New Mexico Rare Plant Conservation Strategy

Plant Conservation Scorecard

Natural Heritage New Mexico Final Report – March 2017

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Final Report

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NM Plant Conservation Scorecard

As part of development of the New Mexico Plant Conservation Strategy, Natural Heritage New Mexico (NHNM) built the New Mexico Plant Conservation Scorecard reflecting the conservation status of 235 target species (Strategy Species). The scorecard factors and process are adopted from and mirror that of the Colorado Natural Heritage Program (CNHP) hierarchical rare plant scorecard methodology with minor modifications (Rondeau et al. 2012).

The primary use of the Plant Conservation Scorecard is to help managers and researchers to identify and prioritize target species for protection, conservation and management actions, surveys and monitoring, and filling of data gaps. In addition, the scorecard can be used to quickly identify documented and potential threats and assess the status of a rare plant species. The scorecard can be sorted in a variety of ways to help establish a target list, including sorting by ownership, agency status, conservation ranks, threats, ecoregion, conservation actions needed, etc. The scorecard approach is standardized and flexible to allow for updates, edits and future additions.

Species list and data

Underpinning the scorecard process is population data on 235 Strategy Species of conservation interest. The species list for the scorecard was generated from the Natural Heritage New Mexico (NHNM) database (Biotics) of tracked and watch-list species, and includes the Navajo Nation Endangered Species List, the NM State Endangered Species List, the Bureau of Land Management and the U.S. Forest Service sensitive species lists. An initial query was used to determine how much data was available for each species. For species where location and observation data in Biotics were not

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available or sparse, data from SEINet and the NHNM data entry backlog were added in the database.

Following NHNM protocols, species locations are grouped into Element Occurrences (EOs) that act as operational populations or sub-populations for tracking species-specific changes in distribution and population status and trends (NatureServe 2002). EO methodology for delineation and classification is used across the NatureServe network and identifies biologically meaningful features for monitoring efforts. EOs are delineated using known mapped locations of the plant that are grouped into a given EO based on inter-observation distances (separation distance) and habitat factors. Separation distances are 1 km for unsuitable habitat and 3 km for suitable habitat. For example, two mapped locations that are separated by 1.5 km of unsuitable habitat are considered separate EOs. For the scorecard, we used minimum bounding geometry in ArcGIS to generate EO polygons (Figure 1). EO polygons along with textual data (observer, date, population size, etc.) were used to assess the suite of scorecard factors outlined below.

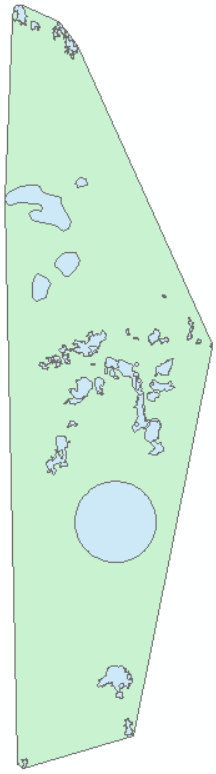

Figure 1. An example of Element Occurrence (EO) minimum bounding geometry representing a local population of Amsonia tharpii (green polygon). Blue polygons are known mapped locations of the plant that are grouped into an EO based on minimum inter-observation distances and habitat factors.

Scorecard Factors and Calculation

For each species on the scorecard, an Overall Conservation Status of the species is evaluated as a combination of biodiversity score, threat score, and protection score.

The biodiversity score (scale of 1 to 10; see Table 1, last column for classification of scores) is an average of the scores for three factors: size, quality, and landscape integrity with the landscape integrity score down-weighted by 0.5 to account for uncertainty/confidence in the accuracy of that layer (Rondeau et al. 2012, p. 112 and 183). If the quality score was Unknown, then the size score was substituted to get the average.

Size Score

Species size scores are based on the average of scaled scores for species range, occupied area, and number of occurrences. Range, occupied area, and number of occurrences are transformed to a scale of 1 to 10 using the equation for a line of best fit (see figures below) through the range of values used in Natural Heritage methodology (Rondeau et al. 2012, p. 181-182).

Species Range Score

All EO polygons are input into a GIS tool to generate a minimum bounding geometry that represents the documented range for each species in square miles. The range values are converted to Range Scores on a scale from 1 to 10 using the formula from CNHP (Rondeau et al. 2012, p. 185) in Figure 2.

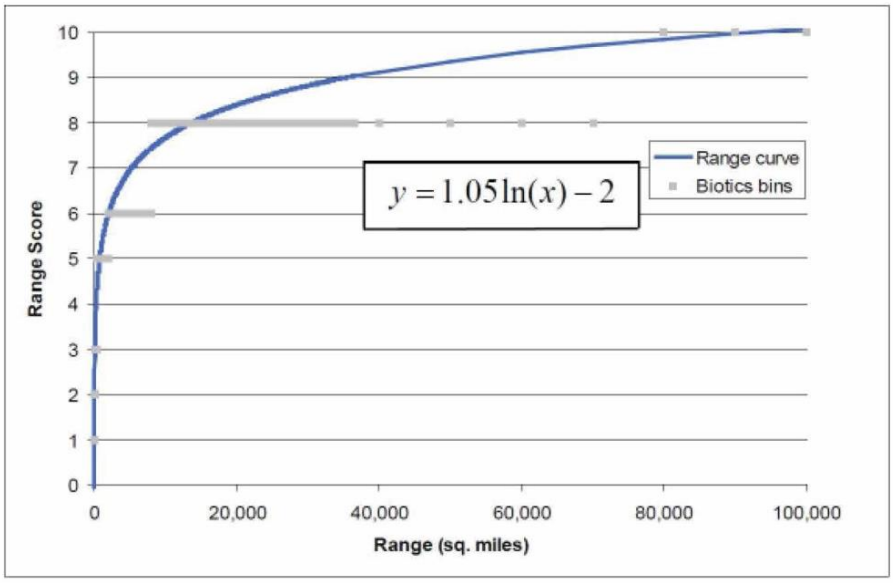

Figure 2. Line of best fit of species range values using NatureServe bins for species ranges scaled to a Range Score between one and ten (from CNHP 2012 Fig. E-6).

Occupied Area Score

The area of all EO polygons is summed per species to estimate occupied area in acres. These values are also converted to a score of 1 to 10 (see Table 1 for classification of scores) using the formula from CNHP (Rondeau et al. 2012, p. 184) in Figure 3.

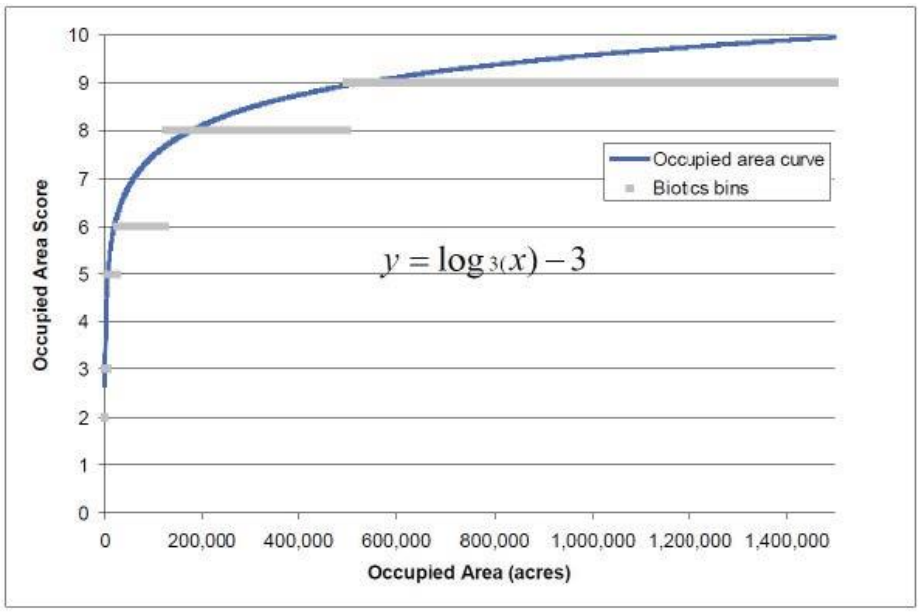

Figure 3. Line of best fit of species occupied area based on NatureServe values scaled to a Occupied Area Score between one and ten (from Rondeau et al. 2012; Fig .E-4).

Number of Occurrences

The number of EOs for each species (excluding extirpated EOs) is converted to a score using the formula from CNHP (Rondeau et al. 2012, p. 183) in Figure 4.

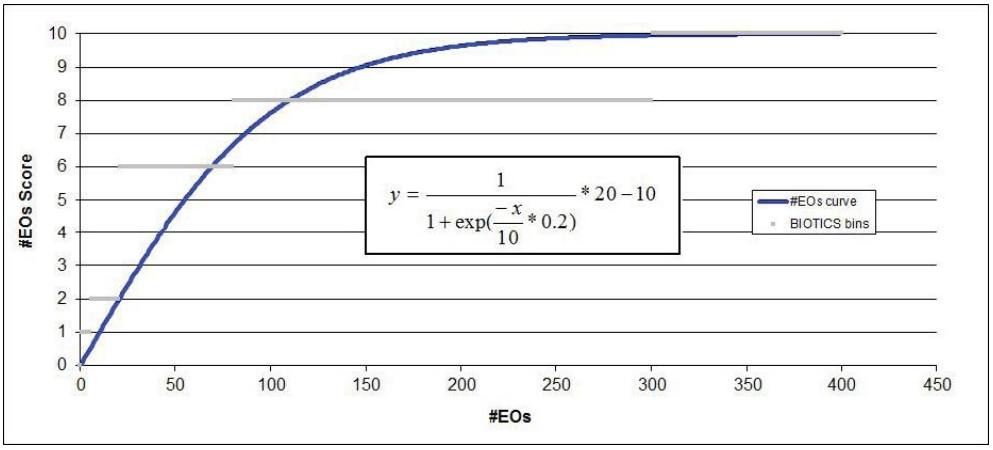

Figure 4. Line of best fit of number of species occurrences based on NatureServe values where the score is on a scale of one and ten (from Rondeau et al. 2012; Fig E-2).

Quality Score

EO quality is the proportion of EOs that have an EO rank of A or B. EO rank is assessed based on information provided about the threats and population size by observers (Hammerson et al. 2008). The proportion of EOs with A or B ranks is converted to a scale of 0 to 10 for scoring purposes by multiplying the proportion by 10. A score of 10 means 100% of EOs have an EO rank of A or B. If greater than 80% of EOs had ranks of E (extant, not enough info to rank viability) or H (historic, last observation > 35 years old), then the quality was listed as Unknown.

An A-rank or Excellent Estimated Viability is assigned when the population is considered to have optimal numbers of individuals that are in excellent condition suggesting that the population can be sustained for the long term all else being equal;

B or Good Estimated Viability is assigned when numbers and conditions may not be optimal but the population is still considered viable.

C (Fair Estimated Viability) and D (Poor Estimated Viability) ranks are not counted in this score since they indicate lower quality EOs.

Landscape Integrity

We used the landscape integrity layer from the NMCHAT that was developed by NatureServe (Comer and Hak 2012), which captures the intensity of development (i.e. roads, urbanization, infrastructure). The values for intensity range from 0 to 10000. We used cutoffs to classify raster pixels into low (<500), medium (>500 and <4500), and high intensity (>4500). Cutoffs for classification of raster pixels were determined by inspection. EO polygons were intersected with the landscape integrity to get the percent of area per species that is in medium and high impact. These percentages were compared to Table E1 of CNHP (Rondeau et al. 2012) to score landscape integrity for each species (Figure 5).

Table E-1. Landscape Integrity Scores.

% acreage in High Impact	% acreage in Medium Impact	Interpretation	Score
50-100%	any	Poor integrity	0
25-50	50-100		1
25-50	25-50	Fair integrity	2
25-50	0-25		4
1-25	50-100	Good integrity	5
1-25	25-50		6
1-25	0-25	Very good integrity	8
<1	<5		10

Figure 5. Landscape integrity scoring table from CNHP (Rondeau et al. 2012).

Threat Score

The most severe/imminent *documented* threat for each species was identified from previous species conservation ranking efforts (East et al. 2016), expert opinion, survey and status reports, or the NM Rare Plant Technical Council website (NMRPTC) where available. The threat score is based on a combination of scope, severity, and immediacy for the documented threat. Scope, severity, and immediacy were classified according to rank calculator methodology (Faber-Langendoen et al. 2012, Table E-2/Figure 6). Scope is the proportion of the species affected by the threat. Severity is the degree to which the affected populations are impacted. Immediacy represents the time frame in which the threat is likely to be actualized. Table E-2 of CNHP (2012) was used to score each threat (

Figure 6). If no threat information was available or the NMRPTC website indicated that there were no apparent threats for a species then this factor is classified as “No information” and given a score of 10.

Table E-2. Threat summary table from BIOTICS.

Scope	Severity	Immediacy	Score	Description
High	High	High	0	Moderate to high, imminent threat for most (>60%) of population, occurrences, or area
High	High	Moderate		
High	Moderate	High		
High	Moderate	Moderate		
Moderate	High	High		

Figure 6. Scoring table for threats from CNHP (2012).

Protection Score

We modified the Protected Area Database (PAD) GIS layer by clipping it to New Mexico and applying the methodology of Supples et al. (2007) to assess protection status per parcel of managed land. Protection scores are assessed as a combination of three indicators: management Intent, Tenure, and Potential Management Effectiveness (PME) (Supples et al. 2007). Intent is defined as the explicit objectives for protection and management of each land parcel. Tenure is a measure of protection permanence. PME is the ability of the land manager to implement actions as outlined in the management Intent. For each parcel, Intent is assigned as Very Good, Good, Fair or Poor (see Table 1 in Supples et al. 2007). Intent is inferred from GAP status codes in PAD or local knowledge. Tenure is assigned on the same scale as Intent and is also inferred from the GAP status codes (see Table 5 of Supples et al. 2007). PME is assigned on the same scale as the other two indicators but is assigned according to the perceived capacity of each 'managing entity' to take actions to fulfill designated intent (see Table 6 of Supples et al. 2007).

Scores for all three indicators are compared to the tables below to assign a Protection Score to each parcel (Table 2 and Table 3, from p. 16 of Supples et al. 2007). Protection statuses are Poor (score of 0), Unknown (2), Fair (4), Good (7), or Very Good (10). For example, BLM National Monuments are assigned Intent = Good, Tenure = Very Good, and PME = Good which becomes Protection Score = Very Good (10).

Table 2. This matrix represents the combination of *management intent* and *PME* scores (from Supples et al. 2007).

	Intent VG	Intent G	Intent F	Intent P
Pot mgmt VG	very good	Good	good	poor
Pot mgmt G	good	Good	fair	poor
Pot mgmt F	fair	Fair	poor	poor
Pot mgnt P	fair	Poor	poor	poor

Table 3. This matrix represents the relationships between the score in Table 2 and *conservation tenure* (from Supples et al. 2007).

	Tenure VG	Tenure G	Tenure F	Tenure P
Table 2: VG	CMS - very good	CMS – good	CMS - fair	CMS – poor
Table 2: G	CMS – very good	CMS – good	CMS - fair	CMS – poor
Table 2: F	CMS – fair	CMS – fair	CMS - poor	CMS – poor
Table 2: Poor	CMS – poor	CMS – poor	CMS - poor	CMS – poor

Finally, we intersected the EO Polygons with this modified PAD layer featuring protection scores to get an area-weighted average protection score per species.

Overall Conservation Status

To assign the Overall Conservation Status for each species, biodiversity, protection, and threat scores are color coded according to Table 1 and then those three color codes are referenced using the key in Table 2 developed by CNHP (2012, p.112-113)

Table 1. Color code key for assigning level of concern per factor (from p.112 of CNHP 2012).

Color code	Threats Score and Landscape Integrity Score	Size, Quality, Protection Status, and Energy Development Potential Scores
Red (most at risk)	0	0-1.9
Orange	2-4	2.0-2.9
Yellow	5-6	3.0-4.9
Green (least at risk)	8-10	5.0-10

Table 2. Key for assigning overall conservation status using the color codes assigned to threat status, biodiversity, and protection scores.

IF	AND	AND	THEN
Threat Status	Biodiversity	Protection	Overall Conservation Status
R	R O	R O	Under Conserved
R	Y G	R O	
R	R	Y G	
O	R	R O	
O	R	Y G	
O	O	R O	
O	O	Y G	Weakly Conserved
R	O	Y G	
R	Y G	Y G	
O	Y G	R O	
Y	R O	R O	
G	R O	R O	
G	Y	R O	
O	Y	Y	
O	G	Y	Moderately Conserved
O	Y	G	
O	G	G	
Y	R O	Y G	
Y	Y G	R O	
G	R O	Y G	
G	G	R O	
Y	Y	Y	
Y	G	Y	Effectively Conserved
Y	Y	G	
Y	G	G	
G	Y G	Y G	

Confidence

EO data accuracy and currency was assessed in three different categories (A, B, and C) to determine how much confidence we have in the underlying occurrence data.

Category A is the percent of EOs with uncertainty distance >1200 m (where uncertainty distance is a measure of mapping precision).
Category B is the percent of EOs that are historical (last observation >35 years).
Category C is the % of EOs with an EO rank of Extant which indicates not enough information was available to assess quality (see Quality score above).

Confidence was then assigned for each species using the percentages of EOs in the above three categories:

Very High = A, B, and C <10%,
High = A, B, and C ≤10-30%,
Moderate =A, B, or C ≤30-50%,
Low = A, B, or C >50%.

Ancillary Factors

The following factors do not affect the estimation of overall conservation status as outlined above. These ancillary factors are provided as additional information that may help managers working to conserve the species in the list. These will appear at the end of the scorecard.

Actions Needed

We listed proposed actions to benefit species conservation goals by identifying where knowledge gaps existed and management needs were documented in NMRPTC species accounts (nmrareplants.unm.edu), identified by species specialists, or in species survey and status reports.

Potential Threats

Where information is available (see threat score above) additional threats to a given species were identified. For these threats, scope, severity, and immediacy are not attributed. Potential threats are based on knowledge about current land use patterns and biological and climatic factors that are assumed, but have not been properly documented (e.g. livestock impacts, pollinator decline, impacts from invasive species, climate change, predation, etc).

Percent Range NM

We estimated the percent of each species global range that was in New Mexico where global range estimates existed in NatureServe species accounts. The number of EOs and range in NM were compared to global range and/or EO numbers.

Ownership

In GIS, species locations (EOs) were intersected with an ownership layer to determine what percentage of known populations for a species fall under each major land owner's jurisdiction. The percentage of EOs per land owner is provided at the end of the scorecard with a column for each land owner (BLM = Bureau of Land Management, BOR = Bureau of Reclamation, DOA = U.S. Department of Agriculture, DOD = U.S. Department of Defense, DOE = U.S. Department of Energy, FS = Forest Service, FWS = U.S. Fish and Wildlife Service, I = Tribal, NPS = National Park Service, P = Private, S = State Trust, SGF = New Mexico Department of Game and Fish, SP = New Mexico State Parks).

Oil and Gas Development Potential

A layer of oil and gas development potential from the Bureau of Land Management in New Mexico was used to assign a score from low to high for each species whose distribution overlaps oil and gas lease areas. The GIS layer from BLM include polygons with designations of expected development potential (high, moderate, or low) Surface ownership in the GIS layer coverage includes BLM, State, tribal, and private lands. We used ArcGIS to calculate the area-weighted average score per species. If no score is provided, then the species distribution lies outside of expected future BLM oil and gas development.

Oil and Gas – Current

Because the GIS layer for oil and gas potential does not incorporate existing leases and wells we acquired active well locations (New Mexico Energy, Minerals, and Natural Resources Department) and current BLM leases. The well locations were buffered by 100m and then well and lease polygons were intersected with plant EO data to get a list of species occurring in current oil and gas development. We scored each species as 'yes' or 'no' for occurrence within either existing well pads or current leases.

Wind Potential

We downloaded a GIS layer for wind energy potential based on models of annual mean wind speed (NREL 2010). We reclassified the wind power classes (1 through 7) into 0 = No or Low Potential (wind power classes 1 through 3) and 1 = Moderate to High Potential (wind power classes 4 through 7). Wind potential is based on modeled wind

speed thus we intersected species occurrence data with the reclassified wind potential and scored each species as ‘yes’ or ‘no’ according to whether or not any occurrences were in moderate to high wind production areas.

Mining

Active and abandoned mine locations were obtained from New Mexico Energy, Minerals, and Natural Resources Department. We buffered point data by 1000m and then intersected plant EOs to score each species as ‘yes’ or ‘no’ for occurrence in areas of mining activity.

Grazing

Grazing allotments were acquired from the BLM state office and the online GIS portal for each U.S. Forest Service unit in New Mexico. Allotment polygons were intersected with plant EO data to score each species as ‘yes’ for grazing impacts. Species that occurred outside of grazing allotments on private, state, or tribal lands are scored as ‘potential’ in this column since grazing status is probable but unknown. Lastly, any species occupying habitats that are inaccessible to livestock or occur on lands known to be protected from grazing are listed as ‘no’ in this column.

Species Lists

Based on data availability and expert opinion we split the 235 species into 4 lists. List A contains species where there were sufficient data to use the scorecard methods above and for which there was moderate to very high confidence in the data (see section on confidence). List B contains species for which there were sufficient data to generate an overall conservation status but the confidence was low. List B species are assigned a Modified Conservation Status due to the uncertainty indicated by low confidence—the Modified Conservation Status is assigned as two levels below the unmodified score such that if a species assessed as Effectively Conserved with a low confidence score is given a Modified Conservation Status of Weakly Conserved. List C contains species where there were not sufficient data to generate a conservation status using the methods above. List C species are classified as Weakly Conserved based on expert opinion until further data are collected. List D contains species that are regional endemics for which existing data indicates they are stable and not a current conservation priority.

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