**SPARK**

I would like to acknowledge the Kaurna people as the traditional custodians of the lands I'm on today.

I would also like to acknowledge the Maori as the Tangata Whenua and Treaty of Waitangi partners in Aotearoa New Zealand as AFAC partners. I pay my respects to the ancestors and elders both past and present.

My name is Chantelle and I work for AFAC. In this session I'll be sharing the customizability of Spark and show the different ways agencies who have adopted Spark have been able to integrate it into their operational environments.

Spark has been about 10 years in the making. Over that time, it has evolved and matured quite considerably. Spark is built as a framework. The various components can be separate, separately, improved or customized so that the system is scalable, tailorable and updateable.

The spark design principles are that:

* its code base is modern, modular, and maintainable,
* that the user interface is clean, simple, and also optional – there is the ability to run predictions through the API.
* all the inputs are visible, so the ignitions, the weather, the fuels, and all land attributes are able to be seen and interacted with.
* you can also interactively edit ignition points, all the fuels, the disruptions, and the weather.
* Spark runs a wide range of fire behavior models and submodels, including the same models used for the Australian Fire Danger Rating system.
* it is also easily connected to external data sources such as ARI Hotspots, lightning and curing information.
* it also has flexible output generation, including different file types, data inspection and report generation.
* it also has an ensemble capable capability with a framework built to further develop new ensembles.

All this has allowed agencies who have adopted Spark to customize the way it works in their environments.

What you see here is a graphic representation of the Spark architecture and how all the elements linked together and are able to be customized.

The orange layer is the simplest layer to customize and is designed to be customized to suit local conditions and information.

The purple layers are also customizable and have already been by a few agencies.

This level of customization is aimed at people who are able to write code and is not needed to be customized to produce quality simulations.

It can also be seen here in this example that the graphic user interface designed for Spark is not the only way users can view Spark outputs.

To create bushfire simulations, Spark users forecast weather, raster fuel data and terrain data to assist in the simulation of bushfire paths using rate of spread models.

Currently, the rate of spread models used are based on Australian fuels and conditions, but work is being done to incorporate overseas models such as the Rothermel Fire spread Model.

Spark currently uses nine different rate of spread models that align with the fuel type they've been simulated in. Each model uses different inputs to determine rate of spread. The architecture of Spark also allows users with the knowledge of coding to change the fire spread models if needed.

Spark simulations are run in a six-kilometre grid. The resolution of the different inputs is different and sometimes there's a need to change small areas of information.

In this example here, two different masks have been applied

to this spark simulation. This has allowed a small-scale customization of the two different inputs, which are weather and fuels.

These masks change the inputs to the models being read on a very small scale. This is helpful if the forecast weather is different to the observed weather on the ground or if the raster fuel data is different to the observed conditions.

The whole principle of Spark operational is to assist incident management teams with the best way to respond to bushfire threat. The visual outputs that it provides are used to produce warnings that are shared with the public to assist with evacuations and other emergency orders. This has been shown to reduce the impact to human lives.

The current deployed version of Spark has a wind direction and wind magnitude ensemble that gives probability of an area being impacted.

Phase four of Spark development has added ensembles for three different forest models, including MacArthur, Vesta and Vesta Mark two, and also a fuel age model ensemble and a fuel weather ensemble.

These ensembles allow quick comparison on small changes of each input, which can assist INT to make decisions based on potential changes.

Spark is also in development to provide risk profiling across the landscape. This in involves creating a grid of ignition points across a given landscape and running a simulation that ignites all points and shows areas that are at high risk of impact from wildfire. This will assist in identifying vulnerable areas and enable changes to building standards, preseason preparation, and creating evacuation plans.

There is a vision to utilize contemporary bushfire behavior models to undertake grid ensembles of fire behavior predictions across a given landscape. So once bushfire risk is known, fuel hazard reduction strategies could be identified and assessed within the area.

The New South Wales RFS are building a framework that uses 3000 ignition points and 18 different weather streams. It shows asset locations and gives vulnerability curves as well as cultural heritage risks. Using a cloud computing deployment of Spark to process this information faster than just on a single computer.

The different ways that Spark has been customized to date is a testament to the developers in creating a program that allows changes to be made to suit the situation that it sits in. This covers customizing the graphic user interface, adding and changing model code, and inserting local data and layers.

The future of Spark is bright with many minds coming together to create and adapt spark to a program that is easy to use, keeps up to date with the science, and can suit the agency it is used in.

Thank you for your time.