Expert-based Model Guidance and Documentation

<u>Project Information</u>

- Species: Mountain golden heather (*Hudsonia montana*)
- Lead modeler: Melissa Ruiz, Stantec (Melissa.ruiz@stantec.com) 919-865-7529
- Date started: July 2018
- Date completed: March 2020

<u>Species Information</u>

NCDOT NRTR Habitat Description

USFWS Optimal Survey Window: late May – early June

Mountain golden-heather, endemic to the Blue Ridge Mountains of North Carolina, occurs in Pine-Oak/Heath and Montane Acidic Cliff natural communities on rock cliffs and shrub balds at elevations of 2,800-4,000 feet above mean sea level. This needle-leaved perennial shrub prefers exposed, windswept quartzite or mica gneiss ledges in a sparsely vegetated ecotone between bare rock and sand myrtle-dominated heath balds that merge into a pine/oak forest. Plants require periodic fire to maintain its suitably open habitat, although they may survive for awhile in areas shaded by pine trees.

NCDOT NRTR Critical Habitat Description:

Burke County, North Carolina contains a Critical Habitat area designated for mountain golden-heather. This area occurs within Pisgah National Forest along the Linville Gorge Wilderness Boundary, Shortoff Mountain, Table Rock Mountain, and the 3,400 and 2,200-foot elevation contours.

Additional Information

There are 5 known populations (28 occurrences) in Pisgah National Forest in Burke County (Table Rock, the Chimneys, Chimney Gap, Shortoff, and the Amphitheater-Carolina Wall). There is one population in McDowell County (2 occurrences). According to recovery plan, plant prefers shallow sandy soils interspersed with quartzite gravel, Chilhowee quartzite ledges and outcrops. All known populations lie between 2800 and 3850 feet in elevation.

<u>County Information</u>

- NHP listed counties: Burke and McDowell
- FWS listed counties: Burke and McDowell

Environmental Data Information

All spatial data are in NAD 1983 StatePlane North Carolina FIPS 3200 (US feet). Table of all environmental data layers available via DOT ATLAS project server.

Layer 1
- Layer name: DEM
- Layer description:
    - NC Floodplain Mapping Program 20-foot DEM acquired August 2018
- Layer selection justification:
    - The data includes a grid of elevation values for the entire state although data is clipped to county boundary plus a buffer. Mountain golden heather is known to occur in a specific range of elevations.
- "Habitat" versus "Nonhabitat" designations:
    - Areas with elevation over 2,800 were identified as habitat. An upper limit was not selected as elevations within the listed counties above the known range for the species are limited in area.

Layer 2
- Layer name: Critical_Habitat
- Layer description:
    - Critical Habitat for Threatened & Endangered Species [USFWS]acquired August 2018 (available as web service from U.S Fish and Wildlife Service Environmental Conservation Online System FWS_HQ_ES_ECOS)
- Layer selection justification:
    - The data includes a critical habitat for many species. One polygon located in Pisgah Forest represents the location of mountain golden heather critical habitat.
- "Habitat" versus "Nonhabitat" designations:
    - Areas with within polygon considered habitat.

Layer 3
- Layer name: County_Boundary
- Layer description:
    - Select Burke and McDowell Counties from County Boundary shapefile
- Layer selection justification:
    - Species listed in Burke and McDowell Counties
- "Habitat" versus "Nonhabitat" designations:
    - Potential habitat Burke and McDowell Counties.

Model Information

- Model domain
    - This model identifies all year-round potential suitable habitat for the species.

- Model output
    - Figure 1 – Model prediction.
    - Model output is binary, and includes the USFWS species range, excluding historic counties. The species model range is split between "High" and "Low" potential habitat. "High potential habitat" represents GIS based layer areas deemed suitable habitat, and "Low potential habitat" representing areas identified as areas deemed low quality or non-habitat.
    - Shapefile covering listed counties.
- ArcGIS Model Builder
    - version ArcMap 10.4.1
    - Model file included in Appendix 1
    - Layer 1 DEM – selected all areas above 2,800 feet above sea level, clipped to select counties. Merged with critical habitat layer and clipped to select counties.
- AGOL Review
    - A model prediction file was shared with select reviewers on ArGIS Online (AGOL). Points were placed within the USFWS potential habitat as well as the model potential habitat in order to solicit feedback. Reviewers could place additional comments for consideration by modeler.
    - AGOL review was completed in May 2019 on a draft version of this model (See Appendix 2)
- Independent Data Review
    - Describe data sources – Natural Heritage Program element occurrences
    - Describe methods – Current aerial imagery was used to determine if EO sites have been developed. Elevation data was used to confirm elevation data included in EO records.
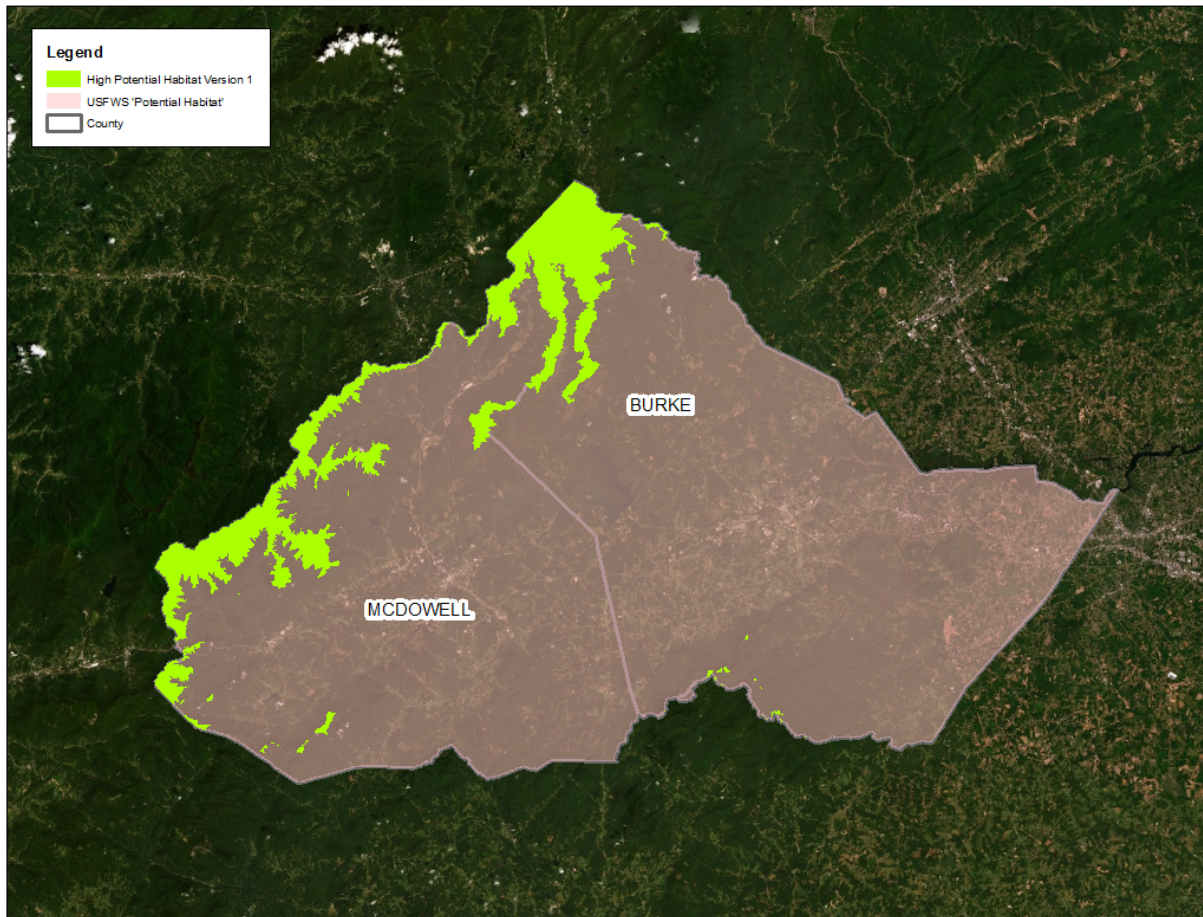
Figure 1 Range Map and High Potential Habitat Version 1

Previous Model Versions (Draft)

The previous version of this model was developed in July 2018. The DEM layer was modified between versions. No new additional layers were added or deleted after its review in 2019.

Layer 1
- Layer name: DEM
- Layer description:
    - NC Floodplain Mapping Program 20-foot DEM acquired August 2018
- Draft Version Layer selection justification:
    - The data includes a grid of elevation values for the entire state although data is clipped to county boundary plus a buffer. Mountain golden heather is known to occur in a specific range of elevations.
- Draft Version "Habitat" versus "Nonhabitat" designations:
    - Areas with elevation between 2,800 and 4,000 feet above sea level were identified as habitat.

List of Delivered Model Products

- *This summary document*
- *Version 1 Model builder toolbox and model screenshot (Appendix 1)*
- *Reviewer documentation (Appendix 2) – summary of comments and general model recommendations*
- *Version 1 Model prediction file(s) (shapefile)*
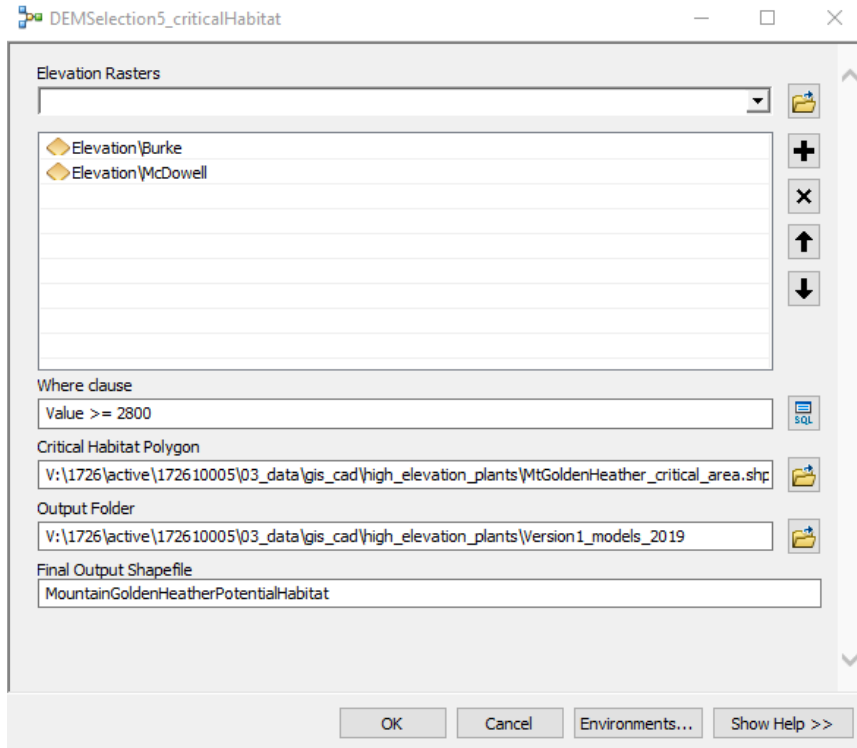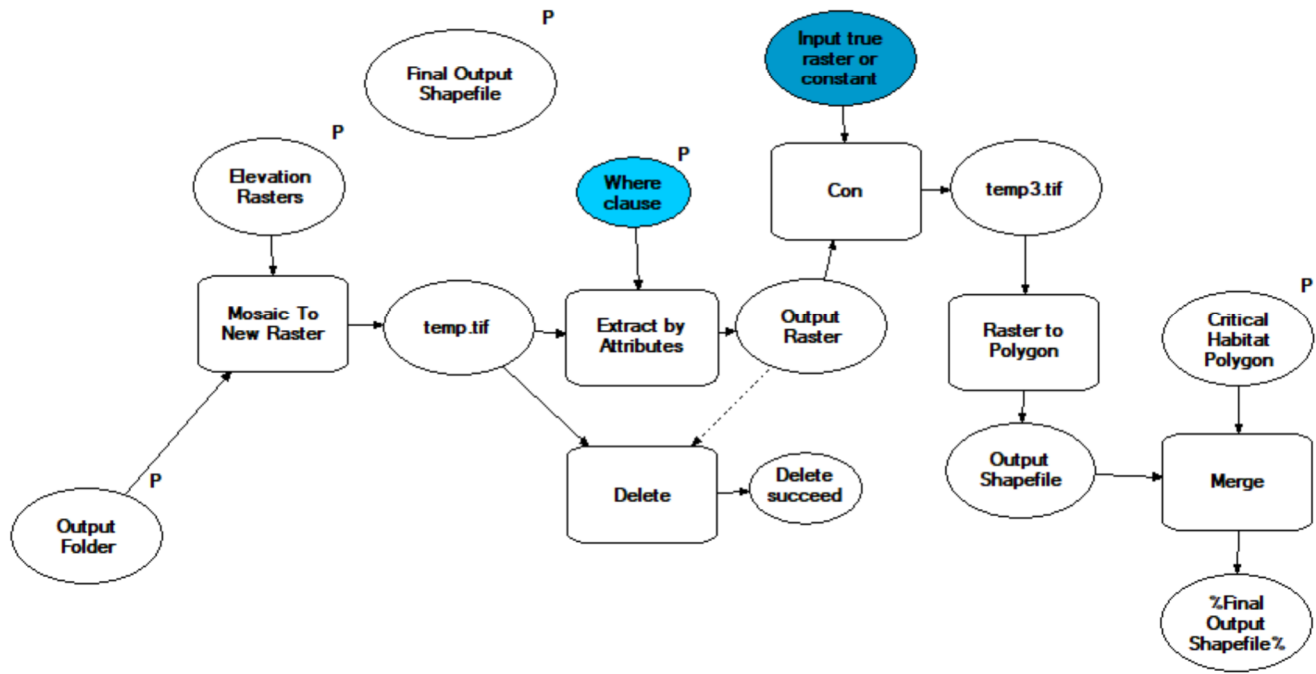- *Desktop AGOL Reviewer comments (shapefile)*

References cited

[USFWS] U.S. Fish and Wildlife Service. 1983. Mountain Golden Heather Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia, 26pp.

[USFWS] U.S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Determination of *Hudsonia montana* to be a Threatened Species, With Critical Habitat. 45 FR 69360-69363.

North Carolina Natural Heritage Program. 2018. Biotics Database. Division of Land and Water Stewardship. Department of Natural and Cultural Resources, Raleigh, North Carolina.

Appendix 1: Model Screenshots

DEMSelection5_criticalHabitat

Elevation Rasters

- Elevation\Burke
- Elevation\McDowell

Where clause

Value >= 2800

Critical Habitat Polygon

V:\1726\active\172610005\03_data\gis_cad\high_elevation_plants\MtGoldenHeather_critical_area.shp

Output Folder

V:\1726\active\172610005\03_data\gis_cad\high_elevation_plants\Version1_models_2019

Final Output Shapefile

MountainGoldenHeatherPotentialHabitat

OK   Cancel   Environments...   Show Help >>

Appendix 2: Reviewer Documentation

Project Information

- Species: Mountain golden heather (*Hudsonia montana*)
- Lead modeler: Melissa Ruiz, Stantec (melissa.ruiz@stantec.com) 919-865-7529
- Reviewer names: 1. Rebekah Reid (USFWS-West)
  2. Suzanne Mason (NCNHP)
  - o Rebekah Reid is a Listing and Recovery Biologist with the US Fish and Wildlife Service. She is the species lead for 15 plant species in present in North Carolina.
  - o Suzanne Mason (NCNHP) – Suzanne is a data manager for the North Carolina Natural Heritage Program. She has been with the NCNHP since 2005 and specializes in maintaining conservation data for federally protected species. Suzanne previously studied the genetic diversity of Schweinitz's sunflower (*Helianthus schweinitzii*) for her Master of Science thesis.

Range Map to Potential Habitat Version 1

- USFWS Range   614,072 acres
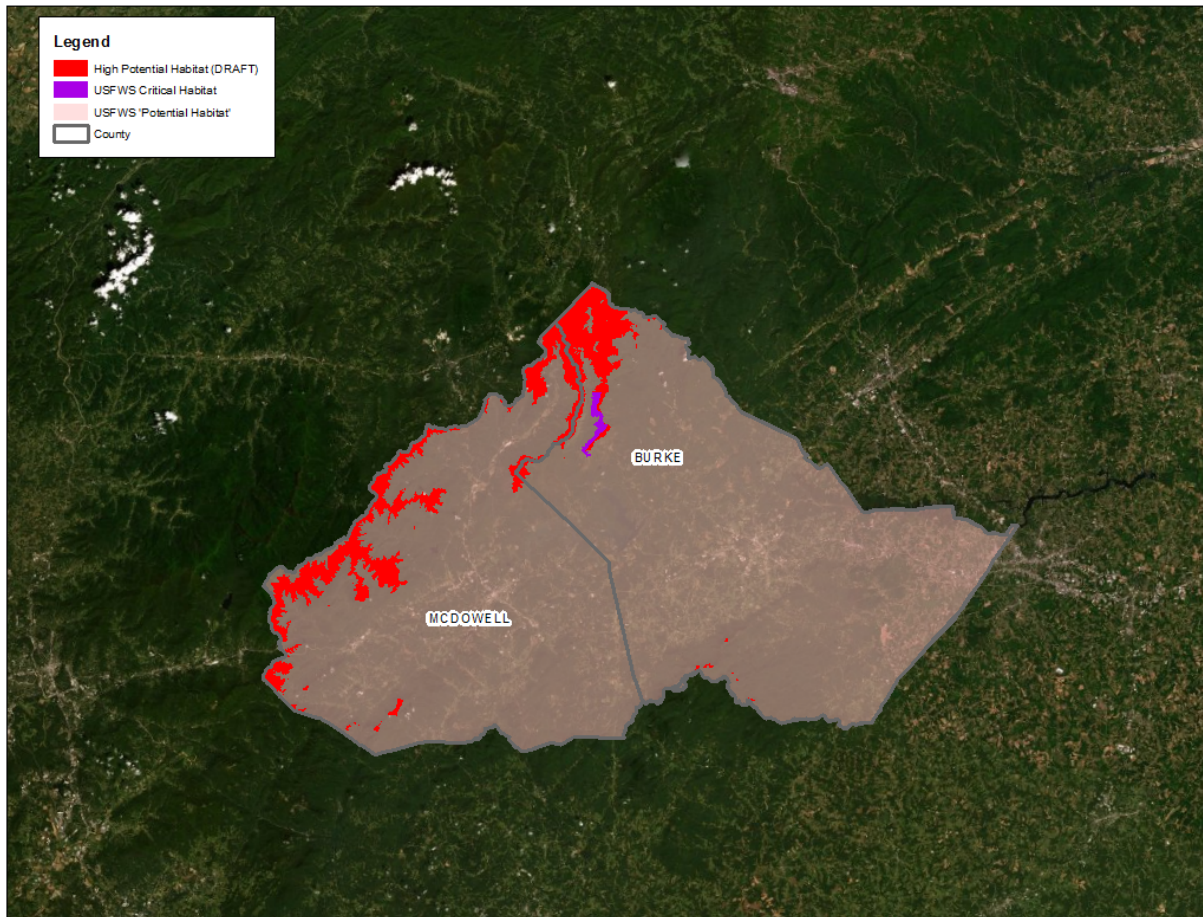- ATLAS Range   48,704 acres

Figure 2. Range Map and High Potential Habitat Draft Version

Summary of Model Draft Version

- Environmental data layers used included DEM, critical habitat and county boundaries
- Selected all areas in DEM between 2,800 and 4,000 feet above mean sea level and merged with critical habitat polygon. Clipped to select counties.

- Response Rate
  - Reviewer Response Rate: 89%
    - 9 reviewer points placed by modeler
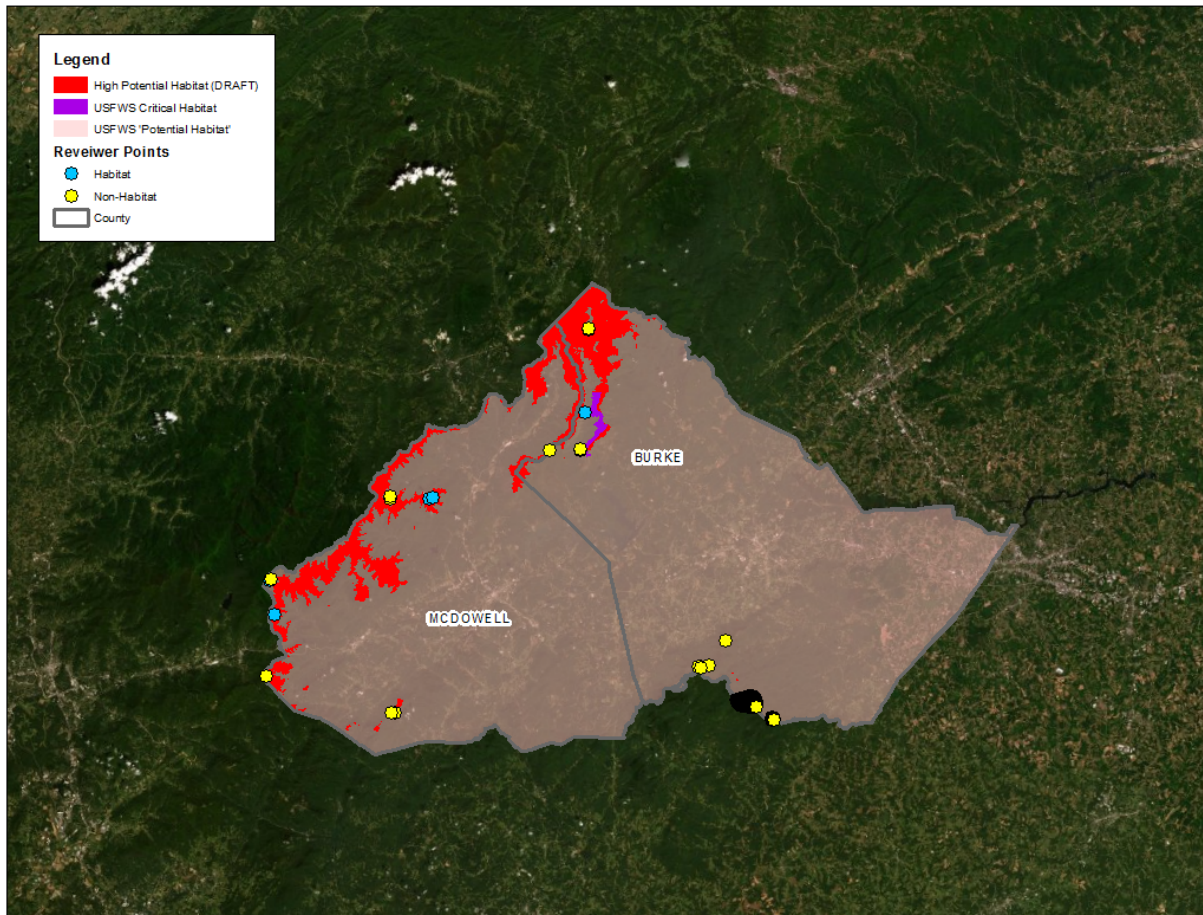 - # Additional Comments (placed by reviewer): 9

Figure 3. Reviewer Points High Potential Habitat (DRAFT)

Reviewer Responses

- Reviewers provided a complete and balanced review. Flags were concentrated on the habitat area as well as a zone at a slightly lower elevation. High elevation plants are not known to grow at lower elevations in the county therefore flags were not placed in those areas nor were comments expected.
- Reviewers for the most part agreed with the potential habitat. There were comments that forests and areas outside of the range were included where they shouldn't. However, they also acknowledged these areas contained granitic formations occur in these areas. There were also comments that habitat could exist at higher elevations than the species is known. A shapefile including all comments is attached to this documentation.

Proposed Version 1 Model

In order to address comments by reviewers, the following changes were made to the model:

- The upper elevation limit of 4,000 feet above sea level was removed. All land over 2,800 feet above sea level is identified as potential habitat (Figure 4).
- While reviewers commented on the overprediction of forested areas, habitat could not be limited to open areas due to limitations in data content and scale therefore, all land within the specified elevations was included regardless of land use/cover
- Version 1 of the potential habitat model includes an additional 3,196 acres for a total range of 48,704 acres
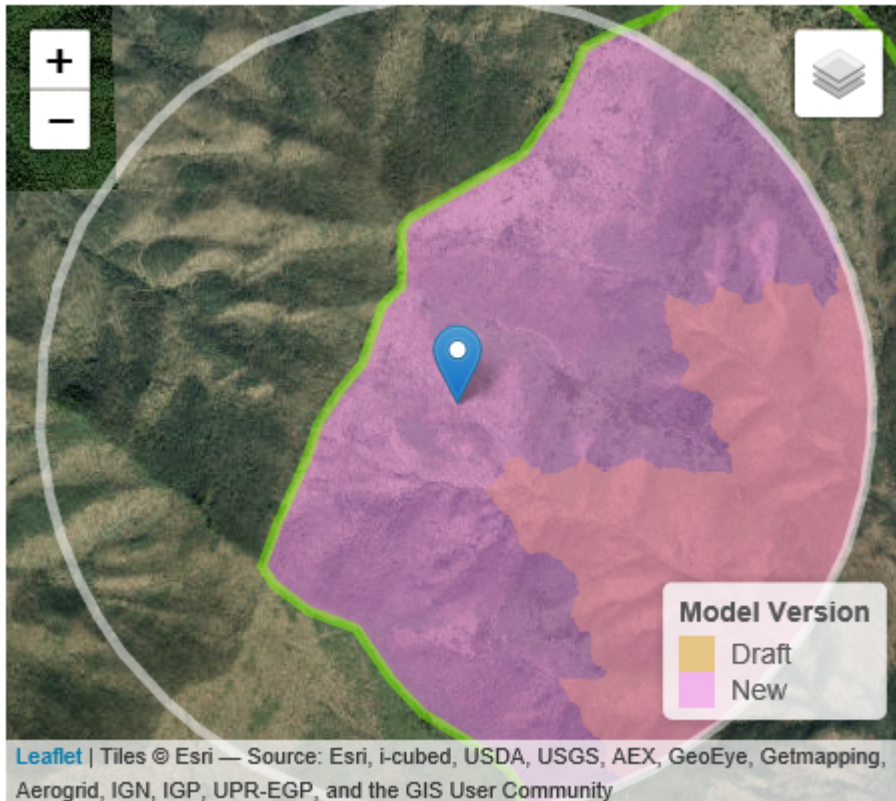

Figure 4. Eliminating upper elevation limit increased area of potential habitat.

Model Accuracy

Model improvements were assessed by calculating the accuracy statistics from the Draft to Version 1 model. This is a binary classification assessment based on reviewer responses of habitat/non-habitat areas. True positives increased from 3 to 4, and false negatives were reduced from 2 to 1 for the Version 1 model (Figure 5). Changes between versions did not raise or lower the percent correctly classified which is approximately 86% for Draft Version and Version 1. Sensitivity increased from 0.6 to 0.8 (Table 1) therefore this model improved the prediction of non-habitat areas. Specificity did not change therefore there is no change in its ability to predict habitat areas.
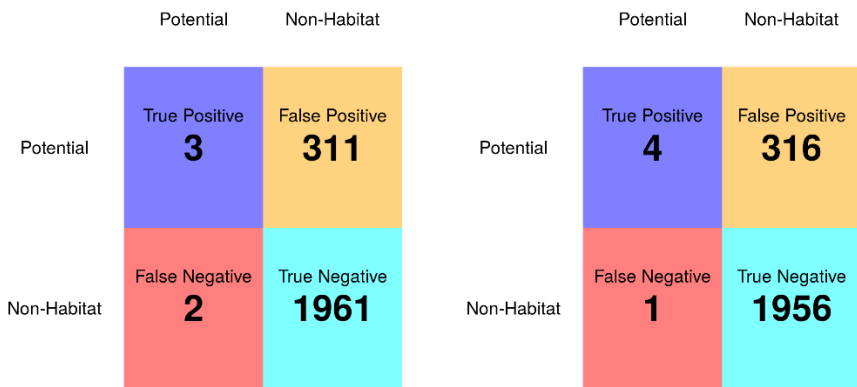
Figure 5. Accuracy summary is the reviewer responses to Draft (left) and Version 1 (right) model output

Table 1. Accuracy statistics based on counts in the above summary table

Statistic	Draft	Version 1
Percent Correctly Classified	86.30	86.10
Sensitivity	0.6	0.8
Specificity	0.9	0.9