

## Modelling risks to better protect communities

# Scottish Fire & Rescue

### The Challenge

- Model risk levels, by area and by building, across Scotland

### The Benefits

- Deeper understanding of risk across diverse communities
- Precisely targeted fire prevention activities
- Well-informed, strategic resource deployment decisions
- Increased public awareness of fire risks

The Scottish Fire and Rescue Service (SFRS) responds to fires and other emergencies across a vast and diverse terrain. It has used ArcGIS to analyse, measure and compare risk levels throughout Scotland and is now using an advanced risk model to help it better protect communities.

### The Challenge

SFRS operates across an area of 79,900 km<sup>2</sup> and responds to emergencies in large cities as well as on busy motorways, remote villages, narrow mountain passes and inhabited islands. Given the diverse geography of Scotland, the risks from fire, traffic accidents, flooding and other incidents varies enormously from one location to another. SFRS wanted to find a way to measure and compare risk levels in every community to give it a better understanding of how to optimally allocate its resources.

### The Solution

Identifying that a spatial approach would be needed to address this challenge, SFRS decided to make better use of Esri's geographic information system (GIS) technology. The organisation already had ArcGIS licenses but had not been making full use of the product's capabilities. "We effectively had a Formula One racing car in the garage, but no-one was really putting it to the test," says Damien Griffith, Community Risk Manager at SFRS. "This project was the ideal opportunity to show what ArcGIS could really deliver."

SFRS started by mapping historic fires and emergencies over the previous ten years in ArcGIS Pro and ranking them from higher priority (e.g. dwelling fires) to lower priority (e.g. animal assistance). It organised this incident data by local area, using Scotland's 6,976 data zones, adding supplementary data on socio-economic indicators, including the Scottish Index of Multiple Deprivation and household profiles from Acorn. It then tested relationships between variables using two regression models within a customised R script to generate a risk metric value for each of the 6,976 areas, forming the baseline Community Risk Index Model (CRIM©).

With assistance from Sweco, a leading European engineering and environment consultancy, SFRS then enhanced CRIM© by incorporating natural and built environment risk factors, including data on flooding, built-up areas, road networks, land use, buildings and addresses across Scotland. At various stages during the project, SFRS also engaged statisticians from the University of Nottingham and the University of Edinburgh to validate the risk calculations and provide statistical proofing using machine learning algorithms.

Using the risk intelligence derived from the enhanced model, SFRS created an interactive ArcGIS Dashboard that allows senior officers to zoom into any area of the country and see colour-coded risk levels. SFRS and Sweco also developed dedicated ArcGIS Dashboards for the flood and built environment risks, as well as a compelling ArcGIS Experience Builder web app that captures Scotland's 3.8 million individual buildings in 3D, colour-coded according to risk level. With these intuitive online solutions, senior officers can view the risk profiles of communities, pinpoint high-risk buildings in context and run fly-throughs to identify where risks are greatest.

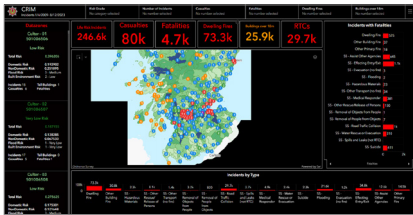
### The Benefits

#### Deeper understanding of risk across diverse communities

Through the use of ArcGIS, SFRS now has a deeper understanding of risk across the different urban, suburban, rural and island communities of Scotland. It can see patterns and relationships between areas and clearly identify buildings with large numbers of residents,

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Damien Griffith, Community Risk Manager, Scottish Fire & Rescue Service



An ArcGIS Dashboard displaying risk analysis across Scotland

including multi-storey buildings, while using these insights to be better prepared in the event of an emergency. Griffith comments, “We cannot predict where the next fire will be, but we can use the digital portfolio of meaningful risk data that we now hold to focus on more vulnerable communities and become better prepared for the future.”

### Precisely targeted fire prevention activities

SFRS is now using its ArcGIS-based risk model to carry out targeted interventions as part of its prevention work, to keep communities safe from the risk of fire and other hazards. For example, Operational Intelligence teams use the built environment web apps to identify high risk buildings and organise risk assessment visits. In the lead up to the United Nations’ COP26 Conference in Glasgow, SFRS used the risk model to assess the risk profiles of properties within a mile of key venues and put effective mitigation plans in place for any high-profile event.

### Well-informed, strategic resource deployment decisions

The ArcGIS-based risk model is currently being used by SFRS to help inform its Strategic Service Review. Senior officers can use the ArcGIS web apps and dashboards to investigate alternative operational asset configurations and align services and resources with the geographical risk levels identified by the risk model. For instance, the service is ensuring that its high-reach appliances are based in the higher-risk locations with the largest concentration of high-rise buildings, where they are most likely to be needed. “It is well-informed decisions like this that help to make communities safer,” Griffith says.

### Increased public awareness of fire risks

SFRS plans to continue to develop its risk model in ArcGIS by, for example, adding data on anonymised population health and wildfire risk locations. SFRS will also consider making a dedicated ArcGIS web app publicly available, to enable property owners to check the risk rating for their own properties and encourage them to take precautions to reduce the risk. “There is huge potential to use ArcGIS to increase public awareness of fire risks,” comments Griffith. “This risk model project has so many possible offshoot benefits for other parts of the service, as well as for protection, prevention and preparedness measures.”