Sagebrush Ecosystem Program

Findings and Improvement Recommendations

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Research – Raven Abundance and Occupancy

- Probability of occupancy (nesting) on anthropogenic structures
  - 80% (53% Transmission Lines; 17% cell towers; 4% nesting platforms; Coates et al. 2014)
  - 90% within 400m of survey locations at oil development, cities, and roads (Bui et al. 2010)

- Howe et al. (2014) found a 31% decrease in odds of nesting ravens for every 1km increase in distance from a transmission line

- Increased raven nesting occupancy by 80% following construction of a 500kV transmission line over 9 years (Steenhof et al. 1993)

Research – Raven Abundance and Occupancy

- Coates et al. (2014) determined the probability of raven occurrence in relation to transmission lines was most significant within 2.2 km of a line, but effect was observed out to 27 km

- Bui et al. (2010) found that raven density was highest within 3km of cities, urban areas, and associated infrastructure and dropped sharply beyond this distance

- Gibson et al. (in Review) linked impacts on sage-grouse behavior and demographics to indirect effects of raven colonization of the Falcon-Gondor (FG) line out to 10km

Research – Raven Nest Depredation

- Ravens have been identified as the primary nest predator of sage-grouse in multiple studies in Nevada and Idaho (Coates et al. 2008, Coates and Delehanty 2008, Coates and Delehanty 2010, Lockyer et al. 2013)

- Sage-grouse survival in Wyoming was more affected by occupancy (e.g. nesting, territorial ravens) than raven density (non-territorial, nomadic ravens) and were responsible for the majority of nest depredations (Bui et al. 2010)

Research – Sage-grouse Avoidance of Transmission Lines

- Sage-grouse showed avoidance within 600m of transmission lines (138kV) in Idaho based on telemetry studies (Gillian et al. 2013), 500m based on pellet counts (Braun 1998, Hanser et al. 2011)

- Hansen et al. (2016) demonstrated transmission line presence negatively influenced sage-grouse winter habitat use in Utah
  - Did not find a difference in use/avoidance between pre- and post-construction of adjacent 345kV line

- Pruett et al. (2008) also found avoidance of transmission lines by greater and lesser prairie chickens in Oklahoma

- Resistance models parameterized by expert opinion that were developed in Washington state predicted that powerlines would significantly affect sage-grouse movement, gene flow, and lek activity to distances beyond 500m (Shirk et al. 2015), which can lead to population level impacts

Research – Sage-grouse Demographics and Transmission Lines

- Gibson et al. (In Review)
  - Nests within 8km of FG line had reduced nest success
  - Pre-fledgling chick survival was lower closer to the line
  - Population growth rate, measure by lek attendance, declined by 3% within 10km
  - Nest site selection was reduced within 10km of the line

- Wisdom et al. (2011) reported the mean distance of historical sage-grouse locations to transmission lines was 6km in extirpated range compared to 15km in currently occupied range

- Dinkins et al. (2014) showed an increase in female mortality with increased density of powerlines

- LeBeau et al. (2014) reported nest survival was not influenced by distance to transmission lines
  - The relationship was not substantial due to very large 90% confidence intervals
  - Habitat quality also influenced and confounded results – nest survival was negatively associated with lower variation in shrub height

Examples of Applied Science in Other States

- FWS and BLM representatives convened to assess the indirect effects of transmission lines and associated infrastructure, produced Whitepaper in 2015
  - "Assessing indirect effects of transmission lines on greater sage-grouse for the Gateway West Interstate Transmission Line Project"

- Described three indirect impact zones
  - Avoidance (600m impact zone) – recommended 75-95% habitat services reduction
  - Increased Avian Predator Presence and Predation (600-1,200m impact zone) – recommended a 20-50% habitat services reduction
  - Decreased Productivity and Survival (1,200-5,000m impact zone) – recommended a 5-40% habitat services reduction

Examples of Applied Science in Other States

- Selection of six members for a Technical Advisory Group to develop a science based approach to quantify indirect effects of transmission lines for two projects: Energy Gateway South and TransWest in WY, CO, UT. FEIS available December 2016

- Revised conclusions in 2015 Whitepaper with latest available research
  - Avoidance (600m impact zone)
  - Decreased Population Growth (0-10,000m impact zone)

- Determined habitat services lost declined linearly to 10km with 75% reduction at the line

Improvement Recommendation

DISTURBANCE TYPE	Disturbance Subtype	WEIGHT (%)	DISTANCE (Kilometers)
Towers (cell, etc.)	NA	75%	6 km
Power Lines	Transmission	75%	6 km
Power Lines	Distribution	25%	6 km

- Transmission Lines
  - High Voltage
  - Steel Lattice, H frame, monopole with cross members
- Distribution Lines
  - Monopole with no cross members, supporting arms, etc, or of a construction that would not support nesting that can be documented
- Primary reasoning for sub-diving relates to ability of ravens to nest and occupy lines, which would include minimization measures (e.g. effective perch deterrents)

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Recommendation	Rationale
75% Weight	1) Avoidance – 600m avoidance zone received 75% Habitat Services Reduction (FWS/BLM 2015, BLM 2016) 2) Raven Occupancy – 80% (Coates et al. 2014); 90% (Bui et al. 2010)
25% Weight	1) Probability of Raven Occurrence – 30% (Coates et al. 2014) 2) Effective minimization measures to significantly reduce raven occupancy (Slater and Smith and Smith 2010; Dwyer and Doloughan 2014; Dwyer and Leiker 2012)
6 km	1) Reduced demographic rates Gibson et al. (In Review) • Reduced Lambda (population growth) by 3% - 10km • Reduced nest survival - 8km • Reduced pre-fledgling chick survival 2) Distance – Highest probability of impact • Coates et al. (2014) – 2.2km, extend to 27 • Bui et al. (2010) – within 3km

Improvement Recommendation

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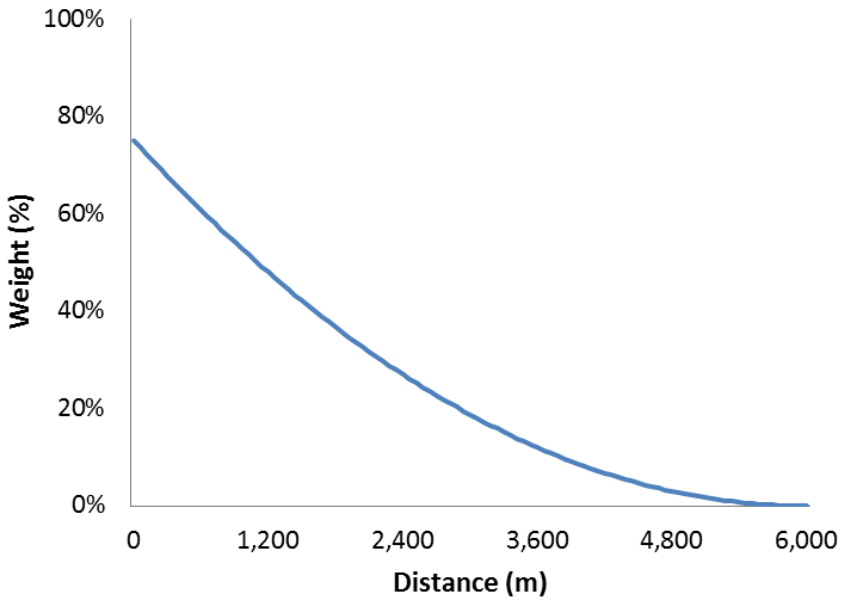
- Change from 8 to 6km to reflect the most significant impacts to sage-grouse (within 3km)
- The impact measured by the HQT beyond 6km (when using 8km distance) is minimal (~1%)



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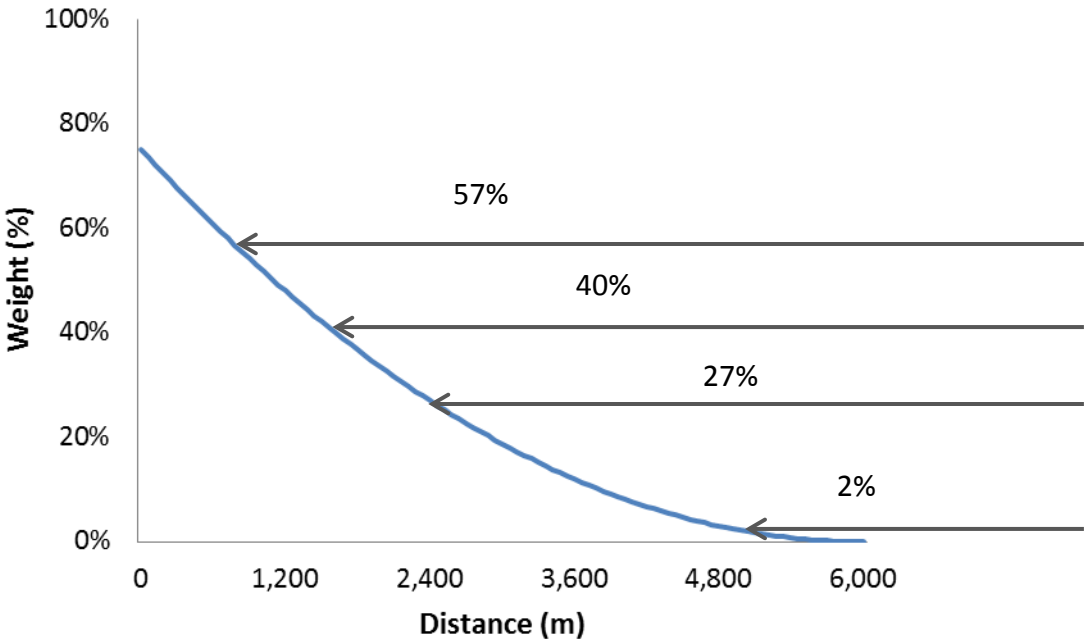

Distance (m)	Weight
0	75%
800	57%
1600	40%
2400	27%
3200	17%
4000	8%
5000	2%
6000	0%