Estimating Environmental Costs of Hazardous Liquid Pipeline Incidents

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The dataset I chose to work with was the Pipeline and Hazardous Material Safety Administration's Pipeline Safety-Flagged Incidents[5]. This dataset includes data from all incidents in the US regarding pipelines from 1986 to the date of its last publication (8/31/2020). These incidents are divided into categories: gas distribution, gas transmission and gathering systems, hazardous liquids, and liquefied natural gas. Each incident is reported to the PHMSA through a form filed out by the responsible party, the information from these forms are then transferred to the dataset for its corresponding category. The fields of this dataset are extensive including information about the date and time of the incident, information about the responsible part(-ies), cost and damage estimations, details about the pipeline, potential causes, and more. Each category of incident has varied fields, so if I was to combine the datasets, I would have to remove or modify fields.

I have chosen to focus specifically on the environmental aspect of the dataset as this is what interests me most. Unfortunately, most of the types of incidents do not require much information about the impact of the incident on wildlife and the environment, only giving a small field asking if any wildlife was affected with a binary response variable. However, the dataset on hazardous liquids incidents does include the same question AND a cost estimation of the cost of the environmental impact. This is why I am limiting the scope of my research to hazardous liquid pipeline incidents.

I want to know what factors in hazardous liquid pipeline incidents cause significant damage to the environment. This will be done in two ways, one, by using a logistic regression to determine the significant factors in causing incidents where wildlife is affected and two, using a logistic regression to determine significant factors in causing incidents with non-zero (or non-trivial) environmental costs. Following the lead of other research about cost estimation on this dataset[6][1], I will not be using any data fields relating to the scope of the impact of the incident (ie. other costs, personnel effected, etc.) or about the cause of the accident (ie. pipe rusting, construction failure, etc.) as there would be no practical use for an estimation of an incident whose input variables can only be obtained once an incident has already occurred. This is more of a risk assessment for pipelines like an ERA[4]. There are multiple different ways of going about this analysis, using previous reports from the same pipeline[2], or by using information about the pipeline in a vacuum[1]. My goal is

to use the second method as it has more reach to make risk estimates for pipelines that have not yet been built or ones that haven't sufficient incidents to provide an estimation. These cost estimations could then be used in tandem with ways of estimating the risk of an incident[7] and other types of consequence estimations[3] to provide a data-driven risk estimation of pipelines.

References

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