



Environmental Concerns in
Rights-of-Way Management

12th
International
Symposium



Liability risks are increasing for electric utilities when wildfires start on rights-of-way (ROWs) and then spread, causing injury or loss of life, damaging private property, or resulting in substantial firefighting expenses. Electric utilities invest in vegetation management (VM) to prevent ignitions resulting from contacts between trees and powerlines, but may overlook fire risks posed by bird contacts. Our objective was to provide new insight into bird-caused fire risk. We evaluated fire records from Beale Air Force Base in California in 2016 and 2017. In 2016, there were no bird-caused fires at powerlines. In 2017, there were five bird-caused fires, including one that burned 292 hectares (ha) (722 acres; 2.9 kilometers [km]²) off the base. We also monitored online reports attributing fires in ROWs to bird contacts. From January 1, 2014 through December 31, 2017, we identified 93 reports, including 78 in North America. Most ($n=45$; 58 percent) fires in North America occurred during the summer months, and California had more fires ($n=17$; 22 percent) than any other state. Mitigating the risks of bird-caused fires in ROWs can be accomplished by retrofitting overhead electric systems to prevent birds from simultaneously contacting two or more conductors at different electric potential.

Bird-Caused Fires in ROWs

James F. Dwyer, Richard E. Harness, Tamara Gallentine, and Andrew H. Stewart

Keywords: Bird, Cause, Eagle, Electrocutation, Fire, Hawk, Ignition, Raptor.

INTRODUCTION

Powerlines have been implicated as ignition sources in large and destructive wildfires in various places around the globe, including the U.S. (Keeley et al. 2011), Australia (Cruz et al. 2012), Chile (Vargas 2016), and Spain (Guil et al. 2018). As a consequence of increasing costs associated with fighting and recovering from wildfires, electric utilities in the U.S. are coming under increasing scrutiny and liability for the effects of wildfires which start on utility rights-of-way (ROWs). For example, Cal Fire, the state of California's Department of Forestry and Fire Protection, recently initiated a series of lawsuits against several investor-owned and municipal utilities throughout the state to recover costs associated with fighting fires attributed to powerlines. Individual civil suits and class action lawsuits are also being pursued in California. To manage fire risk, electric utilities in fire-prone areas typically focus on clearing vegetation from ROWs because vegetation contacts with powerlines are a frequent ignition source. Clearing strategies usually center around mechanically trimming trees that have the potential to grow up, into, fall, be blown down onto, or drop branches across powerlines. Clearing sometimes also includes spraying herbicide or defoliant around the bases of power poles to reduce ignition risks from possible arcs and sparks generated by equipment operation.

Electrocuted wildlife can also cause fires (Lehman and Barrett 2002; Haas et al. 2005; Guil et al. 2018). In the U.S., wildlife species involved in animal contacts can include climbing mammals, climbing snakes, and birds. In this document, we focus on collecting evidence of bird contacts igniting wildfires. We do so to provide the electric utility industry with information that can be useful in evaluating the entire suite of fire ignition risk points. This also provides electric utilities with a more complete suite of information useful in assessing costs and benefits of implementing an Avian Protection Plan

(APP) as described by the Avian Powerline Interaction Committee (APLIC 2006) and by the U.S. Fish and Wildlife Service (USFWS) (2005).

Bird-caused fires on distribution lines result from birds perching on power poles and simultaneously contacting an energized wire and a path to ground (phase-to-ground), or two energized wires of different electric potential (phase-to-phase). Either type of contact consistently results in electrocution of, or an electric shock injury to, the bird (APLIC 2006; Dwyer 2006; Dwyer and Mannan 2007), and occasionally results in an arc flash that ignites the bird's feathers. When the burning bird drops to the base of the power pole, a wildfire may be ignited. In a worst-case scenario, such as the case in Chile where 15 people were killed by a bird-caused fire (Vargas 2016), the consequences of such a fire may greatly outweigh the costs of prevention.

Our objective is to provide new evidence of bird-caused fire risk for electric utilities. The evidence presented here comes from two very different sources. First, we provide a summary of bird-caused fires at Beale Air Force Base in northern California. Second, we provide a summary of news reports of bird-caused fires from around the world. After demonstrating that bird-caused fires occur, we provide a summary of strategies to mitigate bird contacts.

METHODS

Beale Air Force Base

Beale Air Force Base (Beale) encompasses nearly 9,307 hectares (ha) (23,000 acres; 93 kilometers [km]²) where nearly 4,000 military personnel are stationed. Distribution electric power is supplied to Beale by nearly 2,000 power poles. We evaluated records of wildfires at Beale in 2016 and 2017 to identify fires caused by bird contacts, and of those fires, to identify hectares burned on Beale. These fires were reliably identified by on-base personnel with relevant expertise. As a conceptual

surrogate for fires spreading beyond ROWs, we also evaluated a fire caused by a bird contact that started on Beale and burned onto adjacent properties. The data from Beale were limited in scope, leaving open the question of whether concerns of fires caused by bird contacts with overhead powerlines had any application to electric utilities elsewhere. We address this question through our monitoring of Google Alerts.

Google Alerts

A Google Alert is a content detection and notification service provided by Google LLC ("Google", Mountain View, CA) wherein a user can provide keywords to Google, and Google then provides a daily e-mail containing links to new content including the keywords provided. From January 1, 2014 through December 31, 2017, we monitored the results of three Google Alerts. The Google Alerts were for the key words "bird (and) fire," "eagle (and) fire," and "hawk (and) fire."

Google Alerts do not include any filtering, so a Google Alert on "eagle (and) fire," for example, could provide links to any new article by any news agency with "Eagle" in the name any time those agencies placed an article on their websites containing the word "fire." To identify only new content describing a fire caused by a bird in a powerline ROW, we assessed each article in each Google Alert by reading the content of all articles which appeared to have the potential to be relevant. We then discarded articles that were not relevant—for example, bird electrocutions that did not start fires, fires started by bird nests on residential light fixtures, etc. Because the Google Alert data were published by journalists rather than professional fire investigators, any given report could be questioned. However, many reports attributed fire causation by quoting professional firefighters at the scene or by including photos of charred avian carcasses, increasing the likelihood that reports were correct. Reports

originating from a wide variety of independent news sources were considered to have increased credibility. Although photographs were often included in news reports, none of those photos are included here due to copyright limitations. However, the web addresses for all news reports evaluated in this study are available by contacting the authors (see Additional Information). Interested readers may follow those links to view original reports and to view photos. Because web addresses often expire, we also copied the text and photos provided in the reports to our own archives. These archives are available for review upon request, but cannot be included as a publicly available appendix due to copyright limitations.

RESULTS

At Beale, zero of 15 fires in 2016 and five of 22 fires in 2017 were attributed to bird contacts with powerlines (Figure 1). Bird-caused fires resulted in 97 ha (240 acres; 1.0 km²) burned on Beale (mean=48 acres/fire), and when one fire spread off-base, an additional 292 ha (722 acres; 2.9 km²) burned. None of the bird-caused fires recorded at Beale were duplicated through Google Alerts.

Google Alerts enabled us to identify 20 fires in 2014, 34 fires in 2015, 16 fires in 2016, and 23 fires in 2017 (93 fires total) caused by bird contacts with overhead powerlines (Table 1 and Table 2). Of these, 78 fires were in North America (Figure 2), 10 fires were in

Australia, three fires were in Europe, and two fires were in Asia. Of the fires in North America, 68 were in the U.S. (Figure 3), and these were most frequent in summer (Figure 4). Within the U.S., 17 fires were in California, seven were in Texas, and the remainder were scattered throughout 21 other states with no more than four fires identified per state. Many of the reports we identified through Google Alerts included images similar to those we collected at a bird-caused fire that we observed prior to beginning this work (Figure 5). For example, we received photos of burned vegetation surrounding a charred bird carcass at the base of a power pole.



Figure 1. Charred bird carcasses at the base of a power pole on Beale Air Force Base, where a bird-caused fire occurred on an electric power ROW in 2017

City	ST/PR /DI	Country	Date	City	ST/PR /DI	Country	Date
Galena	KS	USA	1/13/14	Bembridge	IOW	Scotland	6/17/15
Narrabri	NSW	Australia	2/11/14	Santa Barbara	CA	USA	6/19/15
Montville	CT	USA	4/7/14	Lewiston	ID	USA	6/25/15
Beaver	PA	USA	4/18/14	Emmett	ID	USA	6/26/15
Mumbai	MH	India	4/30/14	Segovia forest	SG	Spain	7/2/15
Wichita Falls	TX	USA	5/7/14	Kamloops	BC	Canada	7/3/15
Anthony	TX	USA	6/2/14	Alton	IL	USA	7/6/15
Lisbon	IA	USA	6/3/14	Cleveland NF	CA	USA	7/17/15
Stockton	CA	USA	6/16/14	Vernon	BC	Canada	7/23/15
Heppner	OR	USA	6//14	Noank	CT	USA	7/27/15
Tiffin	OH	USA	7/7/14	Roseburg	OR	USA	7/27/15
Kamloops	BC	Canada	7/8/14	Jamestown	CA	USA	7/30/15
Sequin	TX	USA	7/14/14	Spearfish	SD	USA	8/7/15
Pasco	WA	USA	7/29/14	Cedar City	UT	USA	8/18/15
Thunder Bay	ON	Canada	8/4/14	Cascade Locks	OR	USA	8/28/15
Wairarapa	MWT	New Zea	8/5/14	Bayswater	WA	Australia	9/6/15
Hope	AR	USA	9/26/14	Weiser	ID	USA	9/8/15
Los Angeles	CA	USA	11/7/14	West Kelona	BC	Canada	9/9/15
Sandy Hook	NJ	USA	11/14/14	Rosetown	SA	Canada	9/10/15
Clewiston	FL	USA	12/3/14	Berserker	QLD	Australia	9/16/15
Otago	OTA	New Zea	1/15/15	Reno	NV	USA	9/21/15
Welcome Bay	BOP	New Zea	1/20/15	Yreka	CA	USA	9/29/15
Taupo	NTL	New Zea	2/18/15	Fort Hall	ID	USA	10/2/15
Oyster Creek	NJ	USA	3/22/15	College Station	TX	USA	10/2/15
Dennis	MA	USA	5/18/15	Casper	WY	USA	10/2/15
San Diego	CA	USA	6/9/15	Brownwood	TX	USA	10/7/15
Martinez	CA	USA	6/16/15	Ellensburg	WA	USA	10/21/15

Table 1. Locations of bird-caused fires in ROWs identified through Google Alerts in 2014 and 2015. ST/PR/DI indicates State, Province, or District, depending on the country. New Zea indicates New Zealand. See text for Google Alert search terms.

City	ST/PR /DI	Country	Date	City	ST/PR /DI	Country	Date
Soor	CG	India	5/1/16	Steiner	TX	USA	5/4/17
Brick	NJ	USA	5/3/16	Salinas	CA	USA	5/18/17
Lubbock	TX	USA	6//16	New Cuyama	CA	USA	5/23/17
Maumelle	AR	USA	6/22/16	Three Rivers	CA	USA	5/26/17
Loveland	CO	USA	6/30/16	Smithfield	UT	USA	7/3/17
Banning	CA	USA	7/5/16	Los Banos	CA	USA	7/9/17
Rio Linda	CA	USA	7/8/16	Topeka	KS	USA	7/9/17
Wareham	MA	USA	7/18/16	Bella Vista	CA	USA	7/23/17
Livingston	MT	USA	7/22/16	Penticton	BC	Canada	7/25/17
Littleton	CO	USA	7/23/16	Baker	MT	USA	7/28/17
Spokane	WA	USA	7/25/16	Spokane	WA	USA	7/28/17
Berthoud	CO	USA	8/1/16	Redmond	OR	USA	8/2/17
Sandy	Bd	UK	8/17/16	Onida	SD	USA	8/2/17
Whately	MA	USA	8/23/16	Eden	NSW	Australia	8/18/17
Penticton	BC	Canada	9/5/16	Palo Alto	CA	USA	8/23/17
Santa Barbara	CA	USA	9/19/16	Great Falls	MT	USA	8/25/17
Great Falls	MT	USA	10/3/16	Penticton	BC	Canada	8/27/17
Pahrump	NV	USA	12/7/16	Regina	SA	Canada	9/5/17
Gippsland	VIC	Australia	1/15/17	Hampton	VA	USA	10/2/17
Carandooly	NSW	Australia	1/20/17	Napa County	CA	USA	12/5/17
Prescott	AZ	USA	4/20/17				

Table 2. Locations of bird-caused fires in ROWs identified through Google Alerts in 2016 and 2017. ST/PR/DI indicates State, Province, or District, depending on the county. New Zea indicates New Zealand. See text for Google Alert search terms.

DISCUSSION

Our high-quality data from Beale has very little possibility of mis-attributed causation, but the information was narrow in scope and limited to relatively few events. Our data from Google Alerts were low quality, with a higher possibility of mis-attributed causation for at least some events, but were broad in scope and included a large number of events. These two complimentary data sets, each pointing to bird contacts as causative for fires on ROWs, lend credibility to one another. Guil et al. (2018) conducted a similar analysis of fire ignition data from 2000–2012 throughout Spain and identified 30 records of wildfires caused by animal contacts, including but not limited to birds. Similarly, Pacific Gas and Electric (PG&E) reported 117 animal-caused fires to the California Public Utilities Commission (CPUC 2018) from 2014–2016. Presumably, some animal-caused fires were attributable to birds, though the animal type is not reported. Other studies, including Lehman and Barrett (2002), Haas et al. (2005), and Manville (2005) provide passing references to bird contacts resulting in fires, but do so without providing original data. Viewed collectively, our data, together with various other publications on the topic, suggest bird-caused fires may be occurring more frequently than is currently recognized. This suggests that the risk of bird-caused fires warrant ongoing monitoring and active risk management by electric utilities. Flawed risk assessment regarding fires may be particularly important because bird-caused fires tend to be ignited in landscapes where trees are rare (Guil et al. 2018), whereas common fire ignition risk mitigation strategies by electric utilities tend to focus on activities such as tree trimming to avoid tree contacts. Electric utilities are encouraged to consider bird-caused fires as an ignition source in their fire risk management strategies to avoid liabilities associated with this cause.

Because bird-caused fires derive from electrocutions, mitigating bird-caused fire risk can be achieved simply by retrofitting power poles to mitigate



Figure 2. Global Locations of Bird-Caused Fires in ROWs from January 1, 2014 Through December 31, 2017, as identified through Google Alerts. See text for Google Alert search terms.



Figure 3. North America Locations of bird-caused Fires in ROWs from January 1, 2014 through December 31, 2017, as identified through Google Alerts. See text for Google Alert search terms.

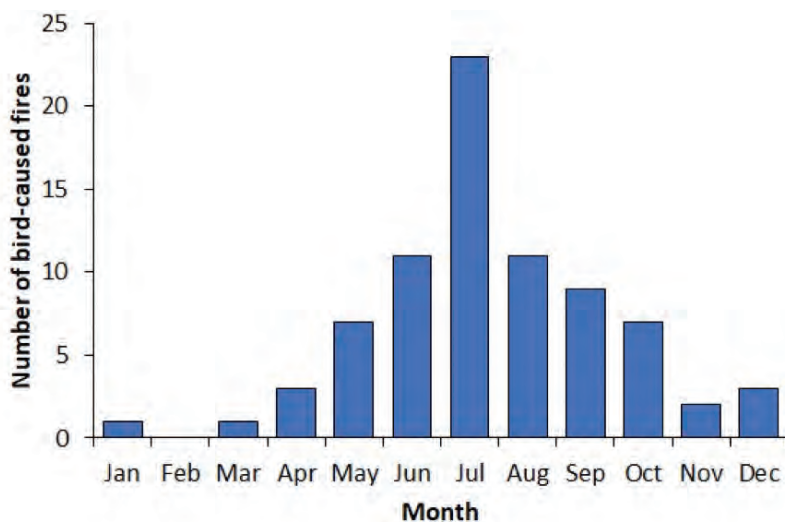


Figure 4. Month of Bird-Caused Powerline Fires in North America from January 1, 2014 through December 31, 2017, as identified through Google Alerts. See text for Google Alert search terms.

bird electrocution risk. Mitigation strategies are known as retrofitting, which includes processes termed redirection, separation, and insulation (APLIC 2006; Dwyer et al. 2017; Eccleston and Harness 2018). In all three approaches, the goal is to modify power poles to create 152 centimeters (cm) (60 inches [in]) of horizontal clearance and 102 cm (40 in) of vertical clearance between potential phase-to-ground and phase-to-phase pathways. These clearances are designed to allow perching by Golden Eagles (*Aquila chrysaetos*), a commonly electrocuted species in North America (Mojica et al. 2018). Because Golden Eagles are larger than all other electrocution-prone bird species in North America (except California Condors [*Gymnogyps californianus*] which are spatially limited), mitigation plans designed for Golden Eagles also protect smaller species (APLIC 2006).

Redirection uses perch discouragers and supplemental perches to shift birds away from high-risk locations on power poles, typically while allowing perching to continue at low-risk locations on the same pole (Dwyer et al. 2017; Eccleston and Harness 2018). Redirection was initially a preferred approach to retrofitting when problems of avian electrocution were first recognized in the U.S. in the 1970s (APLIC 2006). However, because redirection allows exposed energized equipment to persist, and electrocutions also can persist, redirection has become the least preferred mitigation strategy in current avian protection planning. Redirection now tends to be used selectively on locations where neither separation nor insulation can be effectively applied (Dwyer et al. 2016a; Dwyer et al. 2016b)—on overarm switches, for example. Redirection tends also to be used in coordination with insulation such as covering the jumpers in the case of overarm switches.

Separation is accomplished by reframing poles to increase the distance between potential contact points (Dwyer et al. 2017, Eccleston and Harness



Figure 5. View toward power pylon where a bird-caused fire occurred (left). View of bird carcass (flagged) near the base of the power pylon where a bird-caused fire occurred (right).



Figure 6. Incorrectly retrofitted power pole. Lower jumpers are covered, but no other retrofitting exists on the pole. The nestling just visible in the Red-tailed Hawk (*Buteo jamaicensis*) nest on the center transformer is at high risk of electrocution (left). Thoroughly retrofitted power pole. Triangles on each crossarm illustrate redirection, 10-ft upper crossarm illustrates separation, and covers on jumpers, cutouts, arresters, and transformer bushings illustrate insulation (right).

2018). Though ideal for new construction of tangent poles in wide ROWs, separation is impractical as a modification strategy for existing poles that would need to be reframed, impractical for equipment poles that require energized and grounded components in proximity to one another, and impractical in ROWs designed for standard 2.4 meters (m) (eight feet) crossarms.

Most current APPs focus on insulation because insulation does not have the same drawbacks as redirection and separation have (APLIC and USFWS 2005). In this context, the term insulation applies only to protecting against electrocution during incidental contact by birds, not during human contact (APLIC 2006; Dwyer et al. 2017; Eccleston and Harness 2018). Insulation offers three primary advantages over other mitigation strategies. First, when applied correctly, insulation does not allow exposed energized pole-top components to persist. Second, insulation does not require reframing of poles. Third, except for covering jumpers, insulation can often be applied with a hotstick from the ground, facilitating rapid, cost-effective reduction in bird electrocution risk. Insulation is widely used to cover all energized components on power poles. This includes conductor covers and dead-end covers on primary wires, jumper covers or insulated wires on jumpers, disks on switch insulators, covers on fused cutouts, caps on surge arresters, and covers on all energized bushings on transformers, reclosers, capacitors, potheads, and any other pole mounted equipment (Figure 6). Illustrations of insulation are available from a variety of sources, including APLIC (2006), Dwyer et al. (2017), Martín et al. (2017), and EDM International, Inc. (EDM 2018). In all cases where pole-mounted equipment is retrofitted with insulation, the insulation on jumpers connecting the equipment must extend inside the cover on the equipment because even very small seams where covers abut can allow electrocutions to persist (Dwyer and Mannan 2007; Dwyer et al. 2017).

REFERENCES

- Avian Powerline Interaction Committee (APLIC). 2006. "Suggested Practices For Avian Protection On Powerlines: The State of The Art in 2006." Edison Electric Institute, APLIC, and the California Energy Commission, Washington, DC and Sacramento, CA U.S.A.
- Avian Powerline Interaction Committee (APLIC) and the U.S. Fish and Wildlife Service (USFWS). 2005. "Avian Protection Plan (APP) Guidelines." APLIC, Washington, D.C., USA.
- California Public Utilities Commission (CPUC). 2018. "2014-2016 Fire Incident Data Collection." <http://cpuc.ca.gov/fireincidentsdata/>. (Accessed August 2, 2018).
- Cruz, M.G., A.L. Sullivan, J.S. Gould, N.C. Sims, A.J. Bannister, J.J. Hollis, and R.J. Hurley. 2012. "Anatomy of a Catastrophic Wildfire: The Black Saturday Kilmore East Fire in Victoria, Australia." *Forest Ecology Management* 284:269-285.
- Dwyer, J.F. 2006. "Electric Shock Injuries in a Harris's Hawk Population." *Journal of Raptor Research* 40:193-199.
- Dwyer, J.F., R.E. Harness, and D. Eccleston. 2017. "Avian Electrocutions On Incorrectly Retrofitted Power Poles." *Journal of Raptor Research* 51:293-304. Open Access. <http://www.bioone.org/doi/full/10.3356/JRR-16-93.1>
- Dwyer, J.F., and R.W. Mannan. 2007. "Preventing Raptor Electrocutions in An Urban Environment." *Journal of Raptor Research* 41:259-267.
- Dwyer, J.F., M.C. Tincher, R.E. Harness, and G.E. Kratz. 2016a. "Successful Use of a Perch Deterrent To Manipulate Raptor Perching On Model Power Poles." *Colorado Birds* 50:166-174.
- Dwyer, J.F., M.C. Tincher, R.E. Harness, and G.E. Kratz. 2016b. "Testing a supplemental perch to prevent raptor electrocution." *Northwestern Naturalist* 97:1-6.
- Eccleston, D., and R.E. Harness. 2018. "Chapter 12: Raptor Electrocutions and Powerline Collisions." in J.H. Sarasola, J.M. Grande, and J.J. Negro, (eds). "Birds of Prey: Biology and Conservation in the XXI Century." Springer International Publishing, Cham Switzerland. 273-302.
- EDM International, Inc. 2018. "Environmental Services: Avian Protection, Assessment & Mitigation." <https://www.edmlink.com/environmental-services/wildlife-and-avian-assessment>. (Accessed August 2, 2018).
- Guil, F., M. Ángeles Soria, A. Margalida, and J. M. Pérez-García. 2018. "Wildfires As Collateral Effects of Wildlife Electrocution: An Economic Approach To The Situation in Spain in Recent Years." *Science of the Total Environment* 625:460-469.
- Haas, D., M. Nipkow, G. Fiedler, R. Schneider, W. Haas, and B. Schürenberg. 2005. "Protecting Birds From Powerlines." Convention on the Conservation of European Wildlife and Habitats (Bern Convention). Nature and Environment, Council of Europe Publishing. 70.
- Keeley, J.E., W.J. Bond, R.A. Bradstock, J.G. Pausas, and P.W. Rundel. 2011. "Fire in Mediterranean Ecosystems: Ecology, Evolution And Management." Cambridge University Press, Cambridge.
- Lehman, R.N., and J.S. Barrett. 2002. "Raptor Electrocutions and Associated Fire Hazards in The Snake River Birds of Prey National Conservation Area." Technical Bulletin N0. 02-7. Idaho Bureau of Land Management. 24.
- Manville II, A.M. 2005. "Bird Strikes And Electrocutions At Powerlines, Communication Towers, and Wind Turbines: State of The Art and State of The Science – Next Steps Toward Mitigation." USDA Forest Service General Technical Report PSW-GTR-191. 14.
- Martín, J., J.R. Garrido Lopez, J.F. Dwyer, and J.J. Aniceto. 2017. "Líneas Eléctricas Peligrosas Para Las Aves Guía De Identificación De Correcciones Defectuosas." *El Corzo. Una publicación de la Sociedad Gaditana de Historia Natural* 5:56-66. <http://sociedadgaditanahistorianatural.com/articulo-sobre-lineas-electricas-peligrosas-para-aves-no-5-el-corzo/3933/>.
- Mojica, E.K., J.F. Dwyer, R.E. Harness, G.E. Williams, and B. Woodbridge. 2018. "Review and Synthesis of Research Investigating and Mitigating Golden Eagle Electrocutions." *Journal of Wildlife Management* 82:495-506.
- Vargas, S., 2016. "Risk Communication in Chile: A Study of 2014 Valparaíso Wildfire." Master Dissertation. Simon Fraser University (Available at). http://summit.sfu.ca/system/files/iritems1/16691/etd9621_SVargas.pdf.

Additional Information

While conducting this study, we populated a Microsoft Excel document containing the title, story, and web address for each news report used in the Google Alerts portion of this project. This document also contains the date of the story, and the City, County, Region (State, Province, or District), and Continent where the reported fire occurred. This document is available by contacting the authors (jdwyer@edmlink.com) or by contacting EDM International Inc. (info@edmlink.com).