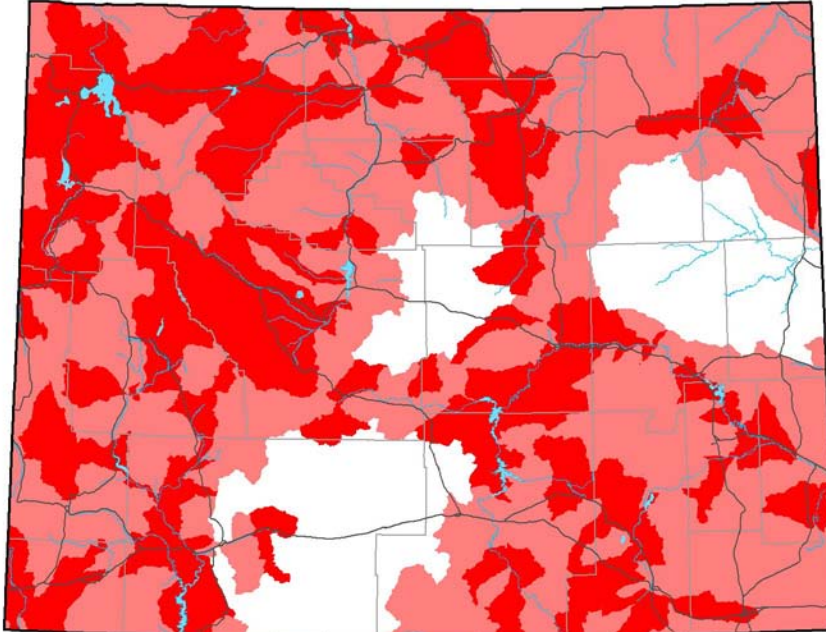


Common Loon (*Gavia immer*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Common Loon (ABNBA01030) 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.

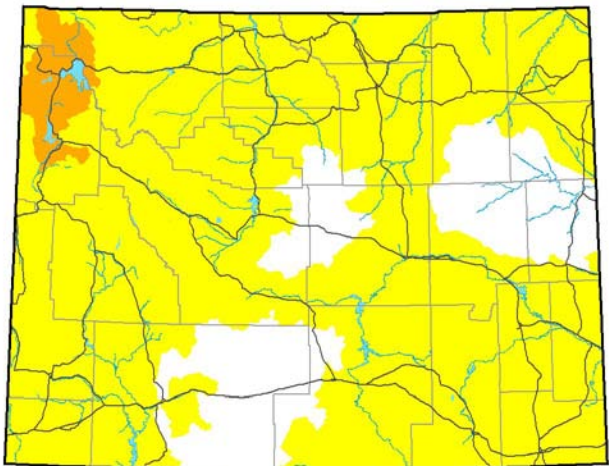
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 1.000
- 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/>).

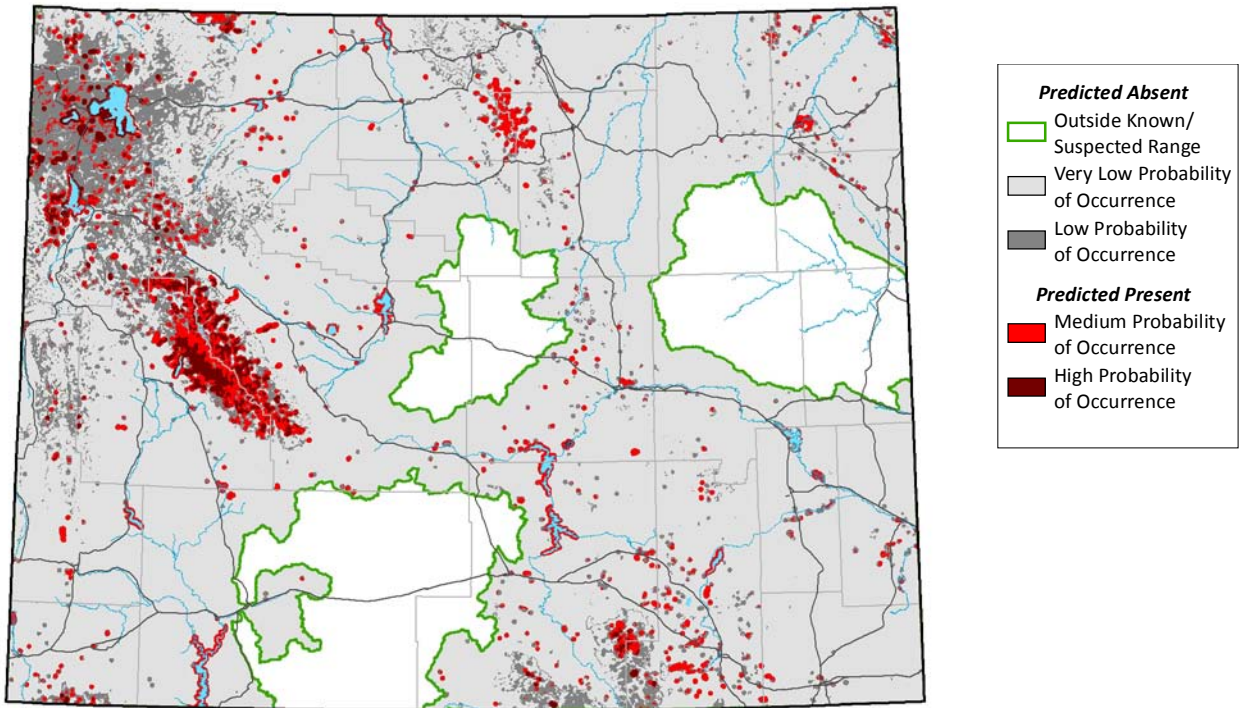
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 30 15:09:34 MDT 2010)

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



Model Parameters

- Season Modeled: Breeding (25-May- 31-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1399470
- High-Probability Threshold Value: 0.6187087
- Low-Probability Threshold Value: 0.0273487

Model Quality Summary

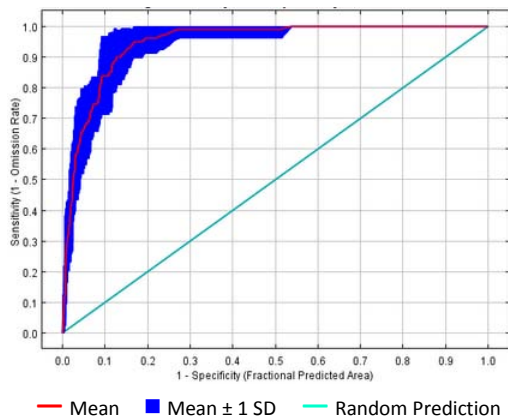
Overall Assessment of Model Quality: HIGH
 Expert Assessment: Medium
 Occurrence Sample Size: Medium-High
 Quality of Occurrences: Medium
 Positive Success Rate: High
 Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

Training AUC: 0.966
 Regularized Training Gain: 2.207

Model Evaluation - ROC Plot

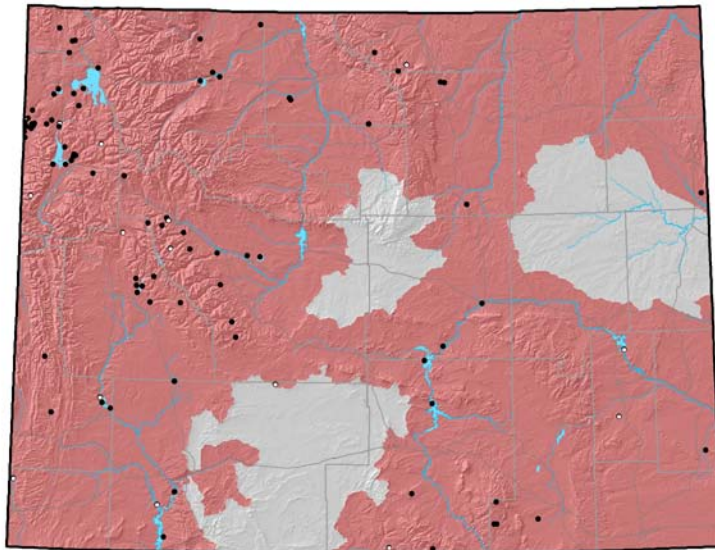


Cross-Validation Statistics

- Average Test AUC: 0.946 ± 0.021
- Upper Bound on Test AUC: 0.950
- Average Test Gain: 1.935 ± 0.356
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.13 ± 0.14

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 924
- Number of Occurrences used to create distribution model: 98
- Average Point Quality Index (highest quality is 12.00): 6.42 ± 2.21
- Most recent occurrence used: 2008
- Oldest occurrence used: 1979
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

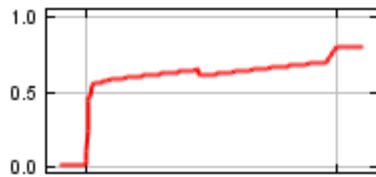
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Permanent Standing Water within 1600 meters	70
Herbaceous Cover Index	7
Conifer Index	6
Annual number of Frost Days	6
Annual Relative Humidity Range	6
Annual mean precipitation	5

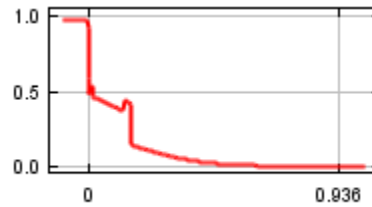
Response Curves

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).

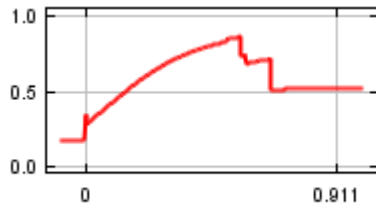
Prevalence of Permanent Standing Water within 1600 meters



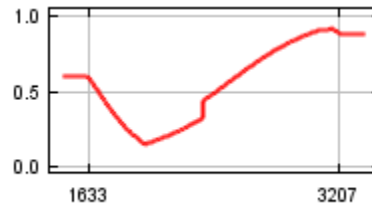
Herbaceous Cover Index



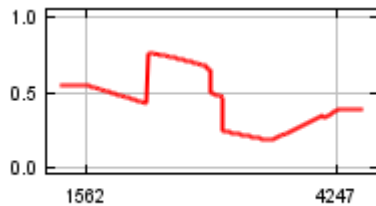
Conifer Index



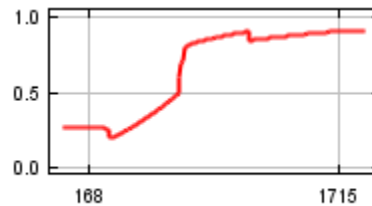
Annual number of Frost Days



Annual Relative Humidity Range



Annual mean precipitation

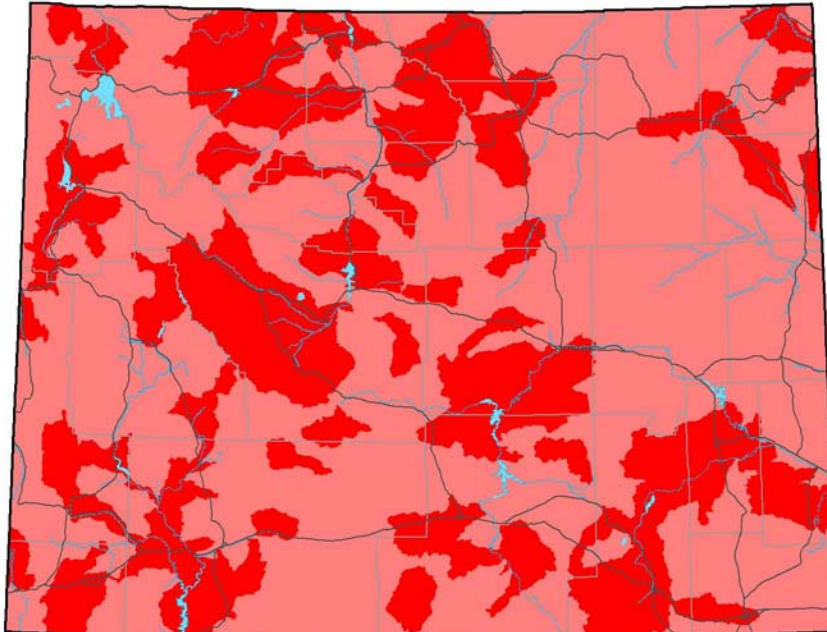


Western Grebe (*Aechmophorus occidentalis*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Western Grebe (ABNCA04010) 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

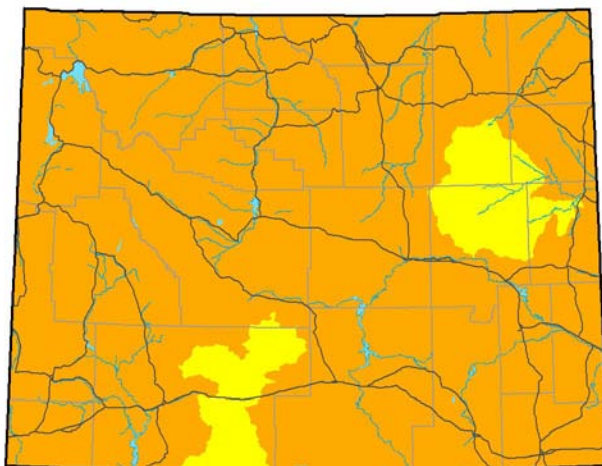


■ Known ■ Suspected ■ Accidental ■ Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.295
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



■ Year-Round ■ Summer ■ Winter ■ Spring/Fall

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

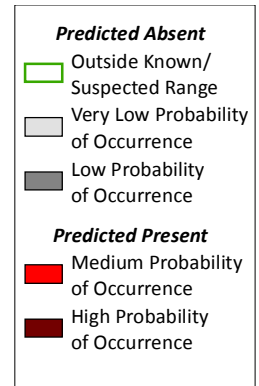
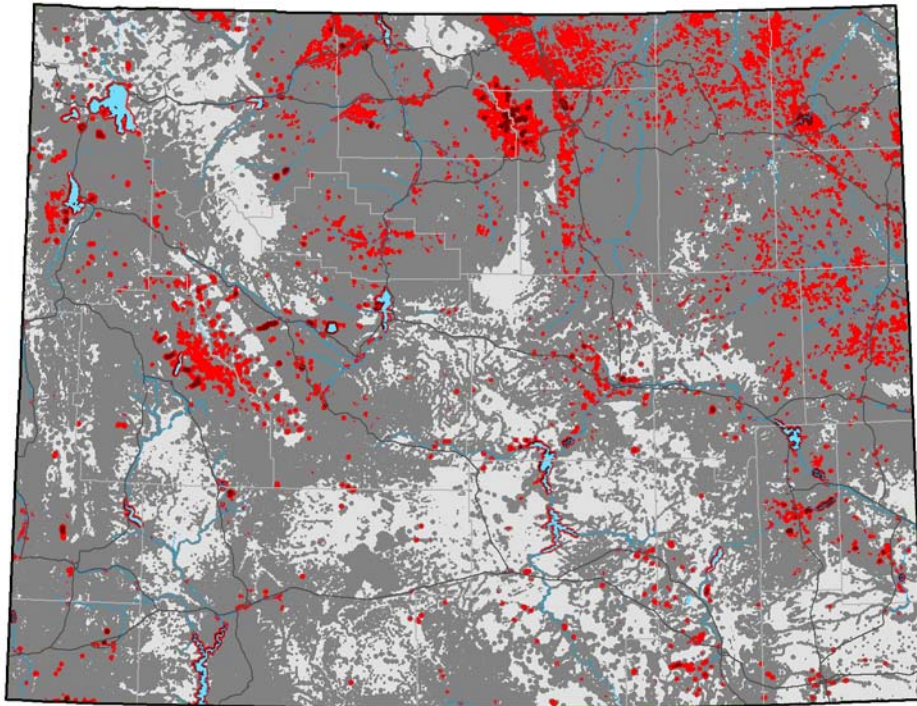
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 30 16:26:13 MDT 2010)

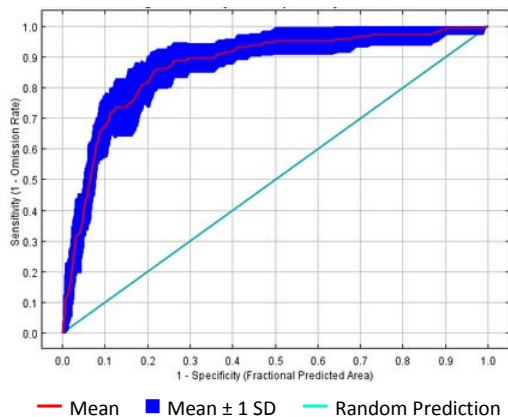
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (25-May- 31-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1976090
- High-Probability Threshold Value: 0.6322537
- Low-Probability Threshold Value: 0.0281695

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

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

Model Evaluation Statistics

Final Model Statistics

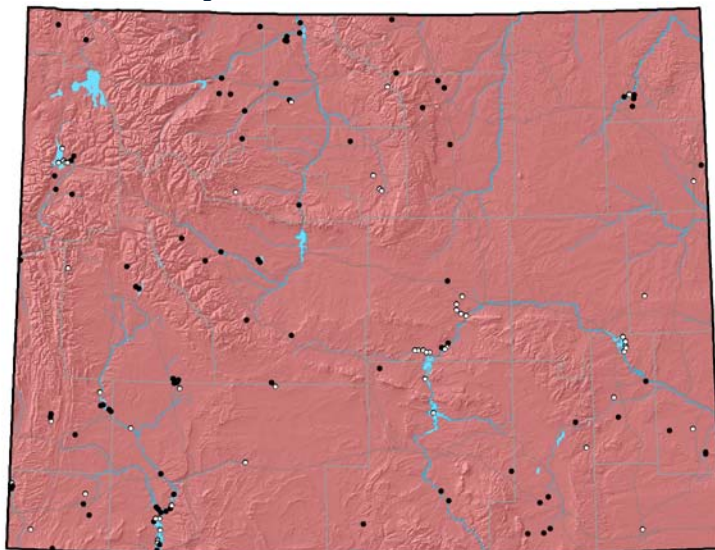
- Training AUC: 0.897
- Regularized Training Gain: 1.235

Cross-Validation Statistics

- Average Test AUC: 0.870 ± 0.032
- Upper Bound on Test AUC: 0.870
- Average Test Gain: 1.087 ± 0.263
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.20 ± 0.10

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 700
- Number of Occurrences used to create distribution model: 144
- Average Point Quality Index (highest quality is 12.00): 5.29 ± 1.38
- Most recent occurrence used: 2007
- Oldest occurrence used: 1977
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. Qualitative expert review of this model suggests that the binary version may over-predict the distribution of this species in Wyoming. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

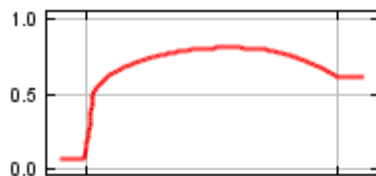
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Permanent Standing Water within 1600 meters	84
Elevation	5
Forest Cover Index	4
Isothermality (T2/T5)	3
Relative Humidity of most humid month	3
Variation in monthly Relative Humidity	2

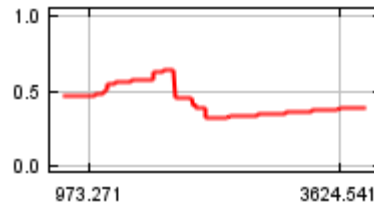
Response Curves

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).

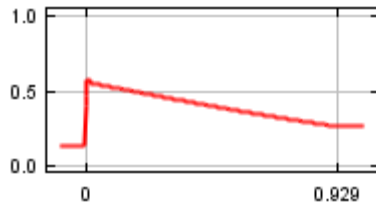
Prevalence of Permanent Standing Water within 1600 meters



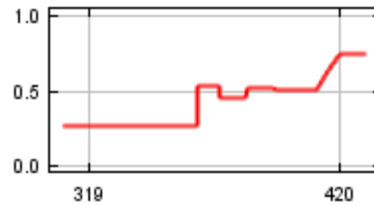
Elevation



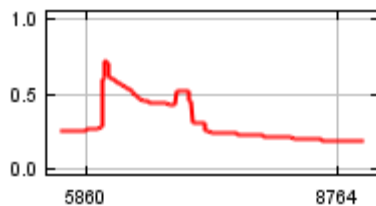
Forest Cover Index



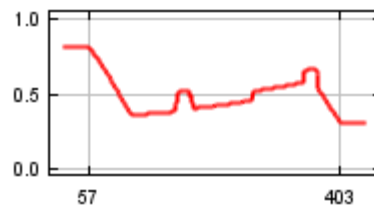
Isothermality (T2/T5)



Relative Humidity of most humid month



Variation in monthly Relative Humidity

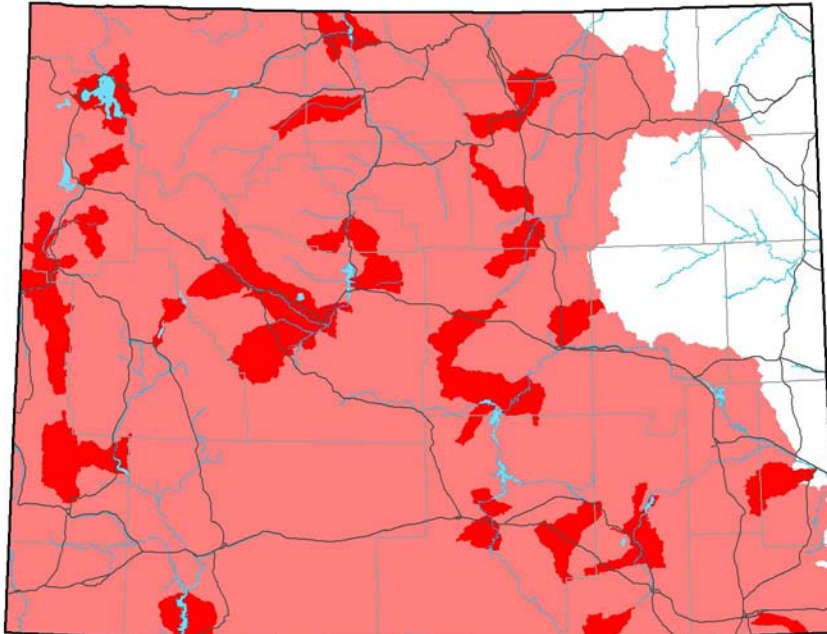


Clark's Grebe (*Aechmophorus clarkii*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Clark's Grebe (ABNCA04020) 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

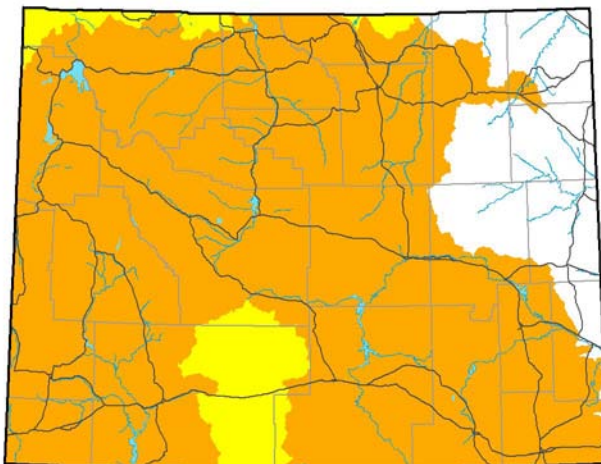


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.114
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

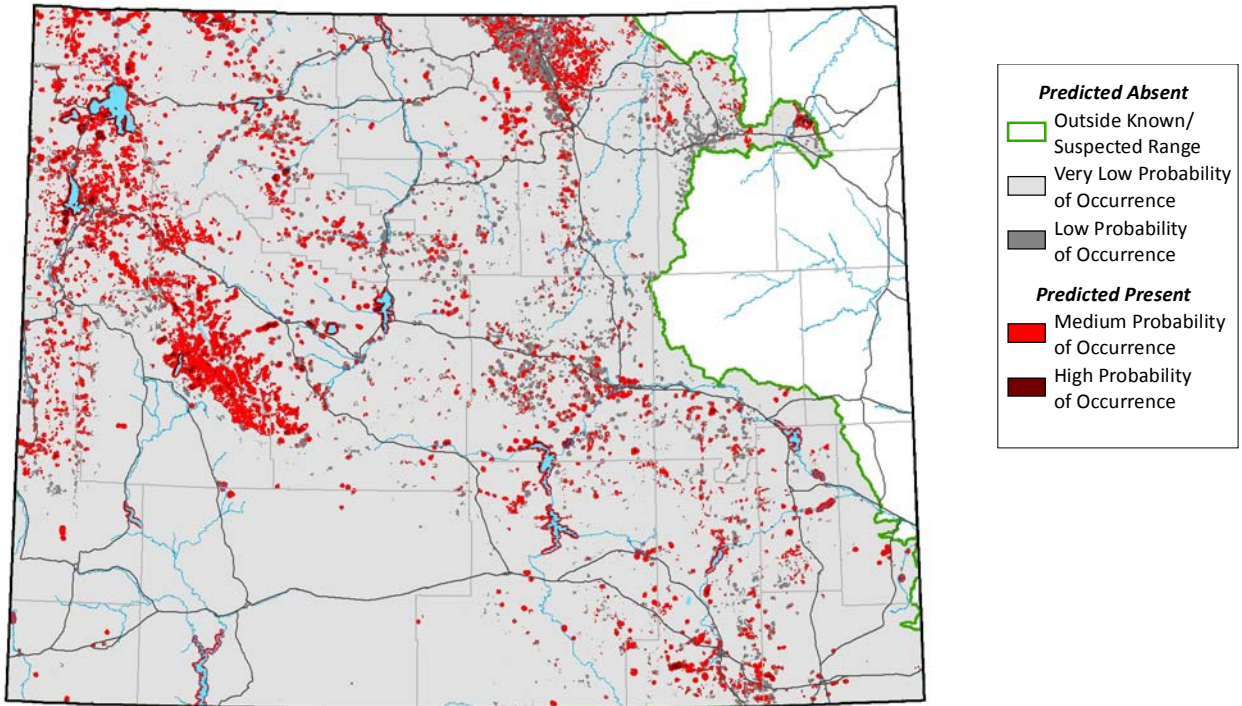
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Fri Apr 09 12:18:17 MDT 2010)

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



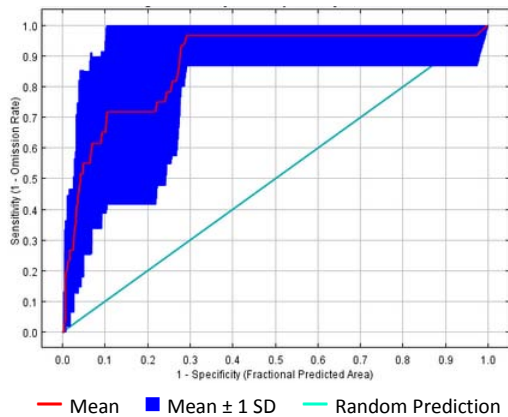
Model Parameters

- Season Modeled: Breeding (20-May- 31-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Equal training sensitivity and specificity
- Binary Threshold Value: 0.1589990
- High-Probability Threshold Value: 0.6735551
- Low-Probability Threshold Value: 0.1206929

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 - ROC Plot



Model Evaluation Statistics

Final Model Statistics

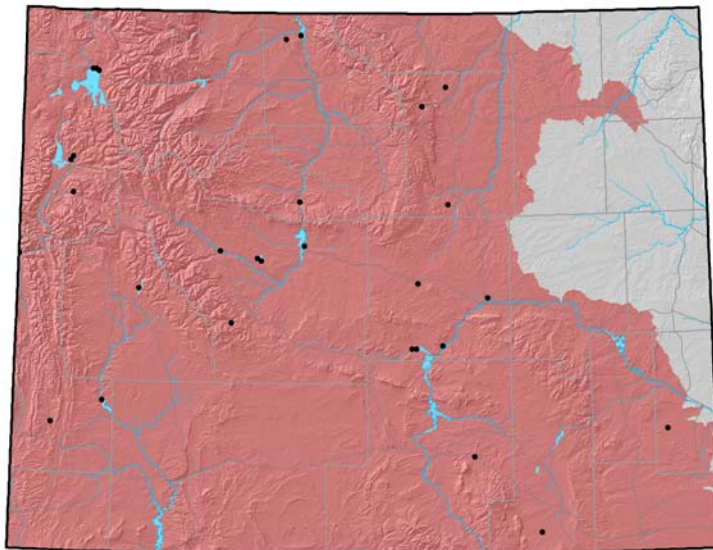
Training AUC: 0.943
 Regularized Training Gain: 1.628

Cross-Validation Statistics

- Average Test AUC: 0.876 ± 0.124
- Upper Bound on Test AUC: 0.916
- Average Test Gain: -0.054 ± 4.553
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.28 ± 0.31

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 65
- Number of Occurrences used to create distribution model: 29
- Average Point Quality Index (highest quality is 12.00): 6.45 ± 2.13
- Most recent occurrence used: 2005
- Oldest occurrence used: 1986
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

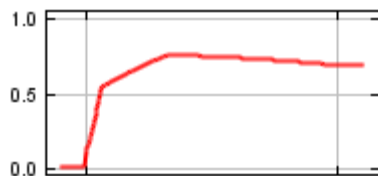
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Permanent Standing Water within 1600 meters	87
Radiation of the lightest month	6
Pinon-Juniper Index	3
Cottonwood Index	2
Wettest quarter mean temperature	1

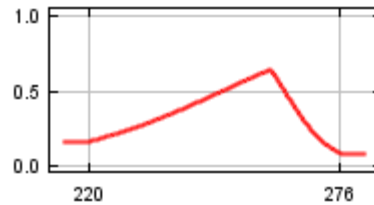
Response Curves

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).

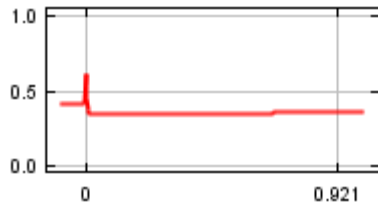
Prevalence of Permanent Standing Water within 1600 meters



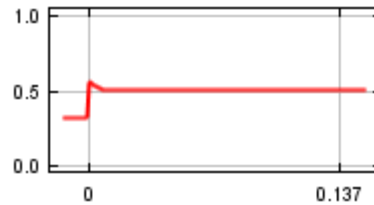
Radiation of the lightest month



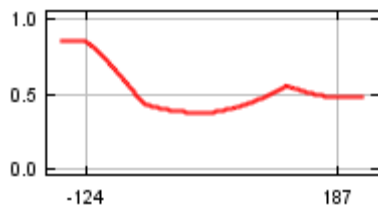
Pinon-Juniper Index



Cottonwood Index



Wettest quarter mean temperature

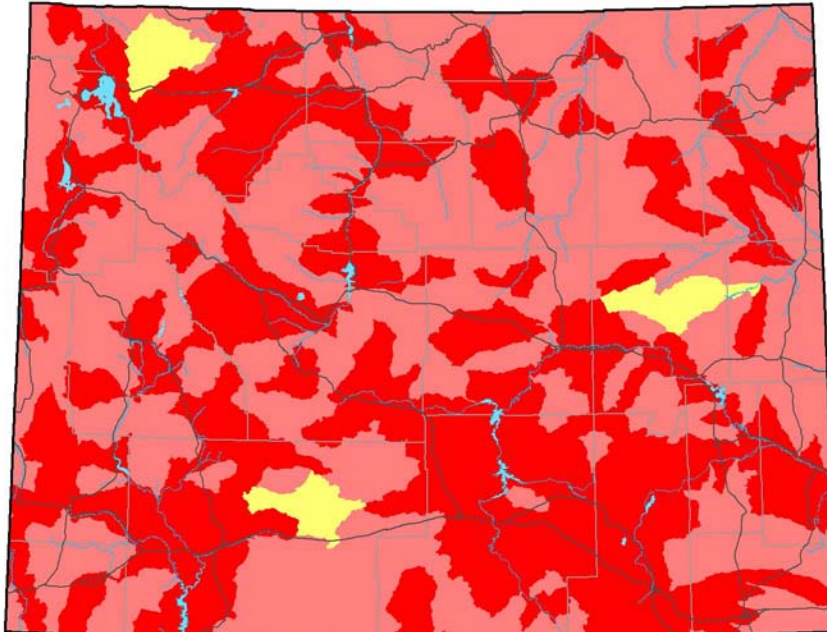


American White Pelican (*Pelecanus erythrorhynchos*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of American White Pelican (ABNFC01010) 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

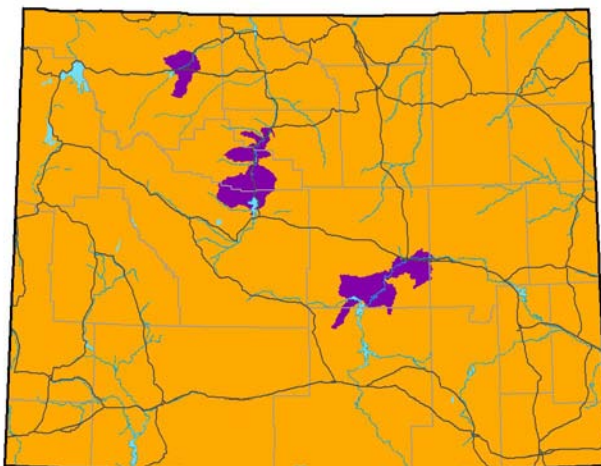


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.400
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

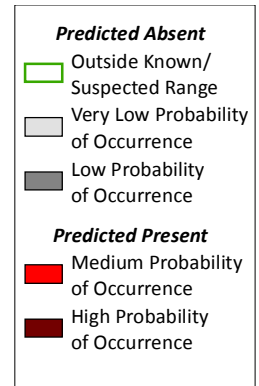
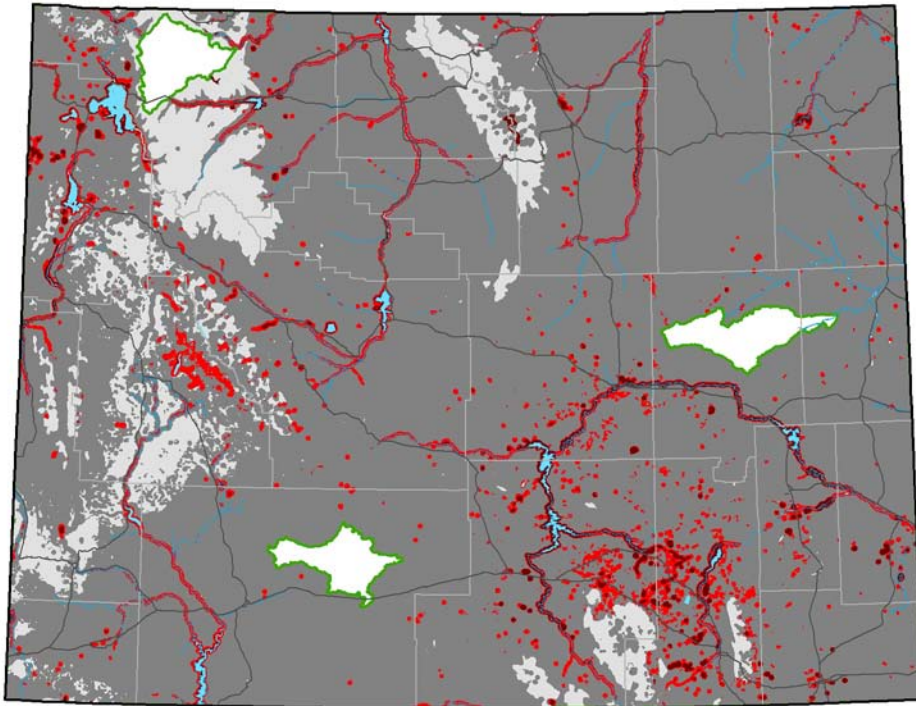
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 30 13:23:03 MDT 2010)

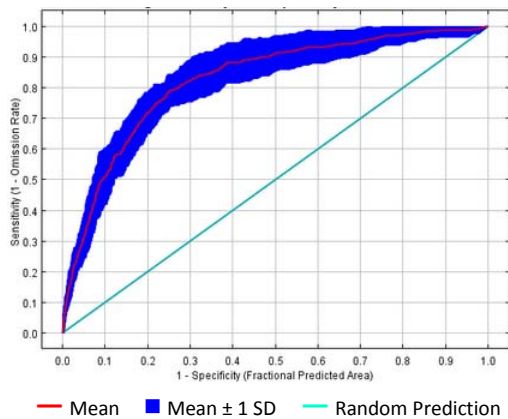
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-Apr- 25-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2886640
- High-Probability Threshold Value: 0.5786364
- Low-Probability Threshold Value: 0.0443388

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

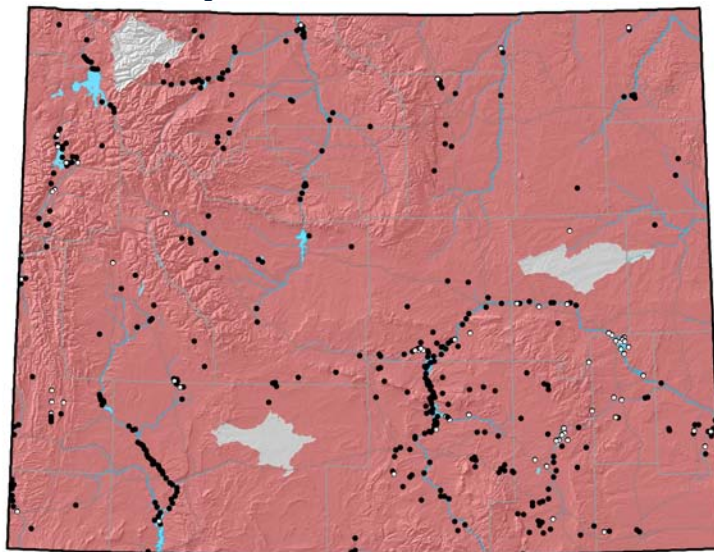
- Training AUC: 0.843
- Regularized Training Gain: 0.834

Cross-Validation Statistics

- Average Test AUC: 0.824 ± 0.044
- Upper Bound on Test AUC: 0.826
- Average Test Gain: 0.791 ± 0.230
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.22 ± 0.06

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,854
- Number of Occurrences used to create distribution model: 430
- Average Point Quality Index (highest quality is 12.00): 6.41 ± 1.89
- Most recent occurrence used: 2008
- Oldest occurrence used: 1964
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

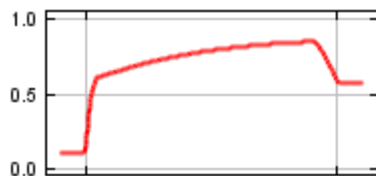
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Lakes/Large Rivers within 1600 meters	80
Coldest month mean minimum temperature	9
Annual temperature range (T3 – T4)	4
Relative Humidity of most humid month	4
Variation of monthly precipitation	2
Cottonwood Index	1

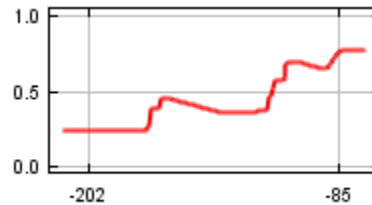
Response Curves

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).

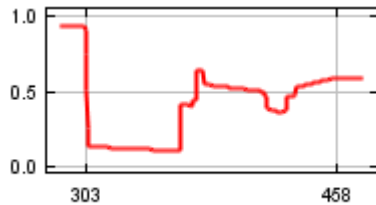
Prevalence of Lakes/Large Rivers within 1600 meters



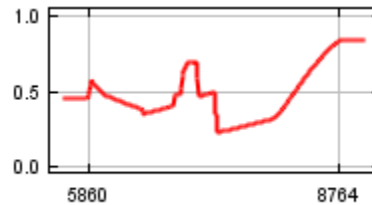
Coldest month mean minimum temperature



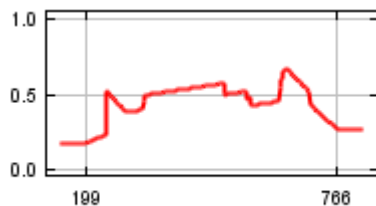
Annual temperature range (T3 – T4)



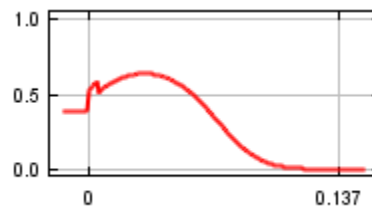
Relative Humidity of most humid month



Variation of monthly precipitation



Cottonwood Index

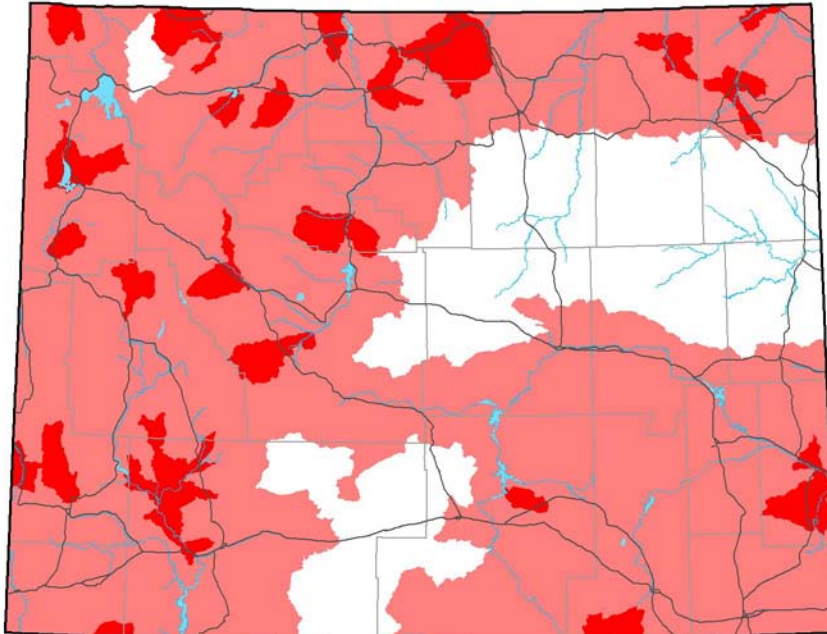


American Bittern (*Botaurus lentiginosus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of American Bittern (ABNGA01020) 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

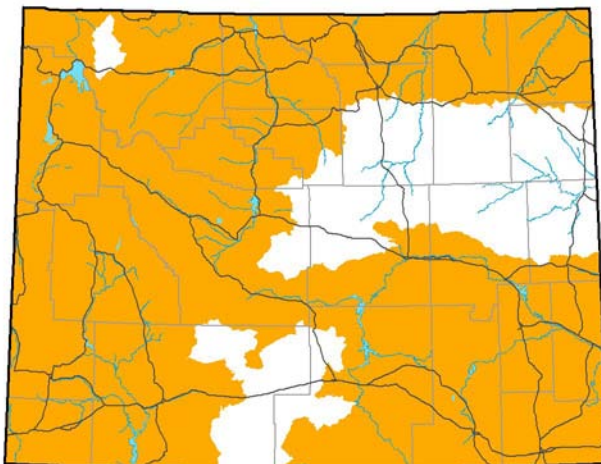


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.096
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

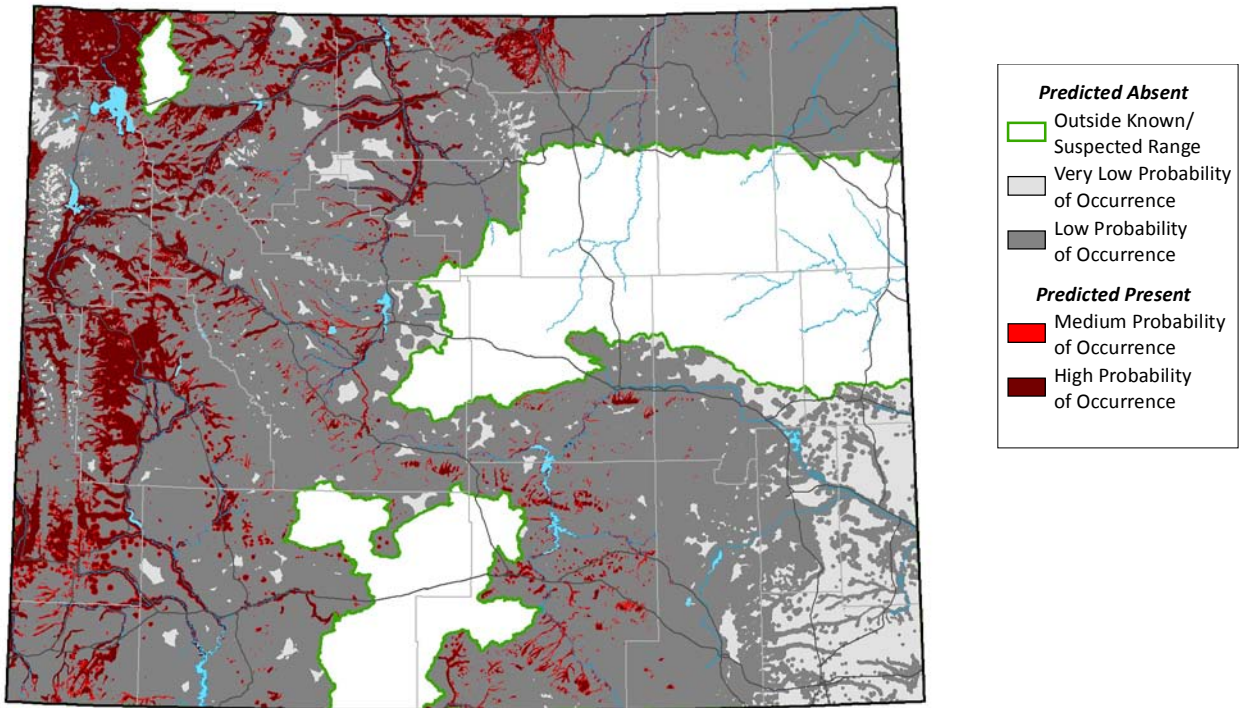
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 16 20:49:43 MDT 2010)

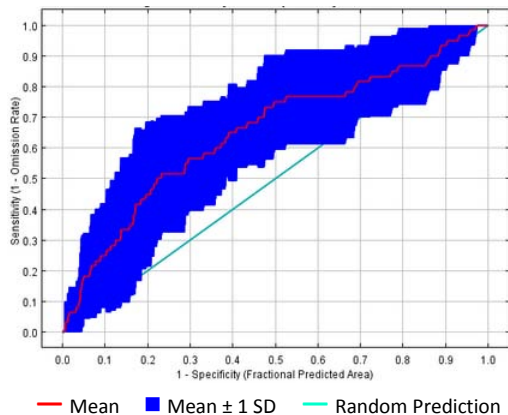
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (7-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.5116400
- High-Probability Threshold Value: 0.5355997
- Low-Probability Threshold Value: 0.1404112

Model Evaluation - ROC Plot



Model Quality Summary

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

Model Evaluation Statistics

Final Model Statistics

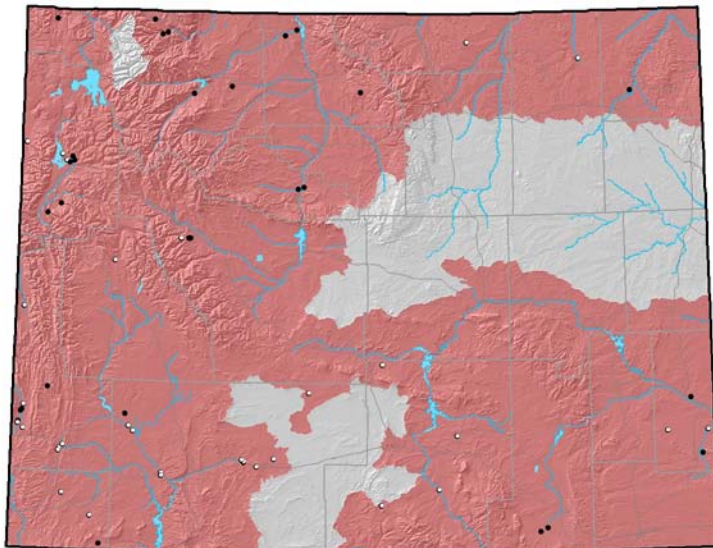
Training AUC: 0.690
 Regularized Training Gain: 0.177

Cross-Validation Statistics

- Average Test AUC: 0.652 ± 0.118
- Upper Bound on Test AUC: 0.665
- Average Test Gain: 0.104 ± 0.262
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.47 ± 0.23

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 151
- Number of Occurrences used to create distribution model: 60
- Average Point Quality Index (highest quality is 12.00): 5.45 ± 1.68
- Most recent occurrence used: 2004
- Oldest occurrence used: 1970
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

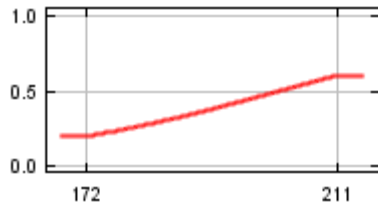
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Annual Radiation range	26
Annual precipitation range (P3 – P2)	23
Distance to Permanent Water	20
Variation in monthly radiation	19
Depth to Shallowest Restrictive Layer	10
Variation of monthly precipitation	2

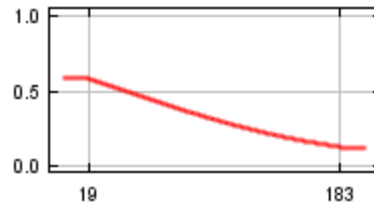
Response Curves

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).

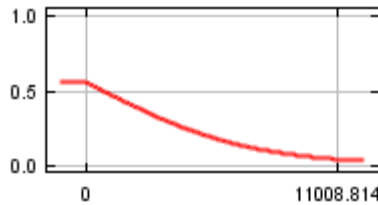
Annual Radiation range



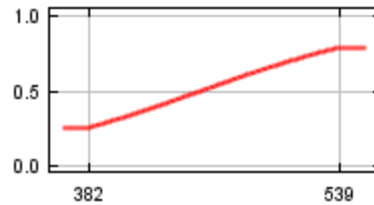
Annual precipitation range (P3 – P2)



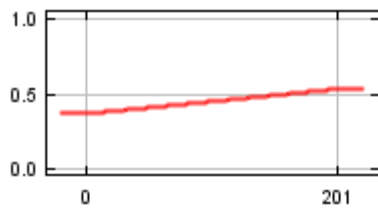
Distance to Permanent Water



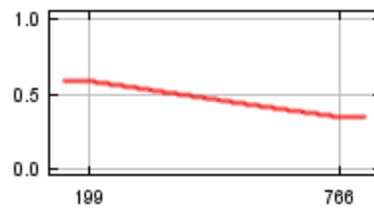
Variation in monthly radiation



Depth to Shallowest Restrictive Layer



Variation of monthly precipitation

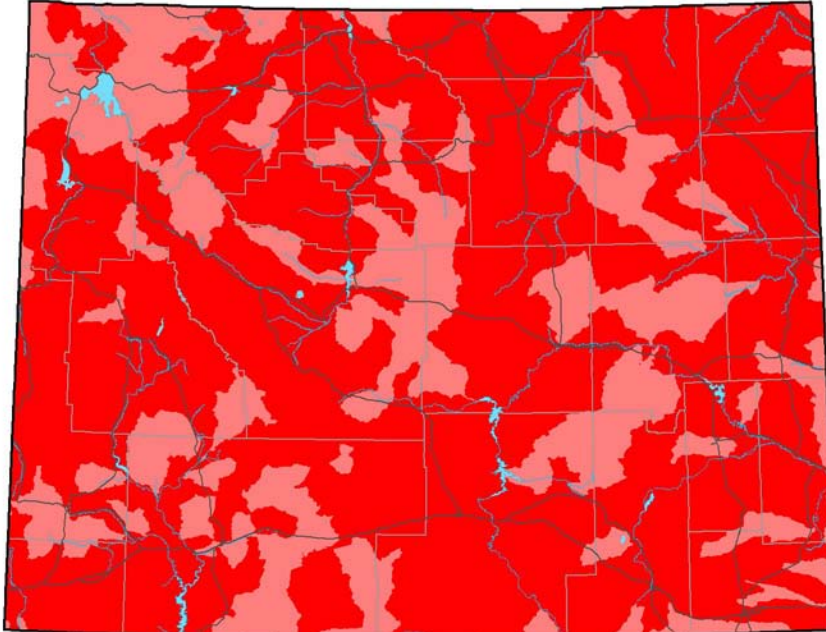


Great Blue Heron (*Ardea herodias*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Great Blue Heron (ABNGA04010) 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

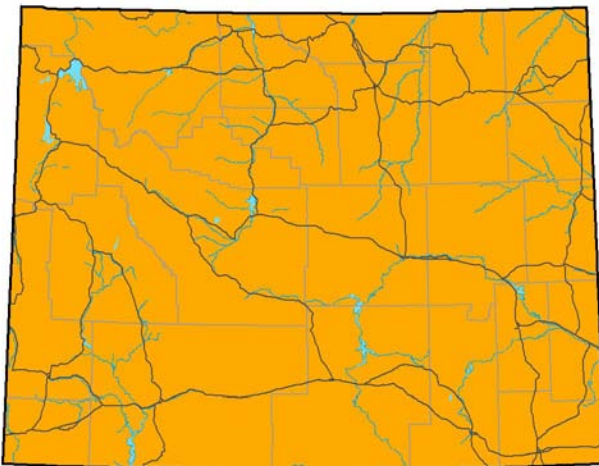


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.634
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

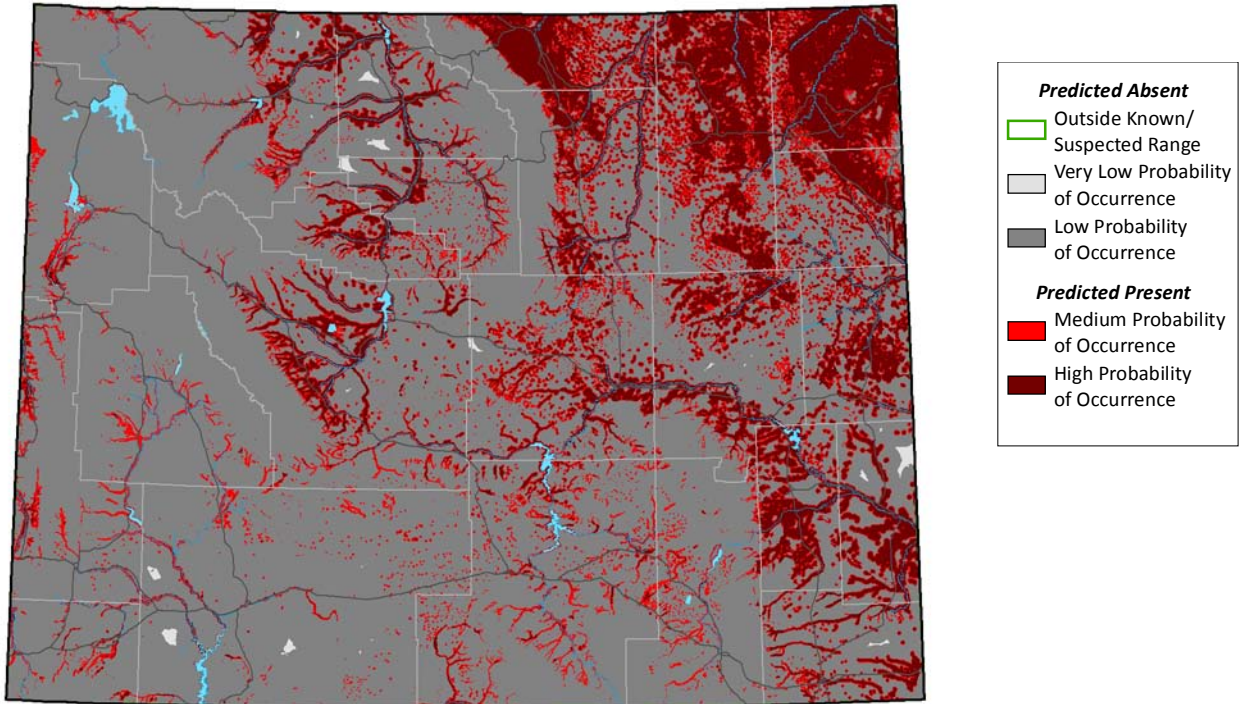
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Mar 17 01:12:37 MDT 2010)

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



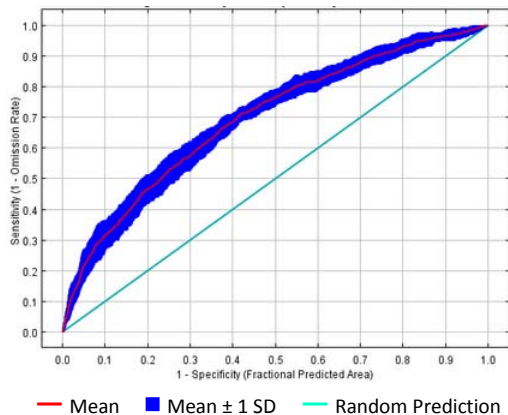
Model Parameters

- Season Modeled: Breeding (25-Mar- 31-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4160760
- High-Probability Threshold Value: 0.4832493
- Low-Probability Threshold Value: 0.0117899

Model Quality Summary

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

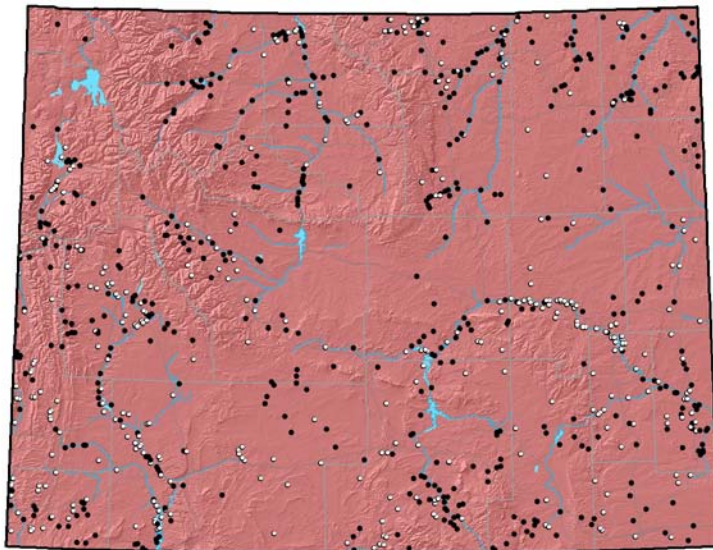
Training AUC: 0.701
 Regularized Training Gain: 0.273

Cross-Validation Statistics

- Average Test AUC: 0.695 ± 0.023
- Upper Bound on Test AUC: 0.694
- Average Test Gain: 0.253 ± 0.095
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.33± 0.04

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 2,671
- Number of Occurrences used to create distribution model: 847
- Average Point Quality Index (highest quality is 12.00): 5.65 ± 1.32
- Most recent occurrence used: 2007
- Oldest occurrence used: 1959
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

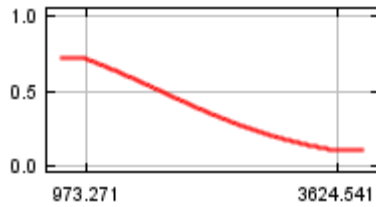
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Elevation	31
Distance to Permanent Water	24
Annual mean temperature	19
Depth to Shallowest Restrictive Layer	14
Cottonwood Index	11
Deciduous Forest Index	1

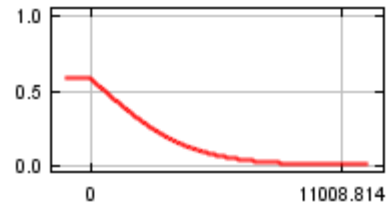
Response Curves

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).

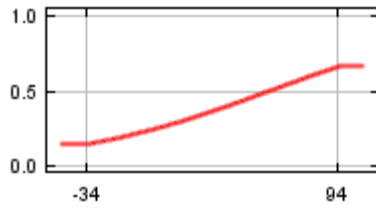
Elevation



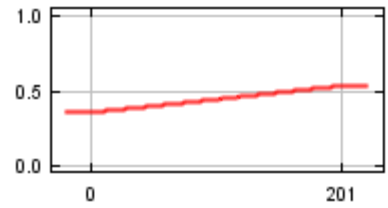
Distance to Permanent Water



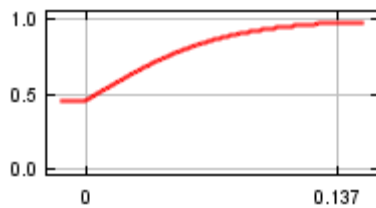
Annual mean temperature



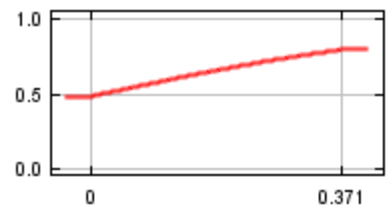
Depth to Shallowest Restrictive Layer



Cottonwood Index



Deciduous Forest Index

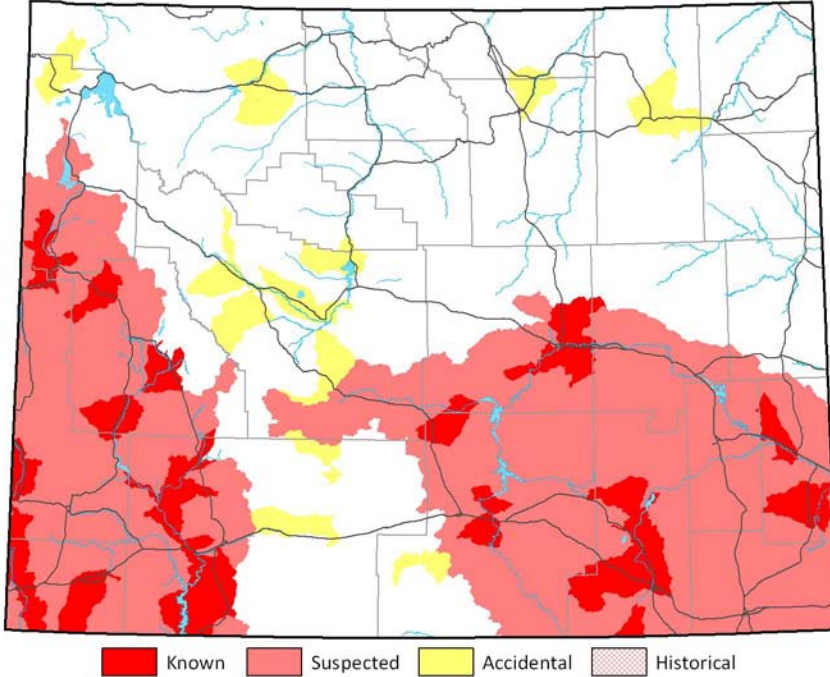


Snowy Egret (*Egretta thula*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Snowy Egret (ABNGA06030) 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.

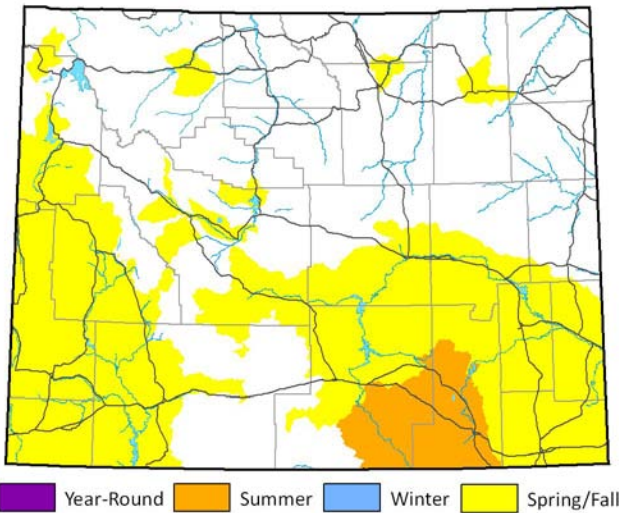
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.217
- 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/>).

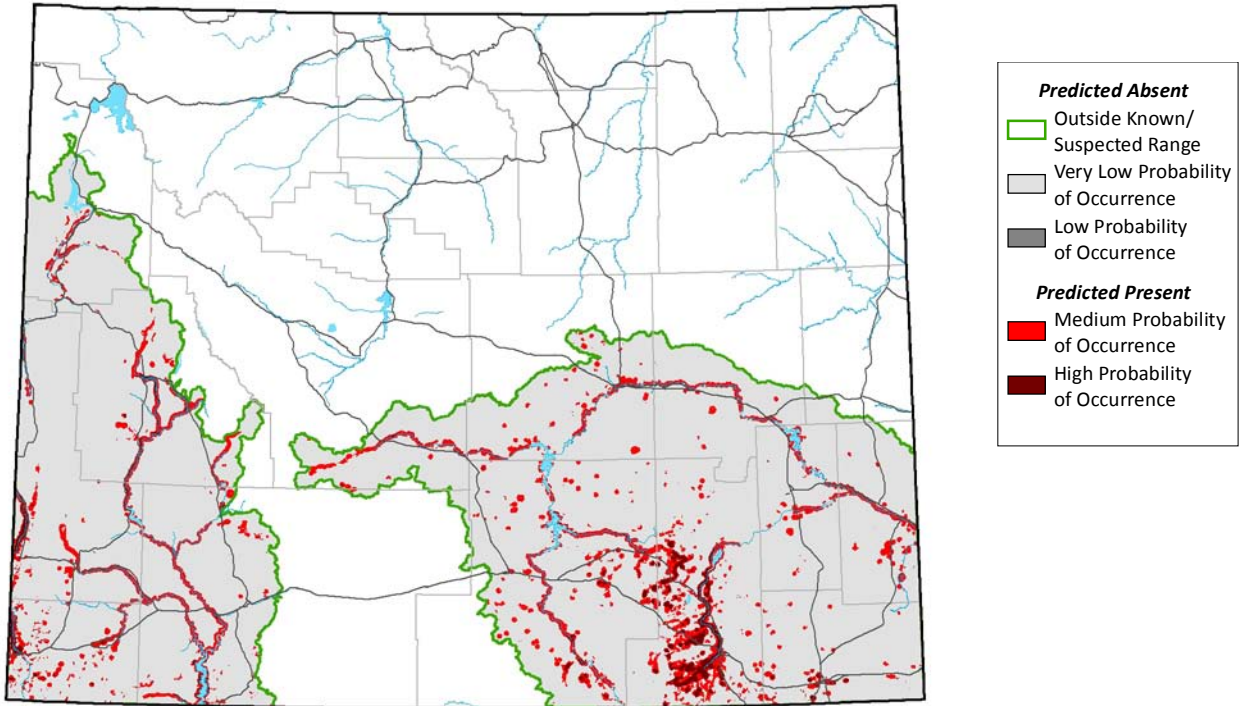
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 30 13:21:51 MDT 2010)

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



Model Parameters

- Season Modeled: Breeding (1-May- 25-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1242050
- High-Probability Threshold Value: 0.5920071
- Low-Probability Threshold Value: 0.1242048

Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

Expert Assessment: Medium

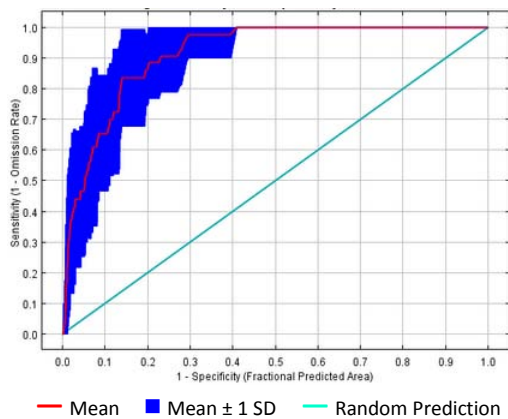
Occurrence Sample Size: Medium

Quality of Occurrences: Low

Positive Success Rate: High

Test AUC and Model Gain: High

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

Training AUC: 0.942

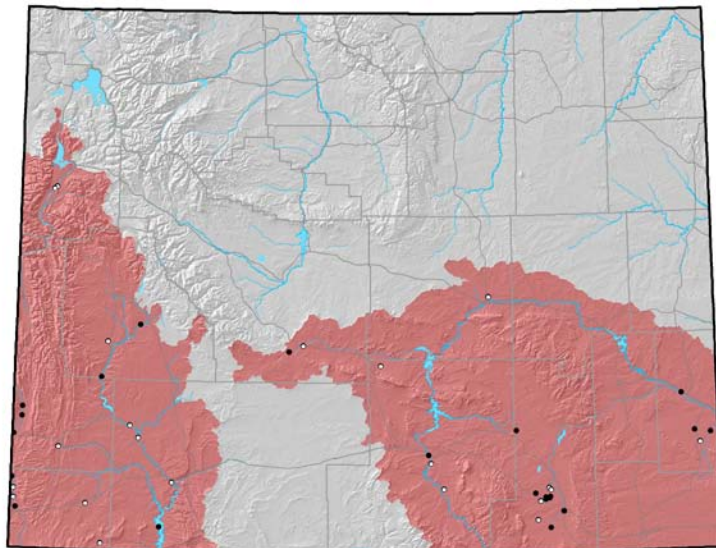
Regularized Training Gain: 1.620

Cross-Validation Statistics

- Average Test AUC: 0.914 ± 0.040
- Upper Bound on Test AUC: 0.920
- Average Test Gain: 1.449 ± 0.631
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.17 ± 0.17

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 163
- Number of Occurrences used to create distribution model: 43
- Average Point Quality Index (highest quality is 12.00): 5.30 ± 1.47
- Most recent occurrence used: 2005
- Oldest occurrence used: 1979
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

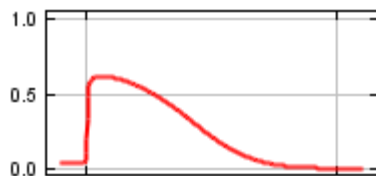
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Lakes/Large Rivers within 1600 meters	56
Pinon-Juniper Index	10
Radiation of the darkest month	10
Annual total radiation	10
Forest Cover Index	7
Interannual variation in annual frost days	7

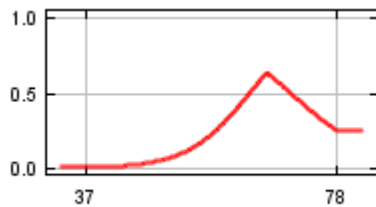
Response Curves

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).

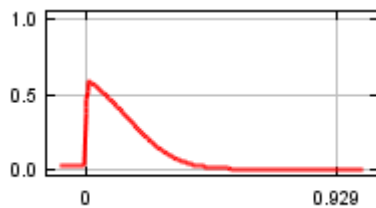
Prevalence of Lakes/Large Rivers within 1600 meters



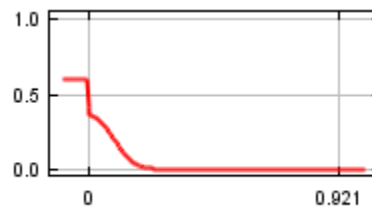
Radiation of the darkest month



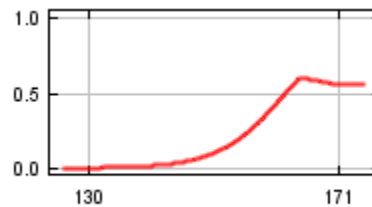
Forest Cover Index



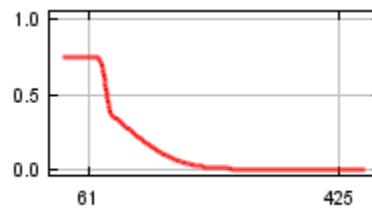
Pinon-Juniper Index



Annual total radiation



Interannual variation in annual frost days

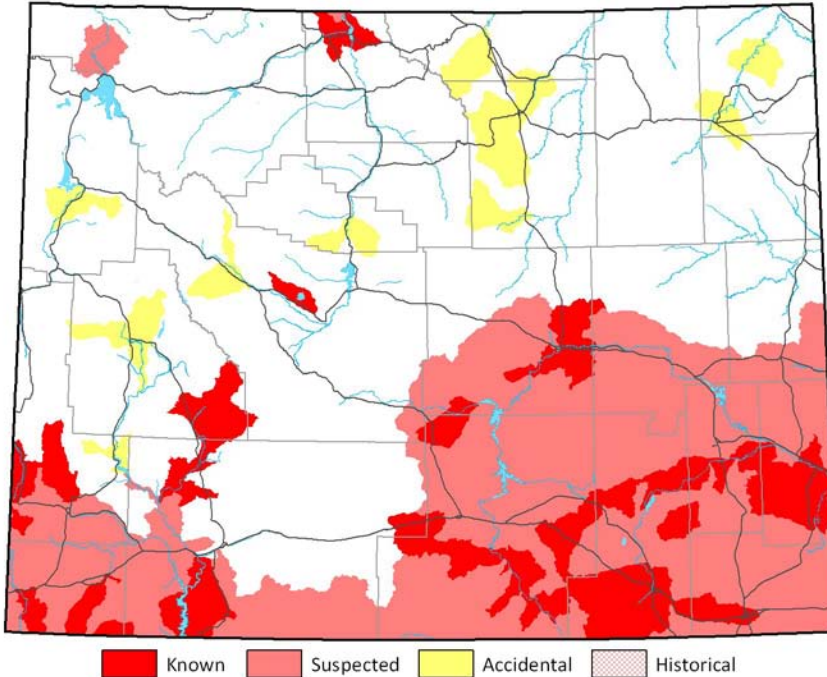


Black-crowned Night-Heron (*Nycticorax nycticorax*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Black-crowned Night-Heron (ABNGA11010) 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.

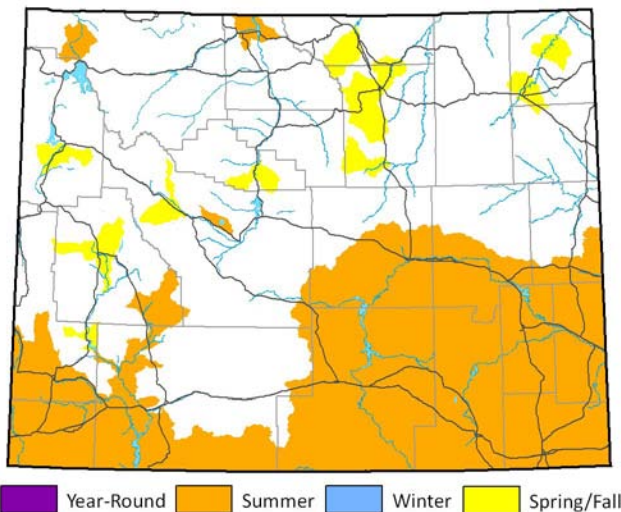
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.216
- 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/>).

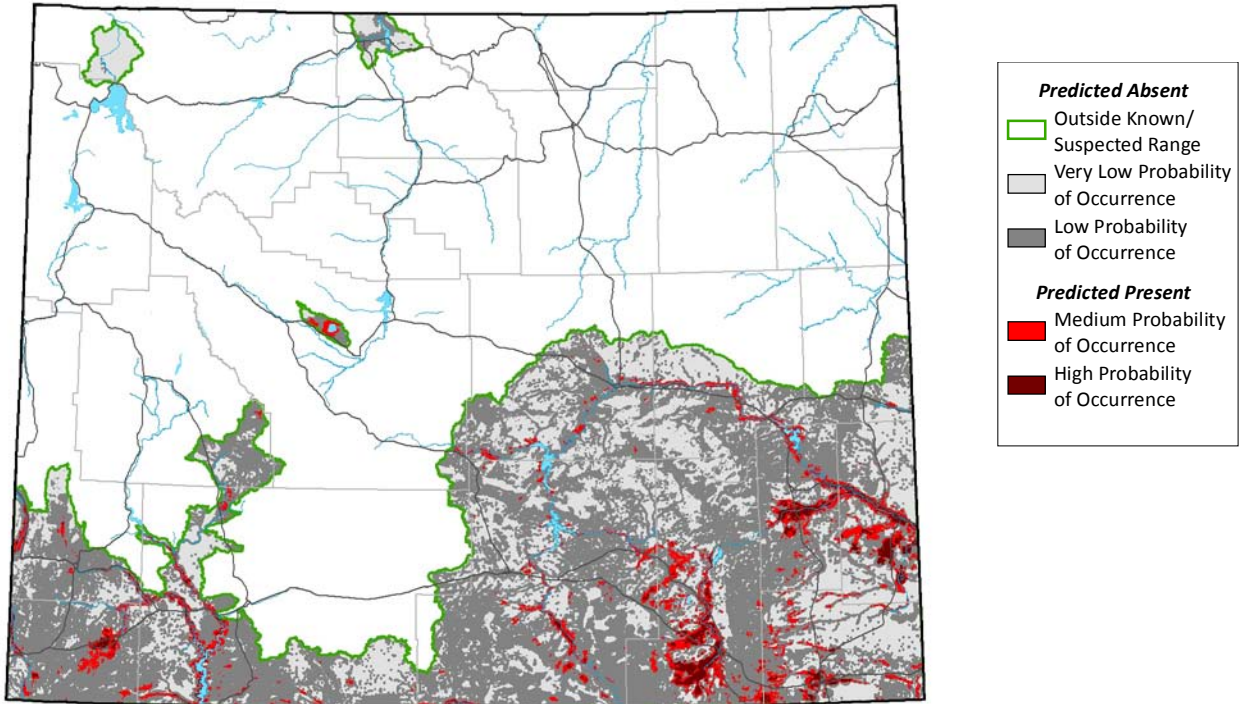
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 30 13:20:34 MDT 2010)

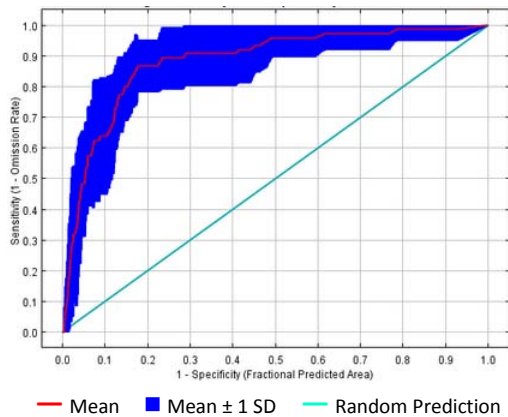
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (7-May- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3298920
- High-Probability Threshold Value: 0.6229382
- Low-Probability Threshold Value: 0.0221583

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:
MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

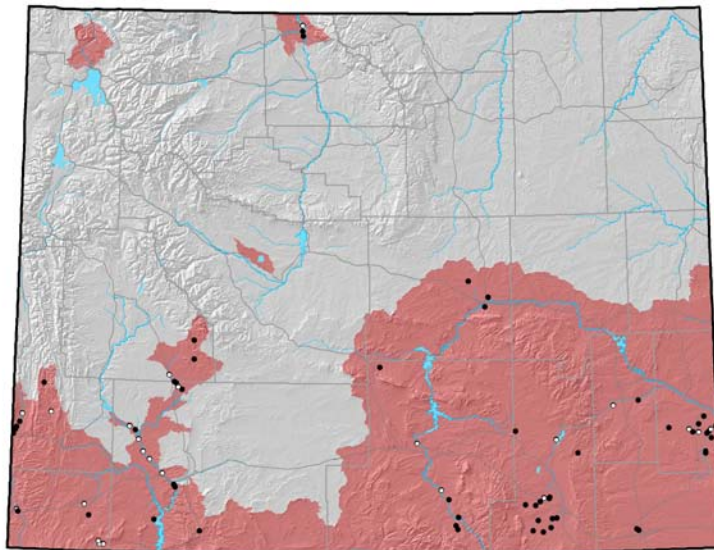
- Training AUC: 0.911
- Regularized Training Gain: 1.347

Cross-Validation Statistics

- Average Test AUC: 0.883 ± 0.064
- Upper Bound on Test AUC: 0.894
- Average Test Gain: 0.894 ± 1.250
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.12 ± 0.10

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 301
- Number of Occurrences used to create distribution model: 76
- Average Point Quality Index (highest quality is 12.00): 5.93 ± 1.80
- Most recent occurrence used: 2008
- Oldest occurrence used: 1978
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

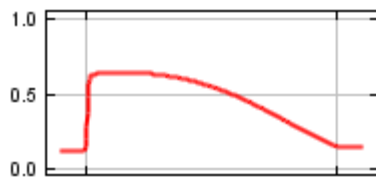
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Lakes/Large Rivers within 3200 meters	36
Radiation of the darkest month	20
Forest Cover Index	13
Annual mean temperature	12
Conifer Index	10
Sagebrush Index	9

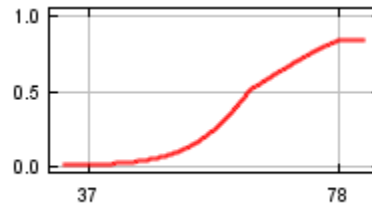
Response Curves

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).

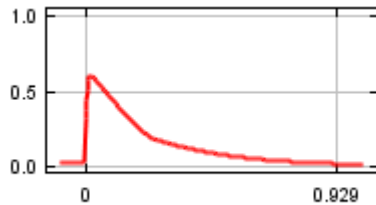
Prevalence of Lakes/Large Rivers within 3200 meters



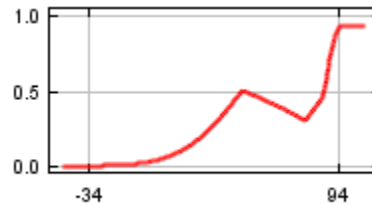
Radiation of the darkest month



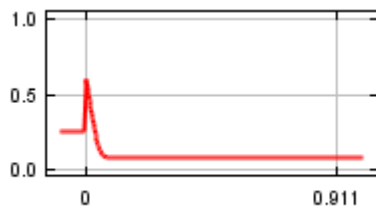
Forest Cover Index



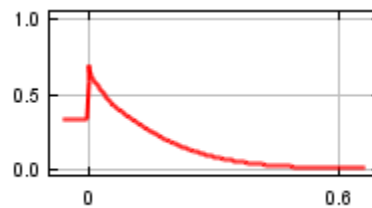
Annual mean temperature



Conifer Index



Sagebrush Index

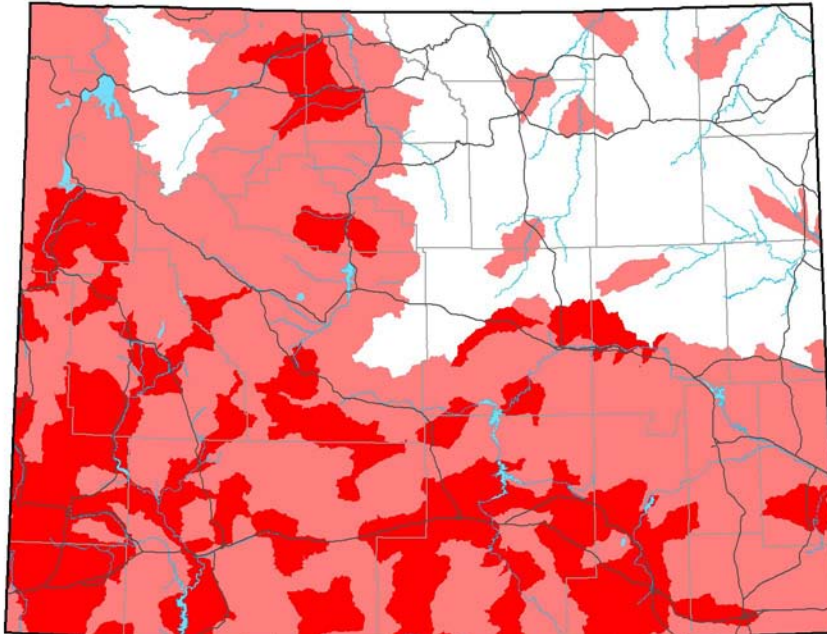


White-faced Ibis (*Plegadis chihi*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of White-faced Ibis (ABNGE02020) 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.

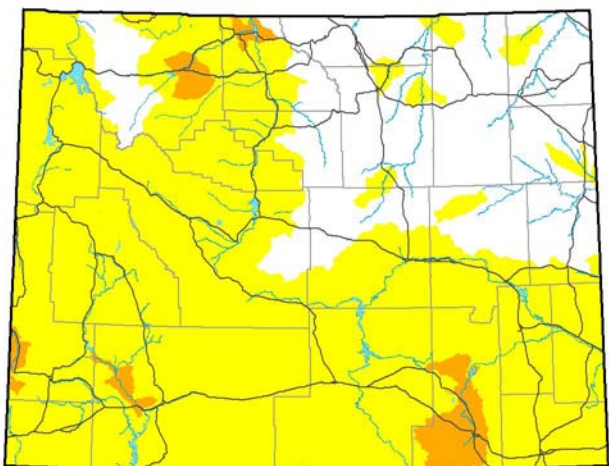
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.625
- 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/>).

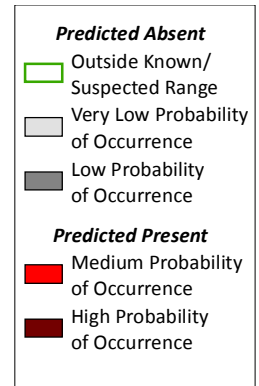
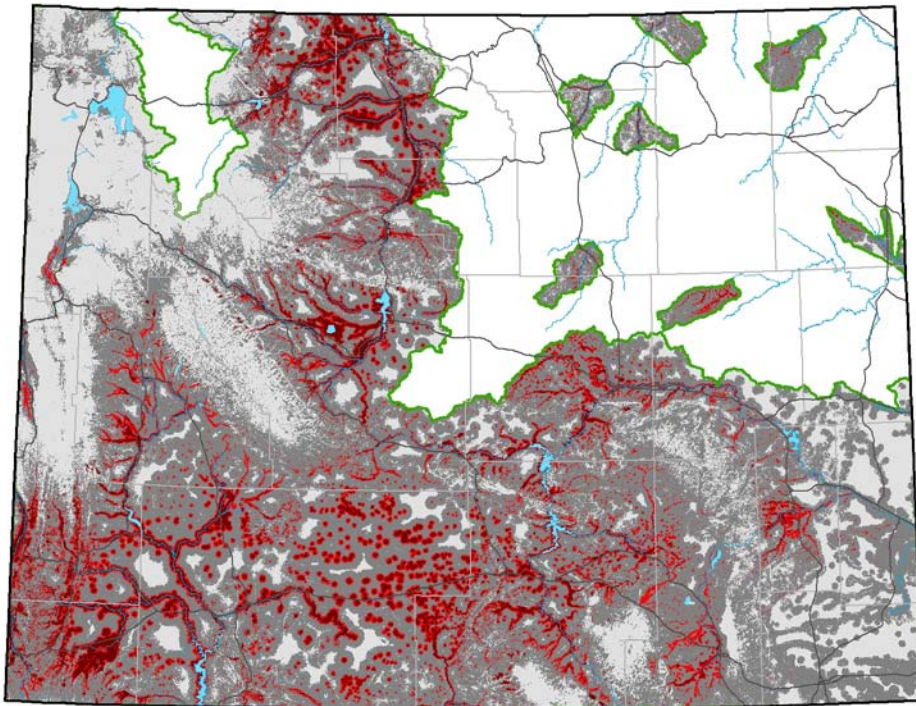
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Mar 17 18:02:08 MDT 2010)

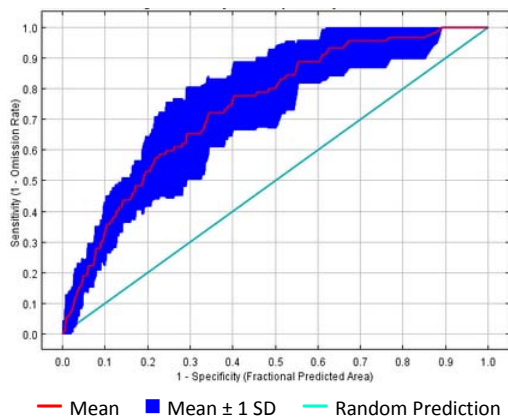
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-May- 31-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4393100
- High-Probability Threshold Value: 0.5467968
- Low-Probability Threshold Value: 0.0652045

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

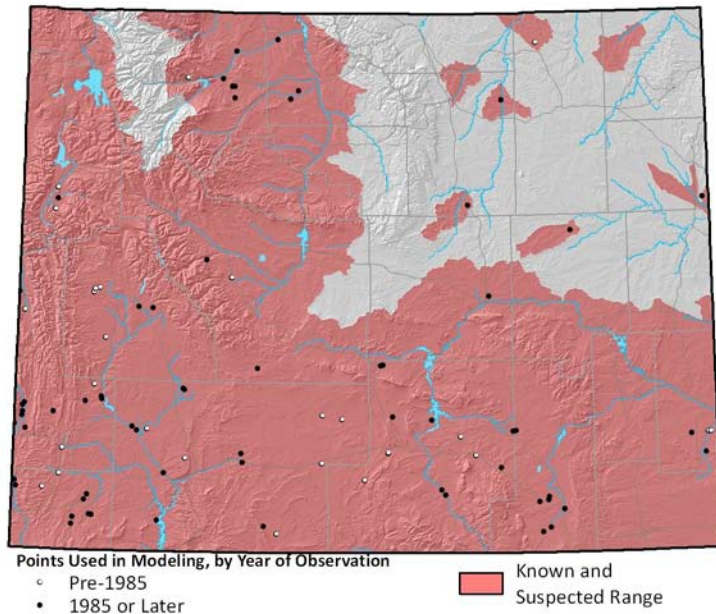
- Training AUC: 0.767
- Regularized Training Gain: 0.451

Cross-Validation Statistics

- Average Test AUC: 0.742 ± 0.061
- Upper Bound on Test AUC: 0.758
- Average Test Gain: 0.356 ± 0.283
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.36 ± 0.19

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 492
- Number of Occurrences used to create distribution model: 89
- Average Point Quality Index (highest quality is 12.00): 5.97 ± 2.03
- Most recent occurrence used: 2007
- Oldest occurrence used: 1975
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

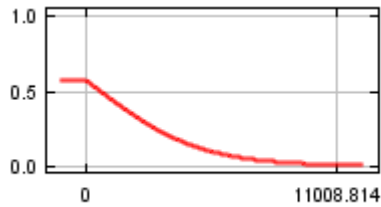
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Distance to Permanent Water	33
Degree Slope	21
Annual Relative Humidity Range	19
Variation in monthly Relative Humidity	19
Precipitation of the wettest month	4
Forest Cover Index	4

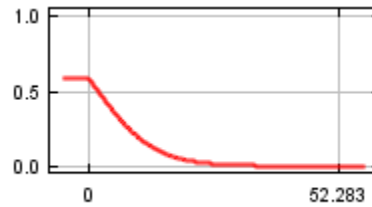
Response Curves

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).

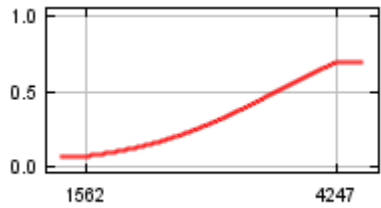
Distance to Permanent Water



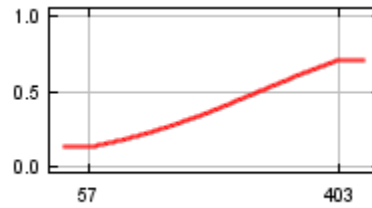
Degree Slope



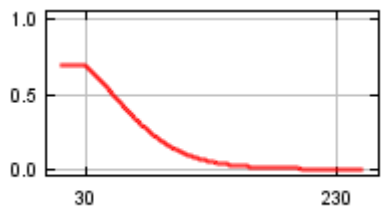
Annual Relative Humidity Range



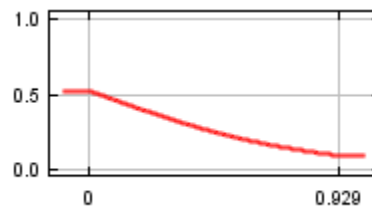
Variation in monthly Relative Humidity



Precipitation of the wettest month



Forest Cover Index

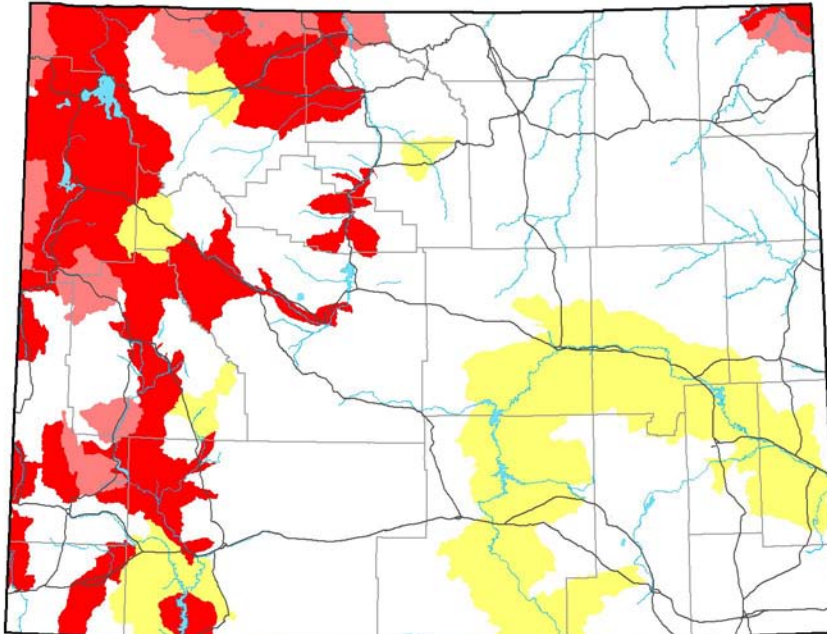


Trumpeter Swan (*Cygnus buccinator*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Trumpeter Swan (ABNJB02030) 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

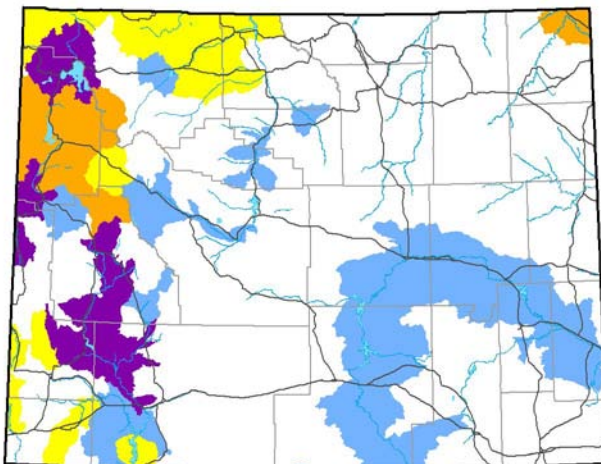


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.776
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

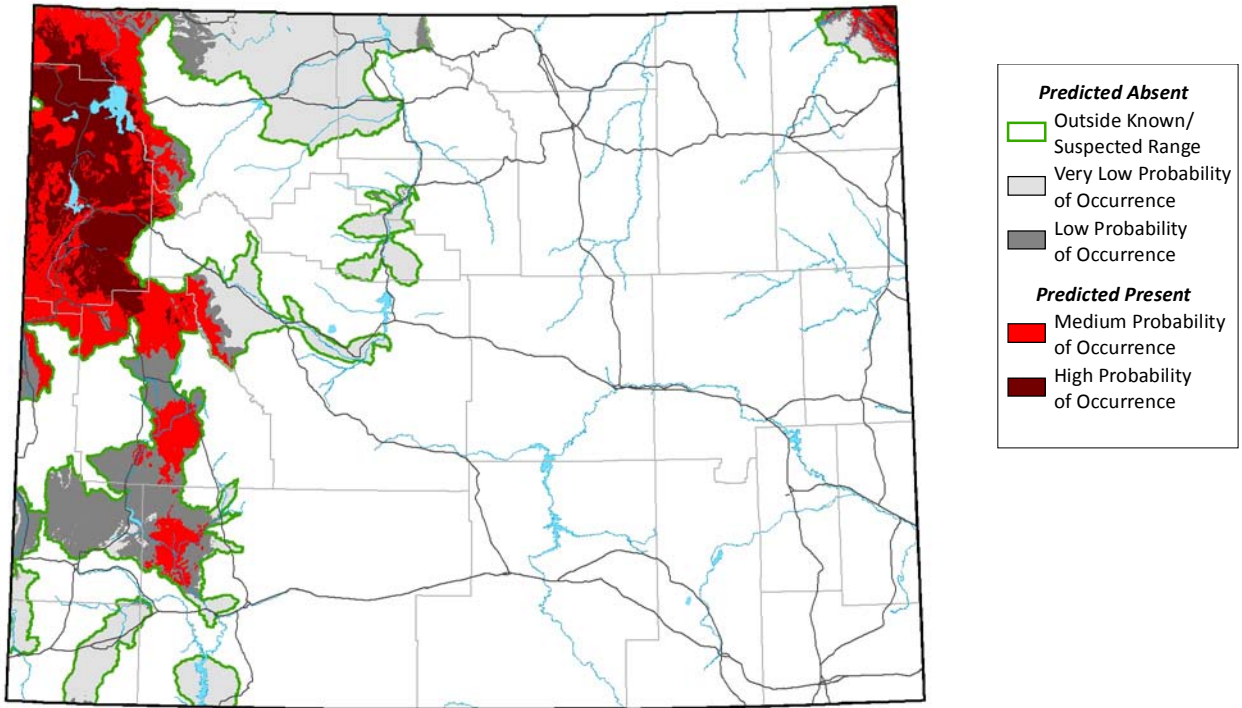
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Feb 09 16:53:45 MST 2010)

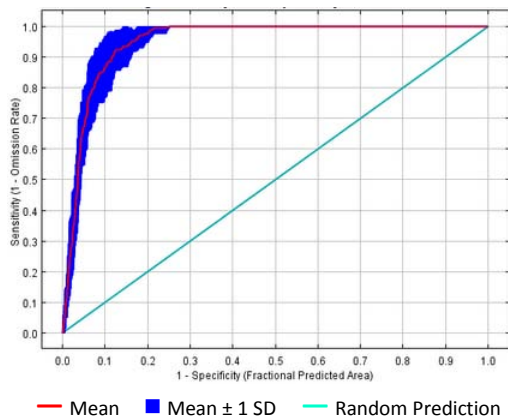
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (7-May- 7-Sep)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1759400
- High-Probability Threshold Value: 0.6158186
- Low-Probability Threshold Value: 0.0400876

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

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

Model Evaluation Statistics

Final Model Statistics

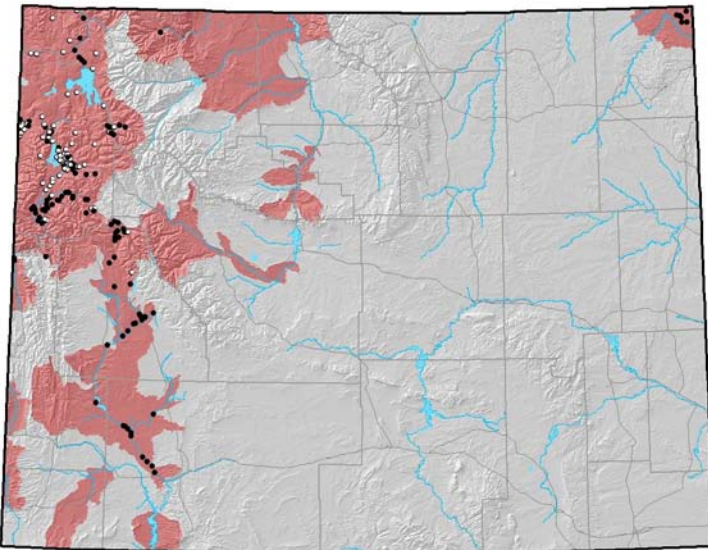
- Training AUC: 0.960
- Regularized Training Gain: 1.954

Cross-Validation Statistics

- Average Test AUC: 0.950 ± 0.013
- Upper Bound on Test AUC: 0.942
- Average Test Gain: 1.938 ± 0.286
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.09 ± 0.09

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 3,145
- Number of Occurrences used to create distribution model: 165
- Average Point Quality Index (highest quality is 12.00): 6.67 ± 2.06
- Most recent occurrence used: 2008
- Oldest occurrence used: 1955
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

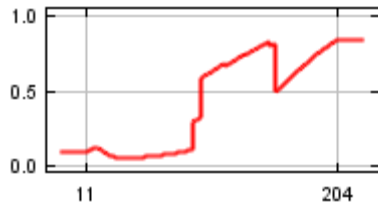
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Precipitation of the driest quarter	39
Coldest month mean minimum temperature	28
Wettest quarter mean temperature	20
Relative Humidity of most humid month	5
Annual temperature range (T3 – T4)	4
Elevation	4

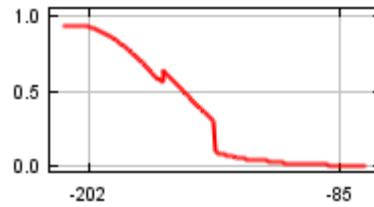
Response Curves

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).

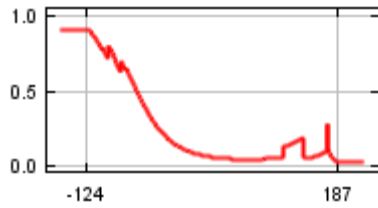
Precipitation of the driest quarter



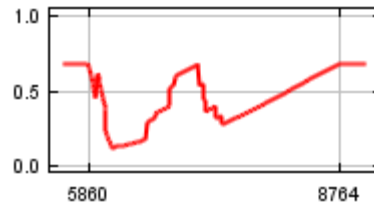
Coldest month mean minimum temperature



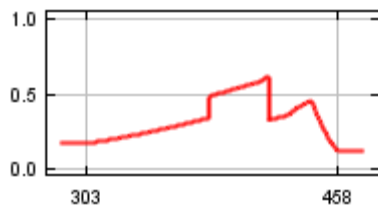
Wettest quarter mean temperature



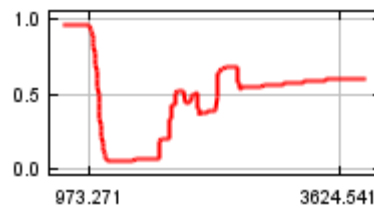
Relative Humidity of most humid month



Annual temperature range (T3 – T4)



Elevation

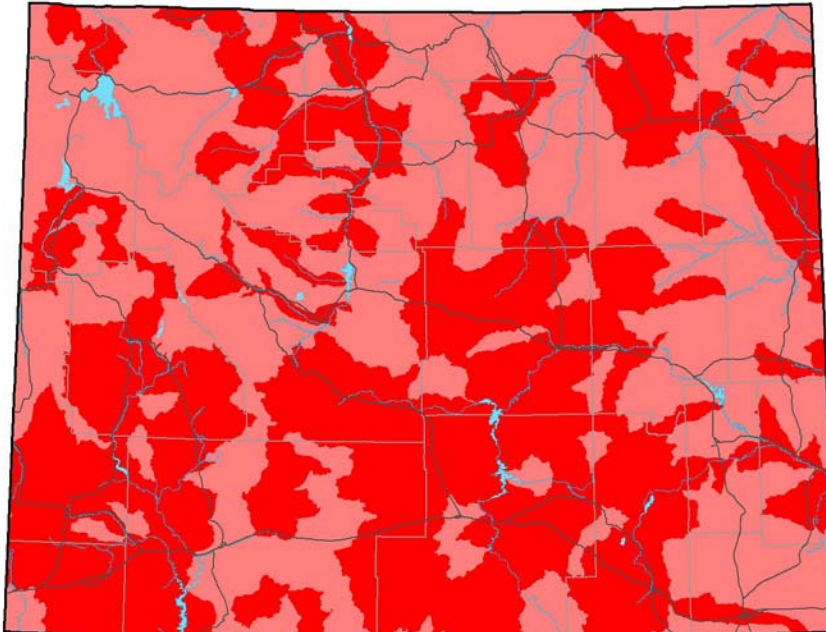


Northern Pintail (*Anas acuta*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Northern Pintail (ABNJB10110) 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.

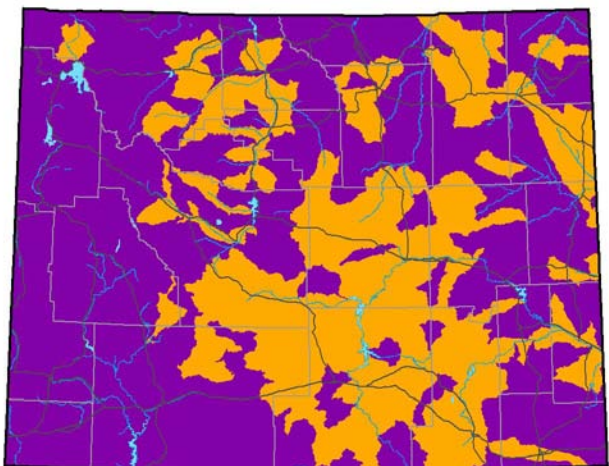
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.423
- 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

© 2010, WYNDD

Comments

A model was not generated for Northern Pintail because there were too few occurrence records. Occurrence records exist in the Wildlife Observation System, but its inclusion on the SGCN list was unclear until after models were created, so occurrence data were not compiled and a distribution model was not generated for this report.

References

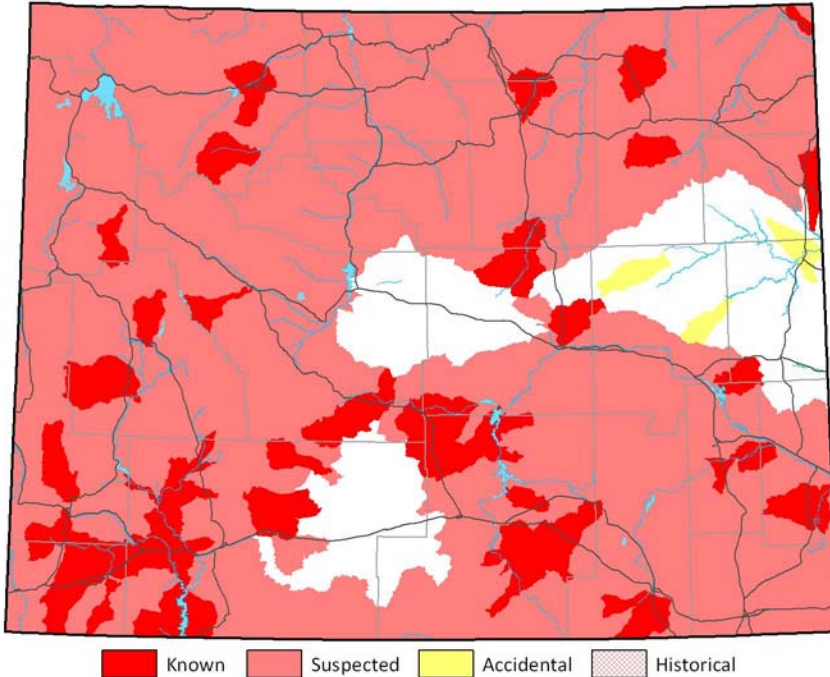
- Keinath, D.A., M.D. Andersen, and G.P. Beauvais. 2010a. Range maps for Wyoming's species of greatest conservation need. Report prepared for the Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, Wyoming. January 19, 2010.
- Keinath, D.A., M.D. Andersen, and G.P. Beauvais.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

Canvasback (*Aythya valisineria*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Canvasback (ABNJB11020) 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.

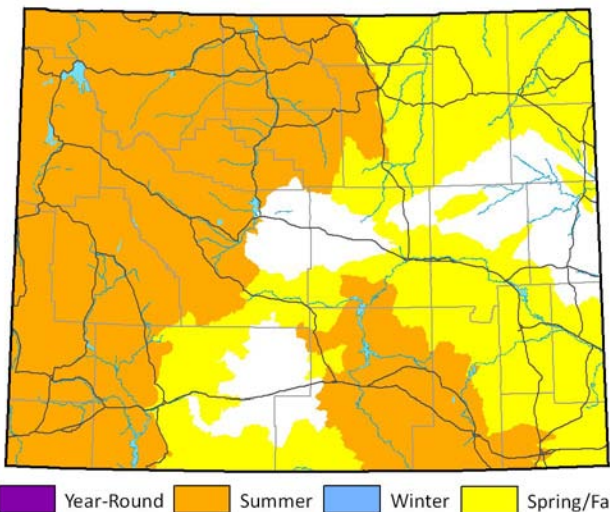
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.117
- 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/>).

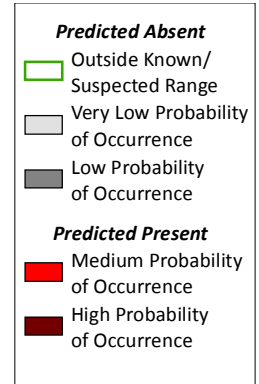
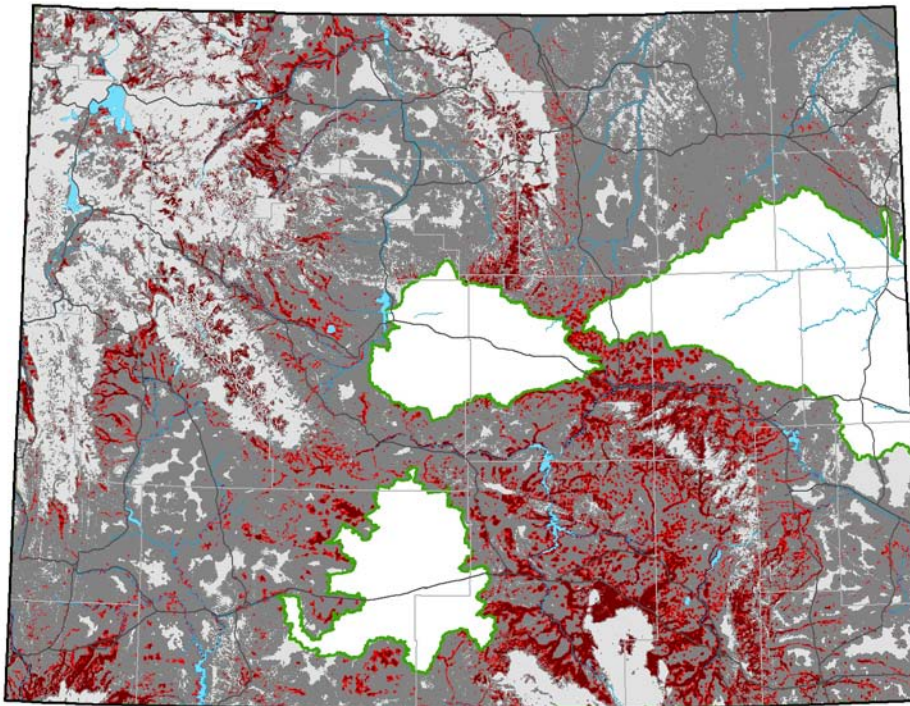
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Mar 17 21:19:14 MDT 2010)

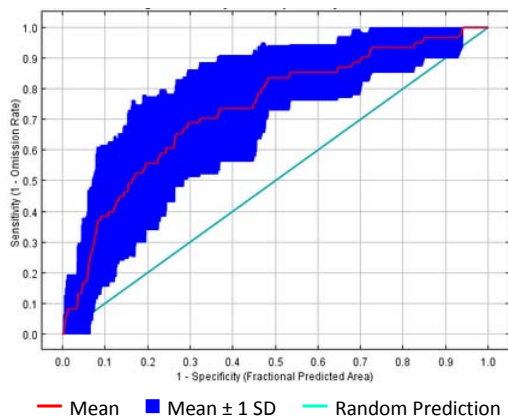
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (25-Apr- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4939270
- High-Probability Threshold Value: 0.5638385
- Low-Probability Threshold Value: 0.0628170

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

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

Model Evaluation Statistics

Final Model Statistics

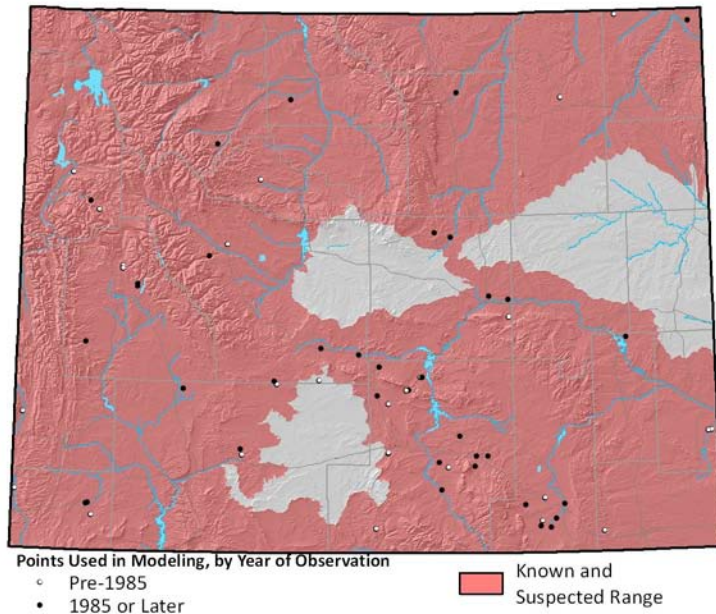
- Training AUC: 0.762
- Regularized Training Gain: 0.364

Cross-Validation Statistics

- Average Test AUC: 0.733 ± 0.086
- Upper Bound on Test AUC: 0.731
- Average Test Gain: 0.010 ± 1.084
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.36 ± 0.25

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 227
- Number of Occurrences used to create distribution model: 62
- Average Point Quality Index (highest quality is 12.00): 5.66 ± 1.33
- Most recent occurrence used: 2007
- Oldest occurrence used: 1978
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

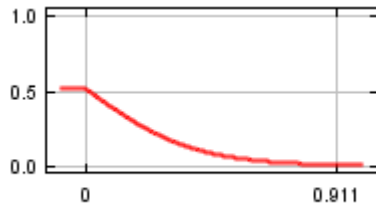
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Conifer Index	26
Annual temperature range (T3 – T4)	22
Contagion Index	19
Distance to Permanent Water	19
Vector Ruggedness Measure	8
Precipitation of the warmest quarter	5

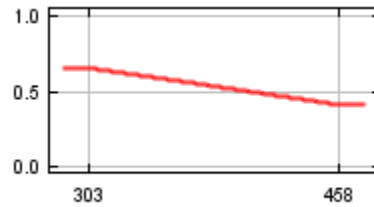
Response Curves

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).

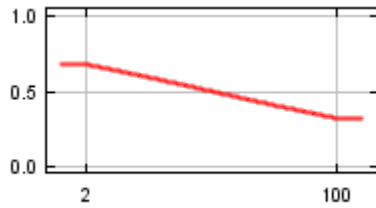
Conifer Index



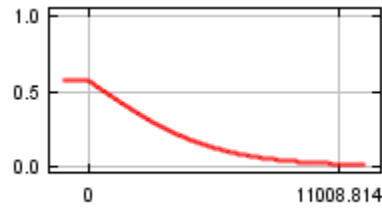
Annual temperature range (T3 – T4)



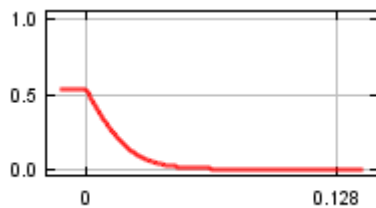
Contagion Index



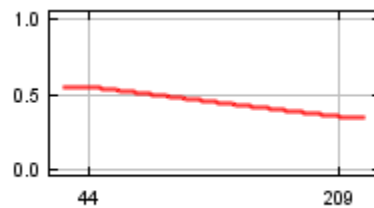
Distance to Permanent Water



Vector Ruggedness Measure



Precipitation of the warmest quarter

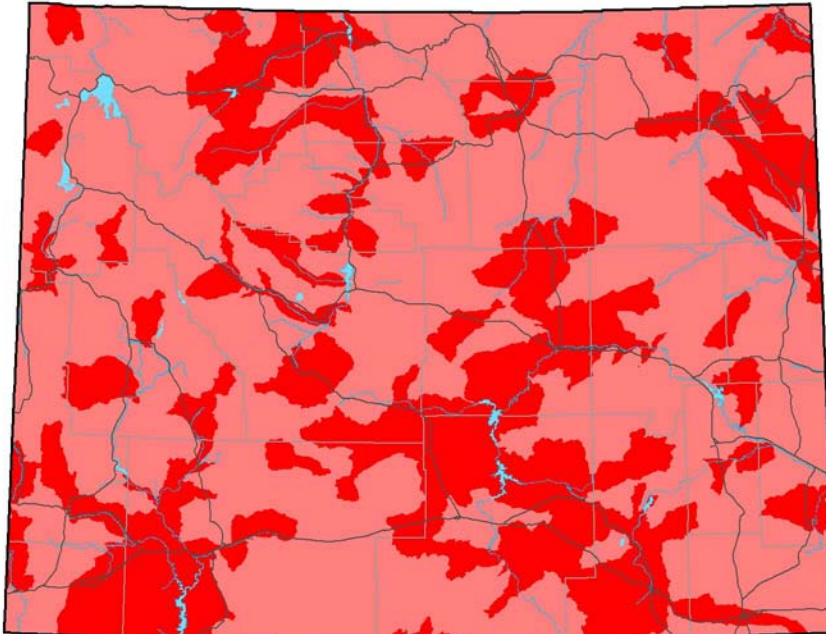


Redhead (*Aythya americana*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Redhead (ABNJB11030) 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

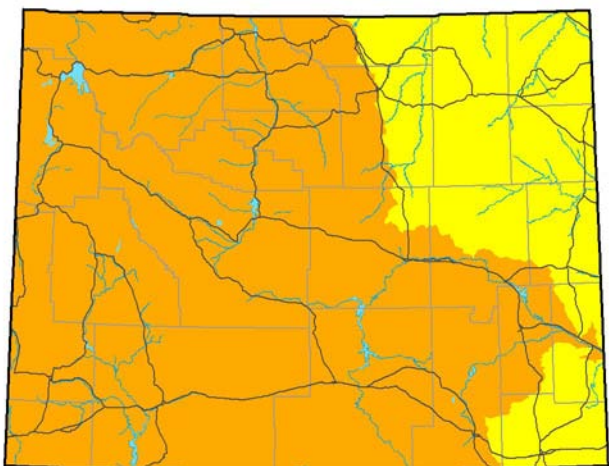


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.300
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

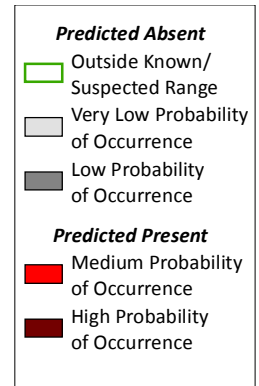
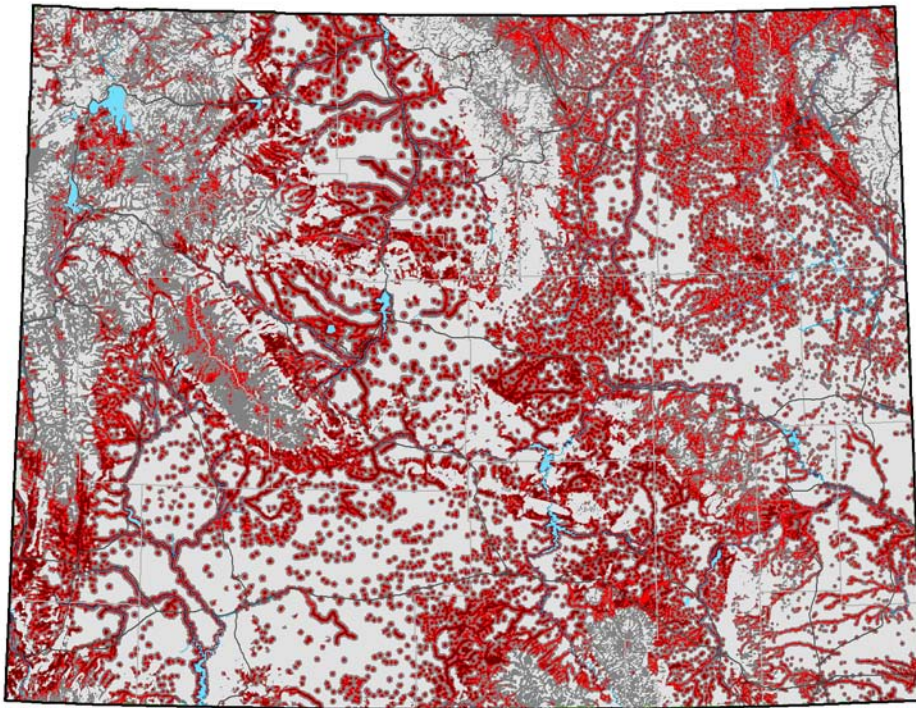
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Fri Apr 09 11:22:14 MDT 2010)

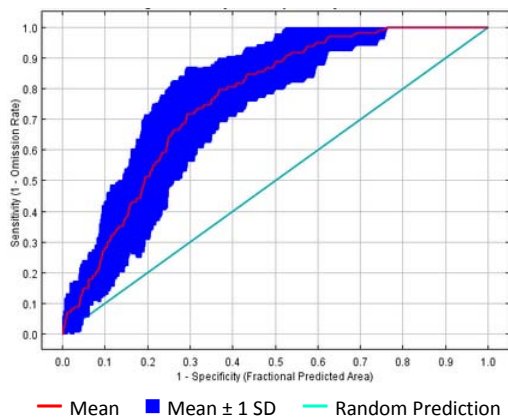
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (25-Apr- 31-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3085620
- High-Probability Threshold Value: 0.5218791
- Low-Probability Threshold Value: 0.0657201

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

Expert Assessment: Medium

Occurrence Sample Size: Medium-High

Quality of Occurrences: Low

Positive Success Rate: High

Test AUC and Model Gain: Medium

Model Evaluation Statistics

Final Model Statistics

Training AUC: 0.791

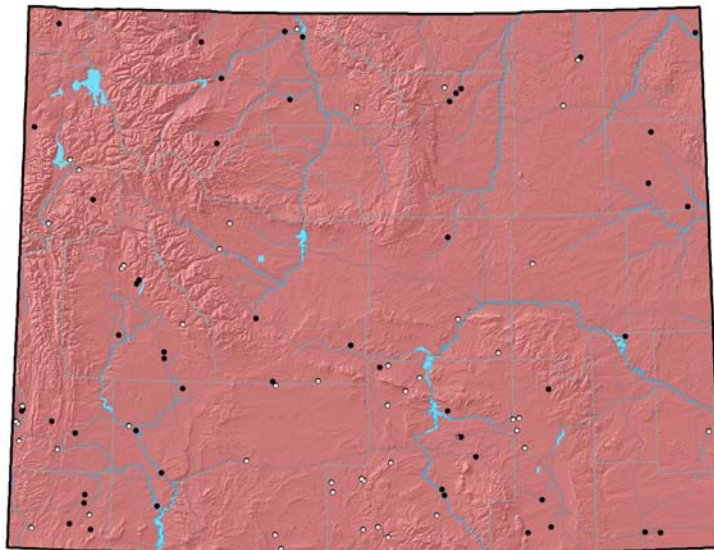
Regularized Training Gain: 0.582

Cross-Validation Statistics

- Average Test AUC: 0.763 ± 0.065
- Upper Bound on Test AUC: 0.790
- Average Test Gain: 0.458 ± 0.266
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.18 ± 0.10

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 621
- Number of Occurrences used to create distribution model: 99
- Average Point Quality Index (highest quality is 12.00): 5.69 ± 1.72
- Most recent occurrence used: 2007
- Oldest occurrence used: 1977
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. 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. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

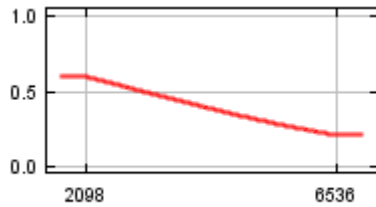
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Relative Humidity of least humid month	36
Distance to Permanent Water	35
Forest Cover Index	11
Pinon-Juniper Index	7
Shrub Cover Index	7
Herbaceous Cover Index	4

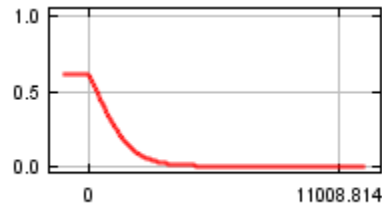
Response Curves

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).

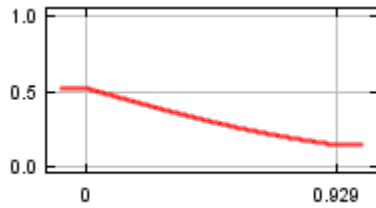
Relative Humidity of least humid month



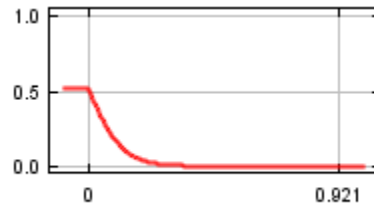
Distance to Permanent Water



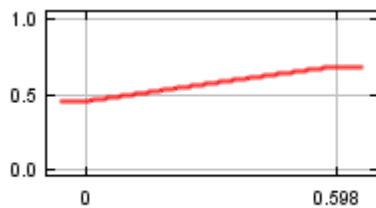
Forest Cover Index



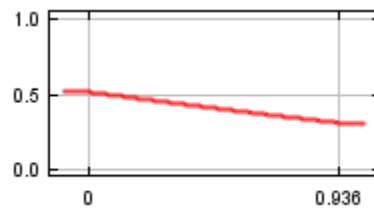
Pinon-Juniper Index



Shrub Cover Index



Herbaceous Cover Index

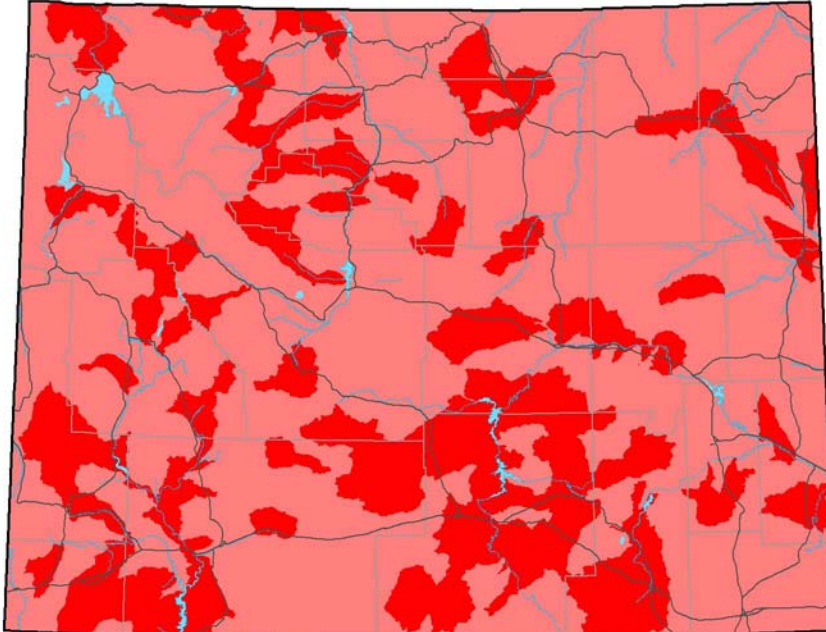


Lesser Scaup (*Aythya affinis*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Lesser Scaup (ABNJB11070) 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

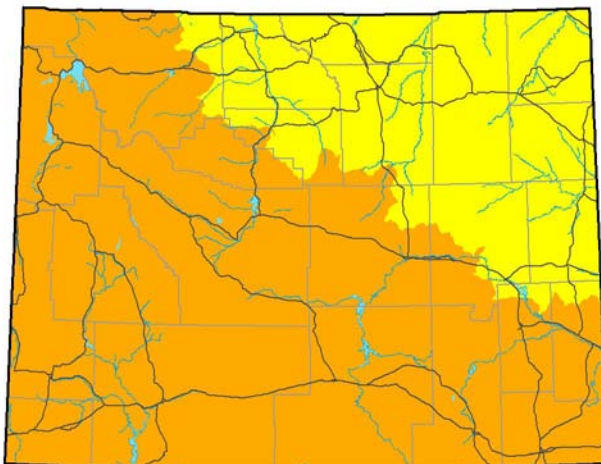


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.273
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

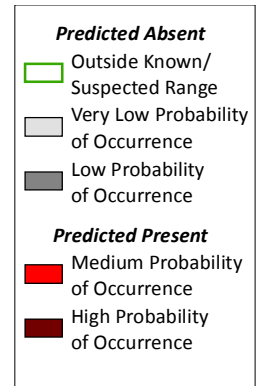
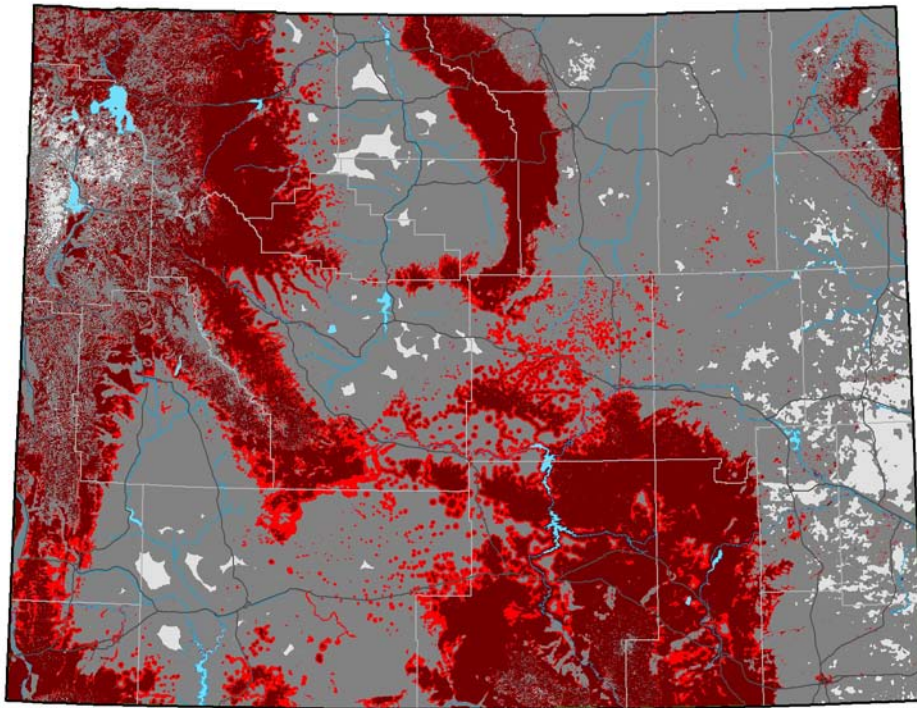
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Mar 17 17:12:57 MDT 2010)

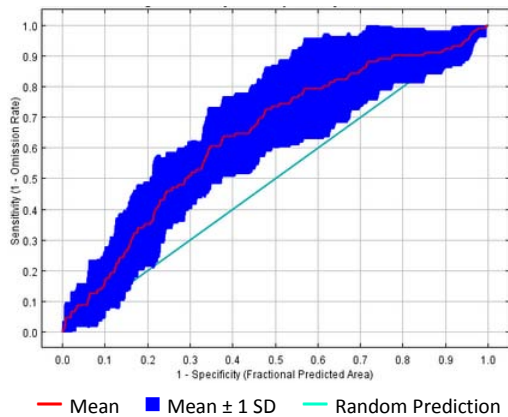
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (25-May- 7-Sep)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4500440
- High-Probability Threshold Value: 0.5040767
- Low-Probability Threshold Value: 0.1077144

Model Evaluation - ROC Plot



Model Quality Summary

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

Model Evaluation Statistics

Final Model Statistics

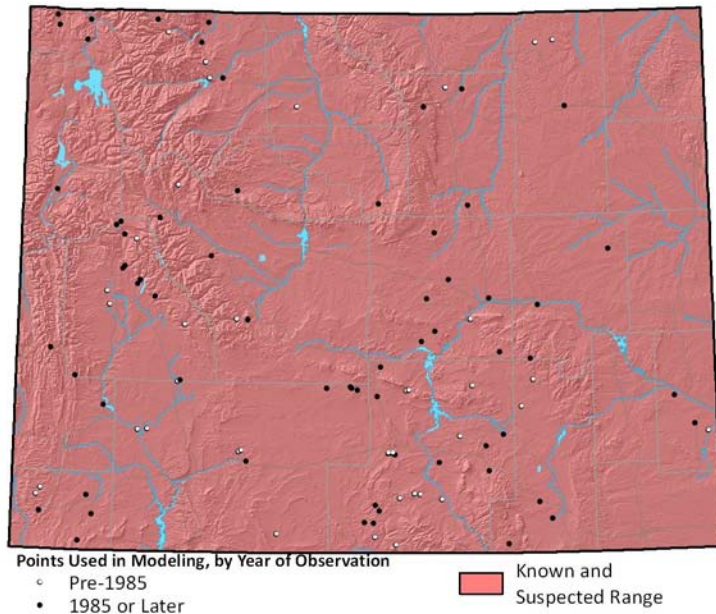
Training AUC: 0.689
 Regularized Training Gain: 0.233

Cross-Validation Statistics

- Average Test AUC: 0.641 ± 0.097
- Upper Bound on Test AUC: 0.682
- Average Test Gain: 0.055 ± 0.283
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.36 ± 0.15

Occurrence Data for Distribution Model

Occurrence Map



Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 536
- Number of Occurrences used to create distribution model: 102
- Average Point Quality Index (highest quality is 12.00): 5.43 ± 1.35
- Most recent occurrence used: 2006
- Oldest occurrence used: 1978
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. 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. 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

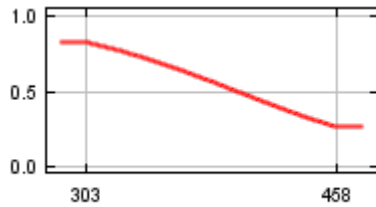
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Annual temperature range (T3 – T4)	36
Precipitation of the coldest quarter	20
Percent Forest Cover	15
Shrub Cover Index	14
Herbaceous Cover Index	9
Distance to Permanent Water	6

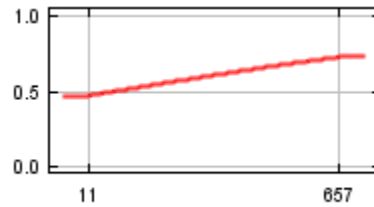
Response Curves

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).

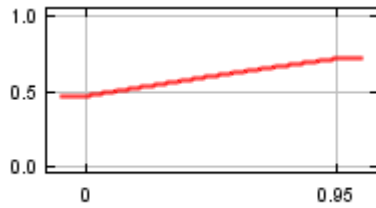
Annual temperature range (T3 – T4)



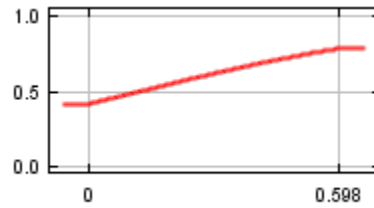
Precipitation of the coldest quarter



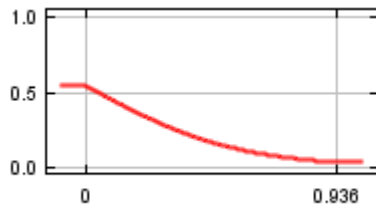
Percent Forest Cover



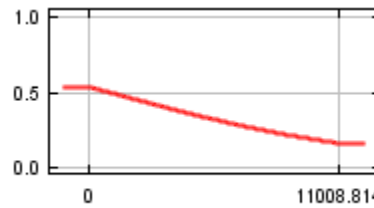
Shrub Cover Index



Herbaceous Cover Index



Distance to Permanent Water

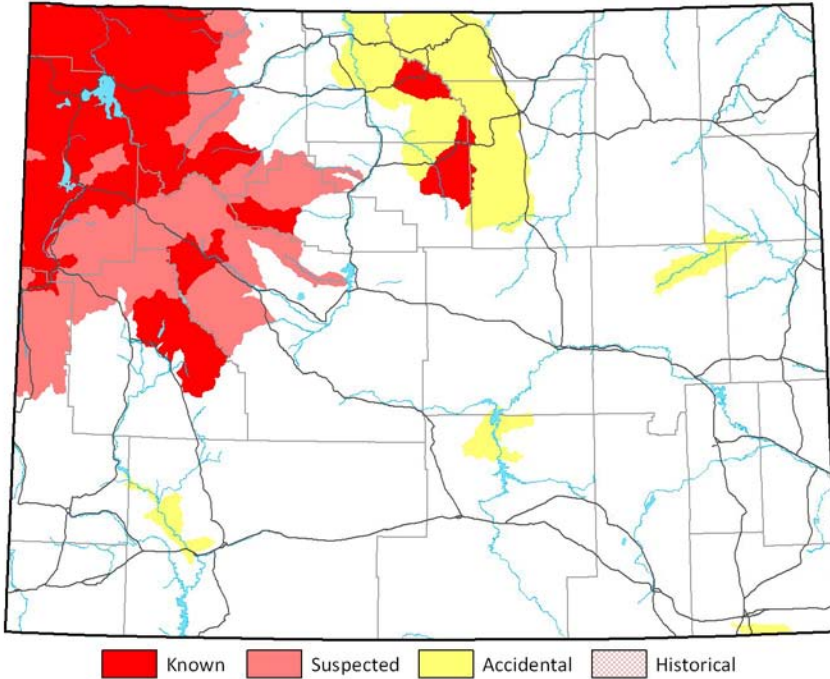


Harlequin Duck (*Histrionicus histrionicus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Harlequin Duck (ABNJB15010) 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.

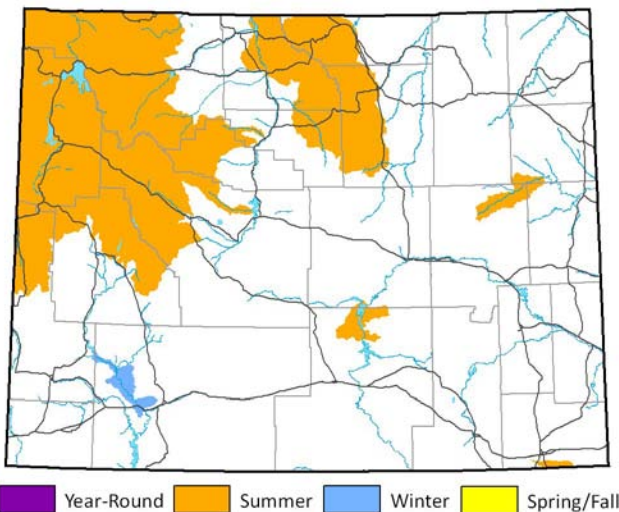
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.588
- 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/>).

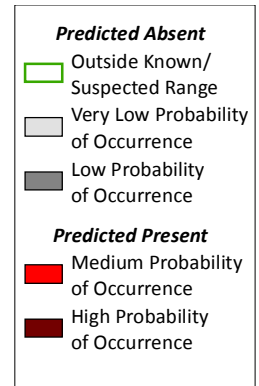
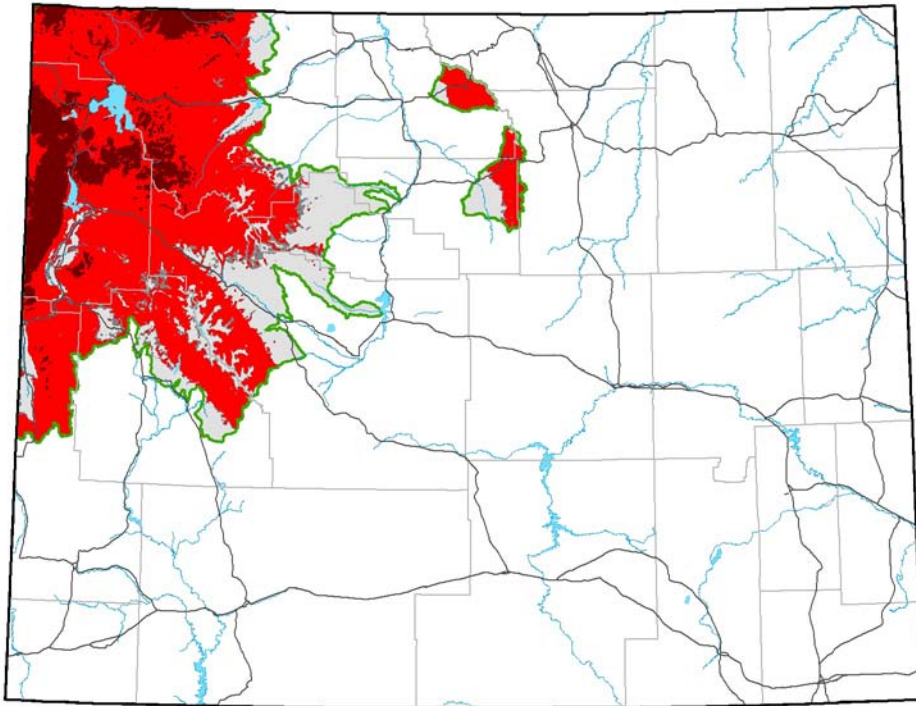
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Thu Apr 22 09:30:55 MDT 2010)

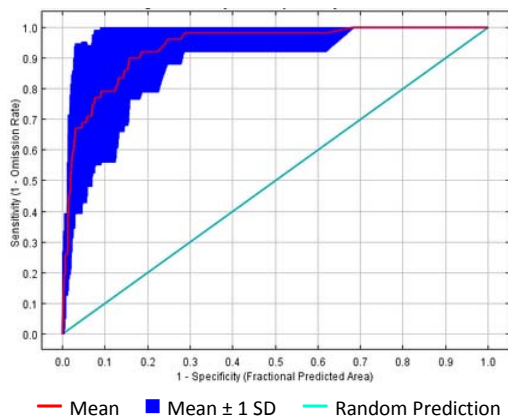
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.0763590
- High-Probability Threshold Value: 0.6186383
- Low-Probability Threshold Value: 0.0517483

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

Expert Assessment: Medium

Occurrence Sample Size: Medium

Quality of Occurrences: Medium

Positive Success Rate: High

Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

Training AUC: 0.967

Regularized Training Gain: 2.301

Cross-Validation Statistics

- Average Test AUC: 0.937 ± 0.058

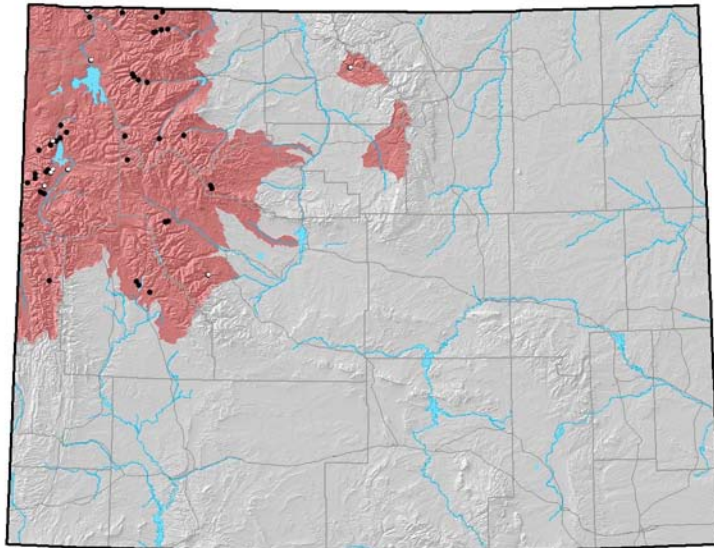
- Upper Bound on Test AUC: 0.952

- Average Test Gain: 1.970 ± 1.001

- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.14 ± 0.19

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 160
- Number of Occurrences used to create distribution model: 47
- Average Point Quality Index (highest quality is 12.00): 6.45 ± 2.06
- Most recent occurrence used: 2006
- Oldest occurrence used: 1959
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. Qualitative expert review of this model suggests that the binary version may over-predict the distribution of this species in Wyoming. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

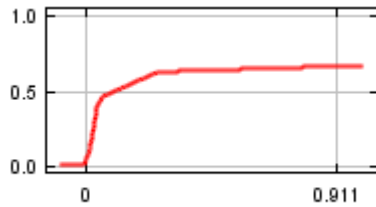
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Conifer Index	39
Precipitation of the driest quarter	29
Radiation of the lightest month	11
Hottest month mean maximum temperature	9
Annual Relative Humidity Range	9
Cottonwood Index	4

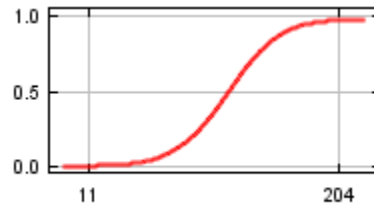
Response Curves

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).

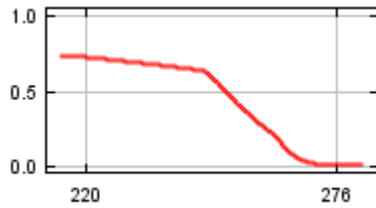
Conifer Index



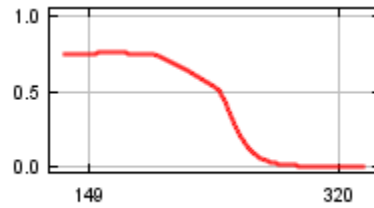
Precipitation of the driest quarter



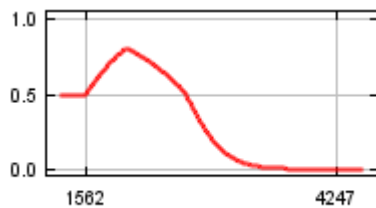
Radiation of the lightest month



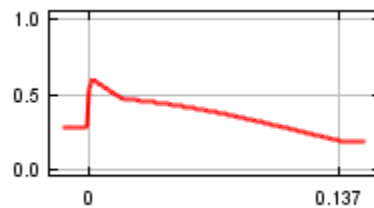
Hottest month mean maximum temperature



Annual Relative Humidity Range



Cottonwood Index

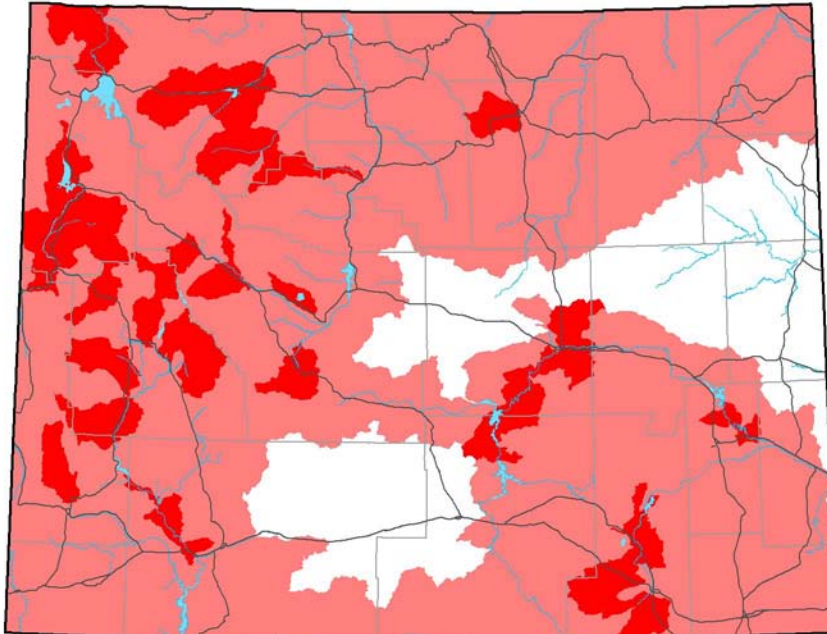


Barrow's Goldeneye (*Bucephala islandica*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Barrow's Goldeneye (ABNJB18020) 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

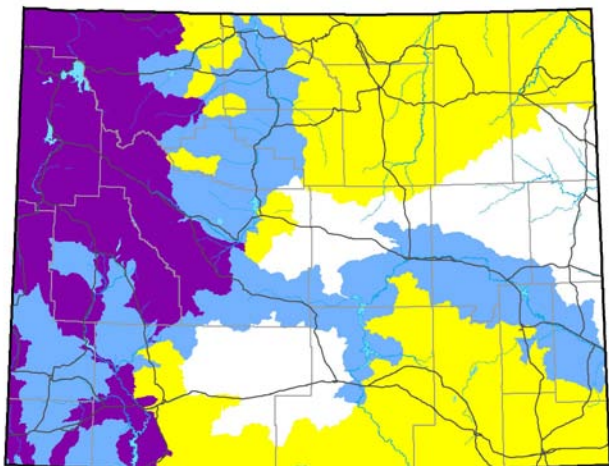


■ Known ■ Suspected ■ Accidental ■ Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.263
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



■ Year-Round ■ Summer ■ Winter ■ Spring/Fall

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

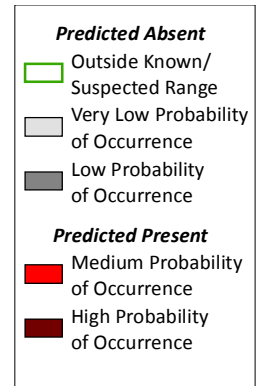
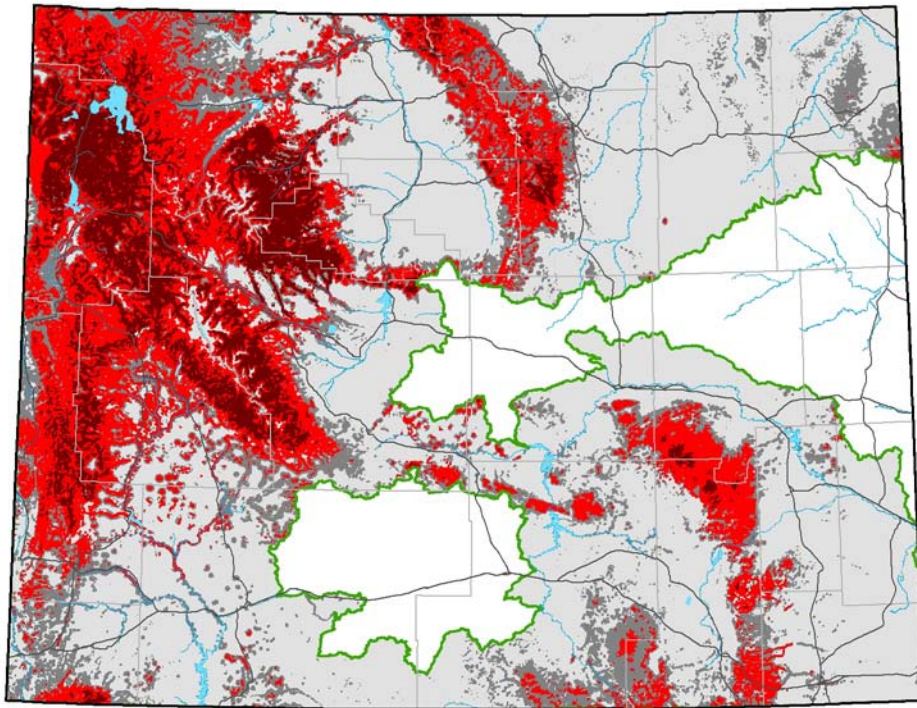
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Thu Mar 11 16:22:56 MST 2010)

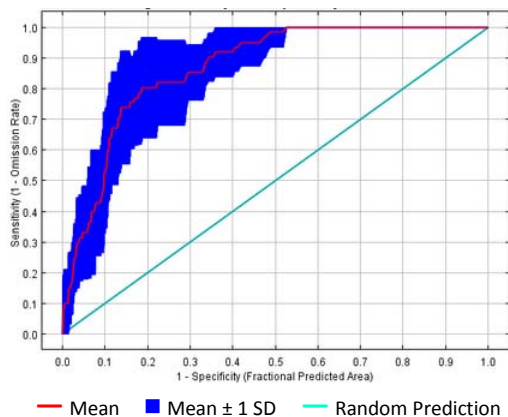
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-Apr- 31-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2243000
- High-Probability Threshold Value: 0.5760866
- Low-Probability Threshold Value: 0.0762812

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:
MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

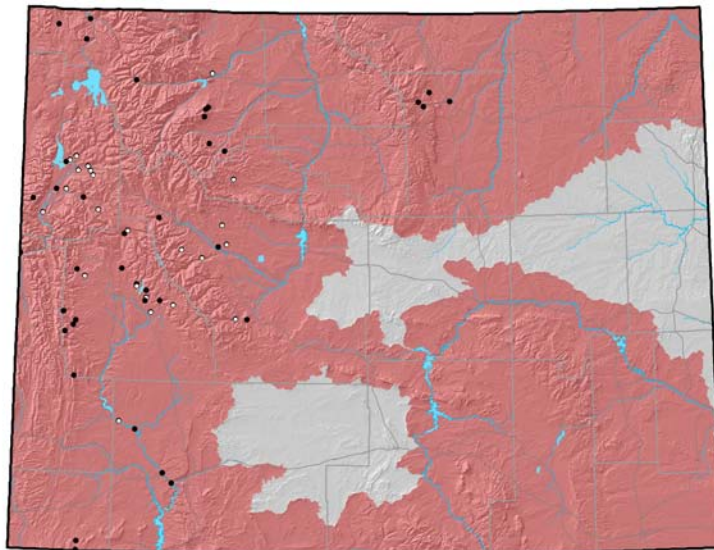
- Training AUC: 0.904
- Regularized Training Gain: 1.230

Cross-Validation Statistics

- Average Test AUC: 0.869 ± 0.042
- Upper Bound on Test AUC: 0.886
- Average Test Gain: 1.054 ± 0.426
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.23 ± 0.21

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 229
- Number of Occurrences used to create distribution model: 61
- Average Point Quality Index (highest quality is 12.00): 5.46 ± 1.40
- Most recent occurrence used: 2005
- Oldest occurrence used: 1978
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. Qualitative expert review of this model suggests that the binary version may over-predict the distribution of this species in Wyoming. We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

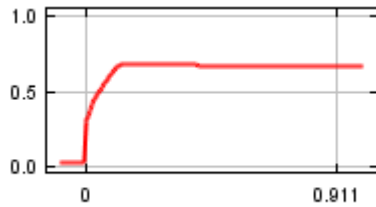
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Conifer Index	29
Annual number of Frost Days	28
Warmest quarter mean temperature	17
Pinon-Juniper Index	10
Variation of monthly precipitation	10
Distance to Permanent Water	6

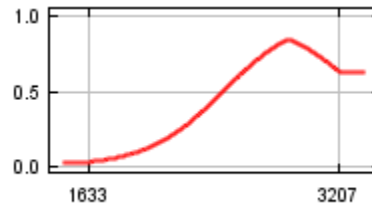
Response Curves

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).

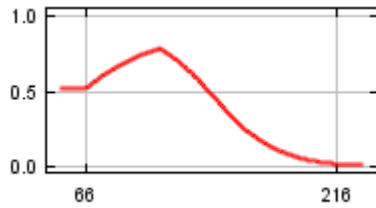
Conifer Index



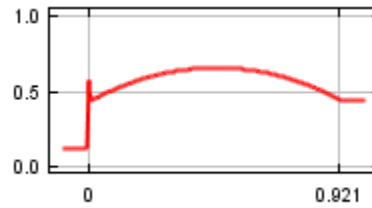
Annual number of Frost Days



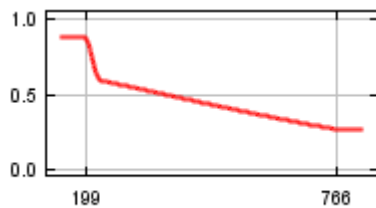
Warmest quarter mean temperature



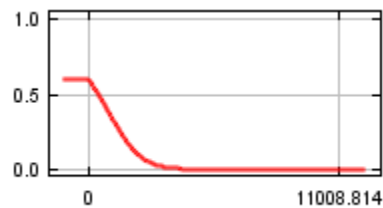
Pinon-Juniper Index



Variation of monthly precipitation



Distance to Permanent Water



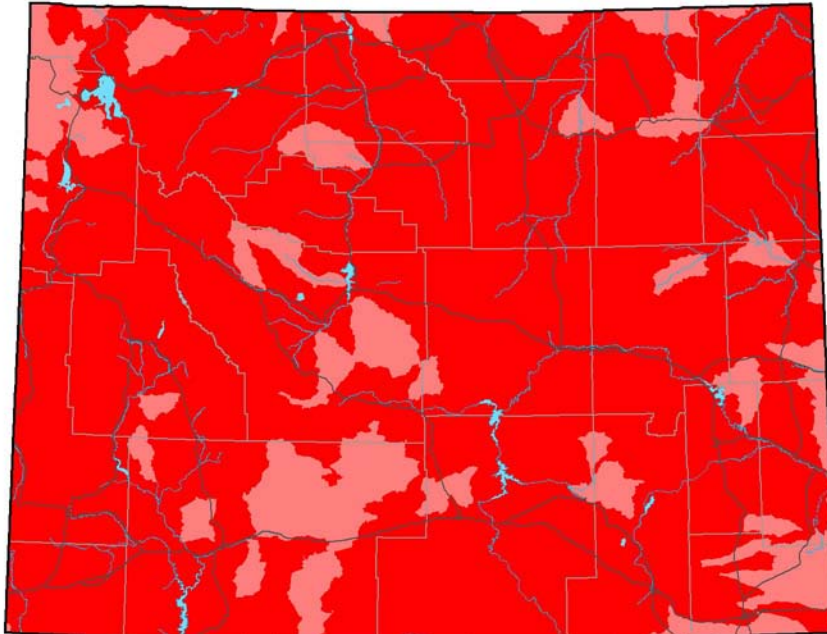
Bald Eagle - summer (*Haliaeetus leucocephalus*)

Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Bald Eagle - summer (ABNKC10010S) 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

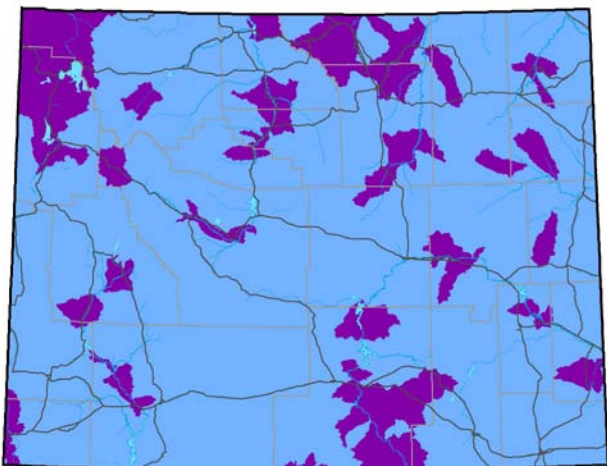


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.778
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

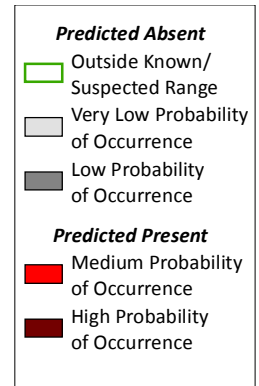
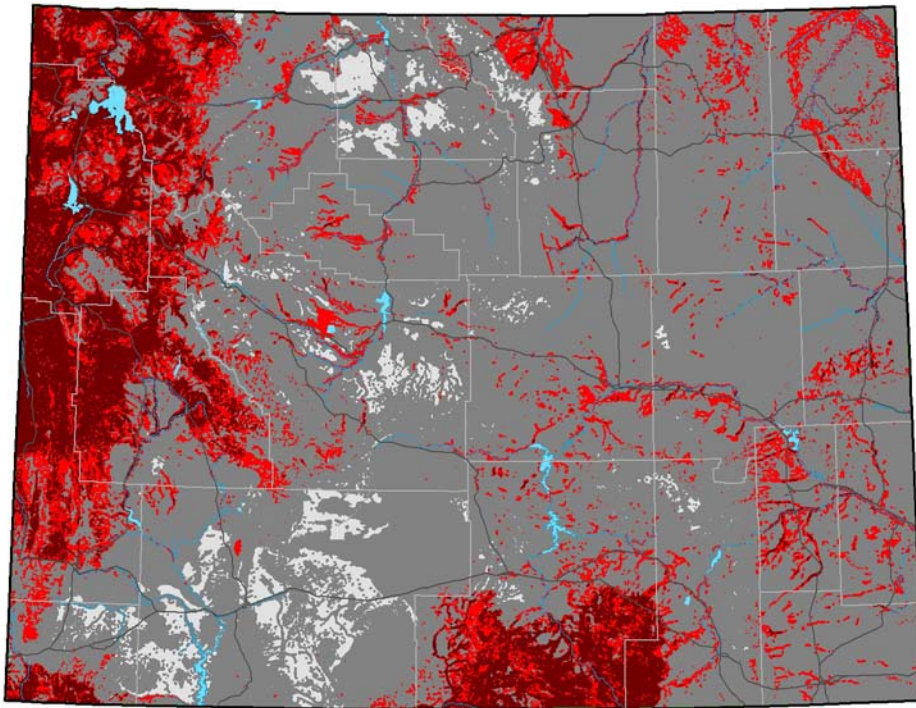
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Mon Dec 21 15:07:08 MST 2009)

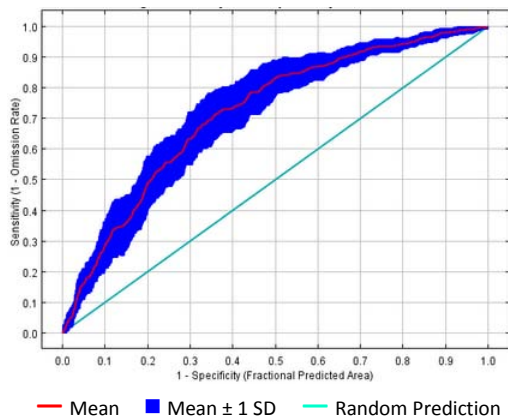
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Summer (15-May- 25-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4093660
- High-Probability Threshold Value: 0.5393025
- Low-Probability Threshold Value: 0.1220973

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

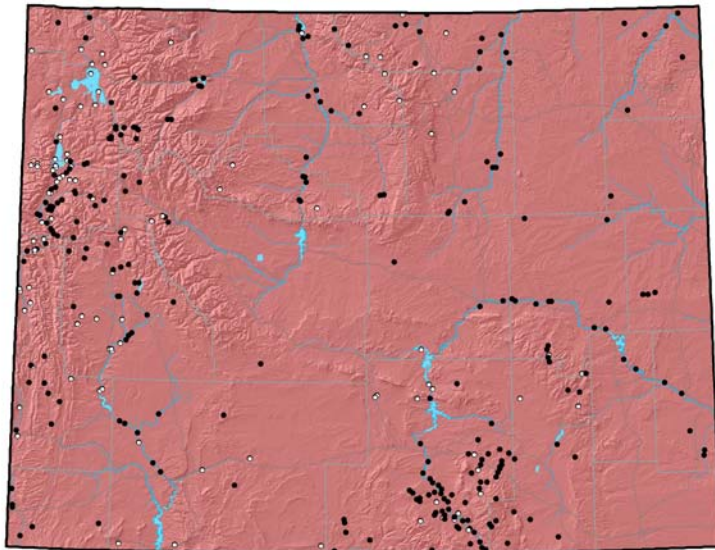
- Training AUC: 0.759
- Regularized Training Gain: 0.360

Cross-Validation Statistics

- Average Test AUC: 0.718 ± 0.043
- Upper Bound on Test AUC: 0.730
- Average Test Gain: 0.283 ± 0.146
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.34 ± 0.13

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,119
- Number of Occurrences used to create distribution model: 353
- Average Point Quality Index (highest quality is 12.00): 6.36 ± 1.93
- Most recent occurrence used: 2008
- Oldest occurrence used: 1971
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL.CSV

Comments

There are no additional comments specific to this species range map or distribution model.

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

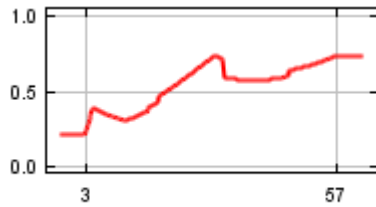
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Precipitation of the driest month	24
Driest quarter mean temperature	20
Cottonwood Index	17
Forest Cover Index	16
Depth to Shallowest Restrictive Layer	13
Deciduous Forest Index	10

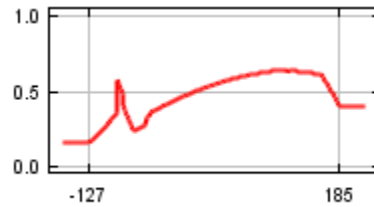
Response Curves

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).

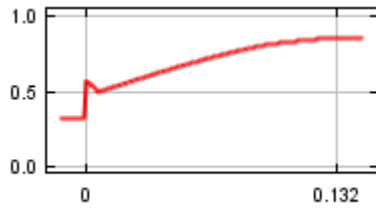
Precipitation of the driest month



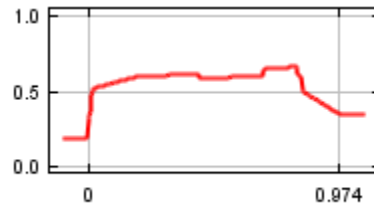
Driest quarter mean temperature



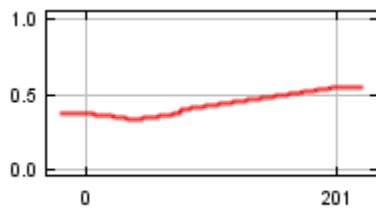
Cottonwood Index



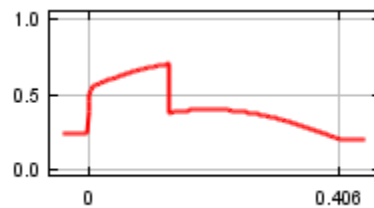
Forest Cover Index



Depth to Shallowest Restrictive Layer



Deciduous Forest Index

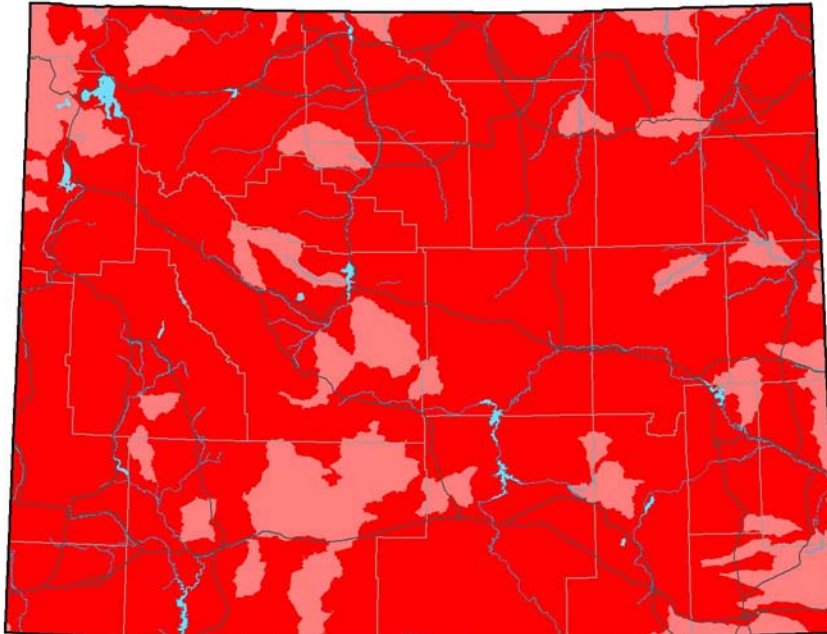


Bald Eagle - winter (*Haliaeetus leucocephalus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Bald Eagle - winter (ABNKC10010W) 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

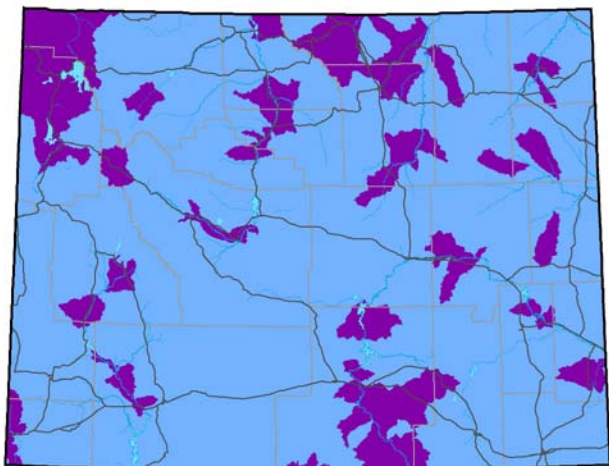


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.778
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

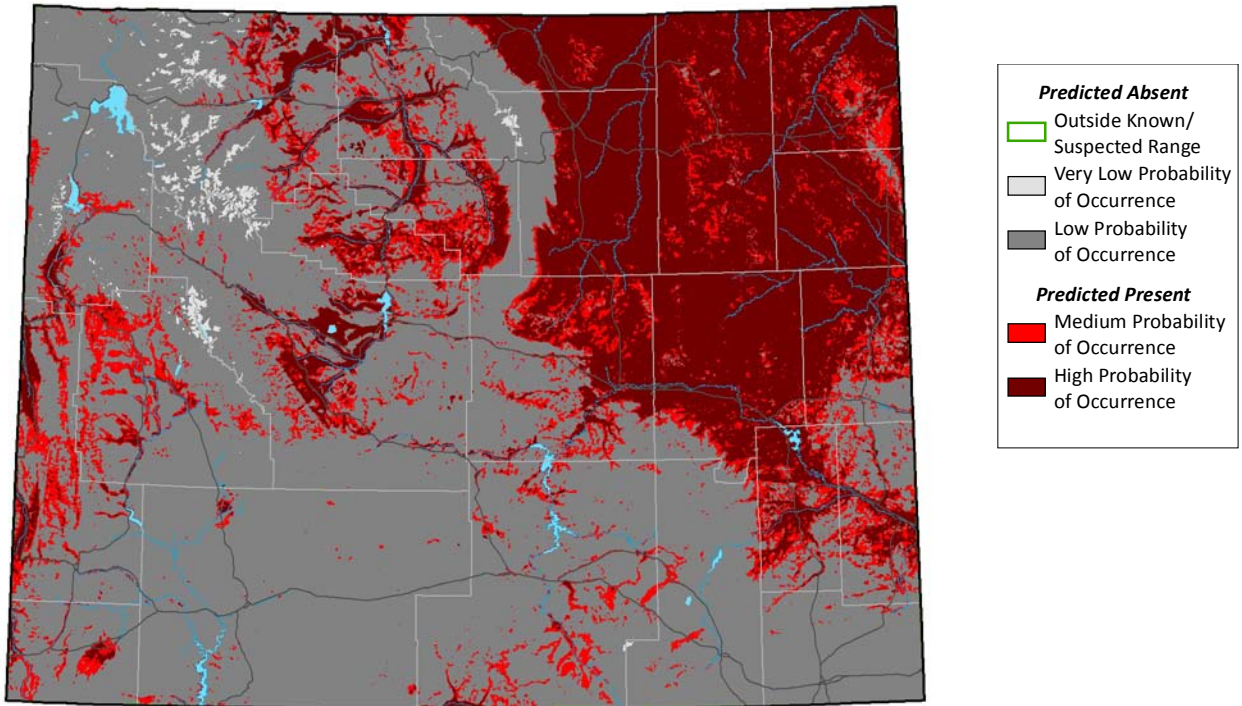
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Mon Dec 21 18:33:45 MST 2009)

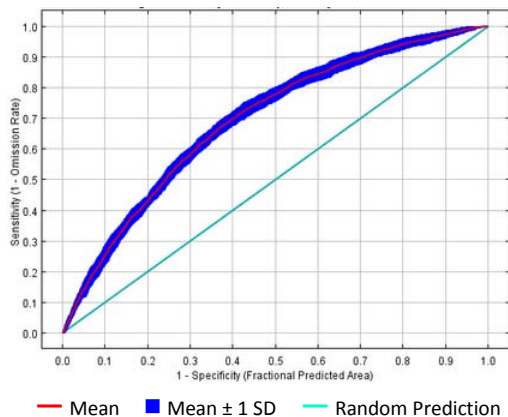
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Winter (1-Oct- 31-Mar)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4372830
- High-Probability Threshold Value: 0.5207806
- Low-Probability Threshold Value: 0.0778948

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

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

Model Evaluation Statistics

Final Model Statistics

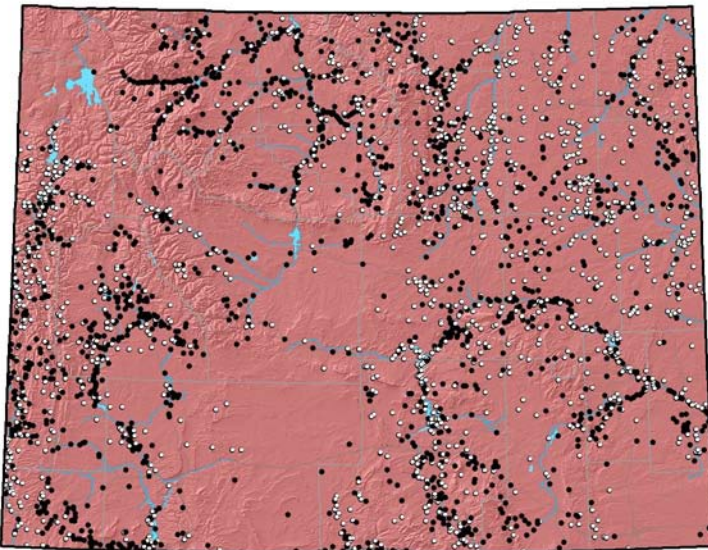
Training AUC: 0.708
 Regularized Training Gain: 0.241

Cross-Validation Statistics

- Average Test AUC: 0.693 ± 0.014
- Upper Bound on Test AUC: 0.691
- Average Test Gain: 0.231 ± 0.039
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.32 ± 0.04

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 9,460
- Number of Occurrences used to create distribution model: 2,794
- Average Point Quality Index (highest quality is 12.00): 5.49 ± 1.53
- Most recent occurrence used: 2008
- Oldest occurrence used: 1972
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL.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

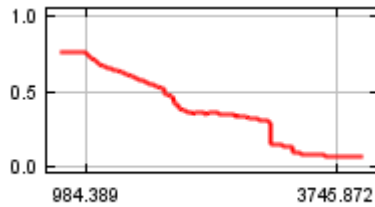
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Elevation	51
Bare Ground Index	15
Cottonwood Index	10
Precipitation of the warmest quarter	10
Herbaceous Cover Index	9
Variation in monthly radiation	4

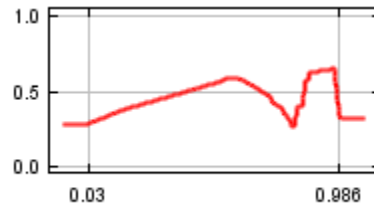
Response Curves

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).

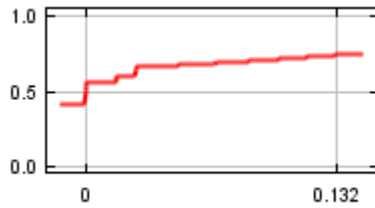
Elevation



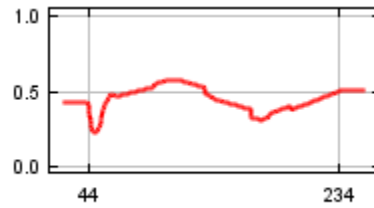
Bare Ground Index



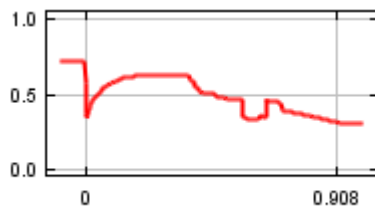
Cottonwood Index



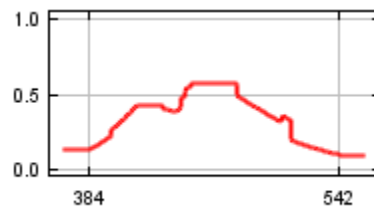
Precipitation of the warmest quarter



Herbaceous Cover Index



Variation in monthly radiation

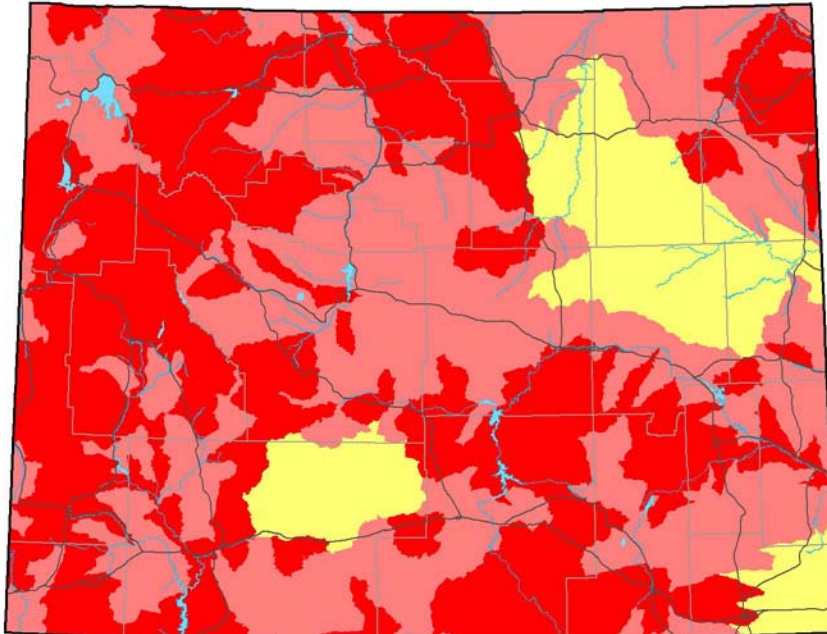


Northern Goshawk (*Accipiter gentilis*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Northern Goshawk (ABNKC12060) 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

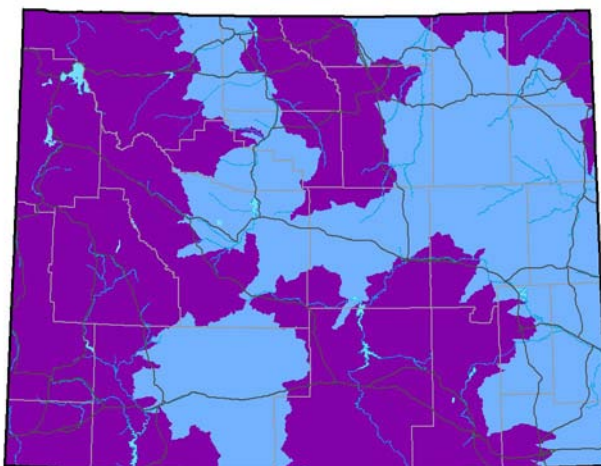


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.599
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

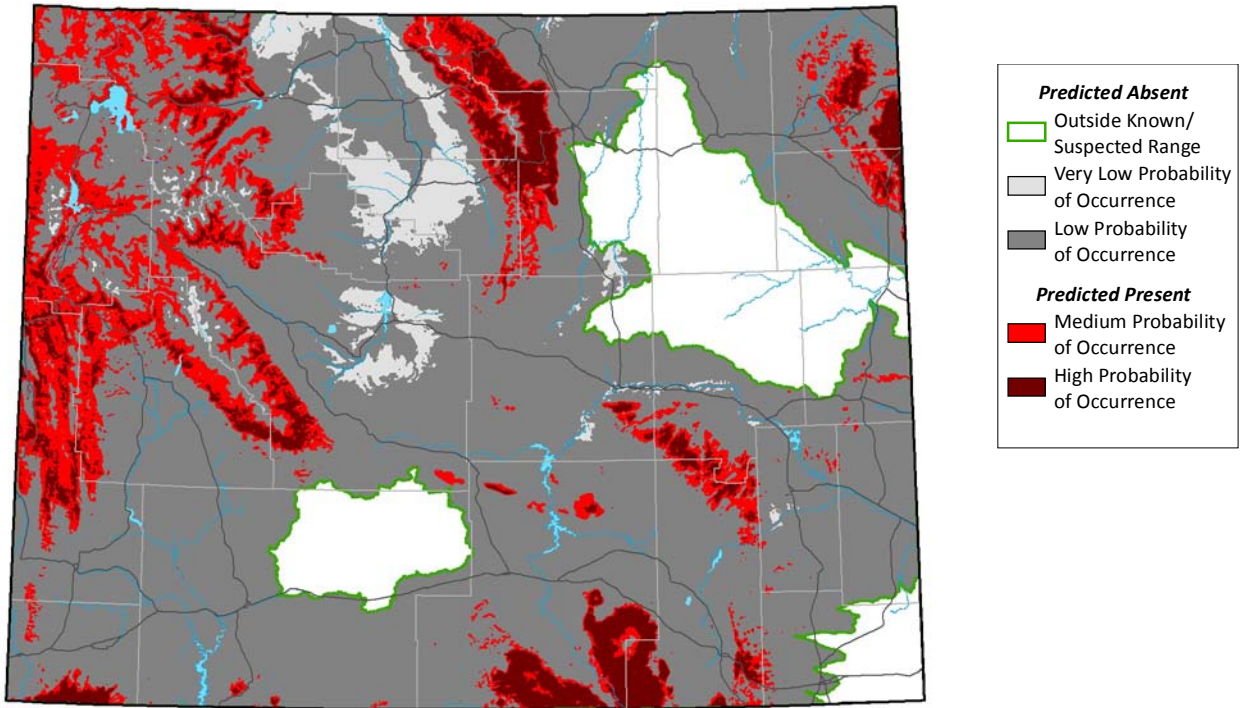
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Mon Jan 04 08:42:13 MST 2010)

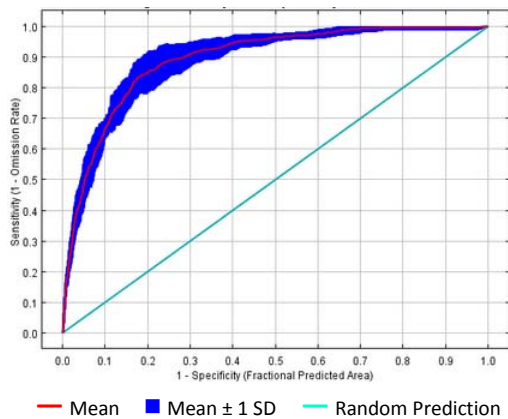
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-Apr- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2549630
- High-Probability Threshold Value: 0.5754688
- Low-Probability Threshold Value: 0.0066447

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

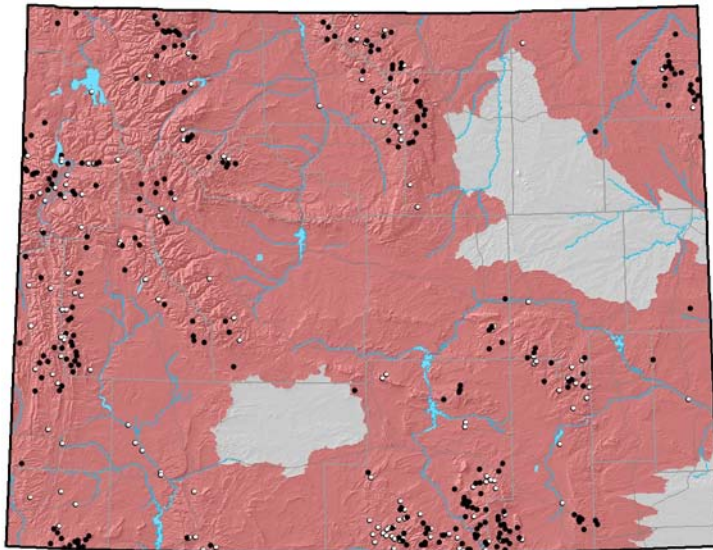
- Training AUC: 0.902
- Regularized Training Gain: 1.349

Cross-Validation Statistics

- Average Test AUC: 0.891 ± 0.017
- Upper Bound on Test AUC: 0.893
- Average Test Gain: 1.301 ± 0.138
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.17 ± 0.06

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,580
- Number of Occurrences used to create distribution model: 421
- Average Point Quality Index (highest quality is 12.00): 6.58 ± 2.41
- Most recent occurrence used: 2008
- Oldest occurrence used: 1969
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL.CSV

Comments

There are no additional comments specific to this species range map or distribution model.

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

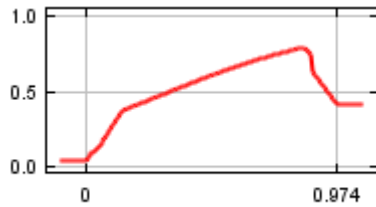
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Forest Cover Index	46
Conifer Index	25
Annual mean precipitation	11
Hottest month mean maximum temperature	6
Variation in monthly radiation	6
Annual mean temperature	6

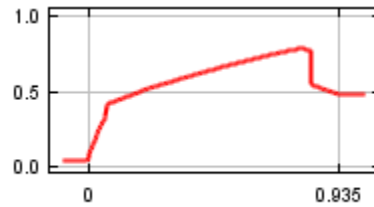
Response Curves

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).

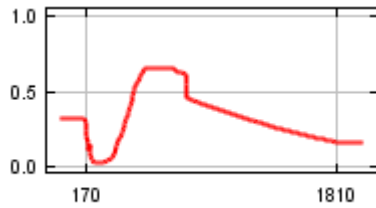
Forest Cover Index



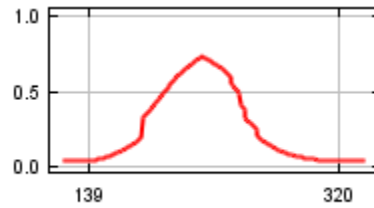
Conifer Index



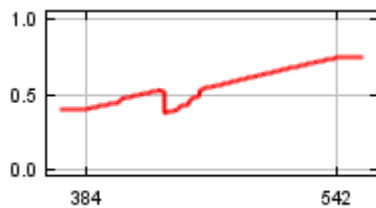
Annual mean precipitation



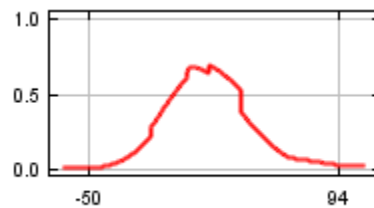
Hottest month mean maximum temperature



Variation in monthly radiation



Annual mean temperature

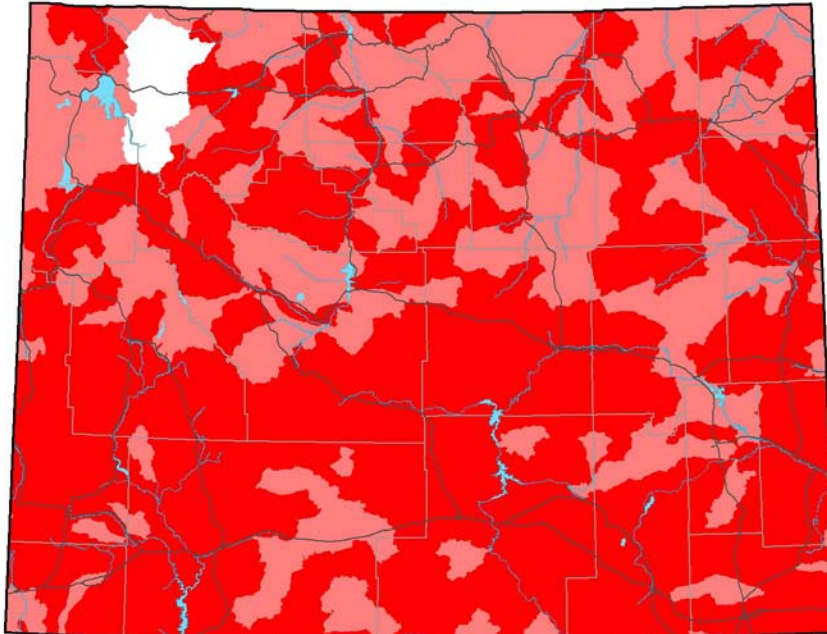


Swainson's Hawk (*Buteo swainsoni*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Swainson's Hawk (ABNKC19070) 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

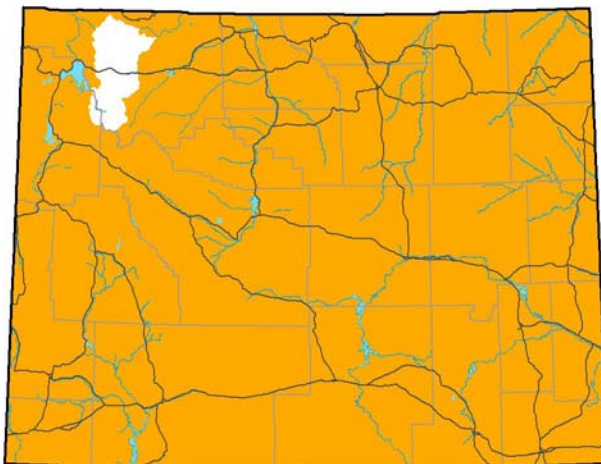


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.590
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

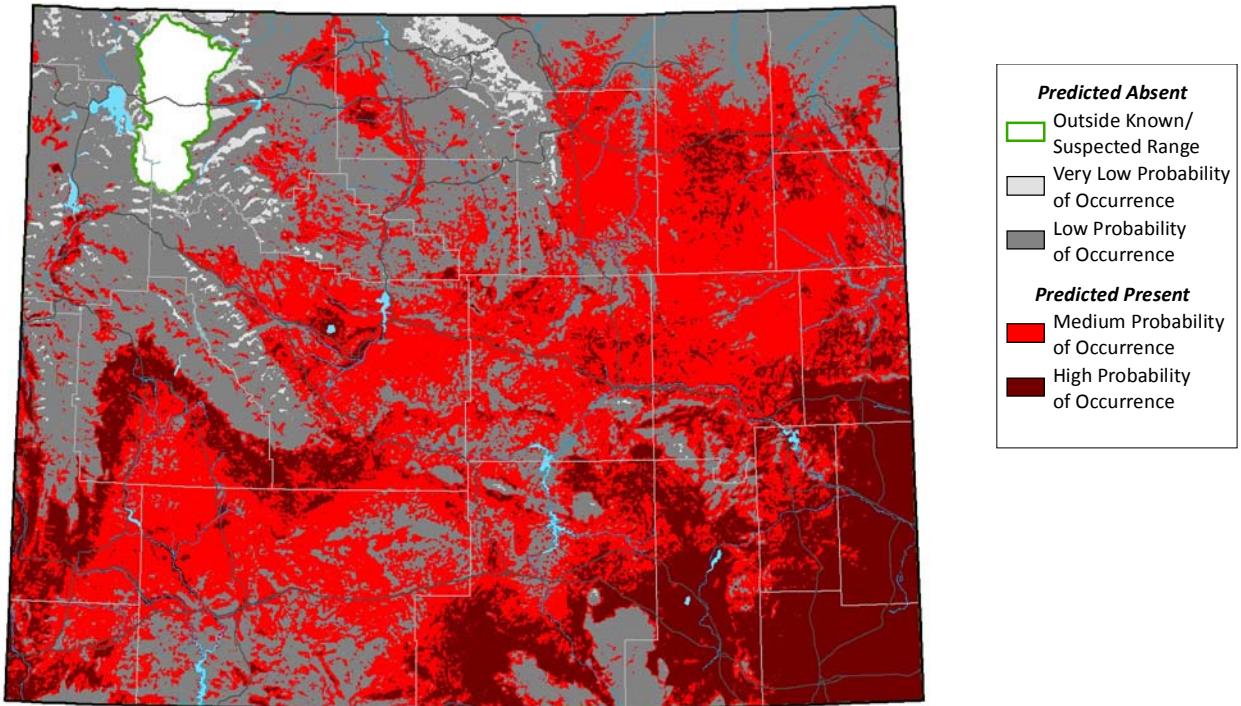
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Sun Apr 25 15:36:15 MDT 2010)

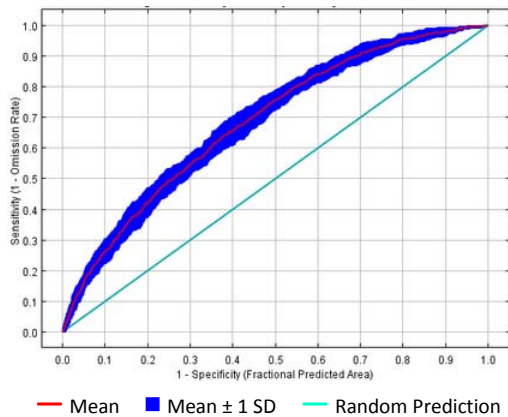
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-Apr- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: 10 percentile training presence
- Binary Threshold Value: 0.3484500
- High-Probability Threshold Value: 0.5119595
- Low-Probability Threshold Value: 0.0502005

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

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

Model Evaluation Statistics

Final Model Statistics

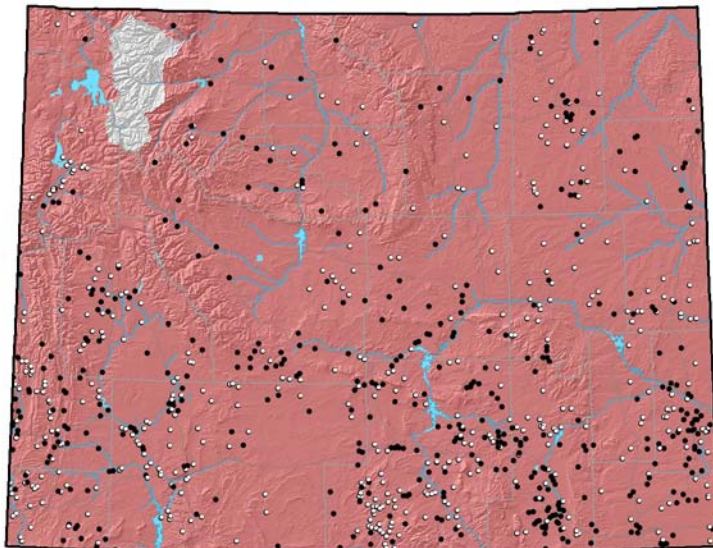
Training AUC: 0.709
 Regularized Training Gain: 0.235

Cross-Validation Statistics

- Average Test AUC: 0.685 ± 0.019
- Upper Bound on Test AUC: 0.686
- Average Test Gain: 0.221 ± 0.049
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.35 ± 0.09

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 2,230
- Number of Occurrences used to create distribution model: 861
- Average Point Quality Index (highest quality is 12.00): 5.64 ± 1.60
- Most recent occurrence used: 2007
- Oldest occurrence used: 1961
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL_2.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.

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

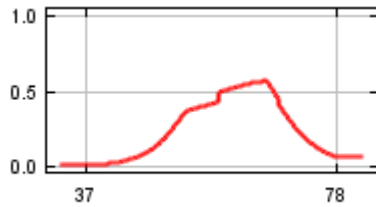
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Radiation of the darkest month	26
Hottest month mean maximum temperature	17
Pinon-Juniper Index	17
Conifer Index	15
Variation in monthly radiation	13
Annual mean precipitation	10
Elevation	2

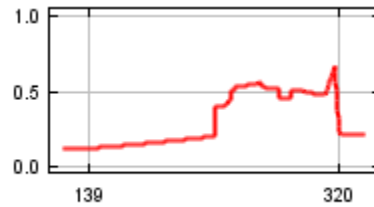
Response Curves

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).

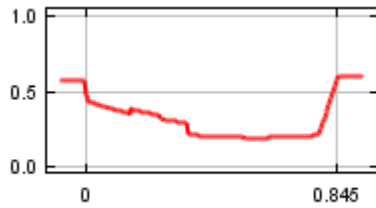
Radiation of the darkest month



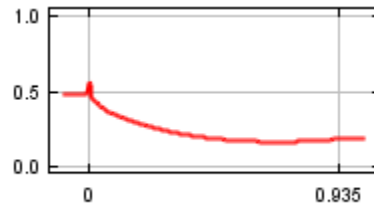
Hottest month mean maximum temperature



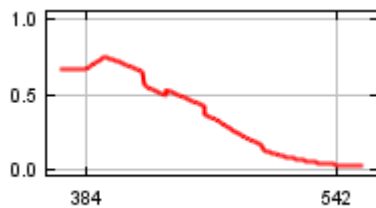
Pinon-Juniper Index



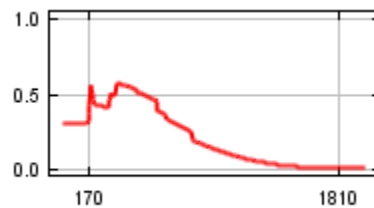
Conifer Index



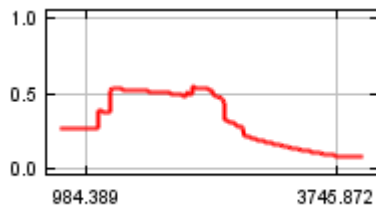
Variation in monthly radiation



Annual mean precipitation



Elevation

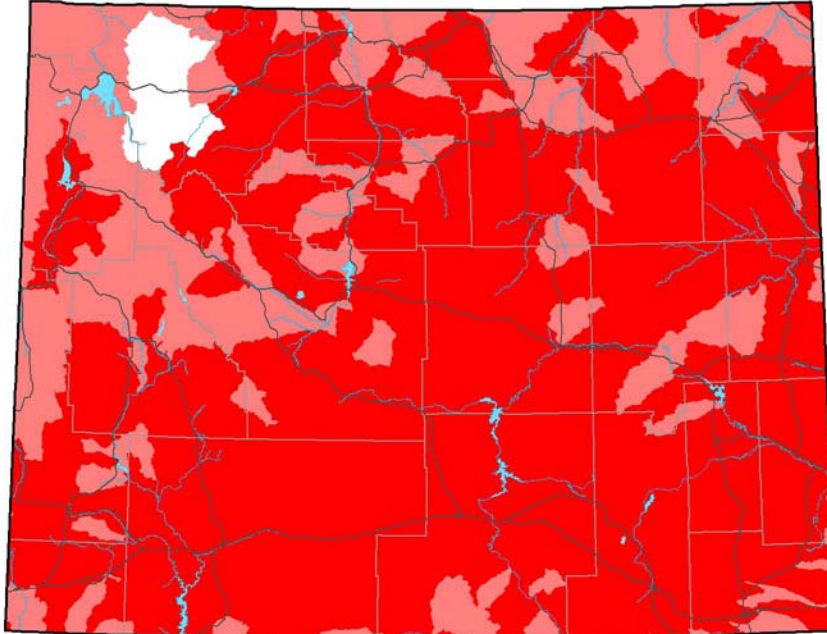


Ferruginous Hawk (*Buteo regalis*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Ferruginous Hawk (ABNKC19120) 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

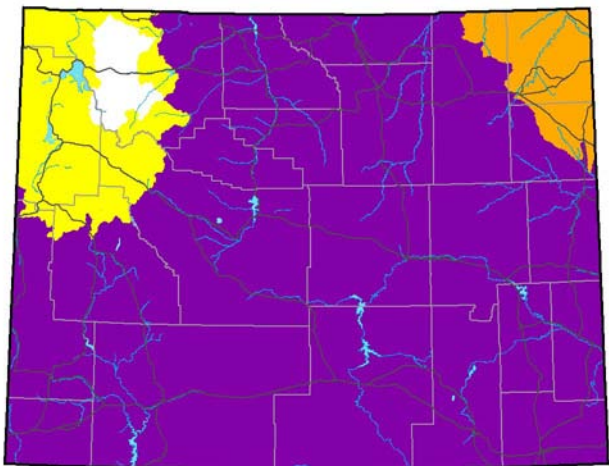


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.710
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

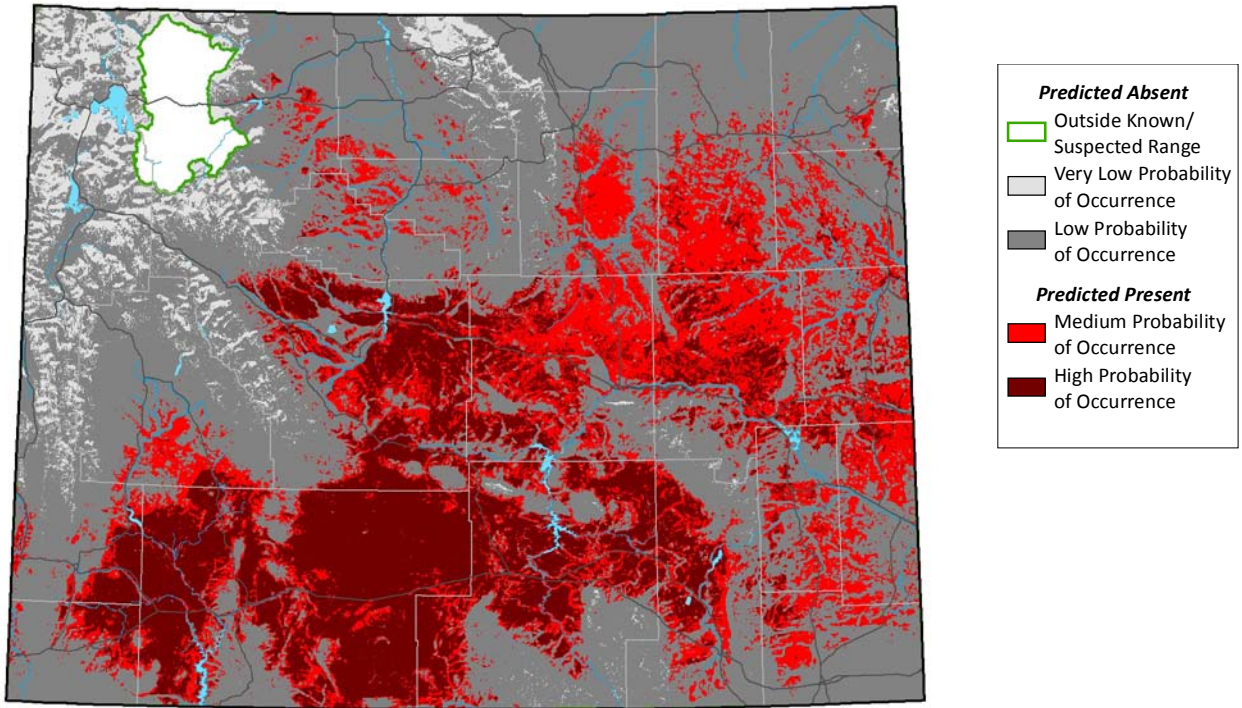
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Mon Jan 04 18:36:30 MST 2010)

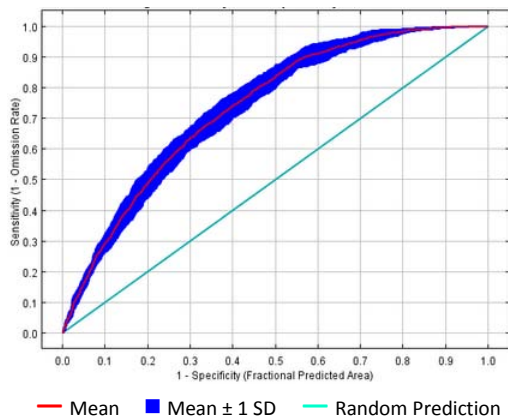
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-Apr- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4379630
- High-Probability Threshold Value: 0.5423713
- Low-Probability Threshold Value: 0.0194921

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

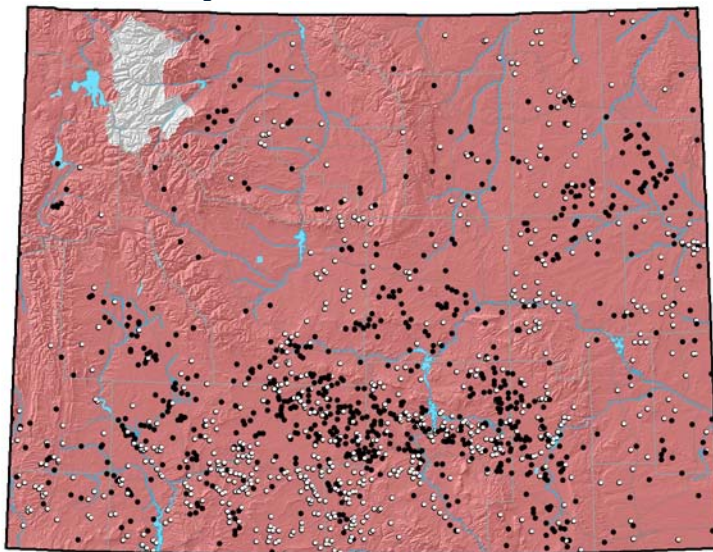
- Training AUC: 0.749
- Regularized Training Gain: 0.383

Cross-Validation Statistics

- Average Test AUC: 0.737 ± 0.023
- Upper Bound on Test AUC: 0.737
- Average Test Gain: 0.373 ± 0.070
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.24 ± 0.10

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 4,914
- Number of Occurrences used to create distribution model: 1,443
- Average Point Quality Index (highest quality is 12.00): 6.12 ± 1.92
- Most recent occurrence used: 2008
- Oldest occurrence used: 1876
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL.CSV

Comments

There are no additional comments specific to this species range map or distribution model.

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

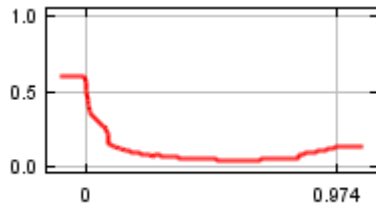
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Forest Cover Index	37
Variation in monthly radiation	17
Conifer Index	15
Warmest quarter mean temperature	15
Bare Ground Index	11
Vector Ruggedness Measure	5

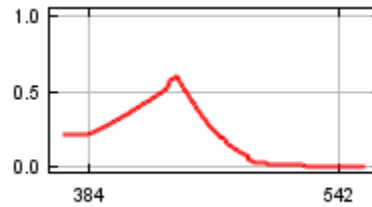
Response Curves

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).

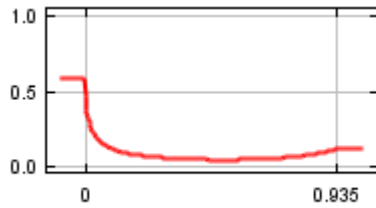
Forest Cover Index



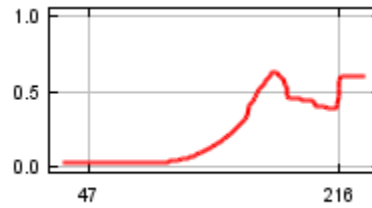
Variation in monthly radiation



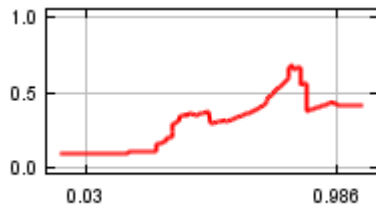
Conifer Index



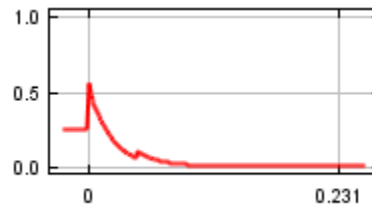
Warmest quarter mean temperature



Bare Ground Index



Vector Ruggedness Measure

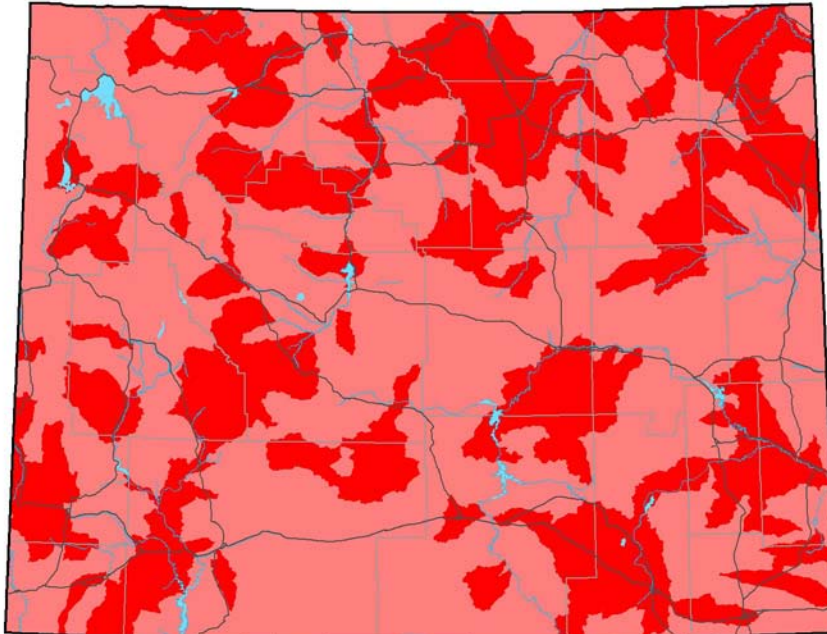


Merlin (*Falco columbarius*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Merlin (ABNKD06030) 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

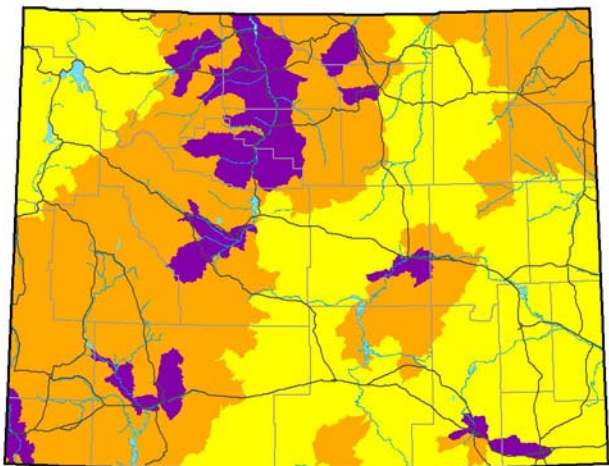


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.409
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

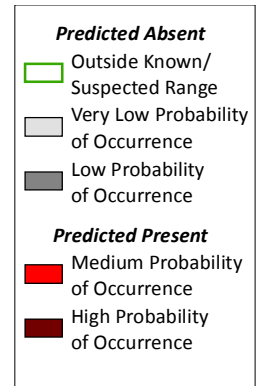
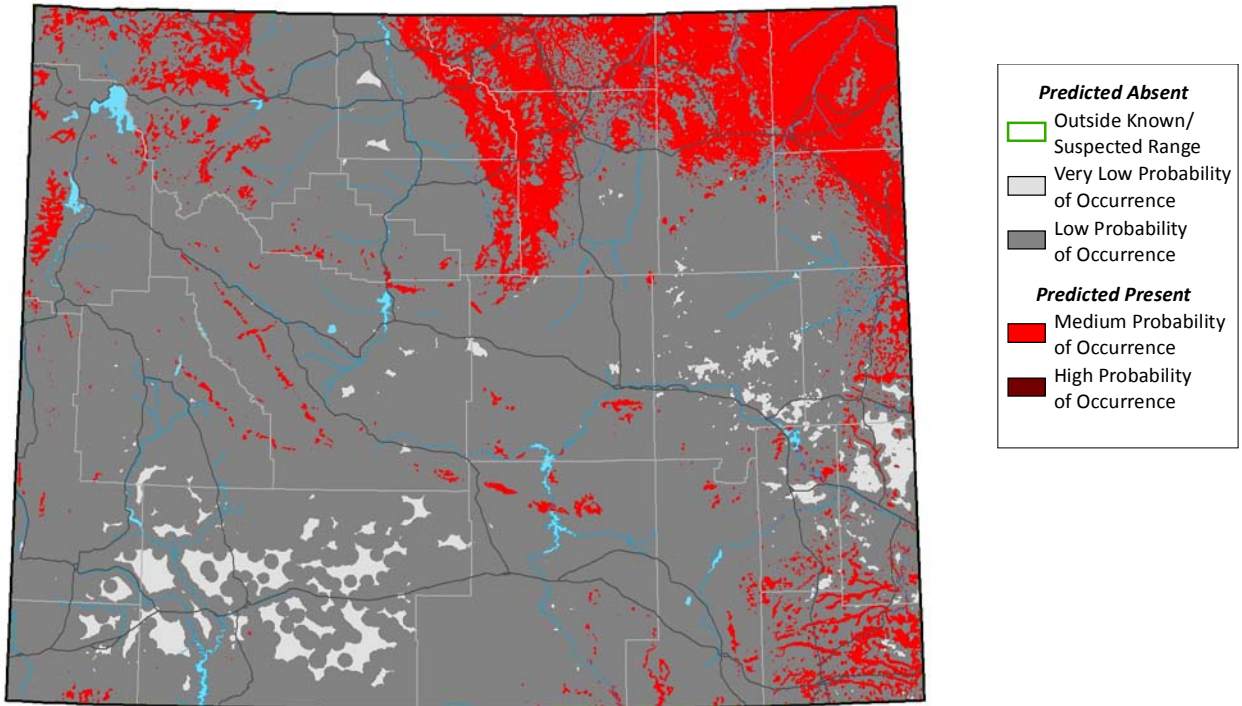
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

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Distribution Model (Version: Wed Mar 17 11:24:51 MDT 2010)

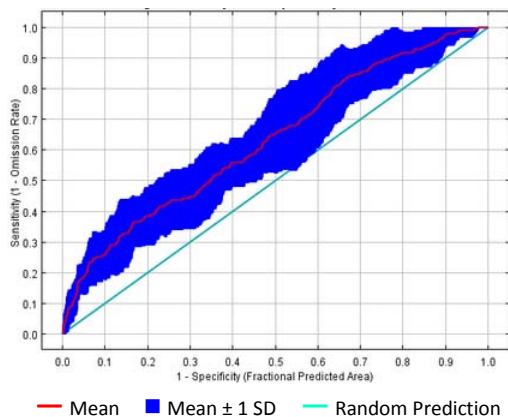
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (25-Apr- 25-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.5679630
- High-Probability Threshold Value: 0.4688465
- Low-Probability Threshold Value: 0.1142441

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

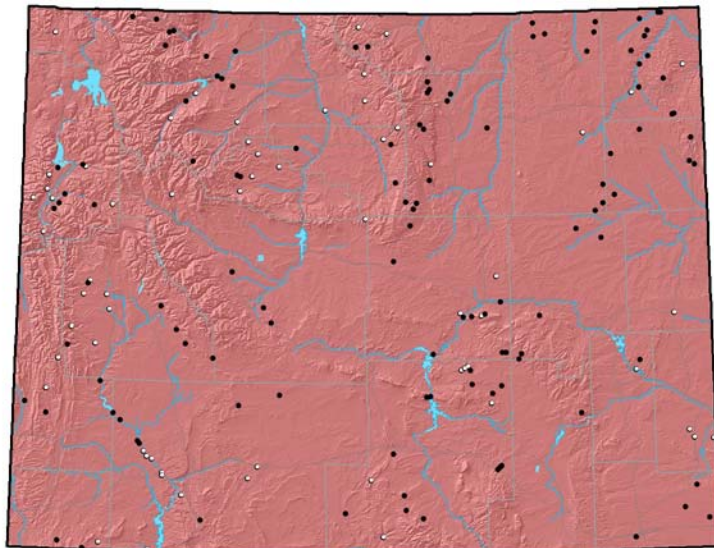
- Training AUC: 0.662
- Regularized Training Gain: 0.220

Cross-Validation Statistics

- Average Test AUC: 0.634 ± 0.066
- Upper Bound on Test AUC: 0.666
- Average Test Gain: 0.139 ± 0.150
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.64 ± 0.15

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 588
- Number of Occurrences used to create distribution model: 182
- Average Point Quality Index (highest quality is 12.00): 6.35 ± 2.28
- Most recent occurrence used: 2008
- Oldest occurrence used: 1966
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL_2.CSV

Comments

Conclusive identification of this species is difficult unless the observer is experienced with the species. We suspect numerous occurrences could be in error, thus resulting in lower than expected model quality. The lack of supporting data provided with many occurrences (notably those from the Wildlife Observation System) makes it impossible to assess the accuracy of such observations. Supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

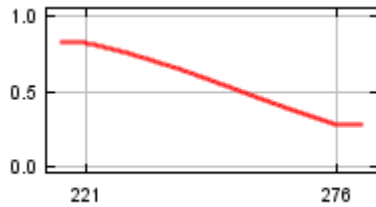
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Radiation of the lightest month	52
Forest Cover Index	17
Pinon-Juniper Index	16
Distance to Permanent Water	8
Herbaceous Cover Index	4
Precipitation of the warmest quarter	3

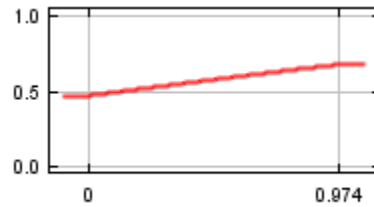
Response Curves

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).

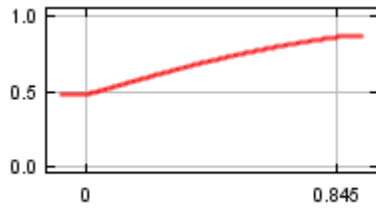
Radiation of the lightest month



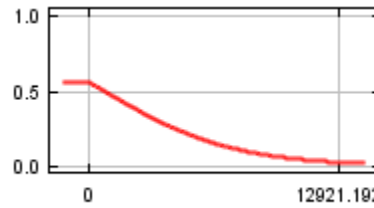
Forest Cover Index



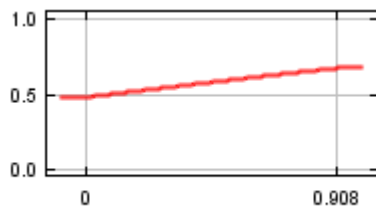
Pinon-Juniper Index



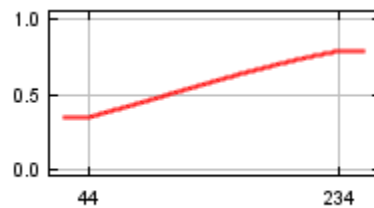
Distance to Permanent Water



Herbaceous Cover Index



Precipitation of the warmest quarter

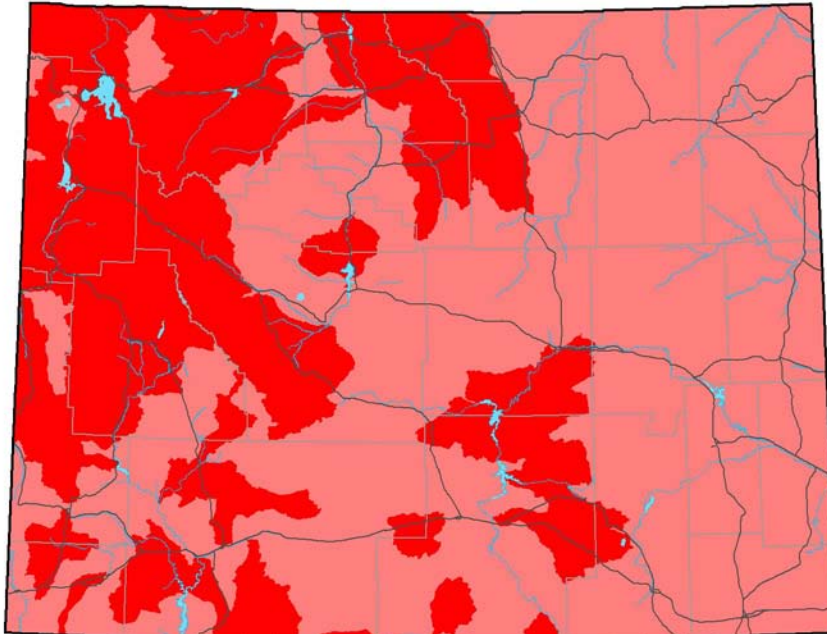


Peregrine Falcon (*Falco peregrinus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Peregrine Falcon (ABNKD06070) 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

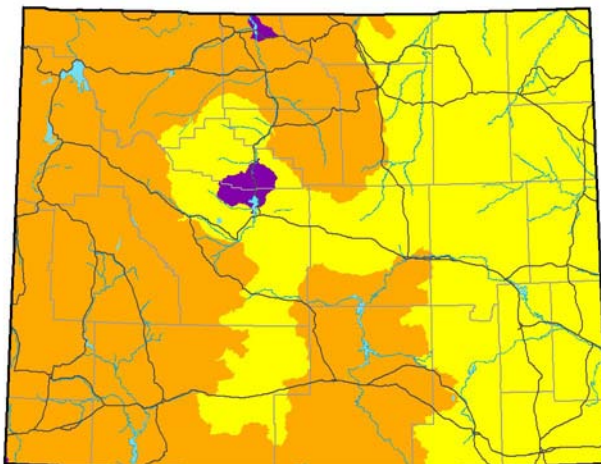


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.610
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

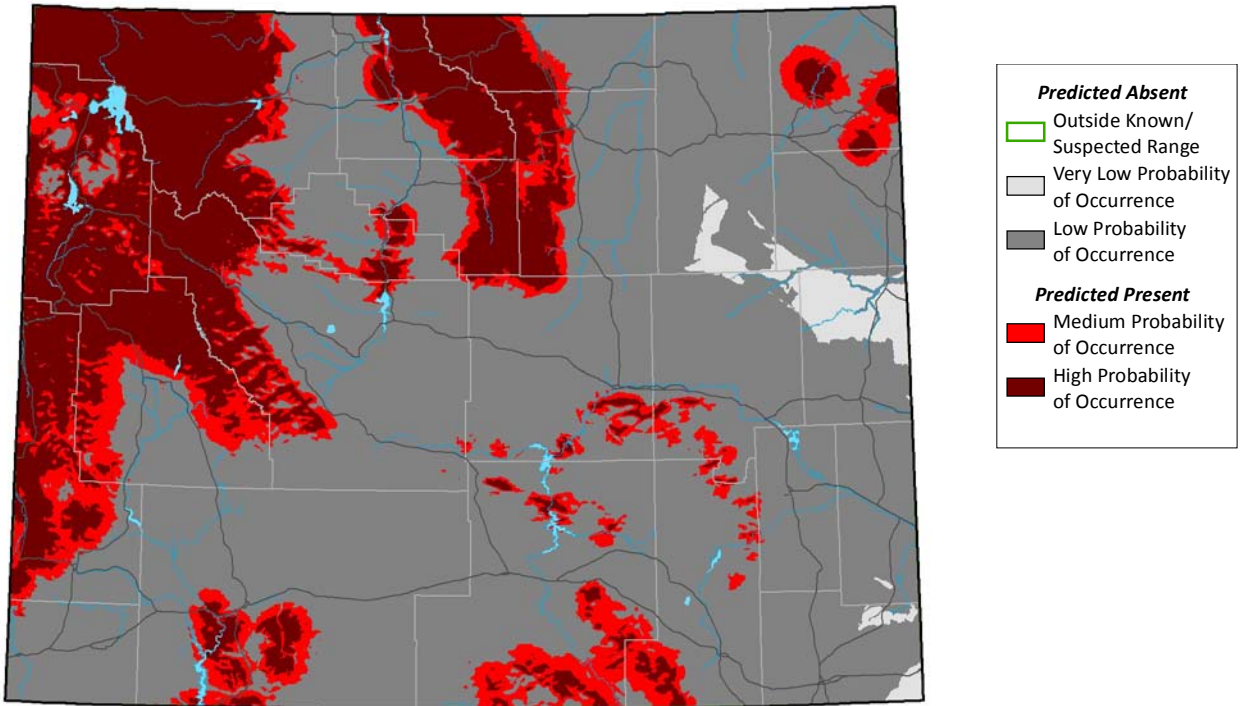
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 16 22:42:56 MDT 2010)

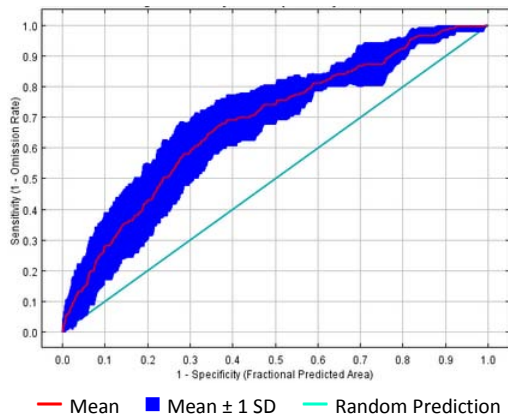
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-May- 31-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4496070
- High-Probability Threshold Value: 0.5073747
- Low-Probability Threshold Value: 0.0431552

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

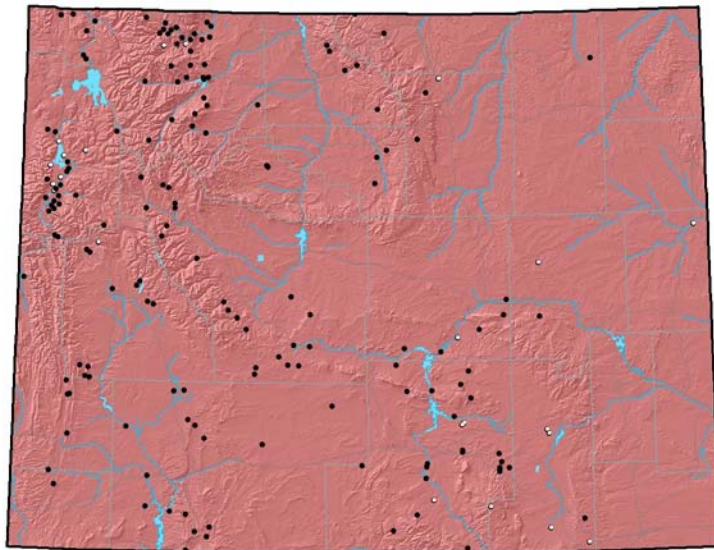
- Training AUC: 0.701
- Regularized Training Gain: 0.269

Cross-Validation Statistics

- Average Test AUC: 0.684 ± 0.055
- Upper Bound on Test AUC: 0.701
- Average Test Gain: 0.212 ± 0.161
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.37 ± 0.10

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 470
- Number of Occurrences used to create distribution model: 181
- Average Point Quality Index (highest quality is 12.00): 7.39 ± 2.58
- Most recent occurrence used: 2008
- Oldest occurrence used: 1978
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL_2.csv

Comments

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

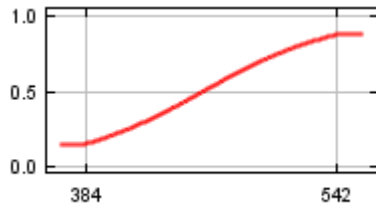
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Variation in monthly radiation	50
Distance to Cliffs	38
Variation of monthly precipitation	7
Annual precipitation range (P3 – P2)	2
Annual Radiation range	2
Depth to Shallowest Restrictive Layer	1

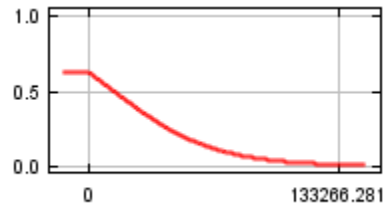
Response Curves

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).

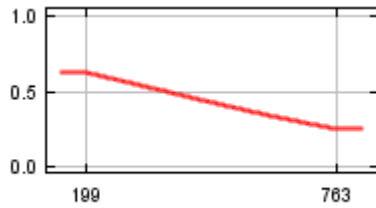
Variation in monthly radiation



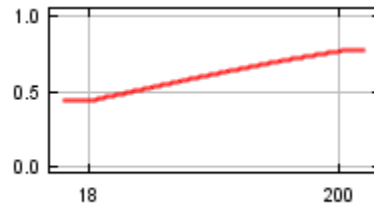
Distance to Cliffs



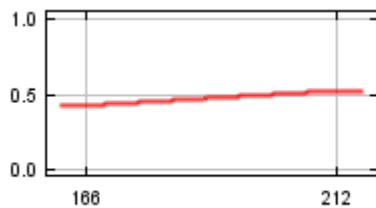
Variation of monthly precipitation



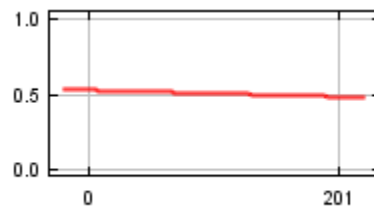
Annual precipitation range (P3 – P2)



Annual Radiation range



Depth to Shallowest Restrictive Layer

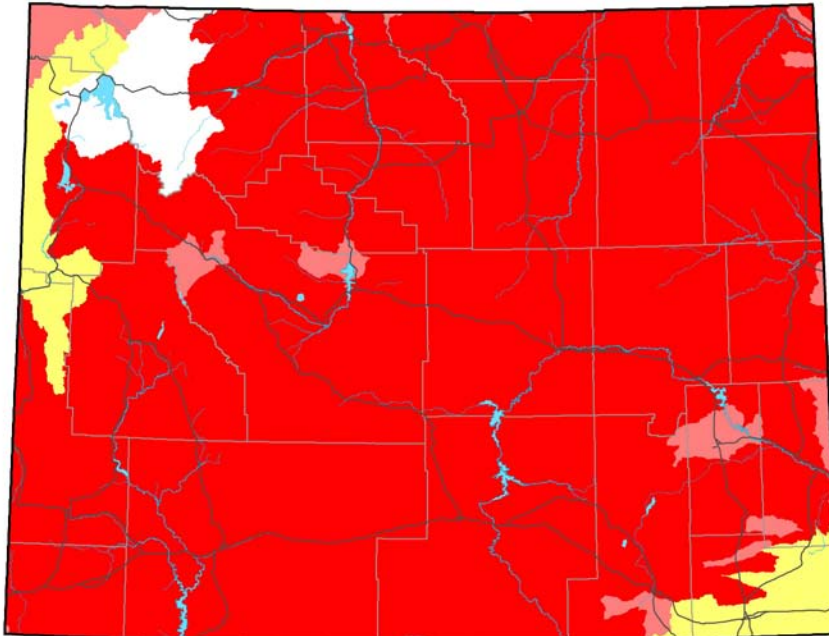


Greater Sage-Grouse (*Centrocercus urophasianus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Greater Sage-Grouse (ABNLC12010) 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

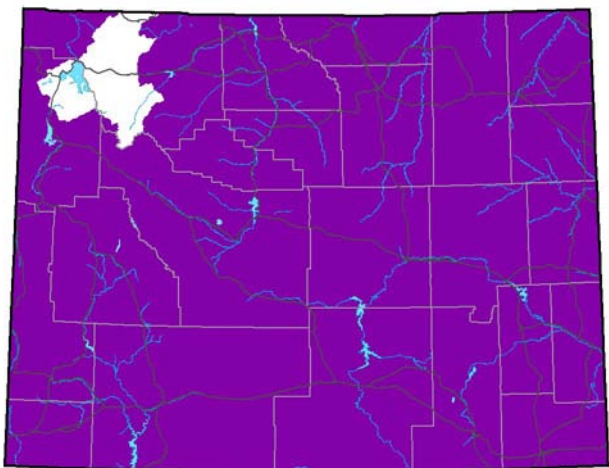


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.904
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

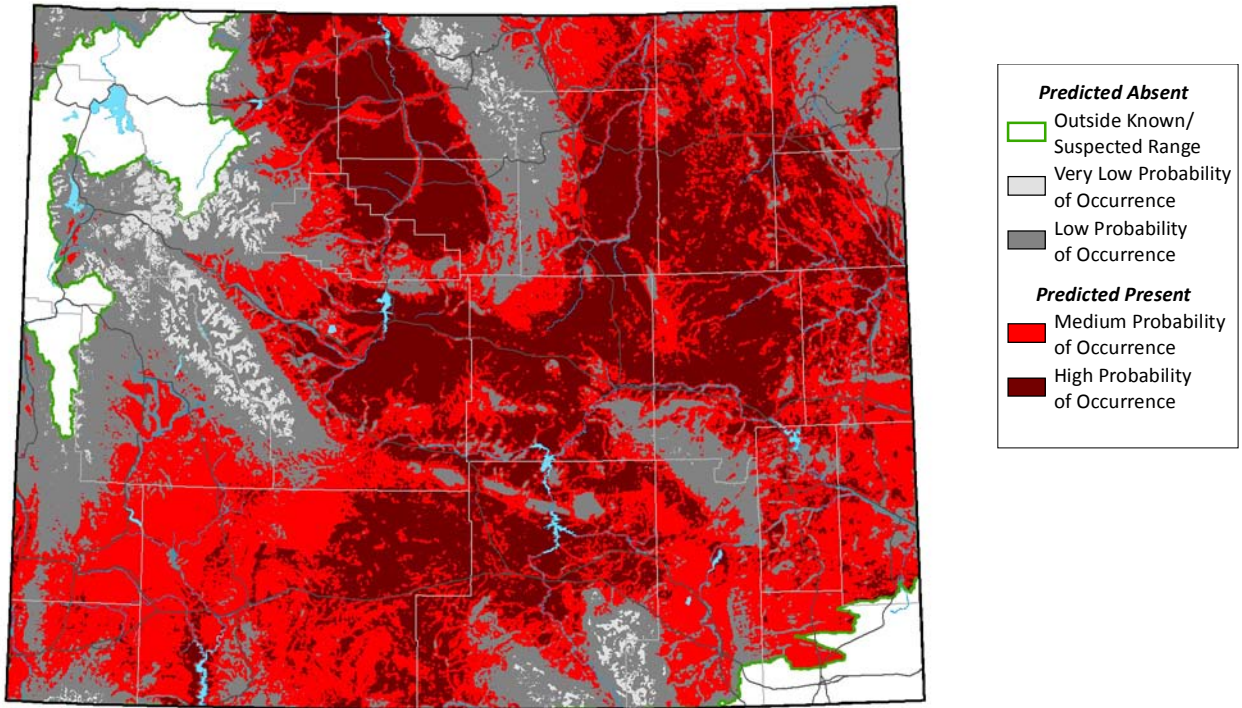
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

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Distribution Model (Version: Wed Mar 17 21:05:41 MDT 2010)

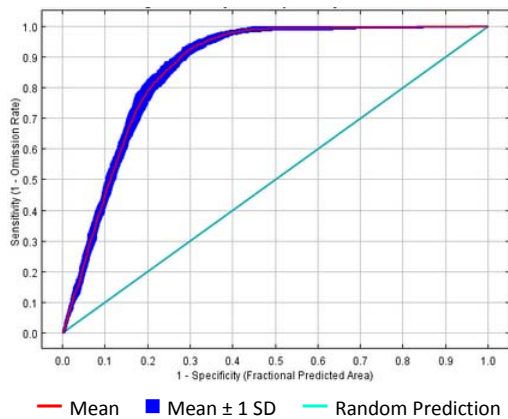
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-Mar- 30-Jun)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2642430
- High-Probability Threshold Value: 0.5747061
- Low-Probability Threshold Value: 0.0015102

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

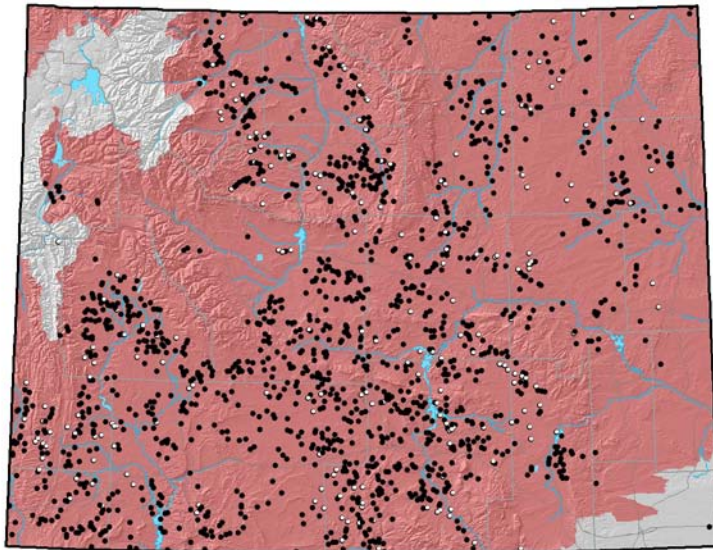
- Training AUC: 0.871
- Regularized Training Gain: 1.042

Cross-Validation Statistics

- Average Test AUC: 0.865 ± 0.010
- Upper Bound on Test AUC: 0.867
- Average Test Gain: 1.033 ± 0.075
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.09 ± 0.03

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 46,089
- Number of Occurrences used to create distribution model: 1,610
- Average Point Quality Index (highest quality is 12.00): 7.87 ± 1.48
- Most recent occurrence used: 2007
- Oldest occurrence used: 1949
- Occurrence File:
GAME_SAMPLE_POINTS_ALL_2.csv

Comments

This is a sagebrush obligate species for which model quality would likely improve if an accurate statewide estimate of sagebrush structure (i.e., density and/or height) were available.

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

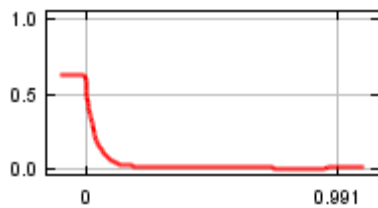
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Forest Cover Index	49
Warmest quarter mean temperature	28
Conifer Index	8
Bare Ground Index	6
Hottest month mean maximum temperature	4
Relative Humidity of most humid month	2
Sagebrush Index	2

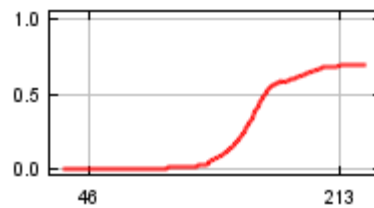
Response Curves

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).

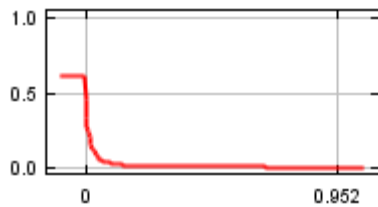
Forest Cover Index



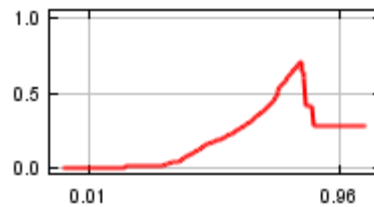
Warmest quarter mean temperature



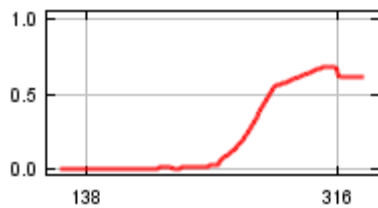
Conifer Index



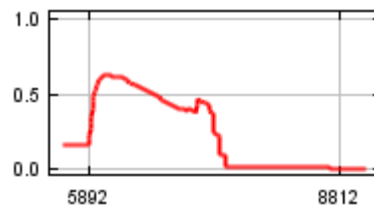
Bare Ground Index



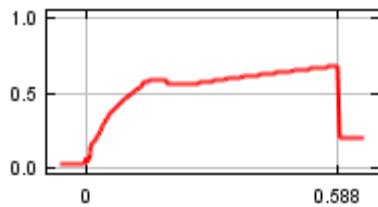
Hottest month mean maximum temperature



Relative Humidity of most humid month



Sagebrush Index



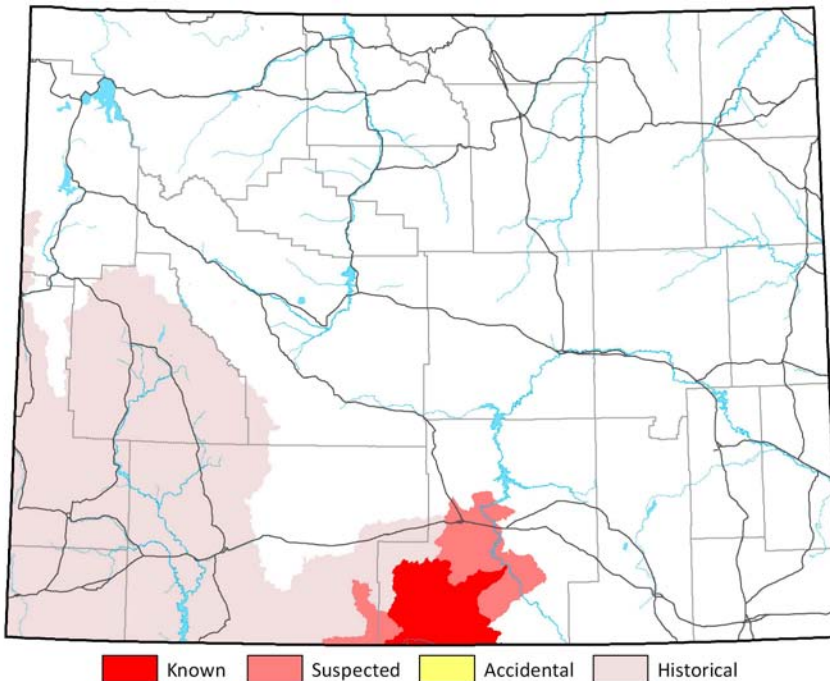
Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*)

Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Columbian Sharp-tailed Grouse (ABNLC13033) 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.

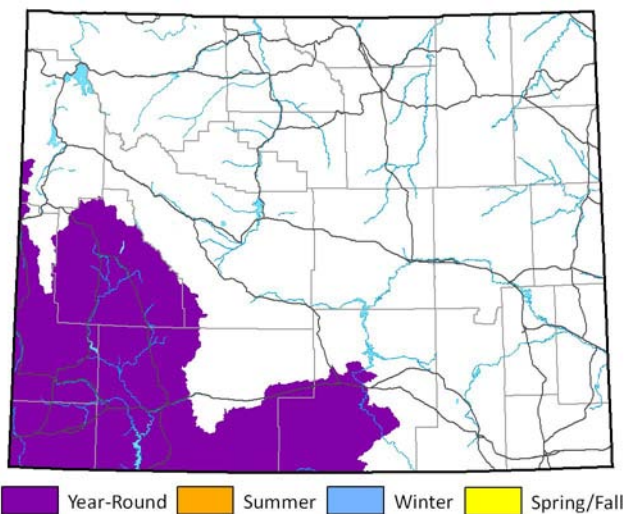
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.429
- 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/>).

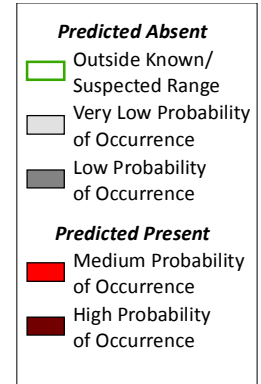
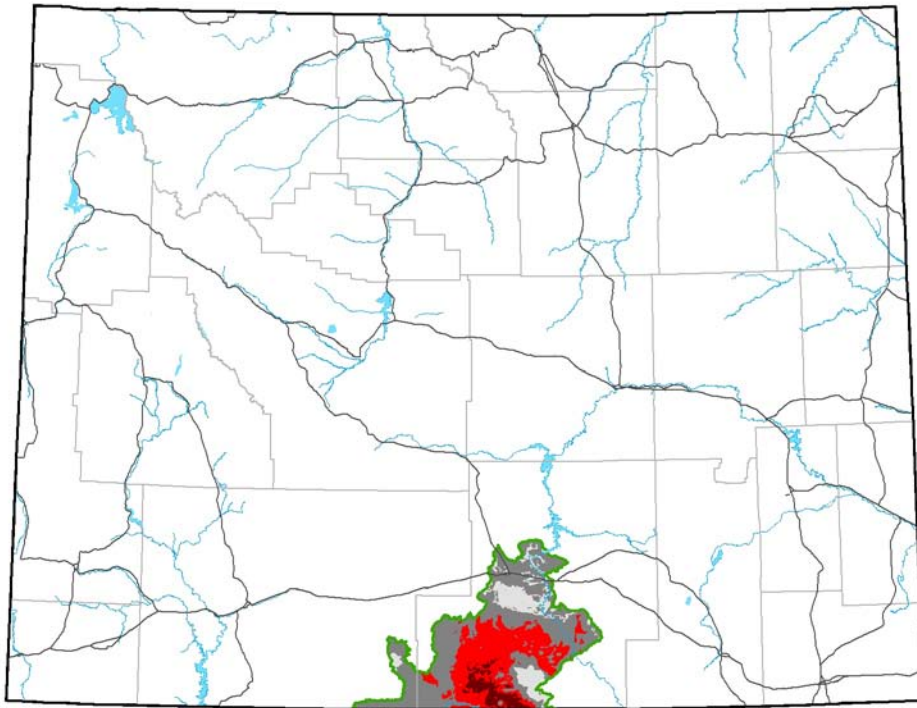
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Sat Jan 23 09:17:33 MST 2010)

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



Model Parameters

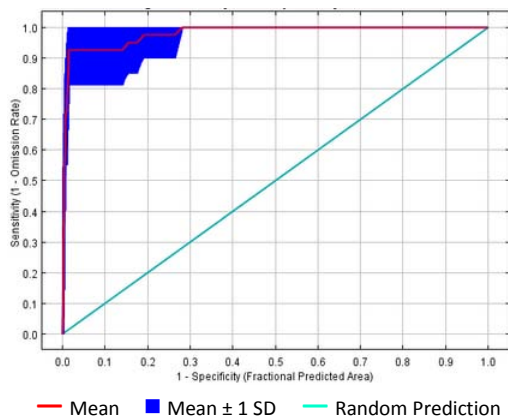
- Season Modeled: Breeding (1-Apr- 15-Sep)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2322070
- High-Probability Threshold Value: 0.6771706
- Low-Probability Threshold Value: 0.0061581

Model Quality Summary

Overall Assessment of Model Quality: HIGH

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

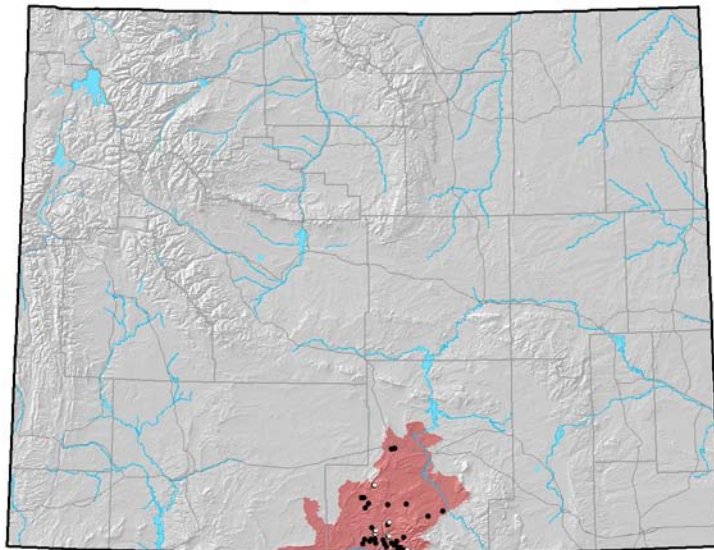
- Training AUC: 0.988
- Regularized Training Gain: 3.565

Cross-Validation Statistics

- Average Test AUC: 0.980 ± 0.026
- Upper Bound on Test AUC: 0.973
- Average Test Gain: 3.628 ± 0.856
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.13 ± 0.18

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 2,673
- Number of Occurrences used to create distribution model: 40
- Average Point Quality Index (highest quality is 12.00): 8.38 ± 2.82
- Most recent occurrence used: 2006
- Oldest occurrence used: 1980
- Occurrence File:
GAME_SAMPLE_POINTS_ALL.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

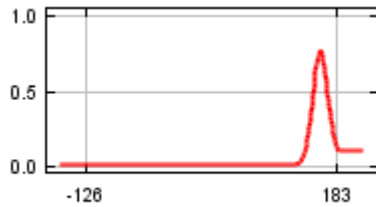
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Driest quarter mean temperature	36
Precipitation of the coldest quarter	22
Sagebrush Index	18
Coldest month mean minimum temperature	13
Depth to Shallowest Restrictive Layer	7
Wettest quarter mean temperature	5

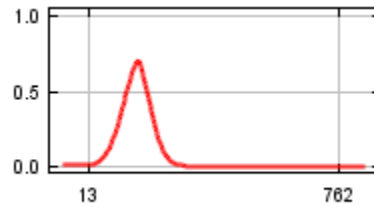
Response Curves

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).

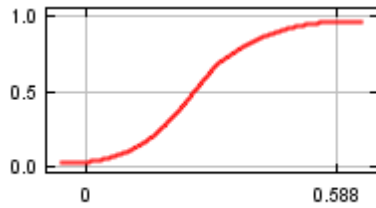
Driest quarter mean temperature



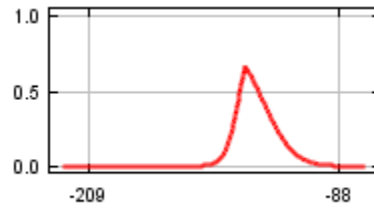
Precipitation of the coldest quarter



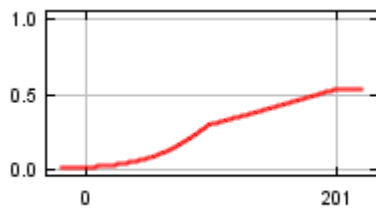
Sagebrush Index



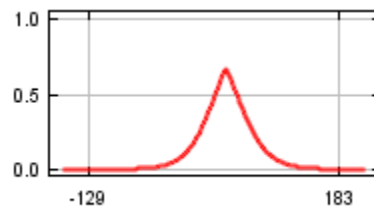
Coldest month mean minimum temperature



Depth to Shallowest Restrictive Layer



Wettest quarter mean temperature

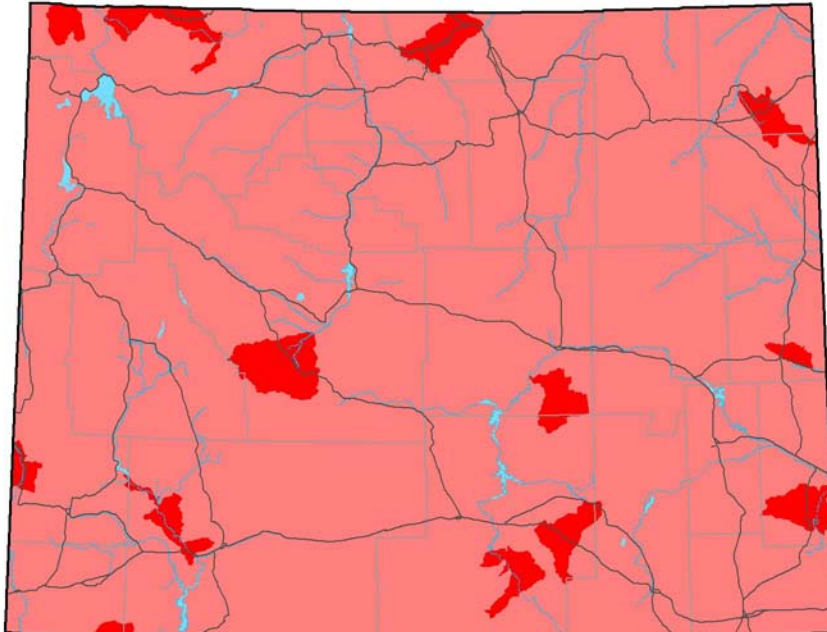


Virginia Rail (*Rallus limicola*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Virginia Rail (ABNME05030) 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.

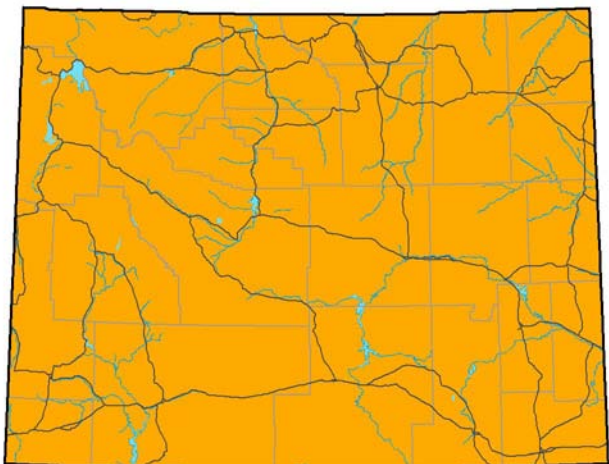
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.038
- 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/>).

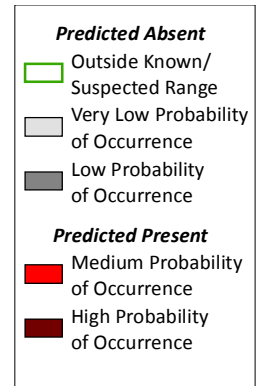
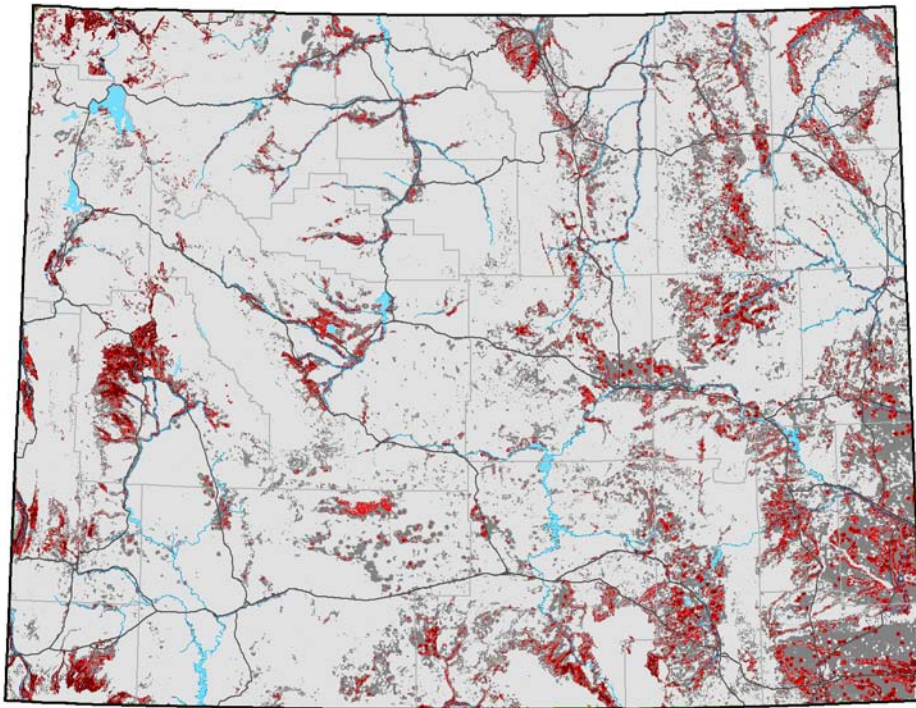
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Feb 09 17:00:21 MST 2010)

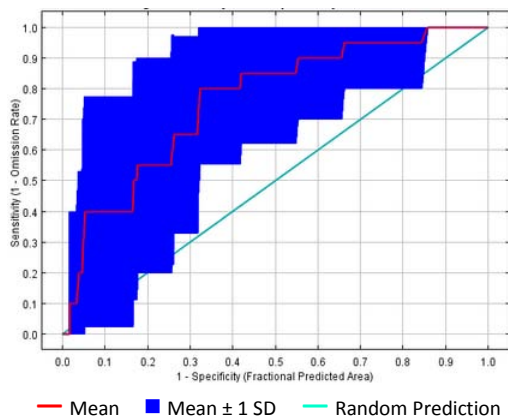
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (7-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4788990
- High-Probability Threshold Value: 0.6221668
- Low-Probability Threshold Value: 0.2341670

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

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

Model Evaluation Statistics

Final Model Statistics

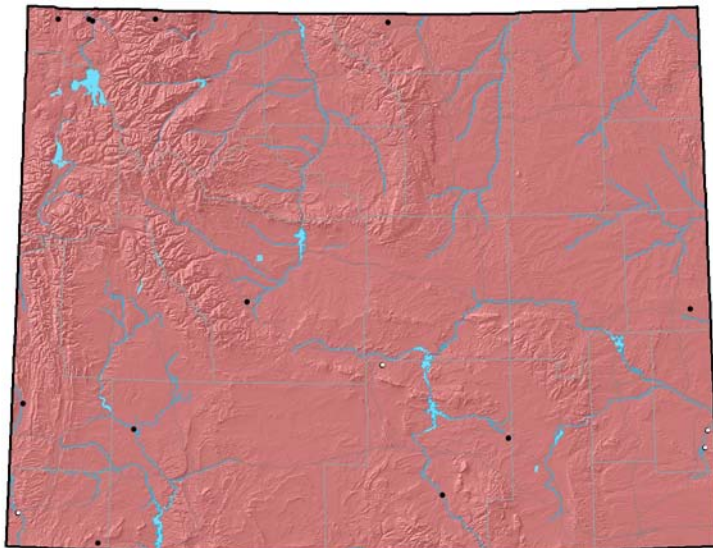
- Training AUC: 0.912
- Regularized Training Gain: 0.884

Cross-Validation Statistics

- Average Test AUC: 0.762 ± 0.156
- Upper Bound on Test AUC: 0.837
- Average Test Gain: 0.277 ± 1.182
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.45 ± 0.37

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 39
- Number of Occurrences used to create distribution model: 16
- Average Point Quality Index (highest quality is 12.00): 6.31 ± 1.54
- Most recent occurrence used: 2008
- Oldest occurrence used: 1982
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state.

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

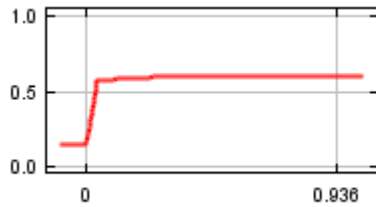
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Herbaceous Cover Index	22
Variation of monthly precipitation	18
Depth to Shallowest Restrictive Layer	17
Vector Ruggedness Measure	15
Forest Cover Index	15
Distance to Permanent Water	14

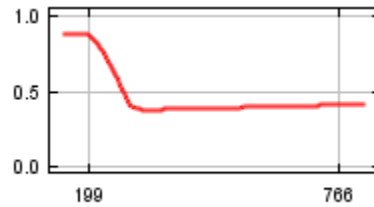
Response Curves

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).

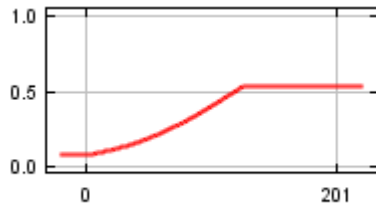
Herbaceous Cover Index



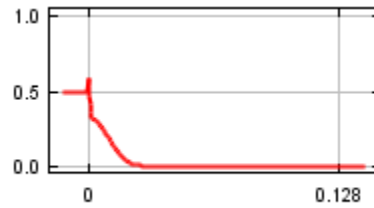
Variation of monthly precipitation



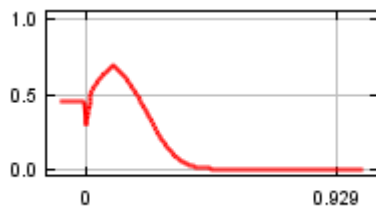
Depth to Shallowest Restrictive Layer



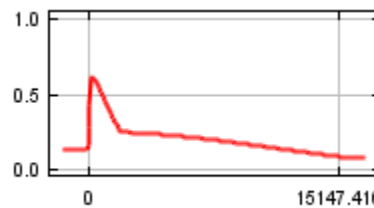
Vector Ruggedness Measure



Forest Cover Index



Distance to Permanent Water

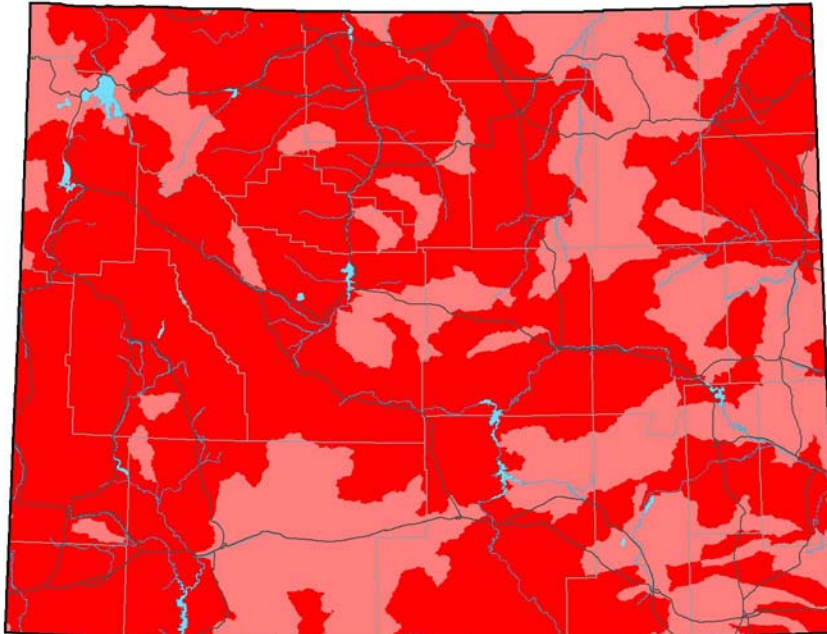


Greater Sandhill Crane (*Grus canadensis*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Greater Sandhill Crane (ABNMK01010) 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

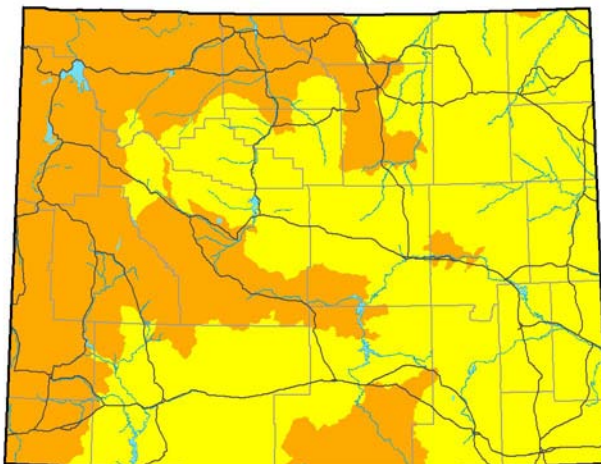


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.839
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

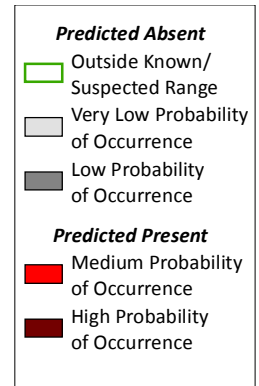
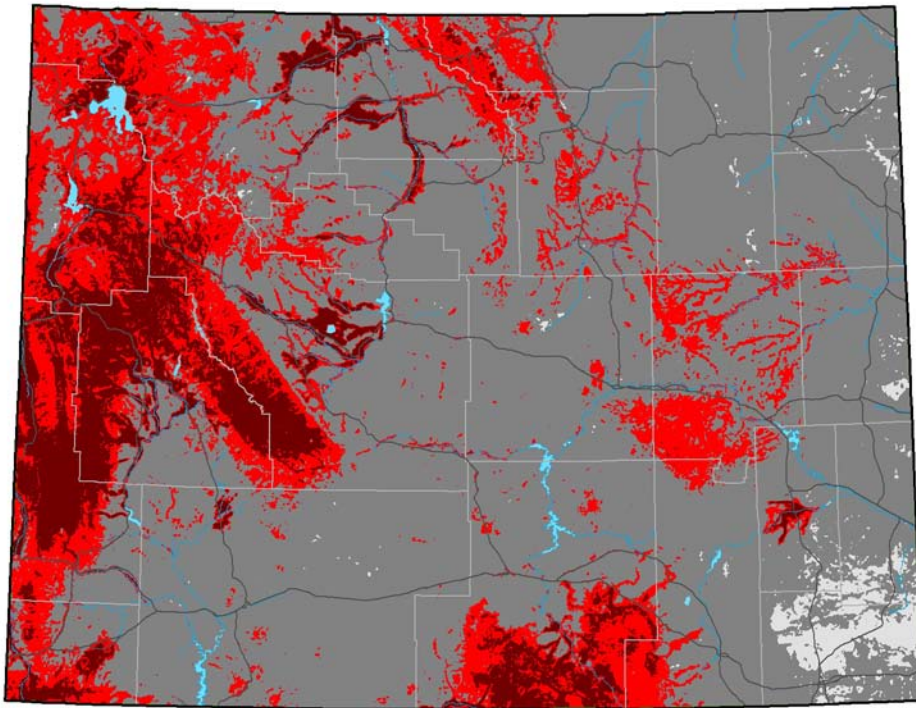
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 08:14:00 MST 2010)

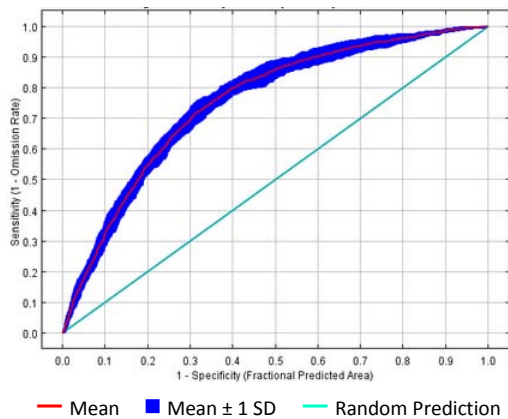
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (7-Apr- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3463090
- High-Probability Threshold Value: 0.5543355
- Low-Probability Threshold Value: 0.0545212

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

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

Model Evaluation Statistics

Final Model Statistics

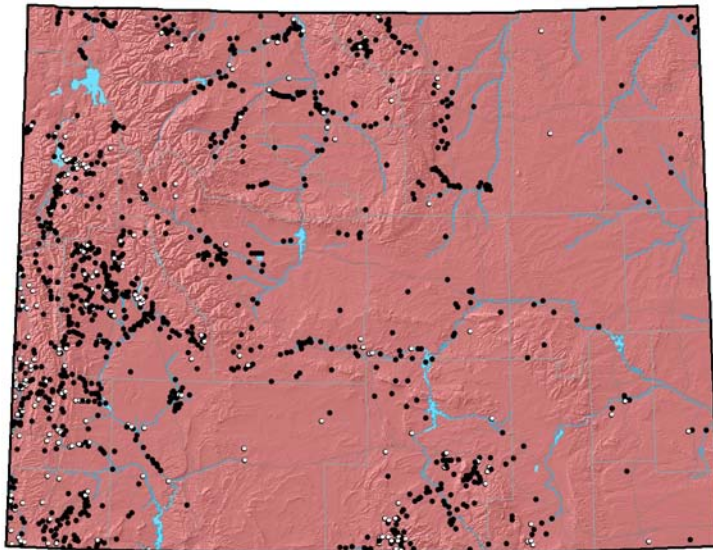
- Training AUC: 0.771
- Regularized Training Gain: 0.420

Cross-Validation Statistics

- Average Test AUC: 0.753 ± 0.016
- Upper Bound on Test AUC: 0.748
- Average Test Gain: 0.410 ± 0.057
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.25 ± 0.03

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 6,090
- Number of Occurrences used to create distribution model: 1,181
- Average Point Quality Index (highest quality is 12.00): 6.54 ± 1.88
- Most recent occurrence used: 2008
- Oldest occurrence used: 1977
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.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

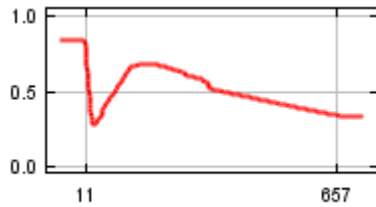
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Precipitation of the coldest quarter	23
Annual number of Frost Days	21
Deciduous Forest Index	19
Precipitation of the warmest quarter	17
Herbaceous Cover Index	11
Bare Ground Index	10

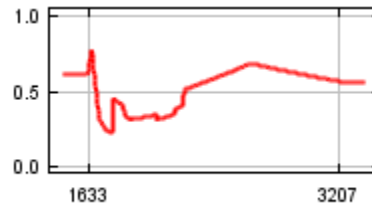
Response Curves

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).

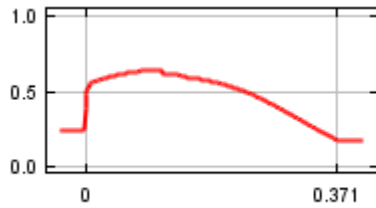
Precipitation of the coldest quarter



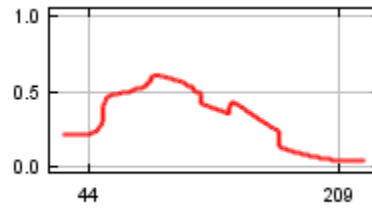
Annual number of Frost Days



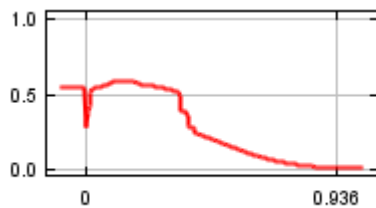
Deciduous Forest Index



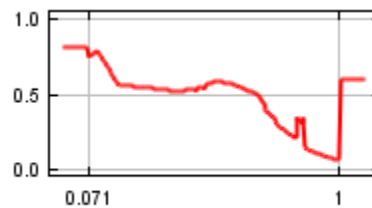
Precipitation of the warmest quarter



Herbaceous Cover Index



Bare Ground Index

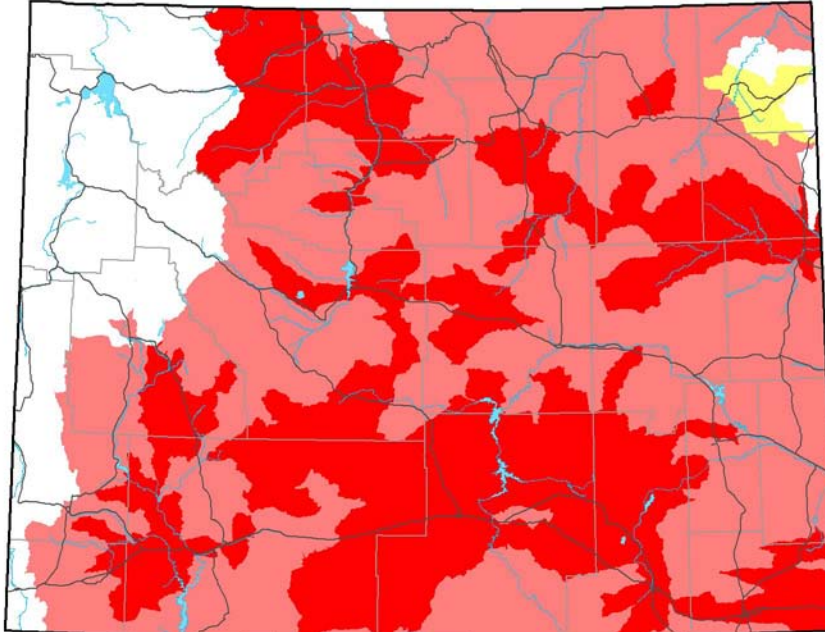


Mountain Plover (*Charadrius montanus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Mountain Plover (ABNNB03100) 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

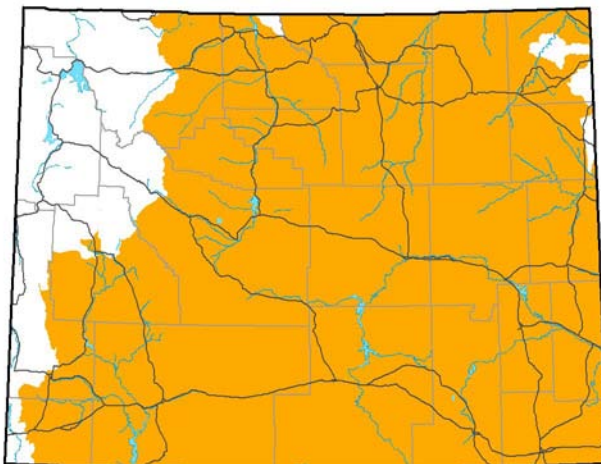


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.361
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

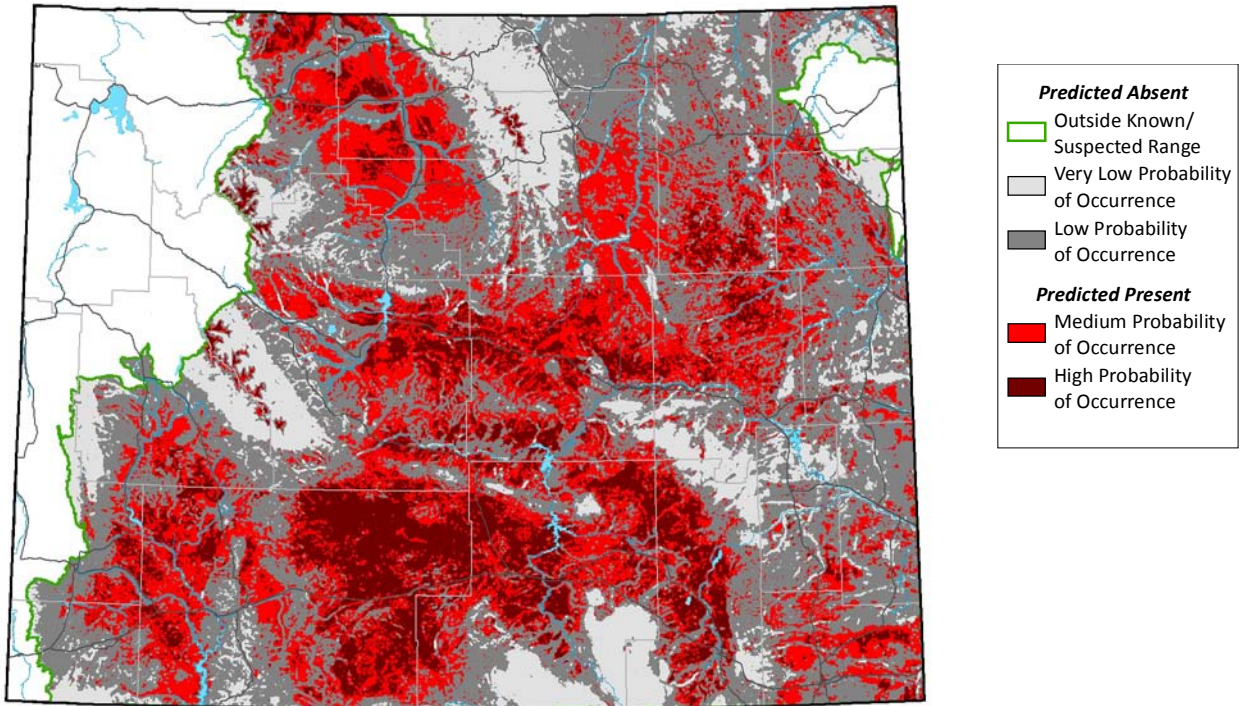
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Fri Mar 19 02:36:24 MDT 2010)

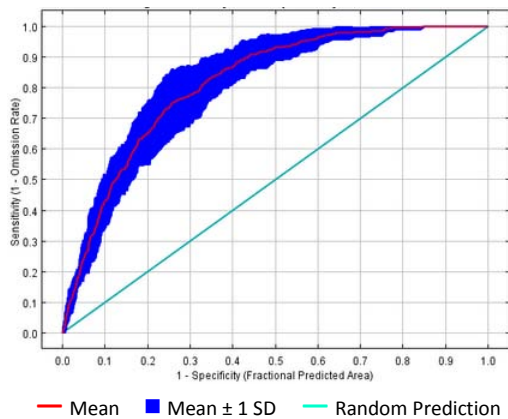
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (25-Apr- 31-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3270460
- High-Probability Threshold Value: 0.5634029
- Low-Probability Threshold Value: 0.0523645

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

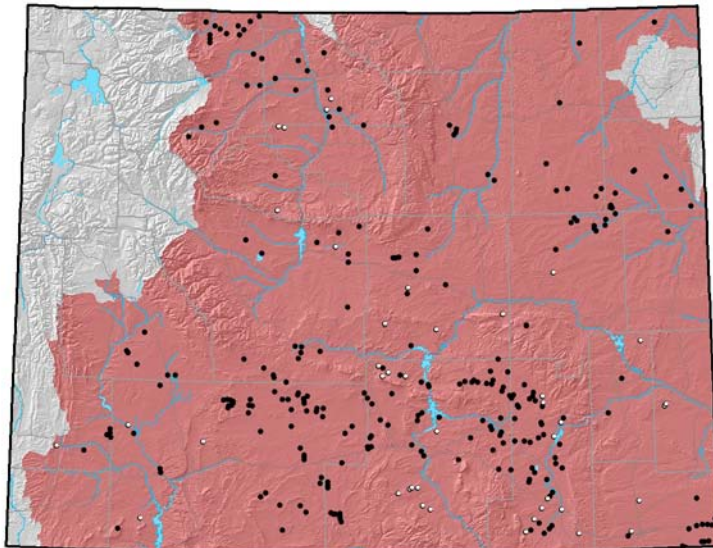
- Training AUC: 0.840
- Regularized Training Gain: 0.738

Cross-Validation Statistics

- Average Test AUC: 0.815 ± 0.037
- Upper Bound on Test AUC: 0.819
- Average Test Gain: 0.680 ± 0.180
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.23 ± 0.12

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,755
- Number of Occurrences used to create distribution model: 302
- Average Point Quality Index (highest quality is 12.00): 8.63 ± 2.91
- Most recent occurrence used: 2007
- Oldest occurrence used: 1960
- Occurrence File:
REVISED_SAMPLE_POINTS_ALL_SPP.csv

Comments

The model for mountain plover could be biased due to a lack of sample points from privately-owned land in the southeastern portion of Wyoming. There is likely much suitable land in this area, but surveys and occurrence data are less common on private property. Qualitative expert evaluation of this model noted that some high-elevation parks are inappropriately predicted.

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

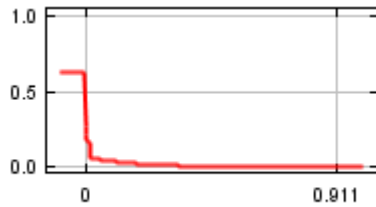
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Conifer Index	42
Deciduous Forest Index	27
Bare Ground Index	11
Relative Humidity of most humid month	9
Potential for Rock Outcrop	7
Forest Cover Index	5

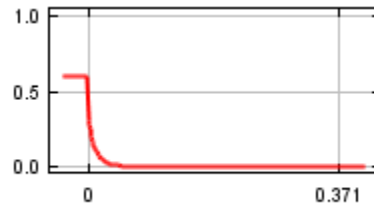
Response Curves

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).

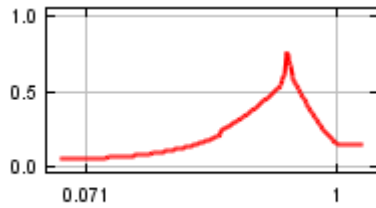
Conifer Index



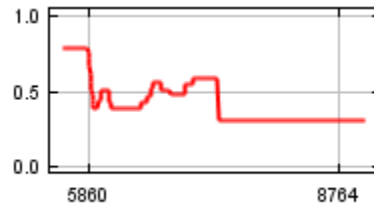
Deciduous Forest Index



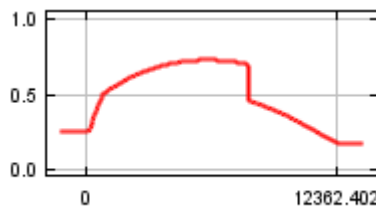
Bare Ground Index



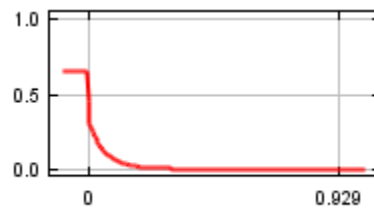
Relative Humidity of most humid month



Potential for Rock Outcrop



Forest Cover Index

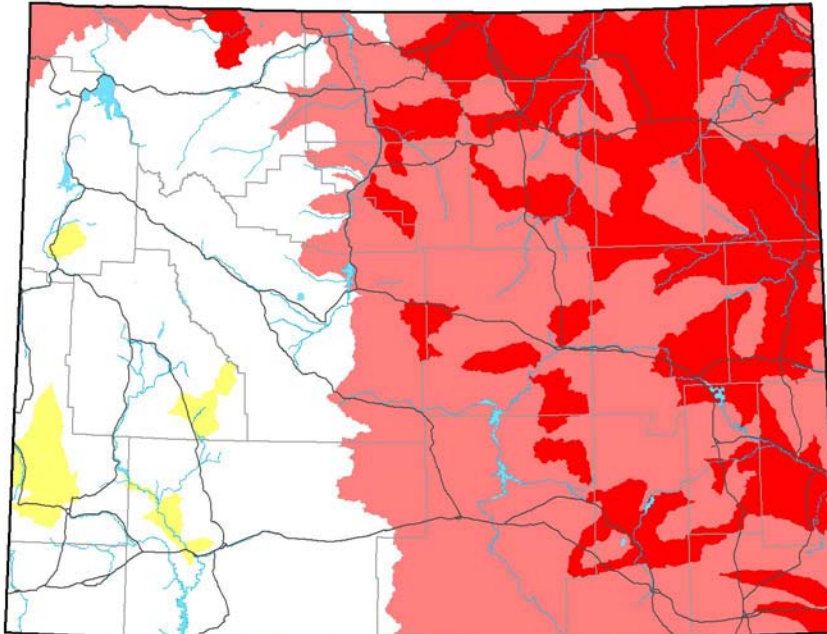


Upland Sandpiper (*Bartramia longicauda*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Upland Sandpiper (ABNNF06010) 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.

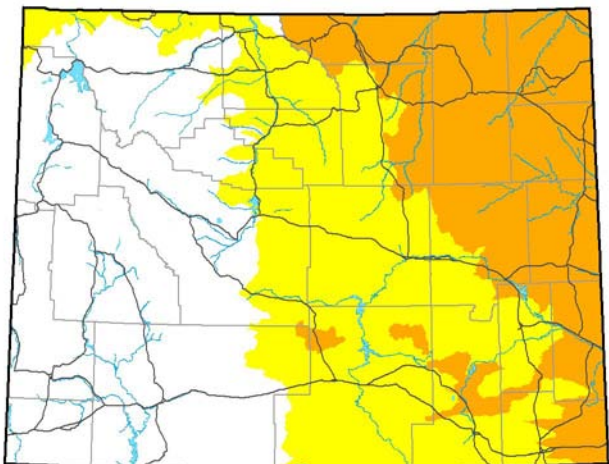
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.580
- 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/>).

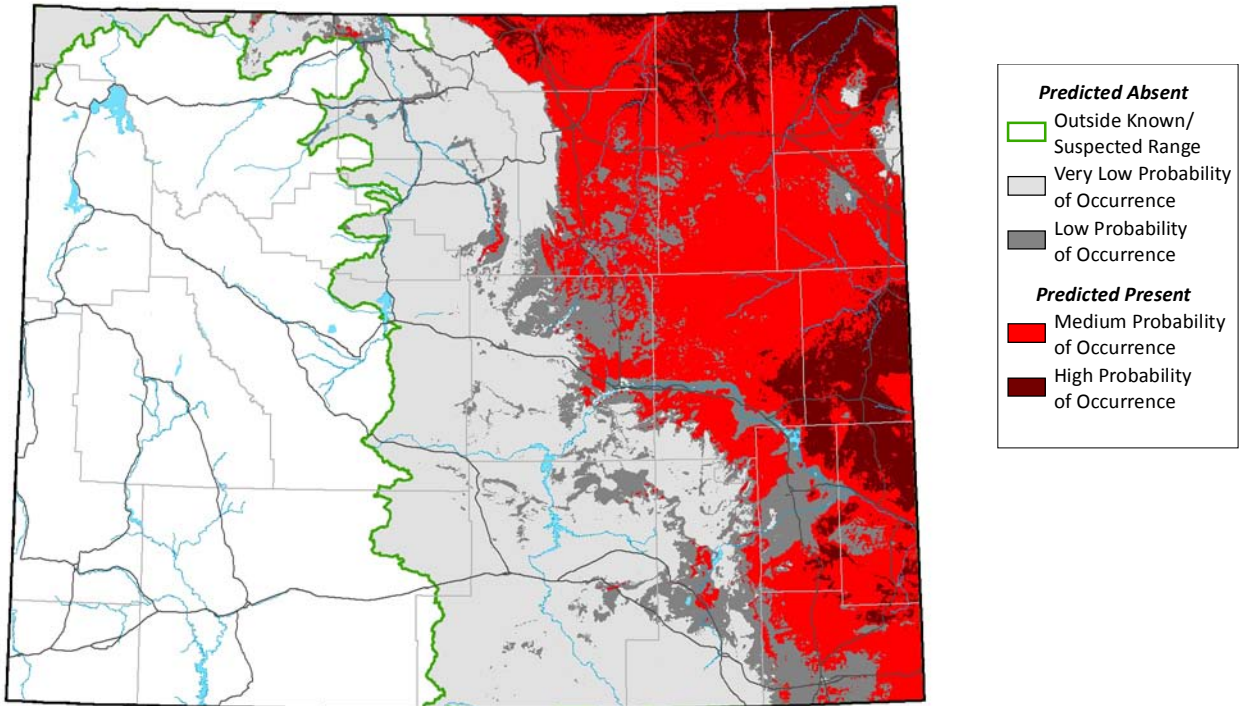
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 09:43:12 MST 2010)

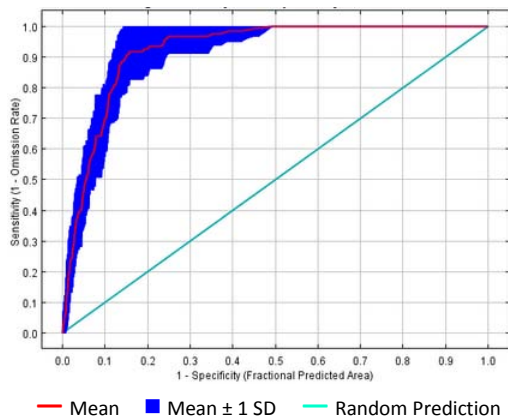
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-May- 7-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1604380
- High-Probability Threshold Value: 0.5936415
- Low-Probability Threshold Value: 0.0352934

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

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

Model Evaluation Statistics

Final Model Statistics

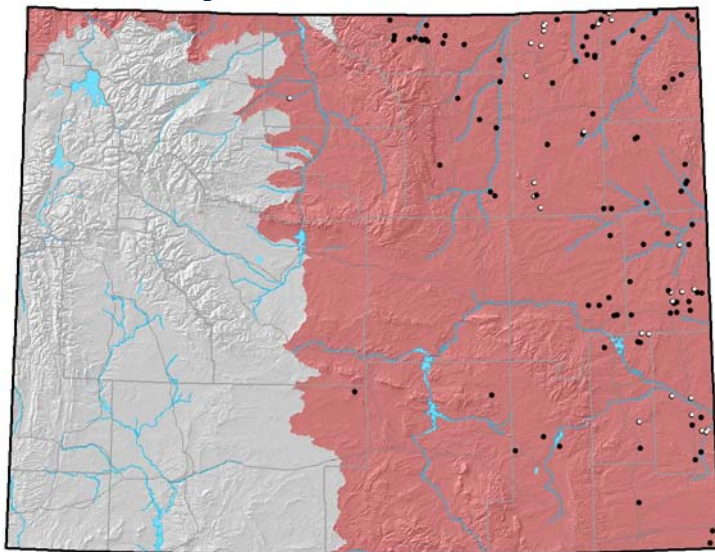
- Training AUC: 0.945
- Regularized Training Gain: 1.662

Cross-Validation Statistics

- Average Test AUC: 0.921 ± 0.025
- Upper Bound on Test AUC: 0.929
- Average Test Gain: 1.545 ± 0.351
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.11 ± 0.14

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 376
- Number of Occurrences used to create distribution model: 120
- Average Point Quality Index (highest quality is 12.00): 6.08 ± 1.66
- Most recent occurrence used: 2005
- Oldest occurrence used: 1974
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state. 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

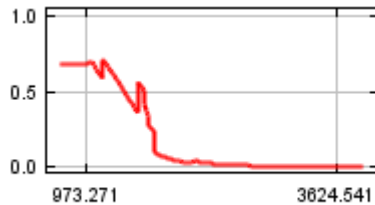
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Elevation	32
Annual Radiation range	31
Herbaceous Cover Index	11
Precipitation of the wettest month	10
Annual number of Frost Days	8
Coldest month mean minimum temperature	8

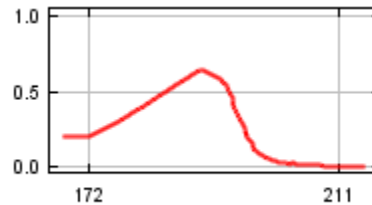
Response Curves

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).

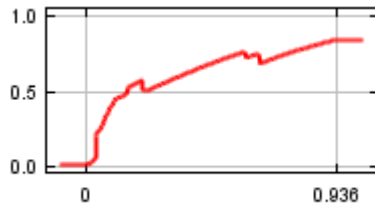
Elevation



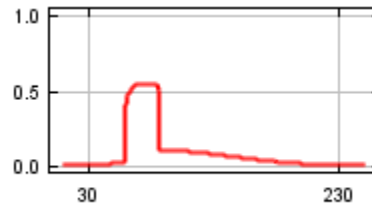
Annual Radiation range



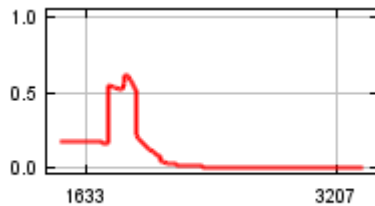
Herbaceous Cover Index



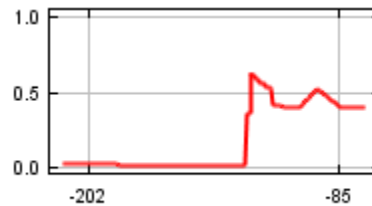
Precipitation of the wettest month



Annual number of Frost Days



Coldest month mean minimum temperature

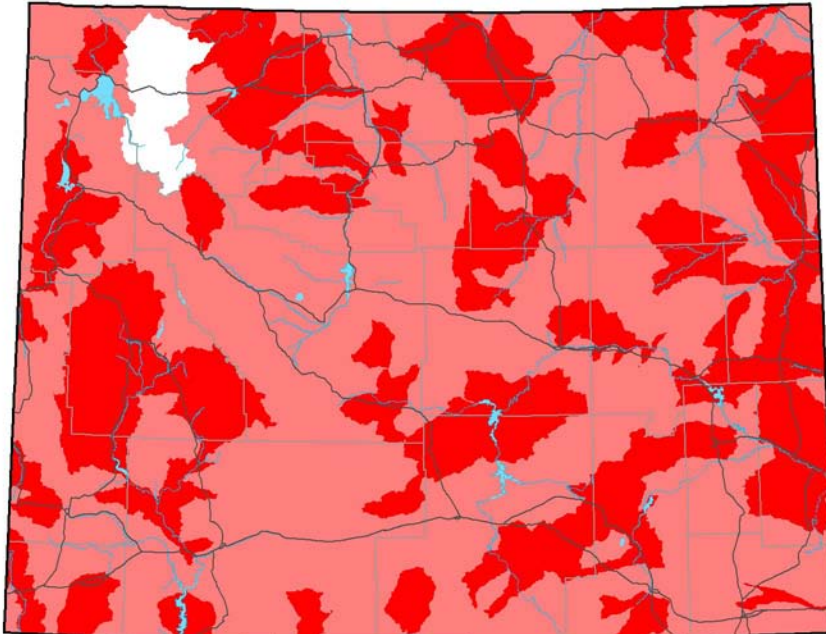


Long-billed Curlew (*Numenius americanus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Long-billed Curlew (ABNNF07070) 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

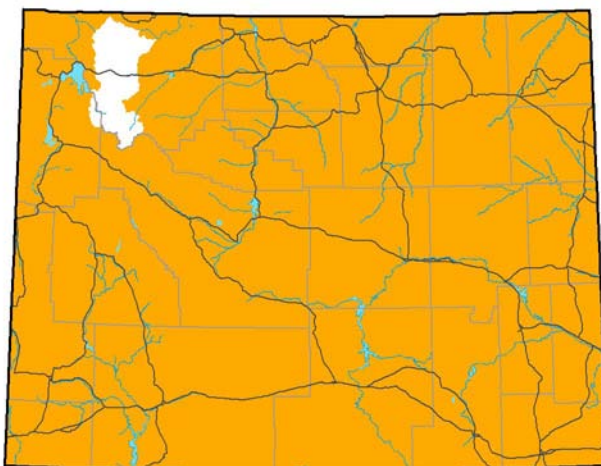


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.319
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

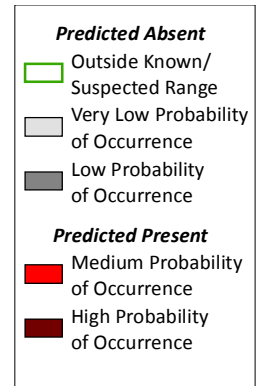
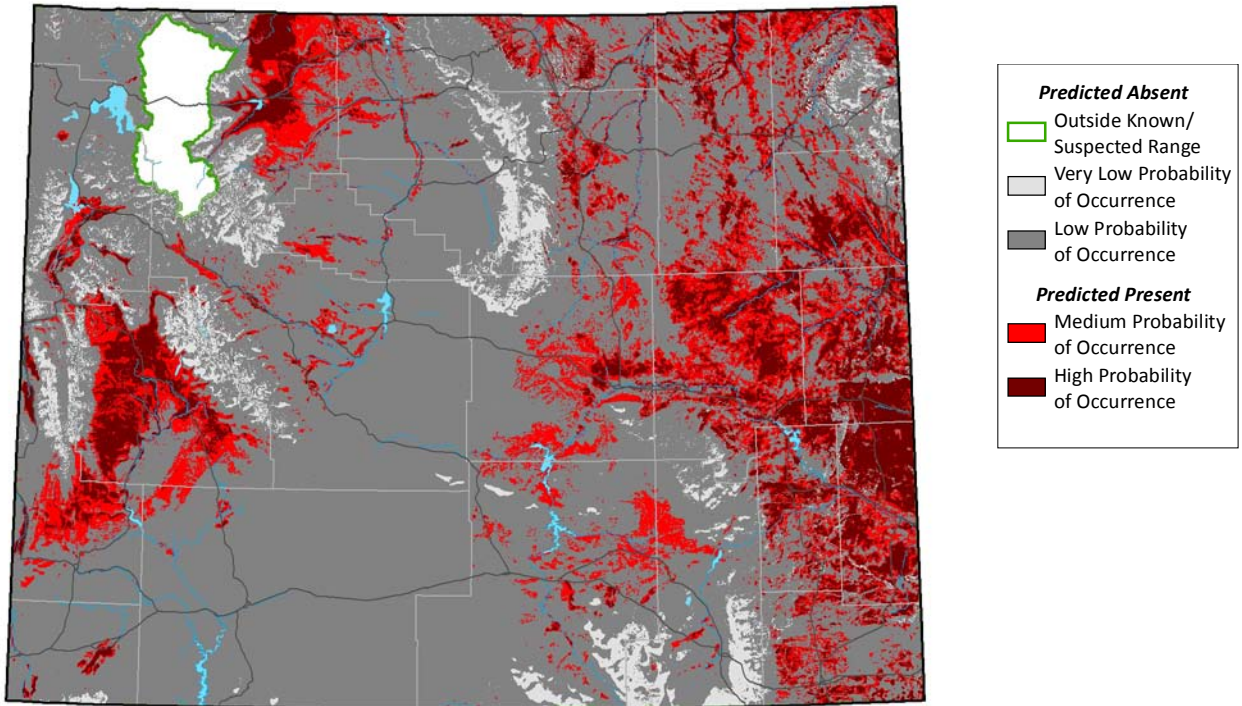
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Thu Mar 18 08:17:24 MDT 2010)

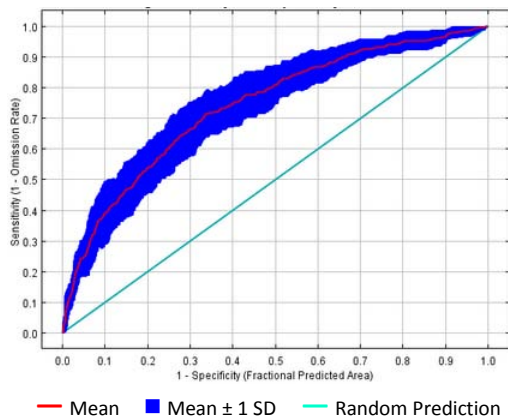
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (7-Apr- 15-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3884580
- High-Probability Threshold Value: 0.5325363
- Low-Probability Threshold Value: 0.0507192

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

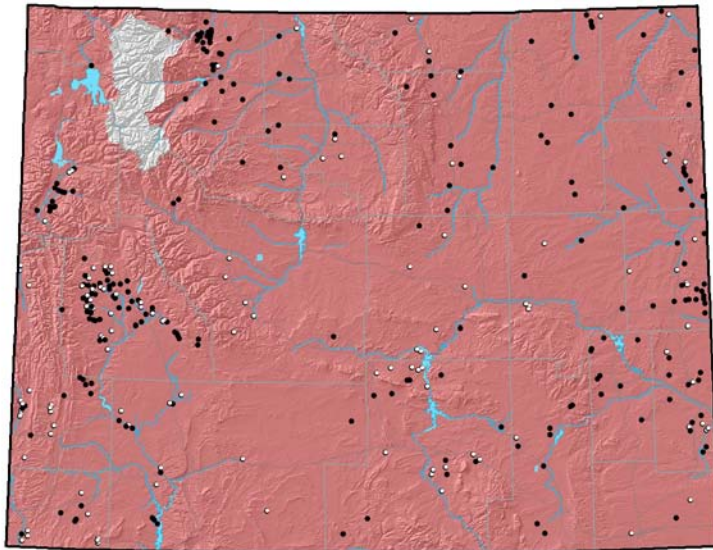
- Training AUC: 0.776
- Regularized Training Gain: 0.454

Cross-Validation Statistics

- Average Test AUC: 0.741 ± 0.046
- Upper Bound on Test AUC: 0.746
- Average Test Gain: 0.410 ± 0.192
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.35 ± 0.09

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,029
- Number of Occurrences used to create distribution model: 341
- Average Point Quality Index (highest quality is 12.00): 6.17 ± 1.77
- Most recent occurrence used: 2008
- Oldest occurrence used: 1961
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state.

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

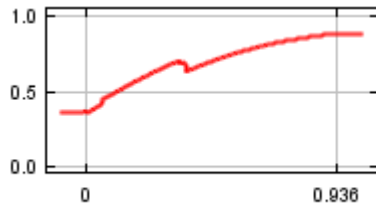
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Herbaceous Cover Index	27
Coldest month mean minimum temperature	22
Vector Ruggedness Measure	17
Radiation of the darkest month	16
Relative Humidity of least humid month	15
Warmest quarter mean temperature	3

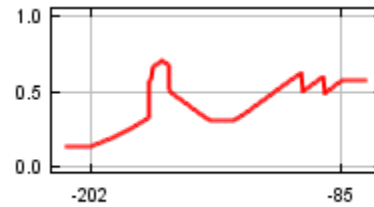
Response Curves

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).

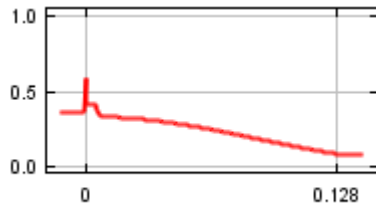
Herbaceous Cover Index



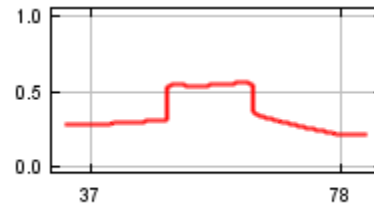
Coldest month mean minimum temperature



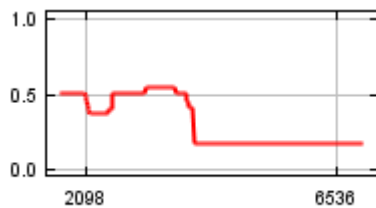
Vector Ruggedness Measure



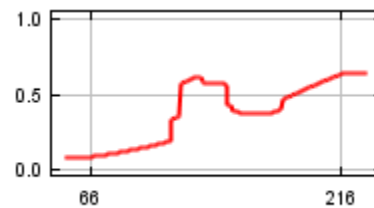
Radiation of the darkest month



Relative Humidity of least humid month



Warmest quarter mean temperature

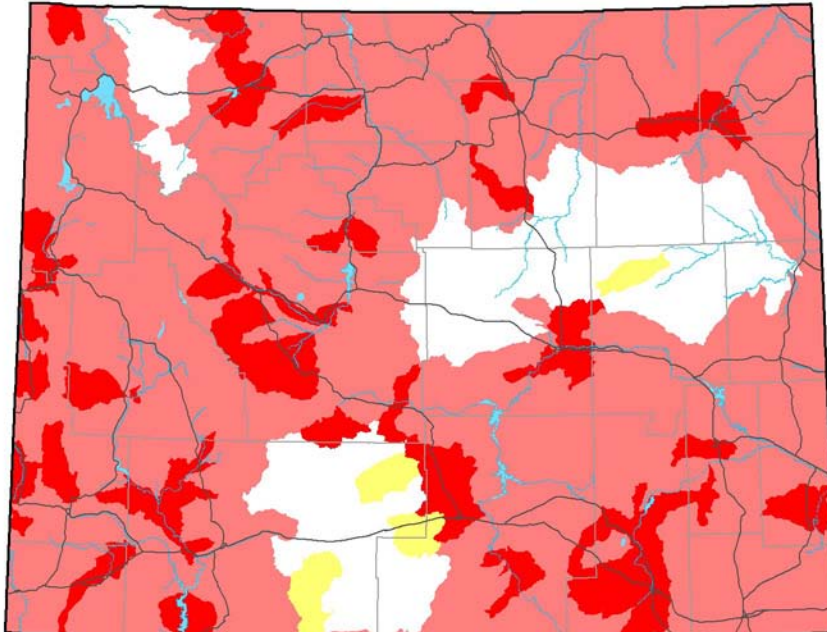


Franklin's Gull (*Larus pipixcan*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Franklin's Gull (ABNNM03020) 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

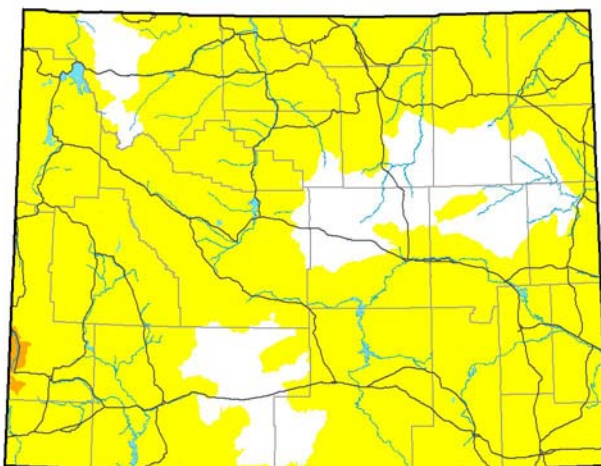


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 1.000
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

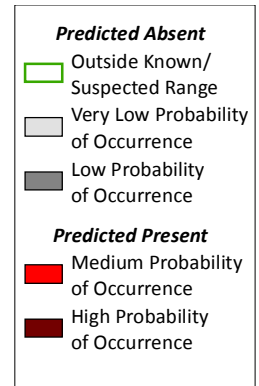
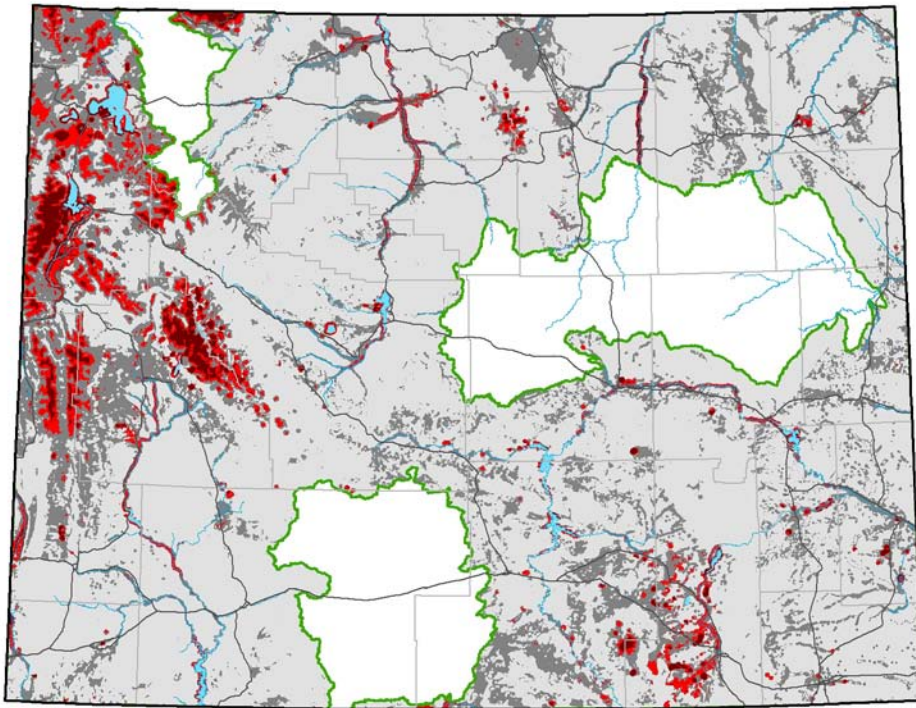
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 30 13:24:32 MDT 2010)

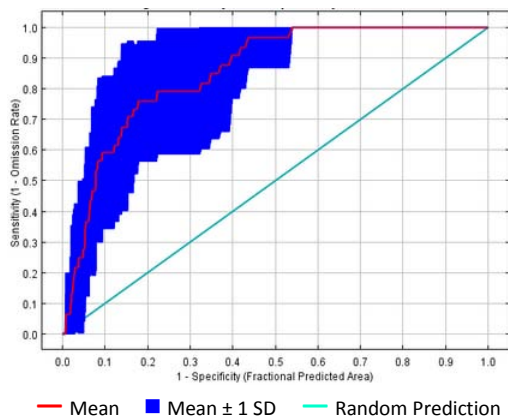
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-May- 25-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3535720
- High-Probability Threshold Value: 0.6410098
- Low-Probability Threshold Value: 0.1550175

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

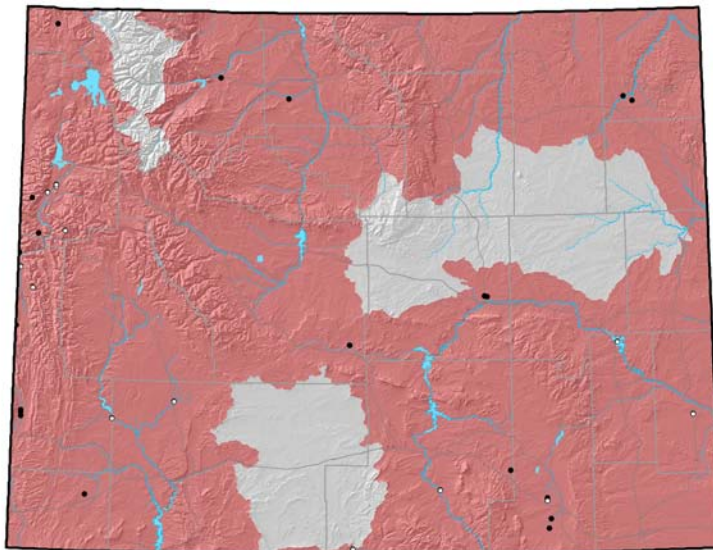
- Training AUC: 0.912
- Regularized Training Gain: 1.092

Cross-Validation Statistics

- Average Test AUC: 0.855 ± 0.079
- Upper Bound on Test AUC: 0.862
- Average Test Gain: 0.864 ± 0.584
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.29 ± 0.30

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 167
- Number of Occurrences used to create distribution model: 33
- Average Point Quality Index (highest quality is 12.00): 4.97 ± 1.33
- Most recent occurrence used: 2005
- Oldest occurrence used: 1969
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state.

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

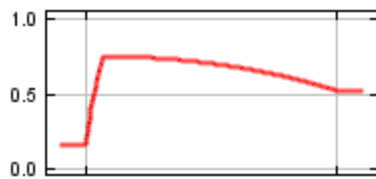
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Lakes/Large Rivers within 1600 meters	57
Forest Cover Index	9
Pinon-Juniper Index	9
Depth to Shallowest Restrictive Layer	9
Precipitation of the driest month	8
Interannual variation in annual frost days	7

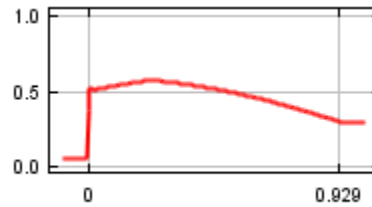
Response Curves

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).

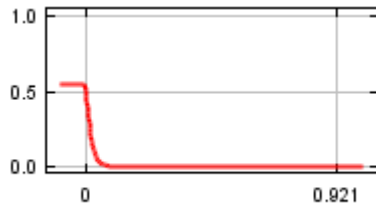
Prevalence of Lakes/Large Rivers within 1600 meters



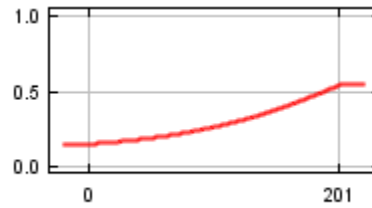
Forest Cover Index



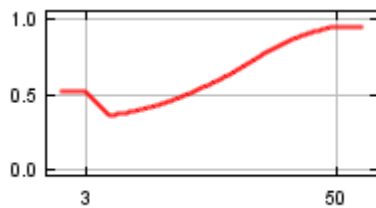
Pinon-Juniper Index



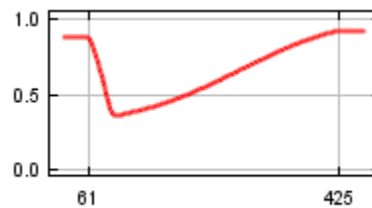
Depth to Shallowest Restrictive Layer



Precipitation of the driest month



Interannual variation in annual frost days

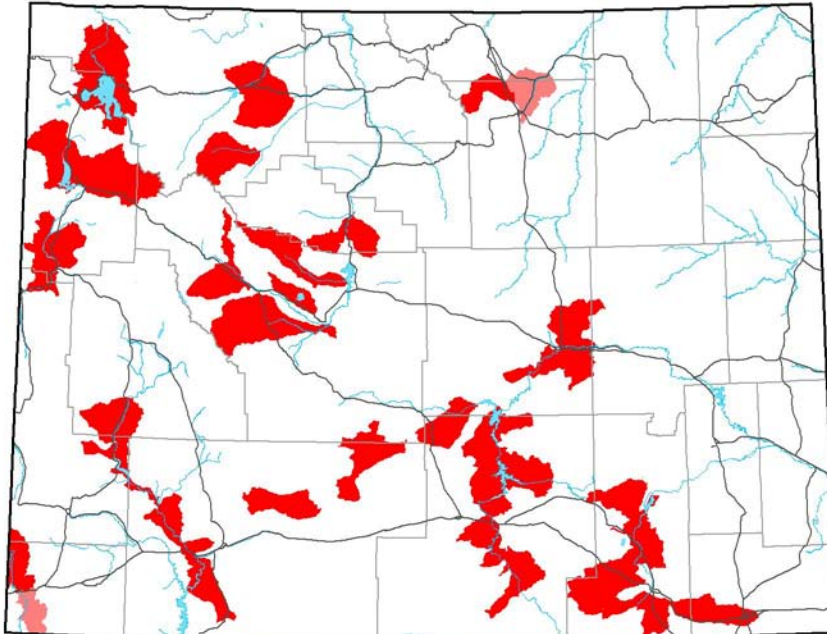


Caspian Tern (*Sterna caspia*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Caspian Tern (ABNNM08020) 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

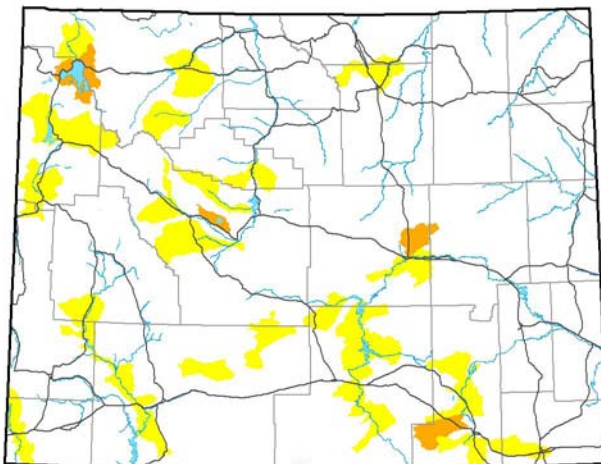


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 1.000
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

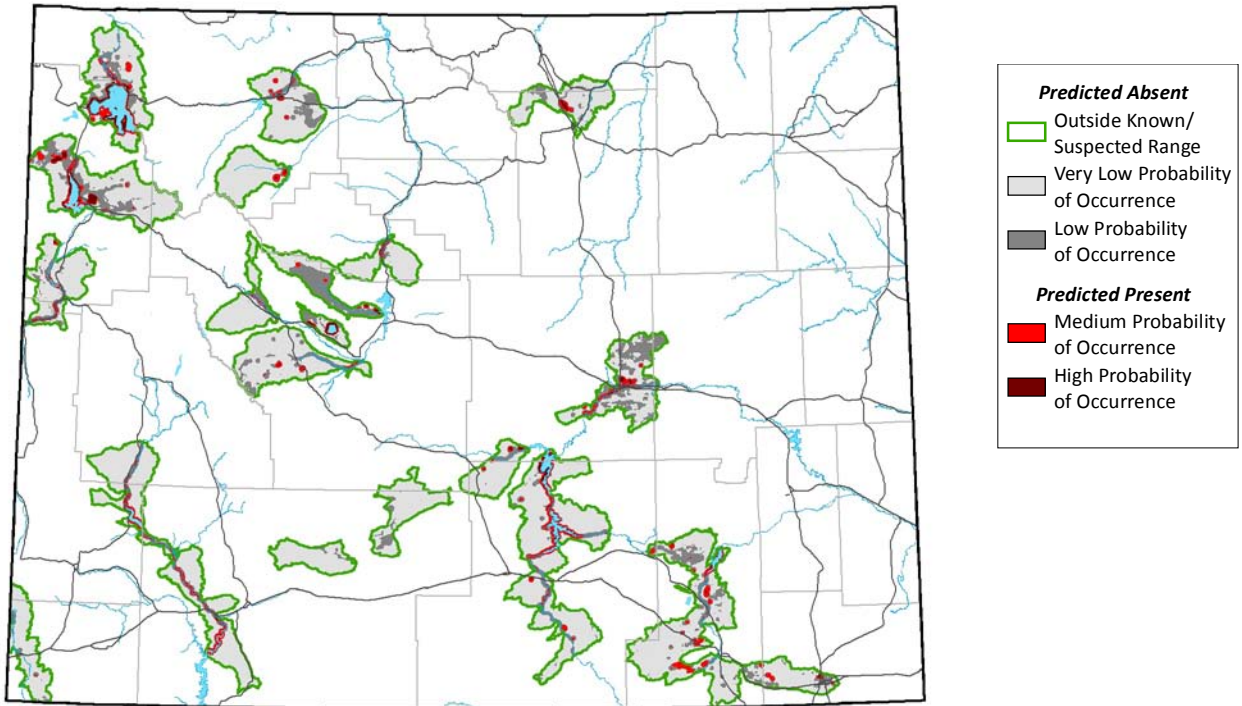
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 30 13:24:17 MDT 2010)

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



Model Parameters

- Season Modeled: Breeding (25-May- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2383300
- High-Probability Threshold Value: 0.6224500
- Low-Probability Threshold Value: 0.0385278

Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

Expert Assessment: Medium

Occurrence Sample Size: Medium

Quality of Occurrences: Medium

Positive Success Rate: High

Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

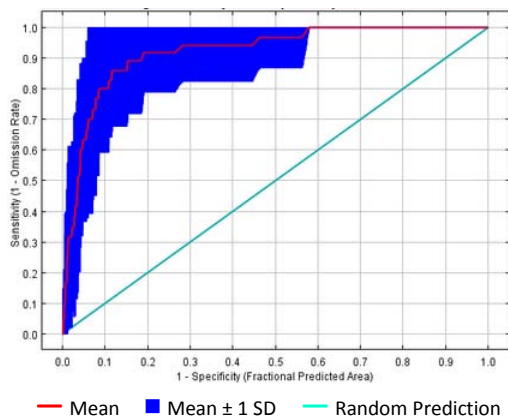
Training AUC: 0.956

Regularized Training Gain: 1.838

Cross-Validation Statistics

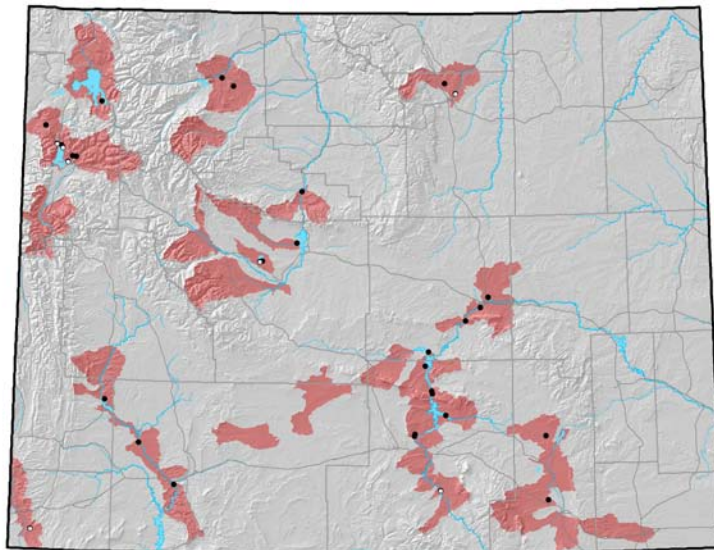
- Average Test AUC: 0.921 ± 0.068
- Upper Bound on Test AUC: 0.928
- Average Test Gain: 1.566 ± 0.911
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.17 ± 0.22

Model Evaluation - ROC Plot



Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 97
- Number of Occurrences used to create distribution model: 33
- Average Point Quality Index (highest quality is 12.00): 5.91 ± 2.10
- Most recent occurrence used: 2004
- Oldest occurrence used: 1955
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

The range of Caspian Tern in Wyoming is highly fragmented and generally tied to localized features of water bodies, which makes environmental niche modeling difficult and could decrease the accuracy of the final model. Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state.

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

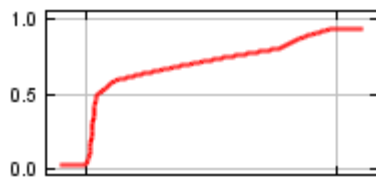
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Lakes/Large Rivers within 1600 meters	76
Wettest quarter mean temperature	7
Variation of monthly precipitation	6
Sagebrush Index	5
Interannual variation in annual frost days	4
Herbaceous Cover Index	2

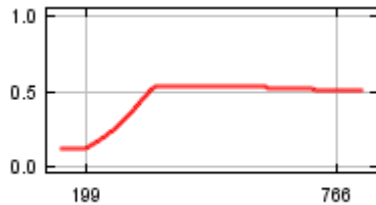
Response Curves

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).

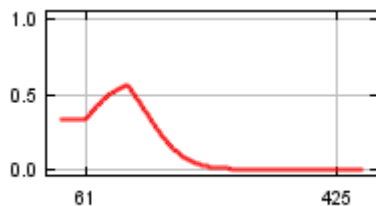
Prevalence of Lakes/Large Rivers within 1600 meters



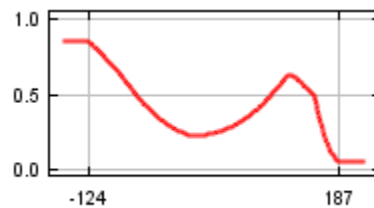
Variation of monthly precipitation



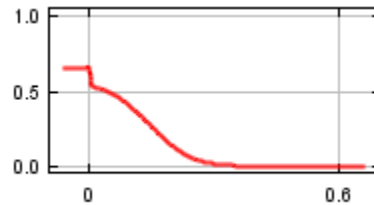
Interannual variation in annual frost days



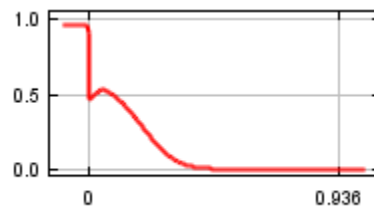
Wettest quarter mean temperature



Sagebrush Index



Herbaceous Cover Index

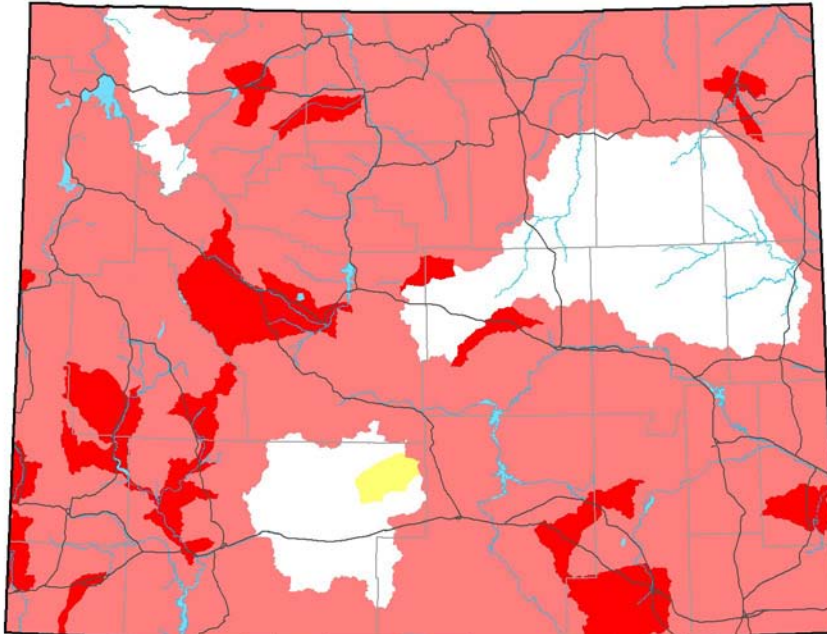


Forster's Tern (*Sterna forsteri*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Forster's Tern (ABNNM08090) 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.

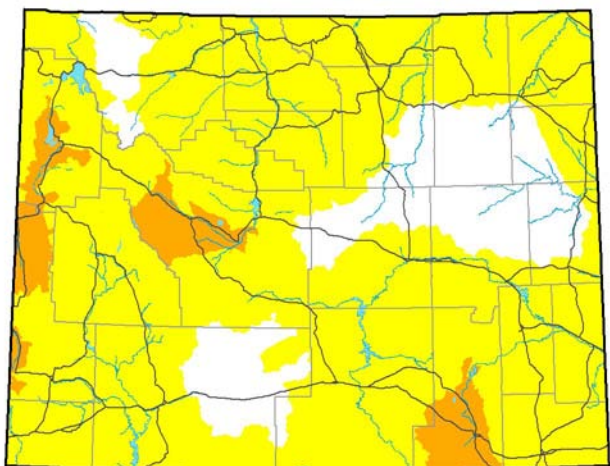
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.556
- 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/>).

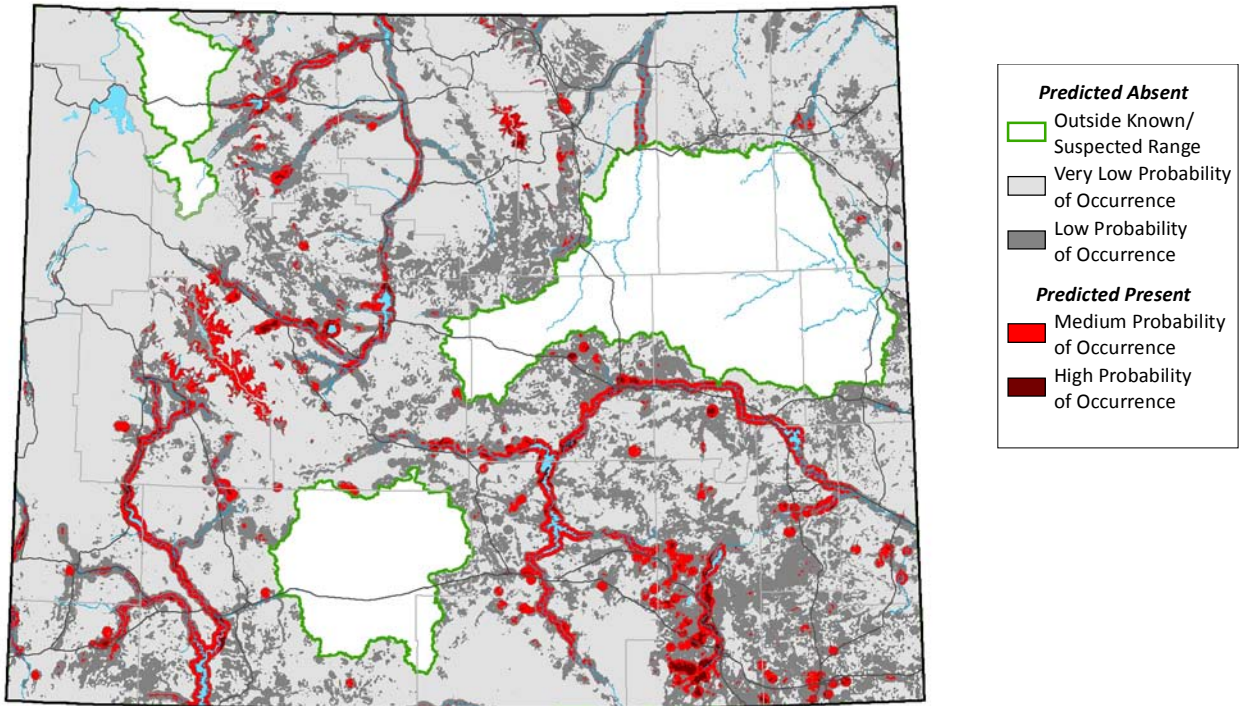
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 30 13:24:11 MDT 2010)

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



Model Parameters

- Season Modeled: Breeding (25-May- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2007730
- High-Probability Threshold Value: 0.6233527
- Low-Probability Threshold Value: 0.0271948

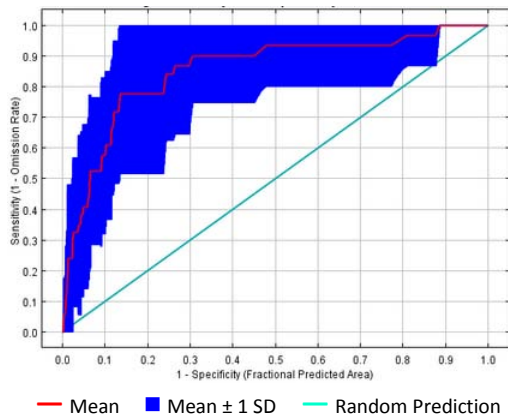
Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

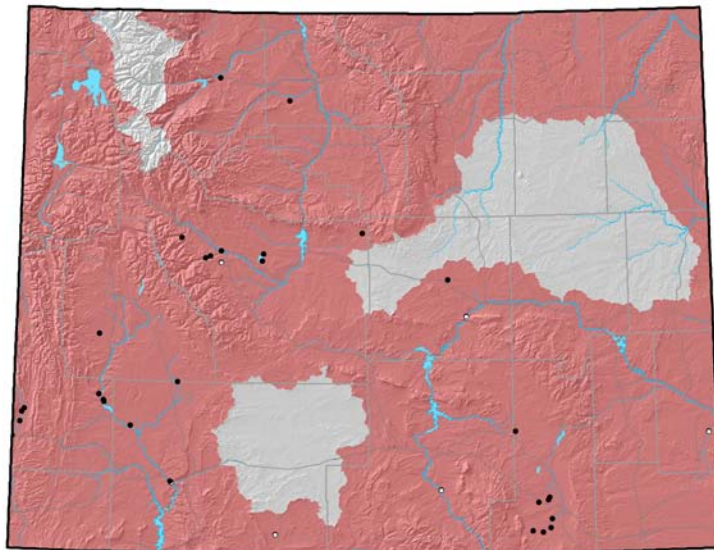
- Training AUC: 0.933
- Regularized Training Gain: 1.501

Cross-Validation Statistics

- Average Test AUC: 0.853 ± 0.134
- Upper Bound on Test AUC: 0.911
- Average Test Gain: 0.612 ± 1.846
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.28 ± 0.27

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 151
- Number of Occurrences used to create distribution model: 35
- Average Point Quality Index (highest quality is 12.00): 6.51 ± 2.13
- Most recent occurrence used: 2006
- Oldest occurrence used: 1981
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state.

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

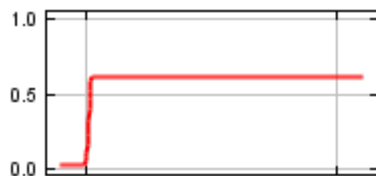
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Lakes/Large Rivers within 3200 meters	64
Deciduous Forest Index	14
Forest Cover Index	7
Precipitation of the coldest quarter	6
Shrub Cover Index	5
Elevation	4

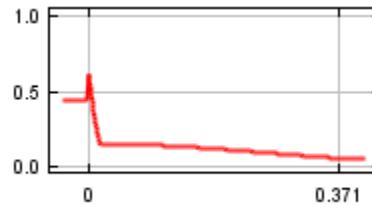
Response Curves

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).

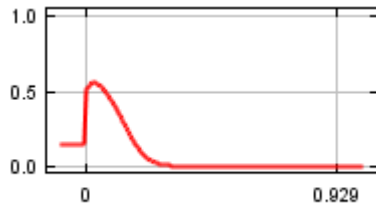
Prevalence of Lakes/Large Rivers within 3200 meters



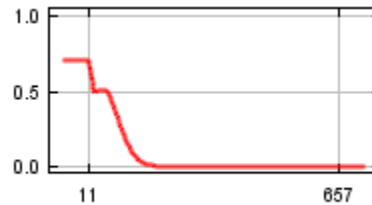
Deciduous Forest Index



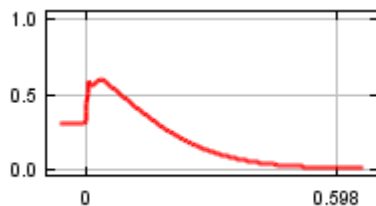
Forest Cover Index



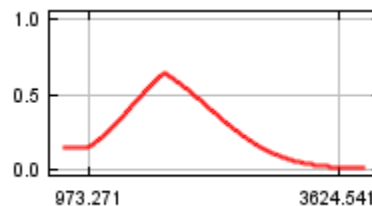
Precipitation of the coldest quarter



Shrub Cover Index



Elevation

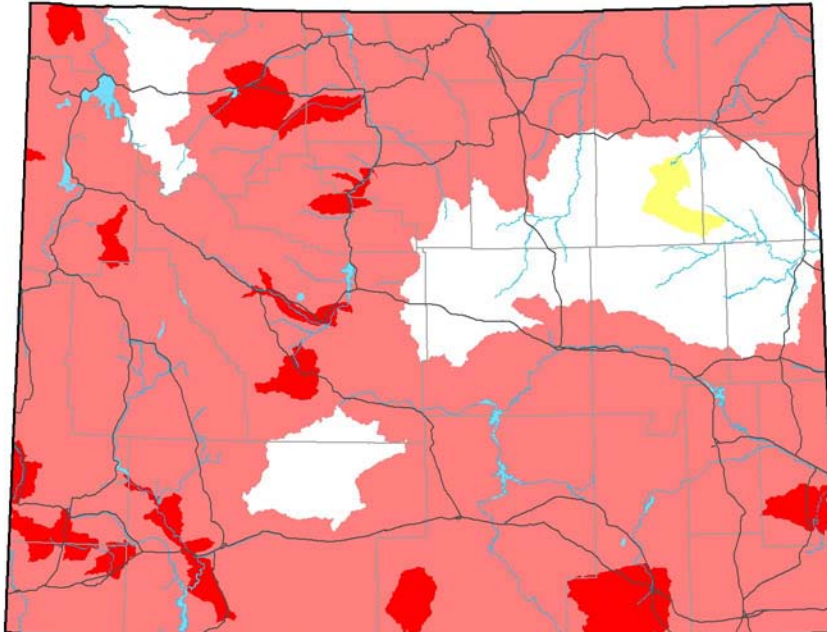


Black Tern (*Chlidonias niger*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Black Tern (ABNNM10020) 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

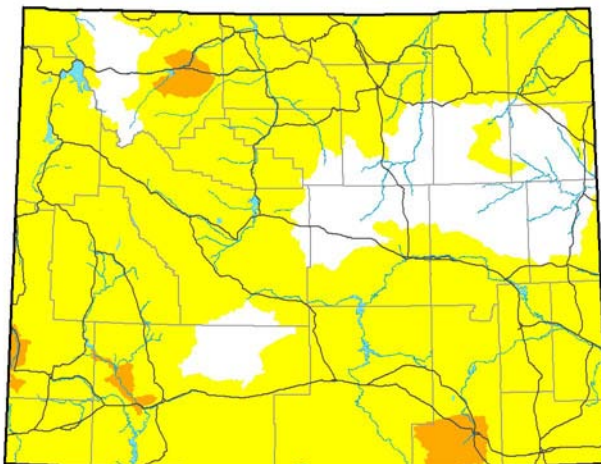


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 1.000
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

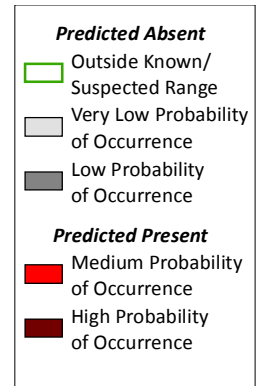
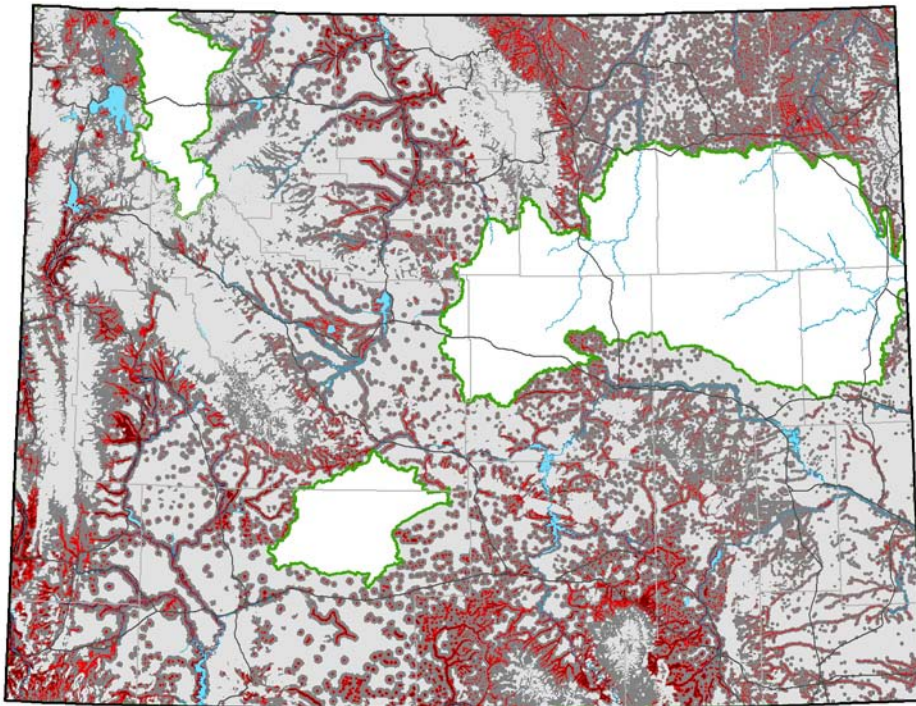
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Fri Apr 09 11:20:58 MDT 2010)

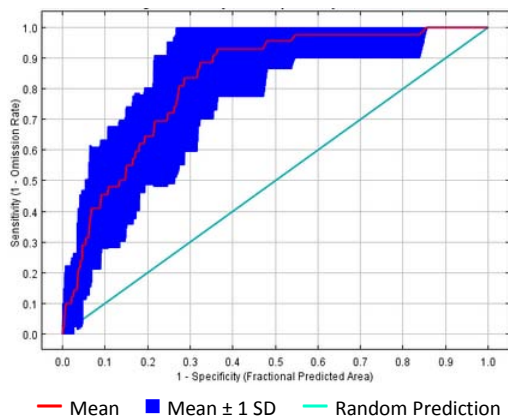
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (25-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4022530
- High-Probability Threshold Value: 0.5854331
- Low-Probability Threshold Value: 0.0269066

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

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

Model Evaluation Statistics

Final Model Statistics

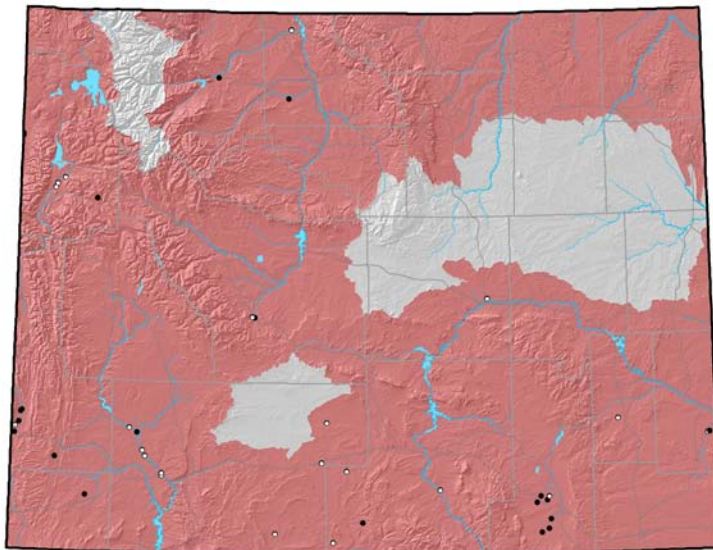
- Training AUC: 0.855
- Regularized Training Gain: 0.789

Cross-Validation Statistics

- Average Test AUC: 0.827 ± 0.096
- Upper Bound on Test AUC: 0.830
- Average Test Gain: 0.664 ± 0.836
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.17 ± 0.19

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 131
- Number of Occurrences used to create distribution model: 42
- Average Point Quality Index (highest quality is 12.00): 5.33 ± 1.48
- Most recent occurrence used: 2005
- Oldest occurrence used: 1962
- Occurrence File:
DRAFT_3_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

Water birds, particularly colonial-nesting species, are difficult to model because they use specific features of water bodies for which statewide data do not exist. This can sometimes result in low model quality because key habitat features are not mappable across the state.

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

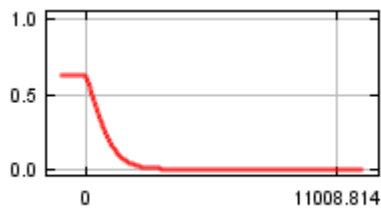
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Distance to Permanent Water	45
Interannual variation in annual frost days	34
Annual precipitation range (P3 – P2)	13
Pinon-Juniper Index	5
Forest Cover Index	3
Driest quarter mean temperature	1

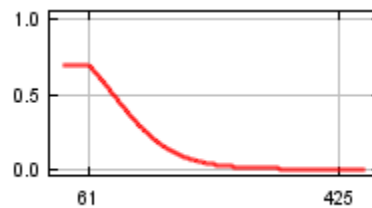
Response Curves

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).

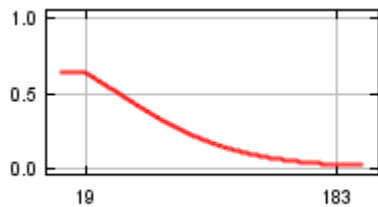
Distance to Permanent Water



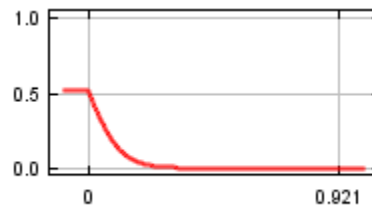
Interannual variation in annual frost days



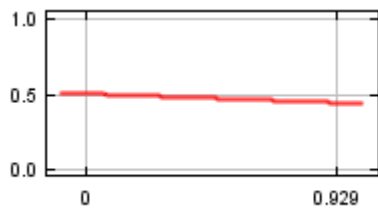
Annual precipitation range (P3 – P2)



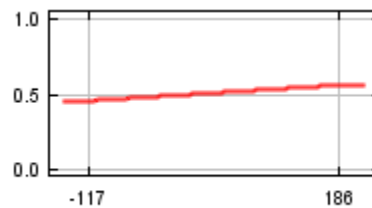
Pinon-Juniper Index



Forest Cover Index



Driest quarter mean temperature

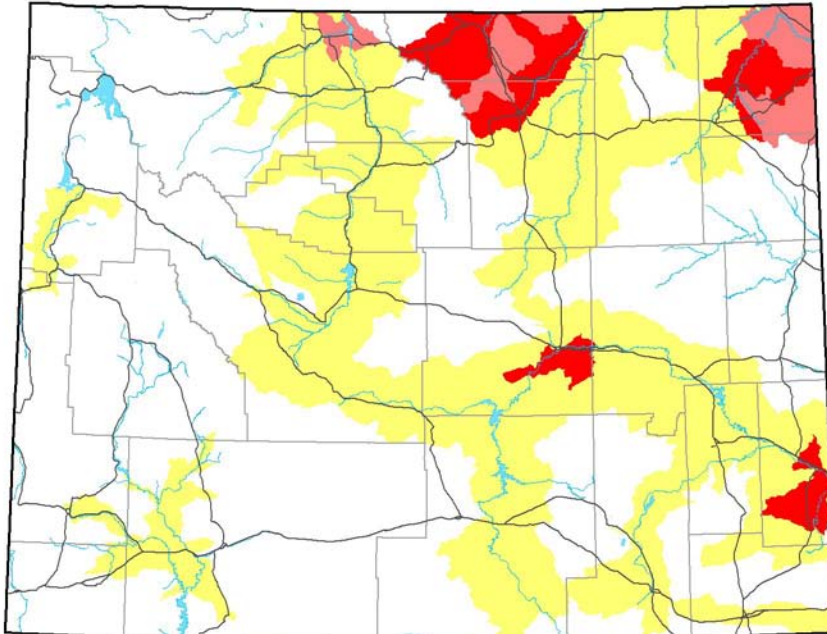


Yellow-billed Cuckoo (*Coccyzus americanus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Yellow-billed Cuckoo (ABNRB02020) 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

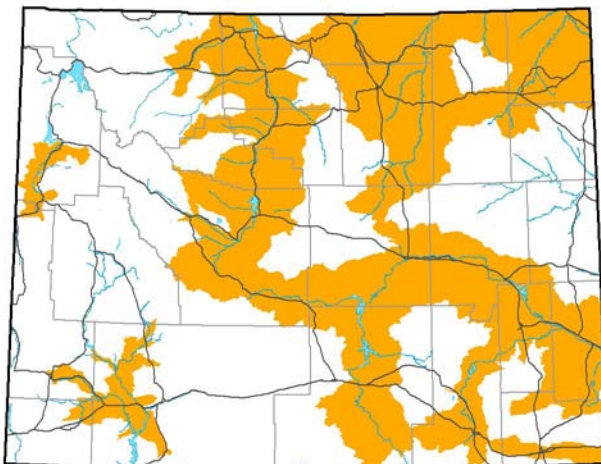


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.448
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

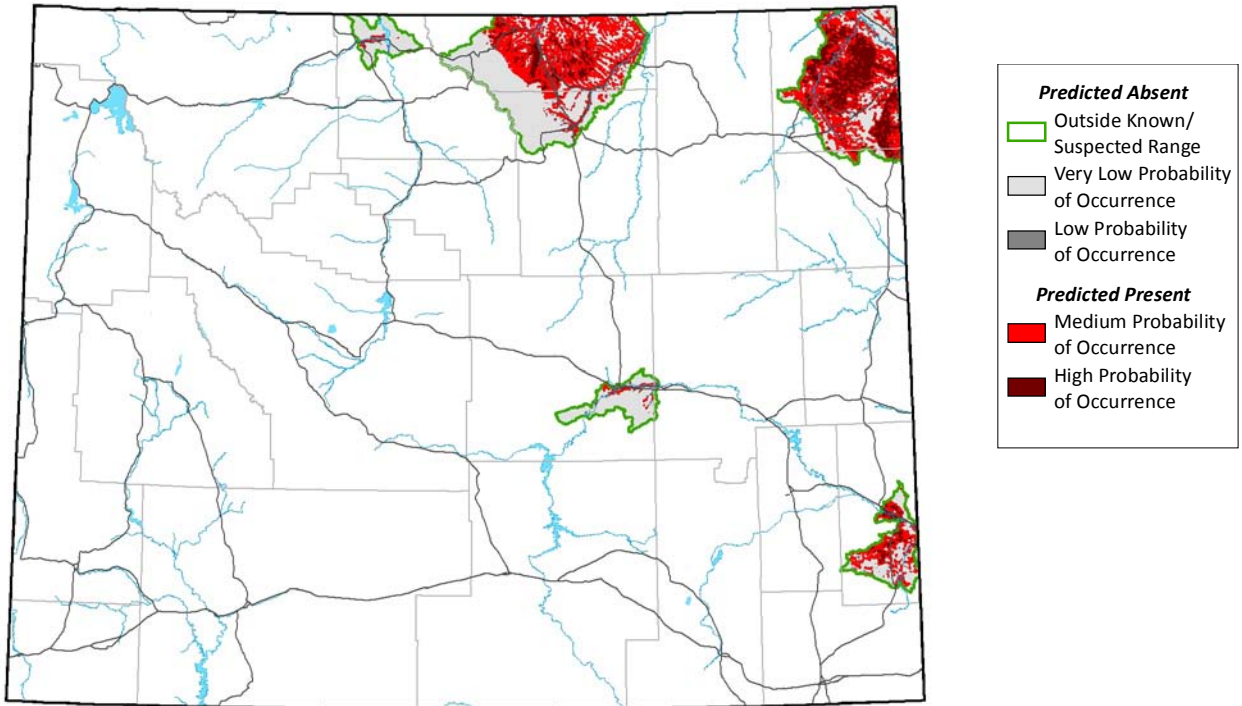
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Fri Apr 09 11:34:07 MDT 2010)

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



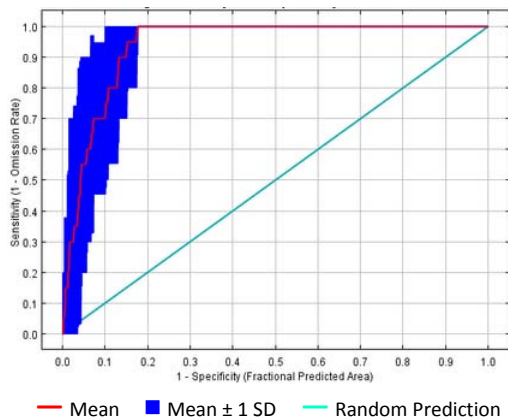
Model Parameters

- Season Modeled: Breeding (25-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: 10 percentile training presence
- Binary Threshold Value: 0.2370000
- High-Probability Threshold Value: 0.6374356
- Low-Probability Threshold Value: 0.1960513

Model Quality Summary

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

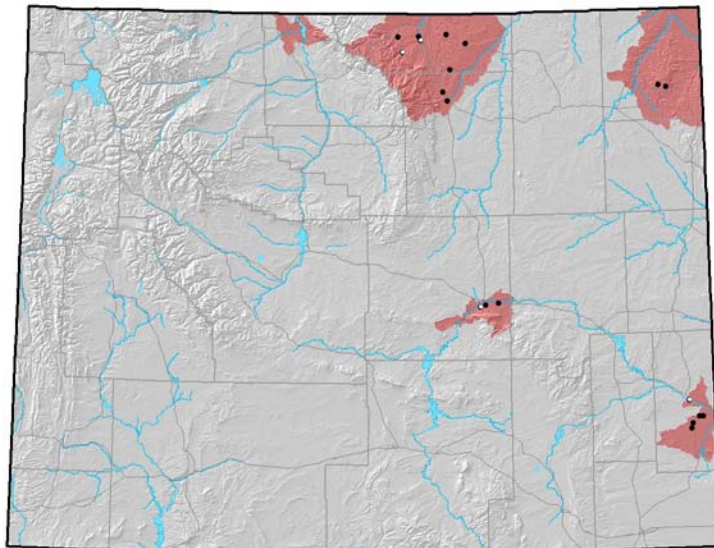
Training AUC: 0.970
 Regularized Training Gain: 1.983

Cross-Validation Statistics

- Average Test AUC: 0.938 ± 0.038
- Upper Bound on Test AUC: 0.942
- Average Test Gain: 1.646 ± 0.836
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.25 ± 0.35

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 68
- Number of Occurrences used to create distribution model: 19
- Average Point Quality Index (highest quality is 12.00): 6.79 ± 2.18
- Most recent occurrence used: 2005
- Oldest occurrence used: 1978
- Occurrence File:
DRAFT_3_SAGE_WATER_RERUNS.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

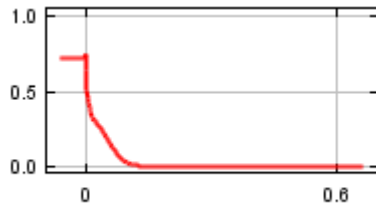
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Sagebrush Index	44
Elevation	22
Cottonwood Index	12
Variation of monthly precipitation	10
Herbaceous Cover Index	8
Radiation of the lightest month	4

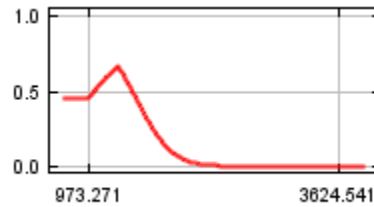
Response Curves

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).

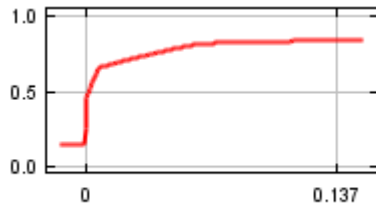
Sagebrush Index



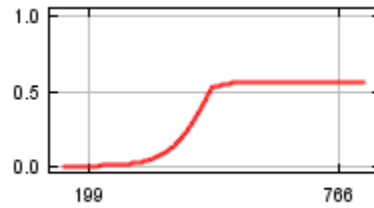
Elevation



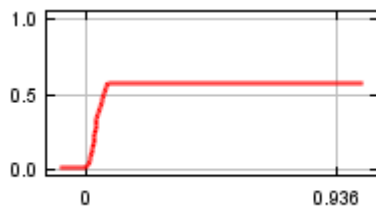
Cottonwood Index



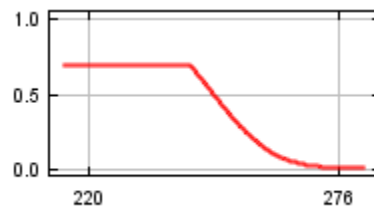
Variation of monthly precipitation



Herbaceous Cover Index



Radiation of the lightest month

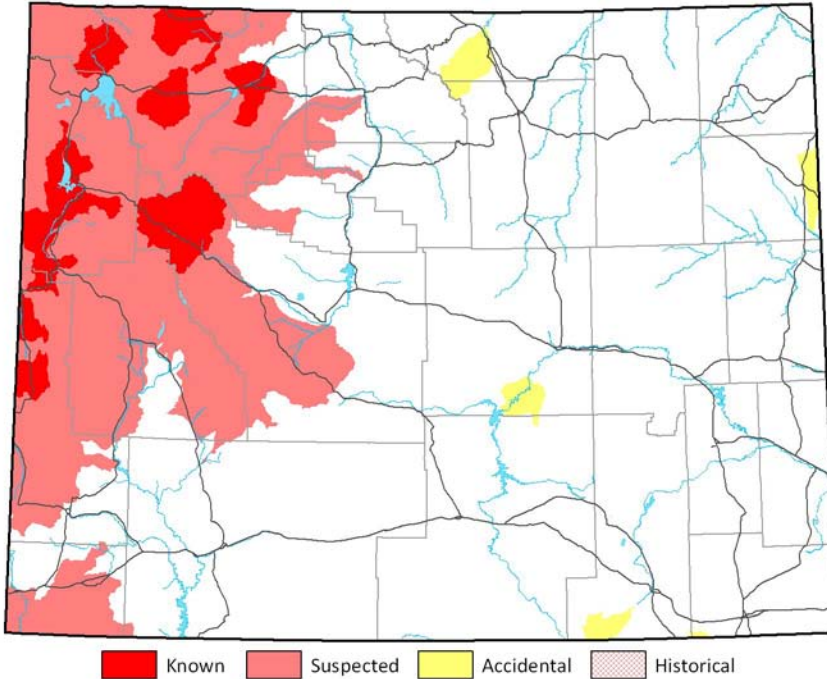


Northern Pygmy-Owl (*Glaucidium gnoma*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Northern Pygmy-Owl (ABNSB08010) 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.

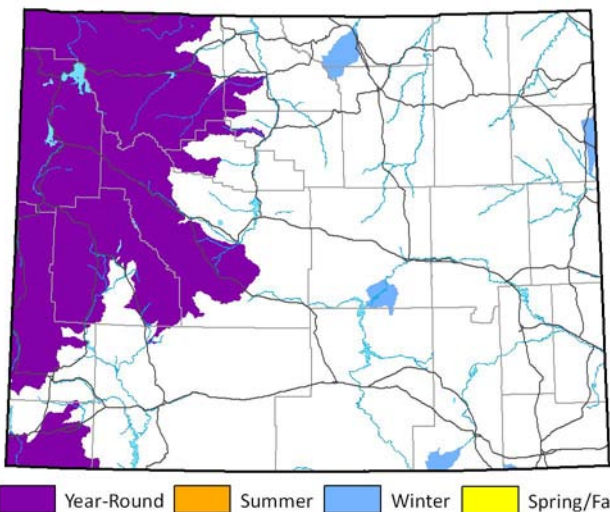
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.143
- 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/>).

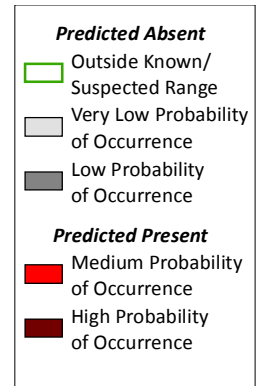
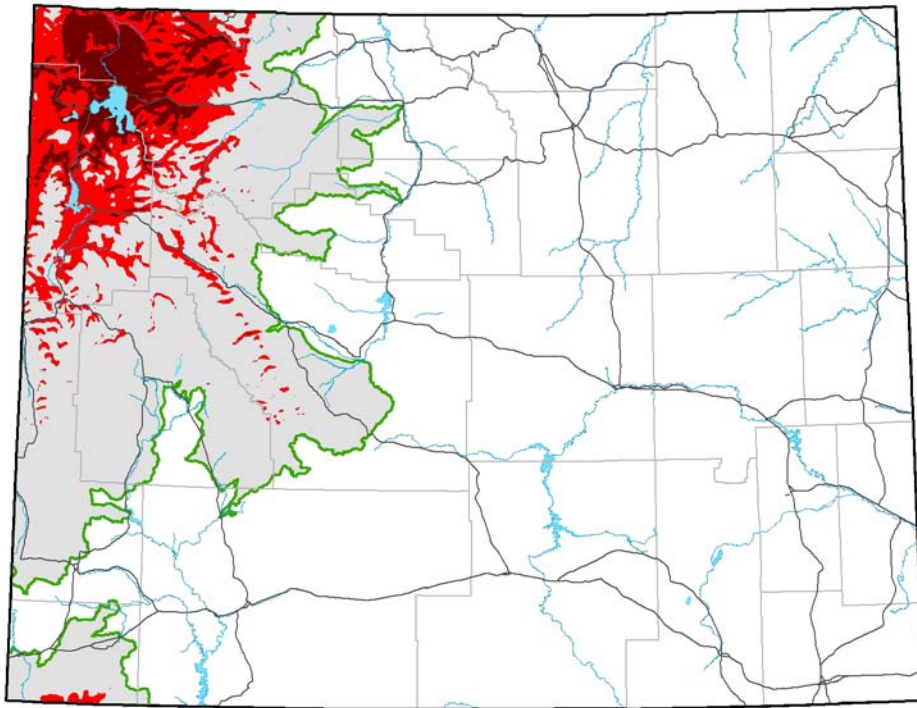
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

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Distribution Model (Version: Thu Mar 18 13:57:48 MDT 2010)

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



Model Parameters

- Season Modeled: Breeding (7-Apr- 30-Jun)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2707220
- High-Probability Threshold Value: 0.6835160
- Low-Probability Threshold Value: 0.2707220

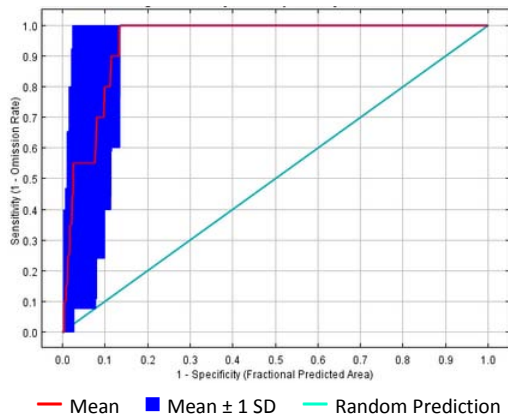
Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

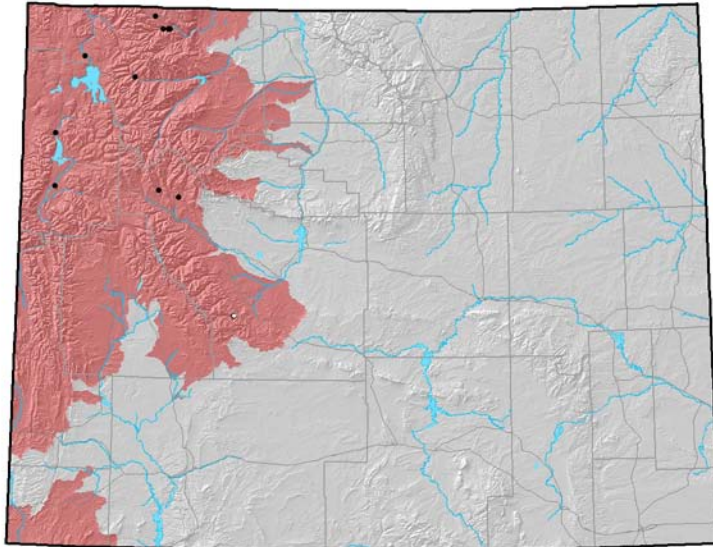
- Training AUC: 0.955
- Regularized Training Gain: 1.574

Cross-Validation Statistics

- Average Test AUC: 0.946 ± 0.047
- Upper Bound on Test AUC: 0.910
- Average Test Gain: 1.723 ± 0.948
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.10 ± 0.32

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 44
- Number of Occurrences used to create distribution model: 11
- Average Point Quality Index (highest quality is 12.00): 7.00 ± 1.41
- Most recent occurrence used: 2007
- Oldest occurrence used: 1981
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL_2.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

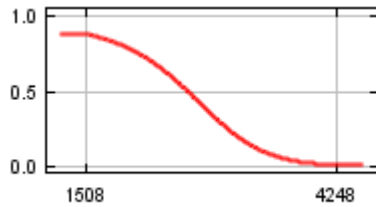
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Annual Relative Humidity Range	43
Radiation of the darkest month	25
Interannual variation in annual frost days	15
Annual total radiation	8
Warmest quarter mean temperature	5
Variation in monthly Relative Humidity	4

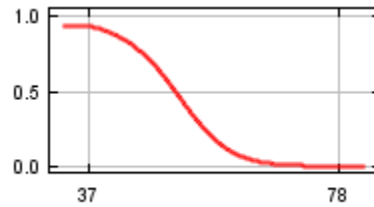
Response Curves

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).

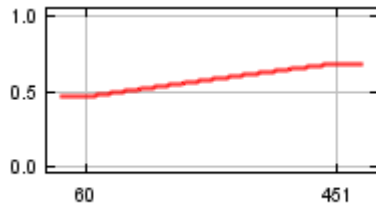
Annual Relative Humidity Range



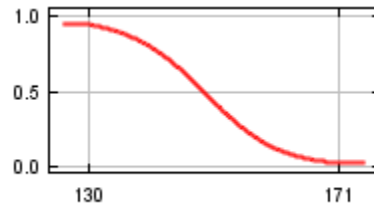
Radiation of the darkest month



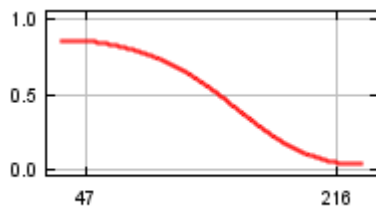
Interannual variation in annual frost days



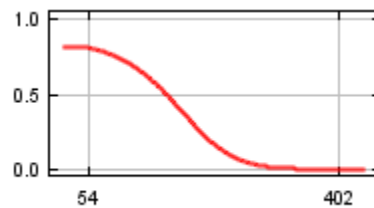
Annual total radiation



Warmest quarter mean temperature



Variation in monthly Relative Humidity

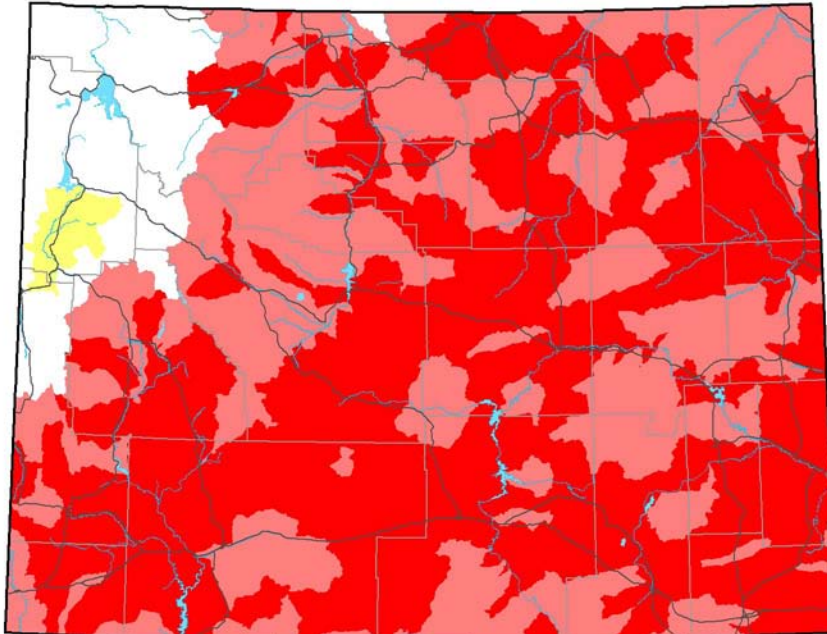


Burrowing Owl (*Athene cunicularia*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Burrowing Owl (ABNSB10010) 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

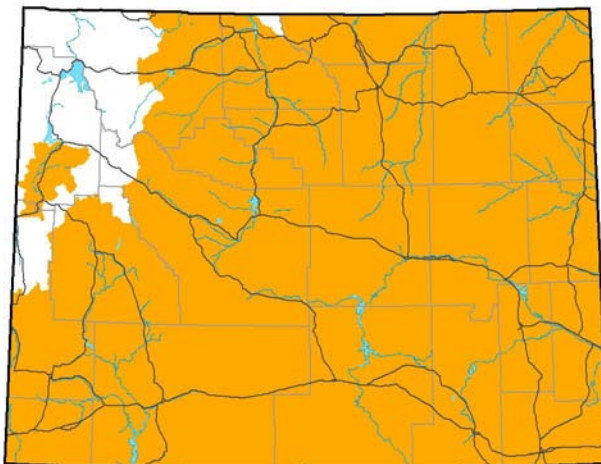


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.520
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

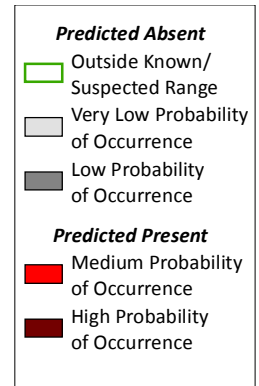
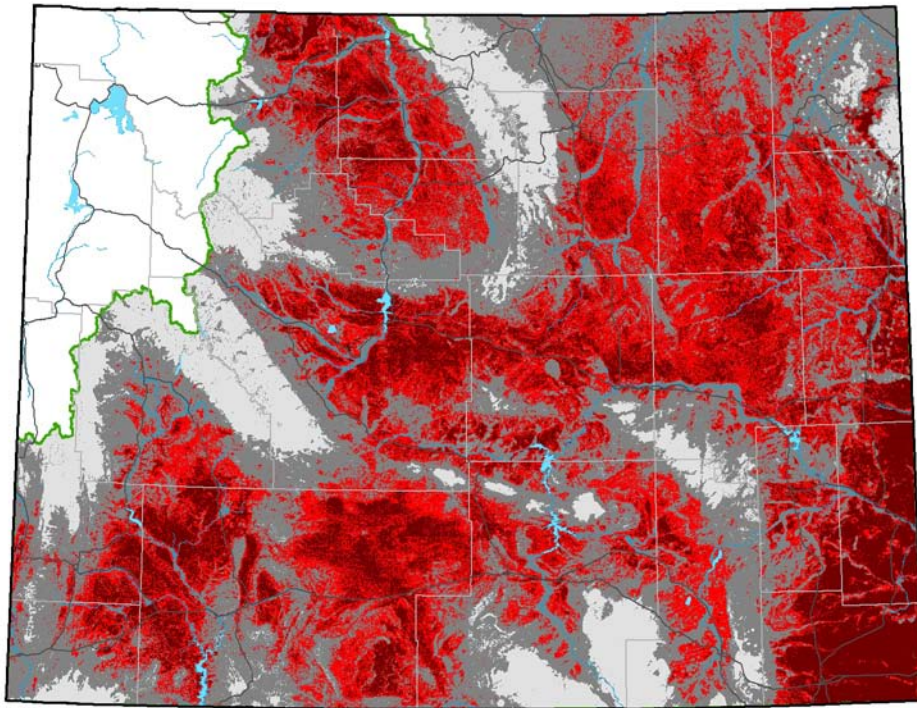
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Mar 31 15:27:36 MDT 2010)

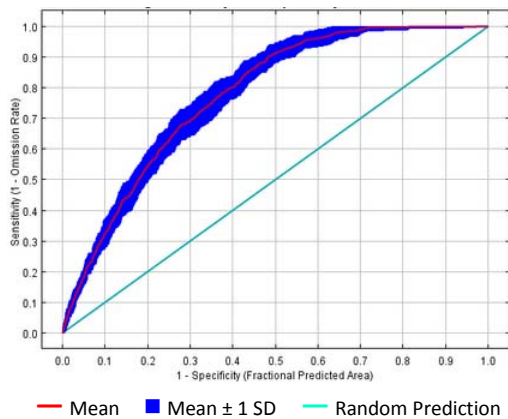
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-Apr- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3791120
- High-Probability Threshold Value: 0.5433848
- Low-Probability Threshold Value: 0.0189194

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

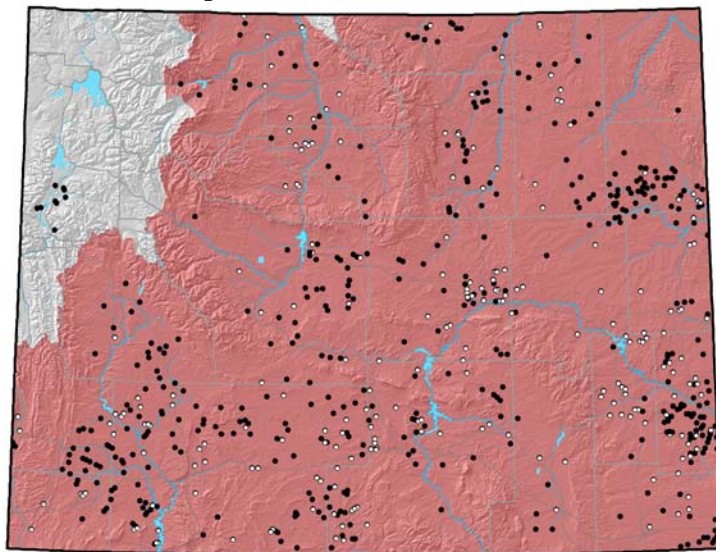
- Training AUC: 0.795
- Regularized Training Gain: 0.572

Cross-Validation Statistics

- Average Test AUC: 0.776 ± 0.020
- Upper Bound on Test AUC: 0.780
- Average Test Gain: 0.500 ± 0.182
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.22 ± 0.05

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,442
- Number of Occurrences used to create distribution model: 655
- Average Point Quality Index (highest quality is 12.00): 6.90 ± 2.41
- Most recent occurrence used: 2008
- Oldest occurrence used: 1974
- Occurrence File:
DRAFT_3_ABNSB10010_RE_REVIEWED_OCCURRENCE_SAMPLES.csv

Comments

We discovered several occurrence points in unlikely locations for this and other species (e.g., river otter occurrences located in upland sagebrush several miles from water). Where possible, we removed or corrected evident errors. Given the number of errors detected, other points in the dataset are likely to be inaccurate, but there is no way to assess their accuracy due to lack of supporting location data. This is notably true for records from Wildlife Observation System. Since unidentified location errors negatively impact model quality, supplementation/replacement of the existing data set with high-quality occurrence locations could greatly improve the modeled distribution for this species.

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

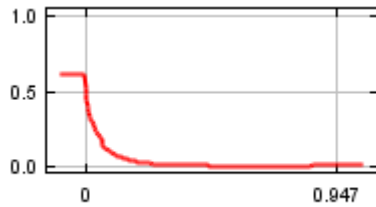
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Forest Cover Index	55
Degree Slope	13
Elevation	11
Conifer Index	10
Prevalence of flowing Water Wtihin 3200 meters	7
Annual Radiation range	4

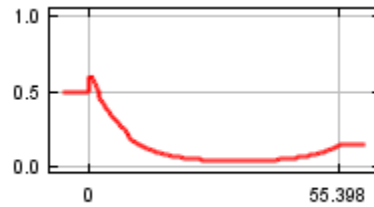
Response Curves

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).

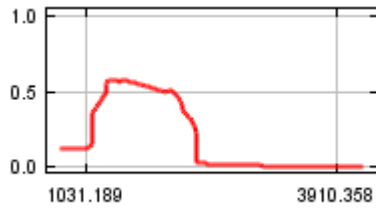
Forest Cover Index



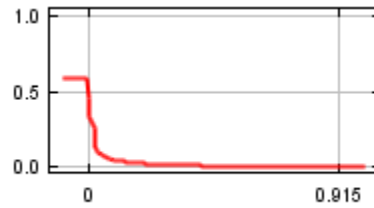
Degree Slope



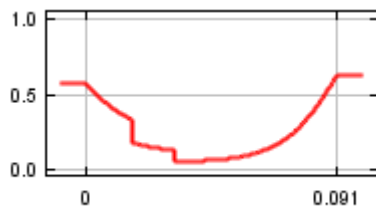
Elevation



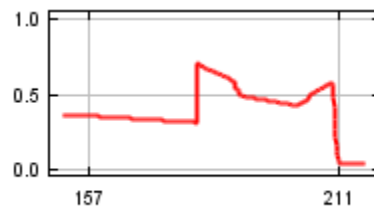
Conifer Index



Prevalence of flowing Water Wtihin 3200 meters



Annual Radiation range

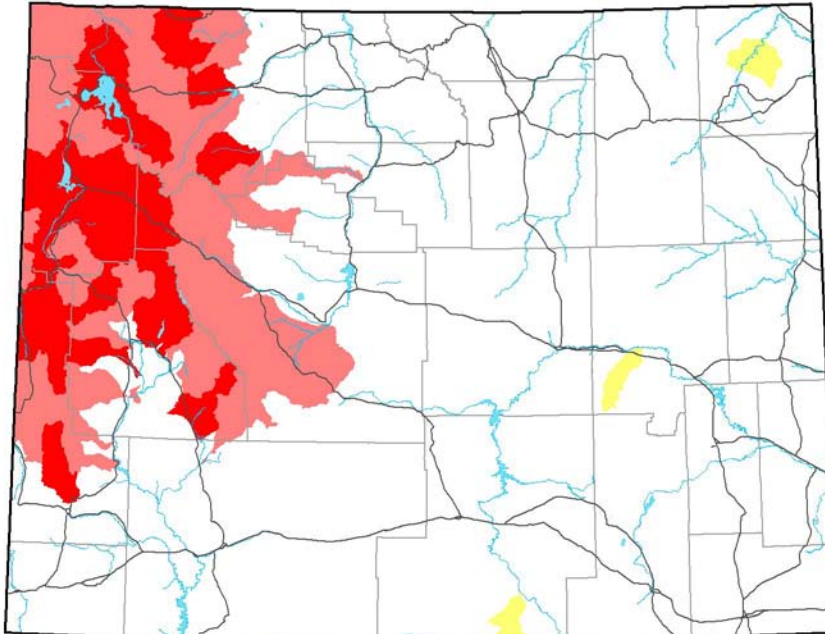


Great Gray Owl (*Strix nebulosa*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Great Gray Owl (ABNSB12040) 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

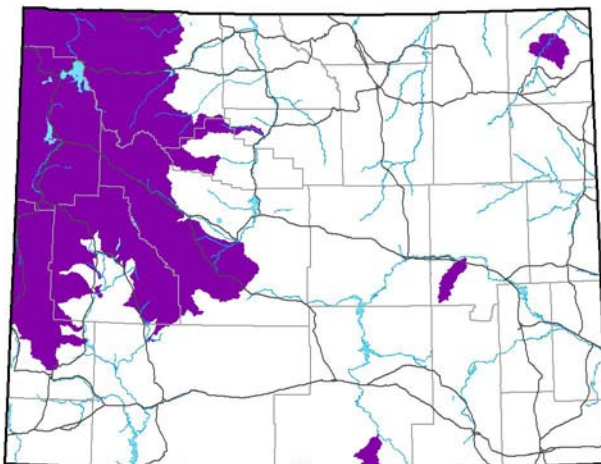


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.367
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

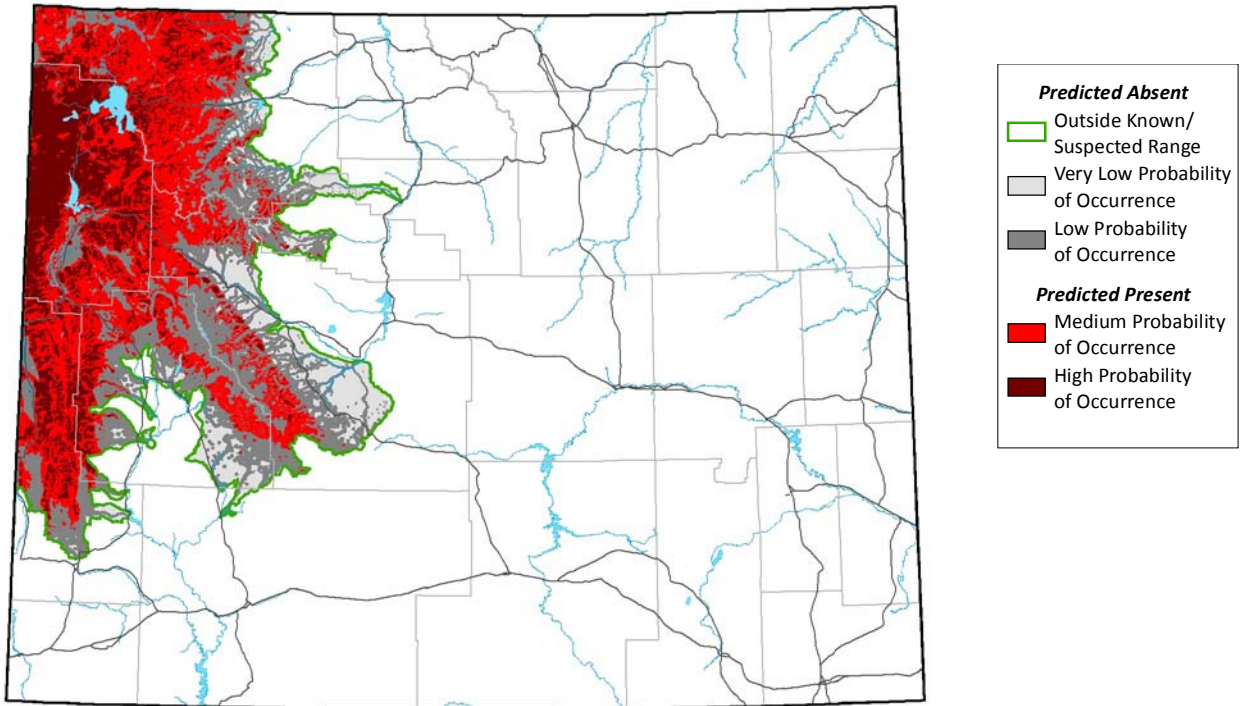
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Mar 17 16:58:46 MDT 2010)

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



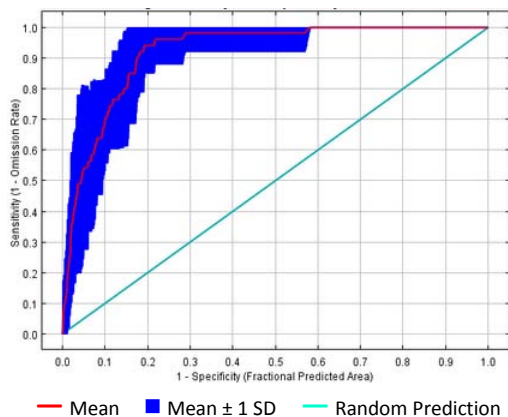
Model Parameters

- Season Modeled: Breeding (25-Mar- 31-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2094810
- High-Probability Threshold Value: 0.5360051
- Low-Probability Threshold Value: 0.0482769

Model Quality Summary

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

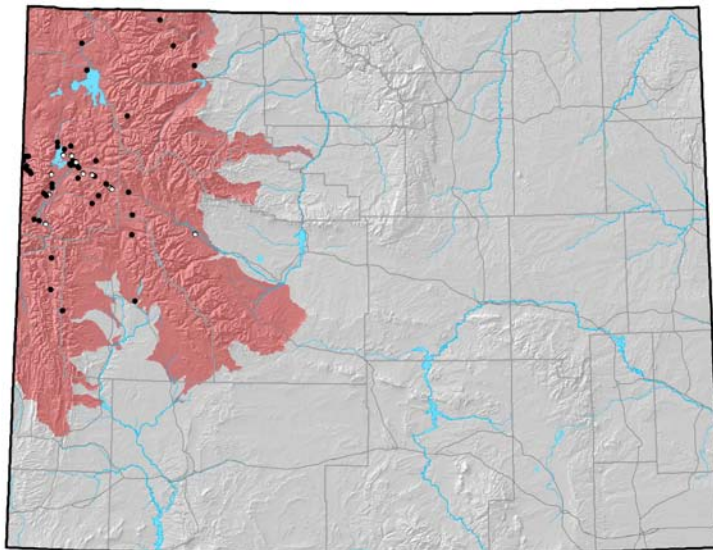
Training AUC: 0.926
 Regularized Training Gain: 1.432

Cross-Validation Statistics

- Average Test AUC: 0.920 ± 0.050
- Upper Bound on Test AUC: 0.874
- Average Test Gain: 1.456 ± 0.615
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.11± 0.16

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 211
- Number of Occurrences used to create distribution model: 55
- Average Point Quality Index (highest quality is 12.00): 6.07 ± 1.74
- Most recent occurrence used: 2007
- Oldest occurrence used: 1969
- Occurrence File:
LOCAL_SAMPLE_POINTS_W_PD OG_2.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

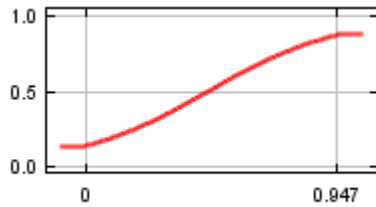
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Forest Cover Index	39
Precipitation of the coldest quarter	37
Distance to Permanent Water	12
Conifer Index	9
Cottonwood Index	2
Deciduous Forest Index	2

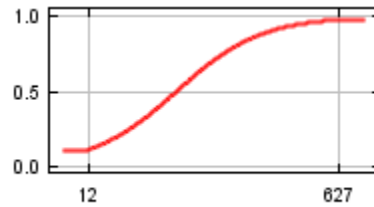
Response Curves

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).

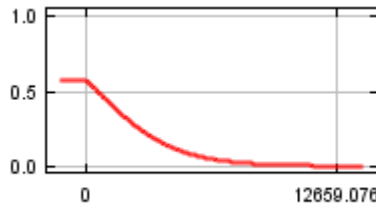
Forest Cover Index



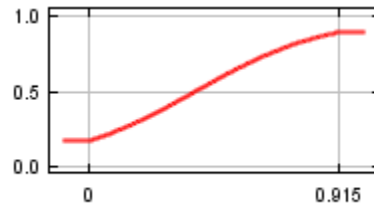
Precipitation of the coldest quarter



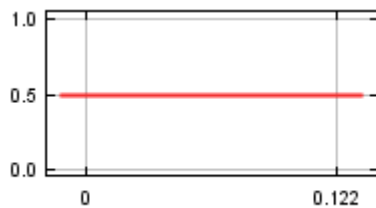
Distance to Permanent Water



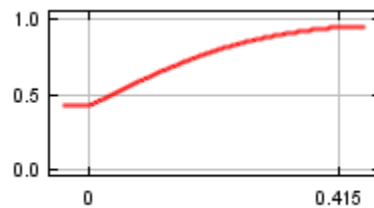
Conifer Index



Cottonwood Index



Deciduous Forest Index

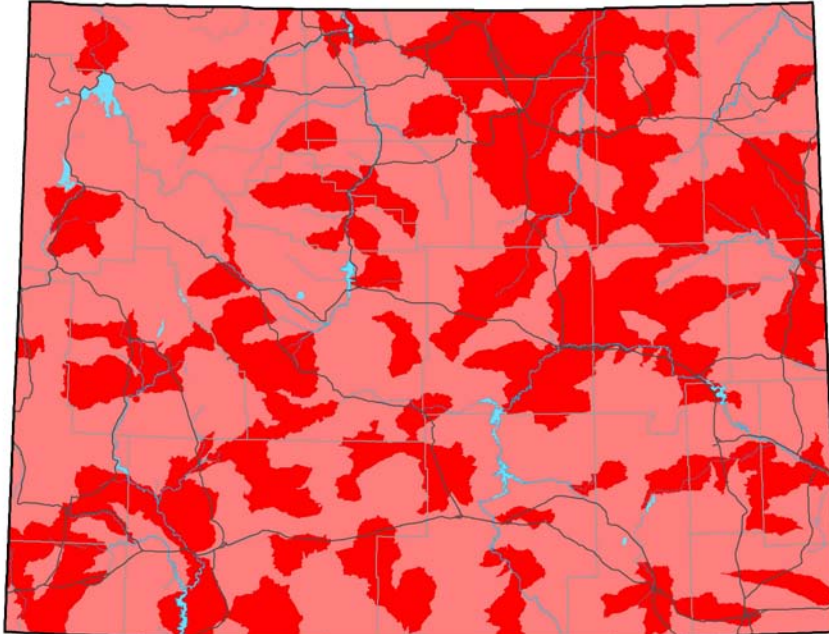


Short-eared Owl (*Asio flammeus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Short-eared Owl (ABNSB13040) 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

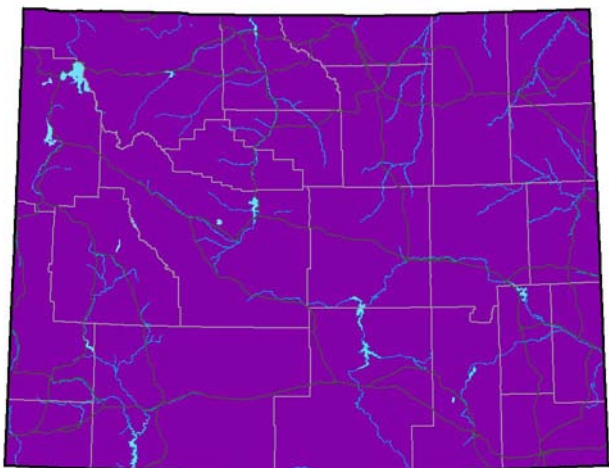


■ Known ■ Suspected ■ Accidental ■ Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.291
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



■ Year-Round ■ Summer ■ Winter ■ Spring/Fall

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

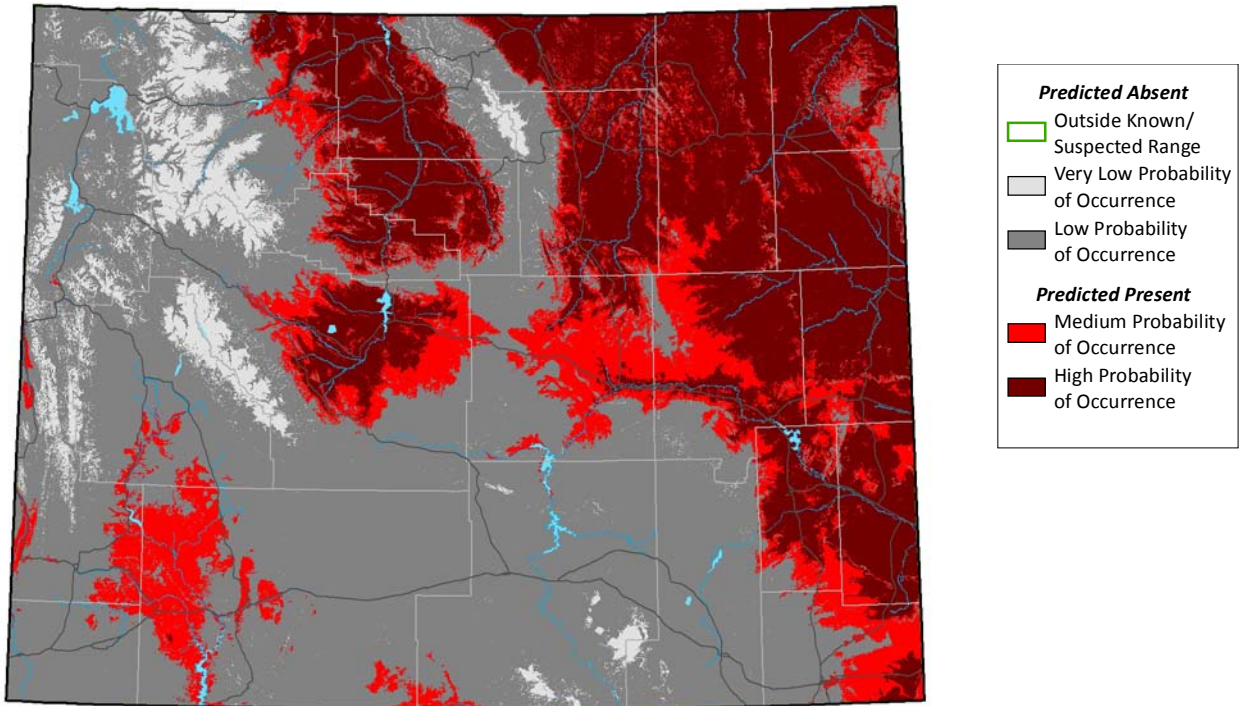
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 16 18:45:05 MDT 2010)

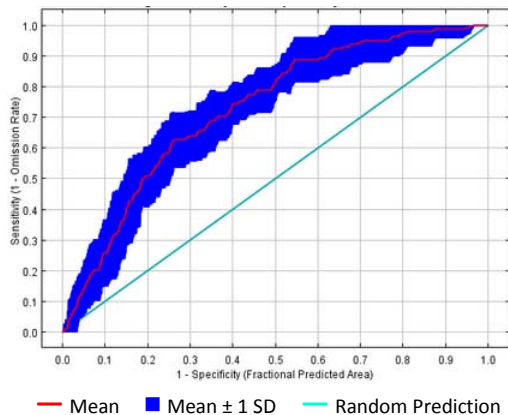
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (7-Mar- 15-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4355500
- High-Probability Threshold Value: 0.5333479
- Low-Probability Threshold Value: 0.0335475

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

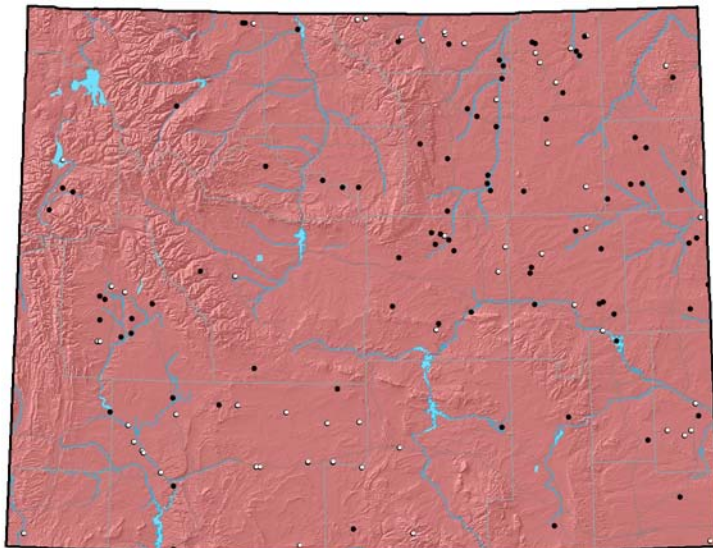
- Training AUC: 0.742
- Regularized Training Gain: 0.356

Cross-Validation Statistics

- Average Test AUC: 0.728 ± 0.046
- Upper Bound on Test AUC: 0.731
- Average Test Gain: 0.302 ± 0.224
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.35 ± 0.10

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 413
- Number of Occurrences used to create distribution model: 142
- Average Point Quality Index (highest quality is 12.00): 6.26 ± 1.81
- Most recent occurrence used: 2008
- Oldest occurrence used: 1968
- Occurrence File:
LARGE_AREA_SAMPLE_POINTS_ALL_2.csv

Comments

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

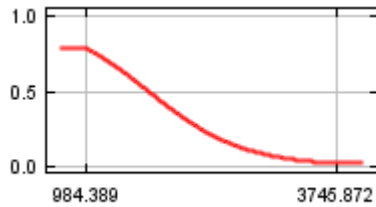
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Elevation	44
Wettest quarter mean temperature	31
Annual temperature range (T3 – T4)	14
Vector Ruggedness Measure	6
Standard deviation of monthly temperature	6
Distance to Permanent Water	0

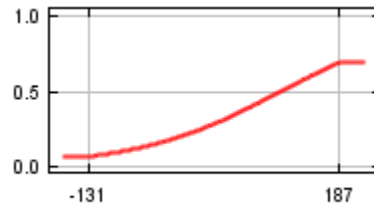
Response Curves

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).

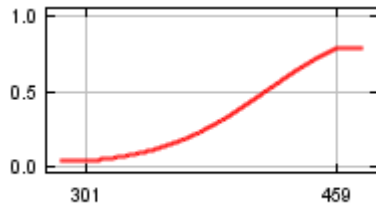
Elevation



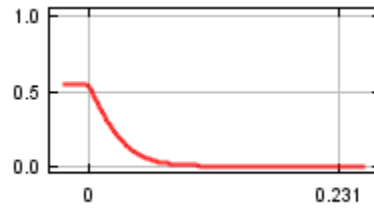
Wettest quarter mean temperature



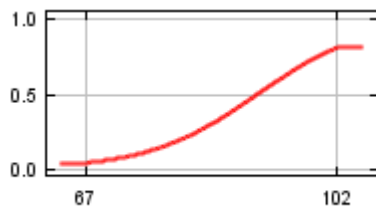
Annual temperature range (T3 – T4)



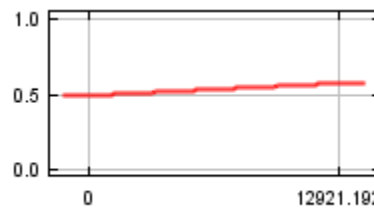
Vector Ruggedness Measure



Standard deviation of monthly temperature



Distance to Permanent Water

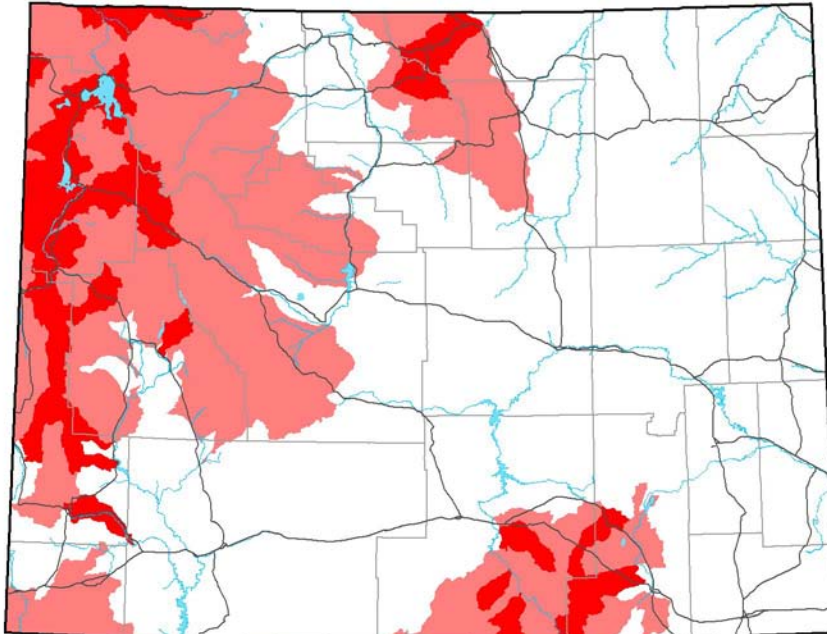


Boreal Owl (*Aegolius funereus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Boreal Owl (ABNSB15010) 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

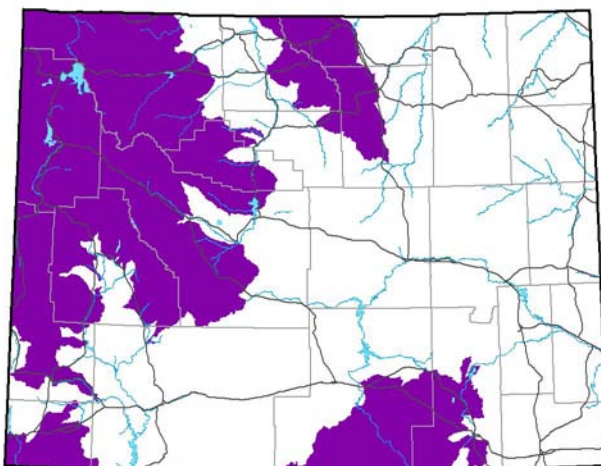


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.224
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

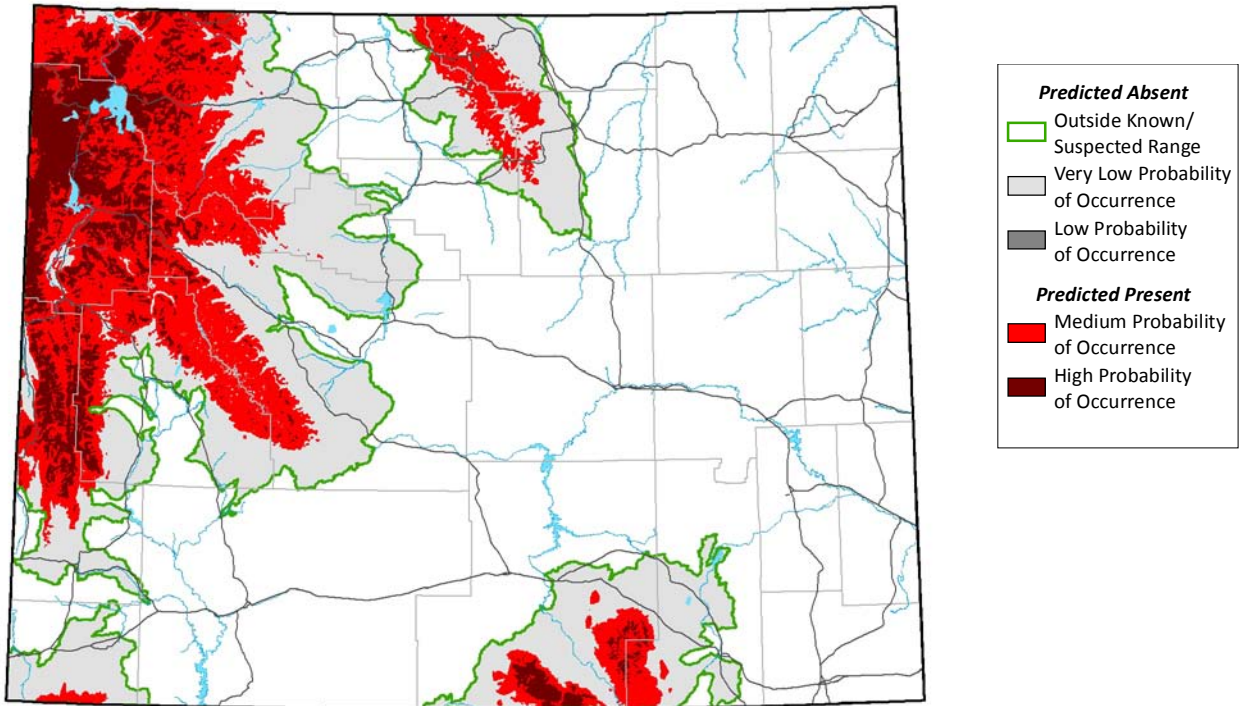
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Mar 17 01:49:13 MDT 2010)

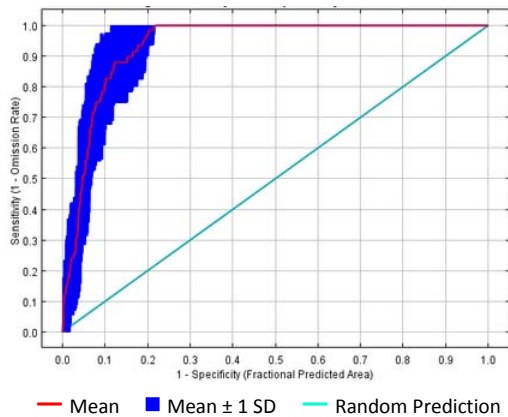
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-Mar- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1544870
- High-Probability Threshold Value: 0.5434354
- Low-Probability Threshold Value: 0.1544870

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

- Expert Assessment: High
- 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

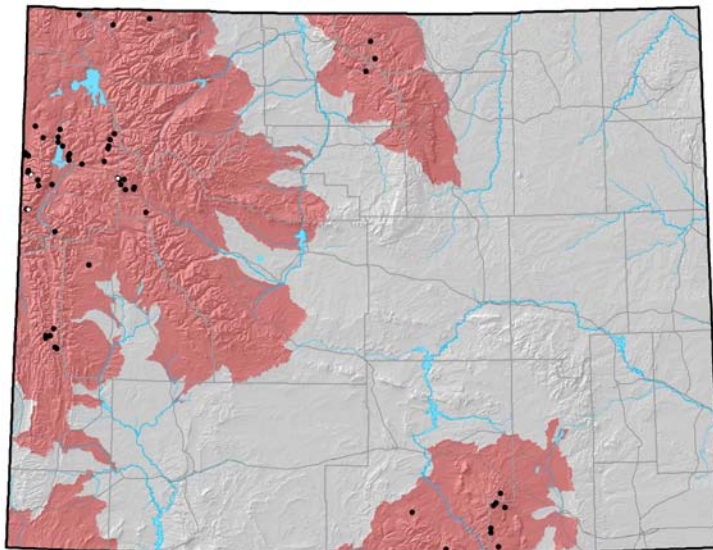
- Training AUC: 0.942
- Regularized Training Gain: 1.680

Cross-Validation Statistics

- Average Test AUC: 0.937 ± 0.026
- Upper Bound on Test AUC: 0.925
- Average Test Gain: 1.692 ± 0.402
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.05 ± 0.11

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 143
- Number of Occurrences used to create distribution model: 58
- Average Point Quality Index (highest quality is 12.00): 9.36 ± 1.98
- Most recent occurrence used: 2006
- Oldest occurrence used: 1976
- Occurrence File:
LOCAL_SAMPLE_POINTS_W_PD OG_2.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

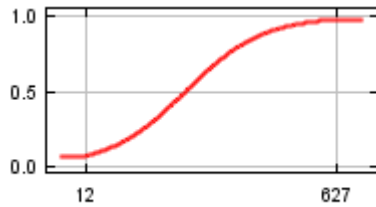
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Precipitation of the coldest quarter	45
Conifer Index	44
Annual mean temperature	8
Distance to Permanent Water	3
Deciduous Forest Index	0
Annual precipitation range (P3 – P2)	0

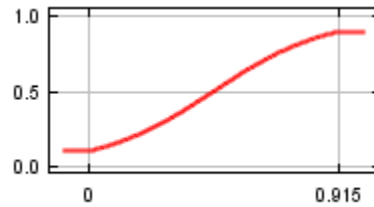
Response Curves

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).

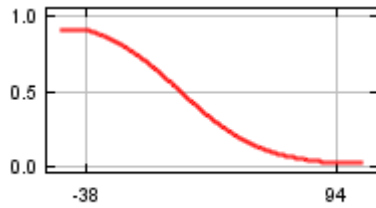
Precipitation of the coldest quarter



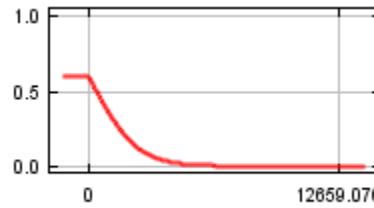
Conifer Index



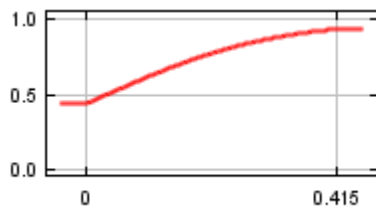
Annual mean temperature



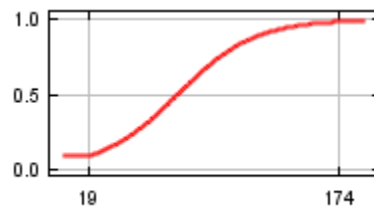
Distance to Permanent Water



Deciduous Forest Index



Annual precipitation range (P3 – P2)

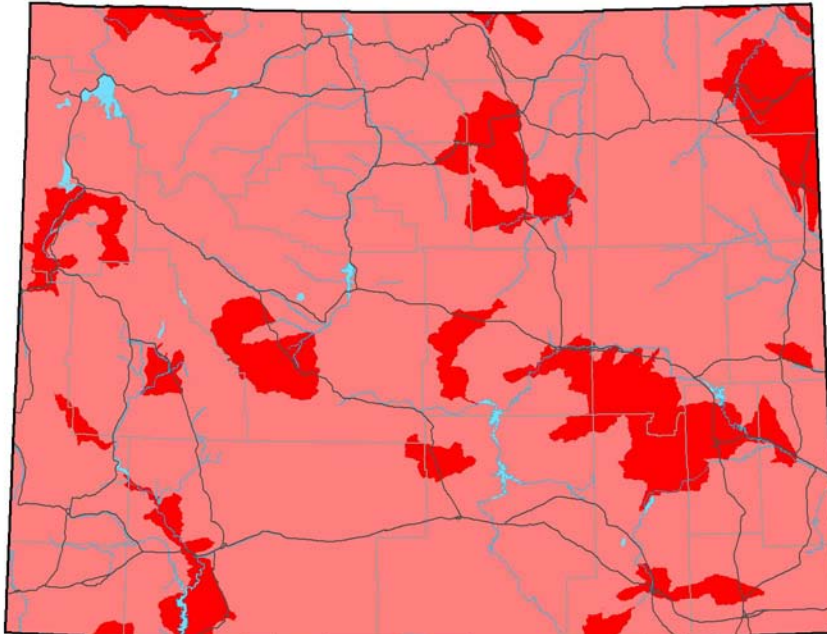


Lewis' Woodpecker (*Melanerpes lewis*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Lewis' Woodpecker (ABNYF04010) 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

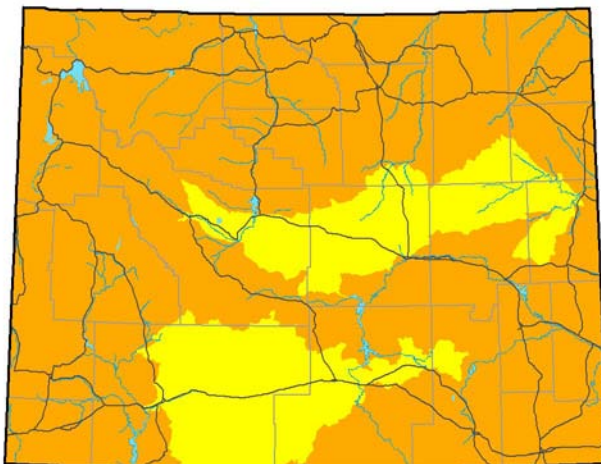


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.148
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

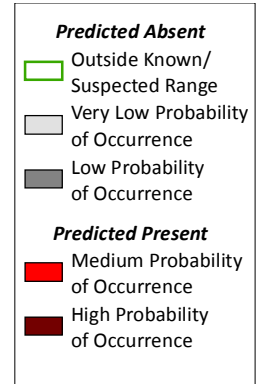
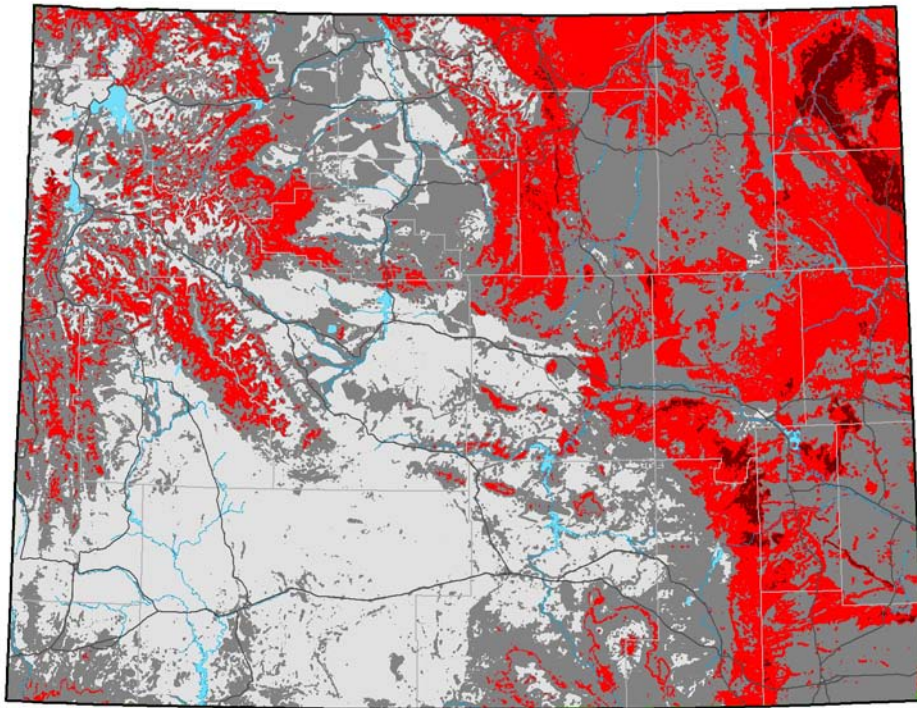
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 01:57:02 MST 2010)

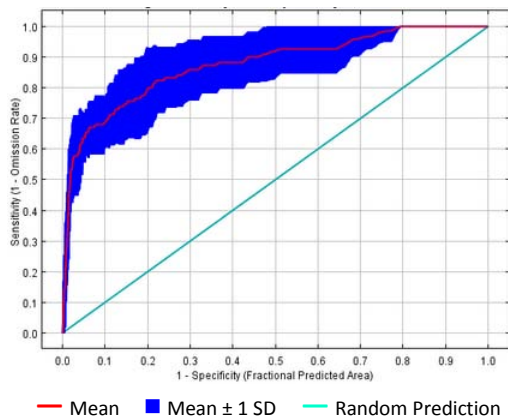
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-May- 25-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1321160
- High-Probability Threshold Value: 0.7330925
- Low-Probability Threshold Value: 0.0167191

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

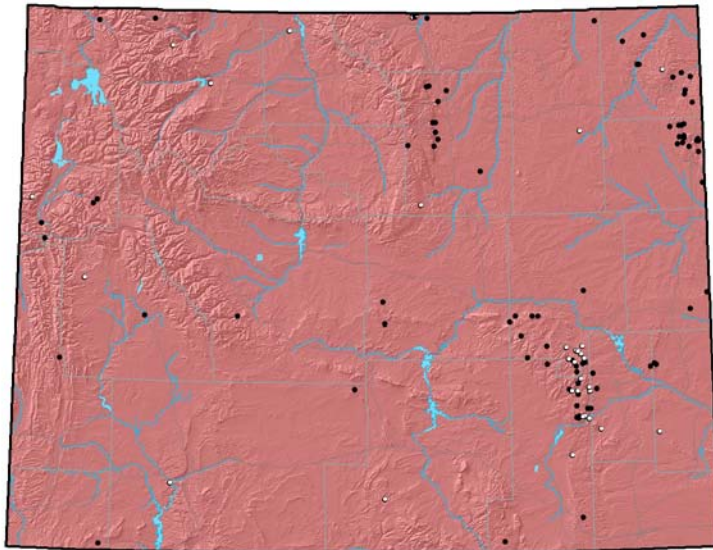
- Training AUC: 0.921
- Regularized Training Gain: 1.746

Cross-Validation Statistics

- Average Test AUC: 0.876 ± 0.057
- Upper Bound on Test AUC: 0.905
- Average Test Gain: 1.527 ± 0.484
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.24 ± 0.12

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 276
- Number of Occurrences used to create distribution model: 118
- Average Point Quality Index (highest quality is 12.00): 5.84 ± 1.55
- Most recent occurrence used: 2007
- Oldest occurrence used: 1978
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

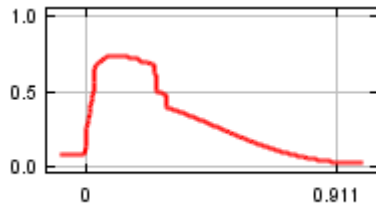
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Conifer Index	29
Depth to Shallowest Restrictive Layer	17
Precipitation of the wettest quarter	17
Variation of monthly precipitation	14
Coldest month mean minimum temperature	11
Herbaceous Cover Index	11

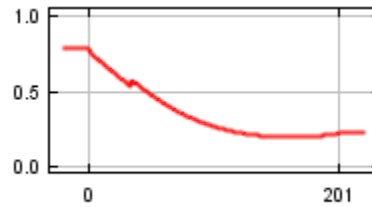
Response Curves

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).

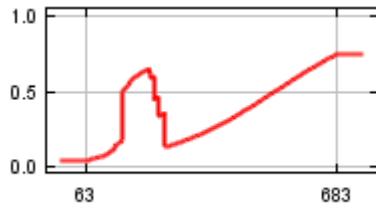
Conifer Index



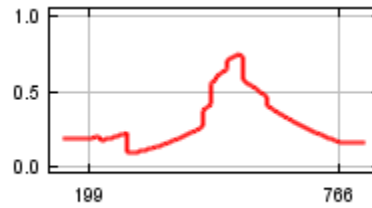
Depth to Shallowest Restrictive Layer



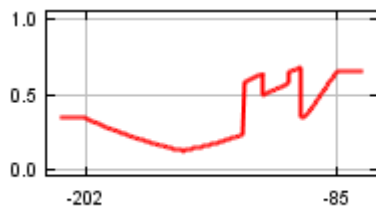
Precipitation of the wettest quarter



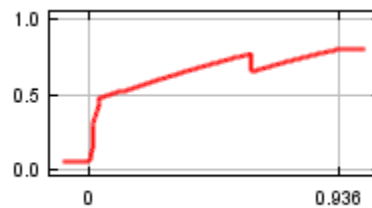
Variation of monthly precipitation



Coldest month mean minimum temperature



Herbaceous Cover Index

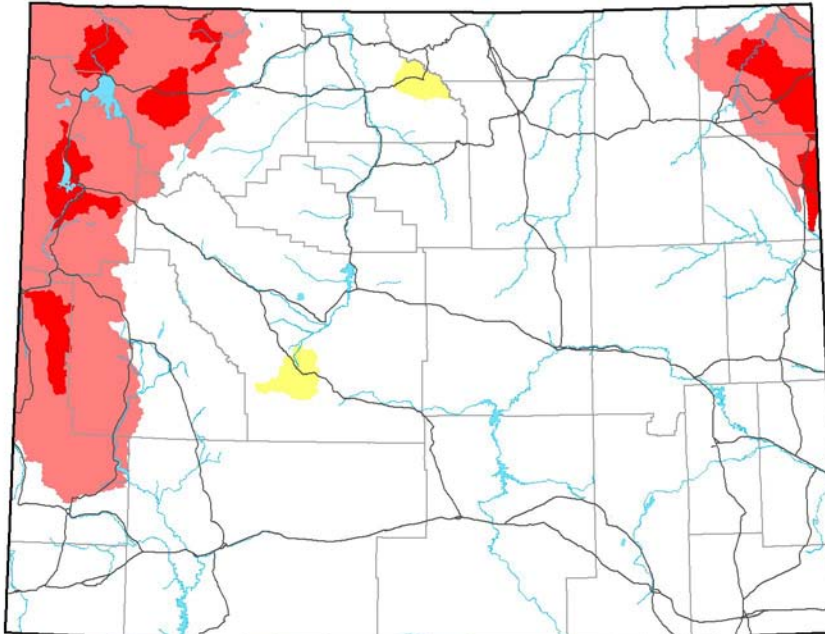


Black-backed Woodpecker (*Picoides arcticus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Black-backed Woodpecker (ABNYF07090) 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

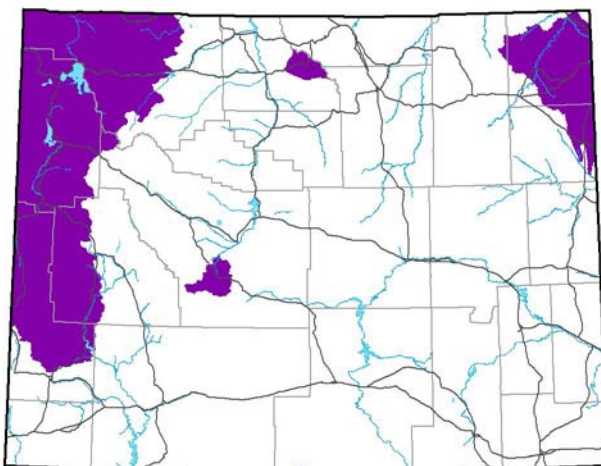


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.128
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

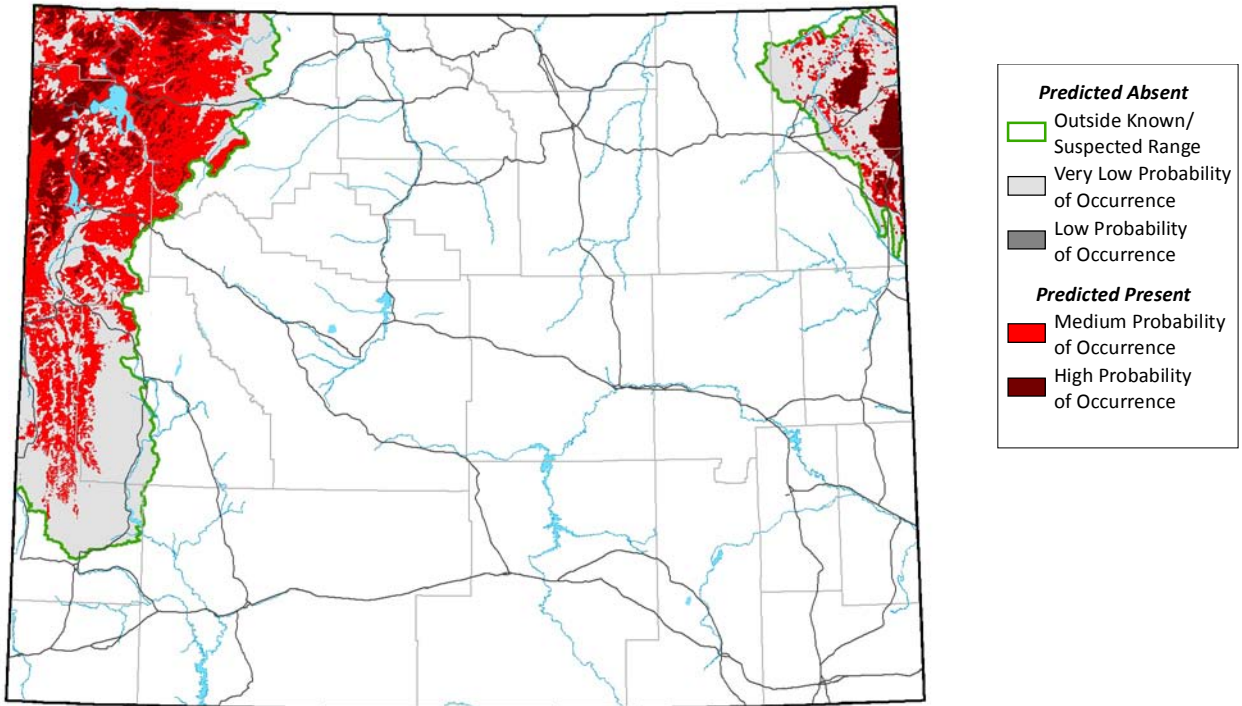
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Feb 09 19:30:36 MST 2010)

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



Model Parameters

- Season Modeled: Breeding (25-May- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1340610
- High-Probability Threshold Value: 0.5891548
- Low-Probability Threshold Value: 0.1340610

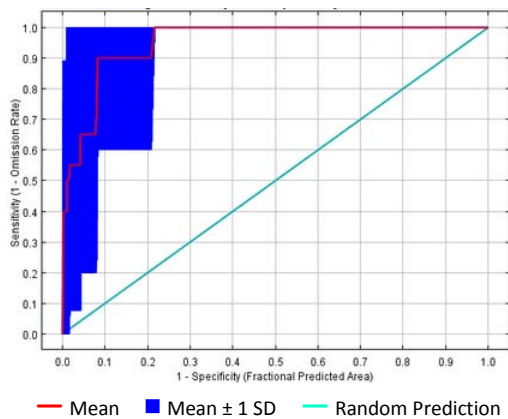
Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

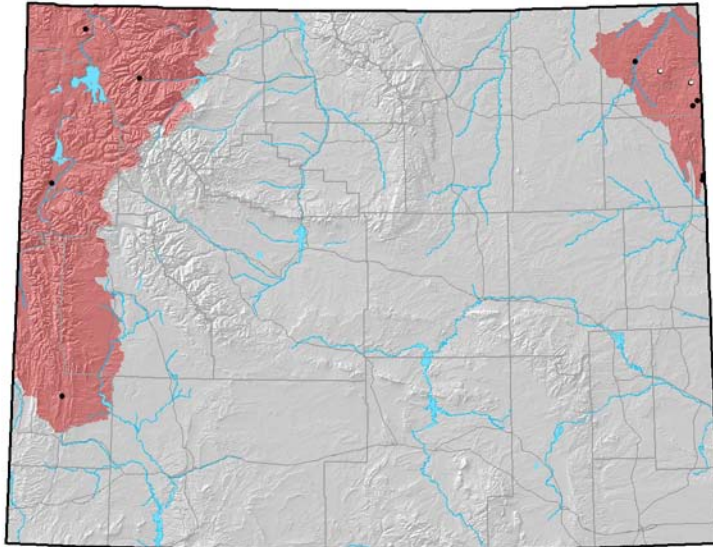
- Training AUC: 0.975
- Regularized Training Gain: 2.498

Cross-Validation Statistics

- Average Test AUC: 0.952 ± 0.066
- Upper Bound on Test AUC: 0.948
- Average Test Gain: 2.527 ± 2.157
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.10 ± 0.32

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 33
- Number of Occurrences used to create distribution model: 11
- Average Point Quality Index (highest quality is 12.00): 7.73 ± 2.69
- Most recent occurrence used: 2007
- Oldest occurrence used: 1980
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

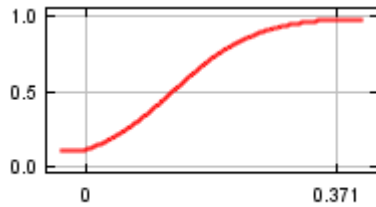
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Deciduous Forest Index	29
Precipitation of the warmest quarter	27
Forest Cover Index	19
Shrub Cover Index	10
Percent Forest Cover	8
Herbaceous Cover Index	7

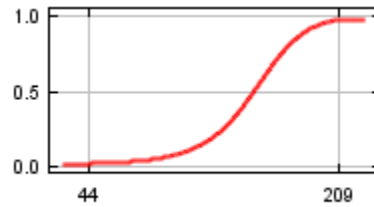
Response Curves

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).

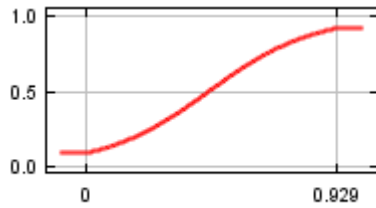
Deciduous Forest Index



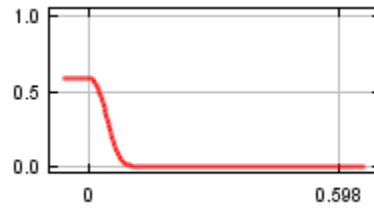
Precipitation of the warmest quarter



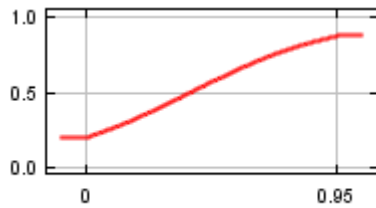
Forest Cover Index



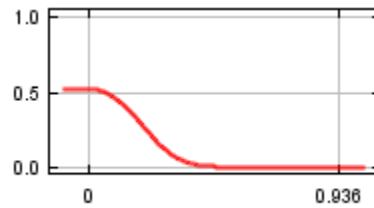
Shrub Cover Index



Percent Forest Cover



Herbaceous Cover Index

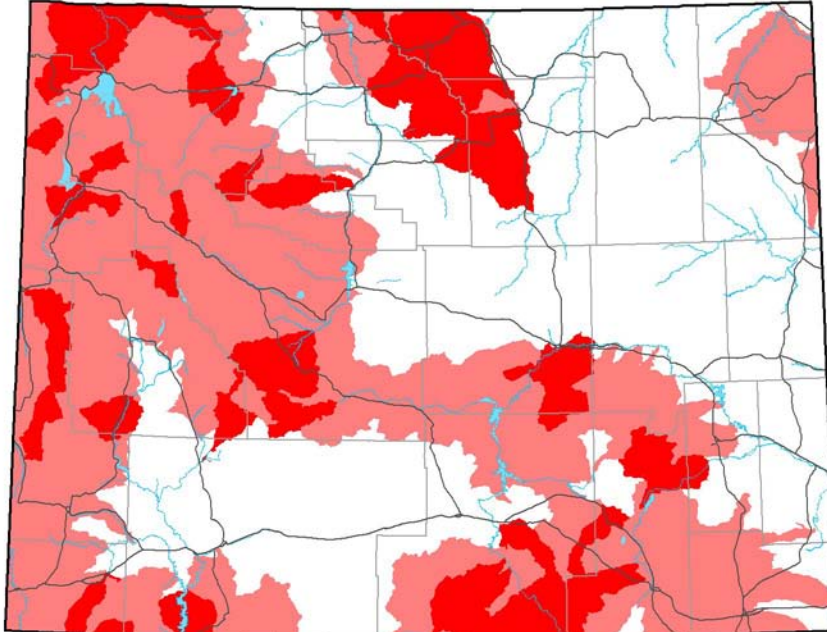


American Three-toed Woodpecker (*Picoides dorsalis*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of American Three-toed Woodpecker (ABNYF07110) 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.

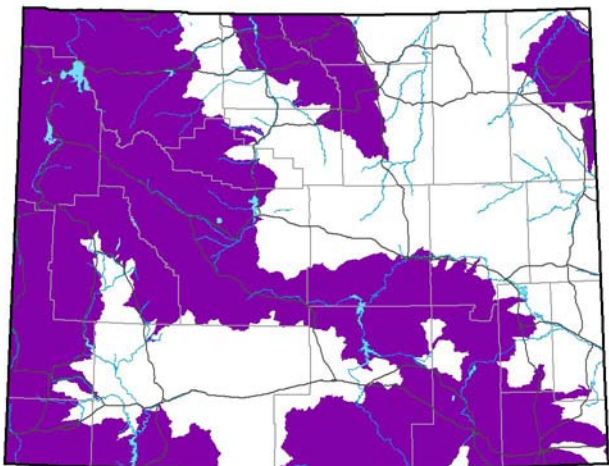
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.239
- 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/>).

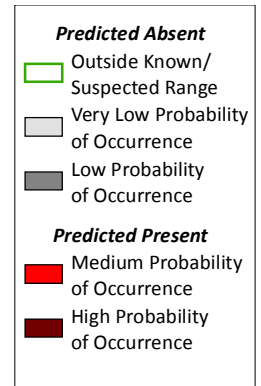
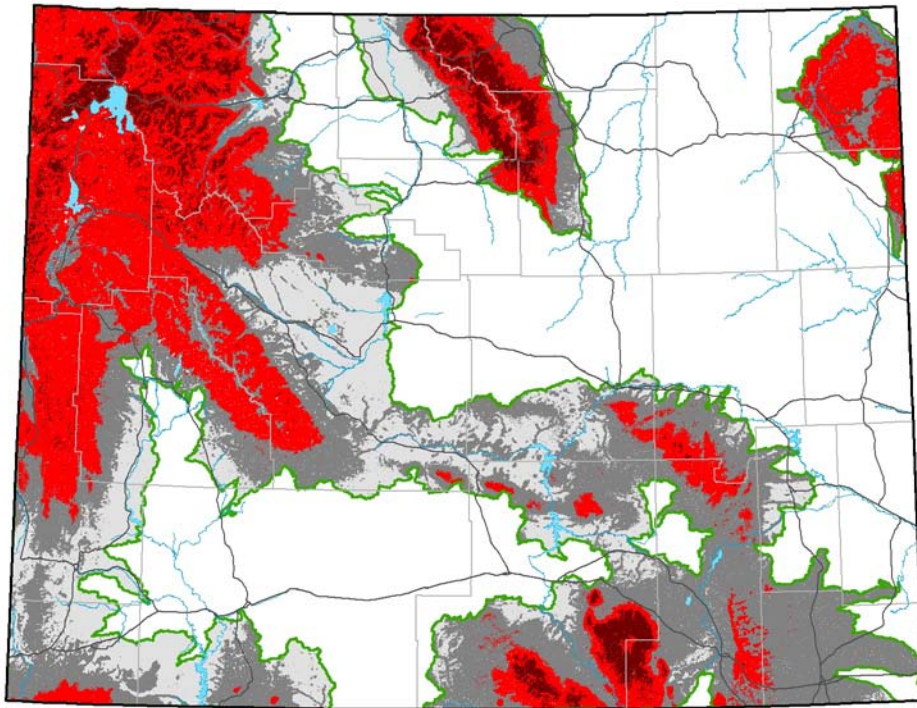
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 11:19:45 MST 2010)

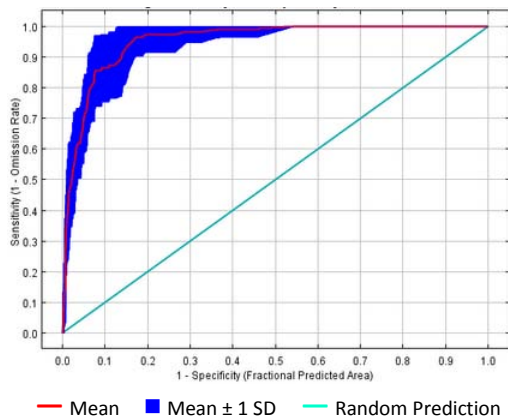
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-Jun- 31-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.0534900
- High-Probability Threshold Value: 0.6189264
- Low-Probability Threshold Value: 0.0005270

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

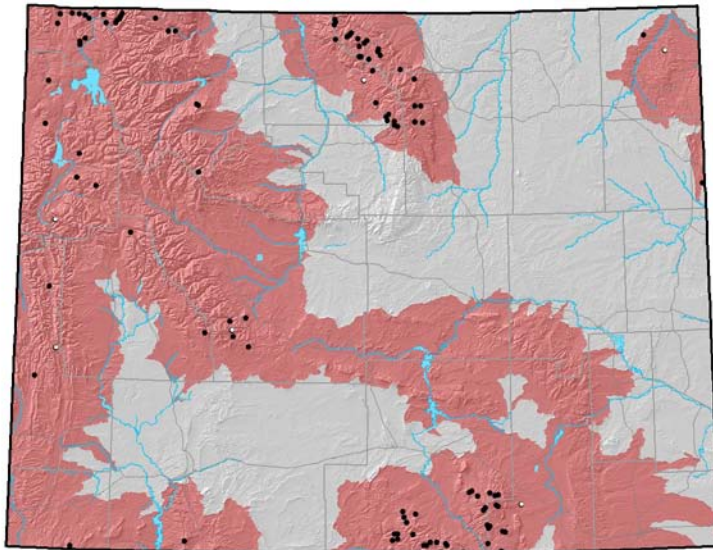
- Training AUC: 0.961
- Regularized Training Gain: 2.358

Cross-Validation Statistics

- Average Test AUC: 0.952 ± 0.021
- Upper Bound on Test AUC: 0.960
- Average Test Gain: 2.083 ± 0.421
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.09 ± 0.14

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 403
- Number of Occurrences used to create distribution model: 110
- Average Point Quality Index (highest quality is 12.00): 9.94 ± 2.72
- Most recent occurrence used: 2008
- Oldest occurrence used: 1964
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

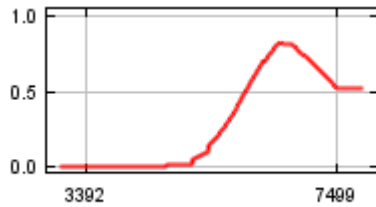
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Annual mean relative humidity	41
Forest Cover Index	19
Conifer Index	16
Variation in monthly Relative Humidity	12
Hottest month mean maximum temperature	9
Radiation Load	3

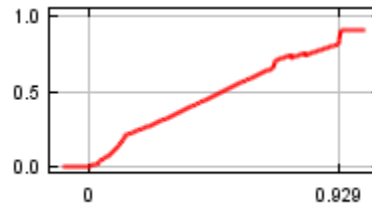
Response Curves

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).

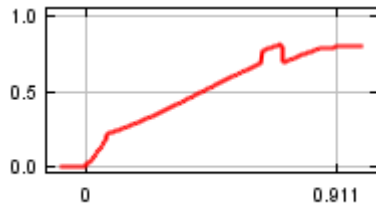
Annual mean relative humidity



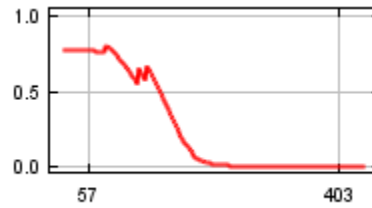
Forest Cover Index



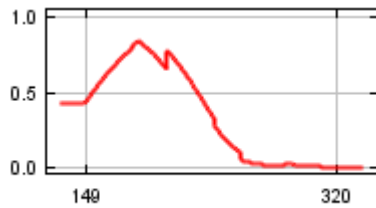
Conifer Index



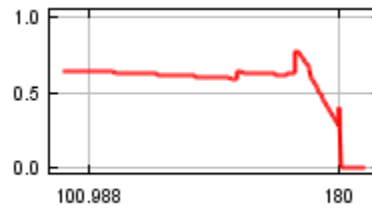
Variation in monthly Relative Humidity



Hottest month mean maximum temperature



Radiation Load

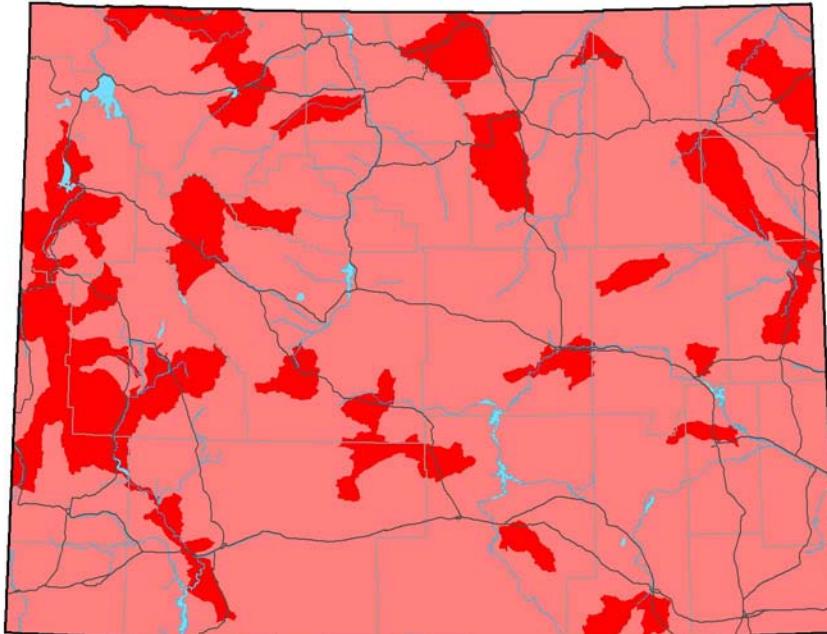


Willow Flycatcher (*Empidonax traillii*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Willow Flycatcher (ABPAE33040Q) 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.

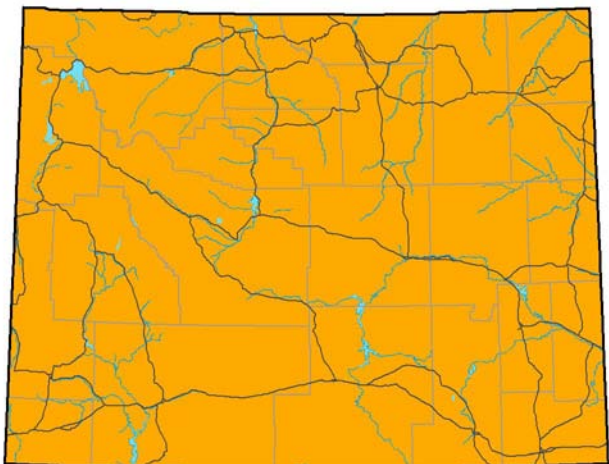
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.135
- 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/>).

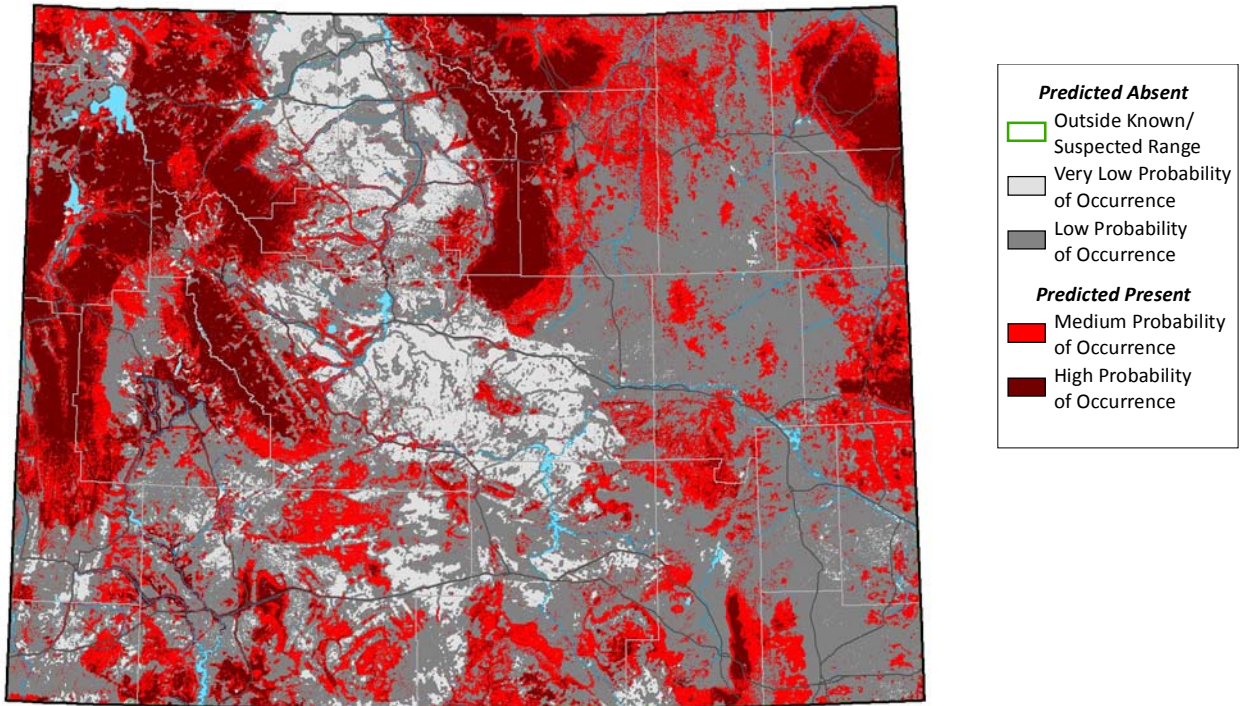
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Apr 20 22:08:57 MDT 2010)

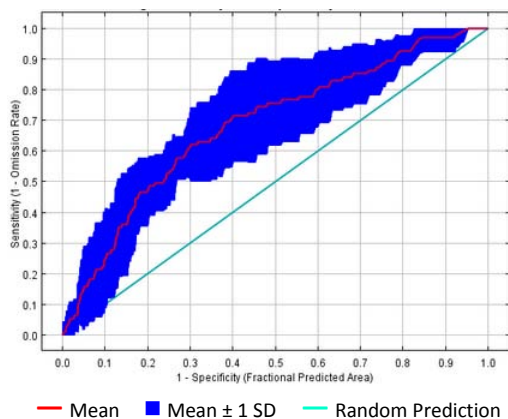
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-Jun- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3951170
- High-Probability Threshold Value: 0.5532648
- Low-Probability Threshold Value: 0.0912954

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: LOW

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

Model Evaluation Statistics

Final Model Statistics

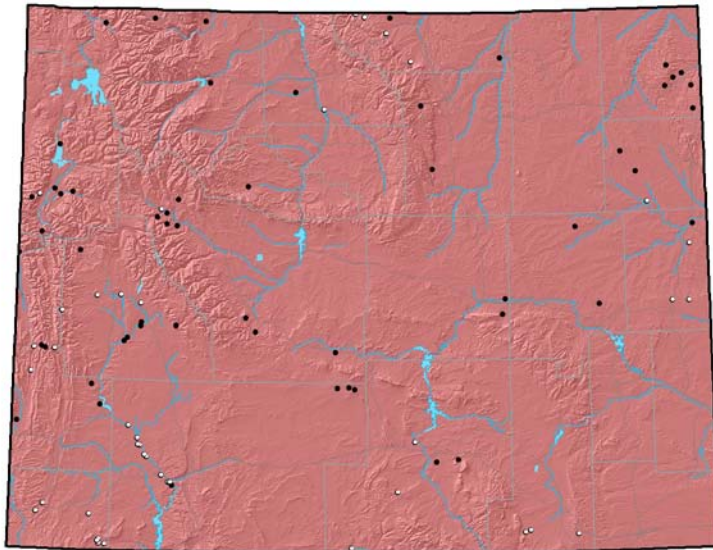
Training AUC: 0.772
 Regularized Training Gain: 0.358

Cross-Validation Statistics

- Average Test AUC: 0.685 ± 0.079
- Upper Bound on Test AUC: 0.727
- Average Test Gain: 0.163 ± 0.255
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.45 ± 0.18

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 397
- Number of Occurrences used to create distribution model: 95
- Average Point Quality Index (highest quality is 12.00): 6.24 ± 1.91
- Most recent occurrence used: 2005
- Oldest occurrence used: 1974
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.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

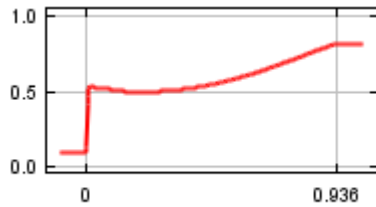
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Herbaceous Cover Index	33
Coldest month mean minimum temperature	16
Variation in monthly Relative Humidity	14
Degree Slope	14
Annual Relative Humidity Range	14
Variation of monthly precipitation	9

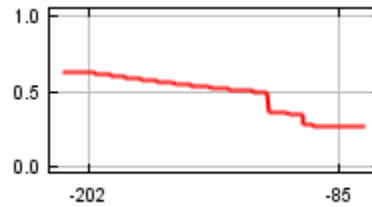
Response Curves

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).

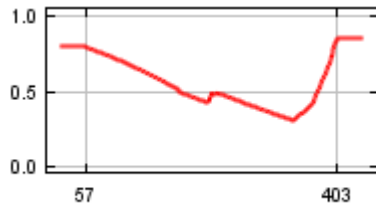
Herbaceous Cover Index



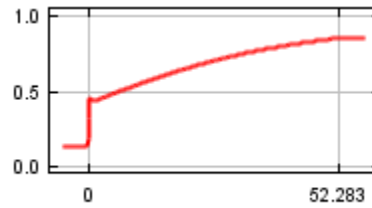
Coldest month mean minimum temperature



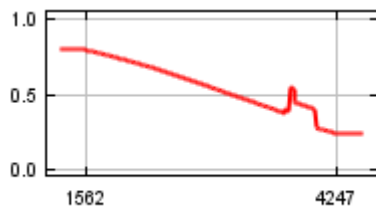
Variation in monthly Relative Humidity



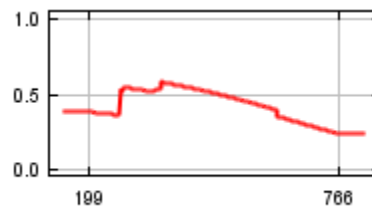
Degree Slope



Annual Relative Humidity Range



Variation of monthly precipitation

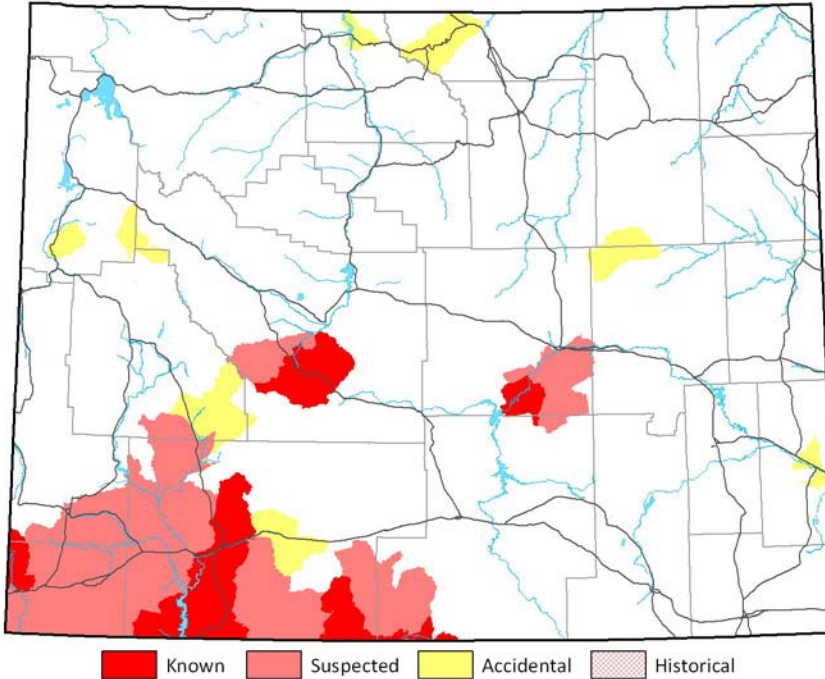


Ash-throated Flycatcher (*Myiarchus cinerascens*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Ash-throated Flycatcher (ABPAE43050) 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.

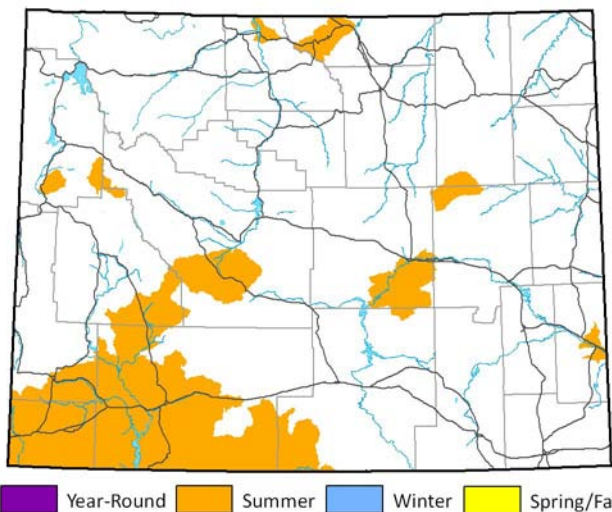
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.275
- 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/>).

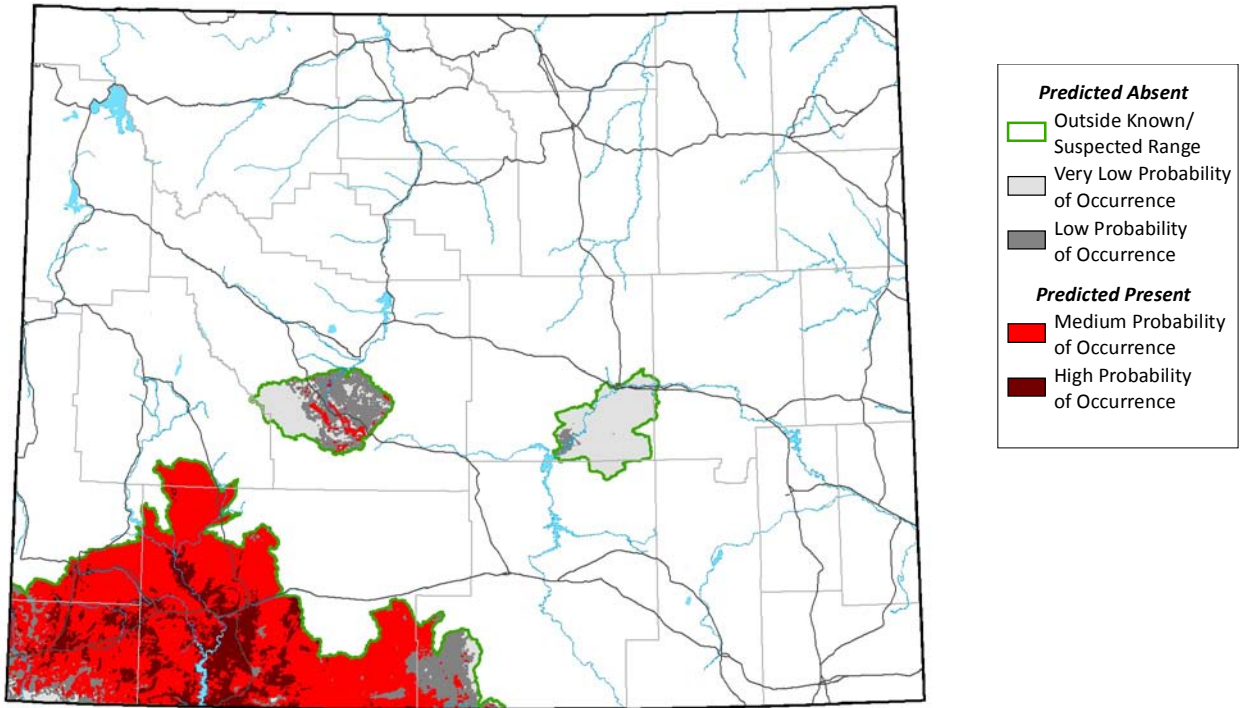
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 05:46:14 MST 2010)

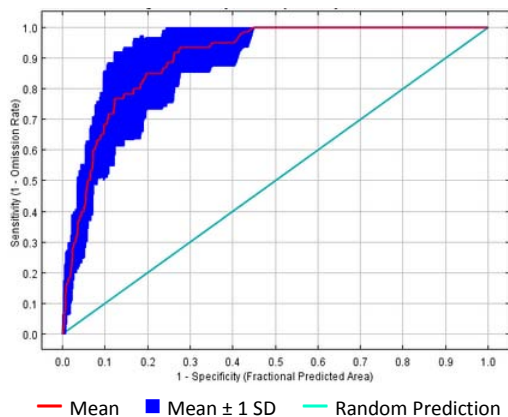
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-May- 15-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1695230
- High-Probability Threshold Value: 0.5834571
- Low-Probability Threshold Value: 0.0492604

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality: HIGH

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

Model Evaluation Statistics

Final Model Statistics

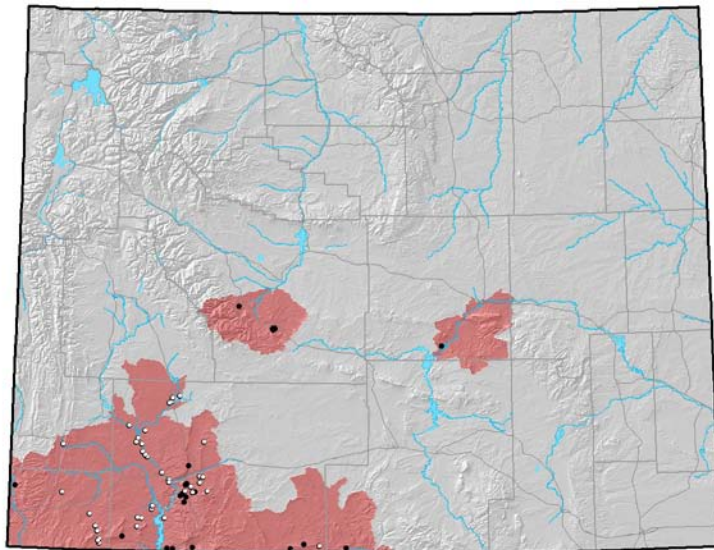
- Training AUC: 0.916
- Regularized Training Gain: 1.349

Cross-Validation Statistics

- Average Test AUC: 0.900 ± 0.039
- Upper Bound on Test AUC: 0.901
- Average Test Gain: 1.294 ± 0.404
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.18 ± 0.17

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 131
- Number of Occurrences used to create distribution model: 60
- Average Point Quality Index (highest quality is 12.00): 6.55 ± 2.73
- Most recent occurrence used: 2008
- Oldest occurrence used: 1978
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

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

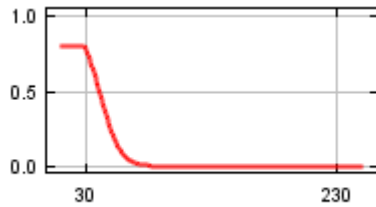
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Precipitation of the wettest month	43
Pinon-Juniper Index	29
Annual precipitation range (P3 – P2)	10
Annual total radiation	10
Relative Humidity of most humid month	7
Annual mean relative humidity	0

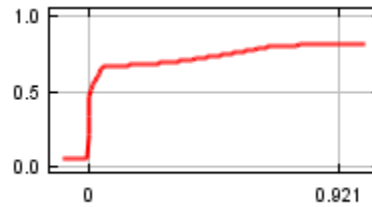
Response Curves

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).

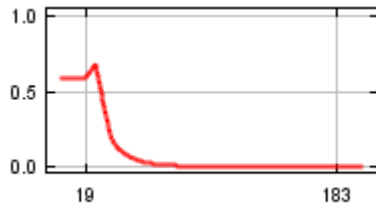
Precipitation of the wettest month



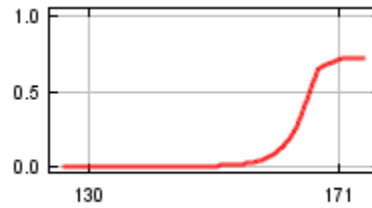
Pinon-Juniper Index



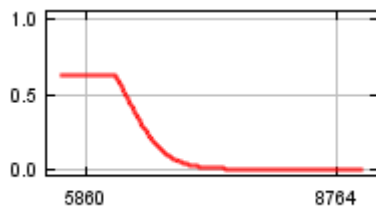
Annual precipitation range (P3 – P2)



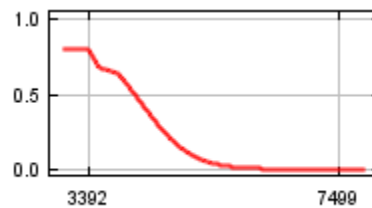
Annual total radiation



Relative Humidity of most humid month



Annual mean relative humidity

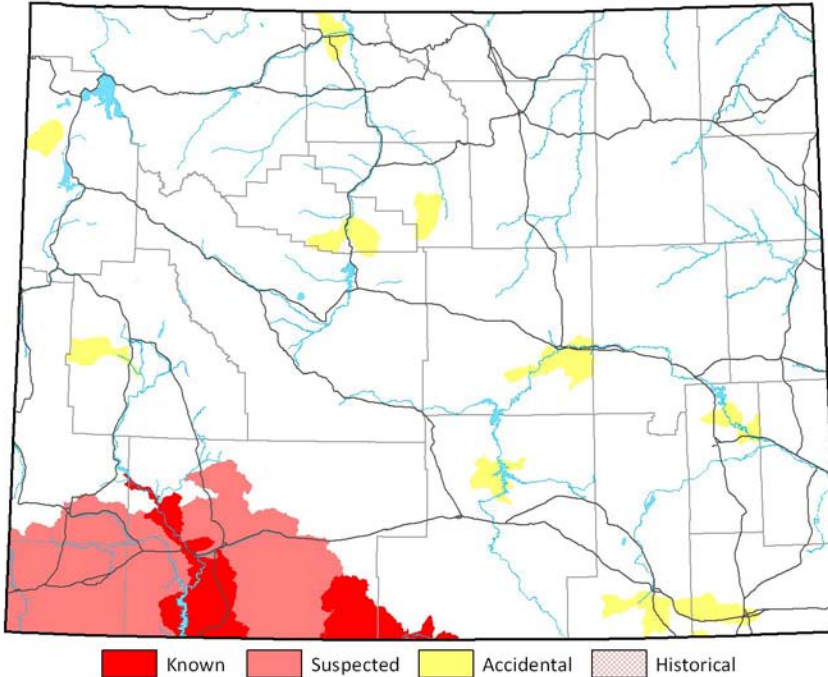


Western Scrub-Jay (*Aphelocoma californica*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Western Scrub-Jay (ABPAV06040) 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.

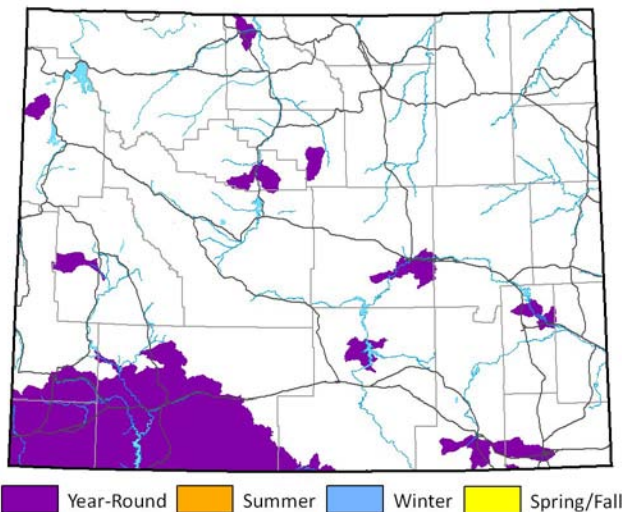
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.209
- 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/>).

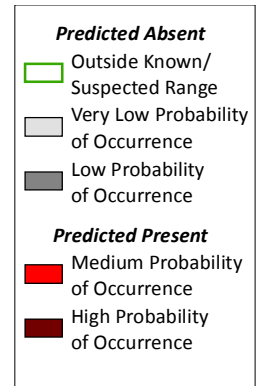
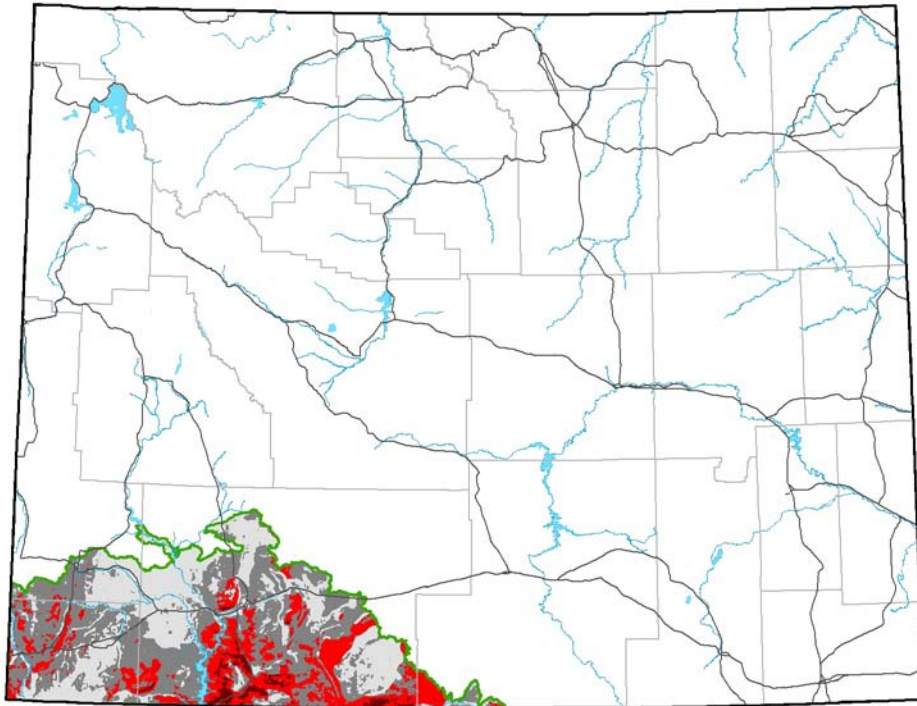
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Thu Apr 22 09:27:36 MDT 2010)

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



Model Parameters

- Season Modeled: Breeding (7-Mar- 15-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2043370
- High-Probability Threshold Value: 0.6629241
- Low-Probability Threshold Value: 0.0349851

Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

Expert Assessment: Medium

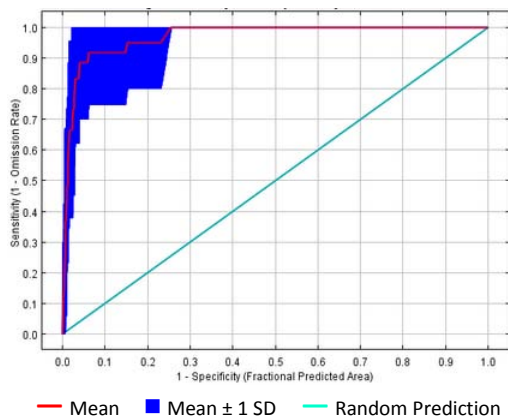
Occurrence Sample Size: Medium

Quality of Occurrences: Medium

Positive Success Rate: High

Test AUC and Model Gain: High

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

Training AUC: 0.985

Regularized Training Gain: 2.826

Cross-Validation Statistics

- Average Test AUC: 0.970 ± 0.036

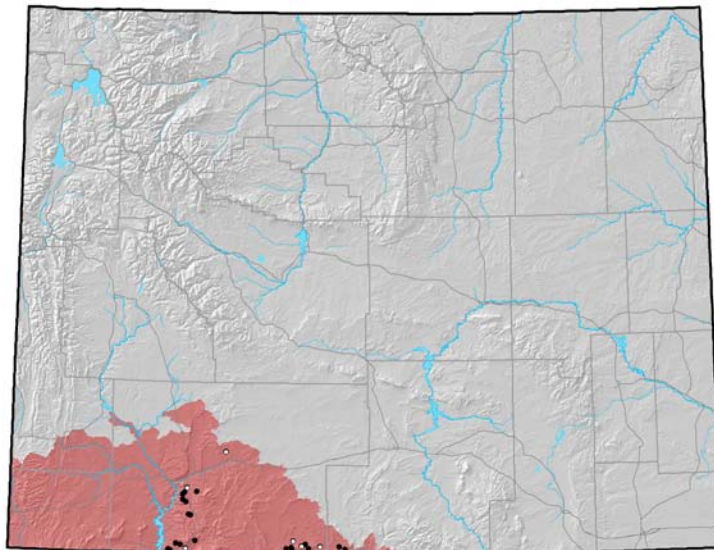
- Upper Bound on Test AUC: 0.968

- Average Test Gain: 2.578 ± 1.123

- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.12 ± 0.19

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 66
- Number of Occurrences used to create distribution model: 26
- Average Point Quality Index (highest quality is 12.00): 7.42 ± 2.80
- Most recent occurrence used: 2005
- Oldest occurrence used: 1977
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

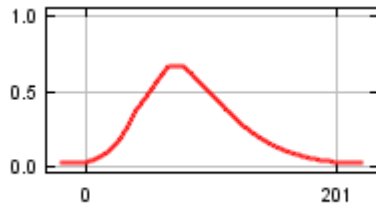
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Depth to Shallowest Restrictive Layer	28
Pinon-Juniper Index	26
Wettest quarter mean temperature	16
Interannual variation in annual frost days	15
Sagebrush Index	9
Radiation of the darkest month	6

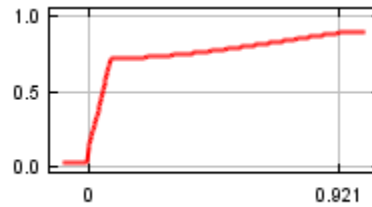
Response Curves

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).

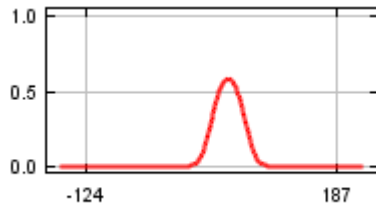
Depth to Shallowest Restrictive Layer



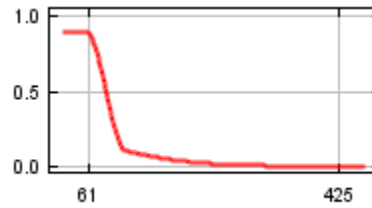
Pinon-Juniper Index



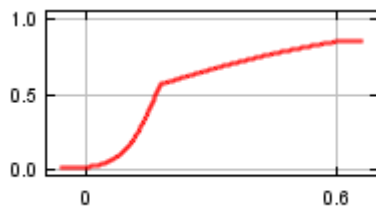
Wettest quarter mean temperature



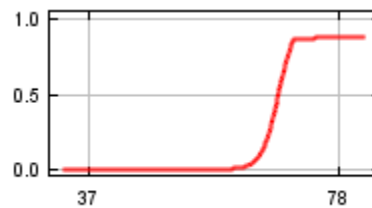
Interannual variation in annual frost days



Sagebrush Index



Radiation of the darkest month

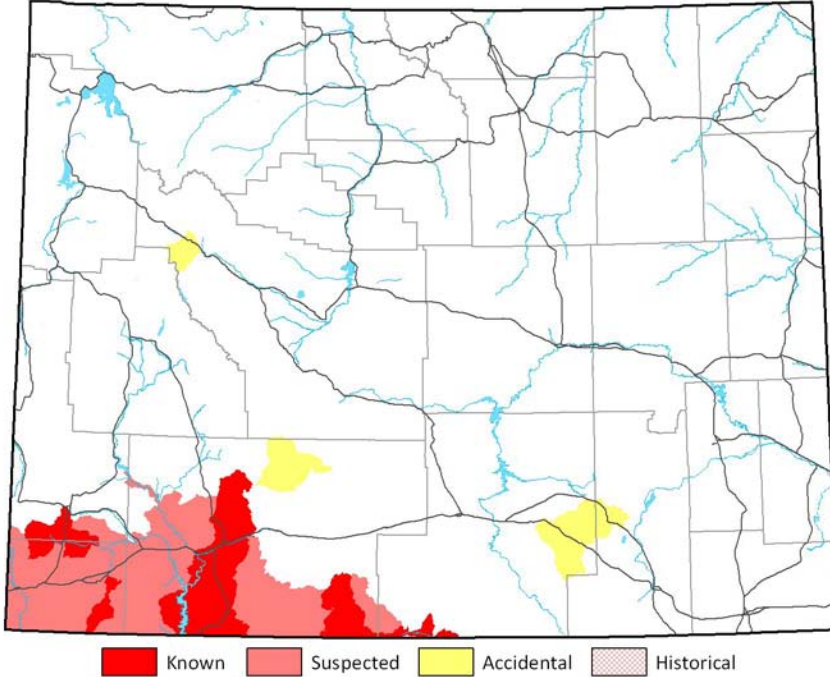


Juniper Titmouse (*Baeolophus ridgwayi*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Juniper Titmouse (ABPAW01120) 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.

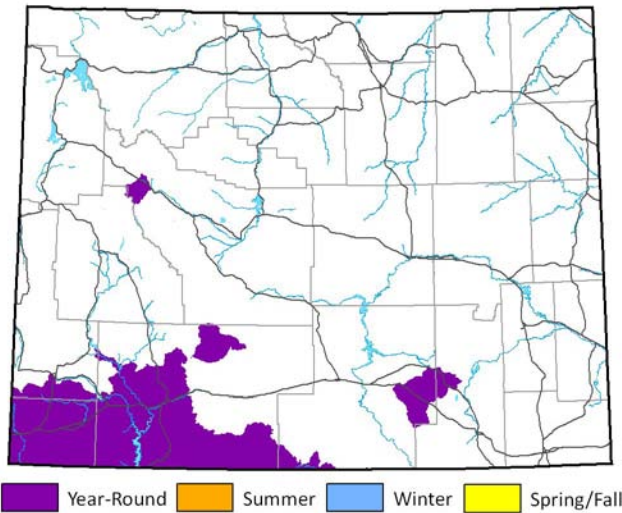
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.314
- 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/>).

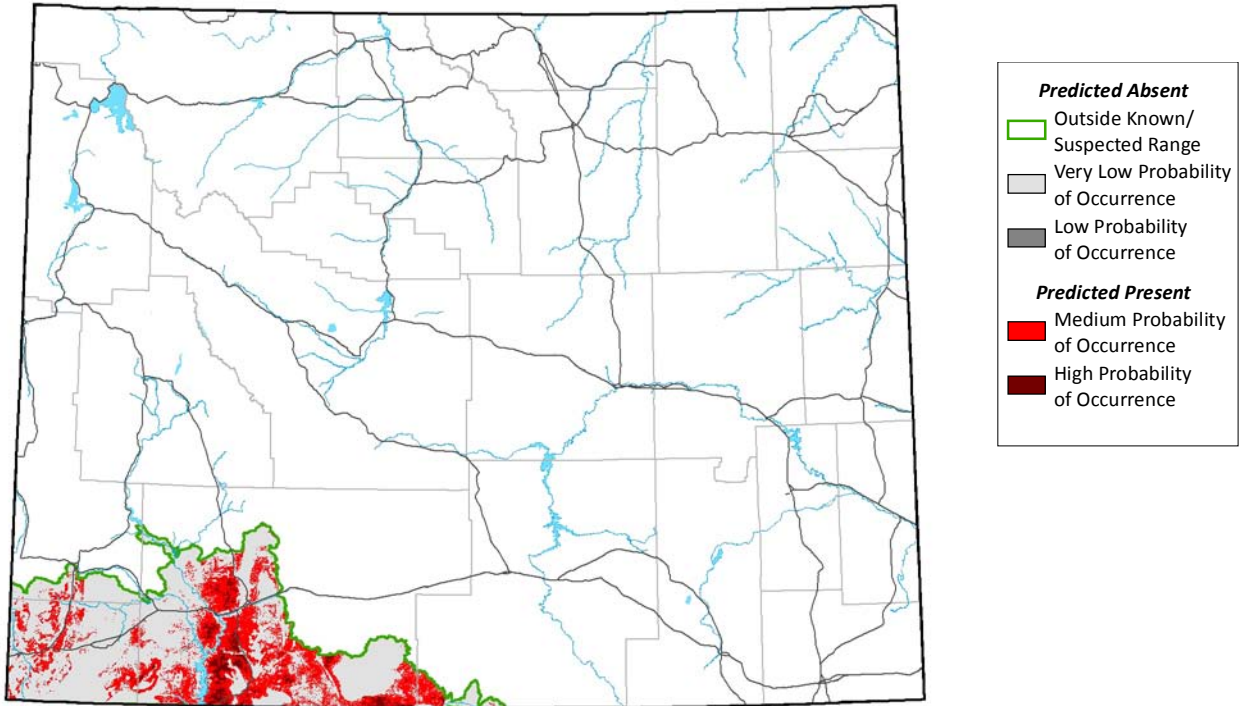
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Fri Mar 19 11:08:29 MDT 2010)

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



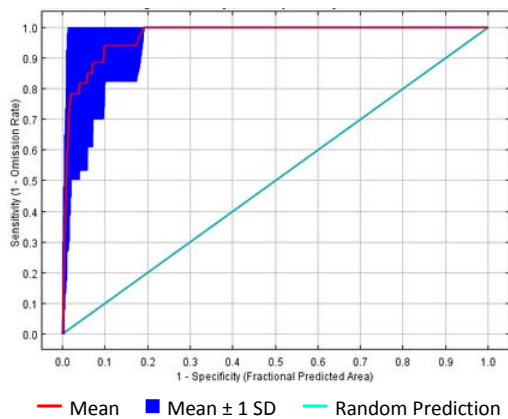
Model Parameters

- Season Modeled: Breeding (7-Mar- 25-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.0534560
- High-Probability Threshold Value: 0.6493052
- Low-Probability Threshold Value: 0.0534560

Model Quality Summary

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

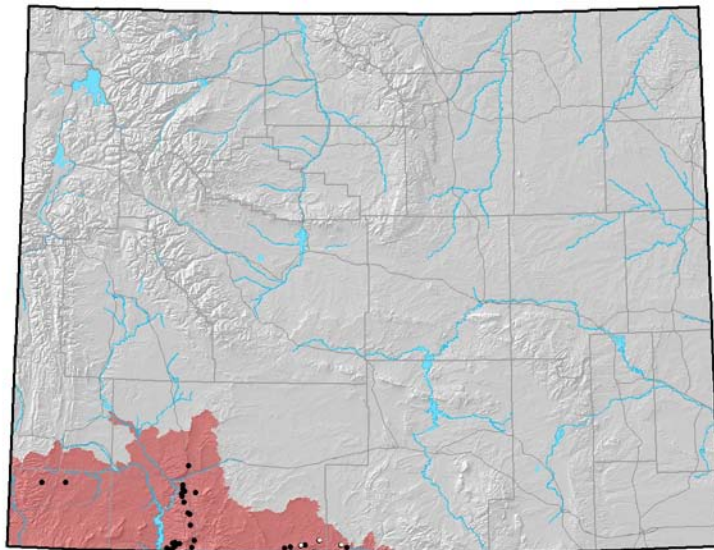
Training AUC: 0.987
 Regularized Training Gain: 3.055

Cross-Validation Statistics

- Average Test AUC: 0.973 ± 0.032
- Upper Bound on Test AUC: 0.975
- Average Test Gain: 2.788 ± 1.361
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.15± 0.25

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 99
- Number of Occurrences used to create distribution model: 31
- Average Point Quality Index (highest quality is 12.00): 8.48 ± 3.03
- Most recent occurrence used: 2008
- Oldest occurrence used: 1981
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

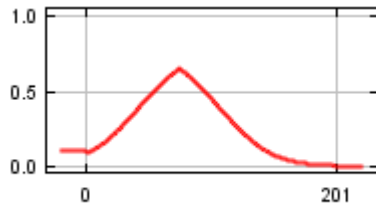
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Depth to Shallowest Restrictive Layer	29
Pinon-Juniper Index	26
Interannual variation in annual frost days	16
Distance to Permanent Water	11
Conifer Index	9
Degree Slope	8

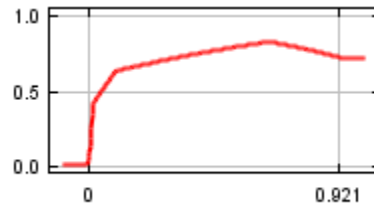
Response Curves

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).

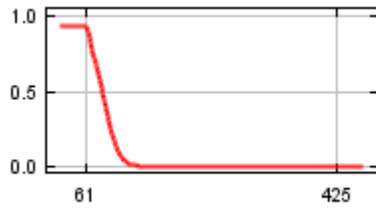
Depth to Shallowest Restrictive Layer



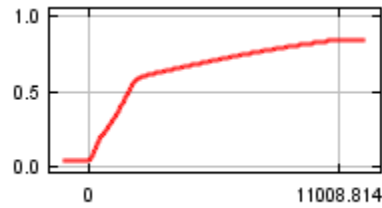
Pinon-Juniper Index



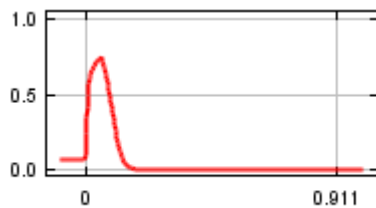
Interannual variation in annual frost days



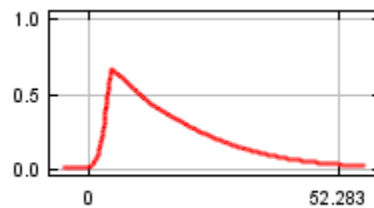
Distance to Permanent Water



Conifer Index



Degree Slope

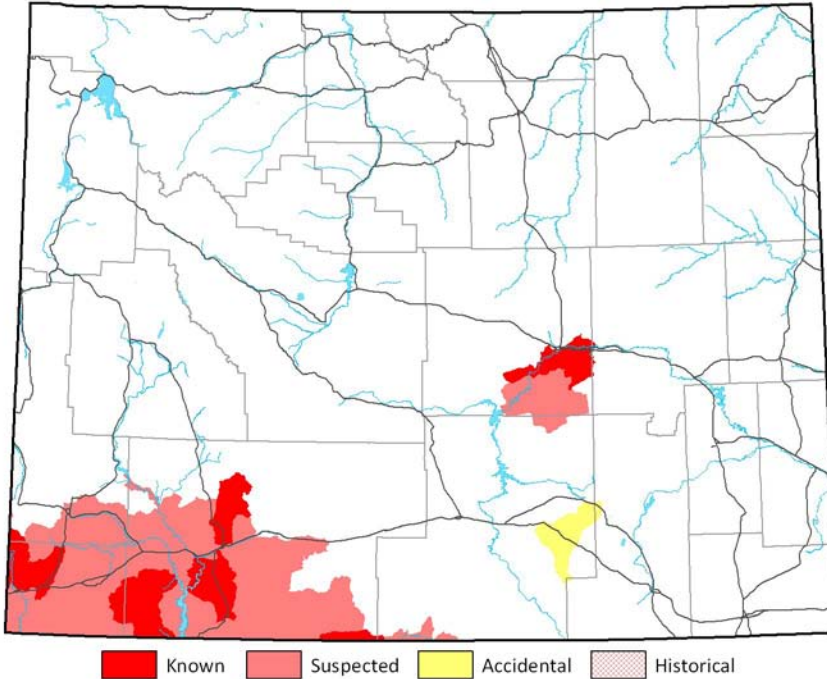


Bushtit (*Psaltriparus minimus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Bushtit (ABPAY01010) 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.

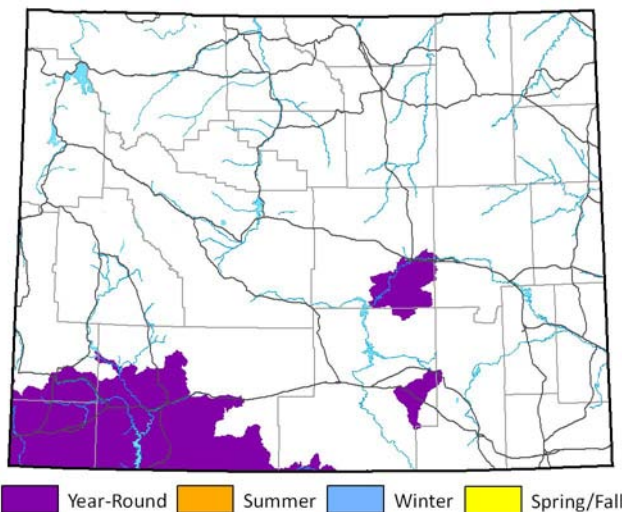
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.209
- 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/>).

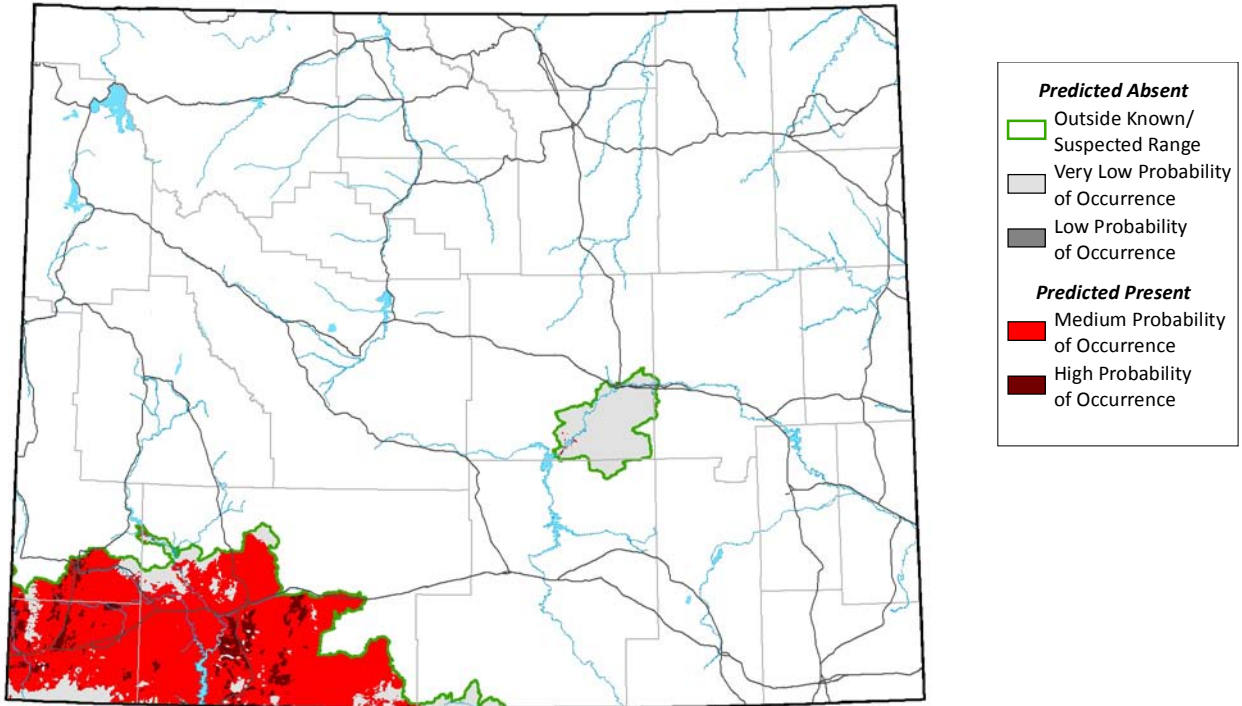
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Thu Apr 22 13:37:04 MDT 2010)

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



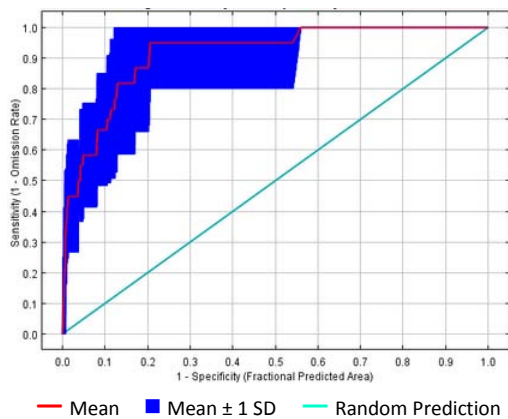
Model Parameters

- Season Modeled: Breeding (1-Mar- 25-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1913420
- High-Probability Threshold Value: 0.5365781
- Low-Probability Threshold Value: 0.1913420

Model Quality Summary

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

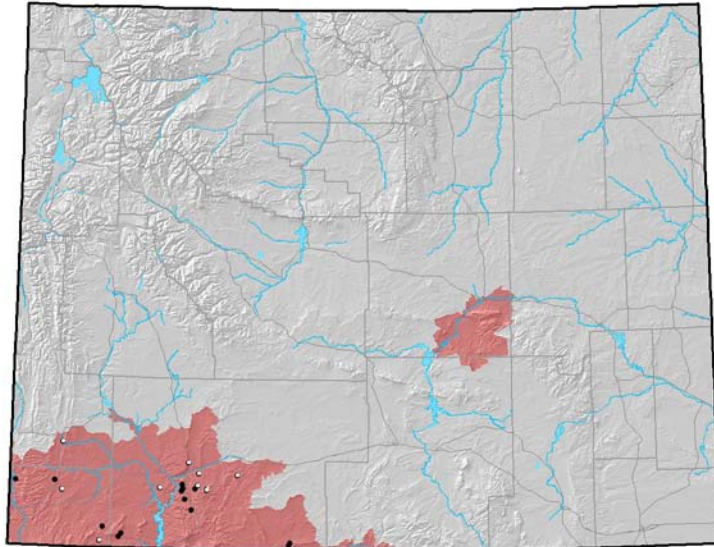
Training AUC: 0.939
 Regularized Training Gain: 1.660

Cross-Validation Statistics

- Average Test AUC: 0.914 ± 0.073
- Upper Bound on Test AUC: 0.909
- Average Test Gain: 1.669 ± 0.648
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.10 ± 0.21

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 59
- Number of Occurrences used to create distribution model: 24
- Average Point Quality Index (highest quality is 12.00): 8.33 ± 3.67
- Most recent occurrence used: 2008
- Oldest occurrence used: 1979
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

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

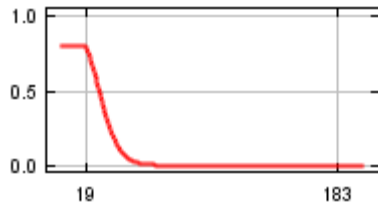
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Annual precipitation range (P3 – P2)	53
Pinon-Juniper Index	37
Wettest quarter mean temperature	5
Deciduous Forest Index	3
Conifer Index	1

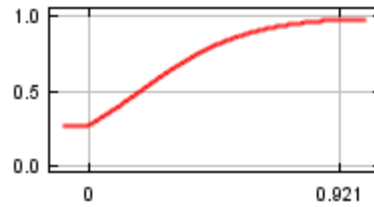
Response Curves

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).

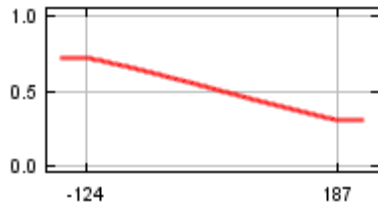
Annual precipitation range (P3 – P2)



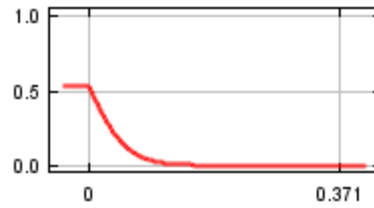
Pinon-Juniper Index



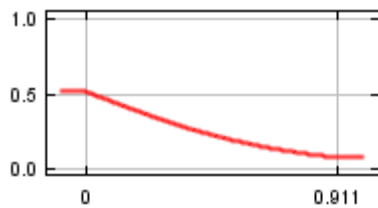
Wettest quarter mean temperature



Deciduous Forest Index



Conifer Index

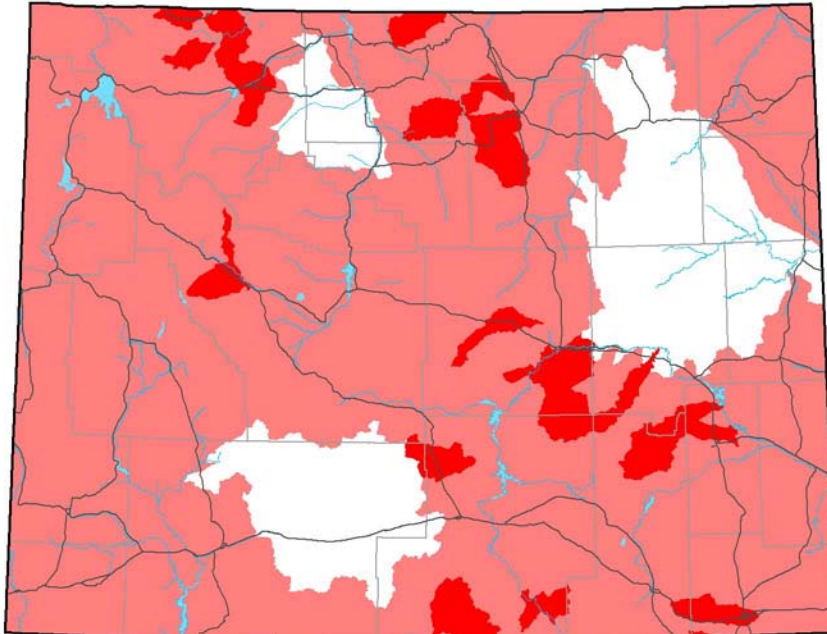


Pygmy Nuthatch (*Sitta pygmaea*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Pygmy Nuthatch (ABPAZ01030) 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

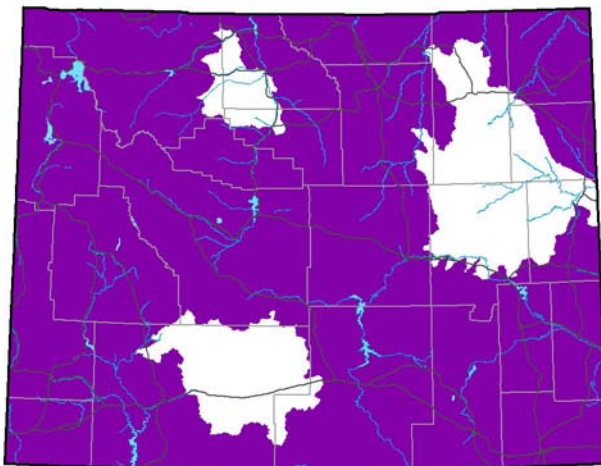


■ Known ■ Suspected ■ Accidental ■ Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.066
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



■ Year-Round ■ Summer ■ Winter ■ Spring/Fall

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

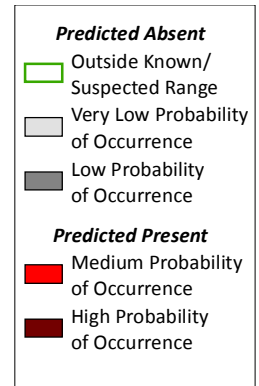
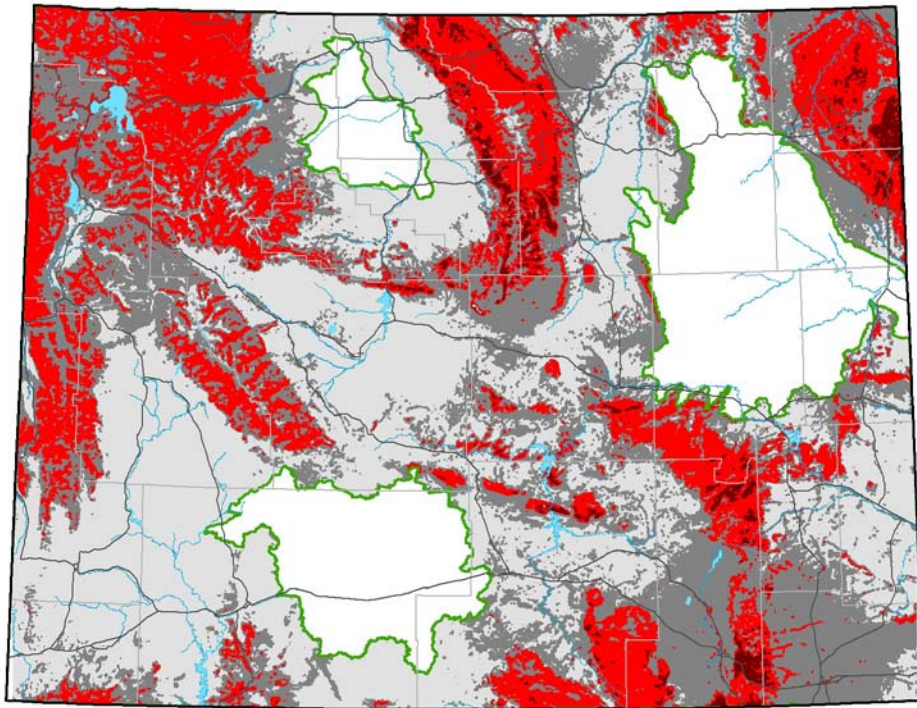
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Apr 14 13:49:13 MDT 2010)

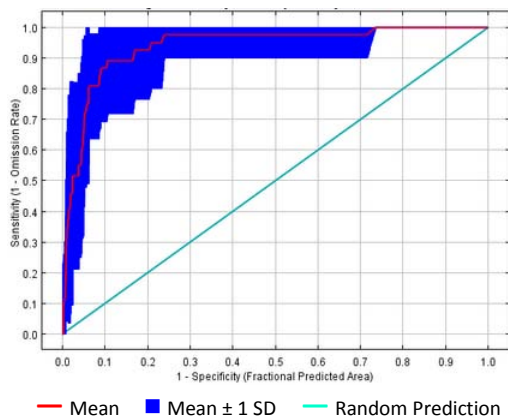
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (7-Mar- 25-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.0764950
- High-Probability Threshold Value: 0.6812938
- Low-Probability Threshold Value: 0.0075432

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

Expert Assessment: Medium

Occurrence Sample Size: Medium

Quality of Occurrences: Medium

Positive Success Rate: High

Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

Training AUC: 0.956

Regularized Training Gain: 1.953

Cross-Validation Statistics

- Average Test AUC: 0.938 ± 0.074

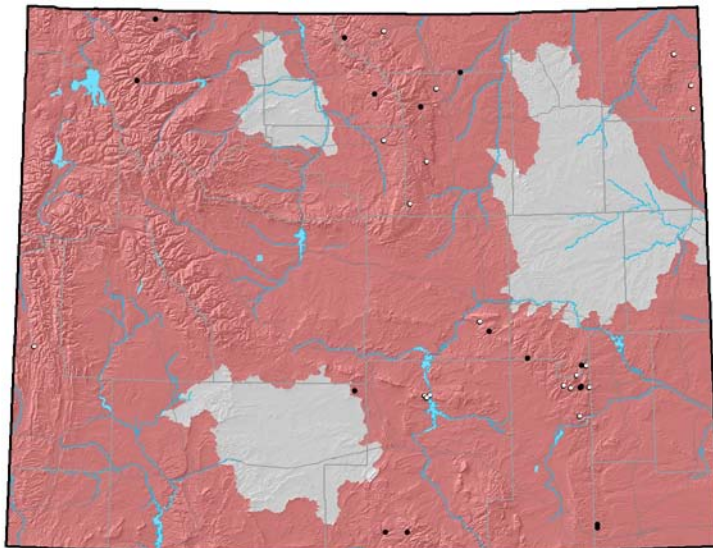
- Upper Bound on Test AUC: 0.946

- Average Test Gain: 1.883 ± 0.932

- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.13 ± 0.19

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 157
- Number of Occurrences used to create distribution model: 35
- Average Point Quality Index (highest quality is 12.00): 6.63 ± 2.66
- Most recent occurrence used: 2008
- Oldest occurrence used: 1975
- Occurrence File: PIPO_OBLIGATES.CSV

Comments

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

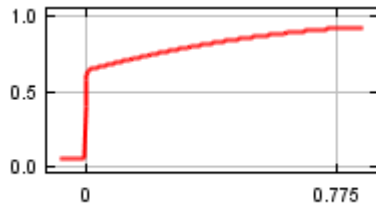
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Ponderosa pine Index	43
Conifer Index	36
Annual Radiation range	7
Pinon-Juniper Index	7
Mean diurnal temperature range	5
Variation in monthly radiation	2

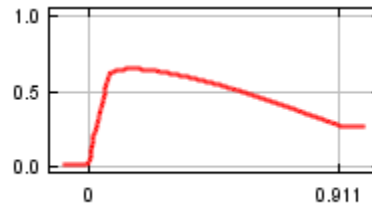
Response Curves

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).

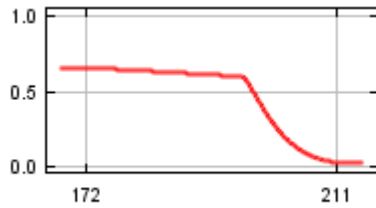
Ponderosa pine Index



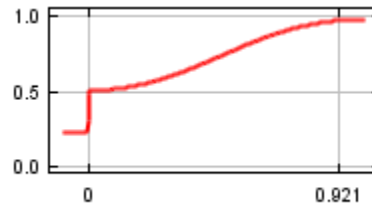
Conifer Index



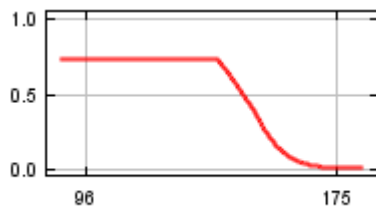
Annual Radiation range



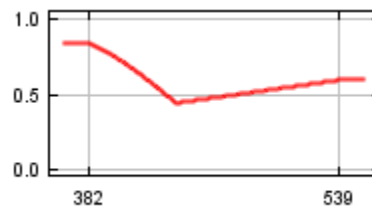
Pinon-Juniper Index



Mean diurnal temperature range



Variation in monthly radiation

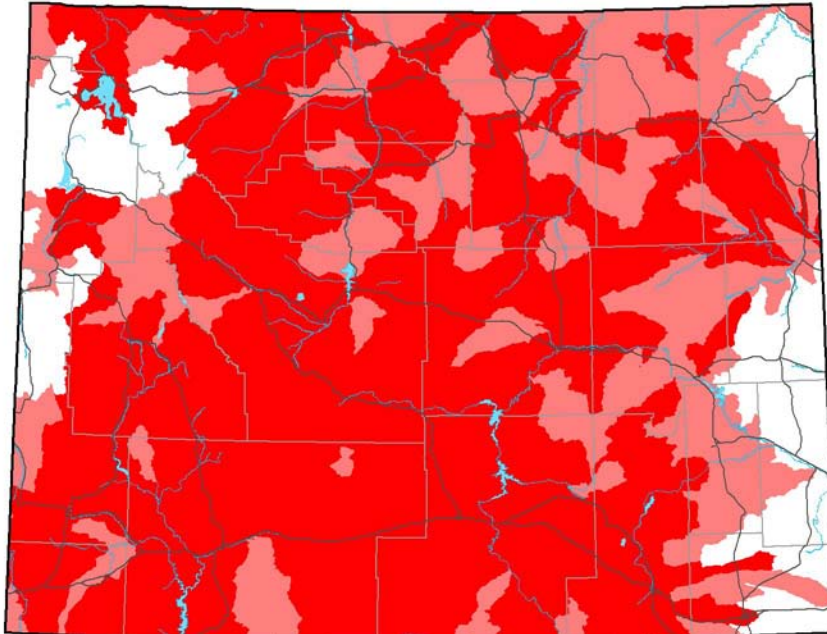


Sage Thrasher (*Oreoscoptes montanus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Sage Thrasher (ABPBK04010) 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

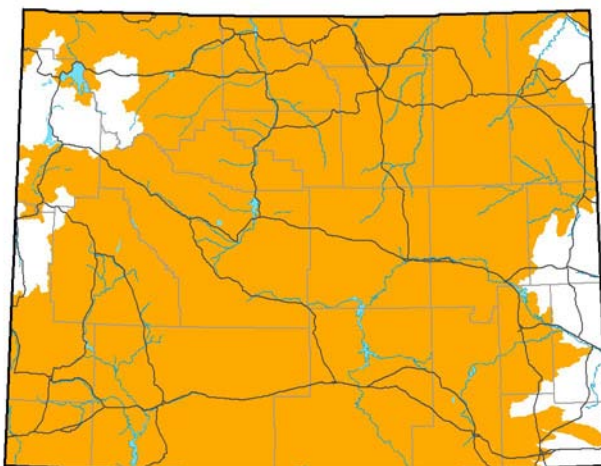


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.642
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

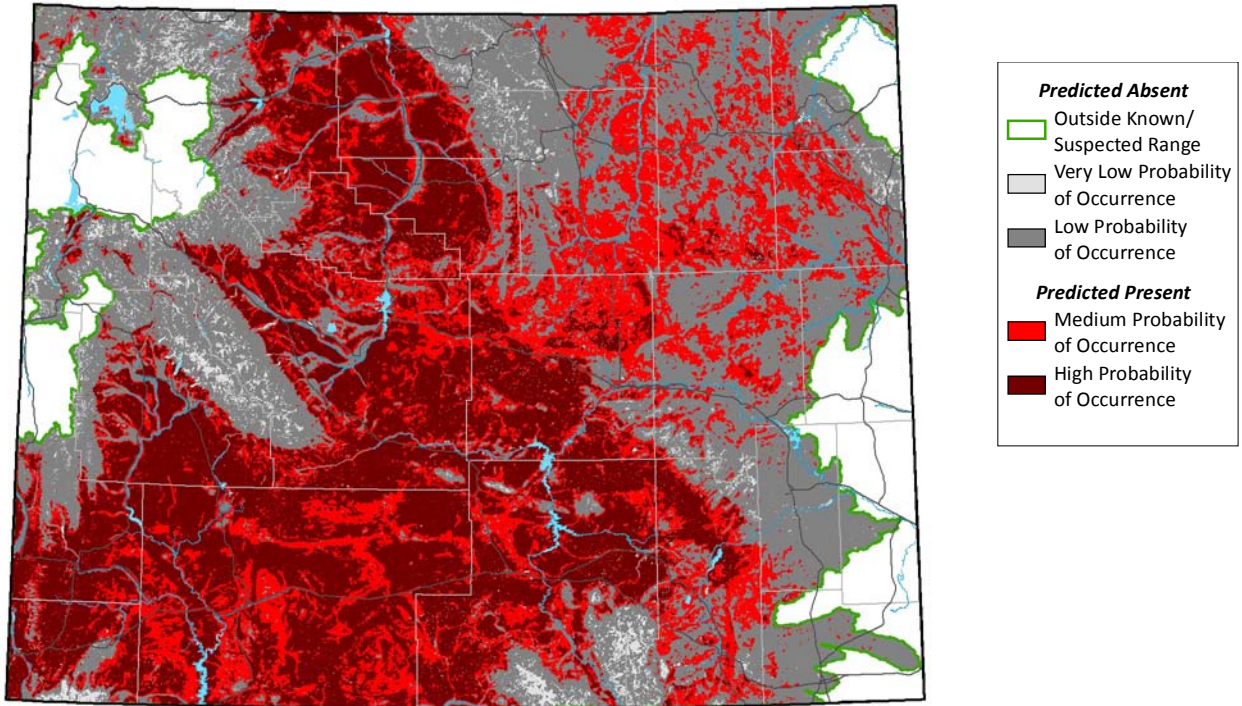
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Fri Apr 02 11:40:40 MDT 2010)

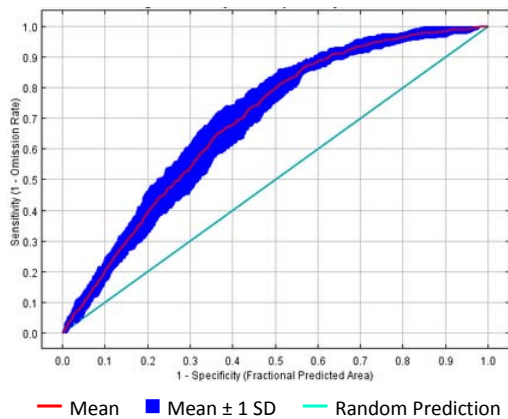
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4160040
- High-Probability Threshold Value: 0.5493645
- Low-Probability Threshold Value: 0.0619820

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: High
- Test AUC and Model Gain: Low

Model Evaluation Statistics

Final Model Statistics

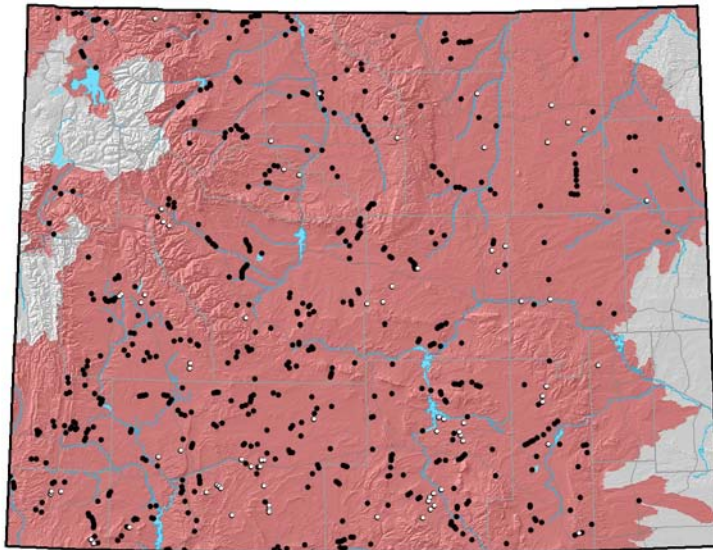
- Training AUC: 0.706
- Regularized Training Gain: 0.266

Cross-Validation Statistics

- Average Test AUC: 0.690 ± 0.029
- Upper Bound on Test AUC: 0.697
- Average Test Gain: 0.233 ± 0.072
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.19 ± 0.07

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 9,144
- Number of Occurrences used to create distribution model: 635
- Average Point Quality Index (highest quality is 12.00): 8.95 ± 2.50
- Most recent occurrence used: 2008
- Oldest occurrence used: 1971
- Occurrence File:
DRAFT_3_SAGE_WATER_RERUNS.csv

Comments

This is a sagebrush obligate species for which model quality would likely improve if an accurate statewide estimate of sagebrush structure (i.e., density and/or height) were available.

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

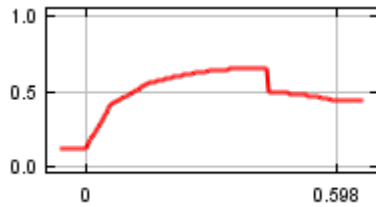
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Shrub Cover Index	29
Prevalence of Lakes/Large Rivers within 300 meters	21
Forest Cover Index	21
Sagebrush Index	21
Bare Ground Index	6
Percent Forest Cover	1

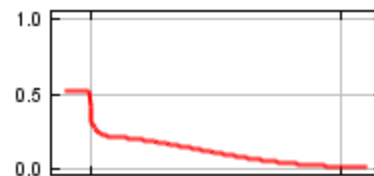
Response Curves

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).

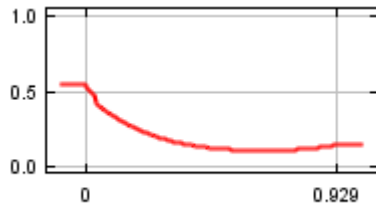
Shrub Cover Index



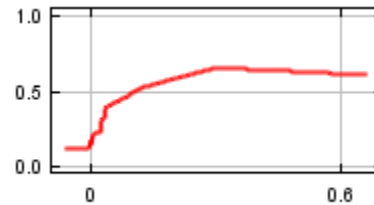
Prevalence of Lakes/Large Rivers within 300 meters



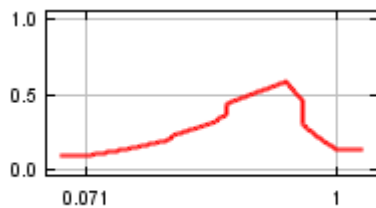
Forest Cover Index



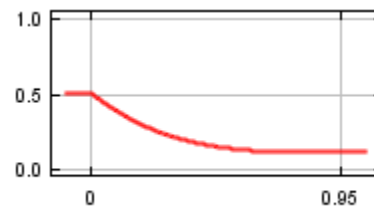
Sagebrush Index



Bare Ground Index



Percent Forest Cover

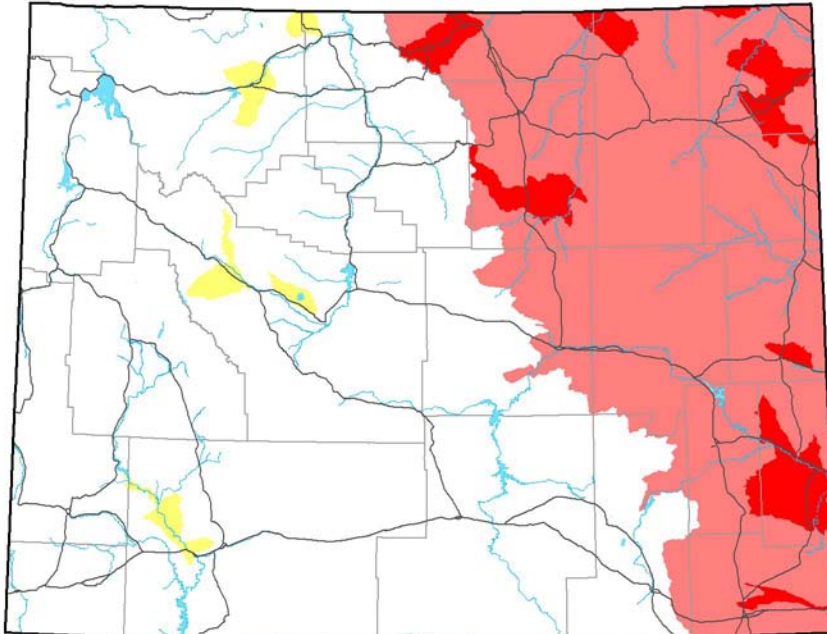


Dickcissel (*Spiza americana*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Dickcissel (ABPBX65010) 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

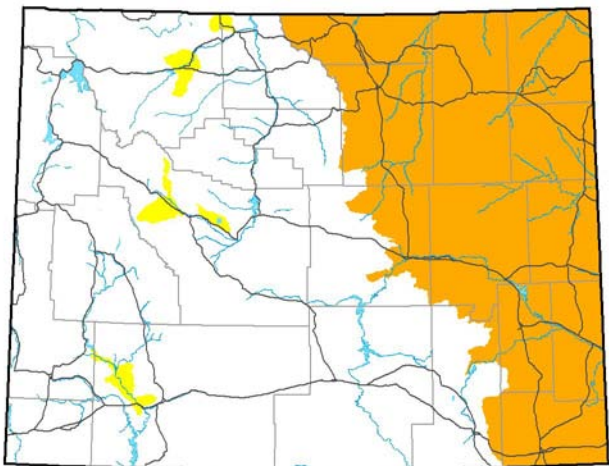


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.097
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

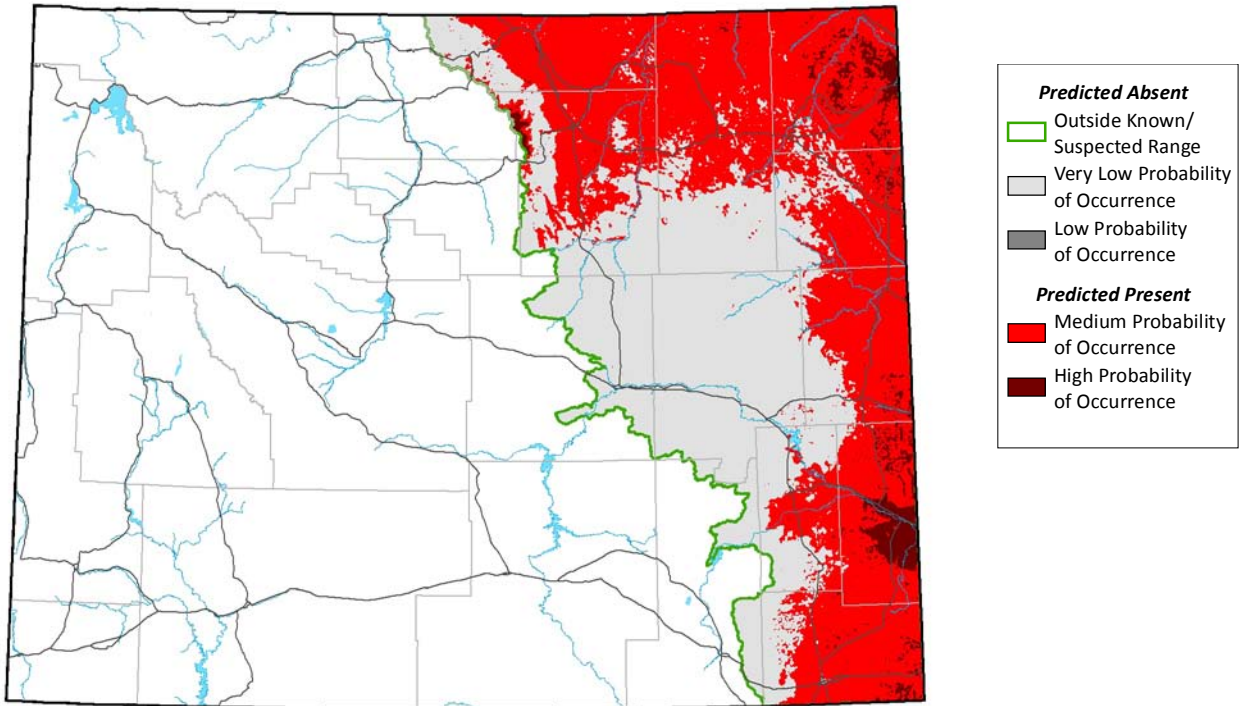
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 09:23:14 MST 2010)

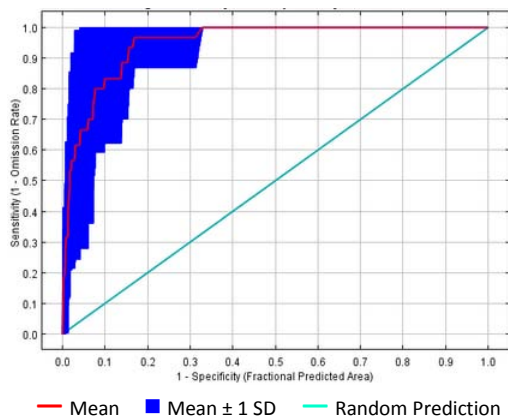
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1209480
- High-Probability Threshold Value: 0.6015590
- Low-Probability Threshold Value: 0.1209480

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

Expert Assessment: Medium

Occurrence Sample Size: Medium

Quality of Occurrences: Medium

Positive Success Rate: Very High

Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

Training AUC: 0.962

Regularized Training Gain: 2.156

Cross-Validation Statistics

- Average Test AUC: 0.948 ± 0.049

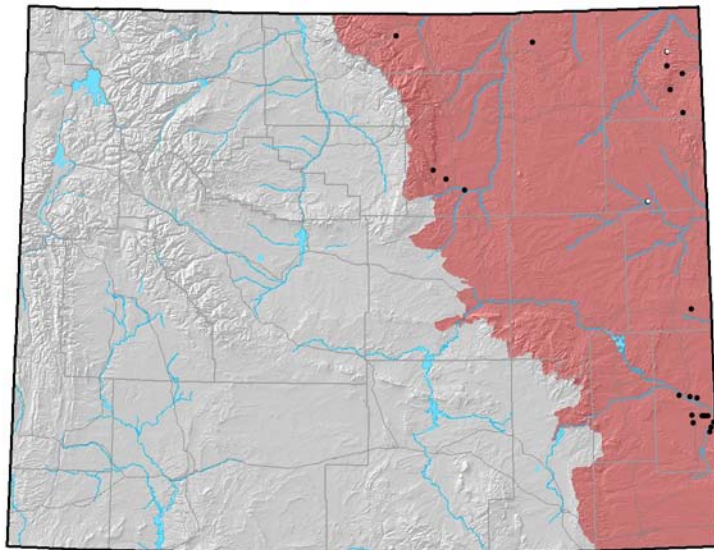
- Upper Bound on Test AUC: 0.948

- Average Test Gain: 2.065 ± 1.122

- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.00± 0.00

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and
Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 68
- Number of Occurrences used to create distribution model: 24
- Average Point Quality Index (highest quality is 12.00): 7.67 ± 2.32
- Most recent occurrence used: 2006
- Oldest occurrence used: 1969
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

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

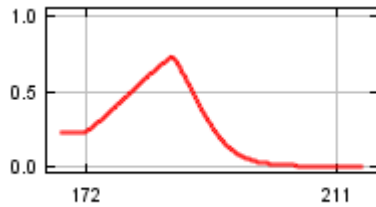
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Annual Radiation range	34
Sagebrush Index	22
Relative Humidity of most humid month	13
Annual mean temperature	10
Herbaceous Cover Index	10
Radiation of the lightest month	10

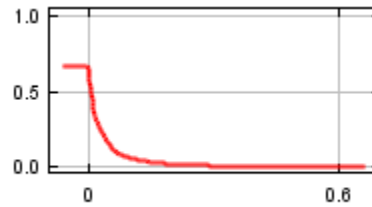
Response Curves

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).

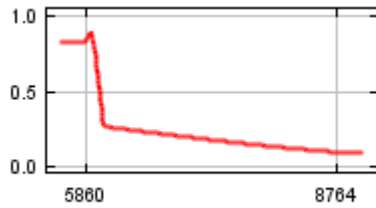
Annual Radiation range



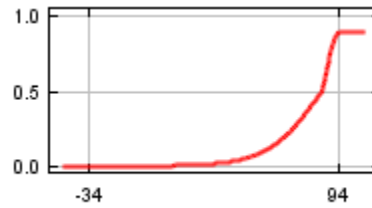
Sagebrush Index



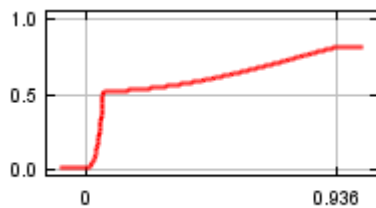
Relative Humidity of most humid month



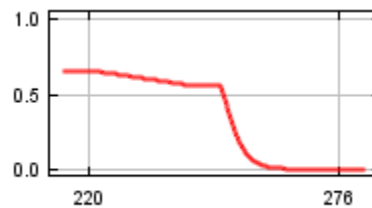
Annual mean temperature



Herbaceous Cover Index



Radiation of the lightest month

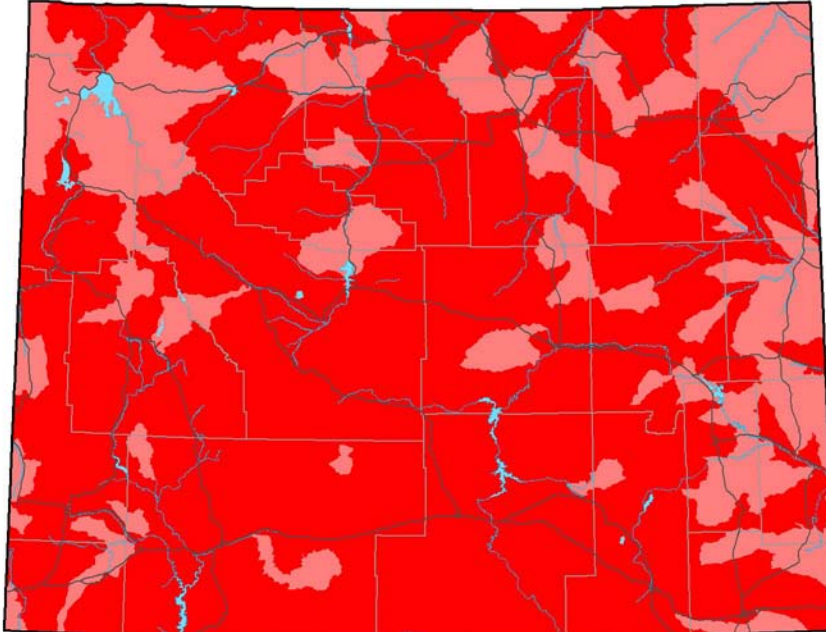


Brewer's Sparrow (*Spizella breweri*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Brewer's Sparrow (ABPBX94040) 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

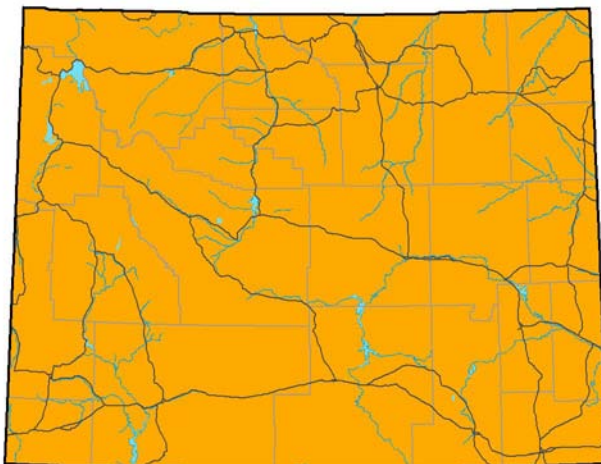


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.678
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

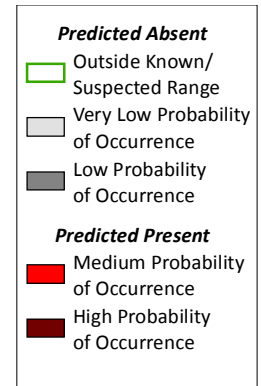
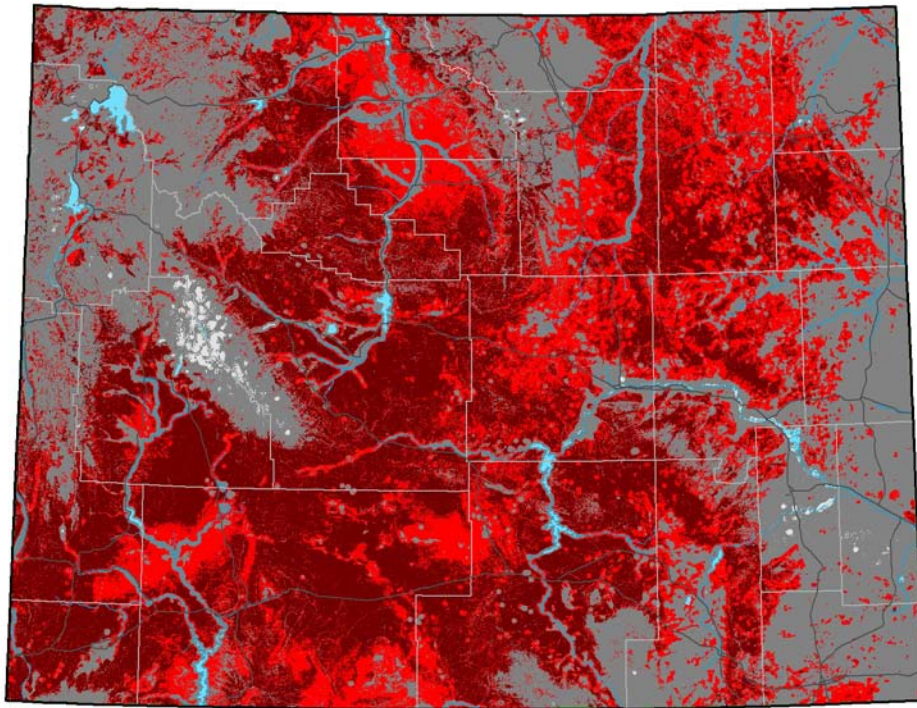
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

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Distribution Model (Version: Fri Apr 02 11:38:50 MDT 2010)

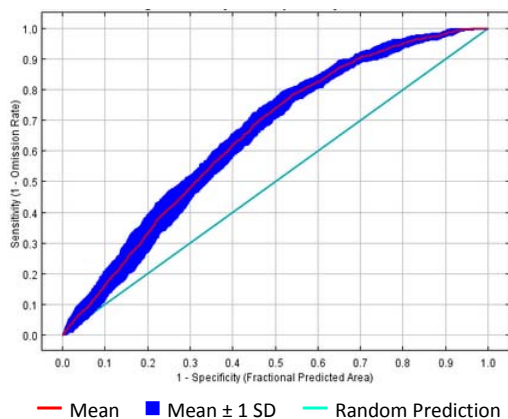
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (15-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4265660
- High-Probability Threshold Value: 0.5391002
- Low-Probability Threshold Value: 0.0426718

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

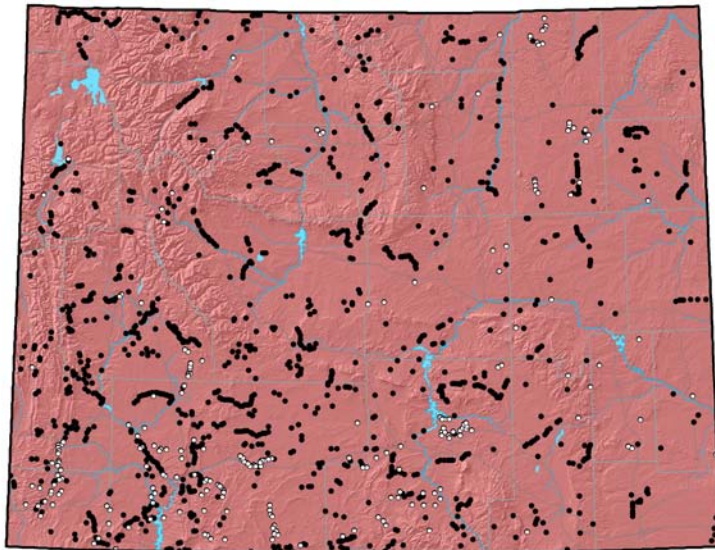
- Training AUC: 0.668
- Regularized Training Gain: 0.176

Cross-Validation Statistics

- Average Test AUC: 0.651 ± 0.024
- Upper Bound on Test AUC: 0.660
- Average Test Gain: 0.152 ± 0.041
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.26 ± 0.05

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 14,516
- Number of Occurrences used to create distribution model: 1,372
- Average Point Quality Index (highest quality is 12.00): 8.80 ± 2.54
- Most recent occurrence used: 2008
- Oldest occurrence used: 1950
- Occurrence File:
DRAFT_3_SAGE_WATER_RERUNS.csv

Comments

This is a sagebrush obligate species for which model quality would likely improve if an accurate statewide estimate of sagebrush structure (i.e., density and/or height) were available.

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

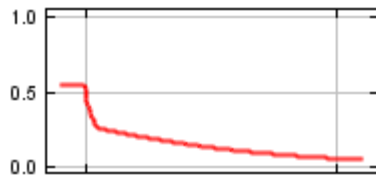
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Prevalence of Lakes/Large Rivers within 1600 meters	36
Sagebrush Index	35
Percent Forest Cover	10
Annual number of Frost Days	8
Degree Slope	5
Interannual variation in annual frost days	5

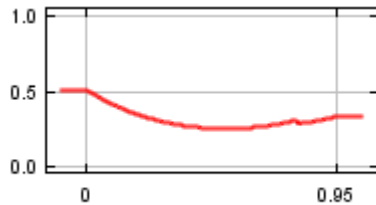
Response Curves

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).

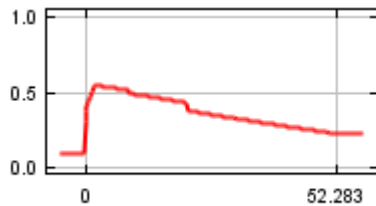
Prevalence of Lakes/Large Rivers within 1600 meters



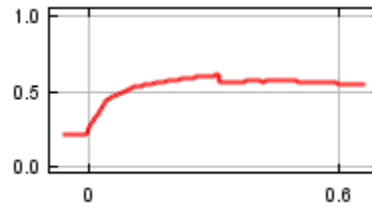
Percent Forest Cover



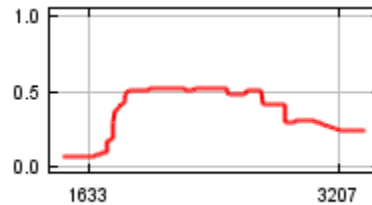
Degree Slope



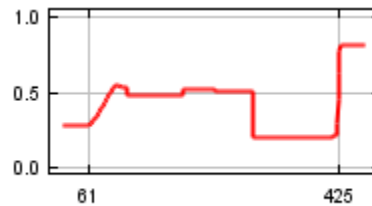
Sagebrush Index



Annual number of Frost Days



Interannual variation in annual frost days

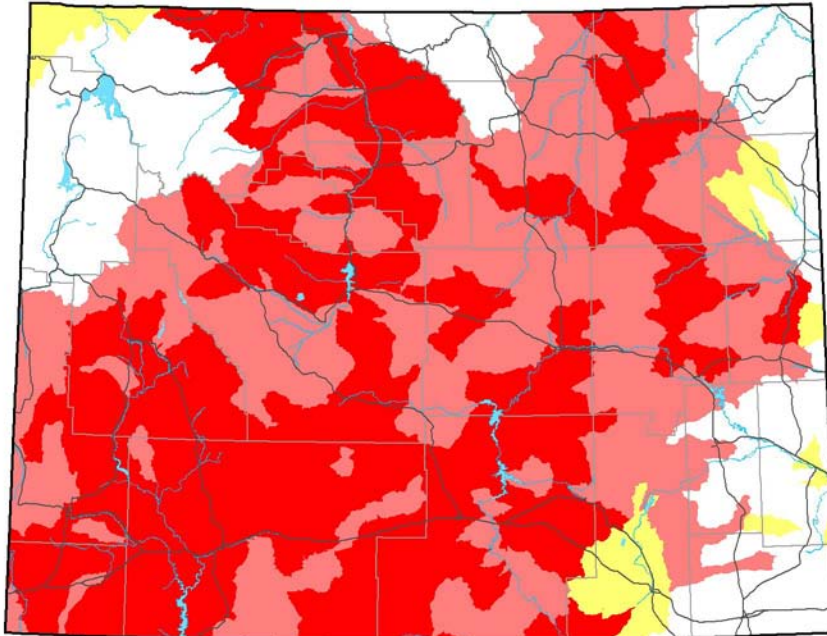


Sage Sparrow (*Amphispiza belli*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Sage Sparrow (ABPBX97020) 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.

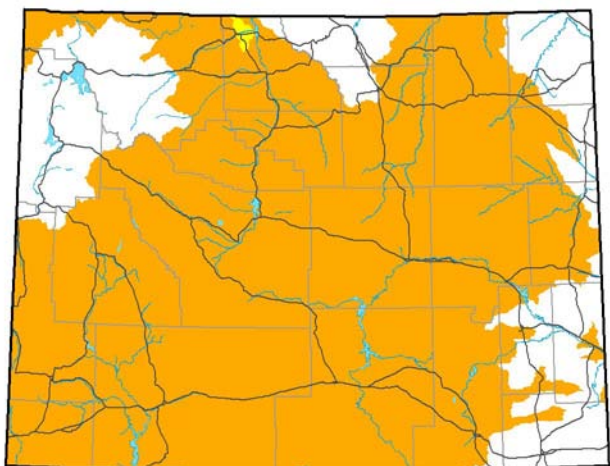
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.507
- 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/>).

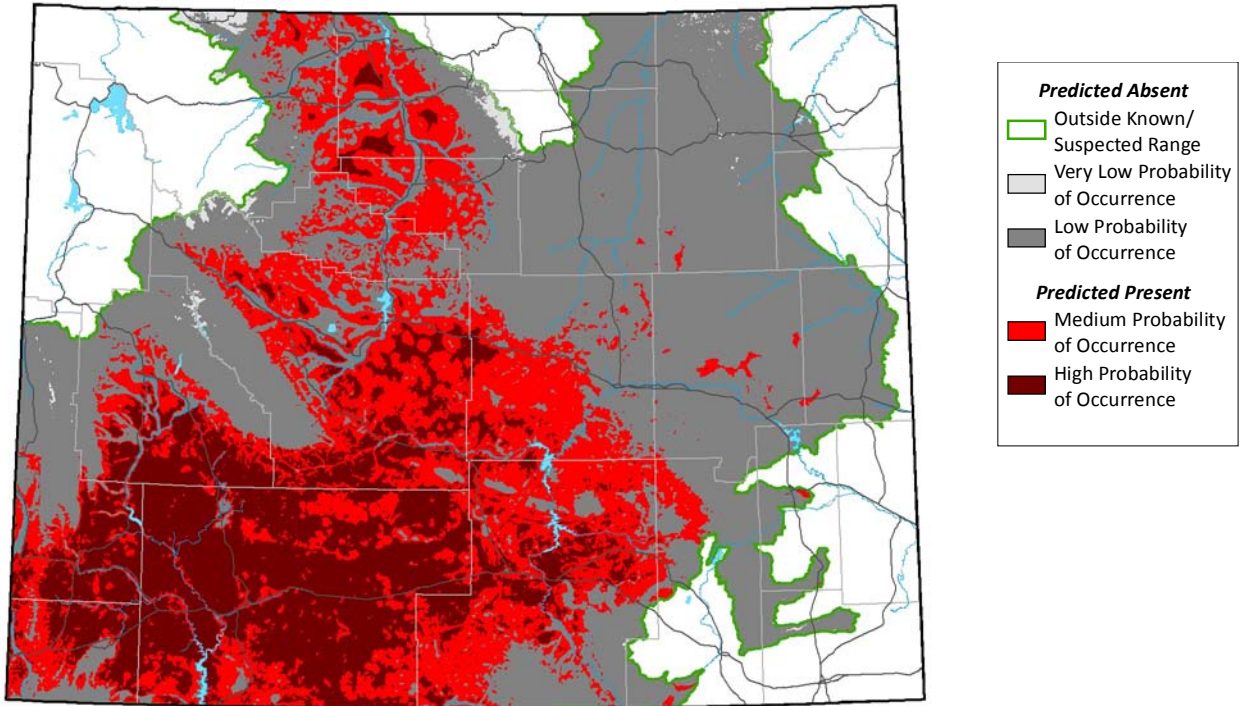
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Mar 17 10:31:32 MDT 2010)

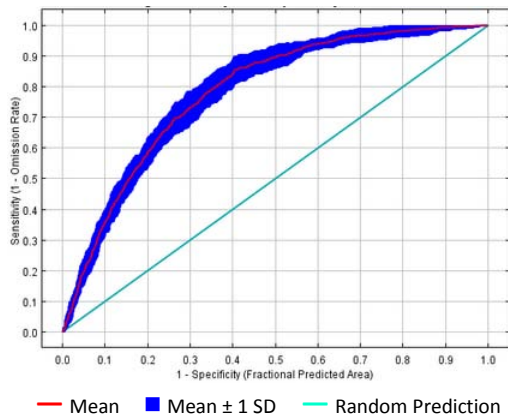
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (24-Apr- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3224320
- High-Probability Threshold Value: 0.5488588
- Low-Probability Threshold Value: 0.0317627

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: High
- Test AUC and Model Gain: Medium

Model Evaluation Statistics

Final Model Statistics

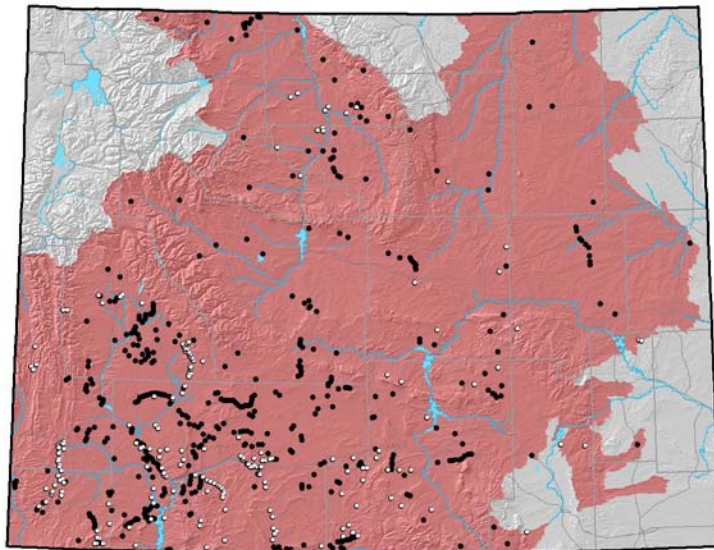
- Training AUC: 0.784
- Regularized Training Gain: 0.533

Cross-Validation Statistics

- Average Test AUC: 0.782 ± 0.022
- Upper Bound on Test AUC: 0.781
- Average Test Gain: 0.528 ± 0.096
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.19 ± 0.06

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 4,431
- Number of Occurrences used to create distribution model: 631
- Average Point Quality Index (highest quality is 12.00): 8.21 ± 2.83
- Most recent occurrence used: 2008
- Oldest occurrence used: 1975
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.csv

Comments

This is a sagebrush obligate species for which model quality would likely improve if an accurate statewide estimate of sagebrush structure (i.e., density and/or height) were available.

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

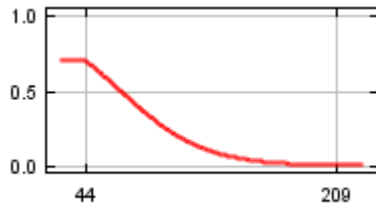
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Precipitation of the warmest quarter	25
Bare Ground Index	23
Radiation of the lightest month	18
Sagebrush Index	14
Distance to Permanent Water	11
Annual total radiation	8

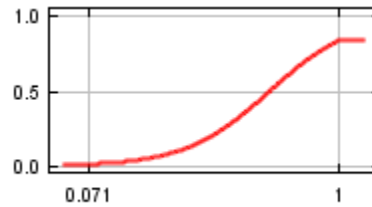
Response Curves

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).

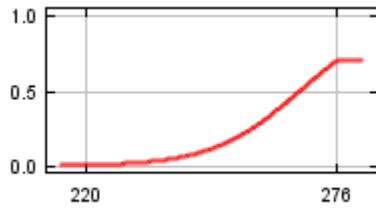
Precipitation of the warmest quarter



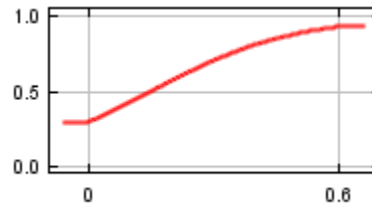
Bare Ground Index



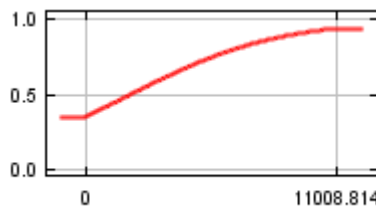
Radiation of the lightest month



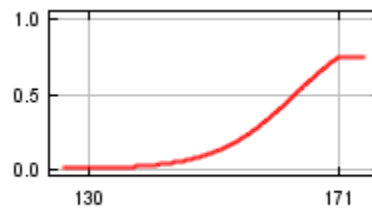
Sagebrush Index



Distance to Permanent Water



Annual total radiation

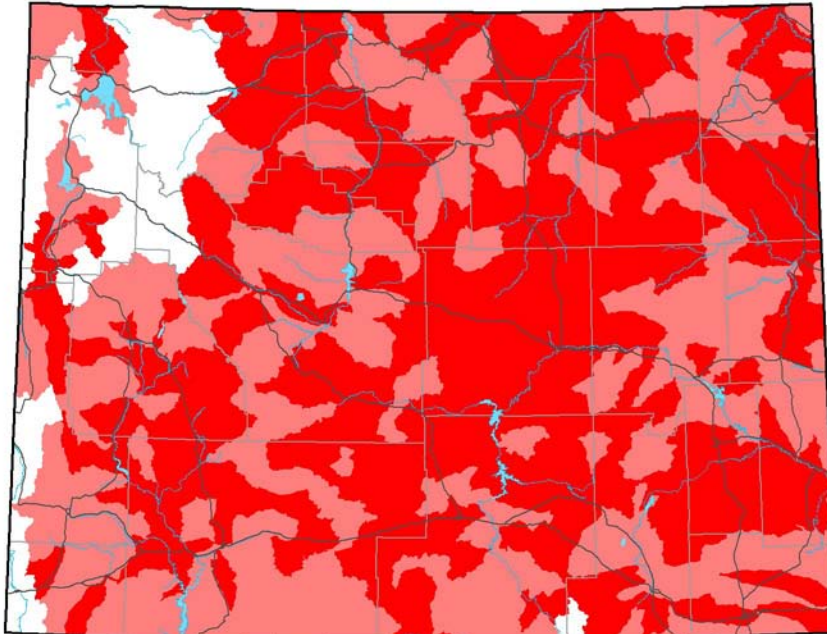


Lark Bunting (*Calamospiza melanocorys*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Lark Bunting (ABPBX98010) 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.

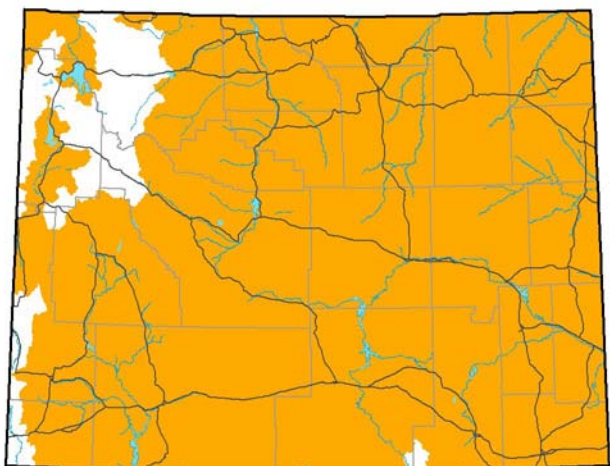
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.493
- 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/>).

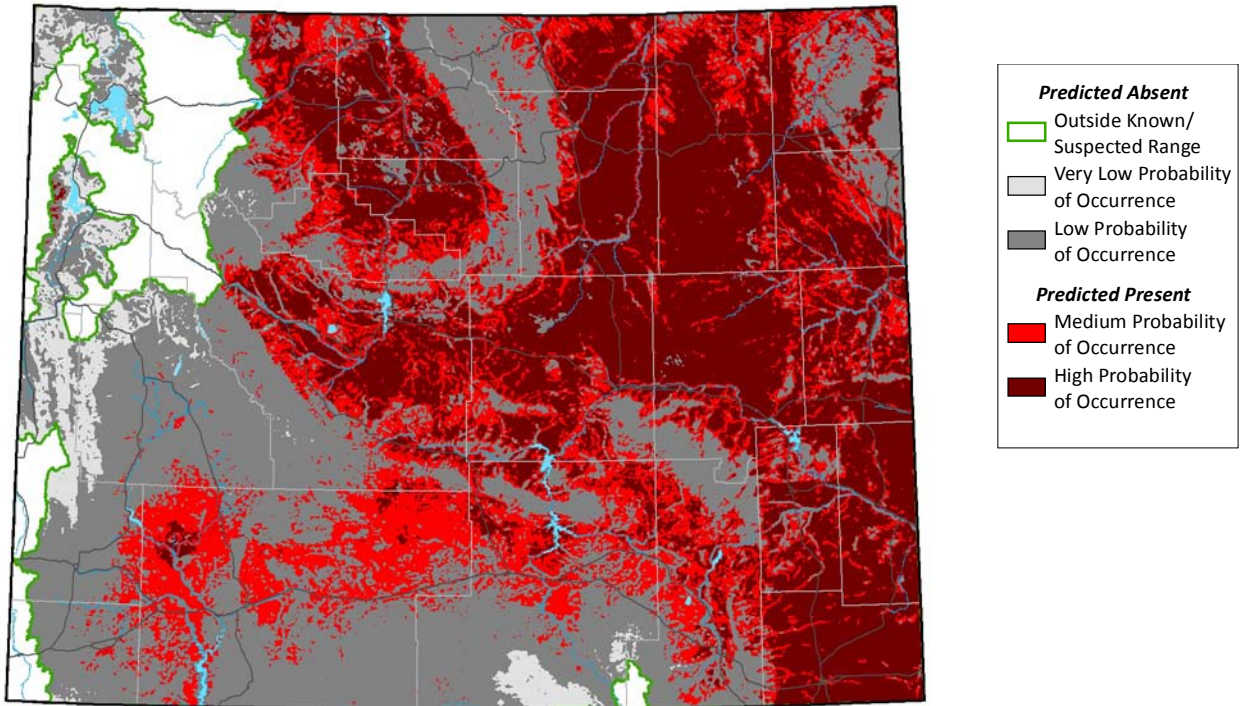
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 14:22:01 MST 2010)

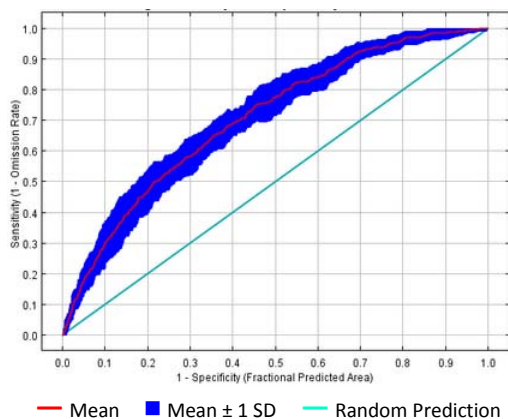
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (25-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.4106290
- High-Probability Threshold Value: 0.5331405
- Low-Probability Threshold Value: 0.0510781

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

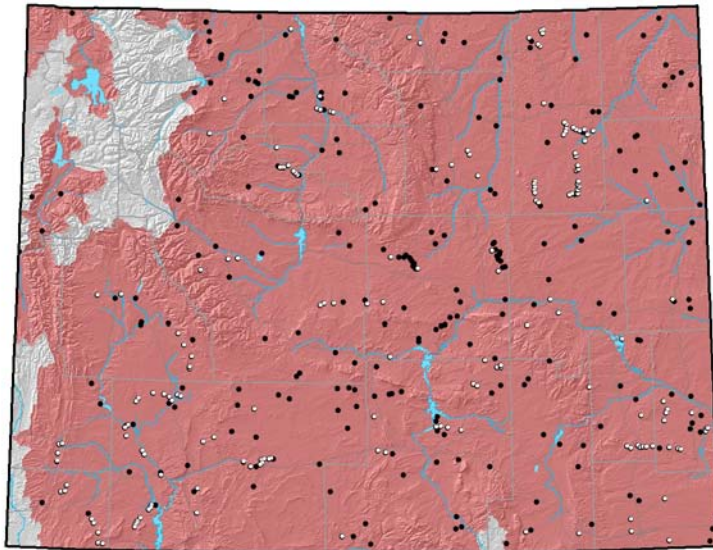
- Training AUC: 0.733
- Regularized Training Gain: 0.327

Cross-Validation Statistics

- Average Test AUC: 0.706 ± 0.025
- Upper Bound on Test AUC: 0.722
- Average Test Gain: 0.258 ± 0.102
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.28 ± 0.14

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,841
- Number of Occurrences used to create distribution model: 407
- Average Point Quality Index (highest quality is 12.00): 6.02 ± 1.50
- Most recent occurrence used: 2006
- Oldest occurrence used: 1968
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

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

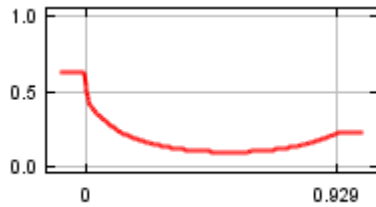
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Forest Cover Index	38
Variation of monthly precipitation	26
Bare Ground Index	10
Precipitation of the coldest quarter	10
Annual number of Frost Days	8
Precipitation of the driest quarter	8

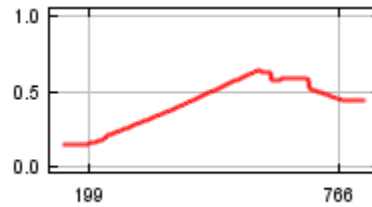
Response Curves

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).

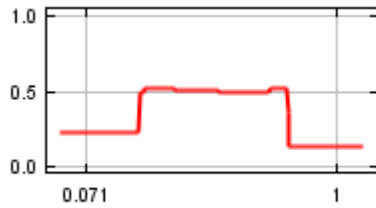
Forest Cover Index



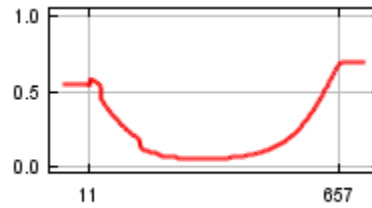
Variation of monthly precipitation



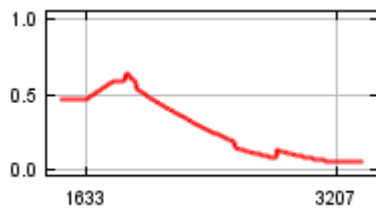
Bare Ground Index



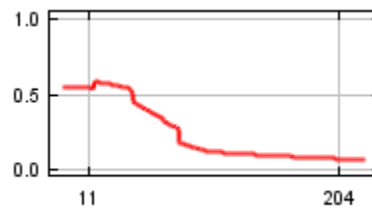
Precipitation of the coldest quarter



Annual number of Frost Days



Precipitation of the driest quarter

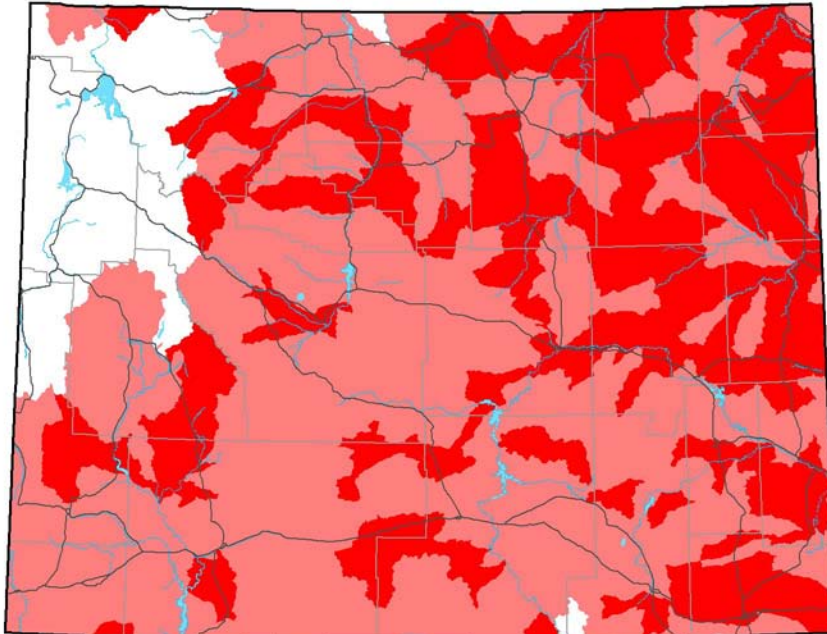


Grasshopper Sparrow (*Ammodramus savannarum*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Grasshopper Sparrow (ABPBXA0020) 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.

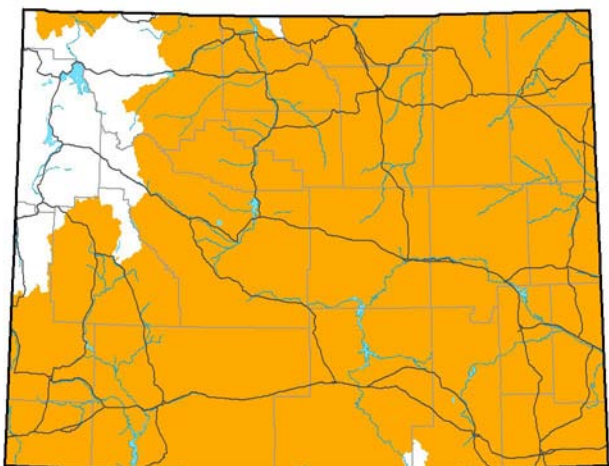
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.327
- 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/>).

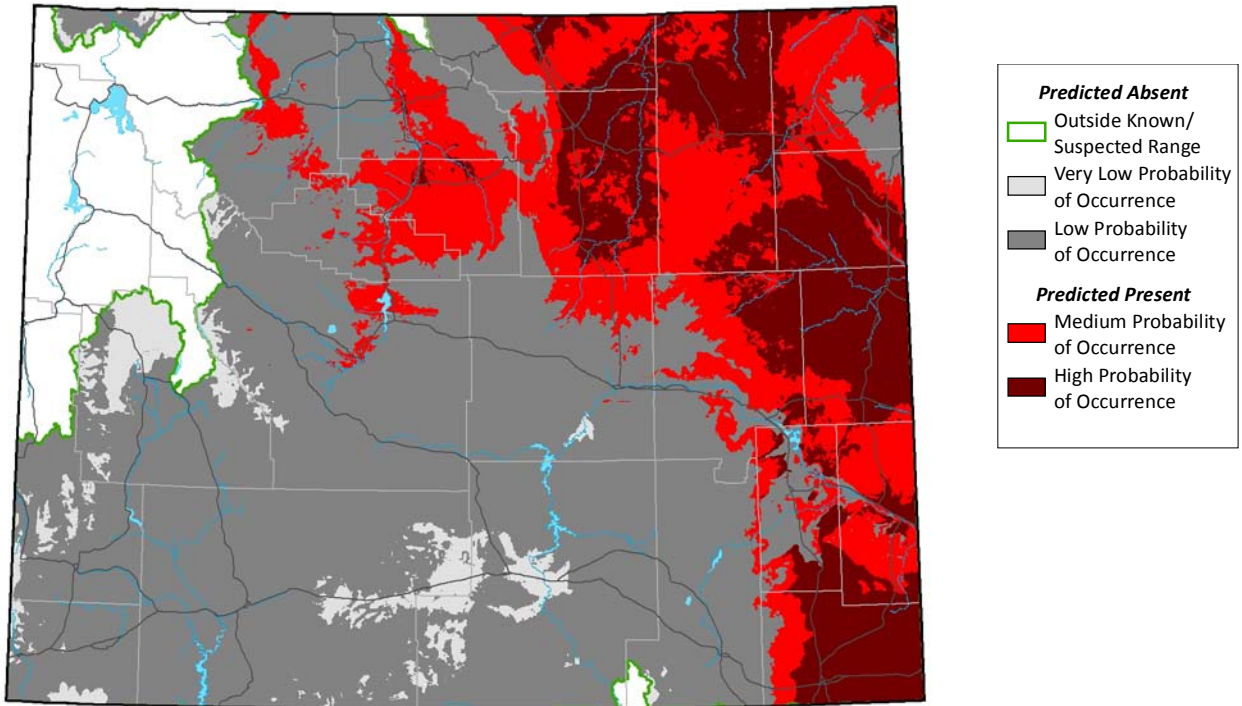
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 20:55:56 MST 2010)

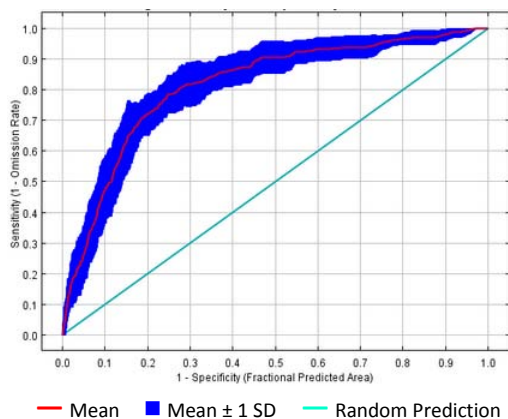
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-Jun- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3821470
- High-Probability Threshold Value: 0.6134398
- Low-Probability Threshold Value: 0.0271540

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

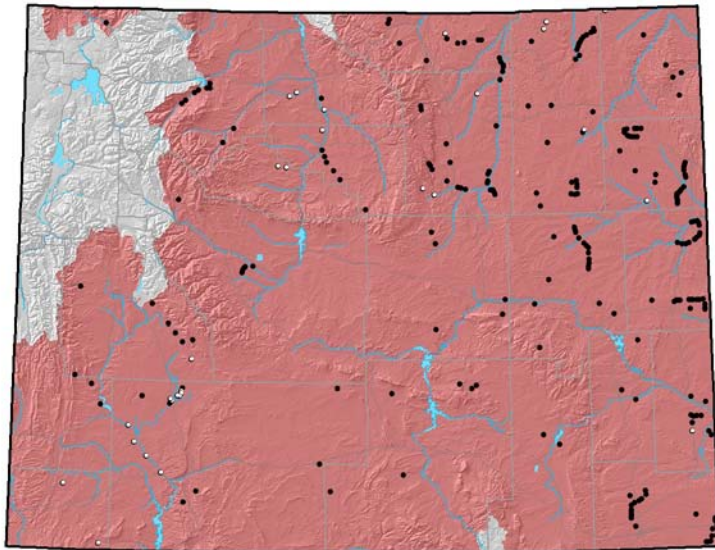
- Training AUC: 0.841
- Regularized Training Gain: 0.774

Cross-Validation Statistics

- Average Test AUC: 0.815 ± 0.034
- Upper Bound on Test AUC: 0.824
- Average Test Gain: 0.728 ± 0.207
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.26 ± 0.06

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

■ Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,873
- Number of Occurrences used to create distribution model: 261
- Average Point Quality Index (highest quality is 12.00): 7.79 ± 1.75
- Most recent occurrence used: 2008
- Oldest occurrence used: 1976
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

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

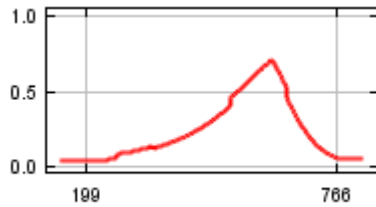
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Variation of monthly precipitation	32
Radiation of the lightest month	22
Annual Radiation range	18
Annual number of Frost Days	17
Wettest quarter mean temperature	5
Annual Relative Humidity Range	5

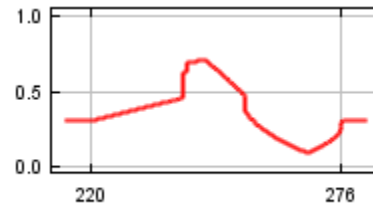
Response Curves

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).

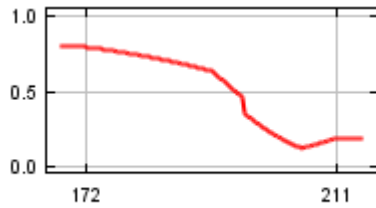
Variation of monthly precipitation



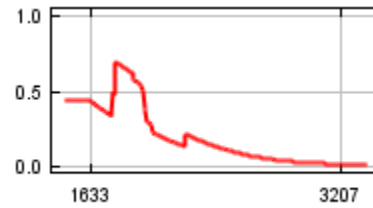
Radiation of the lightest month



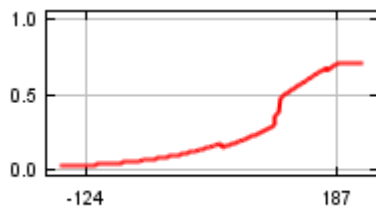
Annual Radiation range



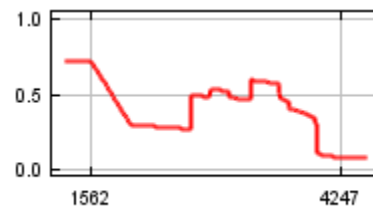
Annual number of Frost Days



Wettest quarter mean temperature



Annual Relative Humidity Range

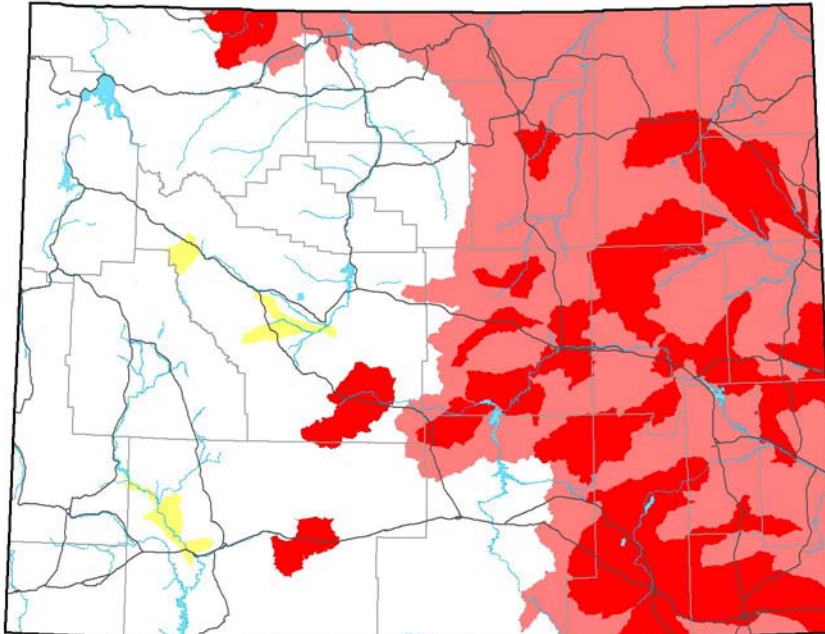


McCown's Longspur (*Calcarius mccownii*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of McCown's Longspur (ABPBXA6010) 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

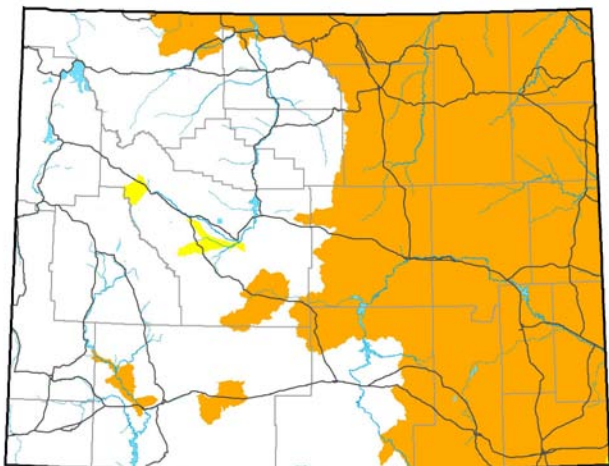


Known Suspected Accidental Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.310
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



Year-Round Summer Winter Spring/Fall

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

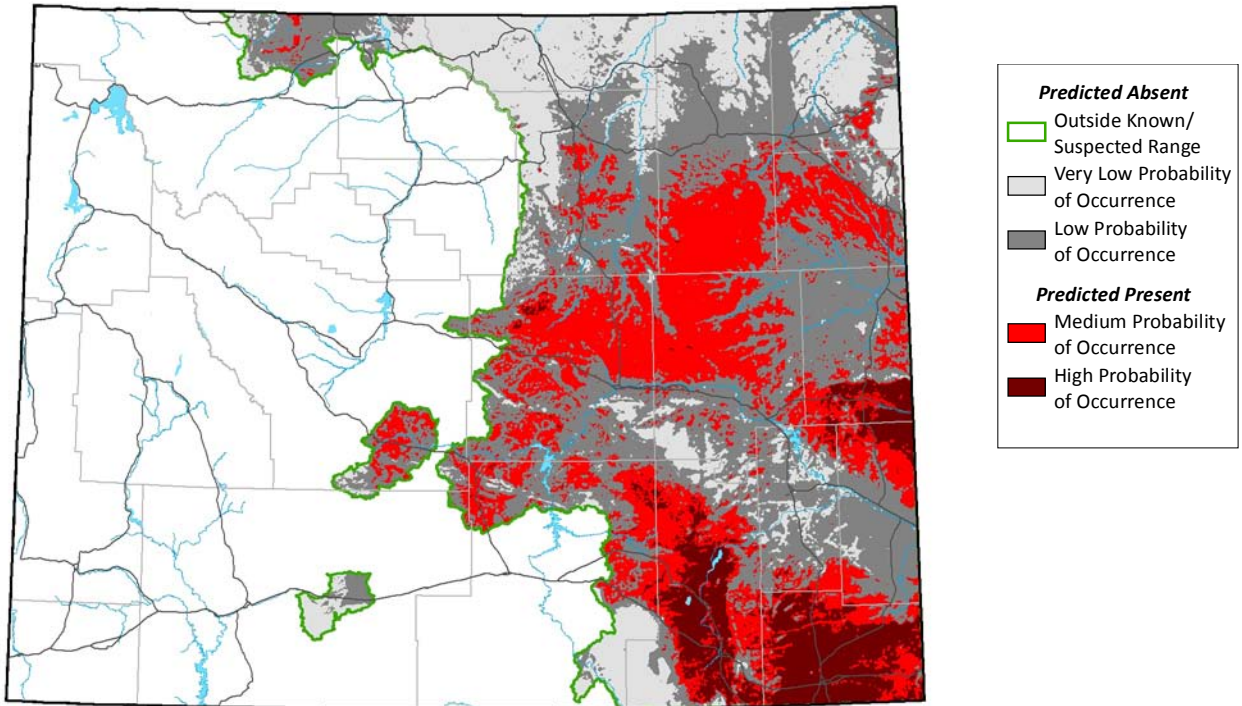
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 09:19:43 MST 2010)

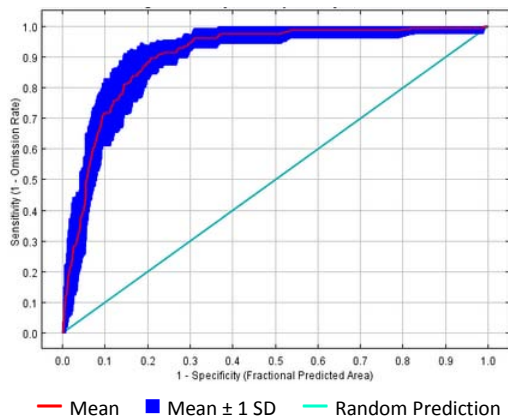
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-May- 15-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2905470
- High-Probability Threshold Value: 0.5903443
- Low-Probability Threshold Value: 0.0406466

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: High
- Test AUC and Model Gain: High

Model Evaluation Statistics

Final Model Statistics

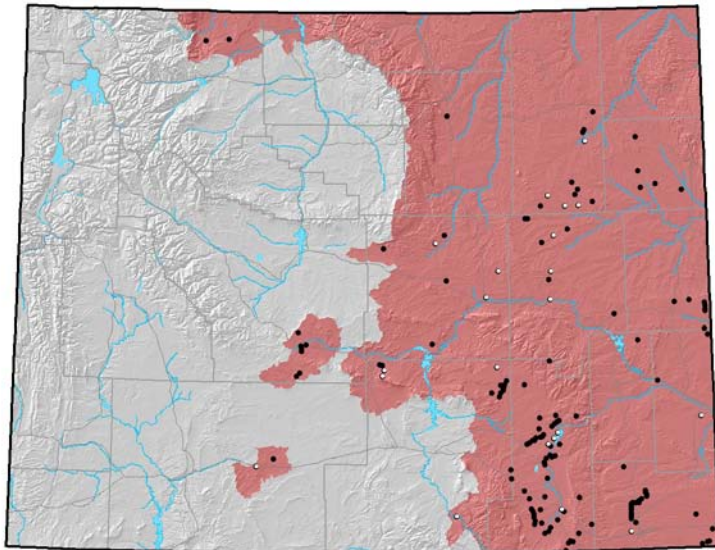
- Training AUC: 0.929
- Regularized Training Gain: 1.417

Cross-Validation Statistics

- Average Test AUC: 0.902 ± 0.032
- Upper Bound on Test AUC: 0.906
- Average Test Gain: 1.255 ± 0.484
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.17 ± 0.11

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 1,145
- Number of Occurrences used to create distribution model: 152
- Average Point Quality Index (highest quality is 12.00): 8.24 ± 2.63
- Most recent occurrence used: 2008
- Oldest occurrence used: 1959
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

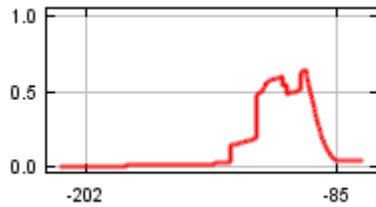
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Coldest month mean minimum temperature	44
Variation in monthly radiation	17
Mean diurnal temperature range	12
Pinon-Juniper Index	12
Forest Cover Index	8
Variation of monthly precipitation	7

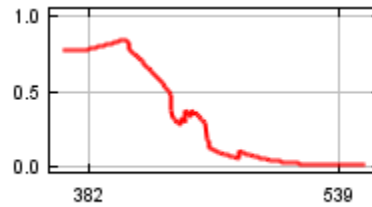
Response Curves

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).

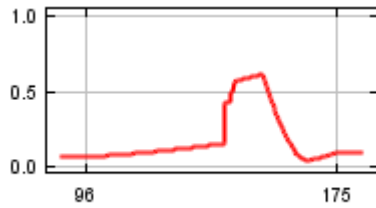
Coldest month mean minimum temperature



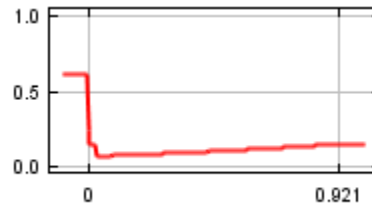
Variation in monthly radiation



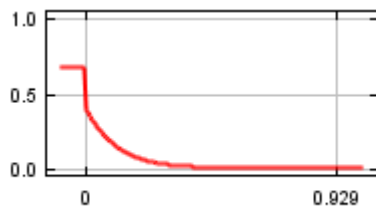
Mean diurnal temperature range



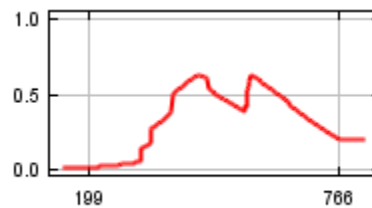
Pinon-Juniper Index



Forest Cover Index



Variation of monthly precipitation

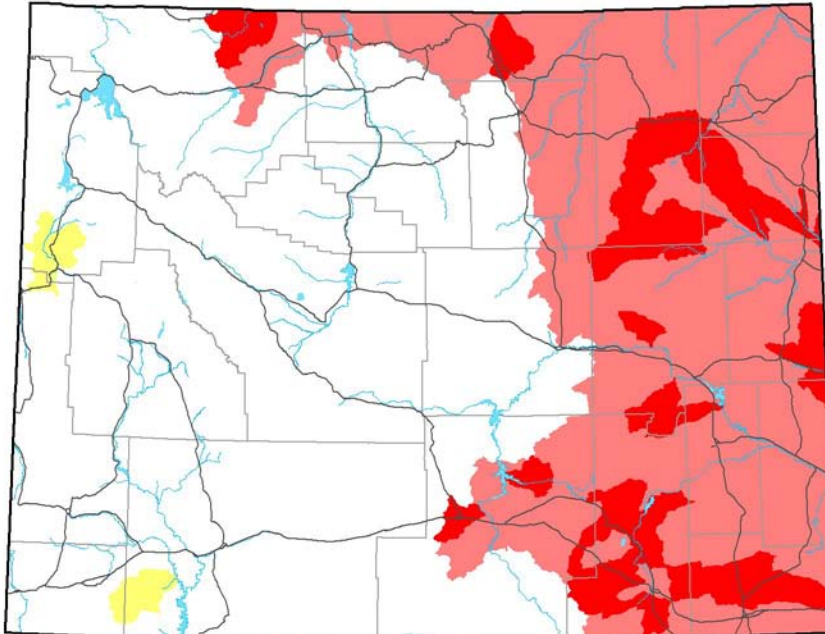


Chestnut-collared Longspur (*Calcarius ornatus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Chestnut-collared Longspur (ABPBXA6040) 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

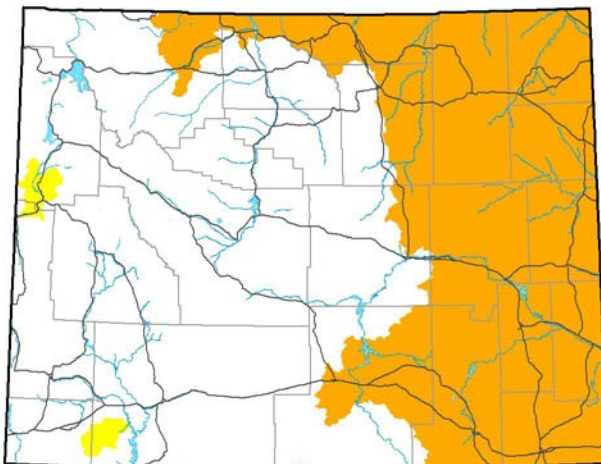


■ Known ■ Suspected ■ Accidental ■ Historical

Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.177
- Details of range map creation noted in Keinath et al. (2010a).

Range Map - Seasonality



■ Year-Round ■ Summer ■ Winter ■ Spring/Fall

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

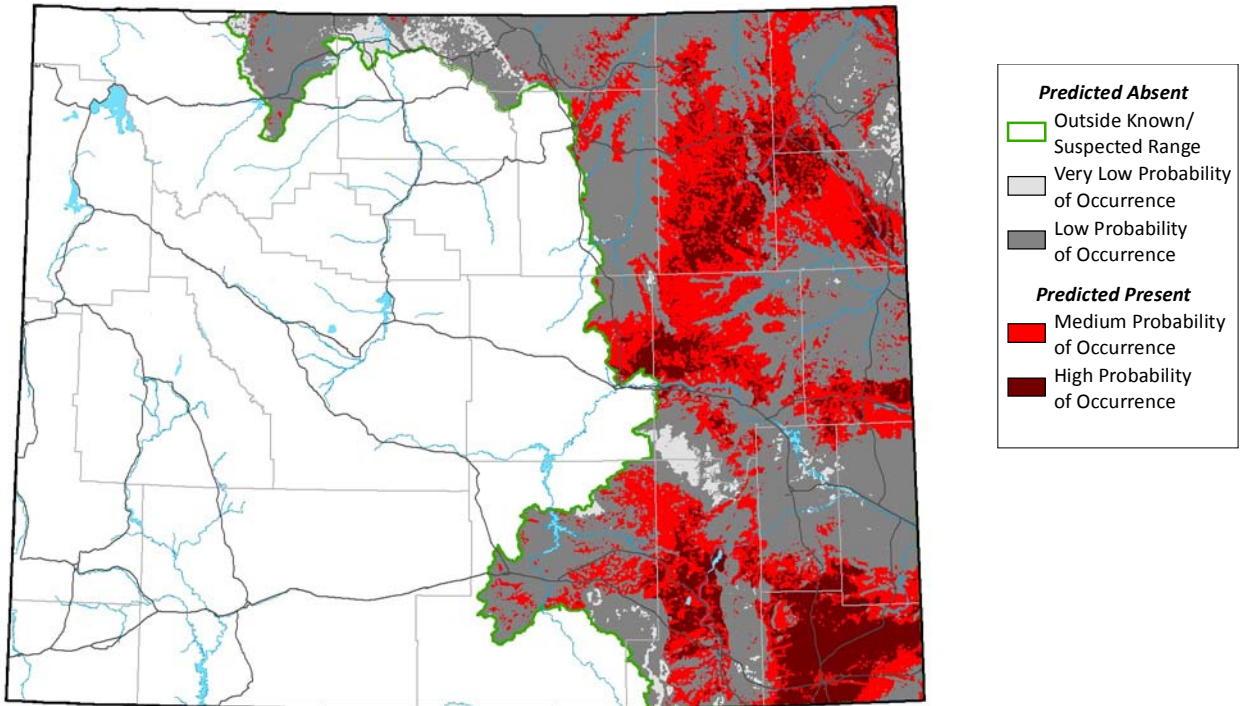
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 12:22:08 MST 2010)

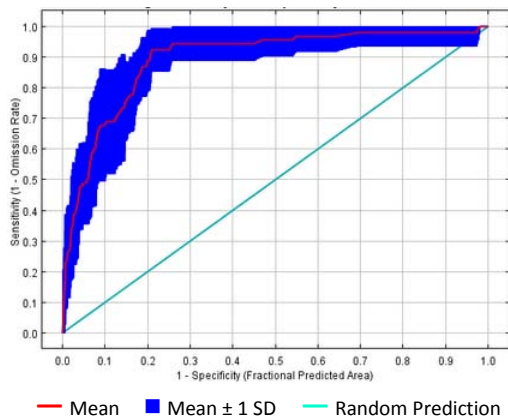
Details of distribution model creation are presented in Keinath et al. (2010b)



Model Parameters

- Season Modeled: Breeding (1-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Product, Quadratic, Hinge, Threshold
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.2622910
- High-Probability Threshold Value: 0.5850031
- Low-Probability Threshold Value: 0.0106719

Model Evaluation - ROC Plot



Model Quality Summary

Overall Assessment of Model Quality:
MEDIUM

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

Model Evaluation Statistics

Final Model Statistics

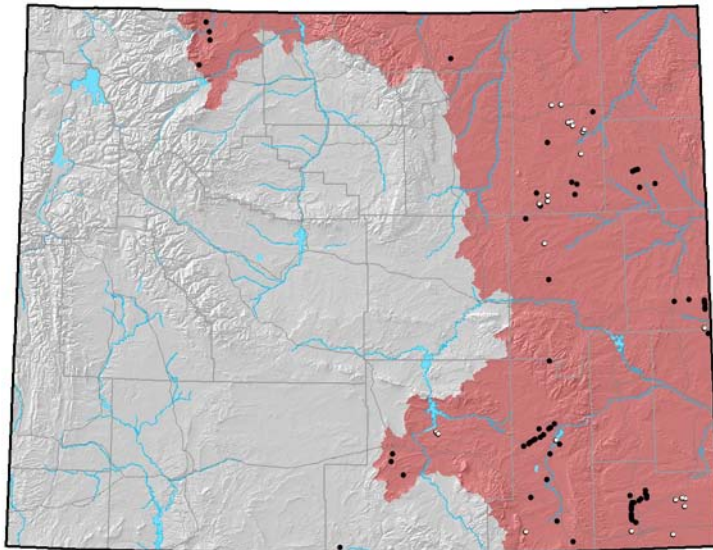
- Training AUC: 0.936
- Regularized Training Gain: 1.588

Cross-Validation Statistics

- Average Test AUC: 0.893 ± 0.046
- Upper Bound on Test AUC: 0.917
- Average Test Gain: 0.893 ± 0.046
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.22± 0.19

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 449
- Number of Occurrences used to create distribution model: 90
- Average Point Quality Index (highest quality is 12.00): 7.38 ± 2.31
- Most recent occurrence used: 2008
- Oldest occurrence used: 1975
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

There are no additional comments specific to this species range map or distribution model.

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

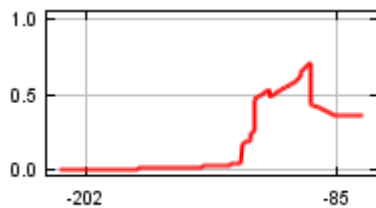
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Coldest month mean minimum temperature	35
Pinon-Juniper Index	22
Annual mean relative humidity	21
Mean diurnal temperature range	10
Deciduous Forest Index	9
Bare Ground Index	2

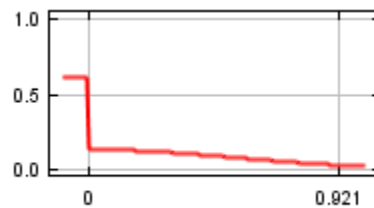
Response Curves

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).

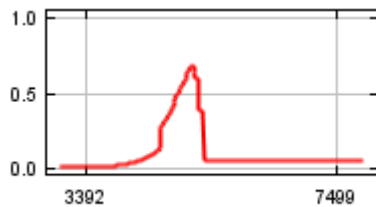
Coldest month mean minimum temperature



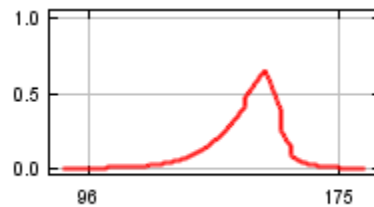
Pinon-Juniper Index



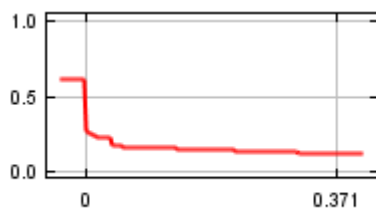
Annual mean relative humidity



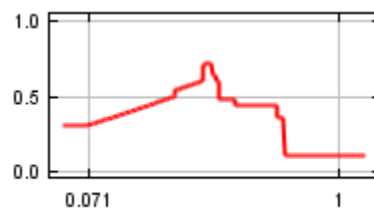
Mean diurnal temperature range



Deciduous Forest Index



Bare Ground Index

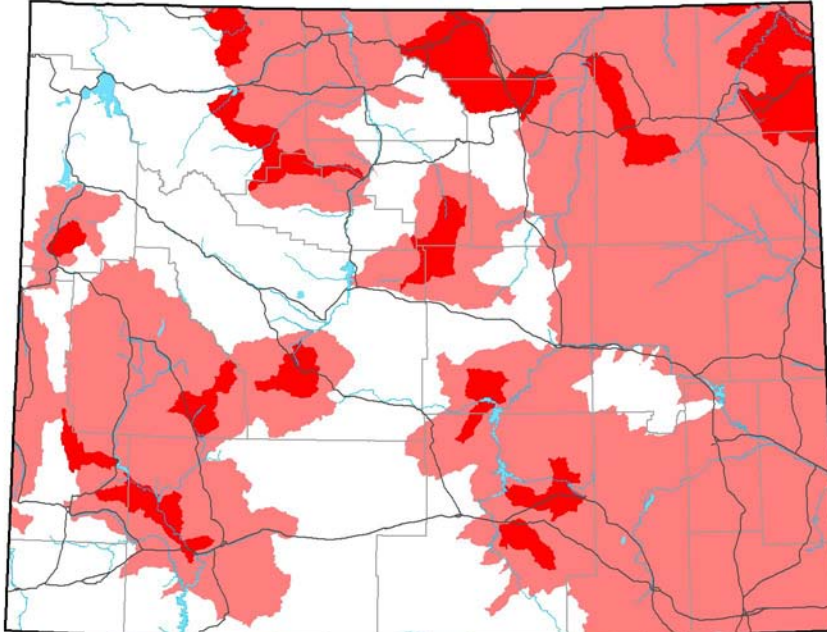


Bobolink (*Dolichonyx oryzivorus*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Bobolink (ABPBXA9010) 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.

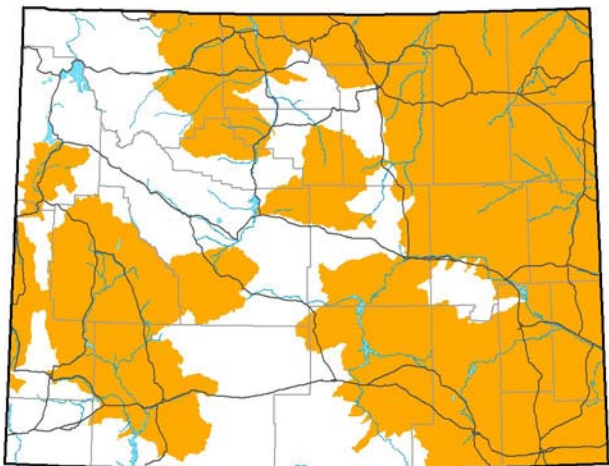
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.111
- 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/>).

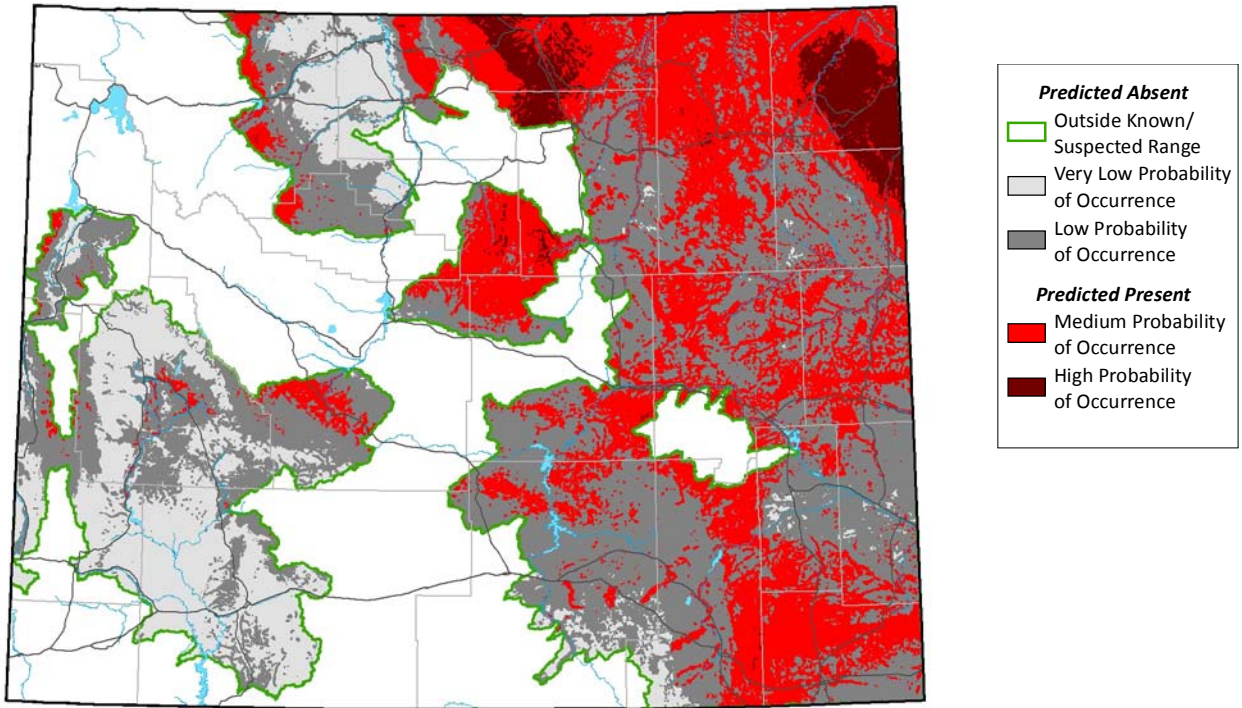
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 15:39:39 MST 2010)

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



Model Parameters

- Season Modeled: Breeding (25-May- 31-Jul)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear, Quadratic, Hinge
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1795850
- High-Probability Threshold Value: 0.6739801
- Low-Probability Threshold Value: 0.0359934

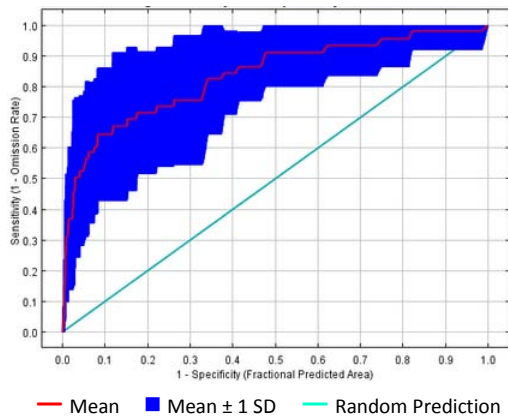
Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

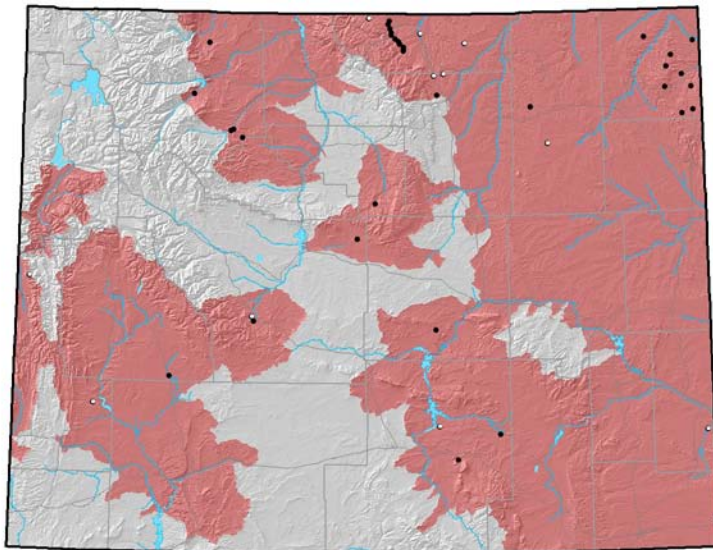
- Training AUC: 0.888
- Regularized Training Gain: 1.305

Cross-Validation Statistics

- Average Test AUC: 0.834 ± 0.106
- Upper Bound on Test AUC: 0.873
- Average Test Gain: 0.530 ± 2.372
- Omission Error (fraction of test points omitted during 10-fold cross validation): 0.27 ± 0.23

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 183
- Number of Occurrences used to create distribution model: 46
- Average Point Quality Index (highest quality is 12.00): 6.72 ± 1.80
- Most recent occurrence used: 2008
- Oldest occurrence used: 1974
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.csv

Comments

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

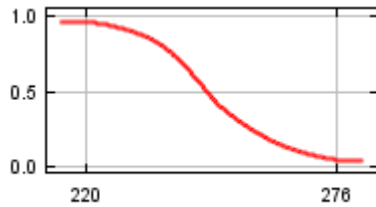
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Radiation of the lightest month	36
Variation of monthly precipitation	16
Herbaceous Cover Index	15
Deciduous Forest Index	14
Precipitation of the coldest quarter	10
Wettest quarter mean temperature	8

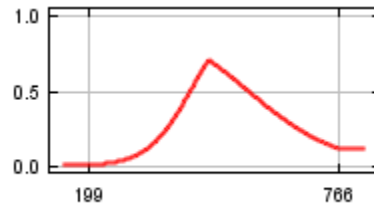
Response Curves

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).

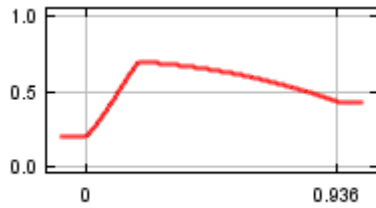
Radiation of the lightest month



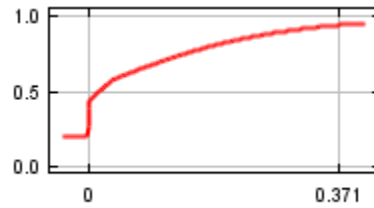
Variation of monthly precipitation



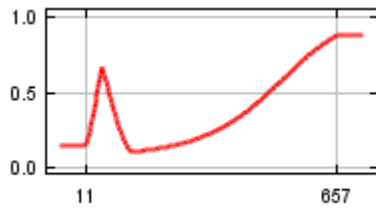
Herbaceous Cover Index



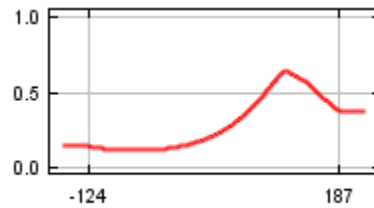
Deciduous Forest Index



Precipitation of the coldest quarter



Wettest quarter mean temperature

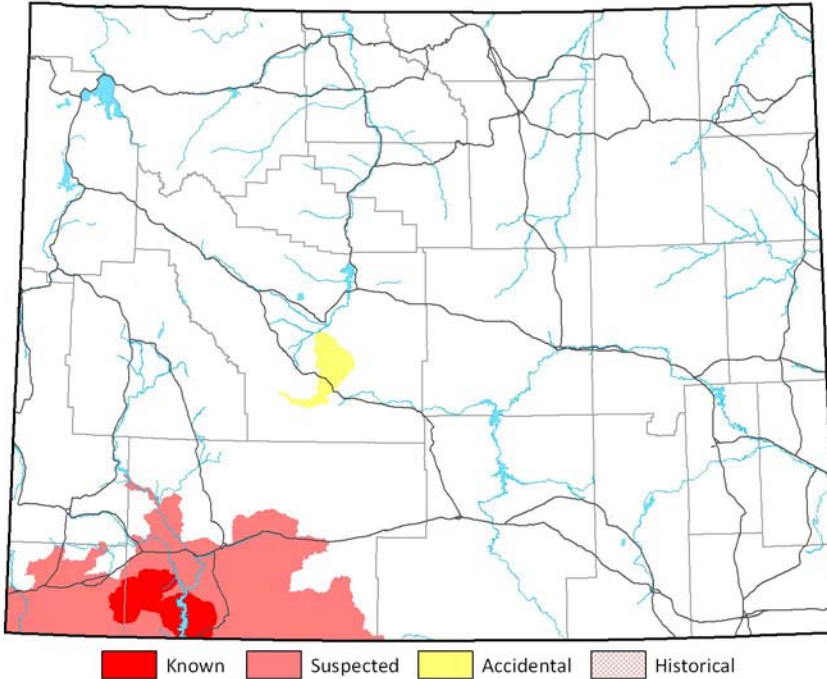


Scott's Oriole (*Icterus parisorum*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Scott's Oriole (ABPBXB9200) 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.

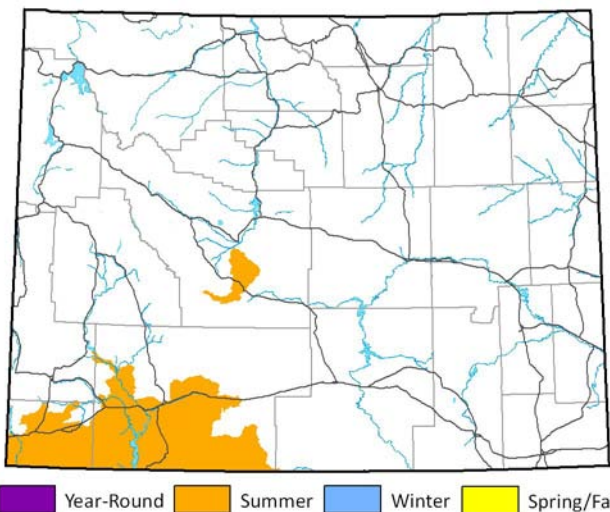
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.069
- 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/>).

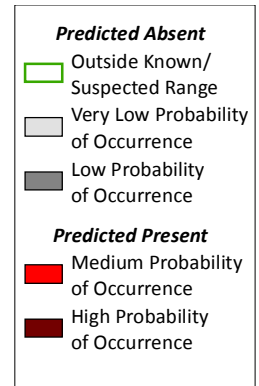
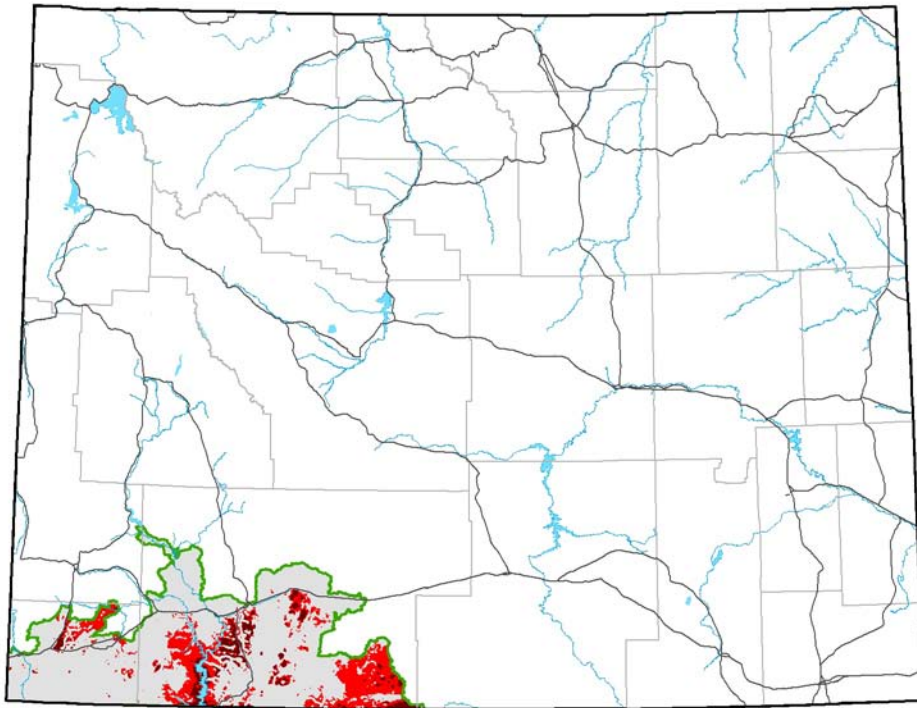
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 10 11:24:11 MST 2010)

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



Model Parameters

- Season Modeled: Breeding (15-May- 7-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.3370420
- High-Probability Threshold Value: 0.5373816
- Low-Probability Threshold Value: 0.3370420

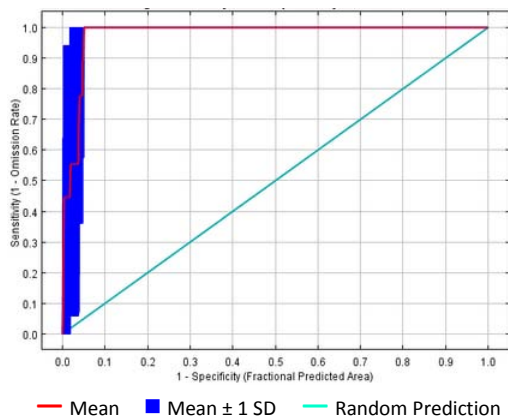
Model Quality Summary

Overall Assessment of Model Quality:

MEDIUM

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

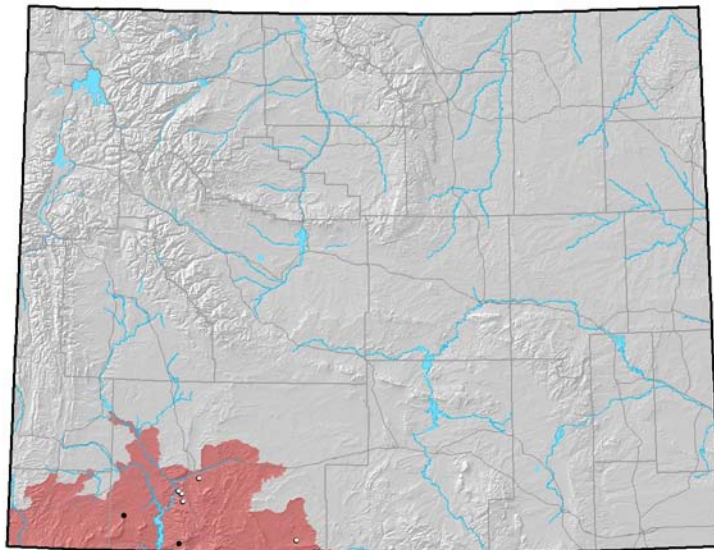
- Training AUC: 0.984
- Regularized Training Gain: 2.325

Cross-Validation Statistics

- Average Test AUC: 0.880 ± 0.310
- Upper Bound on Test AUC: 0.951
- Average Test Gain: 0.880 ± 0.310
- Omission Error (fraction of test points omitted during 9-fold cross validation): 0.22 ± 0.44

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 19
- Number of Occurrences used to create distribution model: 9
- Average Point Quality Index (highest quality is 12.00): 6.56 ± 3.21
- Most recent occurrence used: 2005
- Oldest occurrence used: 1967
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.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.

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

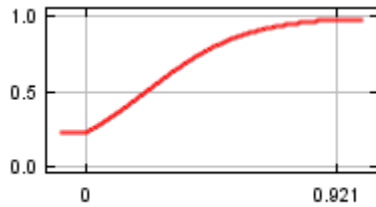
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Pinon-Juniper Index	33
Radiation of the lightest month	31
Annual mean temperature	15
Variation of monthly precipitation	8
Herbaceous Cover Index	7
Cottonwood Index	6

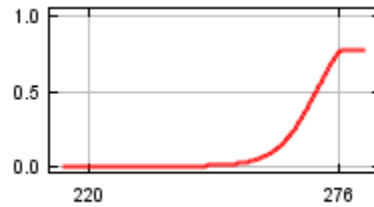
Response Curves

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).

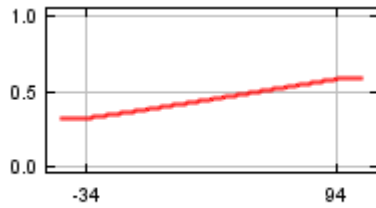
Pinon-Juniper Index



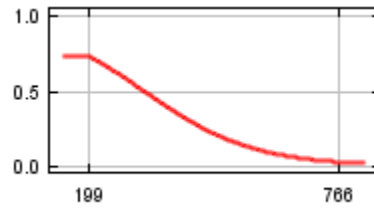
Radiation of the lightest month



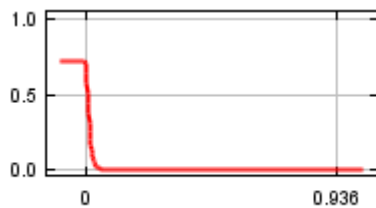
Annual mean temperature



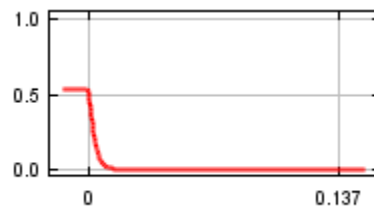
Variation of monthly precipitation



Herbaceous Cover Index



Cottonwood Index

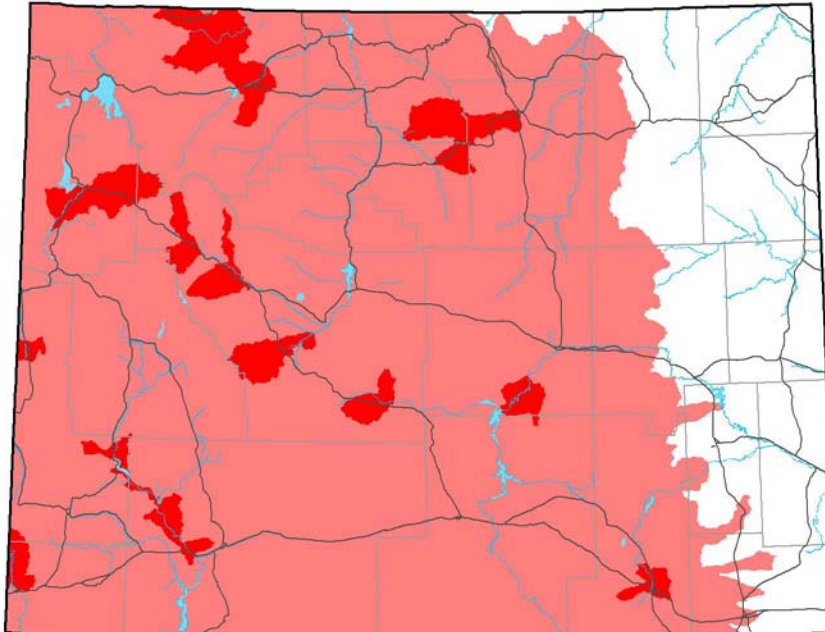


Black Rosy-Finch (*Leucosticte atrata*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Black Rosy-Finch (ABPBY02010) 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.

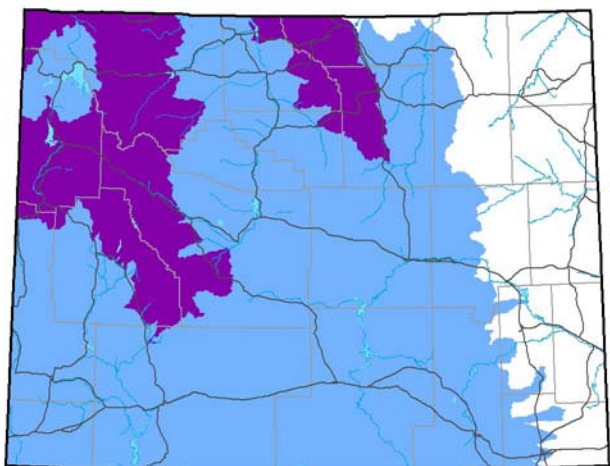
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.167
- 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/>).

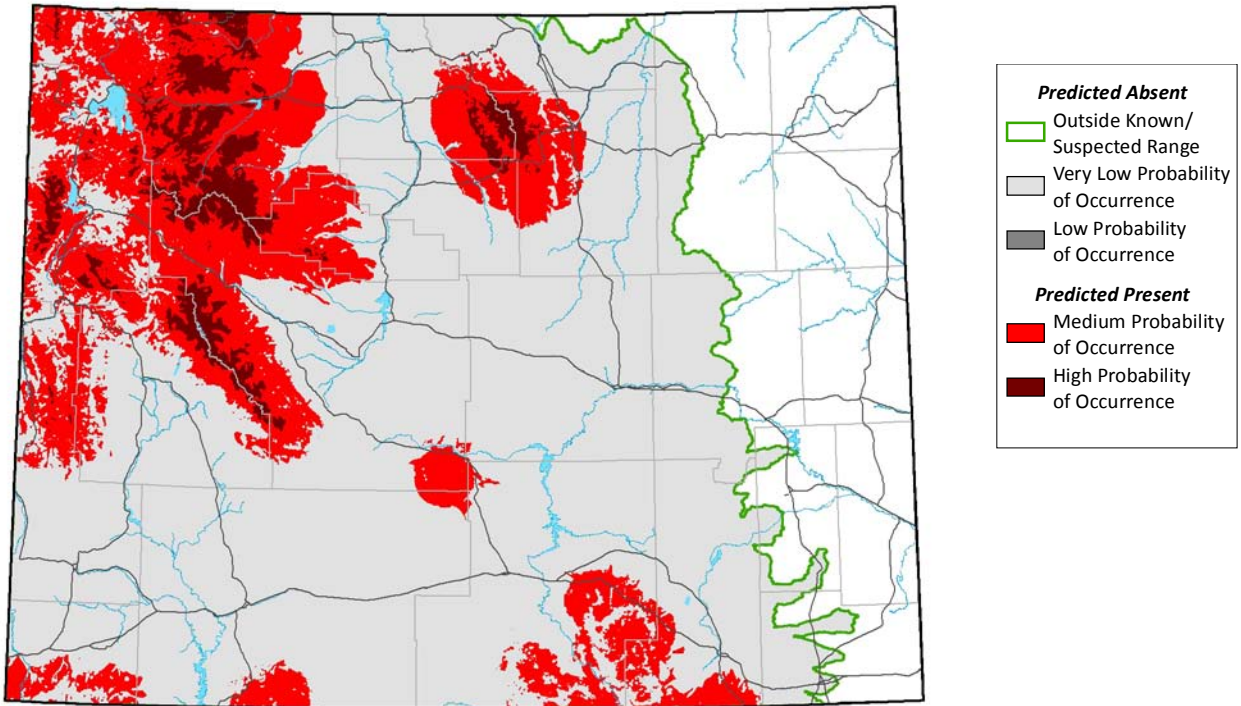
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Tue Mar 16 21:50:16 MDT 2010)

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



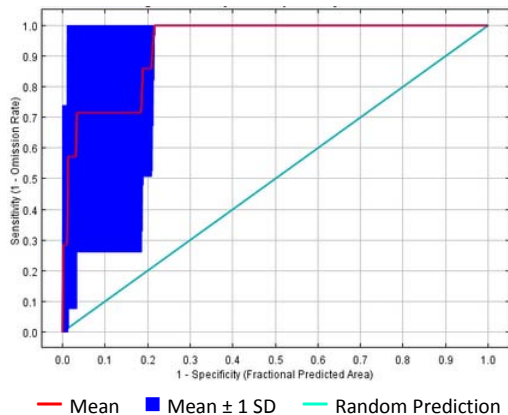
Model Parameters

- Season Modeled: Breeding (25-Jun- 31-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.1482200
- High-Probability Threshold Value: 0.7402744
- Low-Probability Threshold Value: 0.1482196

Model Quality Summary

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

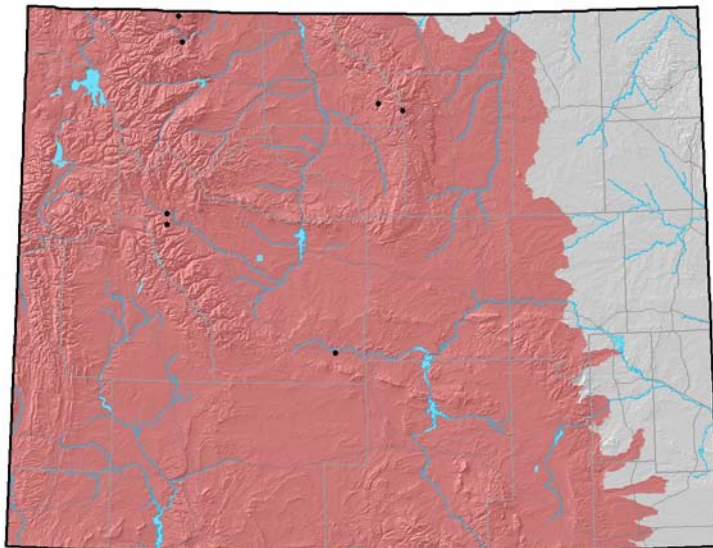
Training AUC: 0.951
 Regularized Training Gain: 1.837

Cross-Validation Statistics

- Average Test AUC: 0.655 ± 0.458
- Upper Bound on Test AUC: 0.926
- Average Test Gain: 1.370 ± 1.857
- Omission Error (fraction of test points omitted during 7-fold cross validation): 0.29± 0.49

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 167
- Number of Occurrences used to create distribution model: 7
- Average Point Quality Index (highest quality is 12.00): 7.86 ± 2.19
- Most recent occurrence used: 2005
- Oldest occurrence used: 1997
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP_2.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. 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

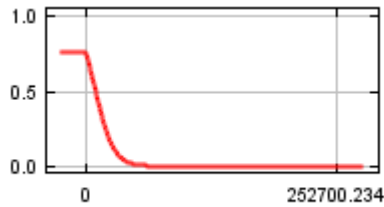
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Distance to Permanent Snow	58
Annual total radiation	24
Depth to Shallowest Restrictive Layer	10
Deciduous Forest Index	8
Mean diurnal temperature range	1
Distance to Water	0

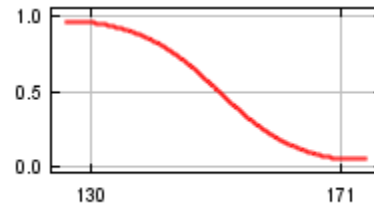
Response Curves

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).

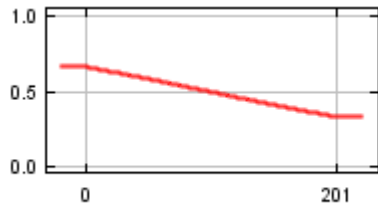
Distance to Permanent Snow



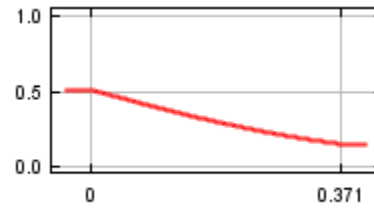
Annual total radiation



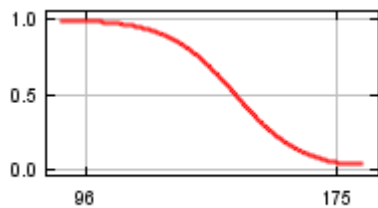
Depth to Shallowest Restrictive Layer



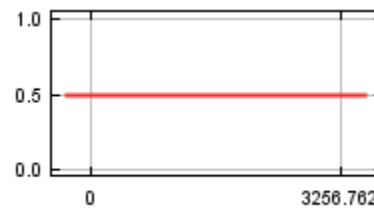
Deciduous Forest Index



Mean diurnal temperature range



Distance to Water

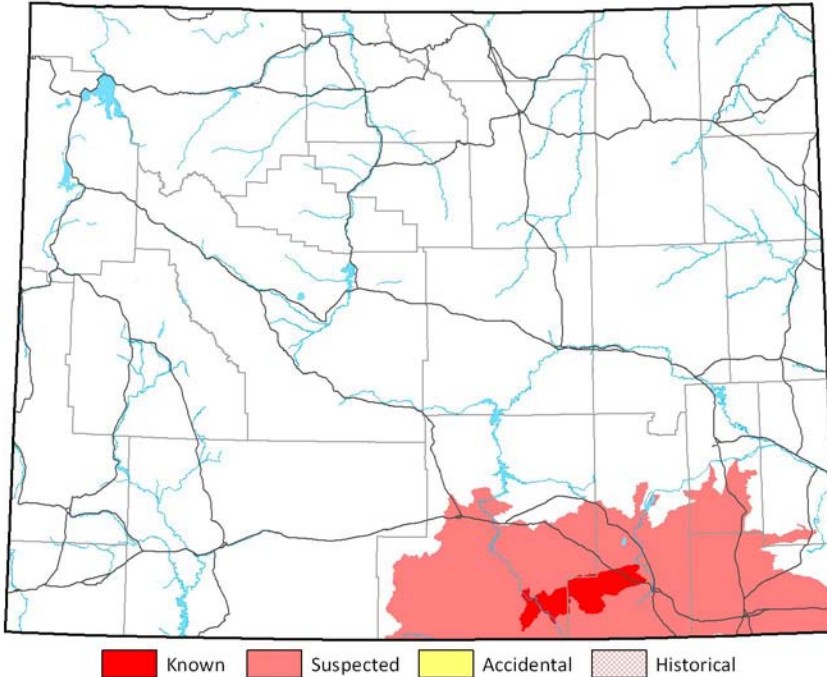


Brown-capped Rosy Finch (*Leucosticte australis*) Range Map and Distribution Model Summary

August 20, 2010

This report presents range and distribution of Brown-capped Rosy Finch (ABPBY02020) 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.

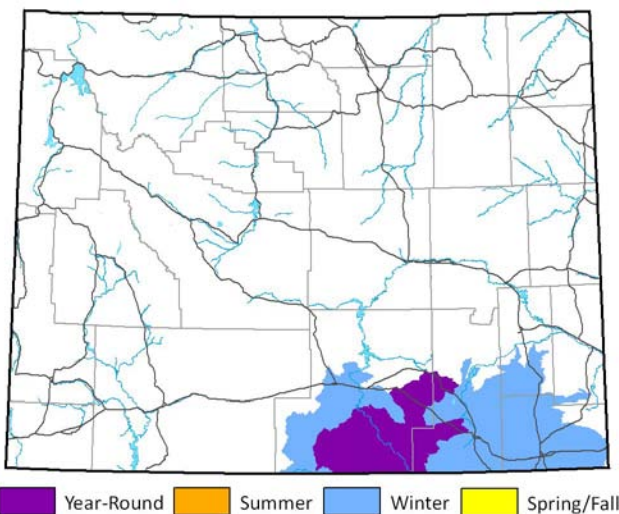
Range Map - Occupancy



Range Notes

- Version: 2010-01-19
- Proportion of range deemed known based on documented occurrences: 0.154
- 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/>).

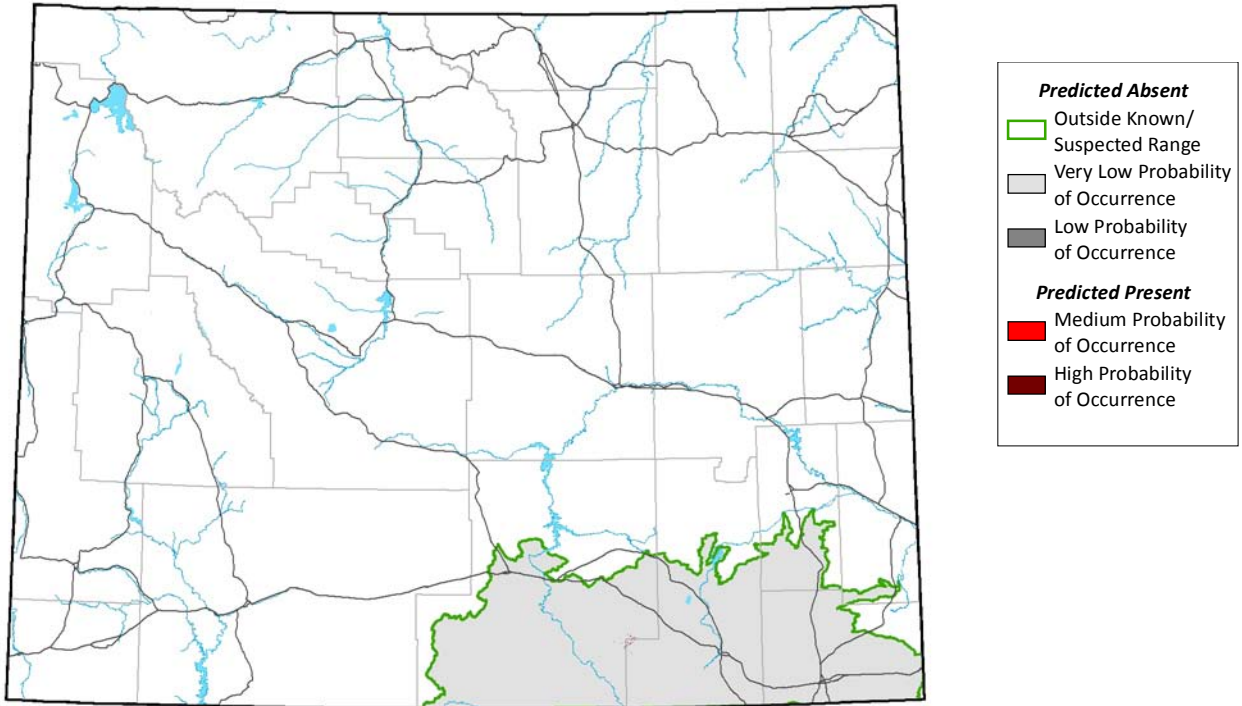
Doug Keinath, Senior Zoologist

Mark Andersen, GIS Specialist

© 2010, WYNDD

Distribution Model (Version: Wed Feb 03 19:52:17 MST 2010)

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



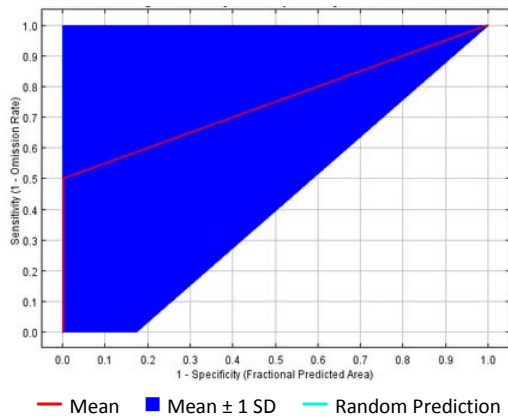
Model Parameters

- Season Modeled: Breeding (25-Jun- 31-Aug)
- Algorithm: Maxent version 3.3.1
- Feature Types: Linear
- Binary Threshold Rule: Maximum training sensitivity plus specificity
- Binary Threshold Value: 0.5528675
- High-Probability Threshold Value: 0.5880093
- Low-Probability Threshold Value: 0.5528675

Model Quality Summary

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

Model Evaluation - ROC Plot



Model Evaluation Statistics

Final Model Statistics

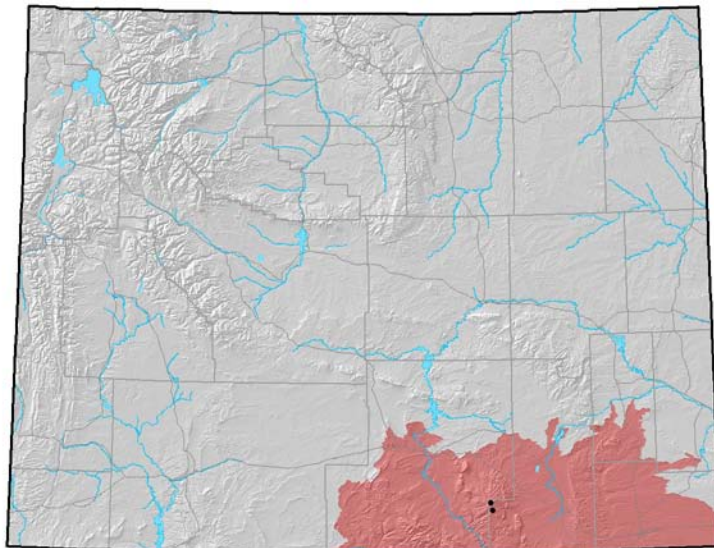
Training AUC: 1.000
 Regularized Training Gain: 8.106

Cross-Validation Statistics

- Average Test AUC: 0.150 ± 0.337
- Upper Bound on Test AUC: 1.000
- Average Test Gain: 0.139 ± 0.440
- Omission Error (fraction of test points omitted during 2-fold cross validation): 0.50 ± 0.71

Occurrence Data for Distribution Model

Occurrence Map



Points Used in Modeling, by Year of Observation

- Pre-1985
- 1985 or Later

Known and Suspected Range

Occurrence Summary Statistics

- Number of Occurrences in AWVED master dataset: 8
- Number of Occurrences used to create distribution model: 2
- Average Point Quality Index (highest quality is 12.00): 9.00 ± 2.83
- Most recent occurrence used: 2006
- Oldest occurrence used: 1991
- Occurrence File:
BIRD_SAMPLE_POINTS_ALL_SPP.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.

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

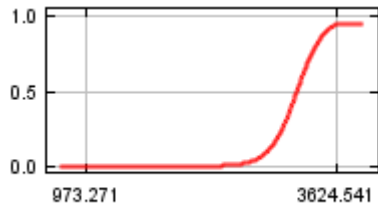
Percent Contribution (PC) to final model

<i>Environmental Variable</i>	<i>PC</i>
Elevation	39
Annual temperature range (T3 – T4)	31
Distance to Permanent Snow	19
Depth to Shallowest Restrictive Layer	6
Percent Forest Cover	5
Annual mean relative humidity	0

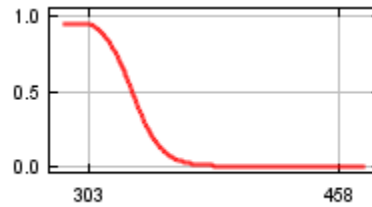
Response Curves

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).

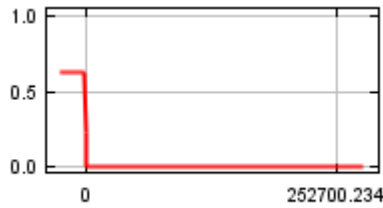
Elevation



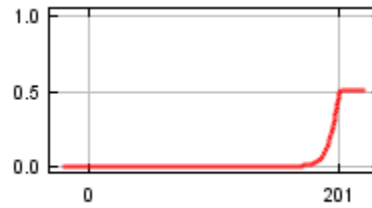
Annual temperature range (T3 – T4)



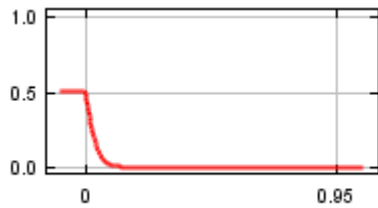
Distance to Permanent Snow



Depth to Shallowest Restrictive Layer



Percent Forest Cover



Annual mean relative humidity

