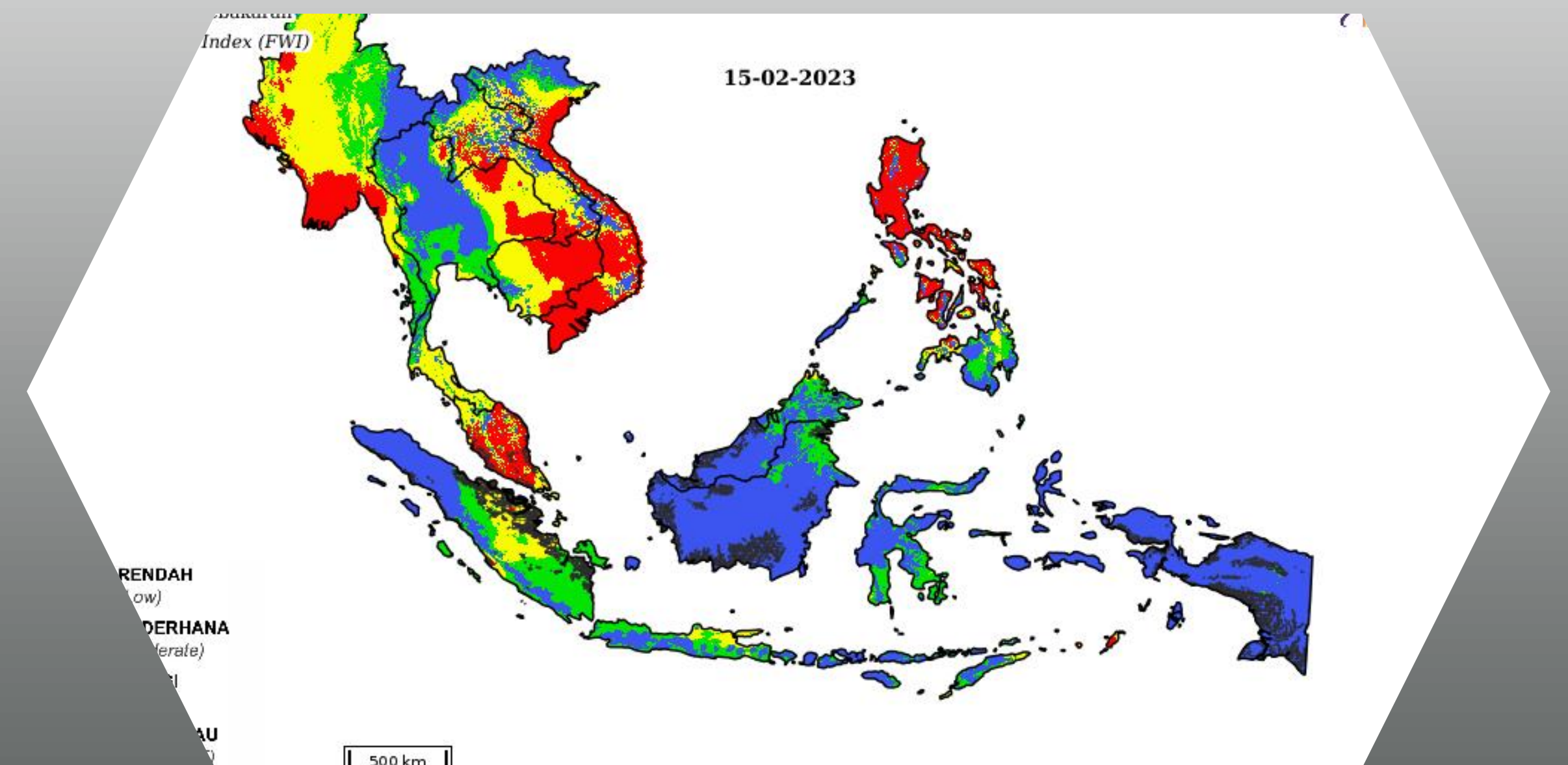




FDRS ADAPTATION, WEB MAP SERVICE DEVELOPMENT AND INTERPRETATION.

Online Training: Fire Danger Rating System (FDRS) and
Applied FDRS for Peatlands
5 - 6 December 2023

Nurizana Binti Amir Aziz
Malaysian Meteorological Department (MET Malaysia)





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- FDRS Adaptation
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- Simulation of ASEAN FDRS
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WHAT IS ASEAN FDRS?

- ASEAN FDRS is a fire management decision-aid system that measures the potential for fire to start and spread for ASEAN region.
- ASEAN FDRS indicates high and extreme risk area for managers to implement action such as open burning ban to reduce the numbers of fire events.
- ASEAN FDRS is generated for ASEAN Member States by MET Malaysia
- Products are available at the Malaysian Meteorological Department's website www.met.gov.my, ASEAN Haze Portal and the ASEAN Specialized Meteorological Centre (ASMC) website <http://asmc.asean.org/asmc-fire/>
- ASEAN FDRS is developed based on Canada Spatial Fire Management System (SFMS).



LETTER AND CERTIFICATE FROM CANADIAN FOREST SERVICES (CFS)

 Natural Resources Canada / Ressources naturelles Canada
Canadian Forest Service / Service canadien des forêts

Mr. Chow Kok Kee, Director-General
Malaysian Meteorological Service
Jalan Sultan
46667 Petaling Jaya
Selangor, Malaysia
Fax 603 795 50964
chow@kjc.gov.my

Dear Mr. Chow:

Subject: Congratulations on Achievements

In mid-2002, the Governments of Canada and Malaysia began a partnership to develop a Fire Danger Rating System (FDRS) for Malaysia. Since that time the Malaysian Meteorological Service (MMS), with assistance from the Canadian Forest Service (CFS), has established an operational FDRS at its headquarters in Petaling Jaya.

The CFS would like to congratulate the MMS on implementation of the Fire Danger Rating System (FDRS) for Malaysia. The establishment of the national FDRS as an Internet-based product to assess fire hazard and provide early warning will enhance the ability of Malaysia's fire agencies to manage vegetation fires and associated haze throughout the country.


The high standard of quality adopted by the MMS will ensure a reliable source of FDR information for both national and international user agencies. Since 2002, the MMS' dedication to FDRS development has been demonstrated in a number of ways, including:


- the speed with which FDRS was brought on-line (only 2 months),
- the consistent availability of FDRS outputs since January 2003,
- the involvement in training activities such as the Weather Observations Procedures Workshop conducted in Sabah for the Sabah Forestry Department and the local MMS office, and
- the commitment shown by pursuing development and operation of a regional Fire Danger Rating System for SE Asia.

The success of the Malaysian Meteorological Service is due, in large part, to the MMS staff involved in the FDRS project, who have consistently displayed their enthusiasm, professionalism and commitment to scientific excellence. Success is also due to the MMS leadership, who decided that FDR is an important tool for Malaysia and provided for its development. It is a pleasure to work with you and your staff.

Again, please accept our congratulations on a job well done.

Yours sincerely,


Steve Price
Acting Director General





- MET Malaysia received a letter and certificate about the ASEAN FDRS in 2003



FDRS SOFTWARE AGREEMENT

DEPARTMENT OF NATURAL RESOURCES
CANADIAN FOREST SERVICE

END-USER AGREEMENT FOR SOFTWARE

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WHEREAS Canada is the owner of the proprietary rights in the computer program ("Software") delivered with this Agreement;

WHEREAS the End-User wishes to obtain the right to use the Software;

AND WHEREAS Canada is prepared to license to the End-User the right to use the Software for the End-Users' own internal use subject to the terms and conditions hereinafter set forth;

NOW, THEREFORE, Canada and the End-User for valuable consideration, the receipt and sufficiency of which is hereby acknowledged by the parties, covenant and agree as follows:

1. The End-User acknowledges that the Software is protected under the *Copyright Act* of Canada.
2. The Software is licensed, not sold, to the End-User for use subject to the terms and conditions of this Agreement. The End-User owns the disk(s) on which the Software is recorded, but Canada retains all ownership interests in the Software.
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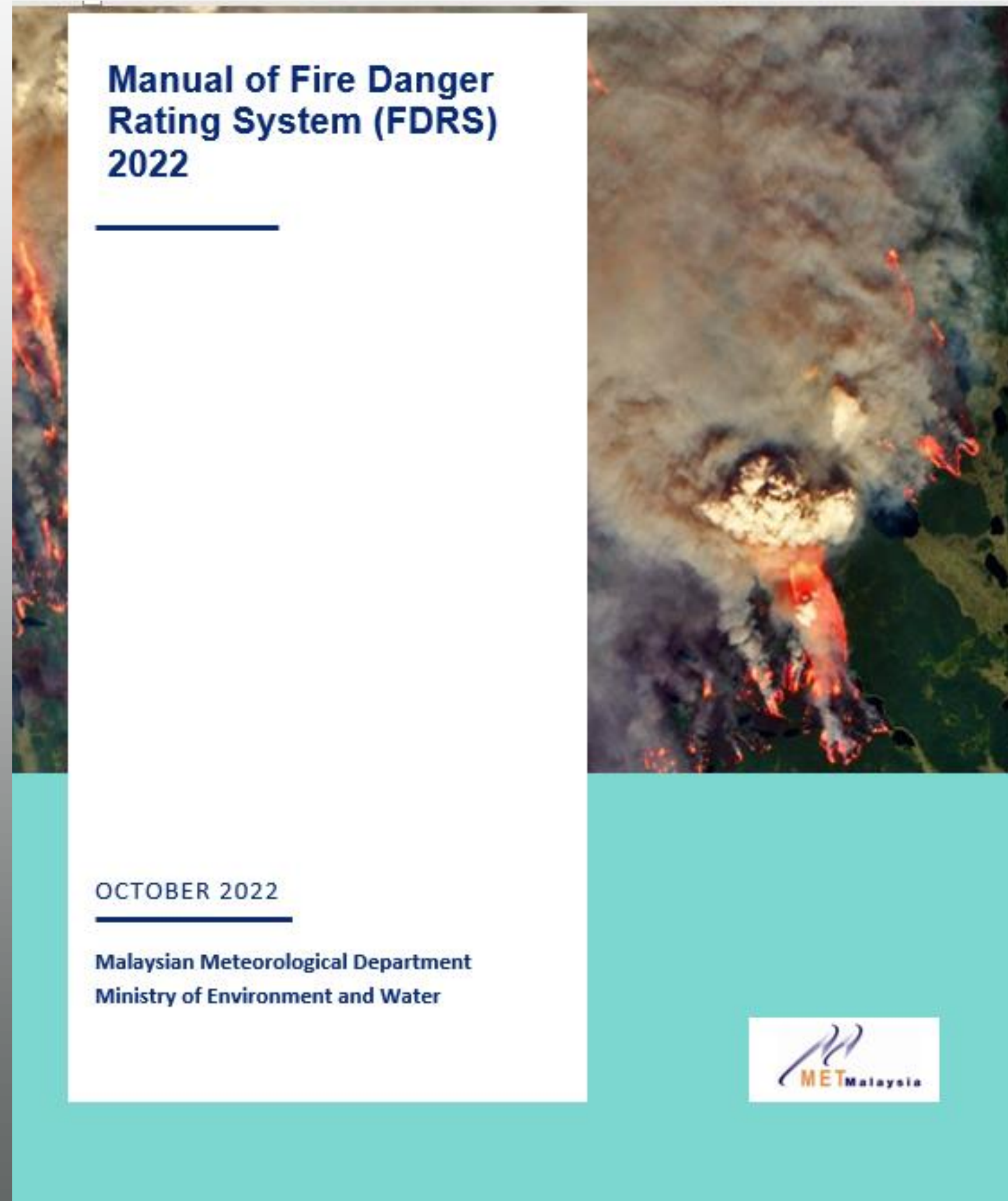
by law or otherwise, including but not limited to, effectiveness, completeness, accuracy or fitness for a particular purpose.

6. Canada shall not be liable in respect of any claim, demand or action, irrespective of the nature of the cause of the claim, demand or action alleging any loss, injury or damages, direct or indirect, which may result from the End-User's use or possession of the Software. Canada shall not be liable in any way for loss of revenue or contracts, or any other consequential loss of any kind resulting from any defect in the Software.
8. The End-User shall indemnify and save harmless Canada and its Ministers from and against any claim, demand or action, irrespective of the nature of the cause of the claim, demand or action, alleging loss, costs, expenses, damages or injuries (including injuries resulting in death) arising out of the End-User's use or possession of the Software.
9. This Agreement shall be interpreted in accordance with the laws in force in the Province of Ontario, Canada.

- MET Malaysia agreed with terms and conditions of FDRS software in 2020 by CFS for the new ASEAN FDRS.
- The new ASEAN FDRS was developed with collaboration from CFS.



FDRS MANUALS



- MET Malaysia has documented the new ASEAN FDRS system architecture and flow in the Manual of Fire Danger Rating System (FDRS), October 2022.



FDRS ADAPTATION

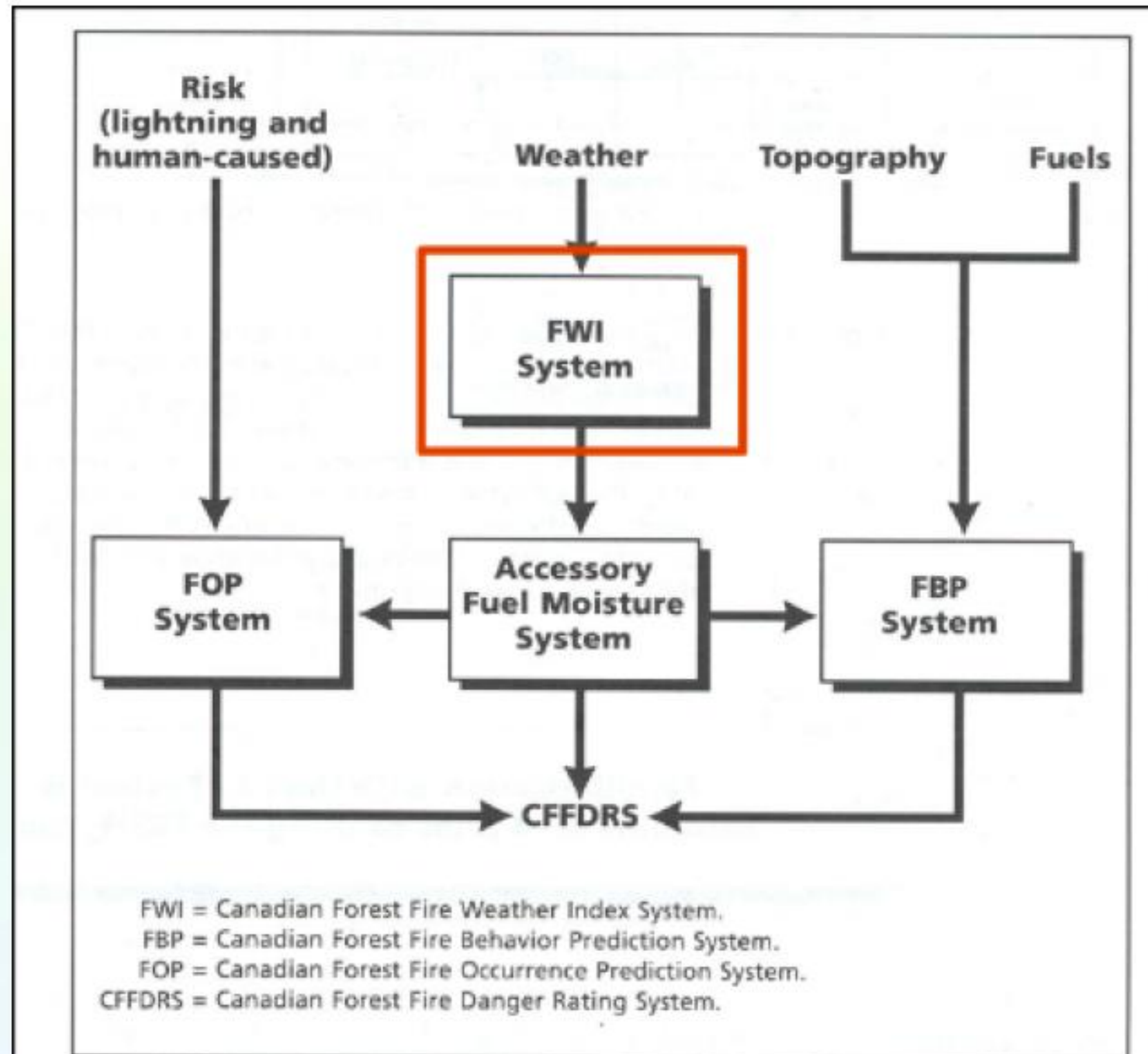
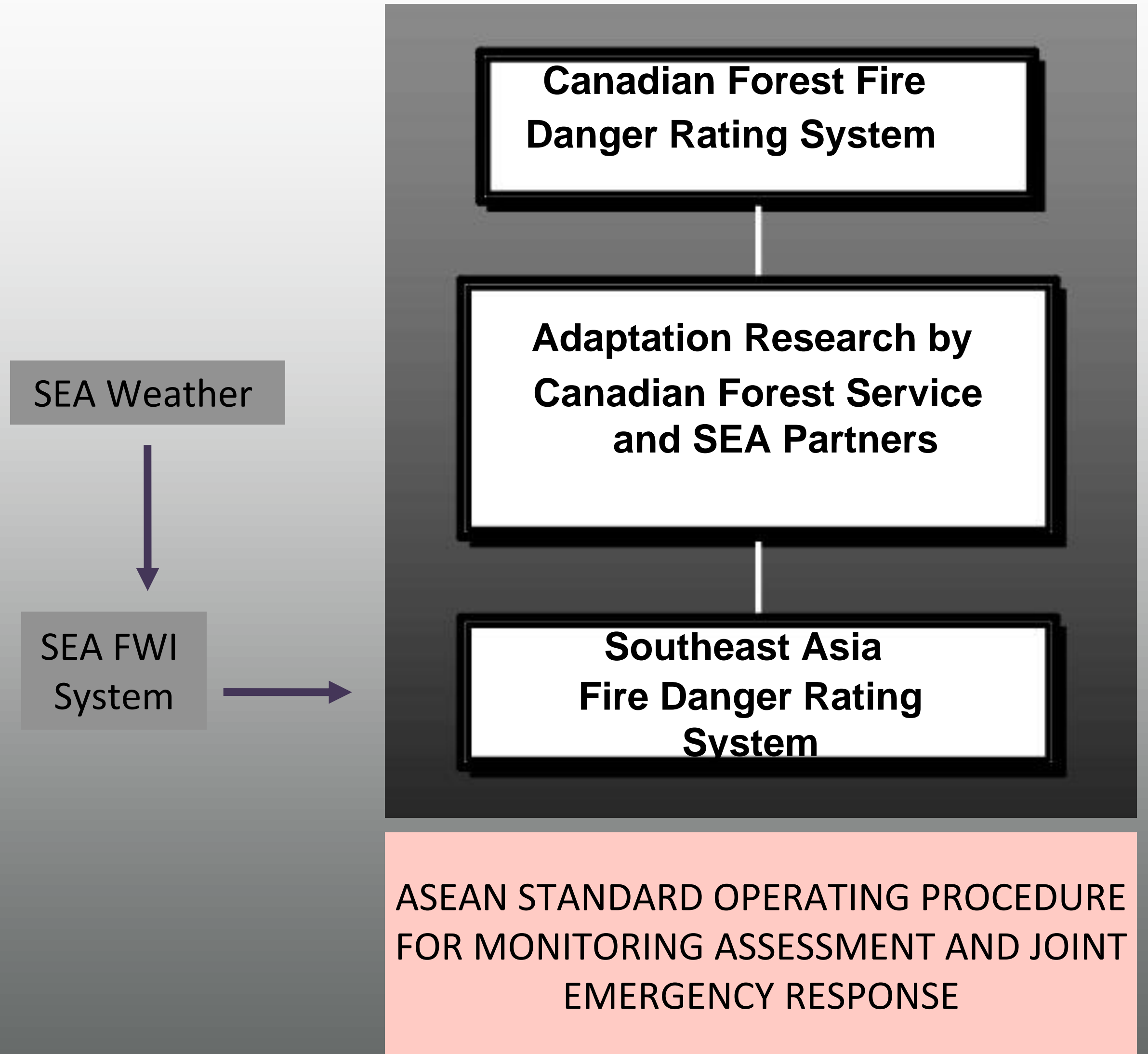


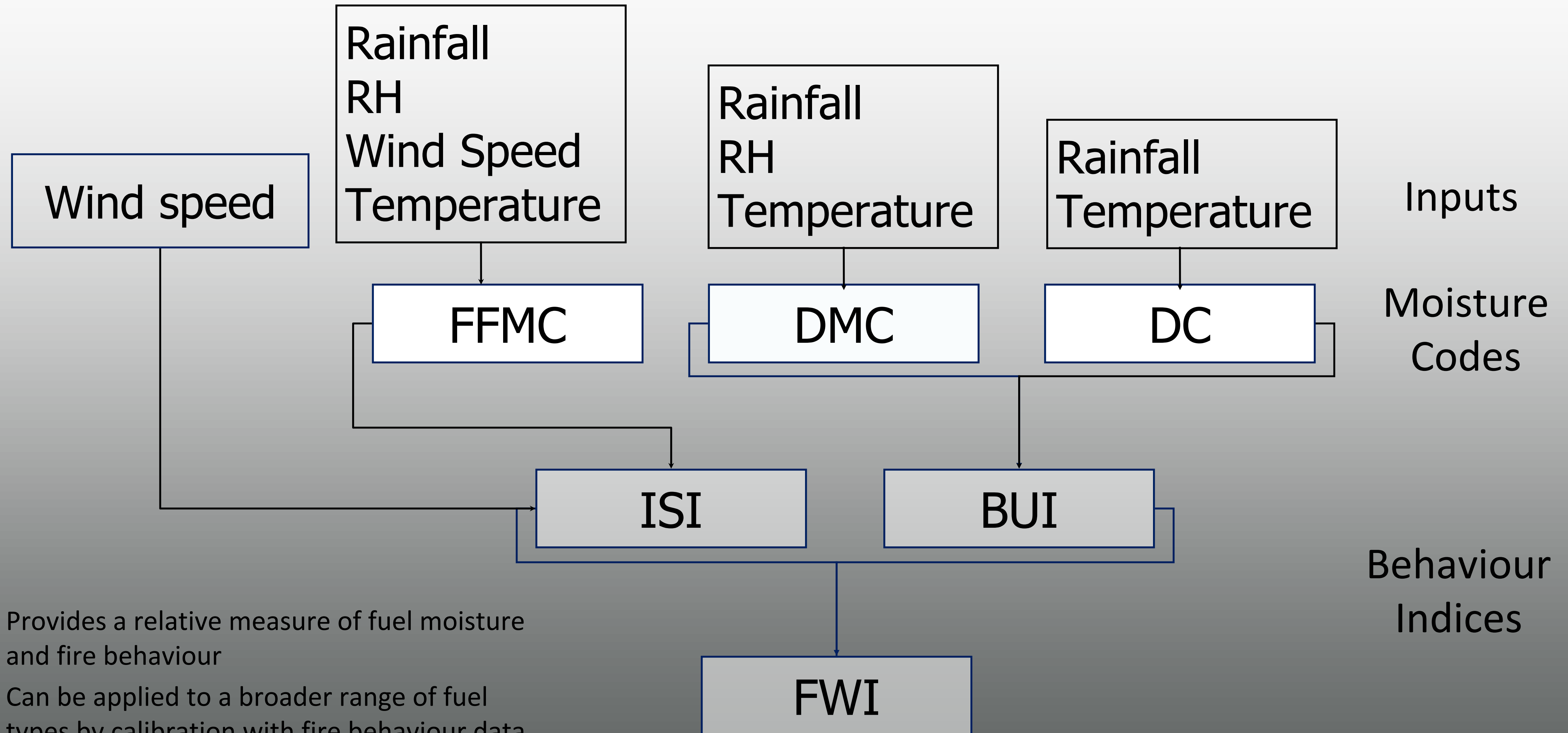
Figure 1. Structure of the Canadian Forest Fire Danger Rating System.



- ASEAN FDRS is adapted from the Canadian Forest Fire Danger Rating System



FWI STRUCTURE



- Provides a relative measure of fuel moisture and fire behaviour
- Can be applied to a broader range of fuel types by calibration with fire behaviour data.



BACKGROUND OF FWI SYSTEM

- Estimates the daily fire danger based on the current and recent weather
- Sub-components of the system track different important attributes of the forest environment
- Produce maximum amount of information with minimum amount of data.
- Used in fire management in Canada since 1970
- Adapted to other global regions (e.g., New Zealand, Florida, Fiji, Spain, Indonesia, Malaysia, SEA, Thailand, Europe, South Africa, Costa Rica, Argentina)
- ASEAN FDRS Adopted the system in 2001 after the historical strong El-Nino and transboundary haze event in 1997 and 1998.



FWI SYSTEM INPUTS

- Required inputs to the FWI system are the:
 - temperature
 - relative humidity
 - 24-hour precipitation
 - wind speed (km/hr, at 10m)
 - previous day's FWI calculations
- All inputs measured at 14:00 Local Standard Time
 - This 2pm observation standardizes the timing of weather observation across SEA
 - Designed to keep input requirements simple.



THE WEB MAP SERVICE (WMS) DEVELOPMENT

1997 - 1999

- 1997 and 1998: El-Nino, dry weather, strong and longer period of haze.
- 1999-2000: Study was conducted
- Publication: A drought-based predictor of recent haze events in western Indonesia.
- Characterising and mapping fuels for Malaysia and western Indonesia

2000 - 2010

- 2001 and 2002: Development of Malaysian and ASEAN FDRS with collaboration from CFS, ASEAN SEC and researcher from each country
- 2003: Implementation of FDRS Malaysia & ASEAN using SFMS software and Arcview 3.2.
- Meteorological data was collected manually from individual website for Malaysia, for SEA FDRS, the data was extracted via GTS.
- Publication: SEA FDRS Manual
- Development of the Indonesian and Malaysian Fire Danger Rating System
- Hardware: 1 workstation

2010 - 2018

- 2013: The SEA FDRS products was process using SFMS software (open source) and ArcGIS platform manually.
- FDRS forecast product for 3 days.
- Increase the number of stations
- Conducted the ground truth study at Selangor, Malaysia peat land pilot-study site.
- Thailand researcher conducted the threshold validation.
- An Operational Fire Danger Forecast System for Lower Mekong River Region: Technical Concepts and Current Implementation
- 2016: Issue of FDRS forecast data upgraded to higher resolution
- 2018: Data reception for FDRS Malaysia using the ftp method. ASEAN data through GTs.
- Hardware: 1 server unit, 1 workstation
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2020 - 2023

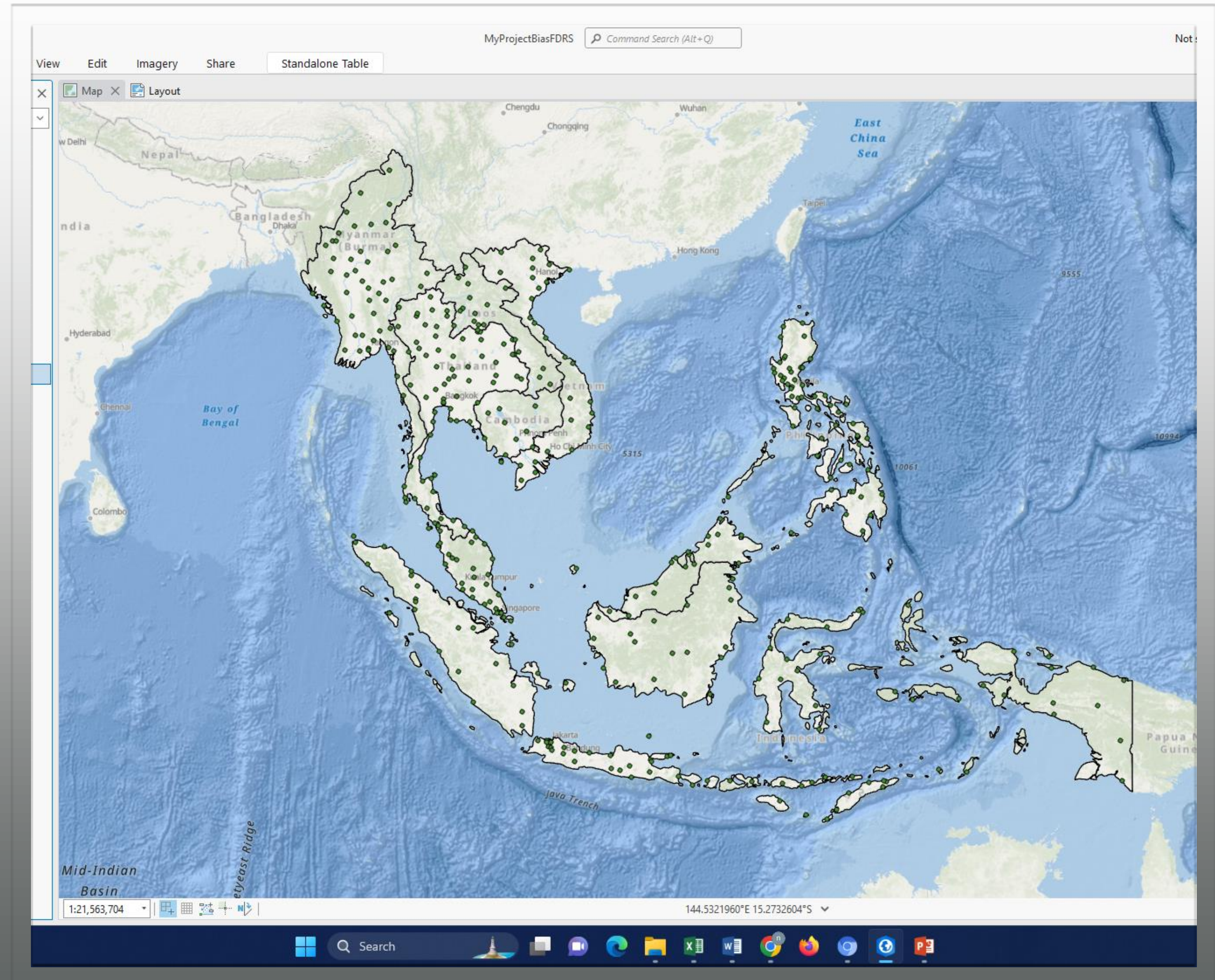
Climate Services Enhancement Project.

- The data collection, processing, calculating of FDRS products using SFMS and GIS platforms is done automatically and periodically for Web Map Services access.
- Hardware Requirements: FDRS Database Server, FDRS Application Server (HA mode), WMS Server



SIMULATION OF THE ASEAN FDRS

- The ArcGIS PRO software was used for the simulation to visualise the processes.
- Step 1:
- The data was ingested in the software after the calculation process from SFMS





- Step 2:
- Display the attribute table to check the data.

The screenshot displays the ArcGIS Desktop interface. On the left, the 'Drawing Order' panel shows the following layers: Map, DataFDRS_sea20230507_2_XYTableToPoint (checked), SEA_MAp (checked), World Ocean Reference (checked), World Ocean Base (checked), and Standalone Tables (DataFDRS_sea20230507_2). The main map area shows a bathymetric map of Southeast Asia with green dots representing data points. The map scale is 1:21,563,704 and the coordinates are 152.7326043°E 1.2300612°S. Below the map, the attribute table for 'DataFDRS_sea20230507_2_XYTableToPoint' is displayed, showing 32 rows of data.

OBJECTID *	Shape *	stn_num	tarikh	lat	lon	wdir	ws	temp	rh	press	pcp	ffmc	dmc	dc	isi	bui	fwi	wdir_2	ws_2	temp_2	rh_2	pcp_2
20	Point	97240	20230507	-8.507	116.06	150	16.668	30.7	70.036682	1007.9	0	84.708557	38.895859	155.198654	4.689754	47.826221	12.295916	149.993866	16.667902	28.963612	75.293961	0.000041
21	Point	97260	20230507	-8.46	117.416664	60	9.26	34.2	55.810721	1005.4	0	88.722618	39.42231	108.486374	5.691597	41.313168	13.209417	59.998775	9.260073	34.141457	55.942574	0.000001
22	Point	97270	20230507	-8.55	118.7	220	20.372	32.6	68.345355	1005.8	0	86.078384	16.442108	74.132332	6.834191	21.154411	10.671112	219.990997	20.371178	32.476536	68.689064	0.000032
23	Point	97320	20230507	-8.216666	124.566666	80	12.964	31.8	72.350731	1006.8	0	85.661621	23.332878	104.121346	4.438488	29.909483	8.982664	79.998627	12.964051	30.240004	77.164467	0.000016
24	Point	97340	20230507	-9.666667	120.333336	100	20.372	32.8	58.566202	1007.2	0	88.070396	55.10508	137.618912	9.073091	55.104362	21.806774	99.998894	20.371298	32.776592	58.623417	0.000032
25	Point	96450	20230507	4.8	115	320	3.704	33.6	64.239087	1005.4	9	64.603638	5.877785	8.453105	0.627023	5.626998	0.284198	319.468475	3.75436	33.606136	64.278481	8.96632
26	Point	96448	20230507	4.05	114.8	200	7.408	34.7	59.715664	1005	8	68.233627	4.46409	8.40266	0.858965	4.333516	0.347891	200.009216	7.407376	33.325893	63.118664	8.00158
27	Point	96413	20230507	1.483333	110.333336	170	18.52	29.7	69.428143	1005.8	8	69.24369	7.599025	13.743536	1.552595	7.448883	0.803868	170.000549	18.516832	29.253391	70.74044	8.002837
28	Point	96418	20230507	1.216667	111.45	210	3.704	33.2	66.081899	1005.6	13	54.89933	4.169198	8.320146	0.333324	4.065348	0.131558	209.99498	3.707036	32.867474	66.977661	13.005894
29	Point	96421	20230507	2.333333	111.833336	270	9.26	33.8	61.305942	1005.8	7	70.543556	8.298878	45.825562	1.015239	11.425117	0.659034	269.988037	9.259862	33.831772	61.228249	7.001066
30	Point	96467	20230507	5.333333	116.13333	280	11.112	33.2	56.580921	1005.5	0	87.184692	13.055902	37.324284	5.013239	13.930077	6.502933	279.992462	11.111842	31.932343	59.584785	0.000239
31	Point	96481	20230507	4.266667	117.88333	160	9.26	32.4	70.35448	1005.8	0.2	81.07341	9.585071	64.235619	2.038421	13.961788	2.384716	159.996811	9.259699	32.49094	70.092644	0.203653
32	Point	96491	20230507	5.9	118.066666	50	16.668	31	78.43467	1005.7	37	58.256813	6.161088	7.996958	0.842888	5.866454	0.389358	49.996761	16.666729	31.071991	78.199051	36.994385



- Step 3:
- The interpolation process uses IDW tool.

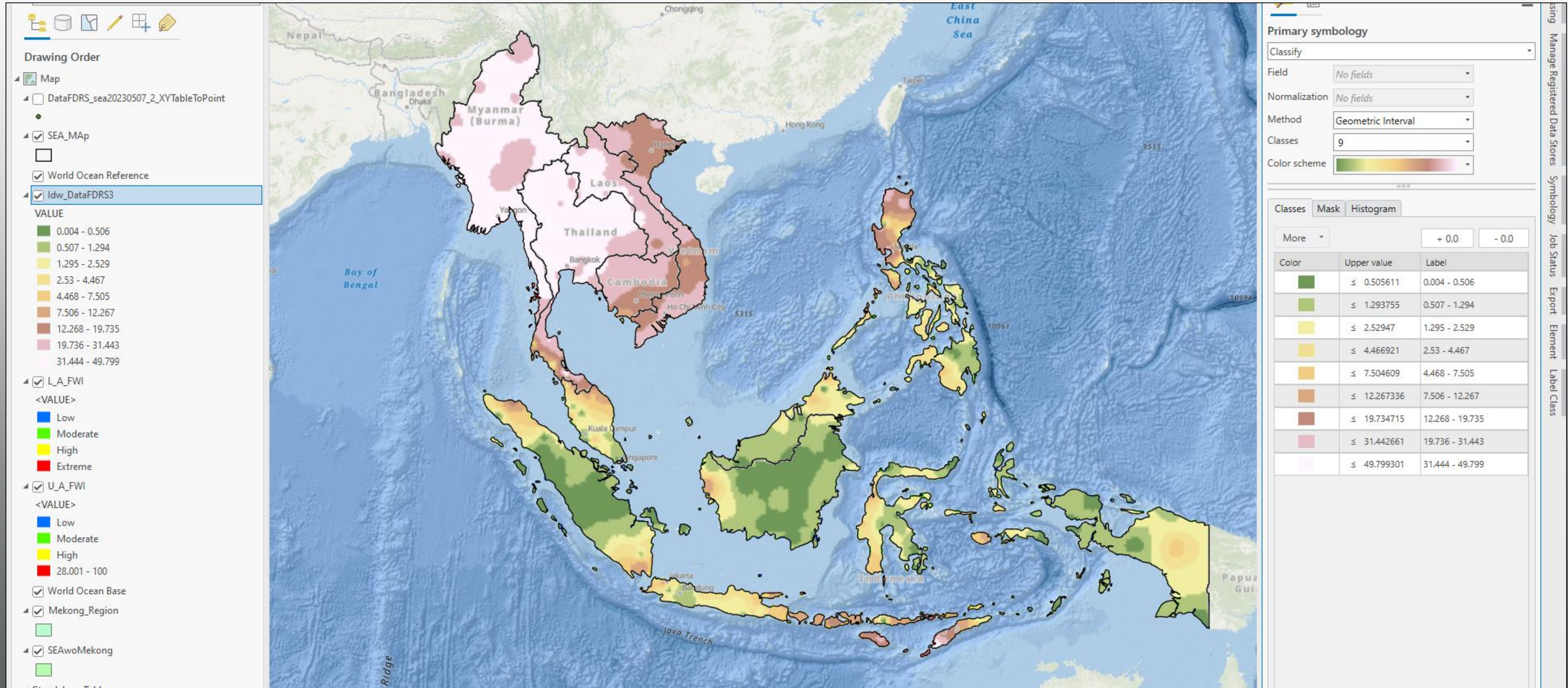
The screenshot displays the ArcGIS Pro interface during an IDW interpolation process. The central map shows Southeast Asia with numerous green circular point features. The left-hand 'Drawing Order' pane lists several layers, with 'U_A_FWI' selected and its legend showing four categories: Low (blue), Moderate (green), High (yellow), and 28,001 - 100 (red). The right-hand 'Parameters' pane is configured for the IDW tool, showing the following settings:

- Input point features: DataFDRS_sea20230507_2_XYTableToPoint
- Z value field: fwi
- Output raster: L_A_FWI
- Output cell size: 6.90394287109375E-02
- Power: 2
- Search radius: Variable
- Number of points: 12
- Maximum distance: (empty)
- Input barrier polyline features: (empty)

The 'Run' button is visible at the bottom right of the Parameters pane.

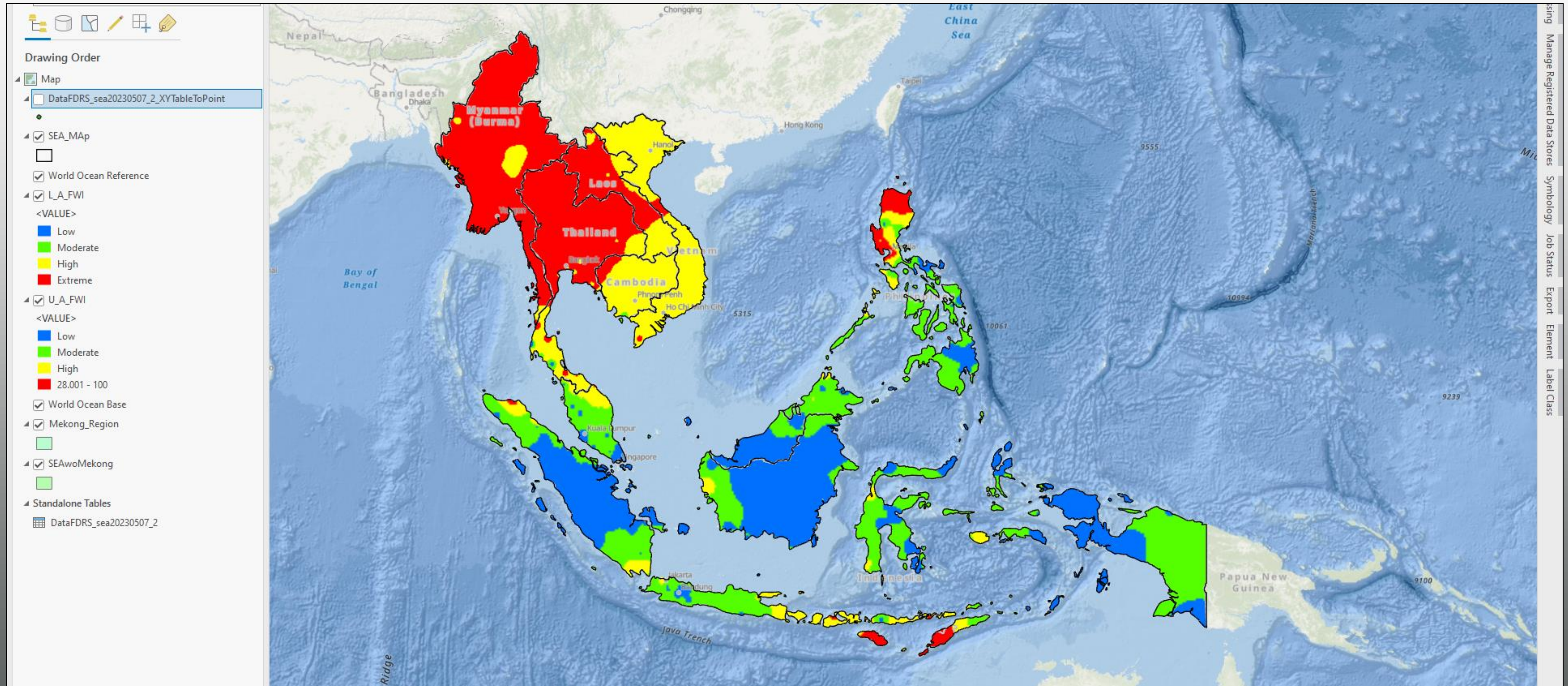


- Step 4:
- The interpolation result



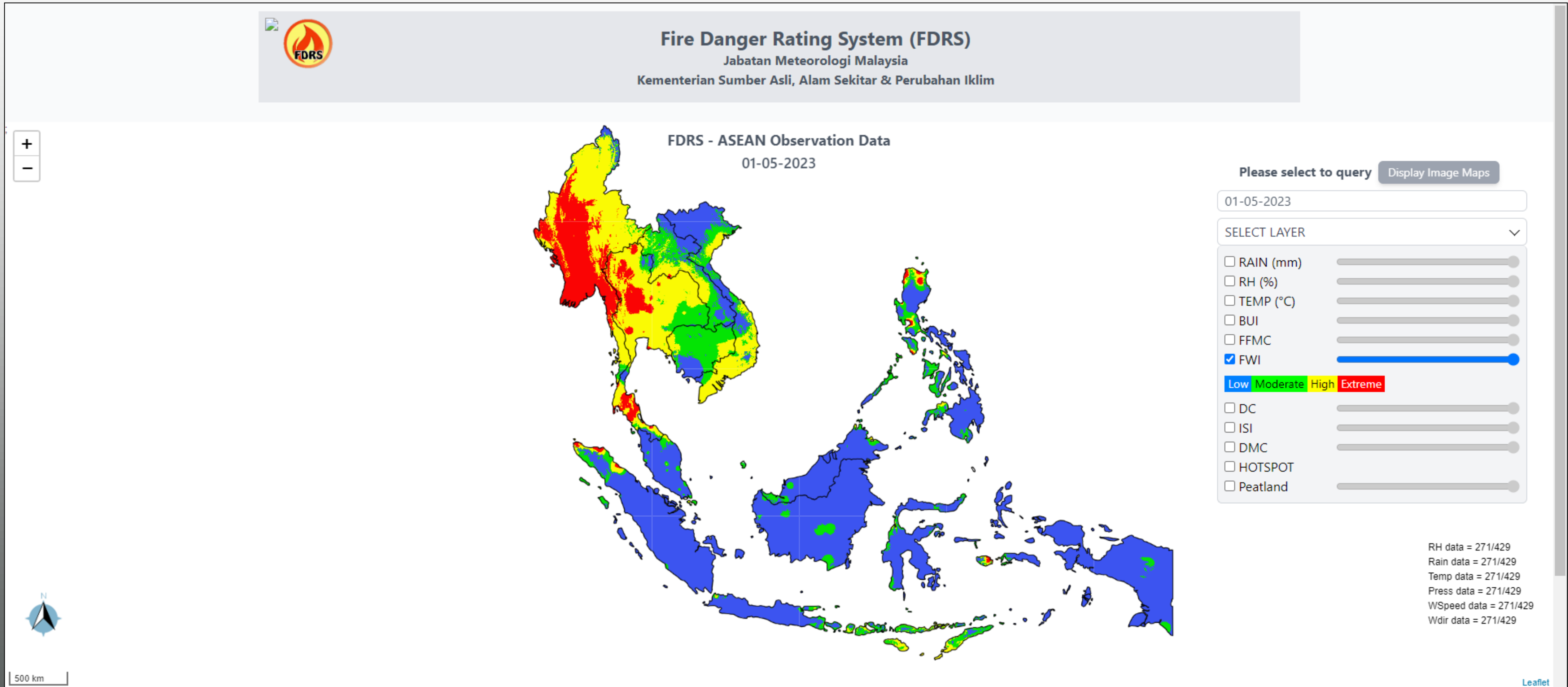


- Step 5:
- Rank the interpolation result according to Low, Moderate, High and Extreme level





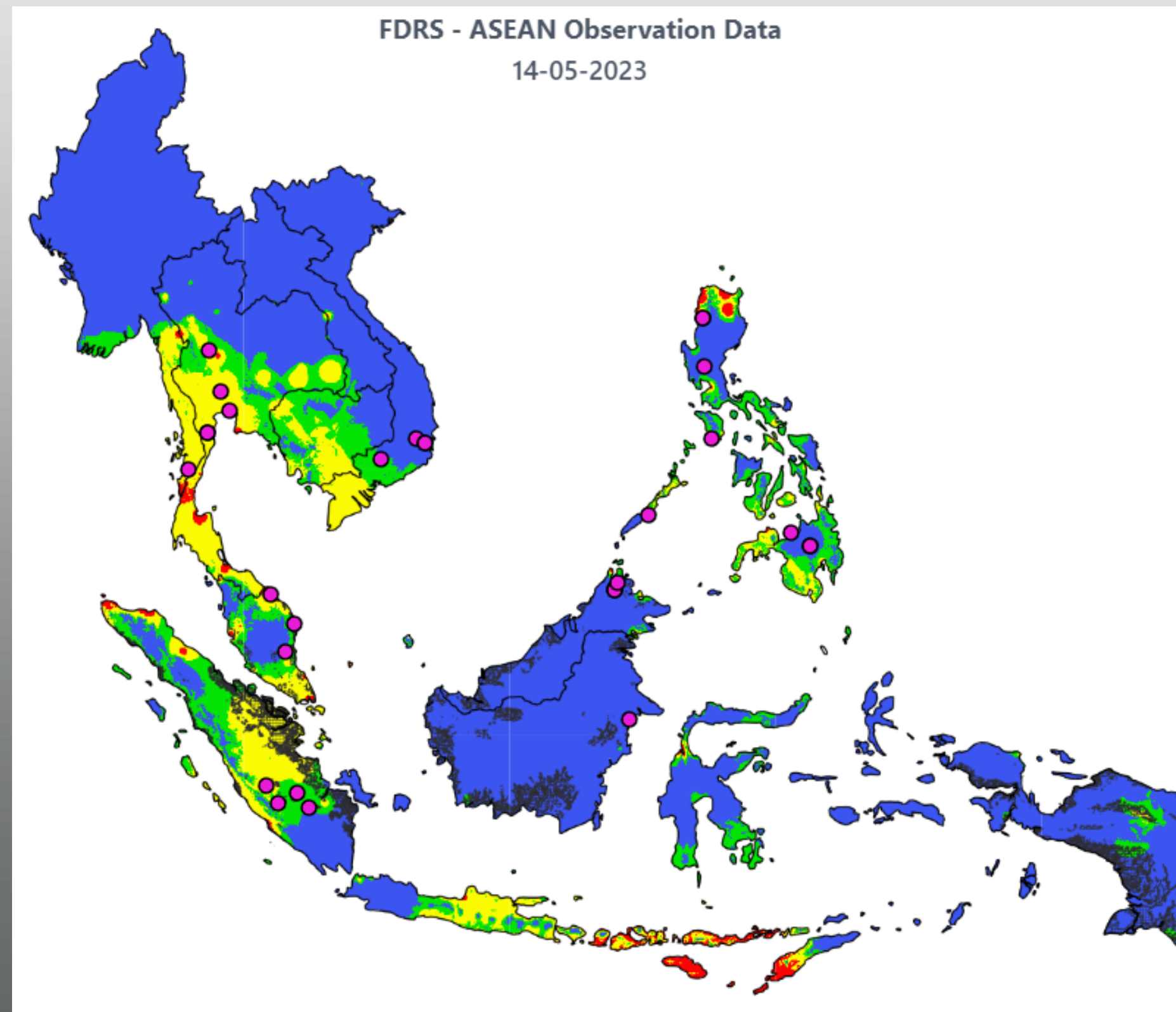
- Step 6:
- Save the layer and upload it to web for user access



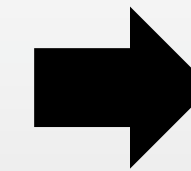


INTERPRETATION

- Fire Weather Index (FWI)
- Indicators of physical fire characteristics, or fire activity

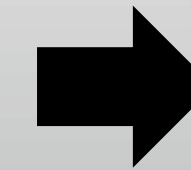


LOW



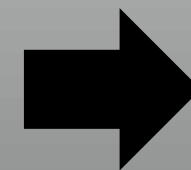
Low fire intensity. Fire will spread slowly or be self-extinguishing. Grassland fires can be successfully controlled using hand tools.

MODERATE



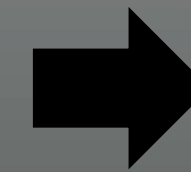
Moderate fire intensity in grass. Hand tools will be effective along the fire's flanks, but water under pressure (pumps, hose) may be required to suppress the head fire in grasslands.

HIGH



High fire intensity in grass. Direct attack at the fire's head will require water under pressure, and mechanized equipment may be required to build control lines.

EXTREME



Very high fire intensity in grass. Fire control will require construction of control lines by mechanized equipment and water under pressure.



SUMMARY

- Days with extreme fire ignition and spread potential are relatively rare
- But these are the most challenging days and the days that require the highest preparedness levels.
- We can use the information for planning and managing.
- Prevention is better than cure.



THANK YOU