Section IV. Assessments of Species and Species Assemblages

Chapter 27. Pygmy Rabbit

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Distribution and Ecology

The pygmy rabbit is the smallest member of the Leporidae family (rabbits and hares) in North America. The species is considered a sagebrush-obligate because of its close association with sagebrush shrublands. The pygmy rabbit's overall range coincides with sagebrush across portions of California, Oregon, Nevada, Utah, Wyoming, Montana, Idaho, and some adjacent intermountain areas (Larrucea and Brussard, 2008a; U.S. Fish and Wildlife Service, 2010). In the Wyoming Basin, pygmy rabbits are generally restricted to the southwestern portion of the ecoregion. There is concern that the pygmy rabbit has undergone range contractions and population declines due to anthropogenic activities, although existing information is insufficient for ascertaining trends (U.S. Fish and Wildlife Service, 2010).

In 2003, a disjunct pygmy rabbit population in the Columbia Basin in Washington was listed as endangered under the U.S. Endangered Species Act (U.S. Fish and Wildlife Service, 2003). Subsequently, the species was petitioned for listing throughout its range; the population in southwestern Wyoming was considered separately because the distribution in the region was poorly described and large-scale energy development was perceived as a potential threat (U.S. Fish and Wildlife Service, 2010). The final decision found that listing was "not warranted" either throughout the range or in specific regions (U.S. Fish and Wildlife Service, 2010); however, the species continues to be the focus of survey and research efforts to better understand its life history, habitat needs, and factors that limit its dispersal and survivorship.

Pygmy rabbits are typically found in relatively tall, dense stands of big sagebrush, which provides both food and year-round escape and thermal cover (U.S. Fish and Wildlife Service, 2010). During the winter, sagebrush composes 82–99 percent of the pygmy rabbit's diet (Green and Flinders, 1980; Thines and others, 2004). During the breeding and brood-rearing season (spring and summer), pygmy rabbits preferentially feed on native bunch grasses and forbs, although sagebrush remains an important component of their diet (Green and Flinders, 1980).

Pygmy rabbits are somewhat unique among Leporids in that reproductive potential is relatively low, and it is one of only two North American Leporids that digs its own burrows (U.S. Fish and Wildlife, 2010). The rabbits use their burrow systems to escape from predators and inclement weather, juveniles in particular, but adults also may rely on burrows for thermal cover in winter. Burrows are generally found in relatively loose, deep, sandy loams of aeolian or alluvial origin. The loose, deep soil structure likely permits burrowing activity and burrow drainage, and the clay component may be important to maintain integrity of the burrow structure. More study is needed, however, to determine the acceptable range of soil textures and maximum proportion of rock fragments associated with burrow development and longevity. Purcell (2006) documented that concentrations of phosphorous, potassium, magnesium, calcium, and sodium varied among sites occupied by pygmy rabbits and unoccupied sites, and speculated that pygmy rabbits were selecting for sites that optimized nutrient availability in vegetative food sources.

Predators of pygmy rabbits include badgers, long-tailed weasels, coyotes, bobcats, great horned and long-eared owls, ferruginous hawks, northern harriers, and common ravens (U.S. Fish and Wildlife Service, 2010). In the Great Basin, annual mortality rates have ranged from 27 to 89 percent due to predation on young and (or) adult rabbits (Sanchez, 2007; Crawford and others, 2010; Price and others, 2010). Sanchez (2007) and Crawford and others (2010) reported that the most common predators were avian and mammalian, including coyotes and weasels. One study also noted that mortality rates peaked when migratory raptors returned in spring and when mammalian and avian predators begin to feed young (Sanchez, 2007).

Landscape Structure and Dynamics

Pygmy rabbit habitat is often patchy due to the heterogeneous distribution of dense sagebrush and soils required by the rabbits (Green and Flinders, 1980; Katzner and Parker, 1997). Sites with the appropriate vegetative and soil characteristics tend to occur in association with specific landscape features, including permanent and intermittent stream corridors, alluvial fans, and sites where winds have deposited fine particles resulting in deeper soils and associated denser sagebrush (Dobler and Dixon, 1990; U.S. Fish and Wildlife Service, 2003). Large, dense patches of sagebrush preferred by pygmy rabbits are more common in the Wyoming Basin west of the Continental Divide than on the eastern side, where snowfall is less reliable and the distribution of sagebrush shrublands tends to be more heterogeneous (Knight, 1994).

The patchy distribution of suitable pygmy rabbit habitat in combination with a pattern of rapid colonization and extirpation (Price and others, 2010) suggests that connectivity between habitat patches is important to maintaining population persistence (Hanski, 1999). Estimates of dispersal distances vary greatly and are strongly influenced by rabbit gender. Maximum dispersal distances for radio-collared juvenile pygmy rabbits in Idaho were 6.5 kilometers (km) (4.0 miles [mi]) and 11.9 km (7.4 mi) for males and females, respectively (Estes-Zumpf and Rachlow, 2009). Although pygmy rabbits establish small home ranges (0.05–20 hectares (ha) [0.12–49.9 acres]) in areas with a high percent of sagebrush cover, during dispersal or when translocated, they may traverse larger areas with minimal sagebrush cover (Estes-Zumpf and Rachlow, 2009; Lawes and others, 2012).

A study in Idaho indicated that pygmy rabbits were absent from locations where recent fires and agricultural development had removed sagebrush cover (Rachlow and Svancara, 2006). Prior to Euro-American settlement, the primary disturbance factor influencing the spatial distribution of dense sagebrush patches was fire (see Chapter 11—Sagebrush Steppe for discussion of historical fire regime). The historical pattern of infrequent, large fires with multicentury fire rotations allowed mature sagebrush to dominate for prolonged periods (Baker, 2011). Following extensive fires, it can take many decades for sagebrush shrublands to return to prefire densities (Bukowkski and Baker, 2013). The extensive and highly connected sagebrush landscapes prior to Euro-American settlement likely would have helped buffer populations from habitat loss resulting from large fires.

Change Agents

Development

Energy and Infrastructure

Pygmy rabbits may tolerate limited levels of energy development (Estes-Zumpf and others, 2009); however, an ongoing study from Wyoming indicates that pygmy rabbit site occupancy is negatively related to the densities of gas well pads and gas field roads (Stephen Germaine, Ecologist, U.S. Geological Survey, unpub. data, 2012). Site occupancy was only 6 percent in areas where well densities were >7.7 wells/square kilometer (km^2) (20 wells/square mile [mi^2]), whereas site occupancy was about 50 percent where well densities were <1.9 wells/km^2 (4.9 wells/mi^2) and in undeveloped sites.

The size and density of roads can affect dispersal, survival, and gene flow of pygmy rabbits. Large highways have been shown to impede pygmy rabbit movement and dispersal (Lawes and others, 2012; Thimmayya and Buskirk, 2012) and may inhibit translocated rabbits from returning to capture sites (Lawes and others, 2012); however, pygmy rabbits may readily cross gravel roads (Estes-Zumpf and Rachlow, 2009). Genetic analysis also indicates that large highways can serve as barriers to movement. In Wyoming, gene flow was measurably reduced by a four-lane highway, but in Idaho and Wyoming, two-lane highways had limited effect on gene flow and genetic differentiation (Estes-Zumpf and others, 2010; Thimmayya and Buskirk, 2012). Survival also may be negatively affected by roads (Lawes and others, 2012).

Infrastructure associated with energy development provides roosting and nesting substrates (for example, transmission poles, and storage structures) for avian predators. Common raven abundance was greater near anthropogenic structures in Wyoming (Bui and others, 2010) and the Mojave desert (Kristan and Boarman, 2007), and in Nevada, the abundance of various avian predators that prey on pygmy rabbits increased with increasing density of anthropogenic structures (Larrucea, 2007). Increased road density may enhance local populations of potential predators, including mesocarnivores. In Utah, for example, the abundance of pygmy rabbits and the number of active pygmy rabbit burrows were lower near sagebrush habitat edges, whereas predators and potential resource competitors (cottontail rabbits and jackrabbits) were higher near edges (Pierce and others, 2011).

Agricultural Activities

Agricultural conversion and habitat manipulation for livestock, such as chaining or prescribed burns, contribute to habitat loss and fragmentation (Estes-Zumpf and others, 2010). Because sagebrush shrublands in deeper soils are the most productive areas for agriculture, more of these sites, which are often preferred by pygmy rabbits, have been converted to agriculture than sites less preferred by the rabbits (White and Bartels, 2002). There is also evidence that agricultural development may impede pygmy rabbit movements. Because pygmy rabbits do not appear to inhabit areas with sparse sagebrush cover, it has been surmised in the past that pygmy rabbit populations may become isolated when sagebrush cover is reduced (Weiss and Verts, 1984), and gene flow among pygmy rabbit populations separated by agricultural fields may be lower than it is for populations separated by roads or other types of unsuitable habitat (Estes-Zumpf and others, 2010). On the other hand, studies have shown that pygmy rabbits often move >1 km (0.62 mi) across areas with little sagebrush cover (Estes-Zumpf and Rachlow, 2009; Lawes and others, 2012), and there was little genetic differentiation among pygmy rabbit populations across wide regions of southern Wyoming and eastern Idaho (Estes-Zumpf and others, 2010; Thimmayya and Buskirk, 2012). The degree to which pygmy rabbit populations are isolated by areas of unsuitable breeding habitat is unclear, and populations may persist within a given region if large areas of sagebrush shrublands remain intact and development does not substantially reduce their movements among sites (U.S. Fish and Wildlife Service, 2010).

Livestock grazing occurs throughout pygmy rabbit habitat, and a summary of studies across the pygmy rabbit's range indicated that pygmy rabbits often occupy areas used for livestock (U.S. Fish and Wildlife Service, 2010). In California and Nevada, when all land variables were considered, 62 percent of sites that showed evidence of current pygmy rabbit activity also were grazed by livestock (Larrucea and Brussard, 2008a). Livestock grazing may be compatible with pygmy rabbit occupancy if livestock are stocked at levels low enough to avoid reductions in cover of sagebrush or soil compaction (Larrucea, 2007; U.S. Fish and Wildlife Service, 2010). However, livestock animals have been reported trampling pygmy rabbit burrows in Montana (Rauscher, 1997) and Idaho (Austin, 2002), although in many areas burrows remained intact when livestock were present (U.S. Fish and Wildlife Service, 2010). Overall, at high stocking levels, livestock grazing may be incompatible with pygmy rabbit occupancy if vegetation structure and composition are changed or trampling of burrows results in burrow collapse (U.S. Fish and Wildlife Service, 2010). Otherwise, livestock grazing may not pose a significant threat to pygmy rabbits (U.S. Fish and Wildlife Service, 2010).

Altered Fire Regime

In the Wyoming Basin, current fire regimes appear consistent with the historical fire regimes (Bukowski and Baker, 2013). Loss of large areas of sagebrush cover, however, coupled with the long recovery times of sagebrush systems (Bukowski and Baker, 2013), would negatively affect pygmy rabbit populations (Knick and Rotenberry, 1997).

Invasive Species

Cheatgrass is one of the most prevalent invasive species within the range of the pygmy rabbit and has potential to affect pygmy rabbits in several ways. First, it may result in reduced amounts of succulent vegetation available to pygmy rabbits during the breeding season when forbs and grasses are an important part of their diet (Green and Flinders, 1980). This could occur through competition between cheatgrass and other herbaceous plants (Melgoza and others, 1990), and because cheatgrass senesces very early and may be unpalatable to pygmy rabbits throughout much of their breeding season. Second, high-density stands of cheatgrass may reduce the ability of pygmy rabbits to detect and evade predators (Weiss and Verts, 1984). Finally, cheatgrass can promote frequent, large fires that kill sagebrush, thereby reducing the amount of pygmy rabbit habitat across large regions (Paige and Ritter, 1999).

Climate Change

Changes in climate that affect sagebrush distributions could affect pygmy rabbits. There is also evidence that increased temperatures could have negative effects on pygmy rabbits. In a Nevada study, even after accounting for changes in vegetation and land use, there were more pygmy rabbit extirpations at low-elevation sites than at high-elevation sites (Larrucea and Brussard, 2008b). Between 1950 and the early 2000s, the mean elevational range of occupied sites increased by 157 meters (m) (515.1 feet [ft]) (Larrucea and Brussard, 2008b), which closely corresponds to the 117 m (383.9 ft) elevational increase expected if rabbits are responding to the observed rise (0.7 °C; 1.3 °F) in global temperature over the past century (McCarty, 2001).

Rapid Ecoregional Assessment Components Evaluated for Pygmy Rabbit

A generalized, conceptual model was used to highlight some of the key ecological attributes and Change Agents affecting pygmy rabbits (fig. 27–1). Key ecological attributes addressed by the REA include (1) the distribution of pygmy rabbit habitat, (2) landscape structure (patch sizes and structural connectivity), and (3) landscape dynamics (fire and sagebrush-juniper ecotone dynamics; table 27–1). The Change Agents evaluated include development and climate change (table 27–2). Ecological values and risks used to assess the conservation potential of pygmy rabbit habitat by township are summarized in table 27–3. Core and Integrated Management Questions and the associated summary maps and graphs are provided in table 27–4.

Methods Overview

We developed a general habitat model for pygmy rabbits by using MaxEnt software (Phillips and others, 2006). Values of vegetation and abiotic variables at 3,066 mapped pygmy rabbit locations in Wyoming were derived from data sources in table 27–1. Variables with the greatest weight included the average temperature of the coldest quarter, annual mean temperature, sagebrush cover, and the percent of sand in the soil. The map of potential pygmy rabbit habitat used MaxEnt parameter threshold values that included 95 percent of the locations (omission rate of 5 percent). The distribution map was used to quantify attributes of baseline pygmy rabbit habitat within the region.

We assessed development levels in pygmy rabbit habitat using the Terrestrial Development Index (TDI) map, and then used the resulting output to calculate patch size and connectivity metrics. We mapped the structural connectivity of relatively undeveloped habitat (TDI score $\leq$1 percent) at three interpatch distances derived from connectivity analysis: local (2.43 km [1.51 mi]), landscape (4.32 km [2.68 mi]), and regional (6.75 km [4.19 mi]) levels. We used development levels to identify areas that may function as barriers or corridors by overlaying relatively undeveloped habitat patches on the TDI map. The perimeters of fires in pygmy rabbit habitat since 1980 were compiled from several data sources to assess fire frequency and extent (see table 27–1).

Landscape-level ecological values (area of habitat) and risk (TDI score) were compiled into an overall index of conservation potential for each township (table 27–3). Conservation potential was summarized by township based on overall landscape-level values and risks (table 27–3). Landscape-level values and risks, and conservation potential rankings are intended to provide a synthetic overview of the geospatial datasets developed to address Core Management Questions in the REA. Because rankings are very sensitive to the input data used and the criteria used to develop the ranking thresholds, they are not intended as stand-alone maps. Rather, they are best used as an initial screening tool to compare regional rankings in conjunction with the geospatial data for Core Management Questions and information on local conditions that cannot be determined from regional REA maps. See Chapter 2—Assessment Framework and the Appendix for additional details on the methods.

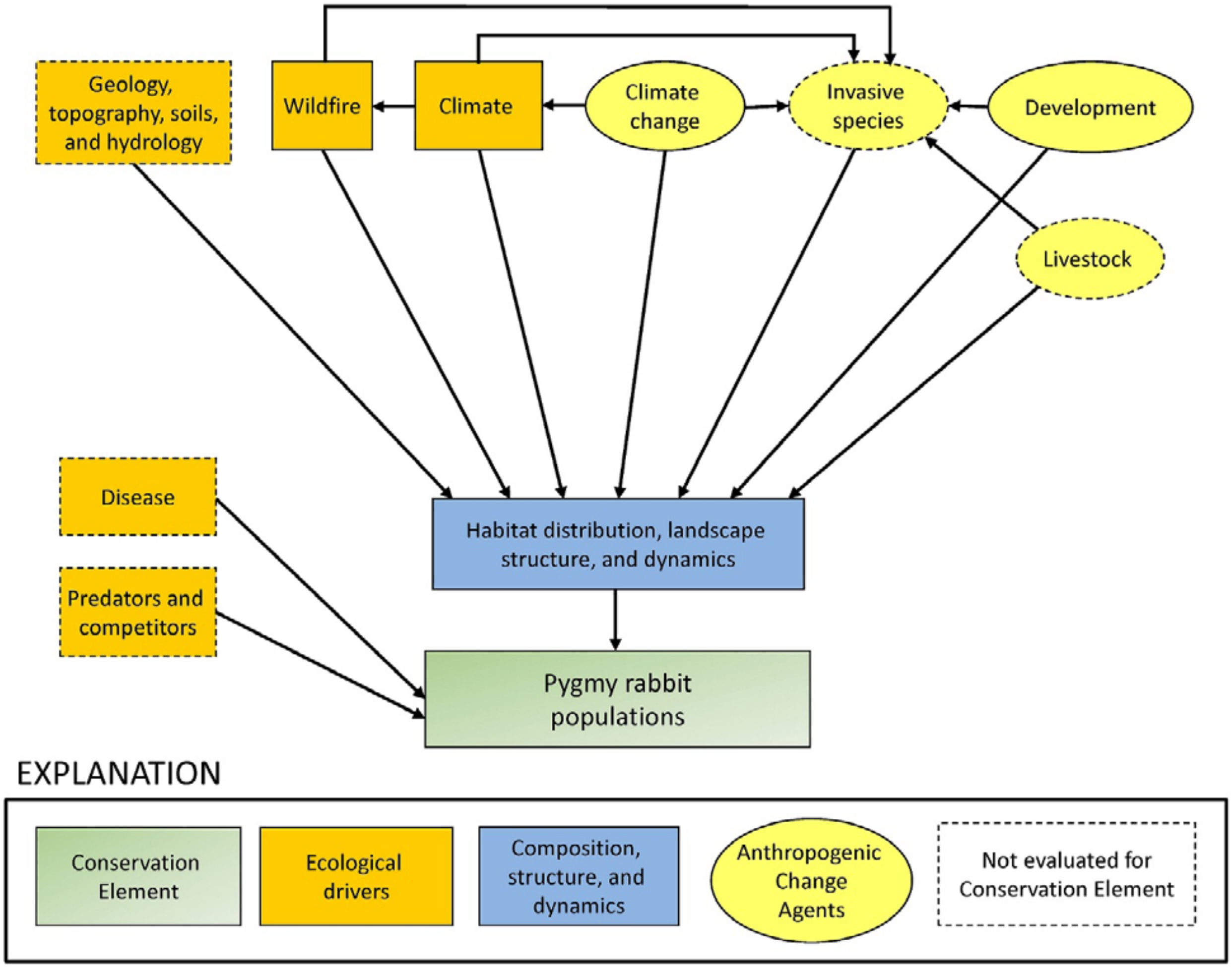

Figure 27–1. Generalized conceptual model of pygmy rabbit habitat for the Wyoming Basin Rapid Ecoregional Assessment (REA). Biophysical attributes and ecological processes regulating the occurrence, structure, and dynamics of pygmy rabbit habitat are shown in orange rectangles; additional ecological attributes are shown in blue rectangles; and key anthropogenic Change Agents are shown in yellow ovals. The dashed lines indicate components not addressed by the REA. Livestock and invasive plants are Change Agents that were not evaluated due to the lack of regionwide data.

Table 27–1. Key ecological attributes and associated indicators of baseline pygmy rabbit habitat[1] for the Wyoming Basin Rapid Ecoregional Assessment.

[km, kilometer; mi, mile]

Attributes	Variables	Indicators
Amount and distribution of habitat	Total area	Habitat distribution derived from vegetation and abiotic variables[2]
Landscape structure	Patch size	Patch-size frequency distribution
	Structural connectivity[3]	Interpatch distances that provide an index of structural connectivity for baseline patches at local (0.09 km; 0.06 mi), landscape (0.18 km; 0.11 mi), and regional (0.36 km; 0.22 mi) levels
Landscape dynamics	Fire occurrence[4]	Locations of fires and annual area burned since 1980
	Sagebrush-juniper ecotone dynamics	See Chapter 17—Juniper Woodlands

[1] Baseline conditions are used as a benchmark to evaluate changes in the amount and landscape structure of habitat due to Change Agents. Baseline conditions are defined as the potential current distribution of pygmy rabbit habitat derived from abiotic and biotic variables without explicit inclusion of Change Agents (see Chapter 2—Assessment Framework).

[2] Habitat modeled using MaxEnt; occurrence data from the Wyoming Natural Diversity Database; habitat variables derived from SAGEMAP (Hanser and others, 2011), and Homer and others (2012).

[3] Structural connectivity refers to the relative proximity of patches at local, landscape, and regional levels but does not reflect species-specific measures of connectivity. See Chapter 2—Assessment Framework.

[4] See Wildland Fire section in the Appendix.

Table 27–2. Anthropogenic Change Agents and associated indicators influencing pygmy rabbit habitat for the Wyoming Basin Rapid Ecoregional Assessment.

[km^2, square kilometer; mi^2, square mile]

Change Agents	Variables	Indicators
Development	Terrestrial Development Index[1]	Percent of pygmy rabbit habitat in seven development classes using a 16-km^2 (6.18-mi^2) moving window
		Patch-size frequency distribution for pygmy rabbit habitat that is relatively undeveloped or has low development scores compared to baseline habitat[1]
		Interpatch distances that provide an index of structural connectivity for relatively undeveloped patches at local (2.43 km; 1.51), landscape (4.32 km; 2.68 mi), and regional (6.75 km; 4.19 mi) levels
Climate change	Potential changes in sagebrush shrublands	See Chapter 11—Sagebrush Steppe

[1] See Chapter 2—Assessment Framework.

Table 27–3. Landscape-level ecological values and risks for pygmy rabbit habitat. Ranks were combined into an index of conservation potential for the Wyoming Basin Rapid Ecoregional Assessment.

		Relative rank			
	Variables[1]	Lowest	Medium	Highest	Description[2]
Values	Area	<9	9−45	>45	Percent of township modeled as pygmy rabbit habitat
Risks	Terrestrial Development Index (TDI)	<1	1–3	>3	Mean TDI score by township

[1] Township was used as the analysis unit for conservation potential on the basis of input from the Bureau of Land Management. A minimum area threshold of total area per township was established for pygmy rabbit habitat to minimize the effects of extremely small areas and put greater emphasis on large areas (see table A–19 in the Appendix).
[2] See tables 27–1 and 27–2 for description of variables.

Table 27–4. Management Questions addressed for pygmy rabbit for the Wyoming Basin Rapid Ecoregional Assessment.

Core Management Questions	Results
Where is baseline pygmy rabbit habitat, and what is the total area?	Figure 27–2
Where does development pose the greatest threat to baseline pygmy rabbit habitat, and where are the relatively undeveloped areas?	Figures 27–3 and 27–4
How has development fragmented baseline pygmy rabbit habitat, and where are the large, relatively undeveloped patches?	Figures 27–5 and 27–6
How has development affected structural connectivity of pygmy rabbit habitat relative to baseline conditions?	Figure 27–7
Where are potential barriers and corridors that may affect animal movements among relatively undeveloped habitat patches?	Figure 27–8
Where have recent fires occurred in baseline pygmy rabbit habitat, and what is the total area burned per year?	Figures 27–9 and 27–10
Integrated Management Questions	**Results**
How does risk from development vary by land ownership or jurisdiction for pygmy rabbit habitat?	Table 27–5, Figure 27–11
Where are the townships with the greatest landscape-level ecological values?	Figure 27–12
Where are the townships with the greatest landscape-level risks?	Figure 27–12
Where are the townships with the greatest conservation potential?	Figure 27–13

Key Findings for Management Questions

Where is baseline pygmy rabbit habitat, and what is the total area (fig. 27–2)?

- Potential pygmy rabbit habitat totals 23,950 km^2 (9,247.2 mi^2) or 13.4 percent of the Wyoming Basin.
- Pygmy rabbit habitat is widely distributed across the southwestern portion of the Wyoming Basin, but small patches of potential habitat are predicted to occur in the northern portion of the Basin (fig. 27–2). Pygmy rabbits have been documented in the Bighorn Basin, but coordinates of the locations were too imprecise to include in the MaxEnt model (thus, the distribution of pygmy rabbit habitat in the northern portion of the Basin has high uncertainty).

Where does development pose the greatest threat to baseline pygmy rabbit habitat, and where are the relatively undeveloped areas (figs. 27–3 and 27–4)?

- Approximately 20 percent of potential pygmy rabbit habitat in the Basin is relatively undeveloped (TDI score ≤1 percent), and 35 percent had high levels of development, as indicated by TDI scores >5 percent (fig. 27–4).
- Development scores are highest for pygmy rabbit habitat in Utah and Idaho, the northern and western portions of the Green River Basin, and near Wamsutter, Wyo. (fig. 27–3).
- Development scores for pygmy rabbit habitat are similar to those for sagebrush shrublands overall (see Chapter 11—Sagebrush Steppe).

How has development fragmented baseline pygmy rabbit habitat, and where are the large, relatively undeveloped patches (figs. 27–5 and 27–6)?

- Most of baseline pygmy rabbit habitat is found in 15 large patches >100 km^2 (38.6 mi^2) (figs. 27–5 and 27–6).
- Development has effectively fragmented pygmy rabbit into smaller patches relative to baseline conditions. Only 7.8 percent of relatively undeveloped areas occurs in patches >100 km^2 (38.6 mi) (fig. 27–5).
- There are no relatively undeveloped patches of potential pygmy rabbit habitat >1,000 km^2 (386.1 mi^2).

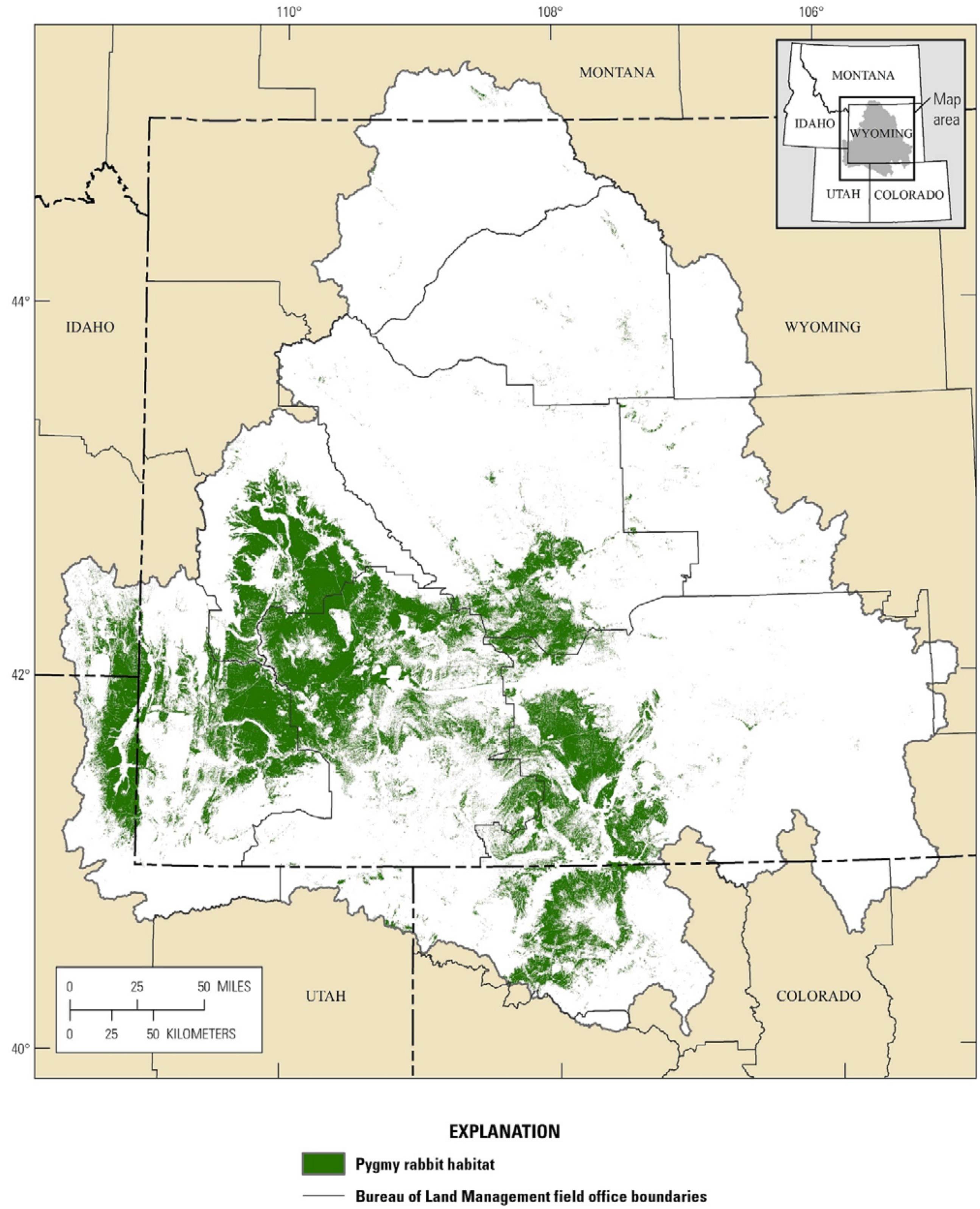

Figure 27–2. The distribution of baseline pygmy rabbit habitat in the Wyoming Basin Rapid Ecoregional Assessment project area.

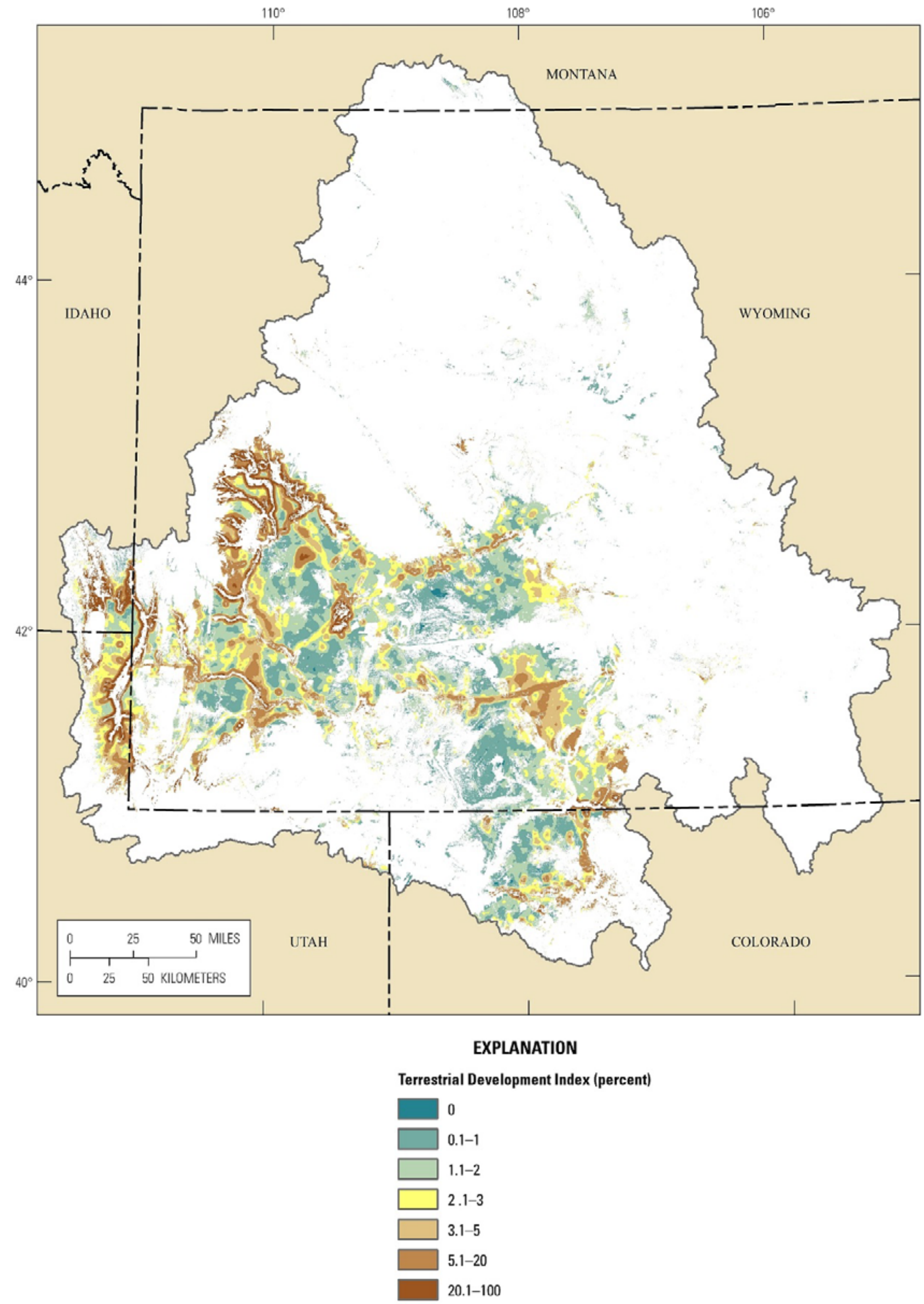

Figure 27–3. Terrestrial Development Index scores for pygmy rabbit habitat in the Wyoming Basin Rapid Ecoregional Assessment project area.

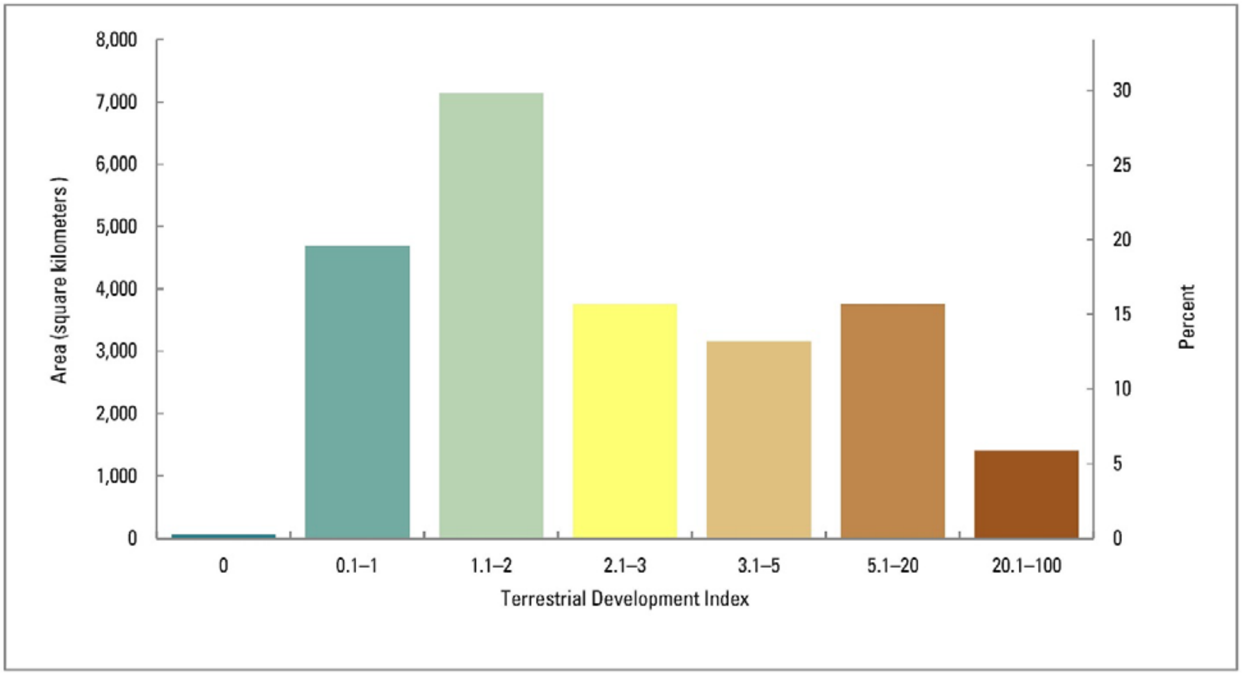

Figure 27–4. Area and percent of pygmy rabbit habitat as a function of the Terrestrial Development Index in the Wyoming Basin Rapid Ecoregional Assessment project area.

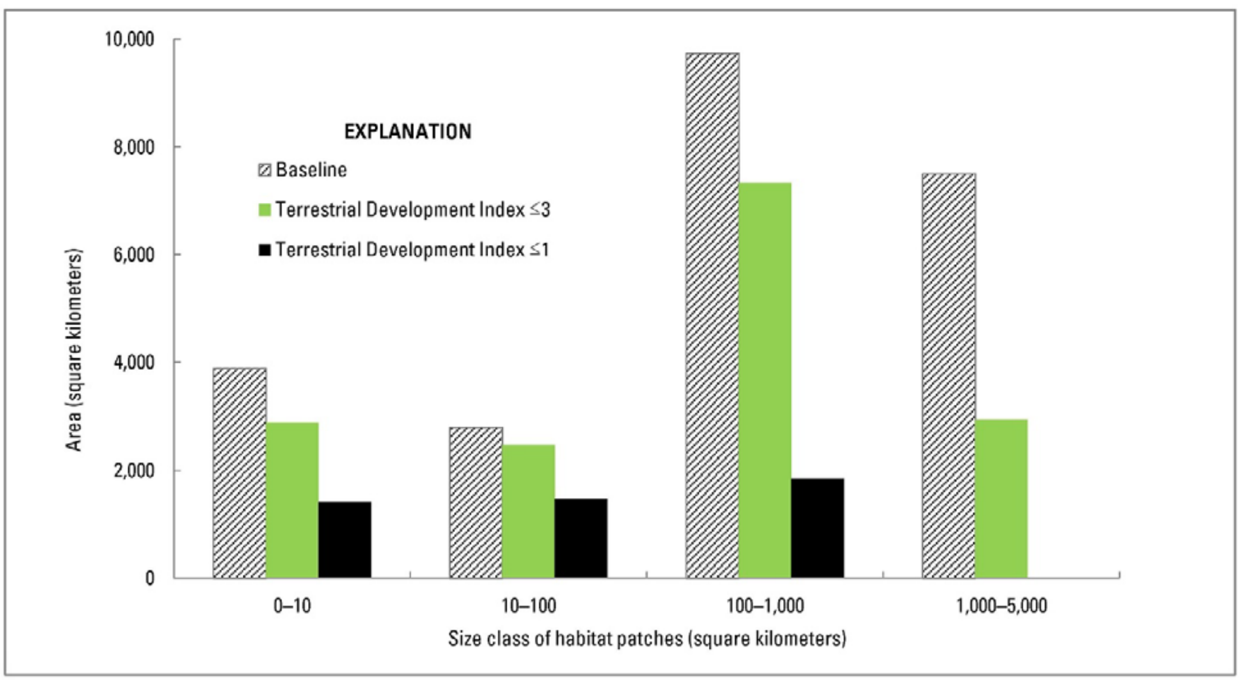

Figure 27–5. Pygmy rabbit habitat as a function of patch size for baseline conditions and for two development levels: (1) Terrestrial Development Index (TDI) score≤3 percent and (2) TDI score ≤1 percent (relatively undeveloped areas) in the Wyoming Basin Rapid Ecoregional Assessment project area.

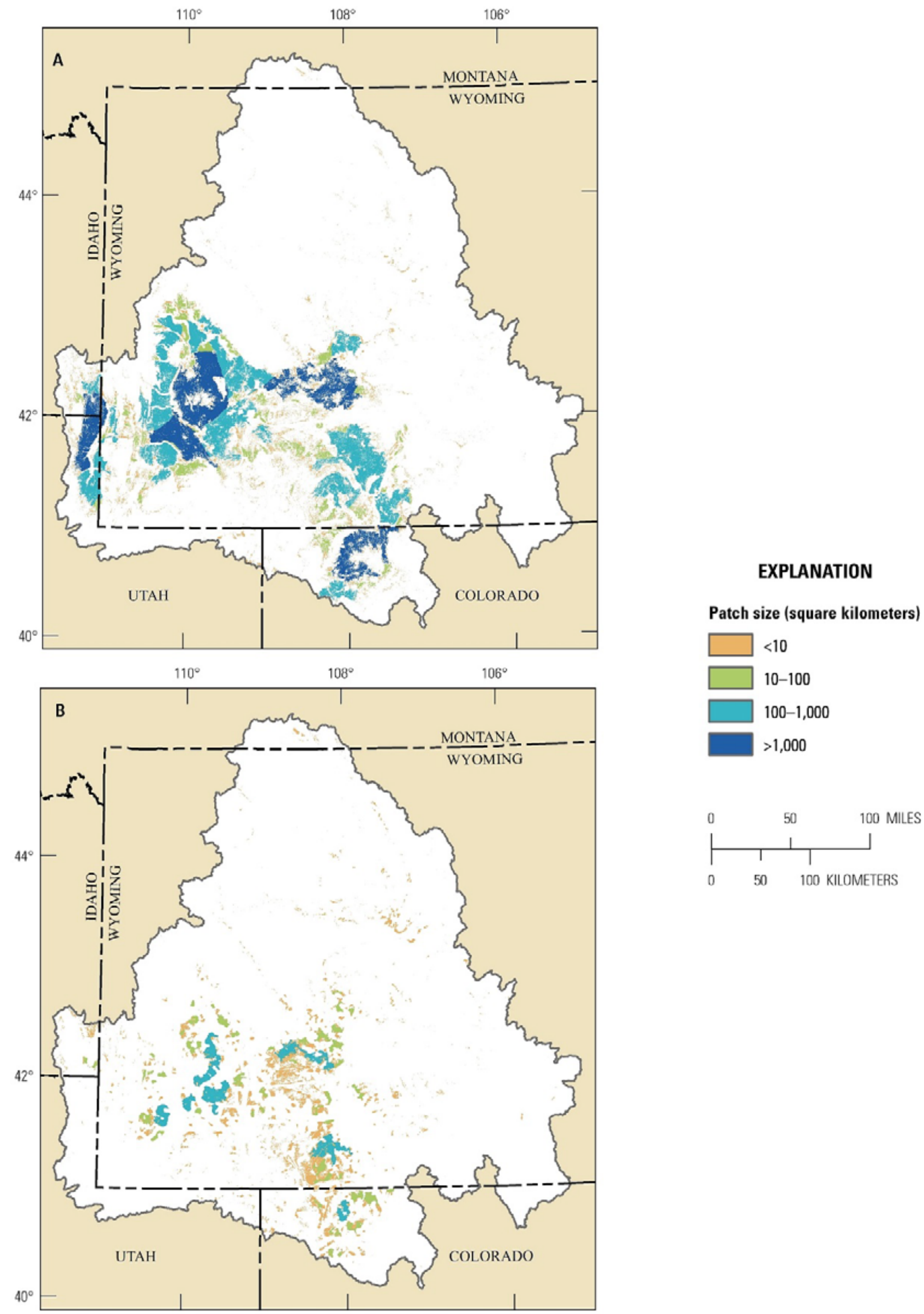

Figure 27–6. Patch sizes of pygmy rabbit habitat for the Wyoming Basin Rapid Ecoregional Assessment project area for (*A*) baseline conditions and (*B*) relatively undeveloped areas (Terrestrial Development Index score ≤1 percent).

How has development affected structural connectivity of pygmy rabbit habitat relative to baseline conditions (fig. 27–7)?

- Baseline pygmy rabbit habitat is highly connected, with regional-scale connectivity occurring at a 0.09-km (0.06-mi) interpatch distance.
- Development has greatly reduced the structural connectivity of potential pygmy rabbit habitat. Local-scale connectivity for relatively undeveloped habitat is 2.43 km (1.51 mi), landscape-scale connectivity is to 4.62 km (2.87 mi), and regional-scale connectivity is 5.04 km (3.13 mi), which is a fiftyfold increase compared to baseline connectivity.
- Although the interpatch distance resulting in regional connectivity among relatively undeveloped areas is smaller than maximum distances reported for pygmy rabbits (6.5 km [4.0 mi] for females and 11.9 km [7.4 mi] for males), dispersal by pygmy rabbits can be negatively affected by roads, either because they avoid roads or due to direct mortality associated with roads, including being hit by vehicles or killed by predators. Consequently, development occurring outside of relatively undeveloped habitat may impede pygmy rabbit movements.

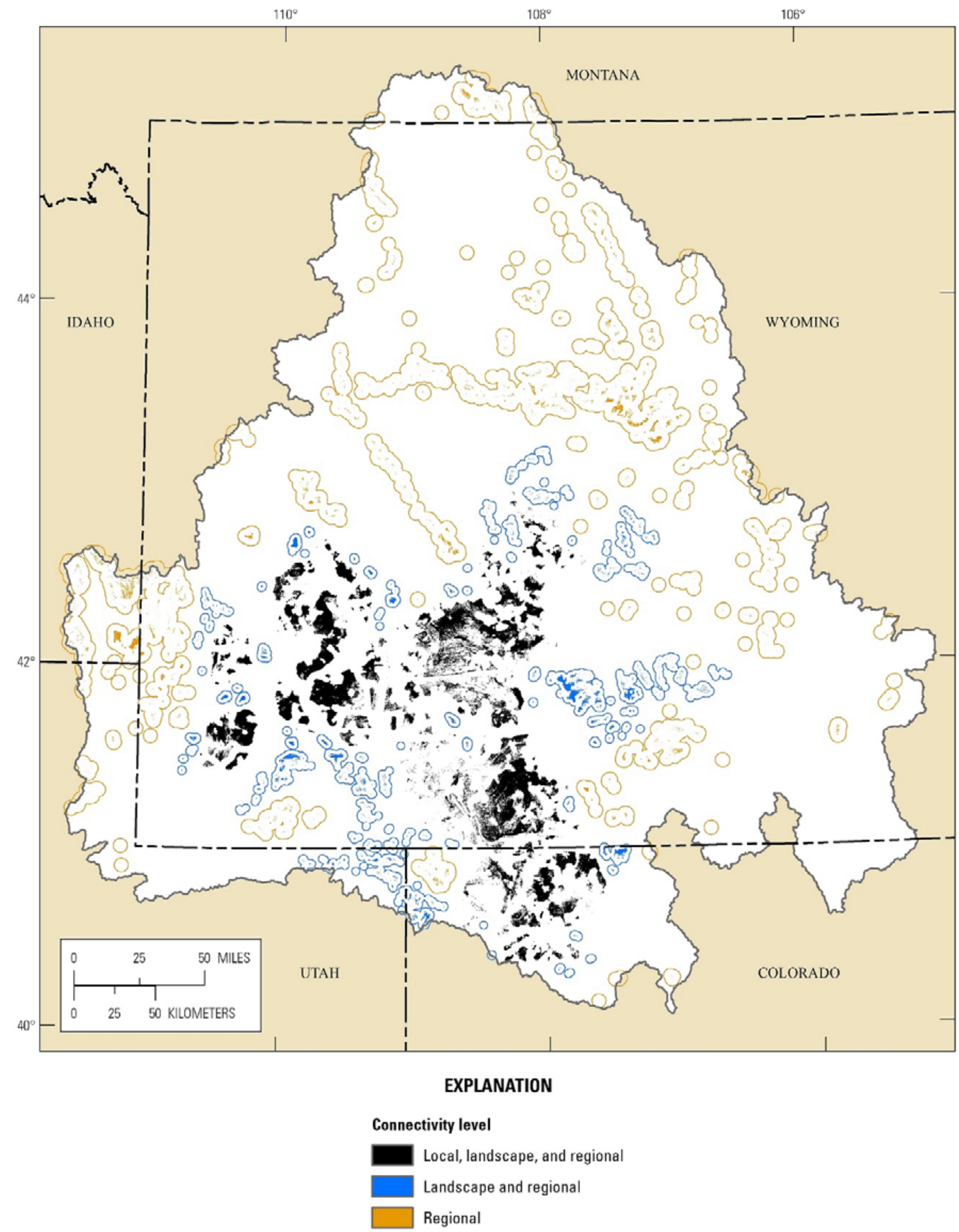

Figure 27–7. Structural connectivity of relatively undeveloped pygmy rabbit habitat in the Wyoming Basin Rapid Ecoregional Assessment project area. Black polygons include large and highly connected habitat patches. Blue polygons include habitat patches that contribute to both landscape and regional connectivity. Orange polygons represent isolated clusters of patches surrounded by developed areas or other cover types.

Where are potential barriers and corridors that may affect animal movements among relatively undeveloped habitat patches (fig. 27–8)?

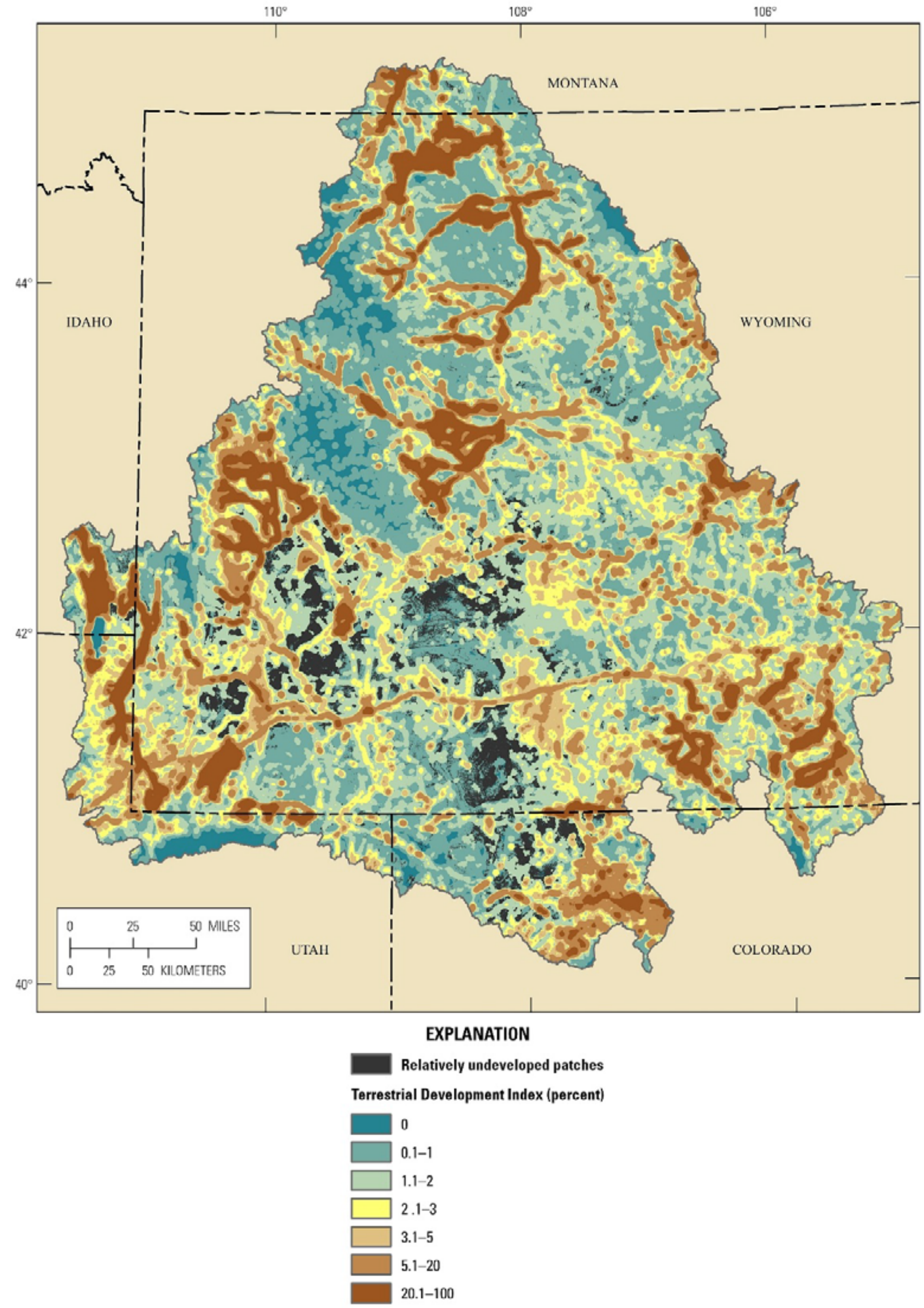

Figure 27–8. Potential barriers and corridors as a function of Terrestrial Development Index (TDI) score for lands surrounding relatively undeveloped pygmy rabbit habitat. Higher TDI scores (for example, >5 percent) represent potential barriers to movement among relatively undeveloped habitat patches. Lower TDI scores (for example, <2 percent) represent potential corridors for movements among patches.

Where have recent fires occurred in baseline pygmy rabbit habitat, and what is the total area burned per year (figs. 27–9 and 27–10)?

- The amount of pygmy rabbit habitat that has burned each year has been highly variable (fig. 27–9).
- The largest fires occurred in pygmy rabbit habitat in Colorado and Utah (fig. 27–10).
- Typically, only a small fraction of pygmy rabbit habitat has burned each year since 1980. Cumulatively, 2.6 percent (633 km^2; 244.4 mi^2) of their habitat has burned since 1980 (figs. 27–9 and 27–10). The area of pygmy rabbit habitat that has been burned should be considered a minimum because some recently burned sagebrush is classified by LANDFIRE as grassland and therefore, may not be included in the pygmy rabbit habitat model.
- Between 1980 and 2012, fires were typically small and, on average only burned <0.15 percent of pygmy rabbit habitat per year. The largest area of pygmy rabbit habitat burned in 2008. (See Chapter 5—Wildland Fire for more comprehensive discussion of fire).

How does risk from development vary by land ownership or jurisdiction for pygmy rabbit habitat (table 27–5, fig. 27–11)?

- The majority of the pygmy rabbit habitat in the Basin is managed by the Bureau of Land Management (BLM) and 28.3 percent occurs on private land (table 27–5).
- Only 28 percent of pygmy rabbit habitat on BLM lands has the highest development risk, whereas 47 percent of private land has the highest development risk (fig. 27–11).
- Most of the pygmy rabbit habitat on private land occurs in a checkerboard distribution with BLM lands along Interstate–80 in Wyoming (fig. 27–11).

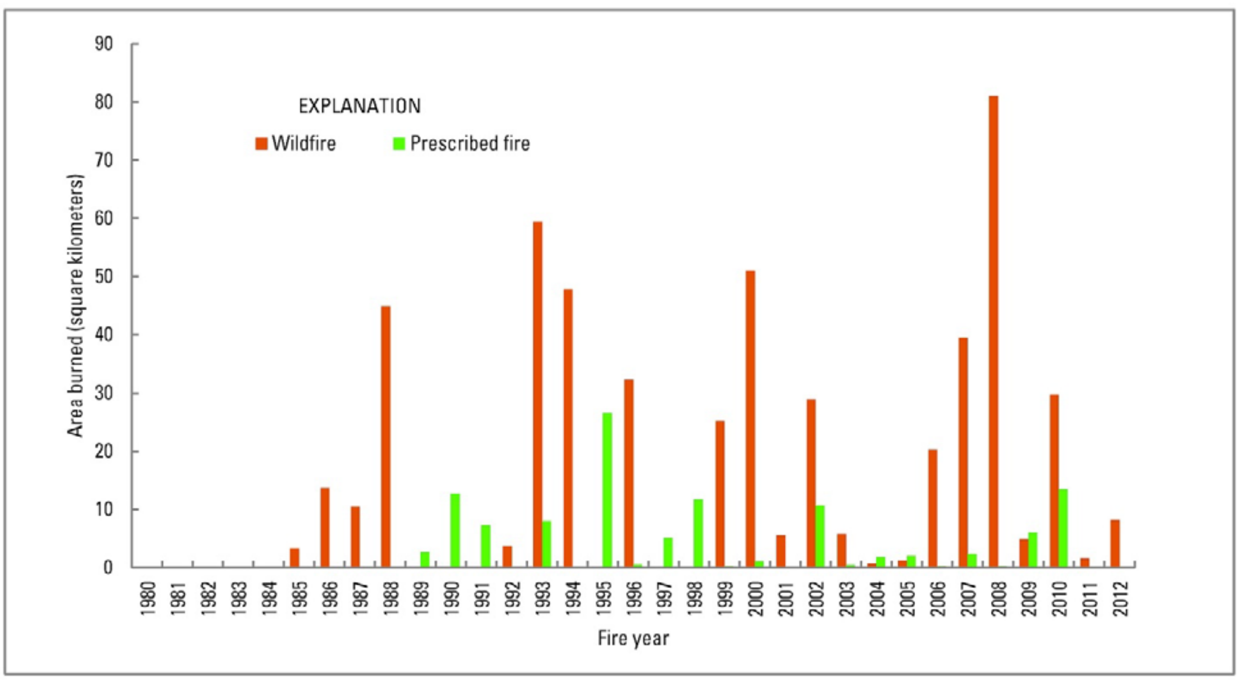

Figure 27–9. Annual area burned by wildfires and prescribed burns in baseline pygmy rabbit habitat since 1980 in the Wyoming Basin Rapid Ecoregional Assessment project area.

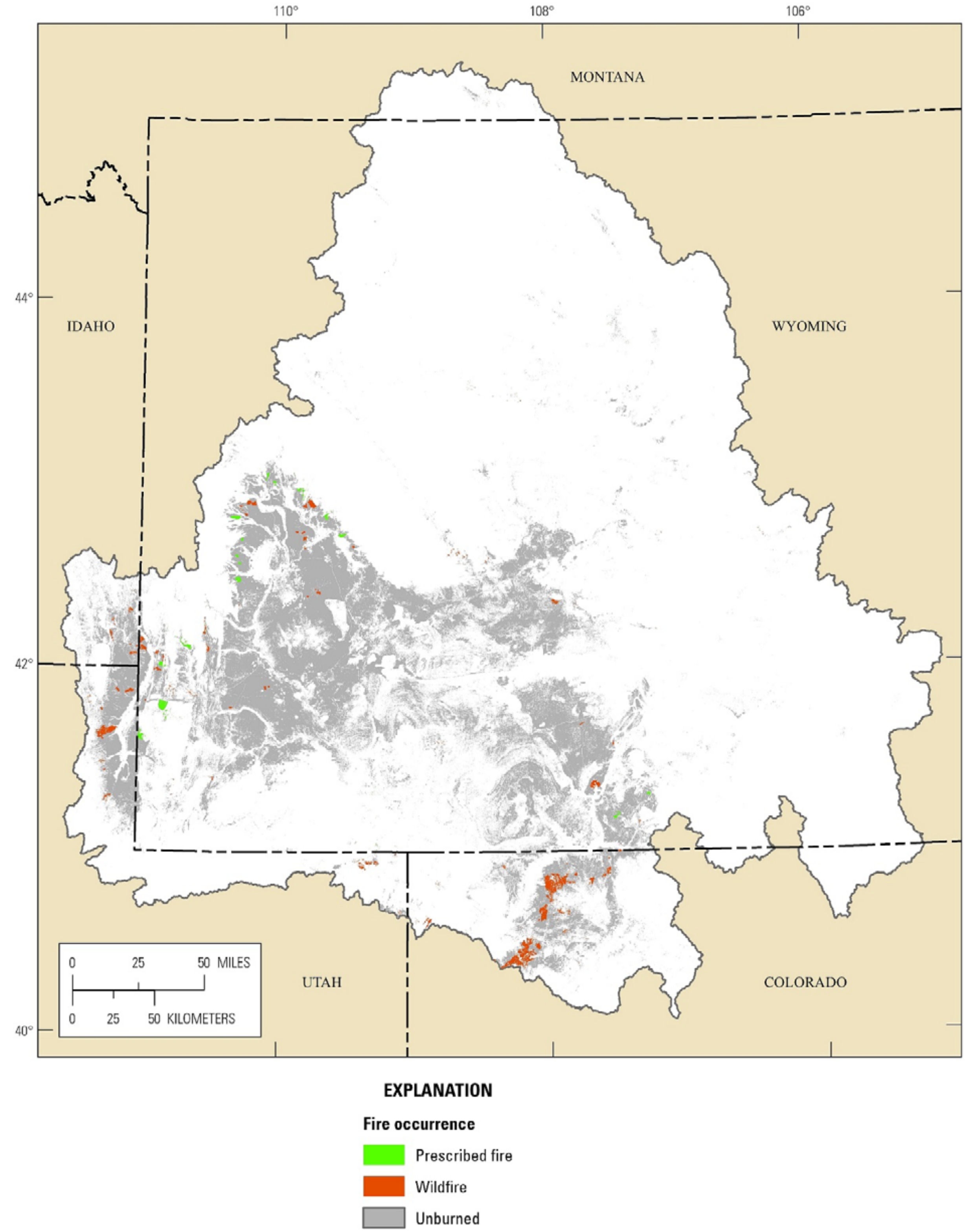

Figure 27–10. Occurrence of prescribed burns and wildfires in baseline pygmy rabbit habitat since 1980 in the Wyoming Basin Rapid Ecoregional Assessment project area.

Table 27–5. Area and percent of pygmy rabbit habitat by land ownership or jurisdiction in the Wyoming Basin Rapid Ecoregional Assessment project area.

[km^2, square kilometer]

Ownership or jurisdiction	Area (km^2)	Percent of area
Bureau of Land Management	1,486	62.1
Private	677	28.3
State/County	134	5.6
Other Federal[1]	73	3.1
Forest Service[2]	13	0.6
Private Conservation	9	0.4
Tribal	2	0.1

[1] National Park Service, Bureau of Reclamation, and U.S. Fish and Wildlife Service.

[2] U.S. Department of Agriculture Forest Service.

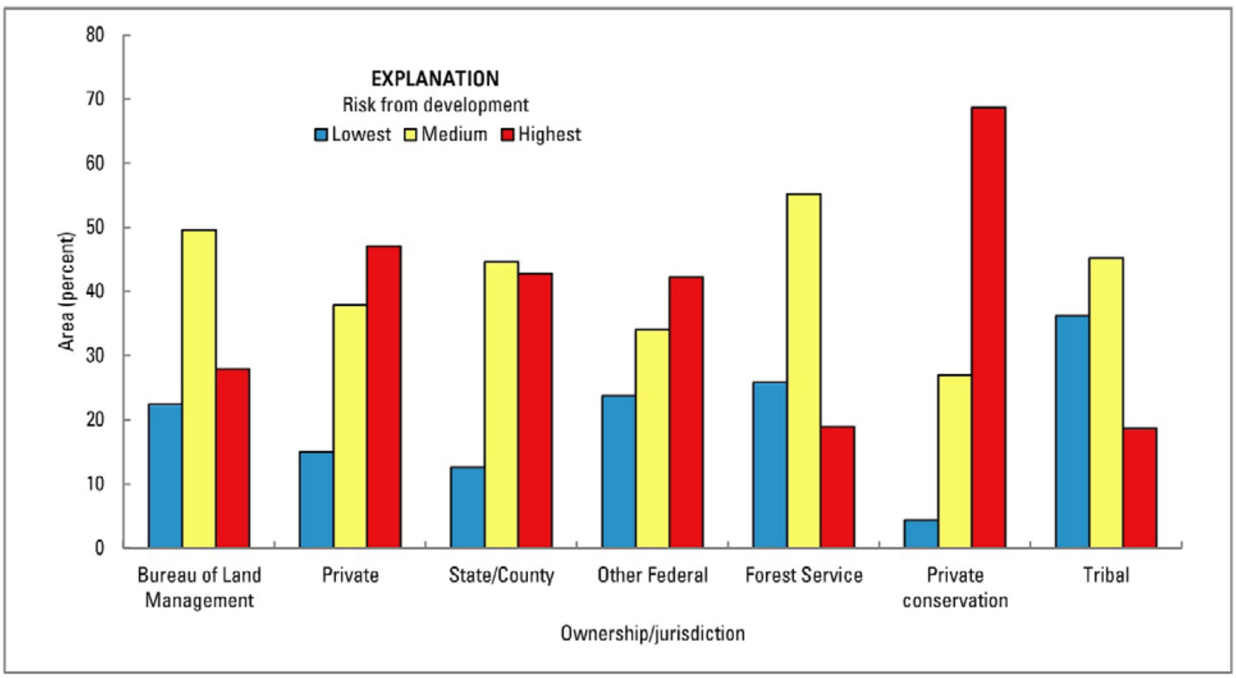

Figure 27–11. Relative ranks of risk from development, by land ownership or jurisdiction, for pygmy rabbit habitat in the Wyoming Basin Rapid Ecoregional Assessment project area. Rankings are lowest (Terrestrial Development Index [TDI] score <1 percent), medium (TDI score 1−3 percent), and highest (TDI score >3 percent). [Forest Service, U.S. Department of Agriculture Forest Service]

Where are the townships with the greatest landscape-level ecological values, and where are the townships with the greatest landscape-level risks (fig. 27–12)?

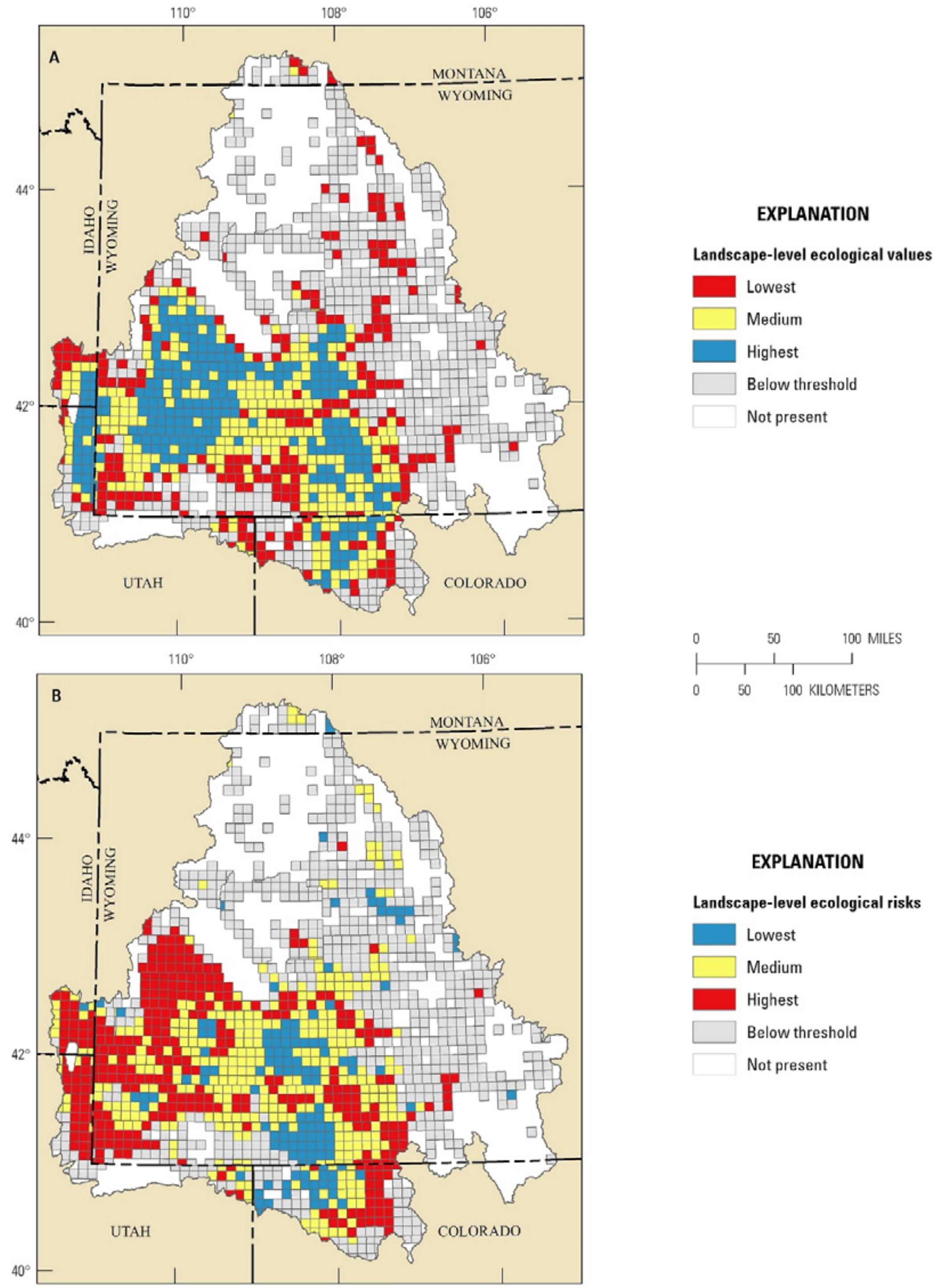

Figure 27–12. Ranks of landscape-level ecological values and risks for pygmy rabbit habitat, summarized by township, in the Wyoming Basin Rapid Ecoregional Assessment project area. (*A*) Landscape-level values based on habitat area and (*B*) Landscape-level risks based on Terrestrial Development Index (see table 27–3 for overview of methods).

Where are the townships with the greatest conservation potential (fig. 27–13)?

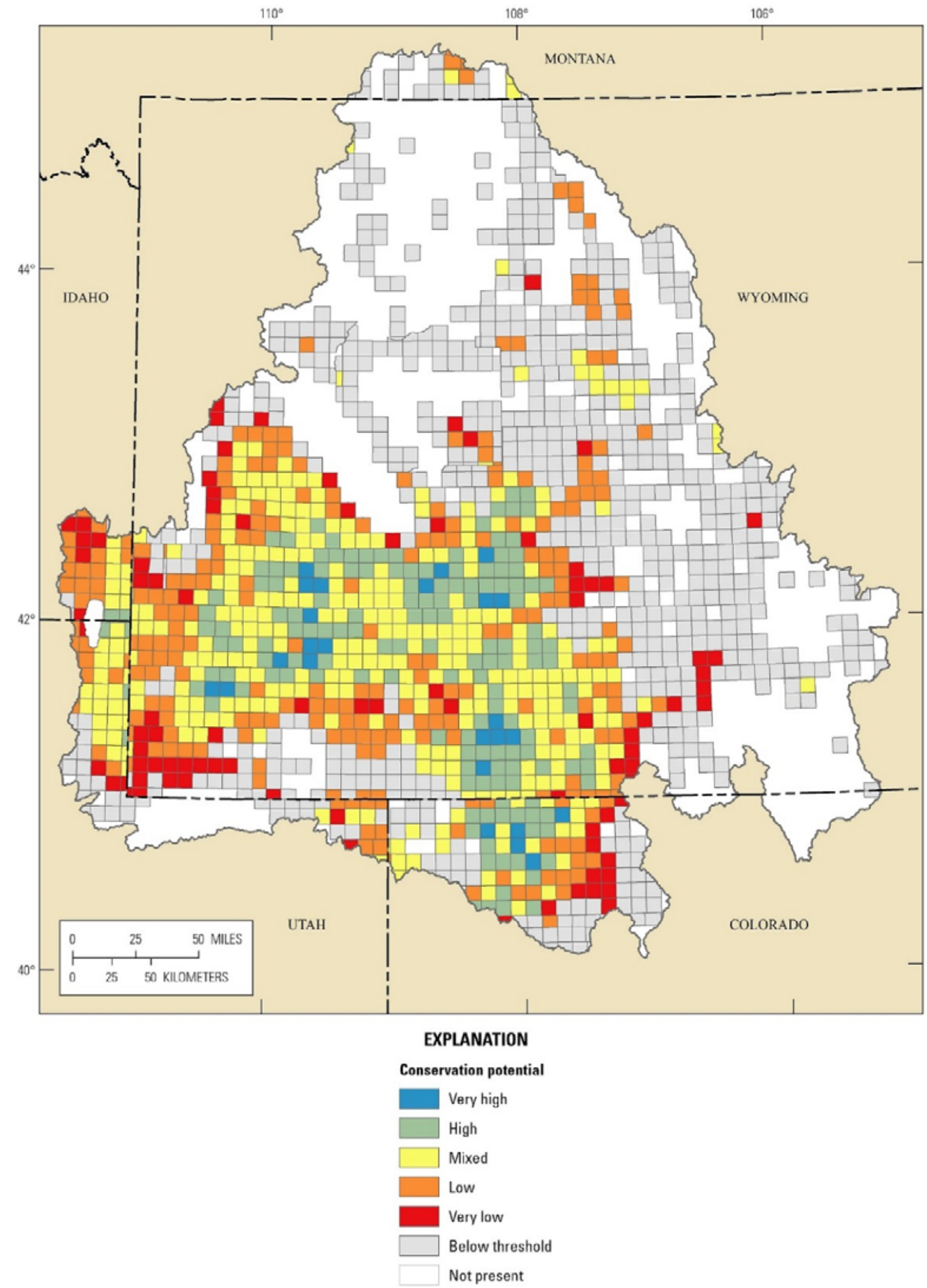

Figure 27–13. Conservation potential of pygmy rabbit habitat, summarized by township, in the Wyoming Basin Rapid Ecoregional Assessment project area. Highest conservation potential identifies areas that have the highest landscape-level values and the lowest risks. Lowest conservation potential identifies areas with the lowest landscape-level values and the highest risks. Ranks of conservation potential are not intended as stand-alone summaries and are best interpreted in conjunction with the geospatial datasets used to address Core Management Questions.

Summary

Baseline pygmy rabbit habitat in the Wyoming Basin totals 23,950 square kilometers (km^2) (9,247.2 square miles [mi^2]) or 13.4 percent of the total area. Approximately 20 percent of potential pygmy rabbit habitat in the Basin is relatively undeveloped and 35 percent has high levels of development. Development has effectively fragmented pygmy rabbit habitat into smaller patches relative to baseline conditions; approximately 7.8 percent of relatively undeveloped areas occur in patches >100 km^2 (38.6 mi^2), and there are no relatively undeveloped patches >1,000 km^2 (386.1 mi^2). The largest patches of relatively undeveloped habitat are found west of Rock Springs and south of Rawlins, Wyoming. Development also has greatly reduced the connectivity of potential pygmy rabbit habitat compared to baseline conditions, and significant barriers may result from I-80 and the high density of roads and energy development south of Pinedale. Consequently, pygmy rabbit dispersal may be impeded by high levels of development outside of the relatively undeveloped areas.

The majority of the potential pygmy rabbit habitat in the Wyoming Basin is managed by the Bureau of Land Management (BLM), and 28.3 percent occurs on private land. The pygmy rabbit habitat on BLM lands is less developed than it is on other lands, and most of the potential pygmy rabbit habitat on private land occurs in a checkerboard distribution with BLM land in southern Wyoming. Many of the townships with the highest conservation potential for pygmy rabbit habitat occur within areas that may function as strongholds for sagebrush shrublands under projections of climate change (see Chapter 11—Sagebrush Steppe).

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