Animal Interactions with Power Facilities

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Golden Eagle – Wyoming USA

UTILITY & ENGINEERING SERVICES

ENVIRONMENTAL SERVICES

POWER OPTIMIZATION PRODUCTS

Overcoming utility infrastructure challenges by merging excellence in engineering, science and technology with a passion for client satisfaction.

EDM

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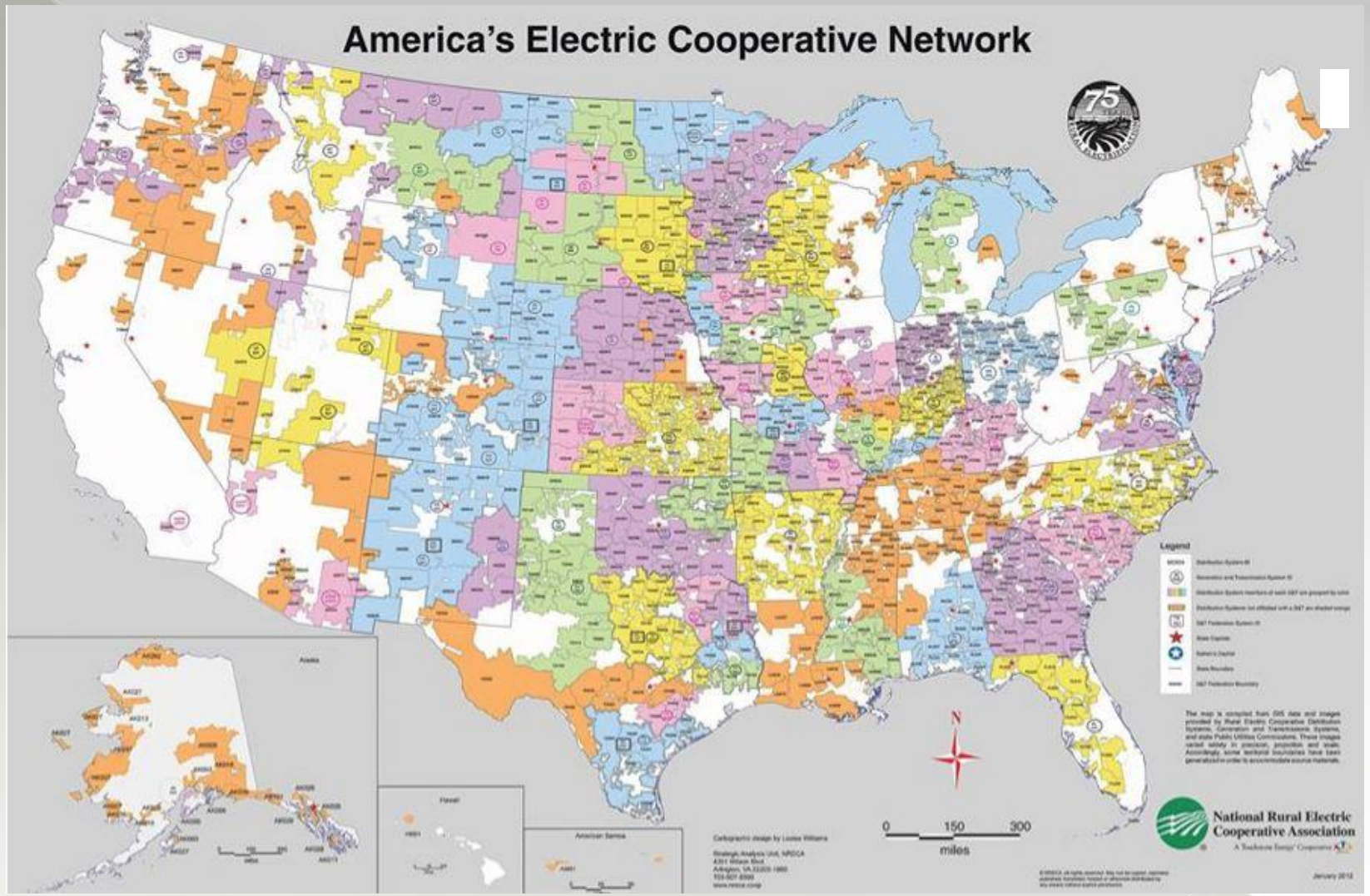
Introduction



The United States has over 2000 electric utility companies!

Historical Context

Eagles electrocuted 1922.

1876 - Battle of the Little Bighorn

Coues (1876) counted approximately 100 avian carcasses (primarily Horned Larks (*Eremophila alpestris*) beneath a 3-mile long (4.8 km) section of telegraph wire between Denver, Colorado, and Cheyenne, Wyoming.

1860

Widespread growing telegraph network

Persistent Problem

Despite 43 years of work…Golden eagle (*Aquila chrysaetos*) electrocution on power poles is a global conservation problem with an estimated 504 eagles electrocuted annually in North America!

Species today facing additive mortality due to electrocutions include:

Bonelli's Eagle (*Aquila fasciata*)
(Hernández-Matías et al. 2015)

Egyptian Vulture (*Neophoron percnopterus*)
Angelov et al. (2013)

Saker Falcon (*Falco cherrug*)
Harness et al. (2008) and Dixon et al. (2013)


Golden Eagle - Mongolia

Utility Animal Problems

Typical Issues…

Animal Interactions with Power Lines

Structural Damage

Pileated Woodpecker (Male) – Texas USA

Issues: Climbing Safety, Deteriorates Poles
Scope: Locally Severe – GIS to Predict Problem Areas, Millions of dollars in damage annually…
Solutions: Wire wraps, Polymer wraps, Alternative Poles (Steel/Concrete/Fiberglass)
New: Testing Anthraquinone as a repellent (EPRI – 2018 Field Trial)

Animal Interactions with Power Lines

Structural Damage

Issues: Rubbing on poles leading to damaged poles and outages
Scope: Locally Severe
Solutions: Reinforce pole butts

Animal Interactions with Power Lines

Chewing

Photo: Australia ESB Electric

Issues: Chewing
Scope: Localized and seasonal
Solutions: Variable depending on species

Animal Interactions with Power Lines

Nesting - Advantages

Golden Eagle – Colorado USA

Issues: None if managed correctly – can enhance reproductive success
Scope: Localized and seasonal
Solutions: Stick deflectors, fecal shields

Avian Interactions with Power Lines

Depredation Issues

Issues: Increased depredation on Protected Species (e.g. Sage Grouse, Desert Tortoise)
Scope: Localized
Solutions: Alternative routing, alternate designs to minimize nesting/perching

Animal Interactions with Power Lines

Nesting - Disadvantages

Osprey – Wyoming USA

Red-tailed hawks – Wyoming USA

Weaver Fiches – South Africa

Issues: Fires, Structural Issues, Restricted Access due to Protected and/or Aggressive Birds
Scope: Localized and seasonal
Solutions: Stick deflectors, alternate designs

Animal Interactions with Power Lines

Fecal Streamer Outages

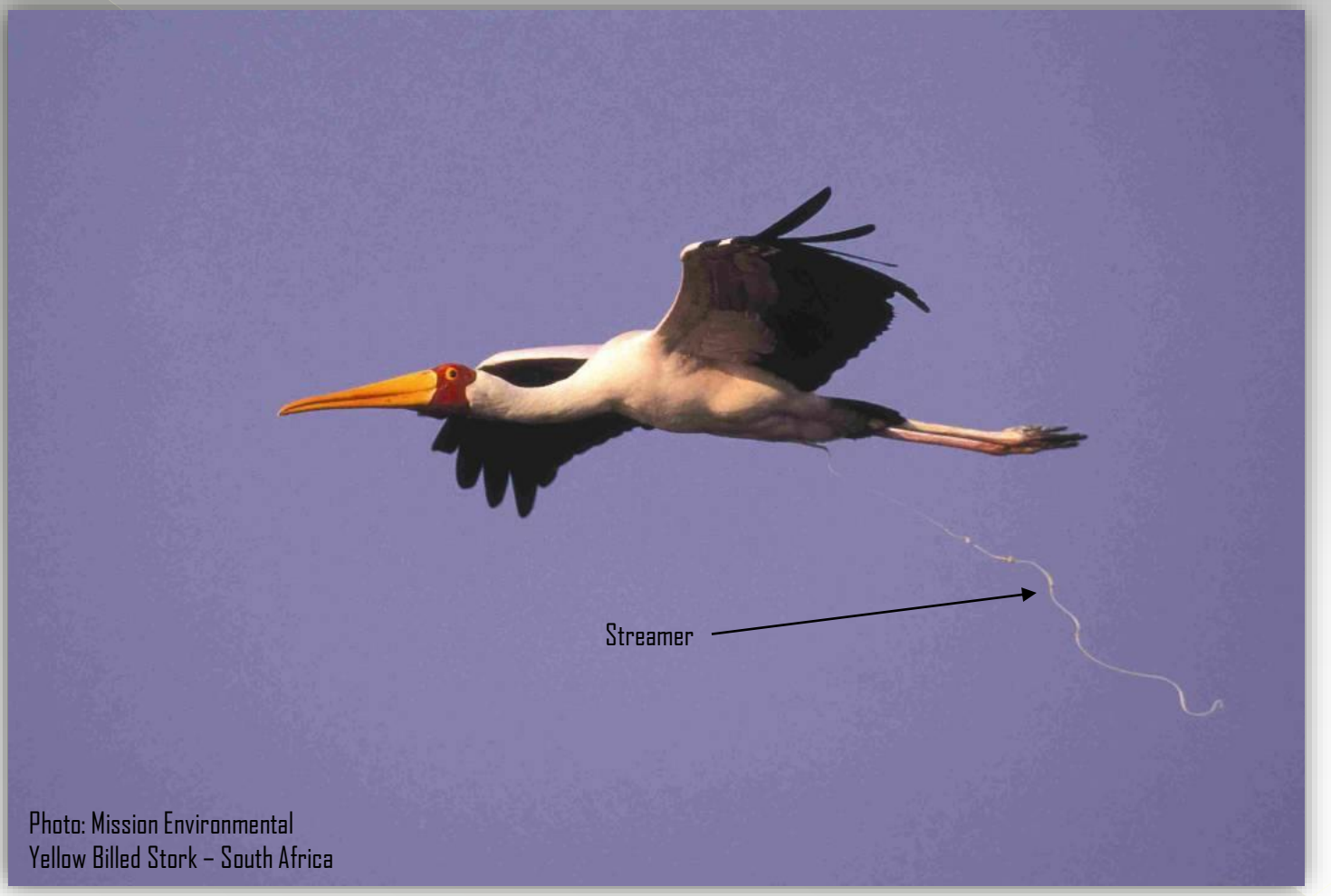


Photo: Mission Environmental
Yellow Billed Stork – South Africa

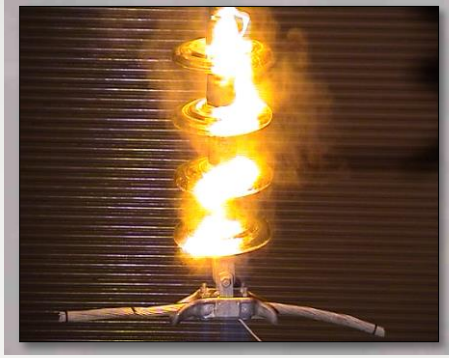
Issues: Transmission Line Flashovers
Scope: Localized and seasonal – caused only by large birds
Solutions: Perch management, shift birds away from critical locations

Animal Interactions with Power Lines

Fecal Pollution Outages

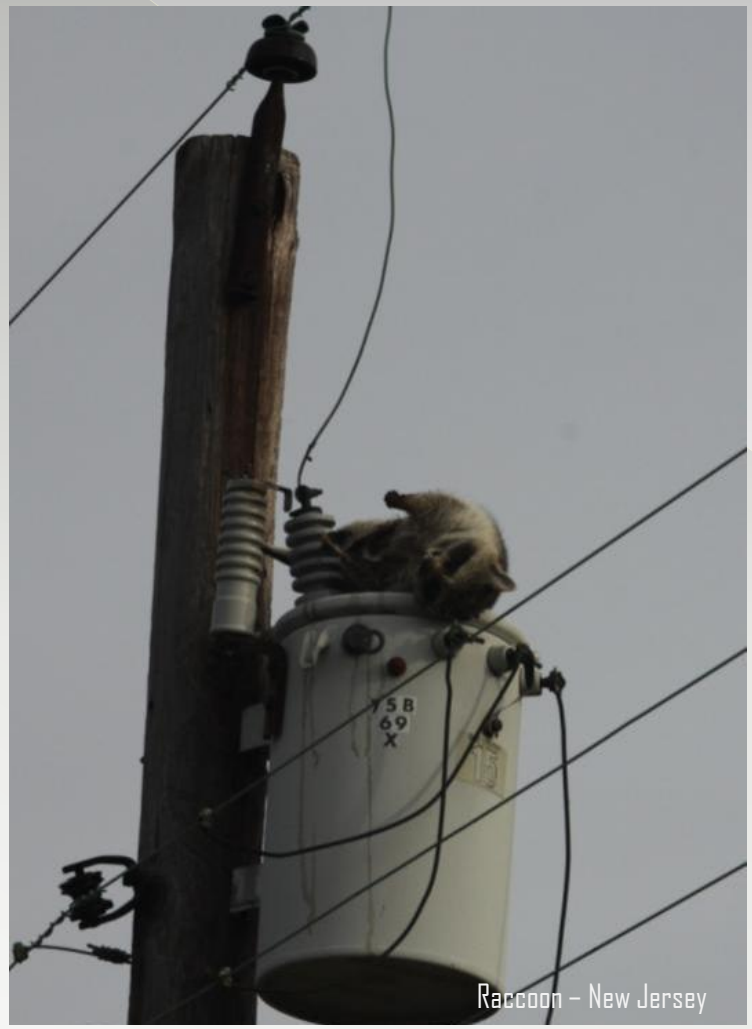
Photo: Arizona Public Service

Photo: ESKOM



Issues: Transmission Line Insulator Flashovers
Scope: Localized and seasonal – caused only by small and large birds
Solutions: Fecal shields

Animal Interactions with Power Lines
Electrical Contacts



Raccoon – New Jersey


Red-tailed Hawk - Utah

Issues: Animals contacting energized facilities – Distribution Issue
Scope: Locally Severe – GIS to Predict Problem Areas, Millions of dollars in damage annually…
Solutions: New – Build in clearances, Existing – Retrofit with insulation and/or barriers

Animal Interactions with Power Lines

Collisions

Great Blue Heron – North Dakota USA

Issues: Birds flying into wires
Scope: Locally Severe – GIS to Predict Problem Areas, Protected species a concern
Solutions: New – Routing is critical, Existing – Marking wires
New: ACAS System (EPRI – 2018 Field Trial), Monitoring with BSIs and Smart Cameras

Why Do We Care?

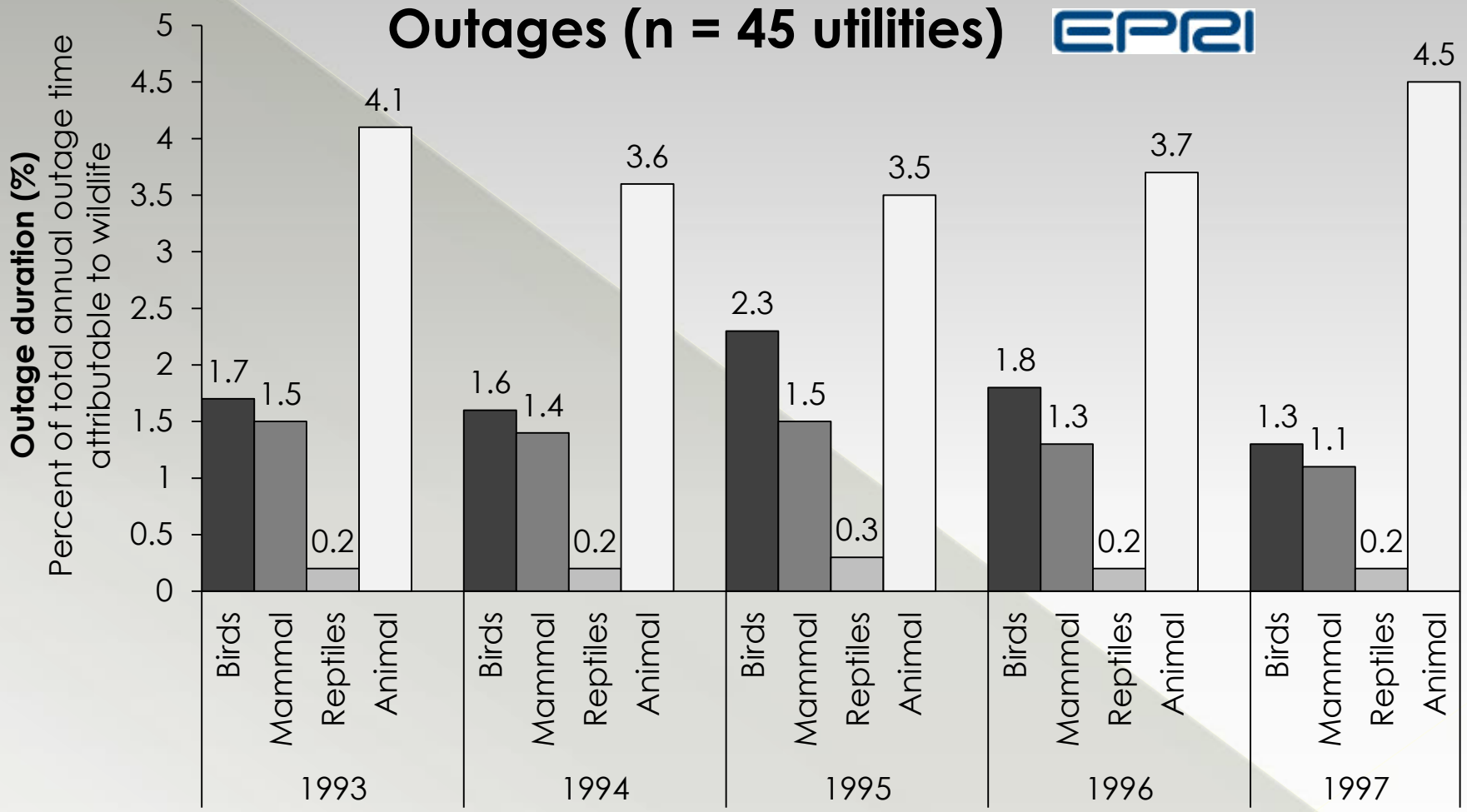
- Reliability
- Regulations
- Relations

RELIABILITY

Squirrel Caused Outage – Station Transformer Destroyed

Source: Southern Company

Reliability



7.2% of All KNOWN Outages (Duration) are Animal-Caused

Plus an Additional 9.5% of All Outages are Unknown!

REGULATIONS

Electrocuted Raptors– Protected Species Under the MBTA

Source: EDM

Regulations

1026 Migratory Birds and their Active Nests have Protected Status - MBTA

Protection	Eagles	Federally Listed Birds	State-listed Birds[a]	Migratory Birds (Native Species)	Game Birds	Non-Native Species
MBTA	✓	✓	✓	✓		
BGEPA	✓					
ESA		✓				
State Regulations	✓	✓	✓	✓	✓	✓[b]

MBTA=Migratory Bird Treaty Act, BGEPA=Bald and Golden Eagle Protection Act, ESA=Endangered Species Act

[a] Some state-listed species also may be covered by the MBTA, BGEPA, and/or ESA.
[b] Some states also protect non-native species.

1999 – **Colorado/Utah:** Moon Lake EA:
$100,000 Fine/Restitution ***(Electrocutions)***
Avian Protection Plan/Retrofitting

2008 – ***Wyoming***: XTO Energy and Yates
$30,000 Fine/Restitution ***(Electrocutions)***
Avian Protection Plan/Retrofitting

2009 – **Wyoming:** Rocky Mountain Power
$510,000 Fine
$900,00 Restitution
$9,100,000 Retrofitting

2013 – **Wyoming:** Duke Energy **(Wind)**
$400,000 Fine
$100,000 Restitution
$340,000 Conservation Fund
$160,000 National Fish and Wildlife Foundation

2014 – **Wyoming:** PacifiCorp **(Wind)**
$400,000 Fine
$200,000 Restitution
$1,900,000 National Fish and Wildlife Foundation

* Amounts are in US Dollars

RELATIONS

[INCITE]

Zapped!

For years, power lines have been electrocuting golden eagles and other raptors. Thanks to a recent court decision, utility companies are now being held liable.

BY TED WILLIAMS

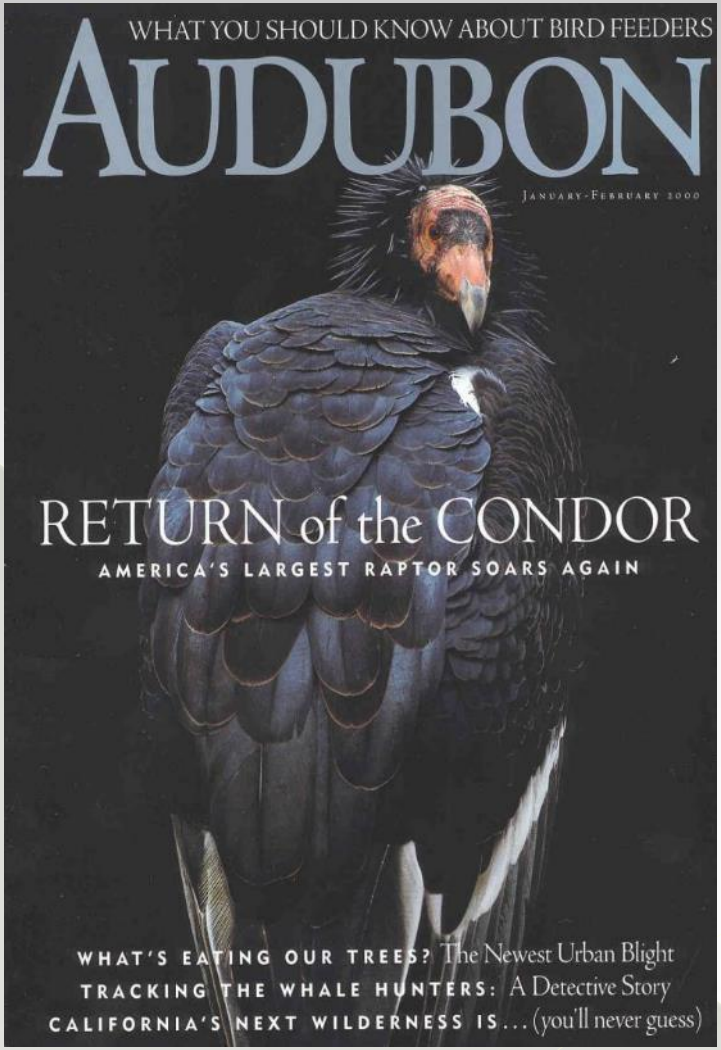
The skull of a golden eagle, a reminder of the Moon Lake power line that killed it.

OF ALL THE WAYS HUMANS ACCIDENTALLY KILL BIRDS OF prey, none is more needless than electrocuting them with ill-designed, poorly insulated power lines. Guided by special agents Roger Gephart and Leo Suazo of the U.S. Fish and Wildlife Service, I glimpsed the extent of this problem last October, in central Colorado. To our west: the Rocky Mountain front, glowing with yellow aspens, dusted with the season's first snow, glittering with new roofs. To our east: low flights of mallards. Overhead: a lethal power line.

Gephart pointed to a new pole. The old one had been destroyed when a great horned owl touched a live wire, completed a circuit by touching another live wire or maybe a grounded wire, then hung batlike while at least 7,200 volts crackled through its body, incinerating it along with the pole. Not much left of that evidence.

The frozen birds in the back of Gephart's truck were more intact. The bald eagle had no beak; it had melted off. The golden eagle, feet clenched in the classic reflex of electrocuted raptors, had no feathers; they had caught fire. The immature red-tail, still clutching a coachwhip by the tail, had carried it to the top of a pole, intending to eat it. Six inches from the snake's head there was a black-rimmed hole where the electricity had entered, killing it along with the bird. The type of injury can tell you how the victim was electrocuted. One of the golden eagles I inspected at the federal wildlife repository near Denver had a burned tail, which meant it had touched an uninsulated jumper wire, which carries current from one circuit to another. Three others had burned underwings, which meant they had bridged the gap between two hot wires. A female golden can have a 90-inch wingspan, yet the utility industry suggests 60 inches of space between energized surfaces, and even

Last August at least *20 brown pelicans were electrocuted by a power line to Smith Island in Chesapeake Bay.*



Story of a Utility prosecuted for Electrocuting Birds

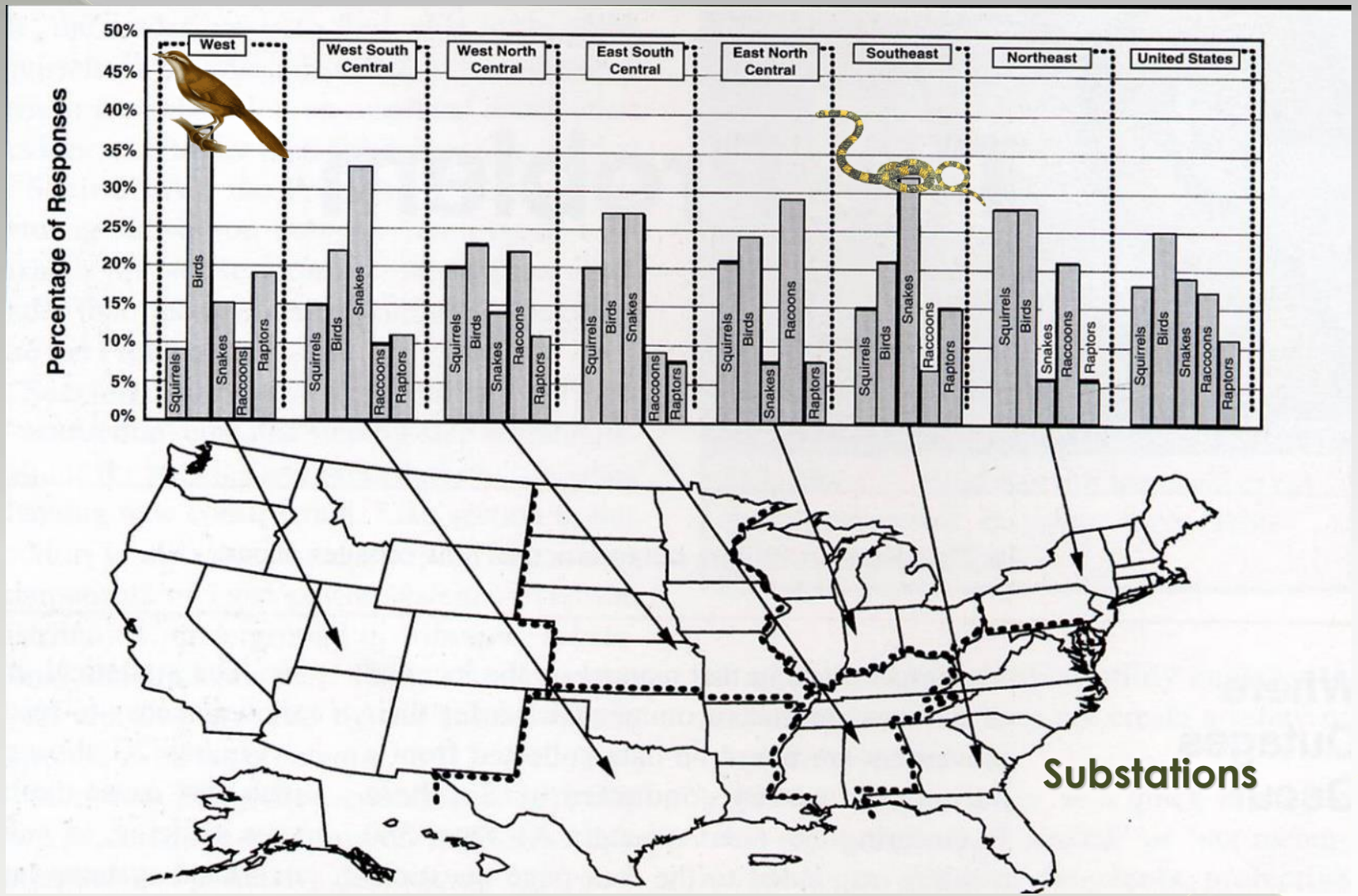
Source: Audubon

ANIMAL CONTACTS

Golden Eagle – Wyoming USA

Background – Mainly Distribution

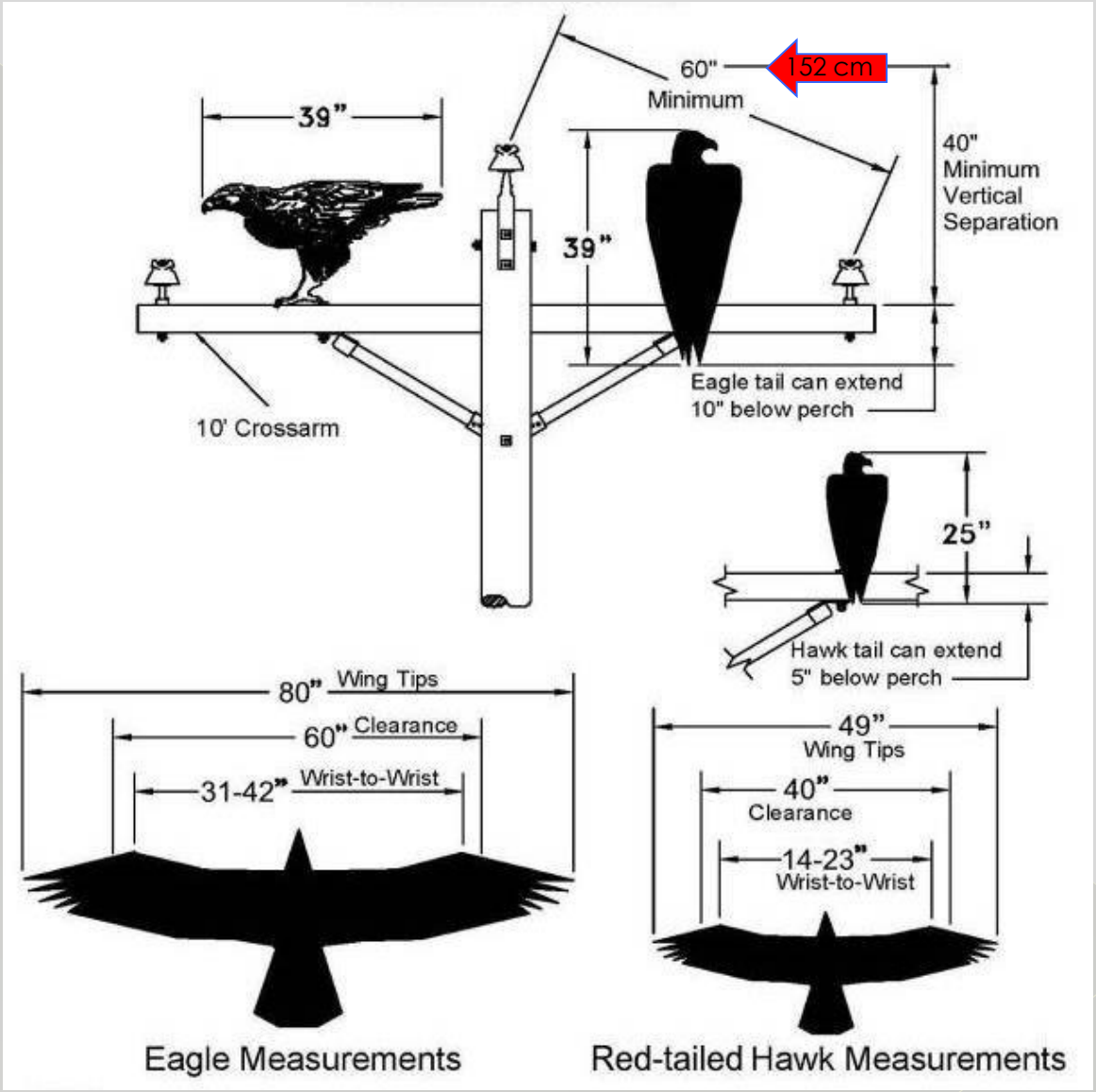
You Must Understand the Issue



Source: NRECA 1996

Animal Interactions with Power Lines

Dimensions are CRITICAL!



Animal Interactions with Power Lines

New Construction

Solutions: New – Build in adequate clearances from the beginning. Use GIS to identify at-risk areas…

Animal Interactions with Power Lines
Existing Construction

Solutions: Existing – Retrofit using custom covers to allow animals to utilize the structures safely. Use GIS and outage records to identify at-risk areas…

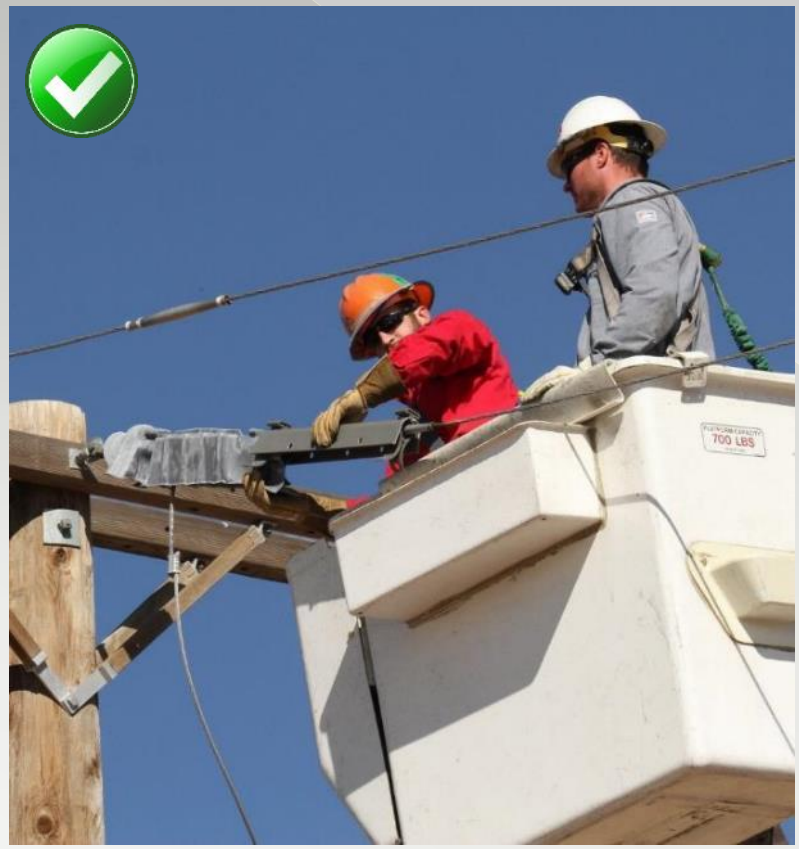
Animal Interactions with Power Lines

Materials are Critical

Solutions: Existing – IEEE Guide 1656 for Testing the Electrical, Mechanical, and Durability Performance of Wildlife Protective Devices on Overhead Power Distribution Systems Rated up to 38kV

Animal Interactions with Power Lines

Installation is Critical



Linemen should be involved in the project with engineering to select retrofitting materials which fit properly, are effective and will last for 15 to 20 years.

COLLISIONS

Canada Geese – Colorado USA

Background

Animal Interactions with Power Lines
Collisions


Pallas Sandgrouse – Mongolia


Siberian Rubythroat– Mongolia

Historically thought to be a transmission problem with large, heavy-bodied species with high wing loading, and poor maneuverability. However distribution power line collisions with small songbirds also occur (Harness et al. 2012) and the scope is unknown.

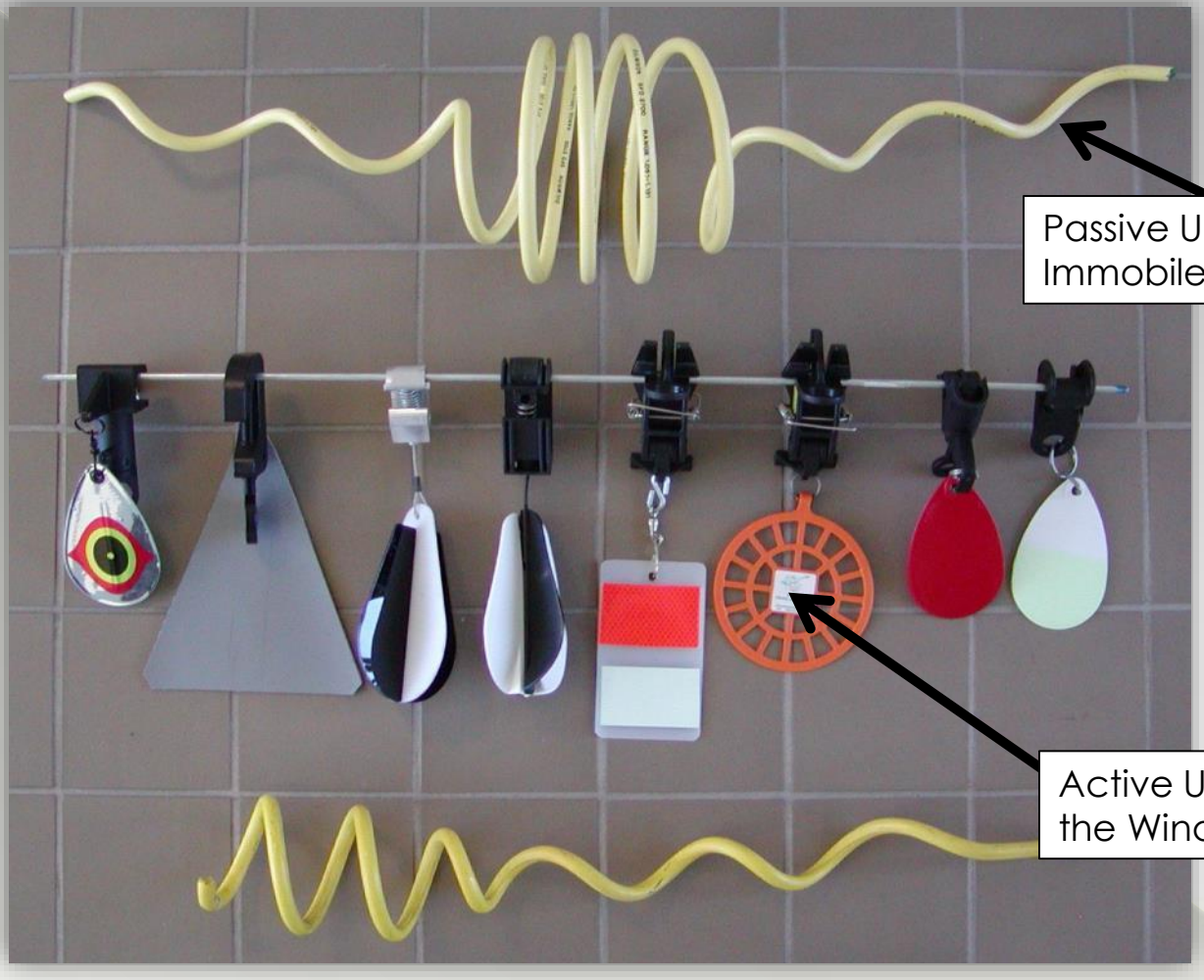
Animal Interactions with Power Lines

Collisions

Study Tool – Under Development (EPRI funded technology)

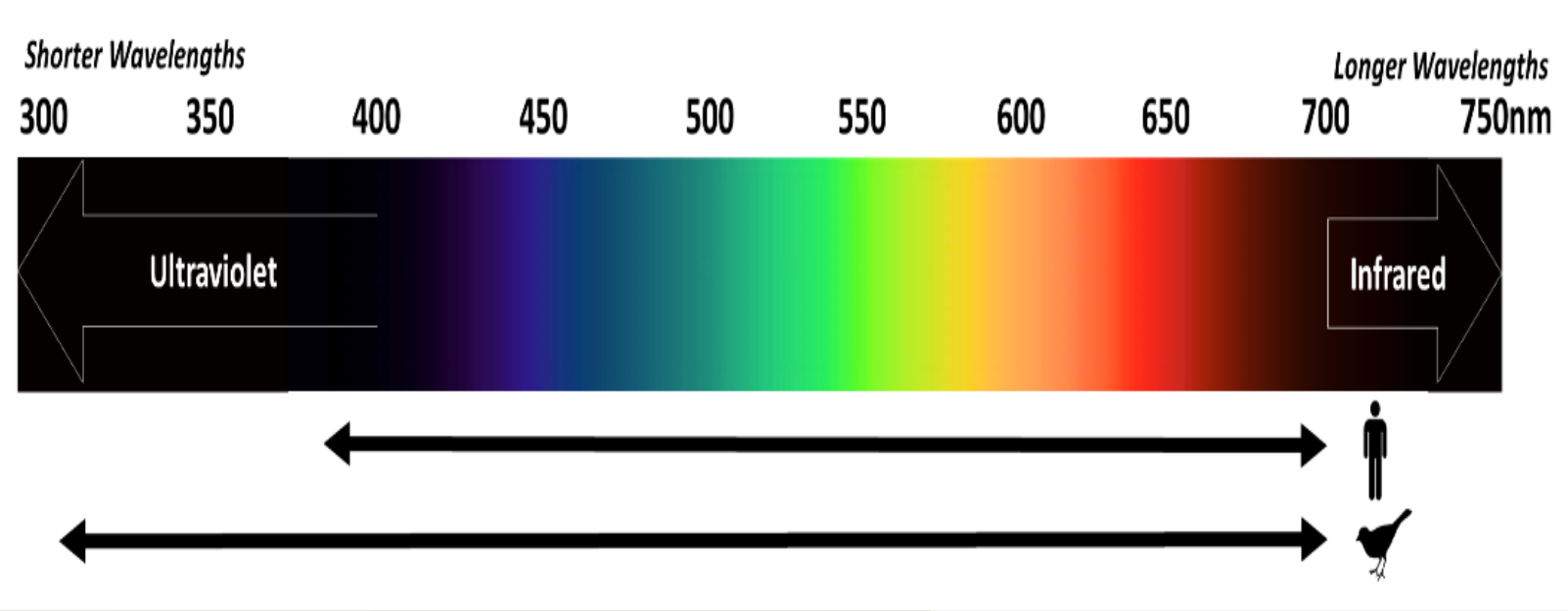
Animal Interactions with Power Lines

Collision Markers



Reduce collision rates by about 50%, on average (Morkill and Anderson 1991, Brown and Drewien 1995, Murphy et al. 2009, Barrientos et al. 2011). When collisions occur at night, markers are less effective…

Avian Vision



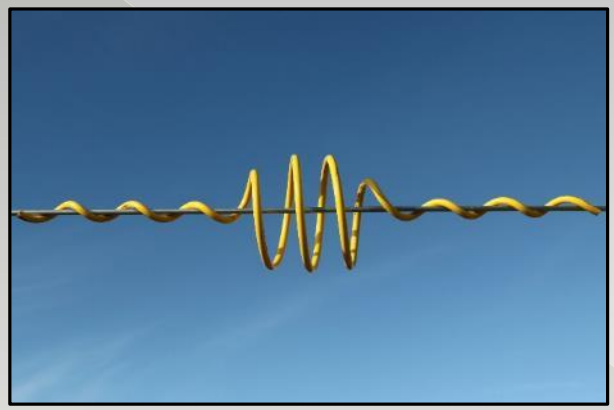
- Little comparable quantitative information is available to describe the diurnal and nocturnal properties of wire markers, or how they relate to avian vision.
- The light detected by avian and human eyes is difficult to compare because birds divide the visual spectrum differently, detecting a wider span of wavelengths than those humans see (EPRI 2016).

Species

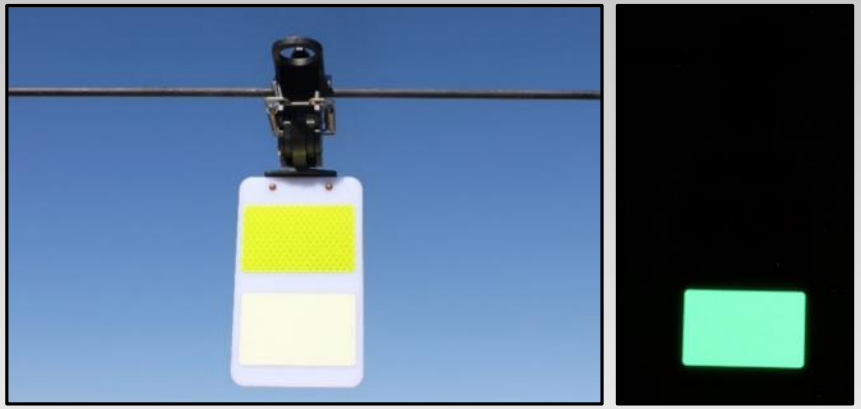
CITATION(S): EPRI. 2016. Power line collision mitigation and avian vision. Final EPRI Report XXXXXXX, EPRI, Palo Alto, CA (In Press)

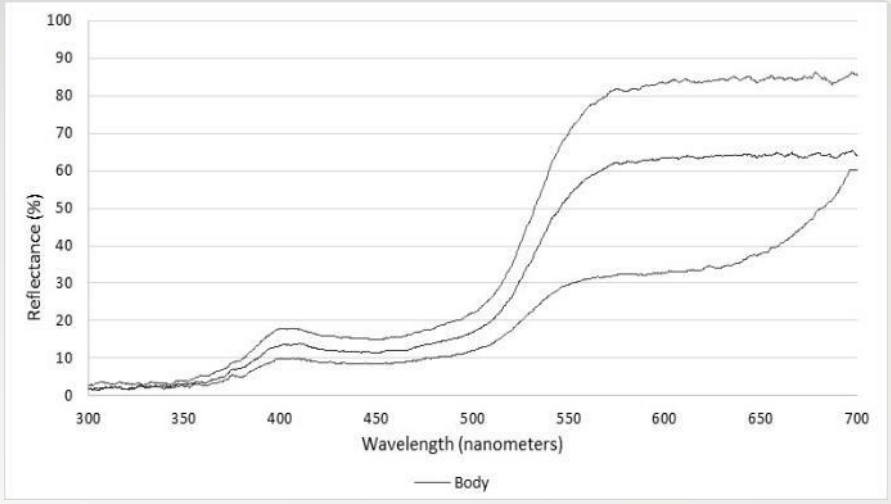
Spectral Reflection of Markers

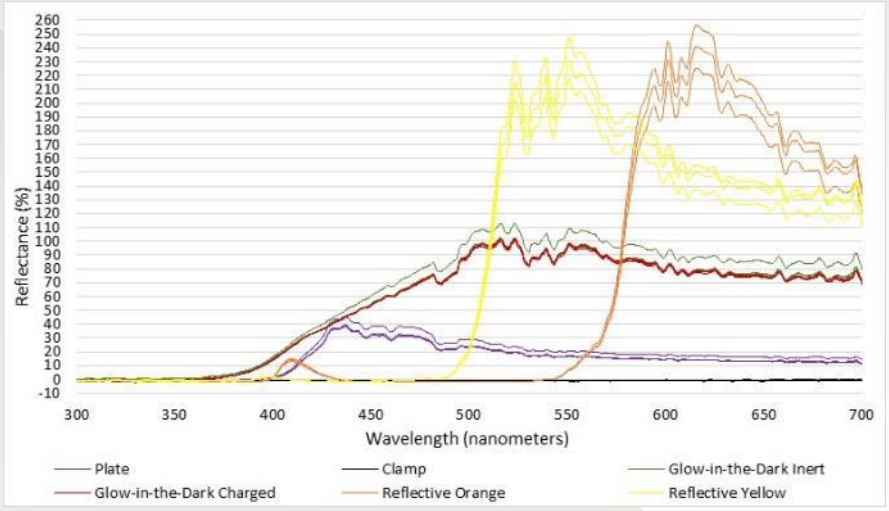
Swan Flight Diverter



FireFly High Wind BFD







Selection of wire markers should be matched to approximate the vision of the species at risk under the appropriate lighting conditions (EPRI 2016).

CITATION(S): EPRI. 2016. Power line collision mitigation and avian vision. Final EPRI Report XXXXXXX, EPRI, Palo Alto, CA (In Press)

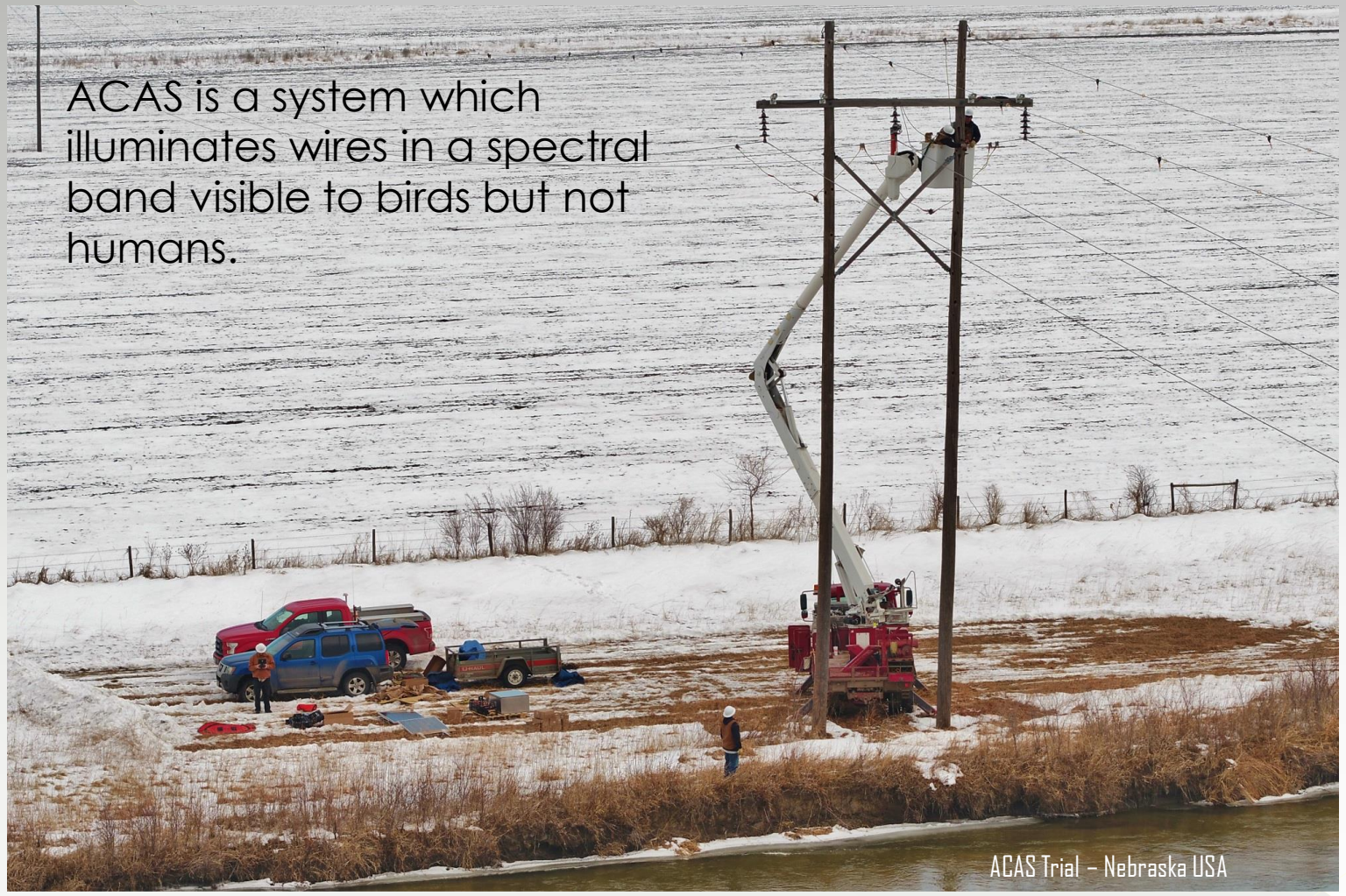
Mitigation - Automation

Prototype Avian Collision Avoidance System (ACAS) – Patent Pending EDM

- EDM constructed a prototype ACAS for trial at a location with historical bird collisions. The unit was designed to mitigate collisions for a 200 meter span.
- Site Testing: EDM set up the system on a transmission line with a history of persistent crane collisions (e.g., Murphy et al. 2016). EDM has also located another site with high numbers of migrating passerines. Both sites have large numbers of annual migratory bird collisions.
- Testing was completed last month at first site, the Rowe Sanctuary in Nebraska.

Mitigation Tool – Under Development (EPRI funded technology)

ACAS Trial Project



Rowe Sanctuary, an important stopover site for Sandhill Cranes.

ACAS Trial Project

Used a randomized study design to test a pole-mounted near ultraviolet light (UV-A) system. We observed 48 Sandhill Crane collisions during 19 nights of monitoring when the ACAS was off. In contrast we observed 1 Sandhill Crane collision during 19 monitoring sessions when the ACAS was on, ***a 192% reduction in Sandhill Crane collisions and a 133% reduction in dangerous flights.*** Moving on to a passerine trial…

Conclusions

1. Animal issues with power facilities are a persistent challenge and cost the utility industry millions of euros each year. Consumers are also negatively impacted.
2. Effective solutions require an understanding of biology and engineering.
3. Fortunately solutions are continually evolving and are available for many existing outage problems (Distribution OH + Transmission OH + Substations).
4. New technologies hold promise for solving more difficult problems such as avian and bat collisions.
5. It is best to build resiliency into the grid during the new construction planning process.
6. It is also critical to develop a program which has support from management, engineers, environmental staff and the linemen.
7. Monitoring and annual reporting needs to be a key component of an animal mitigation program.
8. As electrification expands into other parts of the globe, these lessons need to be carried forward by you!

ACKNOWLEDGEMENTS:

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  - Dr. Francisco Moreira
- **EPRI – Electric Power Research Institute**
- **NRECA – National Rural Electric Cooperative Association**

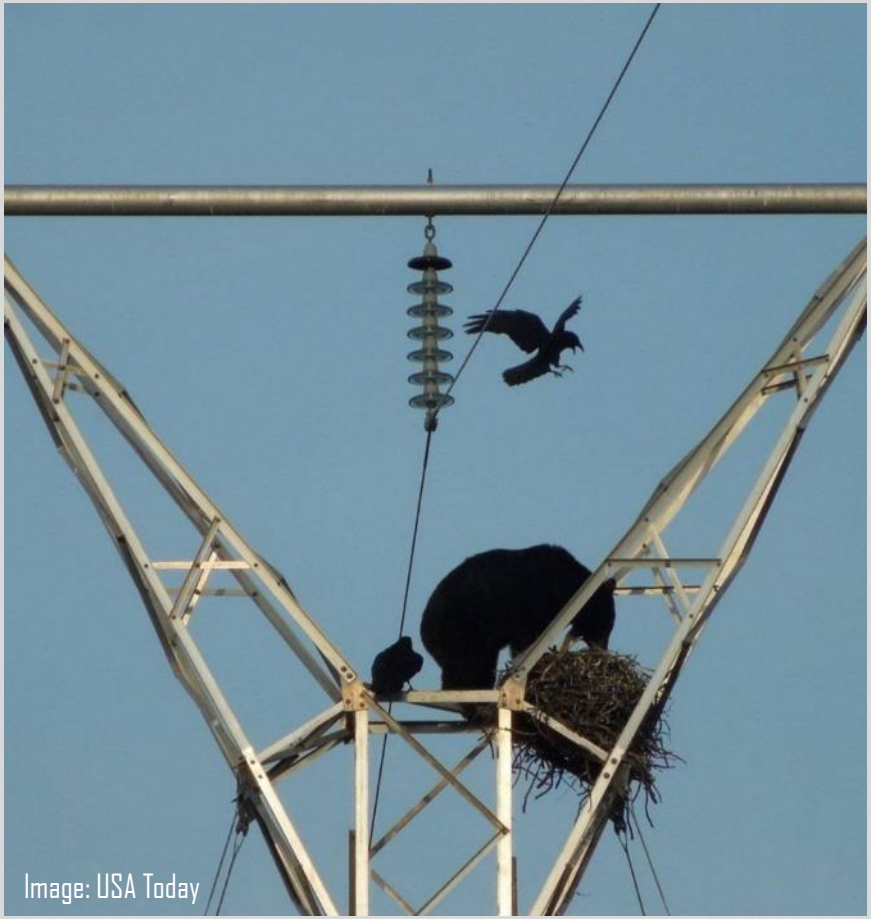

Image: USA Today

Thank You!