Chapter 50

Electrocution

Cause

Power lines and power poles present a potential electrocution hazard to wild birds. Many birds, especially raptors, select power poles for perching, and, sometimes, for nesting (Figs. 50.1–3). If a bird's appendages bridge the gap between two energized parts or between an energized and a grounded metal part, electricity flows through the "bridge" that is filling the gap and the bird is electrocuted.

Most commonly, birds are electrocuted where conducting wires (conductors) are placed closer together than the wingspan of birds that frequent the poles (Fig. 50.2). Feathers are poor electrical conductors, but if contact is made between points on the skin, talons, or beak, or if the feathers are wet, conduction can occur. Common anatomical sites of contact include conduction between the wrists of each wing or between the skin of one wing and a foot or leg. The resulting shock causes severe, usually fatal, cardiovascular injury.

Because conductors on distribution lines are placed closer together than high voltage transmission lines, birds are more frequently electrocuted on distribution lines despite their lower voltage.

In addition to one to three conductors, power poles may also carry ground wires, transformers, or grounded metal crossarm braces. Complicated wiring configurations that put multiple energized and grounded metal parts near attractive perching or nesting sites are the most hazardous configurations (Fig. 50.3).

Species Affected

Electrocution is primarily a problem of large raptors in open habitat, particularly treeless areas. Golden eagles are by far at greatest risk, but other eagles, large buteos, falcons, and the largest owls, such as the great horned owl, are also susceptible. The large wingspan of these birds appears to be the single most important factor in their susceptibility.

In addition to their size, the perching behavior of these bird species puts them at greater risk. Species that prefer exposed high perches are more likely to be attracted to power poles, as are the species that use a "still hunting" technique in which they perch and visually search the landscape for prey rather than hunting in flight.

Immature and subadult raptors are more commonly electrocuted. This predisposition is presumably related to their inexperience and awkwardness in taking off and landing.

Photo by Brian Woodbridge, U.S. Fish and Wildlife Service, Macdoel, CA

Figure 50.1 *A bald eagle using a power pole as a perch.*

Photo by Morlan Nelson, PacifiCorp, Boise, ID

Figure 50.2 *This is a hazardous situation because the eagle's wings can contact two conductors at once.*

Photo by Monte Garrett, PacifiCorp

Figure 50.3 *An eagle nest on the top of a power pole.*

Distribution

Bird electrocutions are most common in the western plains of the United States where open shrub and grassland habitats are common, and are less prevalent in forested habitat (Fig. 50.4). However, birds may be electrocuted wherever electrical lines are above ground.

Generally, electrocutions are more prevalent in sites where a susceptible species' prey base is present and where suitable perches, other than power structures, are lacking. In the western plains, elevated perches are at a premium, and the more susceptible raptor species are abundant. The combination of golden eagles, jackrabbits, grassland habitat, and dangerous power pole configurations can be expected to be lethal. Similar conditions exist on the Russian steppes. Electrocution is a major cause of mortality for the Russian steppe eagle and for other raptors that nest on power poles and use them for perches in this largely treeless area (Fig. 50.5).

Photo by Milton Friend

Figure 50.5 *Power lines that are not designed to prevent electrocution and that cross largely treeless areas, such as this line on the Russian steppes, pose a significant hazard for large raptors that use the poles as perches for hunting and as nesting platforms.*

Seasonality

Birds can be electrocuted during any season, but there can be seasonal fluctuations in electrocution frequency that are related to weather conditions or bird behavior. Electrocutions are more frequent during periods of rain and snow because of the increased conductivity of wet feathers. Inclement wet weather may also combine with windy conditions so that birds are less stable while landing and taking off. Where distribution lines are oriented with crossarms perpendicular or diagonal to the prevailing wind, more electrocutions occur.

Golden eagles may make greater use of power poles as night roosts during migration and wintering. This habit may make them more prone to electrocution as they stretch out to dry their wings in the morning sun.

Inattentiveness during seasonal mating behaviors or territorial conflicts have also been reported to predispose birds to electrocution.

Field Signs

Electrocuted birds often die immediately, so they are found near a power pole or beneath a power line.

The electrical hazard may be apparent in the configuration of the nearby pole. The conductors and other electrical hardware on the pole may be close together. The greatest hazards may be at corner poles where extra wires (jumpers) are required to provide a change in direction, or at poles with transformers or grounded metal equipment near the conductors (Fig. 50.6).

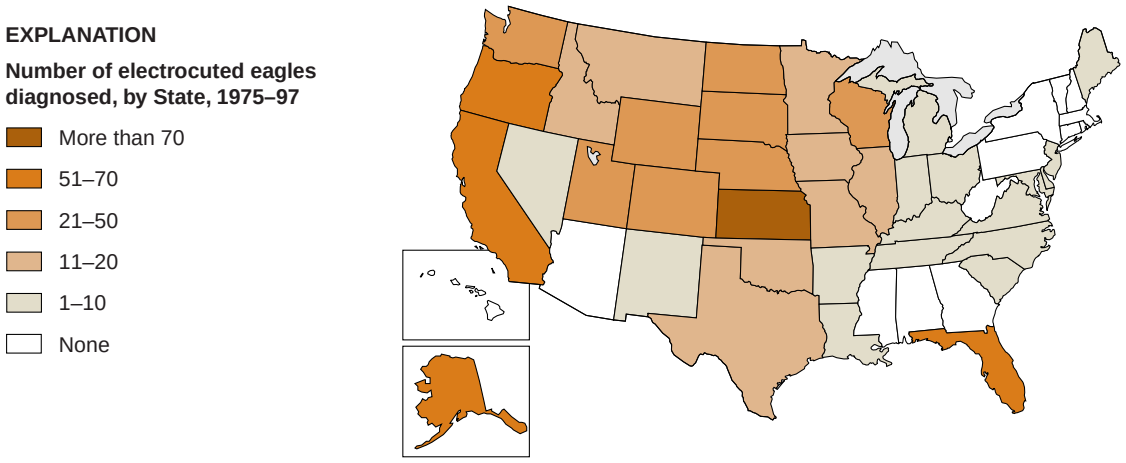


Figure 50.4 *Number of electrocuted eagles diagnosed per State from 1975–95. (From unpublished data from the National Wildlife Health Center.)*

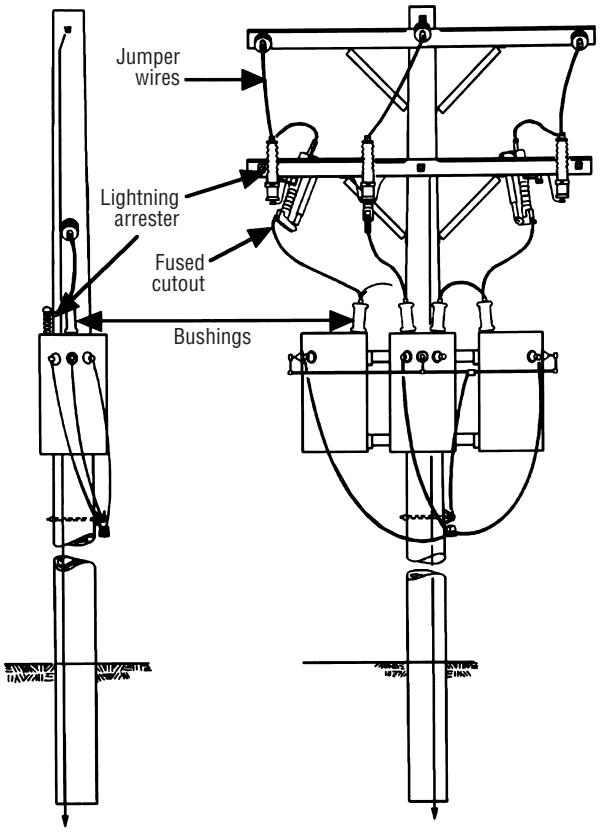


Figure 50.6 *Complicated wiring that is configured with transformers, jumpers, and additional hardware is often responsible for raptor electrocutions. (Graphic provided by Monte Garrett, PacifiCorp)*

Bird electrocutions can cause power outages; therefore, a history of electrical power disruption can help confirm the diagnosis and fix the location and time of electrocution.

Electrocuted birds may catch on fire and ignite vegetation beneath the power structures.

If a bird is electrocuted because the prey item or wet nest material it is carrying comes in contact with an energized part, then these items may be found with the carcass or clutched in its talons.

Gross Lesions

The hallmark of electrocution is burn marks. Burns are generally confined to the sites of body contact with the electrical source; however, if the feathers are ignited then the entire carcass may be charred (Fig. 50.7). Burn marks from fatal electrocutions can have a remarkable range in appearance from very subtle feather disruption to limb amputation. Burns cause the feather edges to curl or twist (Fig. 50.8), and light-colored feathers may be discolored brown or charred. Burns on avian skin appear as dry blisters, particularly on the scales of the feet or legs (Fig. 50.9A and B). The margins of these blisters may be brown or charred. Severe, deep burns can extend through the skin, cauterize muscles and tendons, liquefy fat, and even fracture bones.

Sublethal bird electrocutions are uncommon. In these cases, a single limb is usually affected. Initially, burns may be seen on the skin or the feathers at the contact site. Later, the only evidence may be the loss of blood supply to a wing or foot and eventual gangrene. If the damage can be removed by surgical amputation, some electrocuted birds can recover and be kept permanently in captivity.

Diagnosis

A diagnosis of electrocution is based on the presence of burns and an absence of evidence of other causes of death. Hemorrhages in the subcutaneous tissue and internal organs suggest cardiovascular injury and can support the diagnosis.

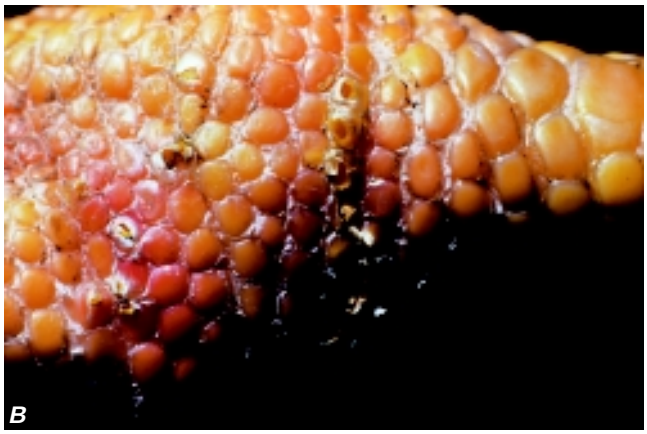
A field history that includes proximity to an electrical line is helpful but not sufficient in itself. Birds may collide with

Photo by James Runningen

Figure 50.7 *An electrocuted bald eagle that is charred over most of its body.*

Photo by James Runningen

Figure 50.8 *Electrical burns on the wing feathers of a bald eagle. Note also the fracture and charring of nearby bones.*



Photos by James Runningen

Figure 50.9 ***(A)*** *A large burn on a golden eagle's foot.* ***(B)*** *Multiple small, subtle burns in the scales on a bald eagle's foot.*

power lines, be shot while perching, or fall from perches after poisoning or illness; therefore, location is not definitive for electrocution.

Control

Raptor electrocutions generally can be reduced by adopting safe electrical pole and line configurations or managing raptor perching. Safe wiring configurations separate the wires and the grounded metal parts so that raptors cannot simultaneously touch two of them at once (Fig. 50.10). Existing installations that contain hazardous configurations can be modified by insulating or reconfiguring the wiring. Rather than comprehensive modifications, an economical but effective approach is to modify selected poles based on field observations of bird use and mortality. If reconfiguring or insulating the wires is not feasible, then access to the hazardous perch can be blocked and safer, alternate perches can be provided. Despite the inherent equipment costs of modification, electrical power companies are often proactive in preventing bird electrocution. Power companies benefit by reducing costly power outages, by avoiding liability for migratory bird mortalities, and by the positive public image that is generated by control projects.

When new electrical installations are planned, the design can take into consideration the likelihood of raptor electrocution. The risk can be evaluated in advance by considering raptor concentrations and behavior along the installation route. Structures in raptor migratory corridors, as well as nesting and wintering ranges, may pose a risk.

Human Health Considerations

Under normal circumstances, there is no exposure.

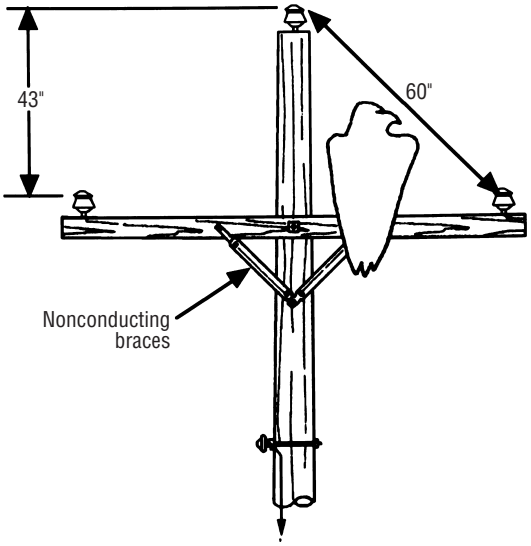


Figure 50.10 *A safe wiring configuration separates the conductors and other energized hardware so that large raptors are unable to touch two pieces of hardware simultaneously. (Graphic provided by Monte Garrett, PacifiCorp)*

Nancy J. Thomas

Supplementary Reading

Avian Power Line Interaction Committee, 1996, Suggested practices for raptor protection on power lines: The state of the art in 1996: Edison Electric Institute/Raptor Research Foundation, Washington, D.C., 125 p.

Bevanger, K., 1994, Bird interactions with utility structures: Ibis, v. 136, p. 412–425.