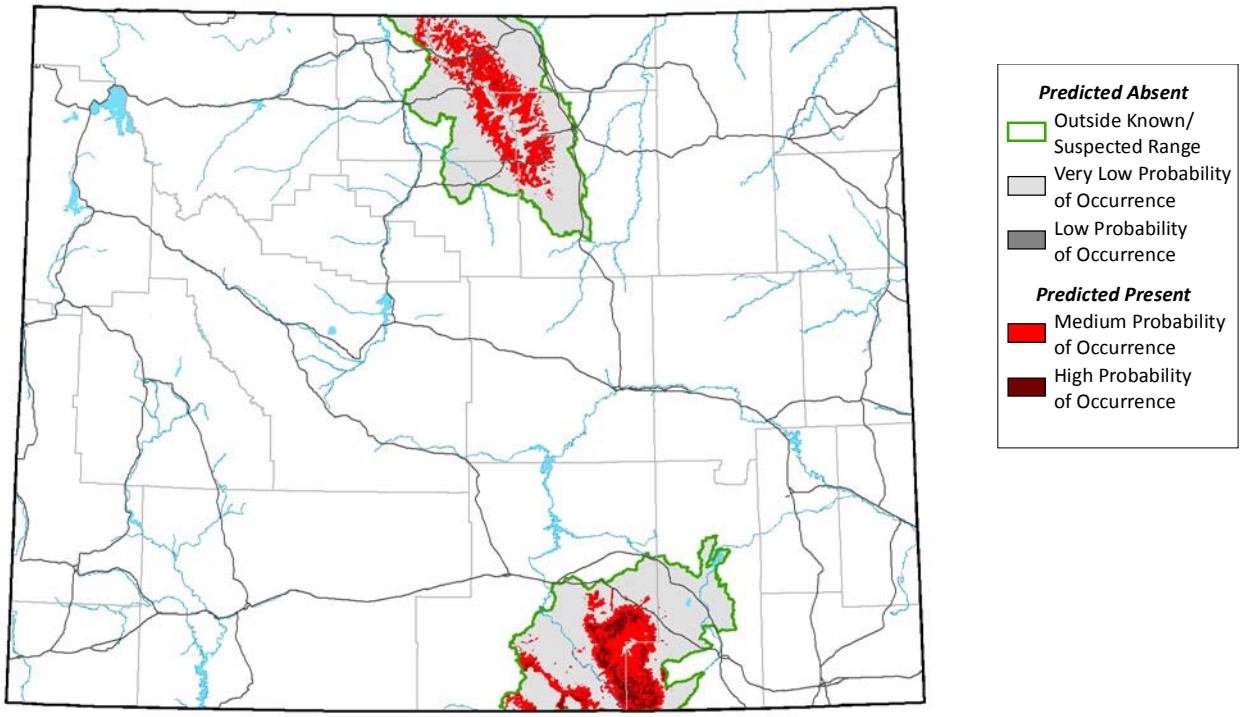
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Wed Mar 17 12:29:54 MDT 2010)

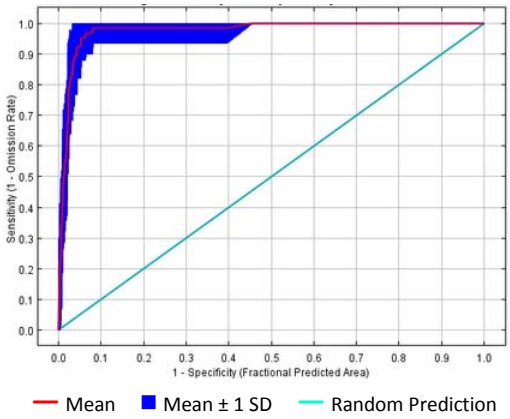
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.0461280
- High-Probability Threshold Value: 0.5653131
- Low-Probability Threshold Value: 0.0461280

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

Expert Assessment: Medium
Occurrence Sample Size: Medium-High
Quality of Occurrences: High
Positive Success Rate: Very High
Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

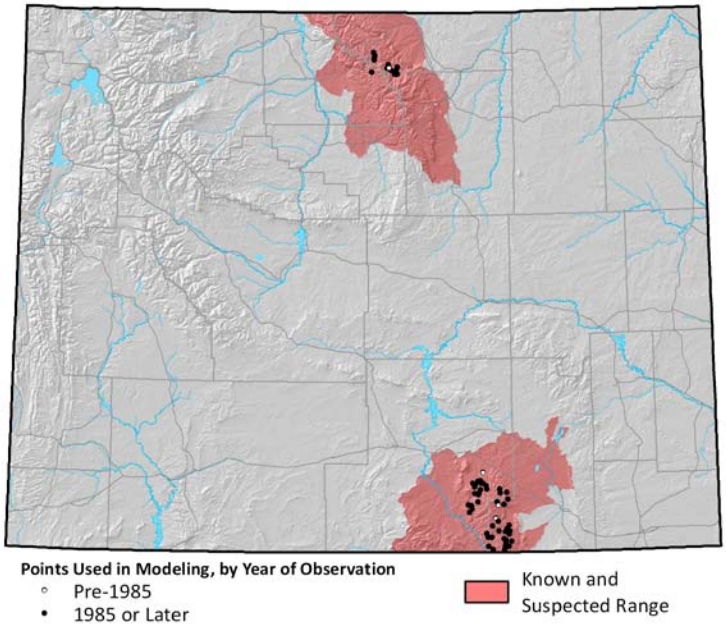
Training AUC: 0.985
Regularized Training Gain: 3.059

Cross-Validation Statistics

- Average Test AUC: 0.977 ± 0.023
- Upper Bound on Test AUC: 0.982
- Average Test Gain: 2.855 ± 0.792
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.05± 0.08

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 405
- Number of Occurrences used to create distribution model: 62
- Average Point Quality Index (highest quality is 12.00): 10.32 ± 2.02
- Most recent occurrence used: 2003
- Oldest occurrence used: 1963
- Occurrence File: LOCAL_SAMPLE_POINTS_W_PDOG_2.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps. Qualitative expert review of this model suggests that the binary version may over-predict the distribution of this species in Wyoming.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

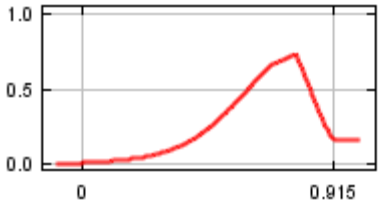
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Conifer Index	55
Wettest quarter mean temperature	21
Sagebrush Index	8
Forest Cover Index	7
Deciduous Forest Index	6
Distance to Permanent Water	4

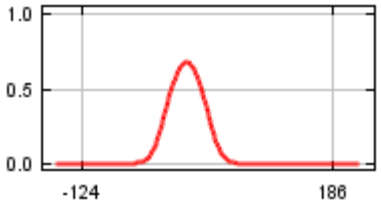
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

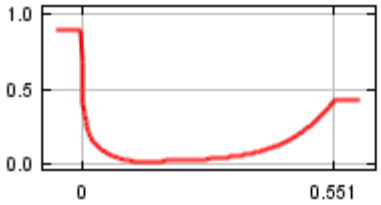
Conifer Index



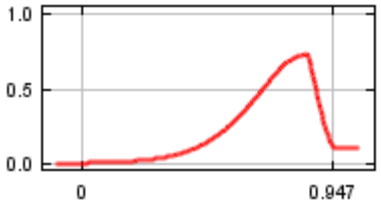
Wettest quarter mean temperature



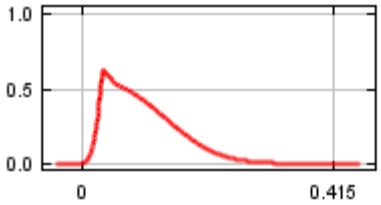
Sagebrush Index



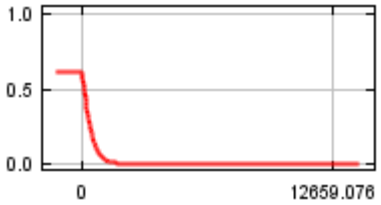
Forest Cover Index



Deciduous Forest Index



Distance to Permanent Water

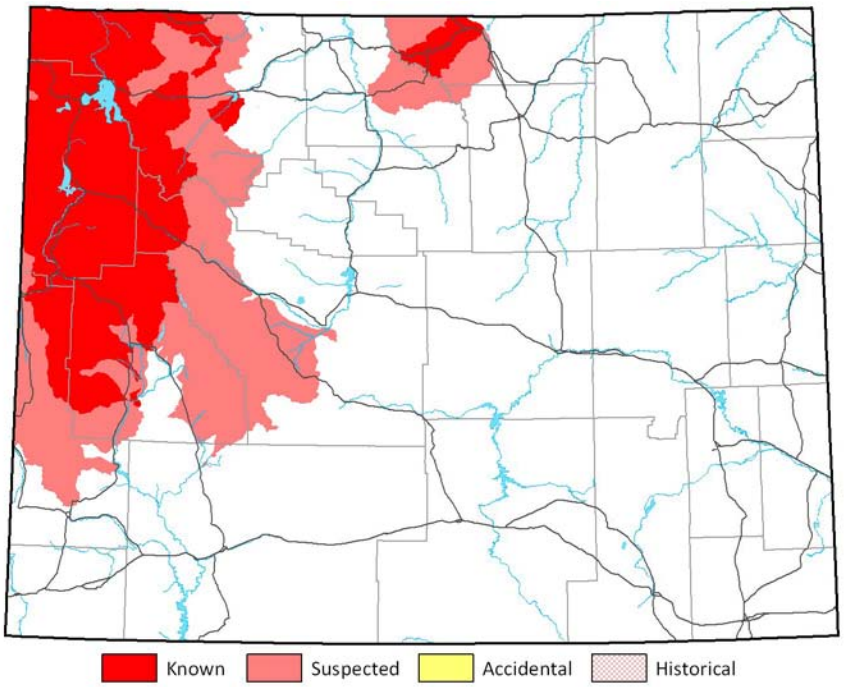


Columbia Spotted Frog (*Rana luteiventris*)
Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Columbia Spotted Frog (AAABH01290Q) in Wyoming (see Keinath et al. 2010b). Similar reports were developed by the Wyoming Natural Diversity Database for terrestrial vertebrate species of conservation need in Wyoming's State Wildlife Action Plan. This effort was supported by the Wyoming Game and Fish Department and the U.S. Geological Survey.

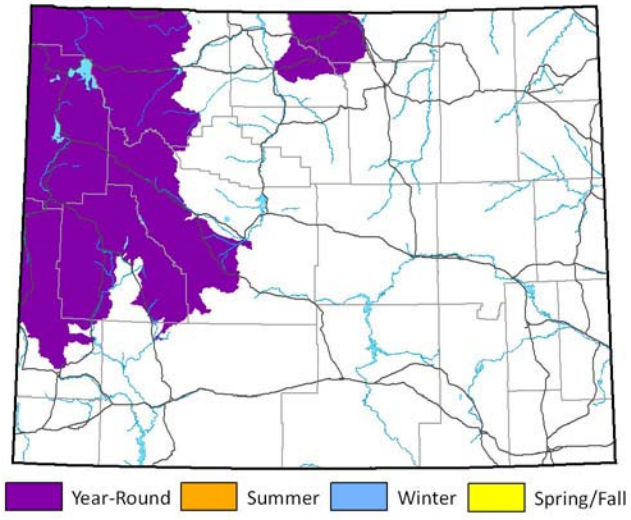
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.515
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



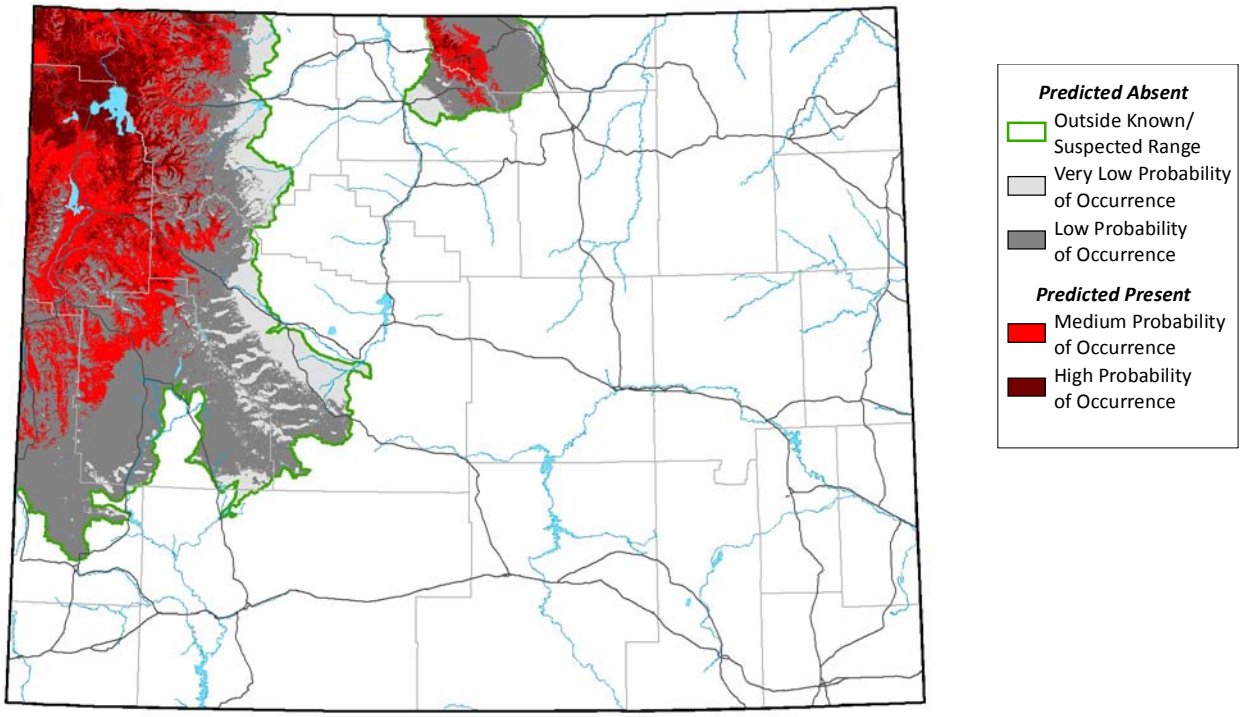
Maps, models and report were created by and are available from the Wyoming Natural Diversity Database. (http://uwadmnweb.uwyo.edu/wyndd/).

Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

Distribution Model (Version: Sun Dec 06 10:36:27 MST 2009)

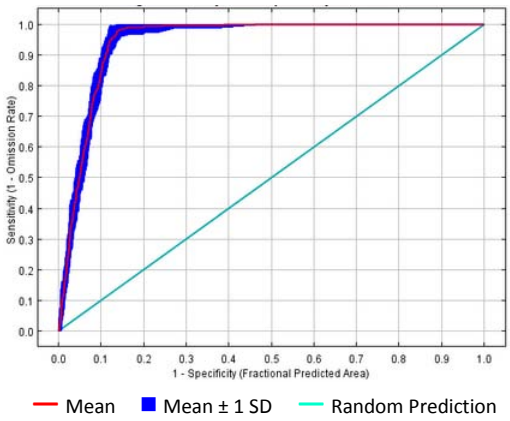
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Year-Round
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2362600
- High-Probability Threshold Value: 0.5391309
- Low-Probability Threshold Value: 0.0013363

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

Expert Assessment: Medium
Occurrence Sample Size: High
Quality of Occurrences: High
Positive Success Rate: Very High
Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

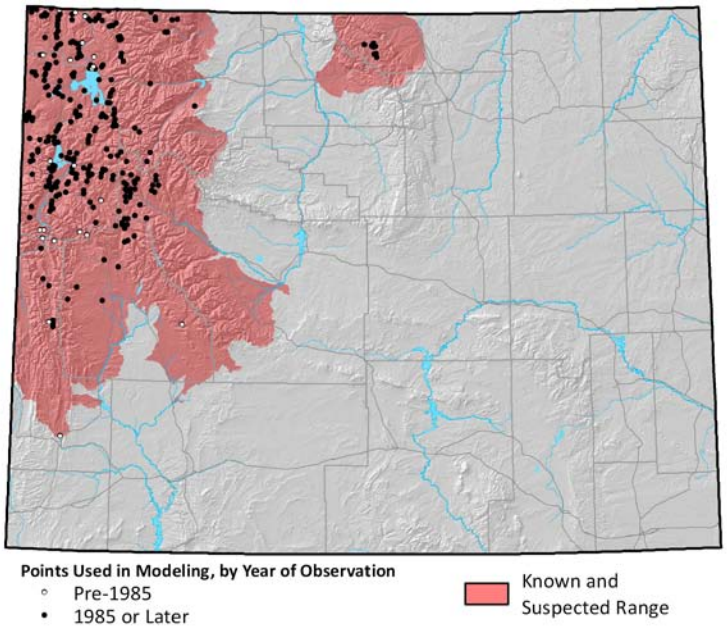
Training AUC: 0.949
Regularized Training Gain: 1.941

Cross-Validation Statistics

- Average Test AUC: 0.943 ± 0.010
- Upper Bound on Test AUC: 0.945
- Average Test Gain: 1.920 ± 0.198
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.02± 0.01

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 2,219
- Number of Occurrences used to create distribution model: 291
- Average Point Quality Index (highest quality is 12.00): 10.33 ± 2.26
- Most recent occurrence used: 2008
- Oldest occurrence used: 1950
- Occurrence File: LOCAL_SAMPLE_POINTS.csv

Comments

This species uses aspects of wetlands (e.g., dense emergent vegetation) for which statewide data are not available or reliable. This often results in low model quality because key habitat features are not mappable across the state. Great improvements in our ability to model this species distribution could be obtained by improving wetland maps.

References

Keinath, D.A., M.D. Andersen, and G.P Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.

Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010b. Range and modeled distribution of Wyoming's species of greatest conservation need. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.

Predictor Variables used in the Distribution Model

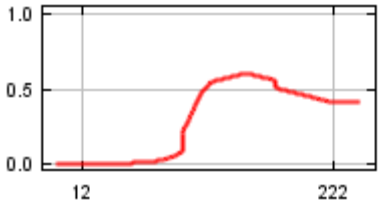
Percent Contribution (PC) to final model

Environmental Variable	*PC*
Precipitation of the driest quarter	69
Variation in monthly radiation	14
Precipitation of the driest month	9
Elevation	3
Variation of monthly precipitation	2
Degree Slope	2

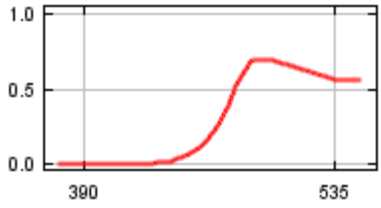
Response Curves

Each curve shows dependence of predicted suitability on input values of a single predictor variable considering correlations with others. Suitability is on the vertical axis (units: probability). Variable values are on the horizontal axis (units based on inputs; see Keinath et al 2010b for details).

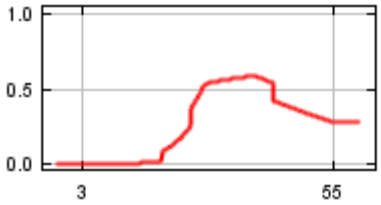
Precipitation of the driest quarter



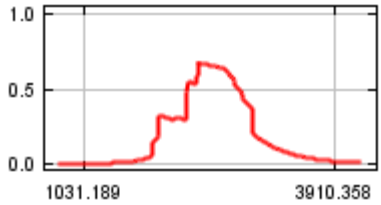
Variation in monthly radiation



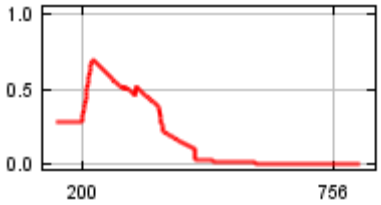
Precipitation of the driest month



Elevation



Variation of monthly precipitation



Degree Slope