## A New Map for Climate-Driven Hazards to Utility Grids



## Introduction

About 150 million wood poles carry utility lines across the United States, and a new fungal decay hazard map highlights – and helps utilities to mitigate - the growing environmental threat to those vital grid assets.

Wood decay fungi, fed by sun, rain, and soil, is a leading cause of damage to the wood poles that support U.S. utility infrastructure. Since the 1970s, American utility companies have relied on a map from the American Wood Protection Association (AWPA) to anticipate decay threats to wooden poles based on environmental conditions in each area. The original map was built on data from 1957 and was last updated nearly thirty years ago.

The AWPA in August 2021 updated the existing five-zone hazard map to a three-zone map based on in-the-field research. Development of a data-driven ground-contact decay hazard map for utility poles is a vital new tool for the industry. The updated map reflects changes in the climate that have accelerated fungal decay of wood poles that could threaten the integrity of the utility grid.



# The public hazard of wood pole decay

Wood utility poles are so prevalent that they are easy to ignore, which makes them susceptible to substandard maintenance by some utilities. Maintaining and extending the lives of these essential structures can be costly until you consider the enormous and potentially tragic cost of inadequate management.

Unfortunately, there's no shortage of news about fatalities, injuries, and property damages due to poles that were inadequately inspected or never inspected at all. Utilities suffer financial and reputational damage from these incidents. That's why managing poles according to the decay hazards they are subjected to is essential for public safety and continuity of operations.

#### Groundline

Pole Butt

#### **18 Inches Below Groundline**

## **Rethinking the hazard map**

The original AWPA map was based on a series of surveys the Rural Electrification Association conducted in 1971 that measured a range of factors across five different climate zones in the United States.



Figure 1. Major regional differences in potential for deterioration of wood poles used in contact with the ground are shown in Figure 1. In certain modified environments such as banks along irrigation canals or irrigated residential or agricultural lands, a higher degree of protection might be needed than would be required in the local natural environment. It must also be recognized that within individual regions, certain natural environments such as river valleys or coastlines may present greater potential for wood pole deterioration than the region as a whole.

[Source: AWPA Standard U1, Commodity Specification D, Figure 1. 2020 AWPA Book of Standards © 2020 American Wood Protection Association, Inc., Birmingham, Alabama.]

Rethinking the decay zone hazard map is essential considering accelerated climate change. As human-caused global warming continues to raise temperatures and humidity worldwide, the industrystandard decay zone map will soon be out of date. According to the Yale School of Forestry & Environmental Studies, the tropics are growing at a pace of 30 miles per decade, and plant hardiness zones are moving north by about 13 miles every decade. By 2080, conditions in many zones will be hotter and wetter, with the projected climate in Atlanta, Georgia resembling Mobile, Alabama, according to an interactive map from the University of Maryland Center for Environmental Science.

The old decay zone map didn't account for the major climate shifts that have and will occur. Also, the previous map didn't account for below-ground

conditions that accelerate wood fungal growth. The groundline section of a pole (from 6 inches above ground to 18 inches below) is most prone to decay because that is where the necessary conditions of moisture, oxygen, food (untreated wood), and temperature exist. The new map incorporates these groundline conditions to redraw the decay zones.



### **Dose response: Better prediction for a variety of threats**

The new map is based on a dose-response methodology, which describes how much organisms, like wood fungi, may change due to the level of exposure (dose) to a stimulus (thermal energy) over a specific period.

Farmers and horticulturalists use the same approach to predict plant development rates. For wood poles, dose response means the more energy there is in the environment feeding fungal growth, the faster fungi may inflict damage on a pole.

Using the dose response approach, the new map has been simplified to three zones. The delineation of three hazard zones was based on analysis of over 6.5 million unique pole inspection records obtained exclusively from Osmose Utilities Services, Inc. from across the United States. Only data obtained from first cycle, fully excavated pole inspection records were used for this evaluation. First cycle fullexcavated poles have never been remedially treated and have been inspected by an excavation of at least 18 inches deep around the complete circumference of the pole.

The analysis used daily observation data from the Soil Climate Analysis Network (SCAN) and the Snow Telemetry Network (SNOTEL) and the growing degree day approach to predict where fungal decay would pose a greater risk to wooden poles based on daily doses.



## **Revised Decay Hazard Map for Utility Poles**

Although the number of zones decreased, the overall fidelity is higher and allows for more variation, particularly in the Intermountain West of the United States. The complex topography results in climate variations which drive differences in decay hazard. The diversity and abundance of fungi in this region are driven strongly by microclimate.



**Decay Hazard Map for Utility Poles** 

Figure 1. Major regional differences in potential for deterioration of wood poles used in contact with the ground are shown in Figure 1. In certain modified environments such as banks along irrigation canals or irrigated residential or agricultural lands, a higher degree of protection might be needed than would be required in the local natural environment. It must also be recognized that within individual regions, certain natural environments such as river valleys or coastlines may present greater potential for wood pole deterioration than the region as a whole. Refer to Section 1.4.1 above for further discussion of ground contact decay hazards.

[Source: AWPA Standard U1, Commodity Specification D, Figure 1. 2021 AWPA Book of Standards © 2021 American Wood Protection Association, Inc., Birmingham, Alabama.]

Pole parameters for decay hazard zone delineation.					
Zone	Pole Count	Reject Count	Reject Rate	Avg. Reject Age	Avg. Pole Age
Low	722,965	15,379	2.13%	49.95	40.87
Moderate	3,839,605	258,669	6.74%	47.49	35.32
Severe	1,995,209	115,370	5.78%	39.64	25.78

[Source: Cowen, Matthew (2021) A Dose Response Approach to Decay Hazard Mapping for Wood Utility Poles. Proceedings of the American Wood Protection Association, Volume 117, pp 54-57. Birmingham, Alabama.]

Note that in the pole parameter trends, that the average reject age and average pole age decrease with an increasing decay hazard. Yet, the reject rate dips in the severe hazard zone nearly a full percent. This situation may be due to the higher replacement rate of in-service poles in this zone due to hurricane damages, as well as an increased replacement rate due to decay. These differing climates and their effect on wood decay were the primary reasons this approach to decay hazard modeling was taken. Integrating daily soil moisture and temperature parameters in the development of the decay dose better describes the soil environment for potential wood decay.

Using the revised AWPA decay hazard zone map will simplify maintenance and inspection for utility companies. Pole owners will experience better results through better maintenance, fewer replacements, or both.



## Adopting a new approach

The decay hazard map is a guideline that helps utility pole owners understand the below-ground decay hazard to which their poles will be subjected. This is the major distinction of this map over previous versions, which were derived from an above-ground based model.

When buying new utility poles, understanding the decay hazard a utility's pole plant is in can drive decisions on minimum preservative retention levels for treated wood poles purchased for new installations. The map is used to assist new pole owners or buyers who are trying to match up the hazard with the appropriate amount of initial treatment, such as penta, creosote, or CCA.

Although the AWPA does not give guidance on inspection cycles for in-service poles, the previously published map was used to establish recommended inspection cycles in the Rural Utilities Service (RUS) Maintenance Bulletin. Currently, the new map does not represent suggested inspection cycles for wood pole inspection and treatment. It simply represents the potential for deterioration of poles. If RUS choses to, once again, use this map to make recommendations on cycle times, then this certainly benefits wood pole owners who can once again reference RUS guidelines for appropriate cycles. In the meantime, pole owners can draw general conclusions from this map like, "Poles located in a SEVERE decay hazard will have a shorter life expectancy than poles in a LOW decay hazard area, thus, pole inspection and treatment programs should be adjusted accordingly to accommodate earlier onset of decay". The revised hazard zone map – matched with a thorough asset management program - can better help utility companies prevent wood pole decay, extend pole lifespan, and reduce replacement spending.

To learn more about how the revised AWPA hazard zone map can help solve your company's unique needs, contact Osmose today.

Pe y 2021 Al Rights Reserved. Osmose Utiles Services.



To find an Osmose representative in your area, call **770-766-8135** or email **poleinfo@osmose.com** 

©2021 Osmose Utilities Services, Inc. All Rights Reserved.