Santa Fe National Forest MSO Nest Roost Model Brief Process Description
Julia.Luetzelschwab@usda.gov, 7/7/2021
GIS Workspace: T:\FS\NFS\SantaFe\Program\2600Wildlife\GIS\MSO\MSO_NestRoost

Mexican Spotted Owl (MSO) Nest Roost (NR) habitat model on the Santa Fe National Forest uses Johnson's Geophysical Model, LiDAR canopy cover/height strata, and INREV (Oregon State University Institute of Natural Resources Existing Vegetation) vegetation polygons. The top 30% scoring of INREV mixed conifer stands in the eastside non-Wilderness and westside non-Wilderness (private land and MSO PACs removed) are considered potential MSO nest roost habitat. Scores were based on Johnson's Geophysical MSO Model (about 50%) and stand structure derived from LiDAR (about 50%, stands with a higher canopy cover percentage of trees taller than 54 feet).

The model was developed in 2020-2021 by Matt Trager (RO Wildlife Biologist Detailer) and Julie Luetzelschwab with input and review by SFNF and RO staff including Forestry/Fuels (Ken Reese, Gennaro Falco, Dennis Carrill), Wildlife Biologists (Andre Silva, Danny Burton, Ramon Borrego, Justin Mapula, Philip Hughes, Brian Davis), RO Wildlife Biologists and Foresters and USFW Shaula Hedwall. The model is somewhat unique in that the data inputs are generally direct measures (topography, LiDAR canopy height, eCognition stand boundaries), with the biggest exception being the cover type classification. Since the Geophysical Model contributed significantly to the final scores, this model does not necessarily model existing NR habitat where there are currently tall trees but stands that could be managed for or towards NR habitat.

For more in-depth discussion of the model, see the Mexican Spotted Owl Nest/Roost Habitat Identification Process for the Santa Fe Mountains Landscape Resiliency Project document in the EA project record. More documents are located here including the Johnson Geophysical Model documentation:
T:\FS\NFS\SantaFe\Program\2600Wildlife\GIS\MSO\MSO_NestRoost\Document

GIS Layer File: T:\FS\Reference\GIS\r03_sfe\LayerFile\WildlifeAndPlants\MSO_NestRoost.lyr
Field: MSONR = MSO NR East or MSO NR West

To see the version that includes Wilderness use this Field:
MSONR_WithWilderness = MSO NR East with Wilderness or MSO NR East with Wilderness

The layer file points to this Geodatabase:
T:\FS\NFS\SantaFe\Program\2600Wildlife\GIS\MSO\MSO_NestRoost\Data\SFE_MSO_NestRoost.gdb\FinalData\SFE_MSONR_AllPolys

Model Inputs:

1. MSO Geophysical Model (GEOPHYSICAL SPOTTED OWL HABITAT MODEL FOR THE SOUTHWESTERN UNITED STATES, Terrell H. Johnson, 2003)
    The Geophysical Model was reclassified as shown below. Zonal Statistics (mean) were computed for each INREV polygon which provided a mean 30 meter pixel score across each INREV polygon. The Zonal Statistics to Table tool was used with the INREV mixed conifer selected stands and a Table Join was done to link the table to the INREV polygons. Value and Owls Percent were outputs of the Geophysical Model, and the Score was used for the input to the SFNF MSO NR model.
    The Score = Owls Percent / 3 for 5%-30% areas (2% and 0 = not habitat = 0 score)
    (e.g. 30% / 3 = score of 10)

Value	Owls	Score
1	0	0.00
2	2%	0.00
3	5%	1.67
4	10%	3.33
5	20%	6.67
6	30%	10.00
7	30%	10.00

Geophysical Model Notes:
- USFW Shaula Hedwall suggested this model contribute at least half to the model input since preferred MSO NR habitat are strongly correlated with topography
- Generally elevations > 9200 feet were considered less or not suitable MSO habitat in this model, effectively leading to much lower scores in stands > 9200 and likely eliminating them for NR. However the SFNF does/did have higher elevation MSO PACs on the eastside in the Viveash Fire area.

2. LiDAR canopy cover percent rasters generated by R3 RO Remote Sensing Group Pete Joria and Tom Mellin using FUSION. In mixed conifer stands on the Santa Fe National Forest, trees 12 to 18 inches dbh average 54-66 feet tall trees over 18 inches dbh are taller than 66ft (Gennaro Falco, SFNF Forestry Program Manager). Because basal area is strongly correlated with canopy cover, canopy cover percent of trees 54+ feet and 66+ feet height classes were used to approximate the vegetation structure characteristics. Output rasters were 30 meter pixel resolution. Zonal statistics mean for each INREV polygon for both Lidar CC 54+ feet and CC 66+ feet run for output score.
   a. Canopy Cover Percent of trees > 54 ft x 5
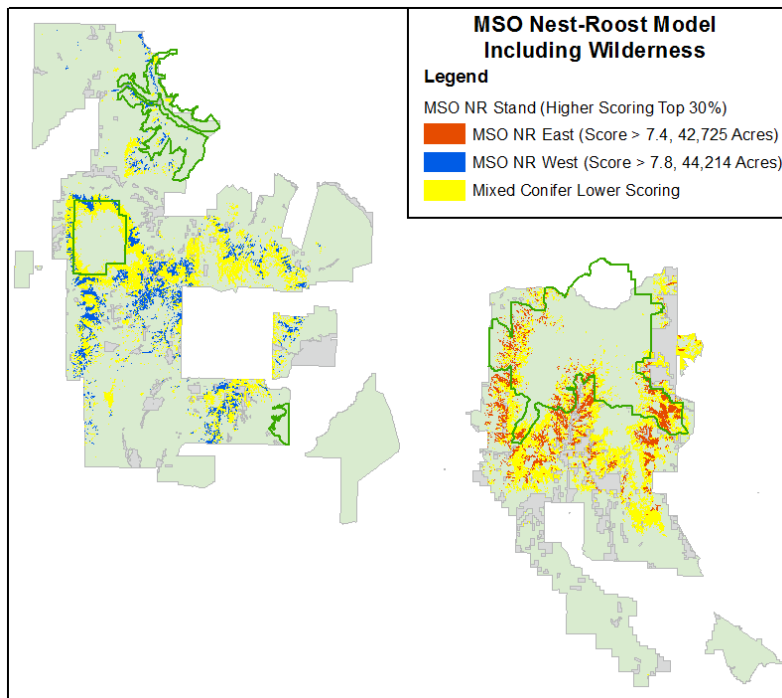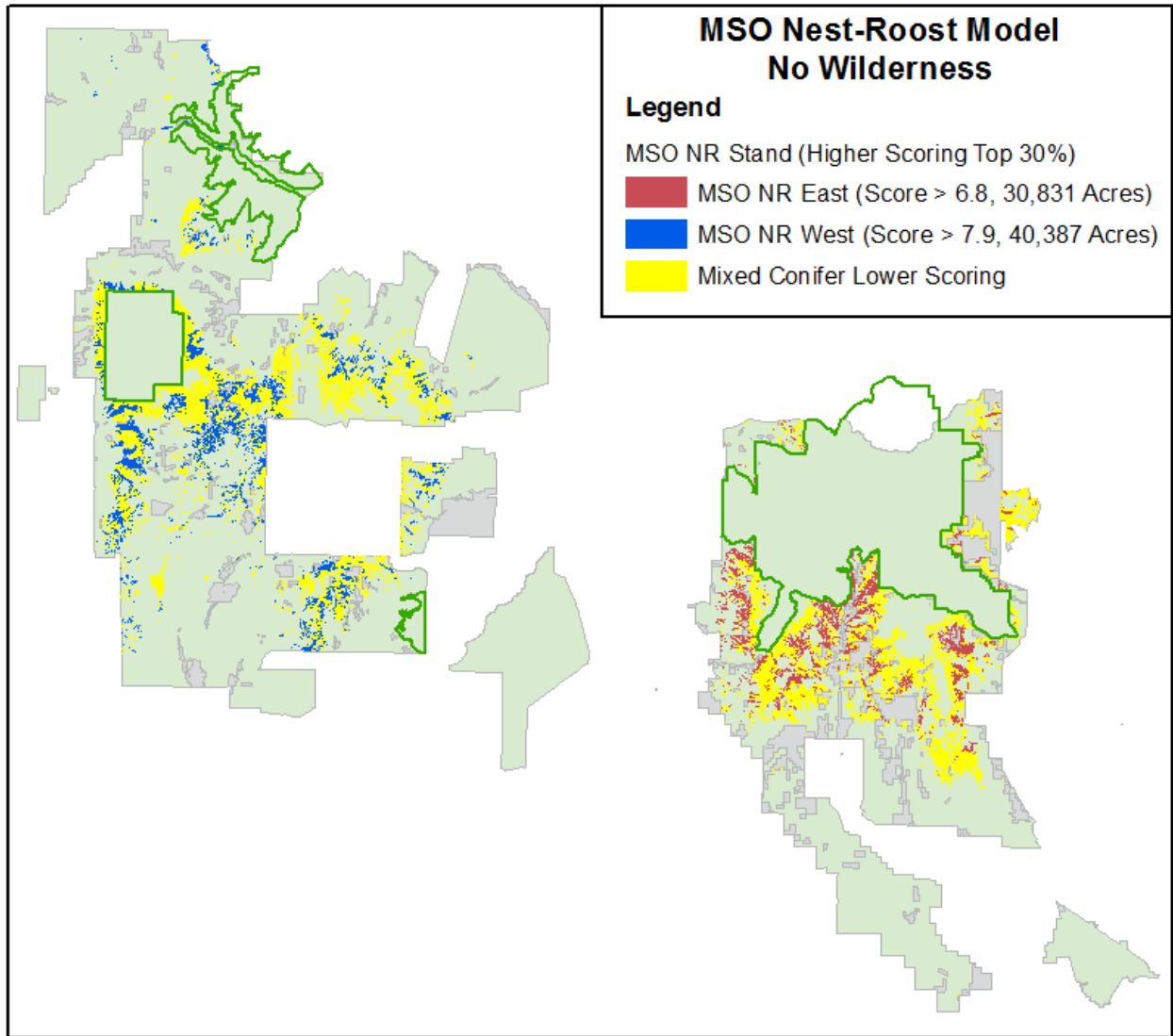   b. Canopy Cover Percent of trees > 66 ft x 10

LiDAR Notes:
- 2b above (CC of trees > 66 ft) were also accounted for in 2a, essentially double counting this category to give stands with exceptionally tall trees a higher score
- Acquisition years: SF County 2014, SWJM 2019, San Luis 2016, North Central 2016/2017.
- NM North Central was flown in November so for stands with deciduous trees (i.e. aspen), canopy cover percent may be lower due to leaf drop in aspen and other deciduous stands. MAXIMUM value used with raster mosaic for overlap areas to try preserve canopy cover values with leaf on.

3. INREV (Oregon State University Institute of Natural Resources Existing Vegetation) vegetation stands/polygons were used since stand boundaries were generated using eCognition using more current imagery (2017) and this automated method creates more homogenous stands based on vegetation type, slope, and aspect. Veg type classifications were also based on more recent imagery and used some FIA plot and FSVeg stand exam data. Forester Ken Reese determined these cover types are consider "mixed conifer" DOMINANCE_TYPE IN ('ABCO', 'ABCO_PIED', 'ABCO_PIFL2', 'ABCO_PINUS', 'ABCO_PIPO', 'ABCO_PIPU', 'ABCO_POTR5', 'ABCO_PSME', 'ABCO_QUGA', 'PIFL2', 'PIFL2_PIPO', 'PIFL2_PSME' , 'PIPO_PSME', 'PIPU', 'PIPU_POTR5', 'PIPU_PSME', 'PIST3', 'PSME', 'PSME_QUGA', 'TEIX', 'TETX').

4. Extent used. MSO PACs and private lands were removed (snapshots from February 2021). East and west, wilderness and no wilderness versions are available, however the **No Wilderness Eastside and No Wilderness Westside are the preferred versions to use.** Total acres of mixed conifer were selected from each extent and 30% of those acres were used to determine the score threshold (rounded to one decimal place) to use for each extent.
   - MSO NR Eastside NOT including Wilderness

- o MixedCon = 'Mixed Con Kens Query' AND Wilderness = 'Not Wilderness' AND EastWest = 'East'
  - o Total mixed conifer = 102,197 acres, 30% = 30,659
  - o ScoreTotal > 6.8 = 30,831 acres
- MSO NR Westside NOT including Wilderness
  - o MixedCon = 'Mixed Con Kens Query' AND Wilderness = 'Not Wilderness' AND EastWest = 'West'
  - o Total mixed conifer = 132,088 acres, 30% = 39,626
  - o ScoreTotal > 7.9 = 40,388 acres

- MSO NR Eastside including Wilderness
  - o MixedCon = 'Mixed Con Kens Query' AND EastWest = 'East'
  - o Total mixed conifer = 141,575 acres, 30% = 42,473
  - o ScoreTotal > 7.4 = 42,725 acres
- MSO NR Westside including Wilderness
  - o MixedCon = 'Mixed Con Kens Query' AND EastWest = 'West'
  - o Total mixed conifer = 147,214 acres, 30% = 44,164 acres
  - o ScoreTotal > 7.8 = 44,214 acres

Extent Notes:
- Scores were not recalculated after clipping/removing MSO PACs, private, and Wilderness. Scores are based on the entire stand area.

**MSO Nest-Roost Model
No Wilderness**

Legend

MSO NR Stand (Higher Scoring Top 30%)

- MSO NR East (Score > 6.8, 30,831 Acres)
- MSO NR West (Score > 7.9, 40,387 Acres)
- Mixed Conifer Lower Scoring

**MSO Nest-Roost Model
Including Wilderness**

Legend

MSO NR Stand (Higher Scoring Top 30%)

- MSO NR East (Score > 7.4, 42,725 Acres)
- MSO NR West (Score > 7.8, 44,214 Acres)
- Mixed Conifer Lower Scoring

MSO Nest Roost Habitat Model Summary and Example:

- Each mixed conifer INREV polygon has a score from each of the 3 model inputs derived from the zonal statistics mean:

  1. LiDAR Canopy Cover % for Trees > 54ft tall * 5
     - o Zonal Statistics (mean) to the polygon
     - o Canopy cover for trees > 54 ft ranged from 0-85% (0-0.85) in the mixed conifer stands
     - o Multiplied by 5 – **scores ranged from 0 – 4.25**

  2. LiDAR Canopy Cover % for Trees > 66ft tall * 10
     - o Zonal Statistics (mean) to the polygon
     - o Canopy cover for trees > 66 ft ranged from 0-70% (0-0.70) in the mixed conifer stands
     - o Multiplied by 10 – **scores ranged from 0 – 7.01**

  3. Geophysical Model
     - o Zonal Statistics (mean) to the polygon
     - o **Scores ranged from 0 – 10**

- EXAMPLE: The attribute table for the mixed conifer INREV polygons had the scores from each of the above 3 criteria. These were added together to get the total score for each polygon.

  FORUMULAS for Canopy Cover Scores:

  ([CanCovAbv54ft]/100) * 5

  ([CanCovAbv66ft]/100) * 10

  EXAMPLE:

  CanCovAbv54ft = 33.7%; ScoreCC54 = (33.7/100) * 5 = 1.68

  CanCovAbv66ft = 17.2%; ScoreCC66 = (17.2/100) * 10 = 1.72

  ScoreGeophys = 7.92

  ScorTotal = 1.68 + 1.72 + 7.92 = 11.32

MSO Nest-Roost Model
Canopy Height
Legend
☐ INREV Stand Polygon
Canopy Height
Feet
- 0 - 54
- 54 - 66
- > 66

MSO Nest-Roost Model
Canopy Cover Trees > 54 ft
For each 30 meter pixel
Legend
☐ INREV Stand Polygon
Canopy Cover Trees > 54 ft
Percent
- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100

Mean CC %
for trees > 54 ft
in this polygn
is 33.7%
Score CC54
0.337 * 5 =
1.68

MSO Nest-Roost Model
Canopy Cover Trees > 66 ft
For each 30 meter pixel
Legend
☐ INREV Stand Polygon
Canopy Cover Trees > 66 ft
Percent
- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100

Mean CC %
for trees > 66 ft
in this polygn
is 17.2%
Score CC66
0.172 * 10 =
1.72

MSO Nest-Roost Model
Geophysical Model
For each 30 meter pixel
Legend
Geophysical Model
Range, Owls, Model Score
- 0 - 76, Not Habitat, 0
- 77 - 90, 2%, 0
- 91 - 113, 5%, 1.67
- 114 - 140, 10%, 3.33
- 141 - 168, 20%, 6.67
- 169 - 209, 30%, 10
- 210 - 250, 30%, 10

Mean
Geophysical
Model
Score for
this polygon is
7.92

6