



# *Web GIS platform for forest fire management*

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**Virtual Fire  
Final Review & PR Event**

**July 5-6, 2010  
Mytilene, Greece**



## Objective of the research:

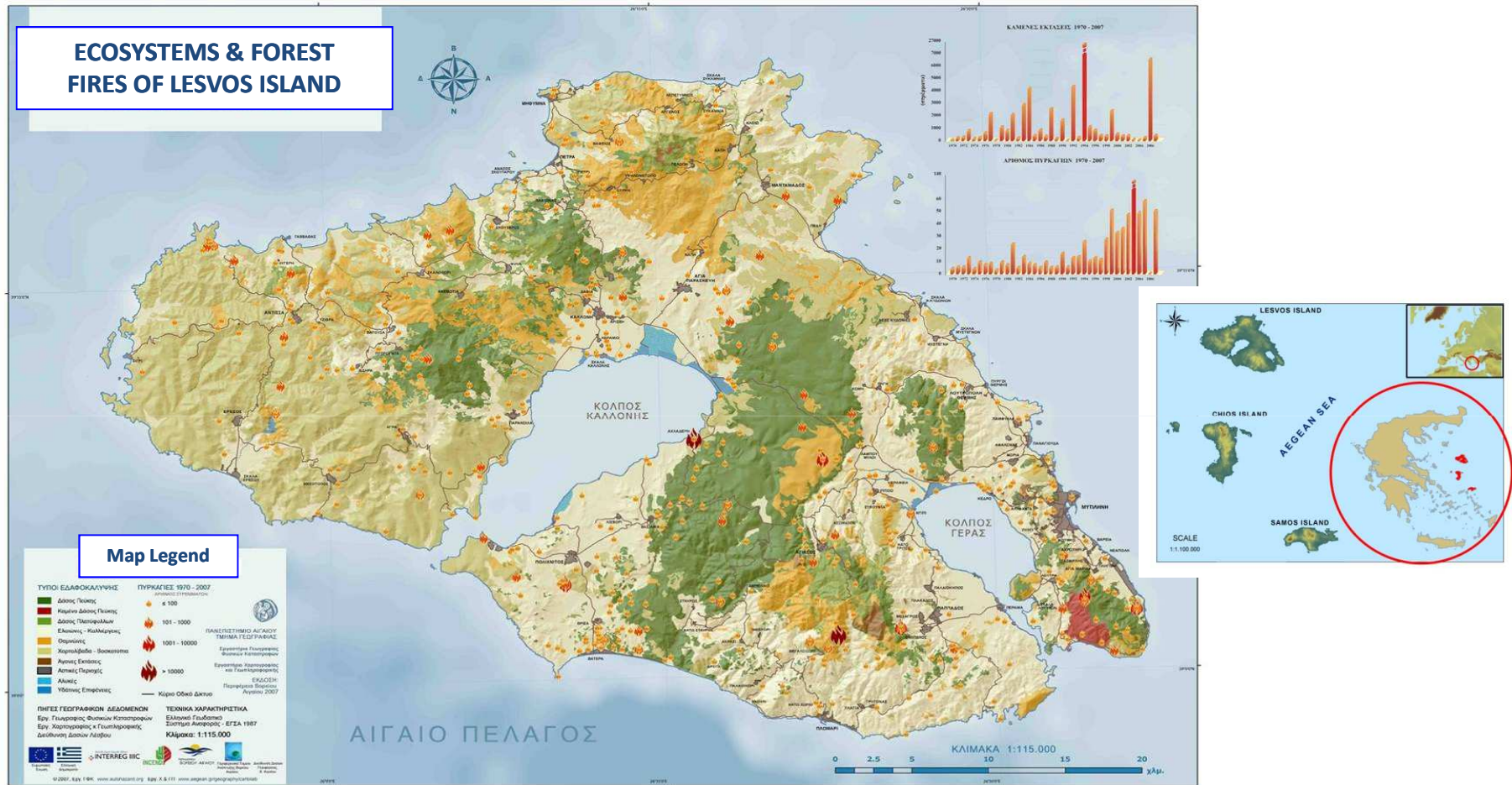
*new Web GIS application of Microsoft® Bing™ Maps aimed to assist on early fire warning, fire control, and GPS navigation and coordination of firefighting forces*

# Identity of the research

- *Virtual Fire* (VF) is a research project run by University of the Aegean, and supported by University of Athens and Microsoft Hellas/MIC in Greece; and funded by Microsoft Research.
- VF is a fully stand-alone, web-based early warning and decision support system for integrated forest fire management, based on geo-informatics and IT modeling.
- The main concept of the project is that firefighting forces need a tool to easily, validly, promptly and immediately access geographical and relational data during a fire event, without the knowledge of handling complicated GIS applications and the installation of special desktop software.
- End-users will be able to access 3-day weather forecasting maps, daily fire risk maps, real-time fire behavior maps, vehicle and resource positions, high-resolution satellite images etc., all through a simple Internet connection of their portable computer or GPS with the VF platform.

# Pilot case study: Lesvos Island, Greece

w/ an area of 1,636 km<sup>2</sup> & 90,000 residents, located at northeastern Aegean Sea



**Fire-prone and high-risk area of Greece: more than 600 wildfires, mostly human-caused, occurred between 1970-2009 resulting in about 9,000 hectares of total area burned**

# Design of services offered to forest fire and civil protection agencies through the VF management system:

1. Remote automatic weather stations and a weather forecasting system provide all the necessary fire meteorology info for fire prevention, early warning, and control
2. Geographical representation of the fire risk potential and identification of high-risk areas at different local regions are provided on-demand, based on meteorological, socio-economic, and biophysical parameters
3. Maps that represent the spread and intensity of a forest fire at different times and places; thus, authorities will have the ability to design an operational plan to encompass the forest fire, choosing the best way to put out the fire with the proper means at the proper time
4. On-line and real-time location of Fire Service vehicles and other resources by using GPS and communications that transmit the coordinates of each item to the system, portraying them on an electronic map/ video wall; thus, achieving better coordination in emergency response & resource dispatching
5. *In-situ* detection cameras along with prompt satellite images are of added value as integrated extensions to the VF platform
6. State-of-the-art know-how and advanced computing schemes; e.g. spatial modeling, GIS and remote sensing, specialized software and algorithms, and high performance computing (HPC).

# Technical contents of the research

**• GSM/GPRS PROTOCOLS FOR DATA SUBMISSION & RECEPTION**

**• INPUT OF DATA INTO GPS**

**• SQL QUERIES: SPATIAL & RELATIONAL**

**SATELLITE IMAGES OF HIGH RESOLUTION**

**THEMATIC MAPPING**

**FIRE RISK AND BEHAVIOR PREDICTION**

**VISUALIZATION VIA MS BING MAPS AND MS SILVERLIGHT 3**

**LIVE COVERAGE OF EVENTS (VIDEOS FROM CAMERAS AND DATA FROM WEATHER STATIONS)**

**FLEET TRACKING MANAGEMENT**

CERES / Madrigalejo  
 ENCA / Campos del Paraiso  
 ENCA / Minglanilla  
 ADALAJARA / Cajanejos  
 ESCA / Lalueza  
 ESCA / Sarinena  
 DRID / Chirchón

FENGYUN 1D 11/03  
 FENGYUN 1D 11/03  
 TERRA 11/03  
 NOAA 17 11/03  
 TERRA 11/03  
 NOAA 17 11/03  
 TERRA 12/03  
 NOAA 17 12/03  
 NOAA 17 12/03  
 AQUA 12/03

# Technologies and platforms employed

- Virtual Fire is based on *ESRI ArcGIS* commercial software: maps and functions are created within this software in close integration with *MS SQL Server 2008*; outcomes are published to the web via the *ArcGIS Server*; *MS Visual Studio 2008* combines them all with *MS Silverlight 3* by using components of *ArcGIS API for MS Silverlight / WPF*.
- *MS Bing Maps* (ex *Virtual Earth*) is the primary mapping information platform, and all data and maps are displayed as overlays on top of it.
- The integration of the above plus the addition of other components from external sites comprise the VF software architecture.



## Other technologies and platforms employed

- Use of *ESRI ArcSDE* geo-databases to store geographic and other data (compliant with *MS SQL Server 2008*)
- Use of *SKIRON* weather prediction HPC models (University of Athens) to create weather forecasting maps
- *FARSITE* and *Flammap* fire growth and behavior simulation models to predict fire behavior
- Neural networks for fire risk mapping (*Windows HPC Server 2008* compliant software developed by the project)
- GPRS / GSM protocols for data transmission.



# Overall Project Achievements

1. Ability to select among the *Bing Maps* database and several other layers (high-resolution satellite images, ortho-photos, thematic maps, topographic maps)
2. GeoRSS live data streams for new fire events, with ability to add new events
3. Ability to monitor and survey several weather forecasting maps (temperature, relative humidity, cloud cover, rain and wind), with a prediction range of 3 days and update once every day (09:00 am local time)
4. Access to data of 5 Remote Automatic Weather Stations (RAWS) with real-time diagrams and weather monitor graphics
5. Ability to access several different fire/ disaster management data (road network, water tanks, evacuations areas, etc.), and switch among them at will
6. Daily fire risk maps that portray the potential of fire occurrence, based on a high performance computing (HPC) pilot application with Microsoft Windows HPC server
7. On-demand fire behavior modeling
8. A rich toolbox with mapping and other tools that enhance interoperability (shortest routes, closest water tanks, service areas, measurement and digitizing tools, e-mails, fleet tracking, web-cameras, etc.)
9. Daily updated world satellite imagery courtesy of NASA/GSFC/JPL-Caltech, OnEarth, MODIS Terra (WMS map); and other live feeds of worldwide disasters
10. GPS navigation and data collection utility with Windows Mobile Operating System.

# BING MAPS

The screenshot displays the VirtualFire web application interface. At the top left, the logo of the University of the Aegean Department of Geography is visible. The main title "VirtualFire" is centered at the top, with "Microsoft Research" on the right. A navigation bar contains tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the navigation bar.

The main map area shows a satellite view of the Northern Aegean region in Greece, including islands like Lesbos, Mytilene, and Chios. The map is overlaid with a grid and various labels for locations and geographical features. A "Layer controls" panel is open on the right side of the map, showing options for "Annotation", "Weather data", and "Base layers". A scale bar at the bottom left indicates 20km and 10mi. Map coordinates are displayed at the bottom center: "Map Coords: X = 25°28'48"E, Y = 39°25'12"N".

Navigation and zoom controls are visible in the bottom right corner, along with the Bing and ESRI logos.

# HIGH-RESOLUTION SATELLITE IMAGES

University of the Aegean  
Department of Geography

## VirtualFire

Microsoft Research

Base Maps Web Feeds Weather Fire Management Fire Prediction Disasters Fire Tools Search: Enter a location...

Layer controls

- Annotation
- Weather data
- Base layers

Aegean Islands Lesbos

Map Coords: X = 26°34'12"E, Y = 39°05'24"N

bing ESRI

# BASE MAP SELECTION

The screenshot displays the VirtualFire web application interface. At the top left is the logo for the University of the Aegean Department of Geography. The main title "VirtualFire" is centered at the top, with "Microsoft Research" on the right. A navigation bar contains tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the navigation bar.

The "Base Maps" dropdown menu is open, showing the following options:

- Orthophoto
- Thematic** (selected)
- Topographic
- Cover types
- Roads (Bing Maps)
- Aerial (Bing Maps)
- Aerial with labels (Bing Maps)

The main map area shows a topographic map of a coastal region with a blue outline. Labels include "Chios-Lesvos" (twice), "Aegean Sea", and "Mediterranean Sea". A scale bar in the bottom left indicates 2km and 10km. Map coordinates are shown at the bottom center: "Map Coords: X = 26°30'00"E, Y = 39°04'12"N". A "Layer controls" panel on the right shows "Annotation", "Weather data", and "Base layers" with expand/collapse icons. The Bing and ESRI logos are in the bottom right corner.

# Overall Project Achievements

1. Ability to select among the *Bing Maps* database and several other layers (high-resolution satellite images, ortho-photos, thematic maps, topographic maps)
2. GeoRSS live data streams for new fire events, with ability to add new events

# GEO-RSS WEB FEEDS

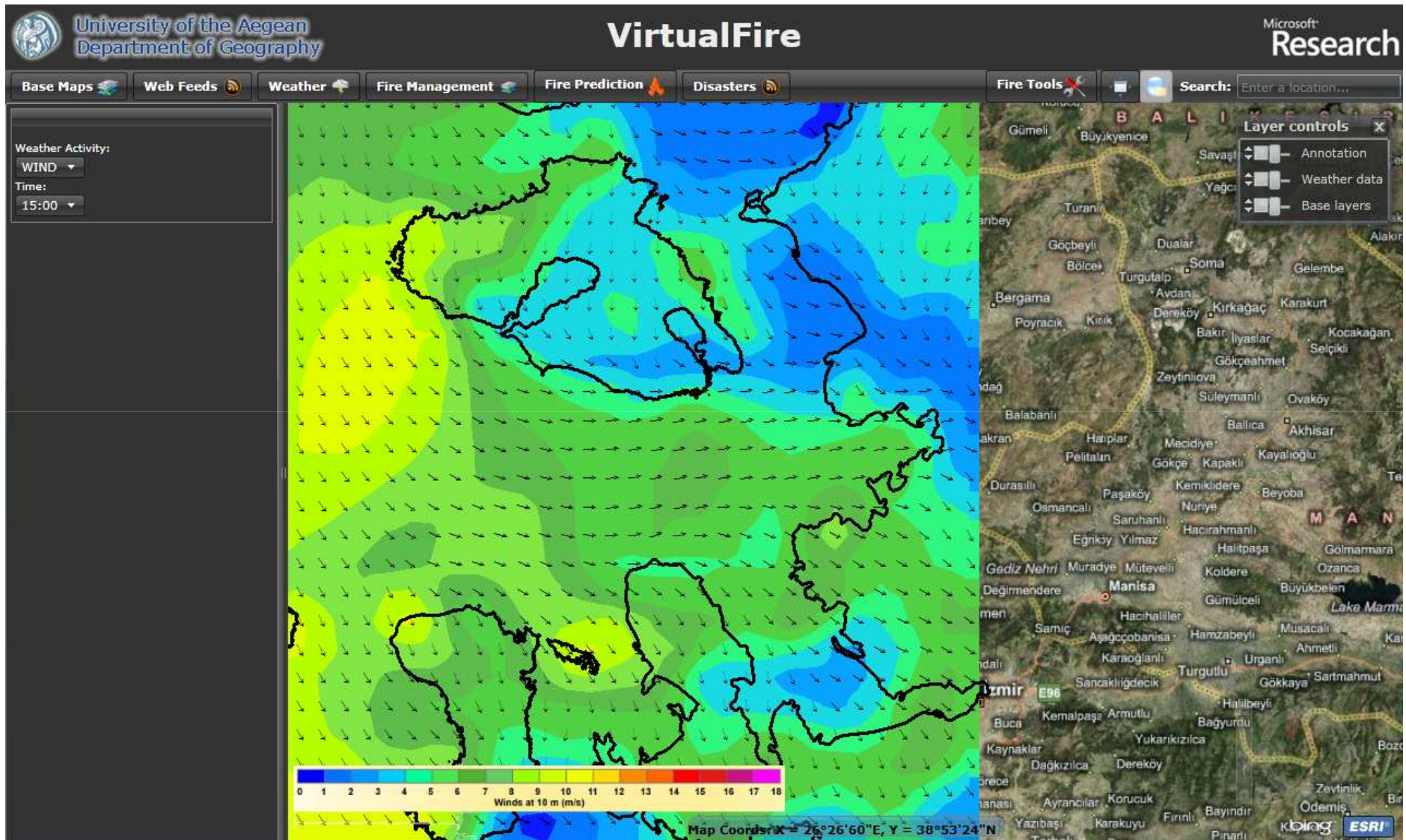
The screenshot displays the VirtualFire web application interface. At the top left, the logo of the University of the Aegean Department of Geography is visible. The main title "VirtualFire" is centered at the top. On the right, the Microsoft Research logo is present. Below the title, a navigation bar includes tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the navigation bar. The main map area shows a satellite view of a coastal region with a wildfire event marked by a red flame icon. A tooltip for this event reads "High intensive wildfire: Thu, 01 Jul 2010 11:32:23 GMT". The map is labeled "NORTHERN AEGEAN" and "Mediterranean Sea". A scale bar in the bottom left indicates 10km and 4000ft. Map coordinates are shown at the bottom center: "Map Coords: X = 26°36'36\"E, Y = 39°02'24\"N". A layer controls panel on the right lists "Annotation", "Weather data", and "Base layers". The Bing and ESRI logos are in the bottom right corner.



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3. Ability to monitor and survey several weather forecasting maps (temperature, relative humidity, cloud cover, rain and wind), with a prediction range of 3 days and update once every day (09:00 am local time)

# WEATHER PREDICTION MAPS





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4. Access to data of 5 Remote Automatic Weather Stations (RAWS) with real-time diagrams and weather monitor graphics

# ONLINE WEATHER MONITORING

University of the Aegean Department of Geography **VirtualFire** Microsoft Research

Base Maps Web Feeds Weather Fire Management Fire Prediction Disasters Fire Tools Search: Enter a location...

Select weather station: University

Time	1120
Tair	25.01
Tair (max)	25.13
Tair (min)	24.91
Relative Humidity	61.19
Relative Humidity (max)	61.81
Relative Humidity (min)	60.36
Wind Speed	4.154
Wind Direction	343.8
Wind Speed (max)	6.25
Rain	0
Rain (in the last 10')	0
Atmosphere Pressure	1003

Real time diagrams  
MODIS TERRA Server (WMS)

Map Coords: X = 26°34'12"E, Y =

MYTILENE TODAY MYTILENE\_30-DAY SOUTH\_LESVOS TODAY SOUTH\_LESVOS\_30-DAY WEST\_LESVOS TODAY WEST\_LESVOS\_30-DAY CENTRAL\_LESVOS\_TODAY

University of the Aegean Department of Geography **Mytilene, Greece Weather**  
University Hill [ 39°05'01" N 26°34'07" E / 71 m a.s.l.]  
Last updated: 03/17/10 13:53

Air Temperature: Max 32.4 °C, Min 7.6 °C, Current 13.1 °C  
Precipitation: 0.0 mm  
Relative Humidity: 49%  
Atm. Pressure: 1,014 hPa  
Fuel Moisture: 9%  
Wind: 4.9 m/s gusting to 7.5 m/s

Precipitation: Daily 0.0 mm, Monthly 23.0 mm, Annual 432.1 mm, Hydro Year 652.8 mm

24-hour Air Temperature and Wind Speed

Temperature (red line) and Wind Speed (green line) over time.

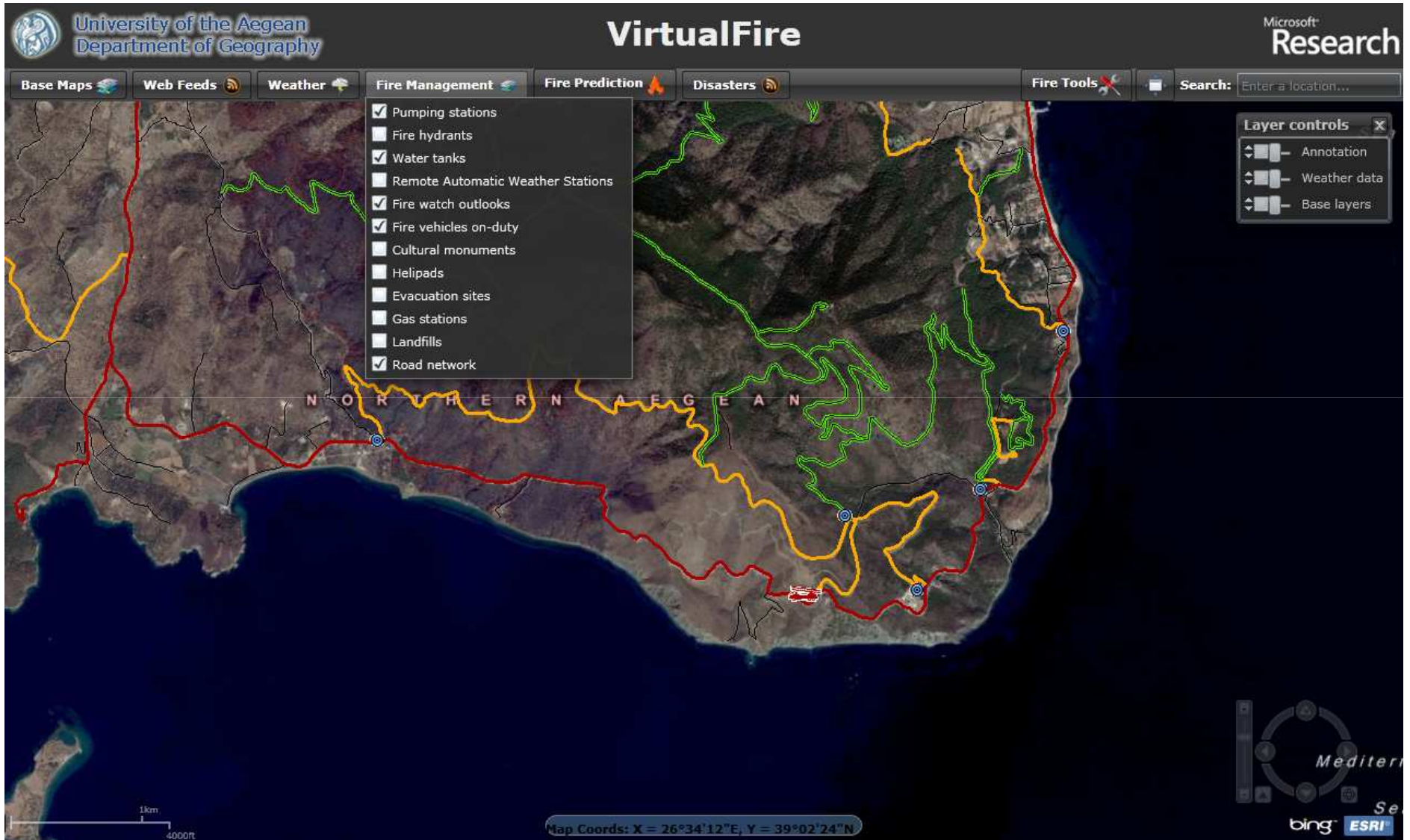
TimeStamp	Stn_Code	Year_BTM	Day_BTM	Hour_Minute_BTM	Rain_TOT	Humidity	Temp_Fuel_AVG	Temp_Fuel_MAX	Temp_Fuel_MIN	RF_Fuel_AVG	RF_Fuel_MAX	RF_Fuel_MIN	T_psd_AVG	T_psd_MAX	T_psd_MIN	Battery
16033 14:00	506.00	2,010.00	75.00	1,400.00	0.00	0.00	13.40	14.19	12.77	9.32	9.47	9.14	10.27	19.05	17.47	14.11
16033 15:00	506.00	2,010.00	75.00	1,500.00	0.00	0.00	12.83	13.46	12.39	9.04	9.11	8.86	10.26	19.26	19.25	14.34
16033 16:00	506.00	2,010.00	75.00	1,600.00	0.00	0.00	12.45	12.93	12.12	8.77	8.93	8.65	10.24	19.89	19.41	14.29
16033 17:00	506.00	2,010.00	75.00	1,700.00	0.00	0.00	12.81	13.21	12.03	8.54	8.70	8.24	10.26	19.41	17.90	14.26
16033 18:00	506.00	2,010.00	75.00	1,800.00	0.00	0.00	11.40	13.51	10.51	9.60	8.81	8.47	8.37	15.81	17.90	12.49
16033 19:00	506.00	2,010.00	75.00	1,900.00	0.00	0.00	9.20	9.69	8.94	9.63	9.73	9.47	11.38	12.90	10.29	13.29
16033 20:00	506.00	2,010.00	75.00	2,000.00	0.00	0.00	8.97	9.12	8.86	9.77	9.86	9.71	9.75	10.30	9.30	13.24

Funding: European Union, Greece, Microsoft Research

# Overall Project Achievements

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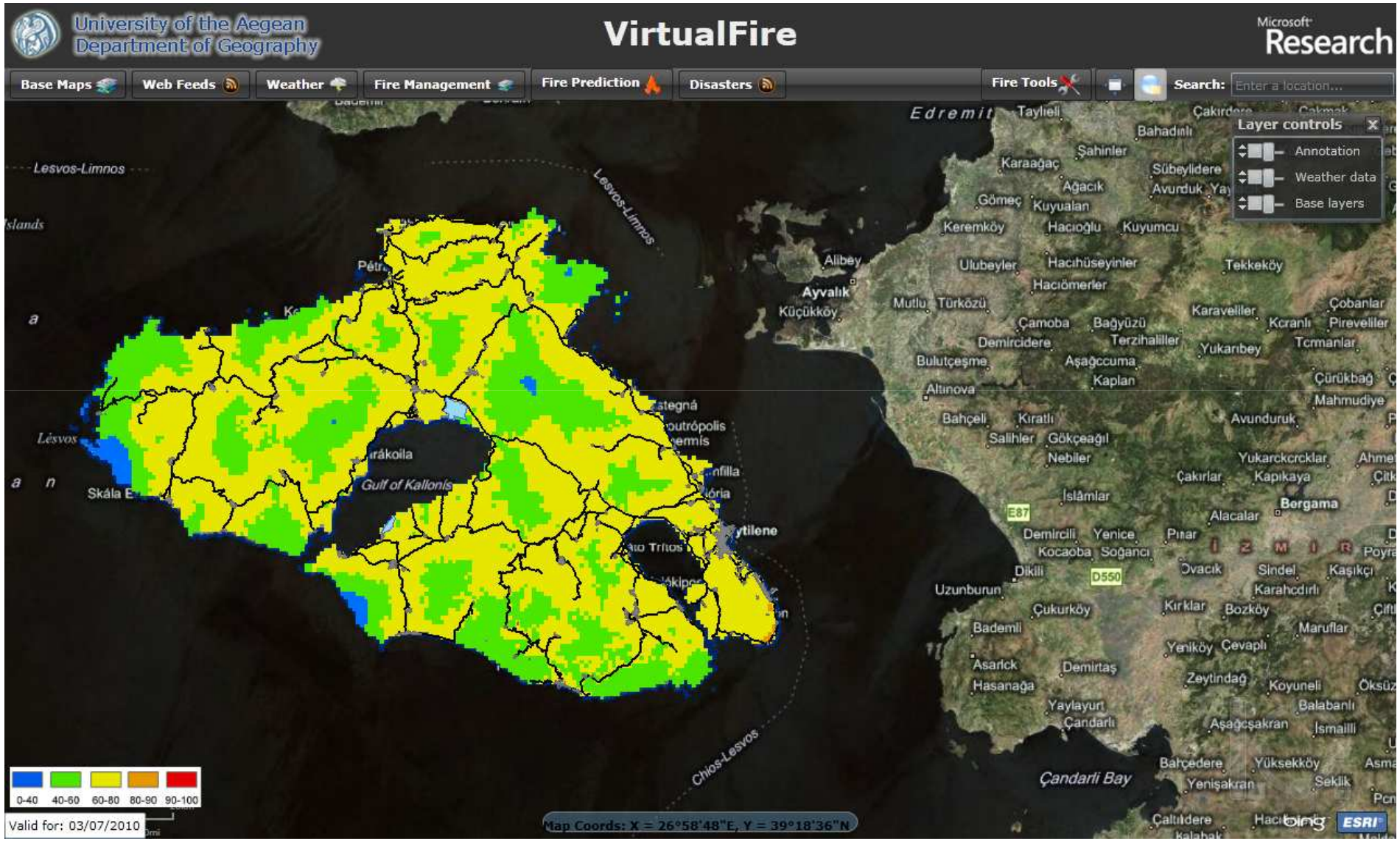
# FIRE MANAGEMENT DATA



# Overall Project Achievements

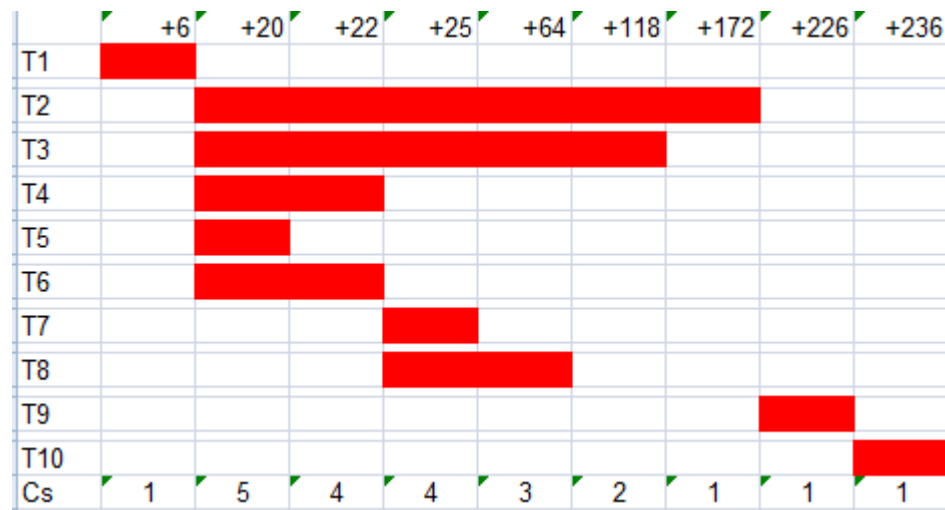
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# FIRE RISK MAPPING



# Fire Risk Mapping w/ Microsoft Windows HPC Server

- implementation of parallel computing / HPC in geospatial problems
- large geographical extent & spatial resolution need increased computing power
- the thread model approach from sequential to parallel utilized
- computation speed increase of about 33% (with 2 computing nodes, 8 cores total)
- processing avg. time: sequential = 333 sec vs. HPC = 224 sec
- easy to be implemented from a non IT end-user
- fast network required, i.e. Infiniband
- expensive third party components need to be installed in every computing node

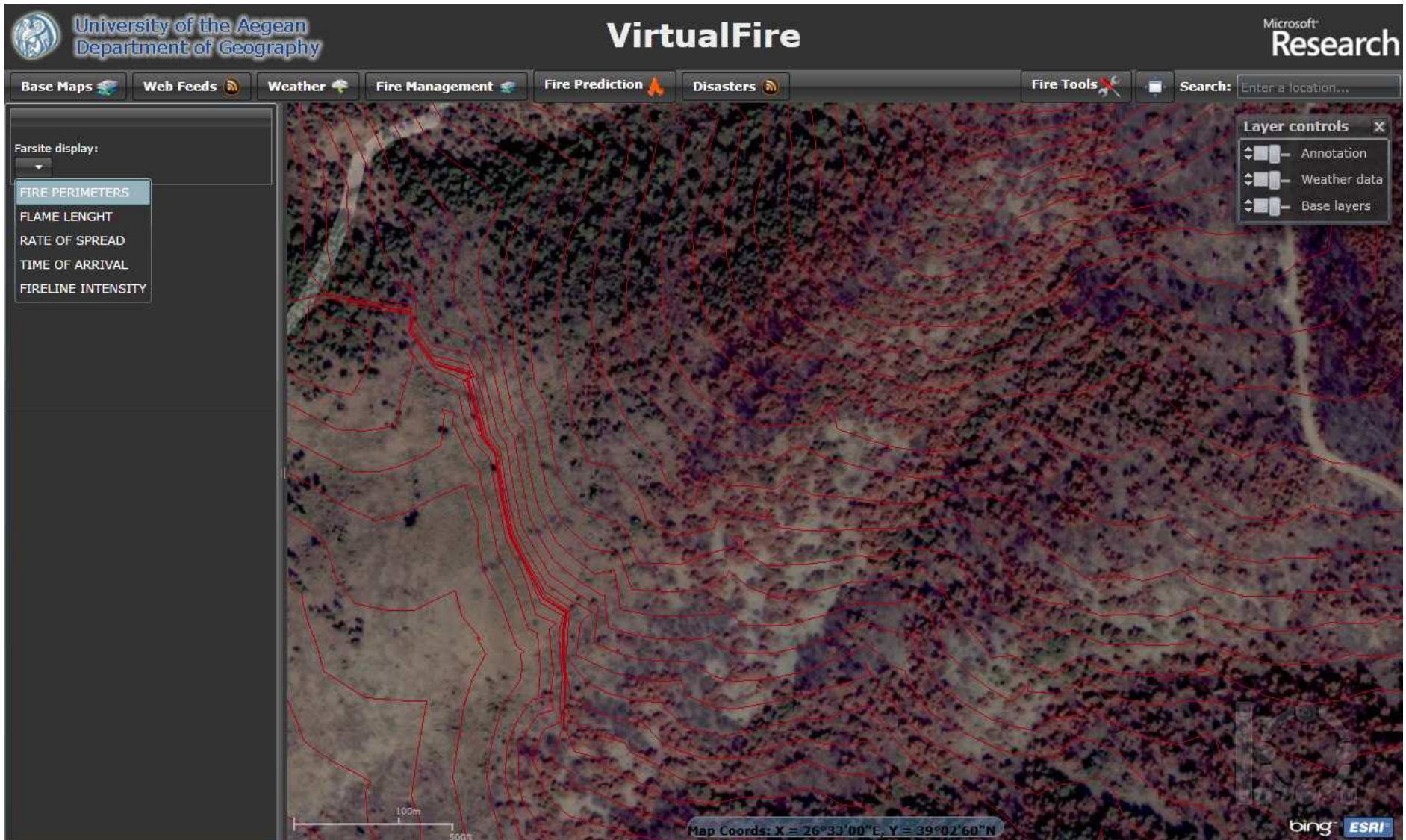


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7. On-demand fire behavior modeling

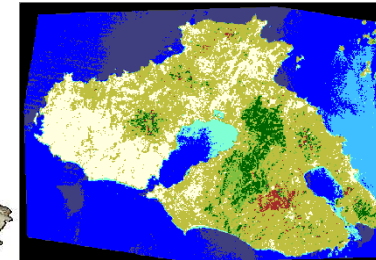
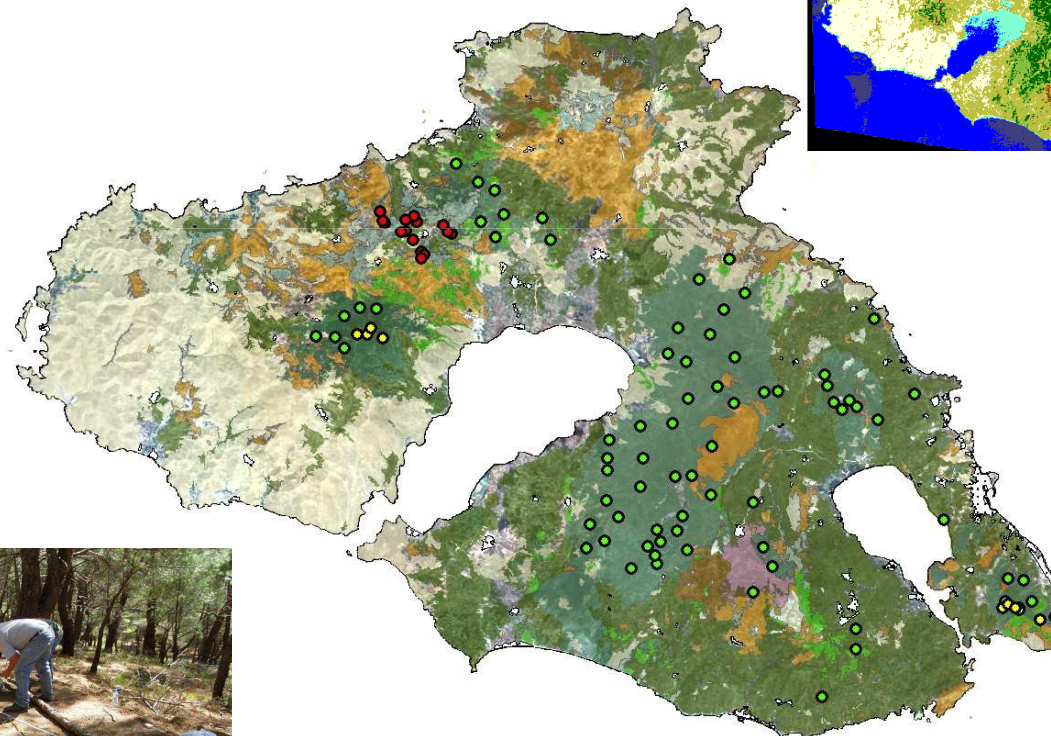


# FIRE BEHAVIOR MODELING



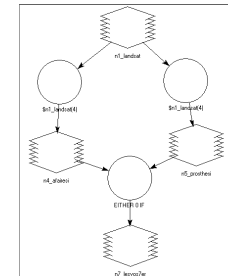
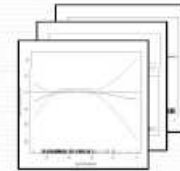
# FIRE BEHAVIOR MODELING

All the necessary land cover data for the creation of a permanent ready-to-launch fire prediction application were inventoried and analyzed; and cover / fuel types were mapped using geo-statistics and GIS techniques.



Multivariate  
statistical  
model

$$g(\mu) = \beta_0 + \beta_1 x_1 + \dots + \beta_n x_n$$



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# FIRE MAP TOOLS



# SKETCH TOOLS

The screenshot displays the VirtualFire web application interface. At the top left, the logo of the University of the Aegean Department of Geography is visible. The main title "VirtualFire" is centered at the top. On the right, the Microsoft Research logo is present. Below the title, there is a navigation menu with tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the menu.

The main map area shows a satellite view of the Northern Aegean region, with labels for "Loutrá" and "Skála Loutrón". The text "NORTHERN AEGEAN" is repeated across the map. A red polygonal sketch is drawn on the map, with a tooltip "Edit annotation" appearing over it. A "Map Tools" panel is open, showing various icons for map manipulation and a login form with fields for "Username" and "Password", and a "Login" button.

At the bottom of the map, there is a scale bar (1km, 4000ft) and map coordinates: "Map Coords: X = 26°35'24\"E, Y = 39°02'60\"N". The Bing and ESRI logos are visible in the bottom right corner.

# DISTANCE MEASUREMENTS

The screenshot displays the VirtualFire web application interface. At the top left, the logo of the University of the Aegean, Department of Geography is visible. The main title "VirtualFire" is centered at the top. On the top right, the Microsoft Research logo is present. Below the title, there is a navigation menu with tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the navigation menu. The main map area shows a satellite view of Mytilene, Greece, with a red line indicating a distance of 4 km. The map includes labels for "Mediterranean Sea", "Mytilene", "Káto Tritos", "Palaiókipos", "Mesagrós", "Skópelos", "Lésvos", "Pérama", "Loutrá", "Skála Loutrón", "NORTHERN AEGEAN", and "Chios-Lesvos". A "Map Tools" panel is open on the right side of the map, containing various icons for map manipulation and a login section with fields for "Username" and "Password", and a "Login" button. A "Layer controls" panel is also visible on the right, showing options for "Annotation", "Weather data", and "Base layers". At the bottom of the map, there is a scale bar (5 km / 3 mi) and a coordinate display: "Map Coords: X = 26°32'24\"E, Y = 39°04'48\"N". The Bing and ESRI logos are in the bottom right corner of the map area.

# DRIVE TIMES

The screenshot displays the VirtualFire web application interface. At the top, the University of the Aegean Department of Geography logo is on the left, and the Microsoft Research logo is on the right. The main title "VirtualFire" is centered. Below the title is a navigation bar with tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the navigation bar.

The main map area shows a satellite view of the island of Lesvos. A large red-shaded area indicates a fire hazard zone, with a smaller green-shaded area inside it representing a "10 minute access" buffer. A red car icon is positioned within the green area. The map is labeled with "NORTHERN AEGEAN", "Lesvos", "Aegean Islands", "Aegean Sea", and "Mediterranean Sea".

On the left side, there is a "Click on map to:" menu with options: "Find street names", "Find shortest routes", and "Remove selection". Below this is a "Map Tools" panel with various icons for map manipulation. A login form is also present, with fields for "Username" (containing "virtualtest") and "Password" (containing "\*\*\*\*\*"), and a "Login" button.

On the right side, there is a "Layer controls" panel with three layers: "Annotation", "Weather data", and "Base layers".

At the bottom of the map, the coordinates are displayed as "Map Coords: X = 2959752.99, Y = 4725813.77". The Bing and ESRI logos are visible in the bottom right corner.

# FIND CLOSEST WATER TANKS

The screenshot displays the VirtualFire web application interface. At the top left is the logo for the University of the Aegean, Department of Geography. The main title "VirtualFire" is centered at the top, with "Microsoft Research" on the right. A navigation bar contains tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the navigation bar.

The main map area shows a satellite view of a region with a red dot indicating a starting point and a cyan line representing a route. A yellow callout box over the route displays "Drive Time: 6.11 min; Drive distance: 3.35 km". A yellow dashed line outlines a specific area on the map. The text "NORTHERN AEGEAN" is visible across the map. A scale bar in the bottom left indicates 1 km. Map coordinates are shown at the bottom center: "Map Coords: X = 26°34'12"E, Y = 39°02'24"N". Logos for "bing" and "ESRI" are in the bottom right corner.

Overlaid on the map are two panels:

- Map Tools:** A panel on the left containing various icons for map navigation and analysis. It includes a login form with the username "virtualtest" and a masked password field, and a "Login" button.
- Layer controls:** A panel on the right with three layers: "Annotation", "Weather data", and "Base layers", each with a visibility toggle.



# FIND CLOSEST PUMPING STATIONS

The screenshot displays the VirtualFire web application interface. At the top left, the logo for the University of the Aegean Department of Geography is visible. The main title 'VirtualFire' is centered at the top, with 'Microsoft Research' on the right. A navigation bar contains several tabs: 'Base Maps', 'Web Feeds', 'Weather', 'Fire Management', 'Fire Prediction', 'Disasters', and 'Fire Tools'. A search bar is located on the right side of the navigation bar. The main map area shows an aerial view of Mytilene, Greece, with a red dashed line indicating a route. A text box on the map displays 'Drive Time: 7.7 min; Drive distance: 5.94 km'. A 'Map Tools' panel is open on the left side of the map, showing various icons for map manipulation and a login form with fields for 'Username' (virtualtest) and 'Password' (masked with dots), and a 'Login' button. A 'Layer controls' panel is also visible on the right side of the map, showing options for 'Annotation', 'Weather data', and 'Base layers'. The map includes a scale bar (10km / 4000ft) and map coordinates: 'Map Coords: X = 26°31'12"E, Y = 39°05'24"N'. The Bing and ESRI logos are visible in the bottom right corner of the map area.

# FIND CLOSEST HYDRANTS

The screenshot displays the VirtualFire web application interface. At the top, the University of the Aegean Department of Geography logo is on the left, and the Microsoft Research logo is on the right. The main title "VirtualFire" is centered. Below the title is a navigation menu with tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the menu.

The main map area shows an aerial view of Mytilene, Greece, with a red dashed line indicating a route from a starting point to a hydrant. A text box on the map displays the route information: "Drive Time: 2.91 min; Drive distance: 1.06 km". The map includes various street names and landmarks, such as "Aegean Islands" and "Mytilene".

On the left side of the map, there is a "Map Tools" panel with various icons for map manipulation. Below the map tools is a login panel with the following fields:

- Username: virtualtest
- Password: •••••
- Login button

At the bottom of the map, there is a scale bar (0 to 1000m) and the map coordinates: "Map Coords: X = 26°32'24"E, Y = 39°06'00"N". The ESRI logo is visible in the bottom right corner of the map area.

# FIND SHORTEST ROUTES

The screenshot displays the VirtualFire web application interface. At the top, the University of the Aegean Department of Geography logo is on the left, and the Microsoft Research logo is on the right. The main navigation bar includes tabs for Base Maps, Web Feeds, Weather, Fire Management, Fire Prediction, Disasters, and Fire Tools. A search bar is located on the right side of the navigation bar.

The central map shows a satellite view of the Aegean Islands with a highlighted green route between two points marked 1 and 2. The text "NORTHERN AEGEAN" is overlaid on the map. A "Click on map to:" pop-up window is open, showing options: "Find street names", "Find shortest routes" (selected), and "Remove selection". Below these options are "Find" and "clear" buttons.

A "Map Tools" pop-up window is also open, displaying a grid of icons for various map functions. Below the icons are input fields for "Username" (virtualtest) and "Password" (masked with dots), and a "Login" button.

A "Layer controls" pop-up window is visible on the right side of the map, showing options for "Annotation", "Weather data", and "Base layers".

A "Directions" pop-up window is open in the bottom left, showing the following instructions: "--Leg #1--", "1. Depart (east)", "2. Keep left onto road", "3. Make a U-turn to stay on road", and "4. Arrive at road".

At the bottom of the map, the coordinates are displayed as "Map Coords: X = 26°33'36"E, Y = 39°03'36"N". The Bing and ESRI logos are visible in the bottom right corner of the map area.

# FORMAT CHANGE OF COORDINATES

The screenshot displays the VirtualFire web application interface. At the top, the University of the Aegean Department of Geography logo is on the left, and the Microsoft Research logo is on the right. The main navigation bar includes tabs for Base Maps, Web Feeds, Weather, Fire Management, Fire Prediction, Disasters, and Fire Tools. A search bar is located on the right side of the navigation bar. The main map area shows a satellite view of Mytilene, Greece, with a coordinate format change menu open over the map. The menu options are: Decimal Degrees, Degrees, Minutes, Seconds, and Meters. A 'Map Tools' dialog box is also visible, containing a grid of icons and fields for Username and Password, with a Login button. The map shows various geographical features and place names, including Skála E, Gulf of Kallionis, and Chios-Lesvos. A scale bar at the bottom left indicates 10m and 20km. The map coordinates at the bottom center are X = 27°07'12"E, Y = 39°02'24"N.



# ADDITION OF NEW FIRE EVENTS

The screenshot displays the VirtualFire web application interface. At the top, the University of the Aegean Department of Geography logo is on the left, and the Microsoft Research logo is on the right. The main title "VirtualFire" is centered. Below the title, a navigation bar contains several menu items: Base Maps, Web Feeds, Weather, Fire Management, Fire Prediction, Disasters, and Fire Tools. A search bar is located on the right side of the navigation bar.

The main content area shows a satellite map of the Aegean region. A "Map Tools" dialog box is open on the left, containing a grid of icons and a login section with fields for "Username" (virtualtest) and "Password" (\*\*\*\*\*), and a "Login" button. A "Layer controls" dialog box is open on the right, showing a list of layers: Annotation, Weather data, and Base layers. A "Rotz" dialog box is also visible on the right side of the map.

In the center, a "rssadd" dialog box is open, allowing the user to add a new fire event. The fields are as follows:

- Publication Date: Fri, 02 Jul 2010 00:36:01 GMT
- Fire event Latitude: 4726353
- Fire event Longitude: 2961756
- Description: High intensive fire near Agrilia.
- Fire Intensity: High (selected from a dropdown menu with options High, Low, Medium, High)

At the bottom of the dialog box, there are "Cancel" and "OK" buttons. The map background shows labels for "TΣΕΚΟΥΡΙΑ", "ΑΓ", "ΧΑΒΙΑΡΟΠΕΤΡΑ", and "Mediterranean Sea". A scale bar at the bottom left indicates 1km and 4000ft. Map coordinates are shown at the bottom center: "Map Coords: X = 26°36'36" E, Y = 39°01'48" N".

# REMOVAL OF OLD FIRE EVENTS

The screenshot displays the VirtualFire web application interface. At the top, the header includes the University of the Aegean Department of Geography logo, the 'VirtualFire' title, and the Microsoft Research logo. A navigation bar contains several menu items: Base Maps, Web Feeds, Weather, Fire Management, Fire Prediction, Disasters, and Fire Tools. A search bar is located on the right side of the navigation bar.

The main content area features a satellite map of Greece with several fire event markers. A 'Remove Fire Event' dialog box is open in the center, displaying a list of fire events with their titles and timestamps:

- Arisvi: Tue, 23 FEB 2010 10:54:43 GMT
- Andissa: Wed, 24 Mar 2010 14:18:06 GMT
- Asomatos: Wed, 02 Jun 2010 10:36:47 GMT
- High intensive wildfire: Thu, 01 Jul 2010 11:32:23 GMT
- High intensive fire near Agrilia.: Fri, 02 Jul 2010 00:36:01 GMT

The dialog box also includes a 'Load Events' button and a 'Remove Event' button. To the right of the map, there are two panels: 'Map Tools' and 'Layer controls'. The 'Map Tools' panel contains various icons for map navigation and analysis. The 'Layer controls' panel shows a list of layers: Annotation, Weather data, and Base layers. A 'Login' dialog box is also visible, with fields for 'Username' (virtualtest) and 'Password' (\*\*\*\*\*).

# E-MAILS FROM END-USERS

The screenshot displays the VirtualFire web application interface. At the top left, the logo of the University of the Aegean Department of Geography is visible. The main title "VirtualFire" is centered at the top, with "Microsoft Research" on the right. A navigation bar includes tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the navigation bar.

A contact form overlay is positioned on the left side of the map. It contains the following fields:

- Your Name:** [Text input field]
- Your E-Mail Address:** [Text input field]
- Subject:** [Dropdown menu with "Bugs" selected]
- Message:** [Text area]
- send** [Button]

The background map shows a region in Greece, with labels for "HELEN AEGEAN", "ΑΓΡΙΑΙΑ ΚΡΑΤΗΓΟΥ", and "Aegean Sea". The map includes various geographical features and a coordinate system at the bottom: "Map Coords: X = 26°33'00\"E, Y = 39°03'36\"N".

On the right side of the map, there are two panels:

- Layer controls:** Includes checkboxes for "Annotation", "Weather data", and "Base layers".
- Map Tools:** Includes a grid of icons for various map functions, a "Username" field with "virtualtest", a "Password" field with "\*\*\*\*\*", and a "Login" button.

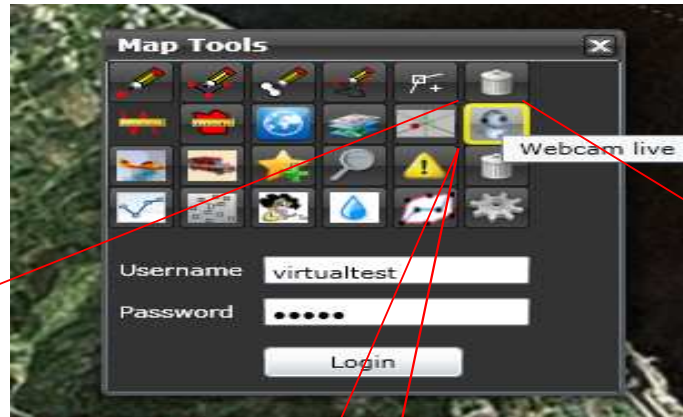
# REAL-TIME TRACKING OF FIRE SERVICE VEHICLES



# REAL-TIME TRACKING OF FIRE PATROL & SUPPRESSION AIRCRAFTS

The screenshot displays the VirtualFire web application interface. At the top left, the logo of the University of the Aegean Department of Geography is visible. The main title "VirtualFire" is centered at the top, with the Microsoft Research logo on the right. Below the title is a navigation bar with tabs for "Base Maps", "Web Feeds", "Weather", "Fire Management", "Fire Prediction", "Disasters", and "Fire Tools". A search bar is located on the right side of the navigation bar. The main content area shows a satellite map of Mytilene, Greece, with various geographical features and place names labeled. A red circle highlights a specific location on the map. A "Map Tools" window is open in the center, containing a grid of icons and a login form with fields for "Username" (virtualtest) and "Password" (masked with dots), and a "Login" button. A "Layer controls" window is also visible on the right side of the map, showing options for "Annotation", "Weather data", and "Base layers". The map includes a scale bar (0 to 10 km) and a coordinate display at the bottom center: "Map Coords: X = 26°31'48\"E, Y = 39°04'12\"N". The map is powered by Bing and ESRI.

# LIVE CAMERA IMAGES



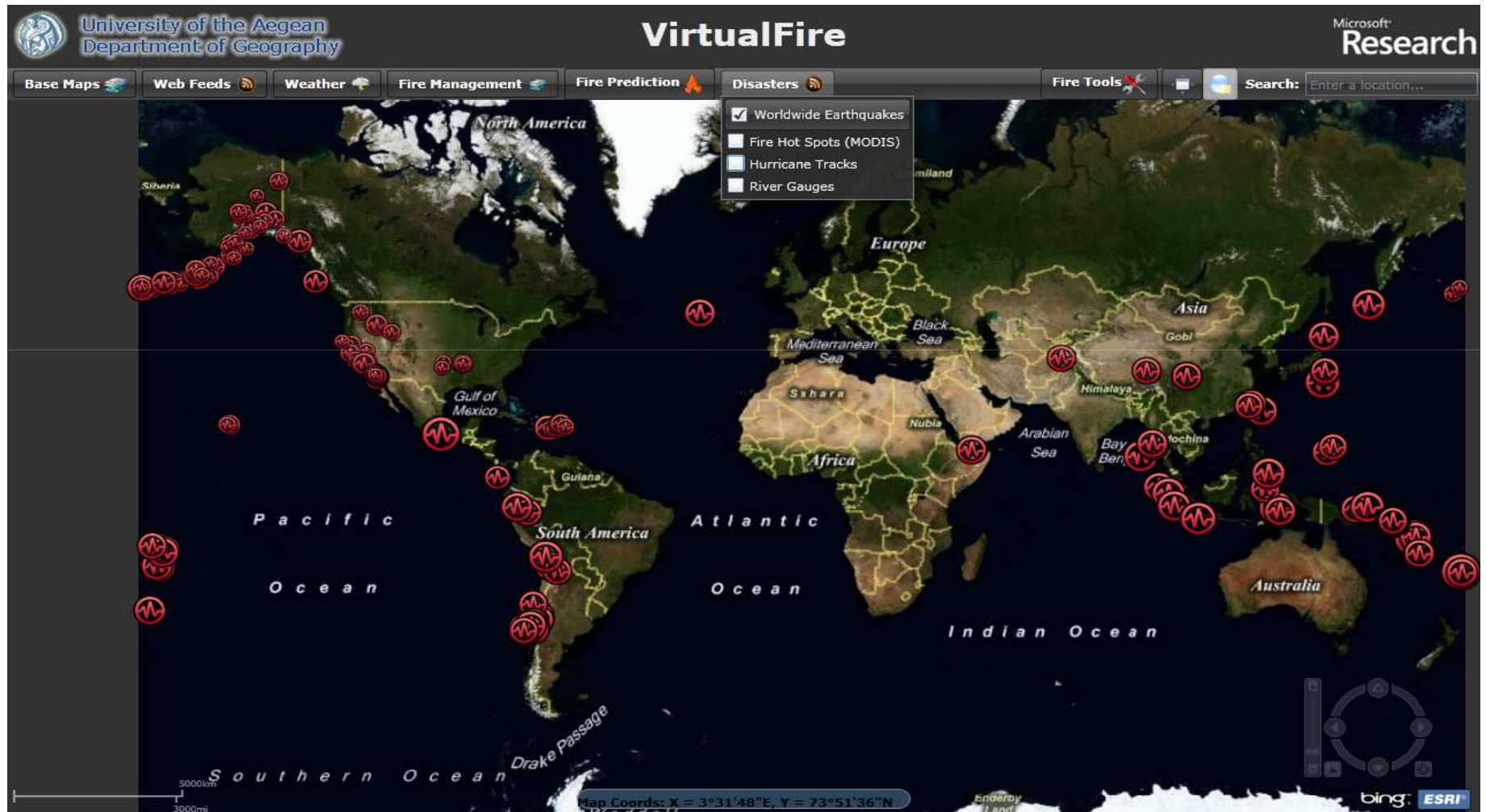
# Overall Project Achievements

1. Ability to select among the *Bing Maps* database and several other layers (high-resolution satellite images, ortho-photos, thematic maps, topographic maps)
2. GeoRSS live data streams for new fire events, with ability to add new events
3. Ability to monitor and survey several weather forecasting maps (temperature, relative humidity, cloud cover, rain and wind), with a prediction range of 3 days and update once every day (09:00 am local time)
4. Access to data of 5 Remote Automatic Weather Stations (RAWS) with real-time diagrams and weather monitor graphics
5. Ability to access several different fire/ disaster management data (road network, water tanks, evacuations areas, etc.), and switch among them at will
6. Daily fire risk maps that portray the potential of fire occurrence, based on a high performance computing (HPC) pilot application with Microsoft Windows HPC server
7. On-demand fire behavior modeling
8. A rich toolbox with mapping and other tools that enhance interoperability (shortest routes, closest water tanks, service areas, measurement and digitizing tools, e-mails, fleet tracking, web-cameras, etc.)
9. Daily updated world satellite imagery courtesy of NASA/GSFC/JPL-Caltech, OnEarth, MODIS Terra (WMS map); and other live feeds of worldwide disasters

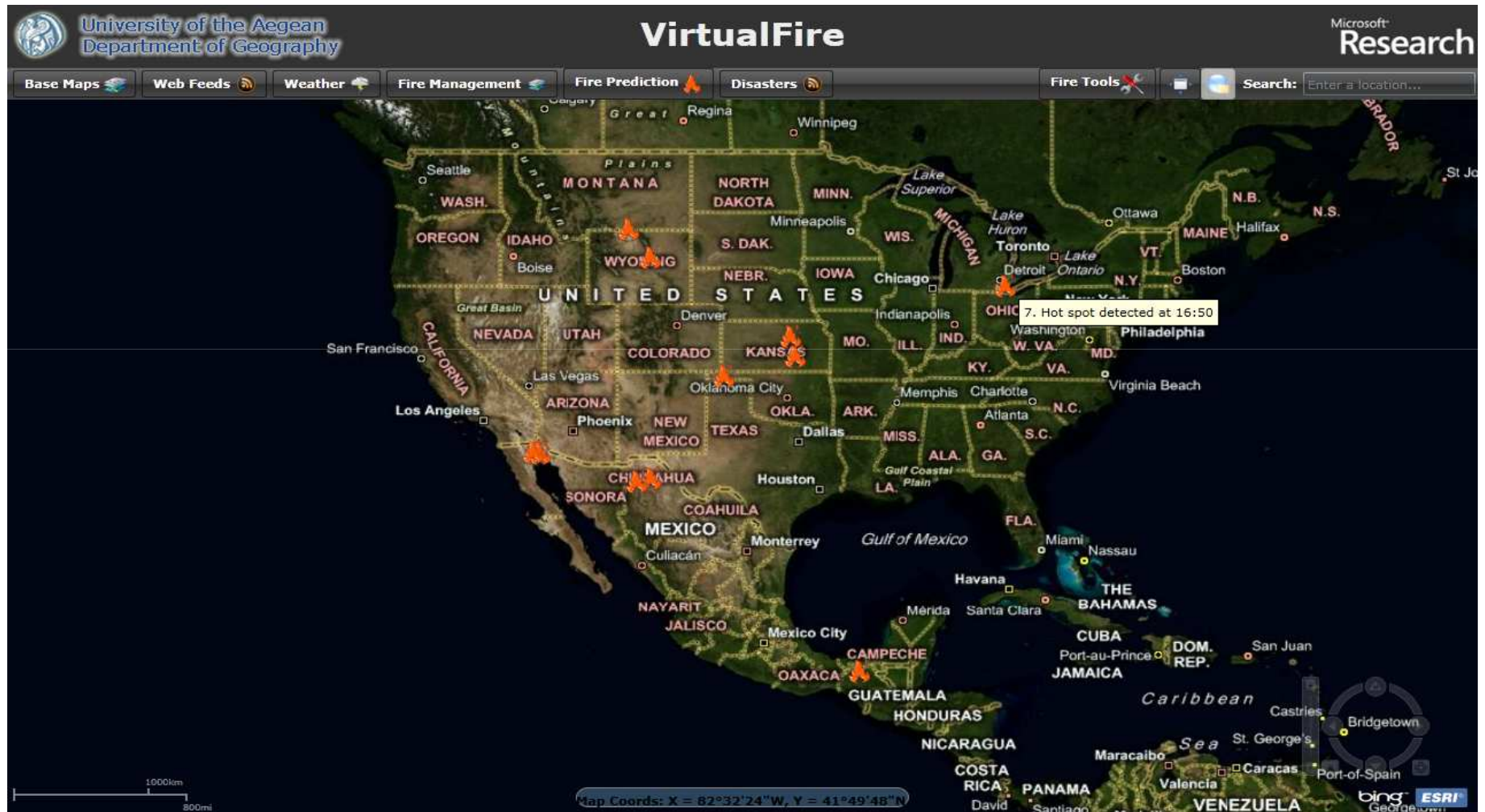
# MODIS TERRA SATELLITE IMAGES (Daily Planet)



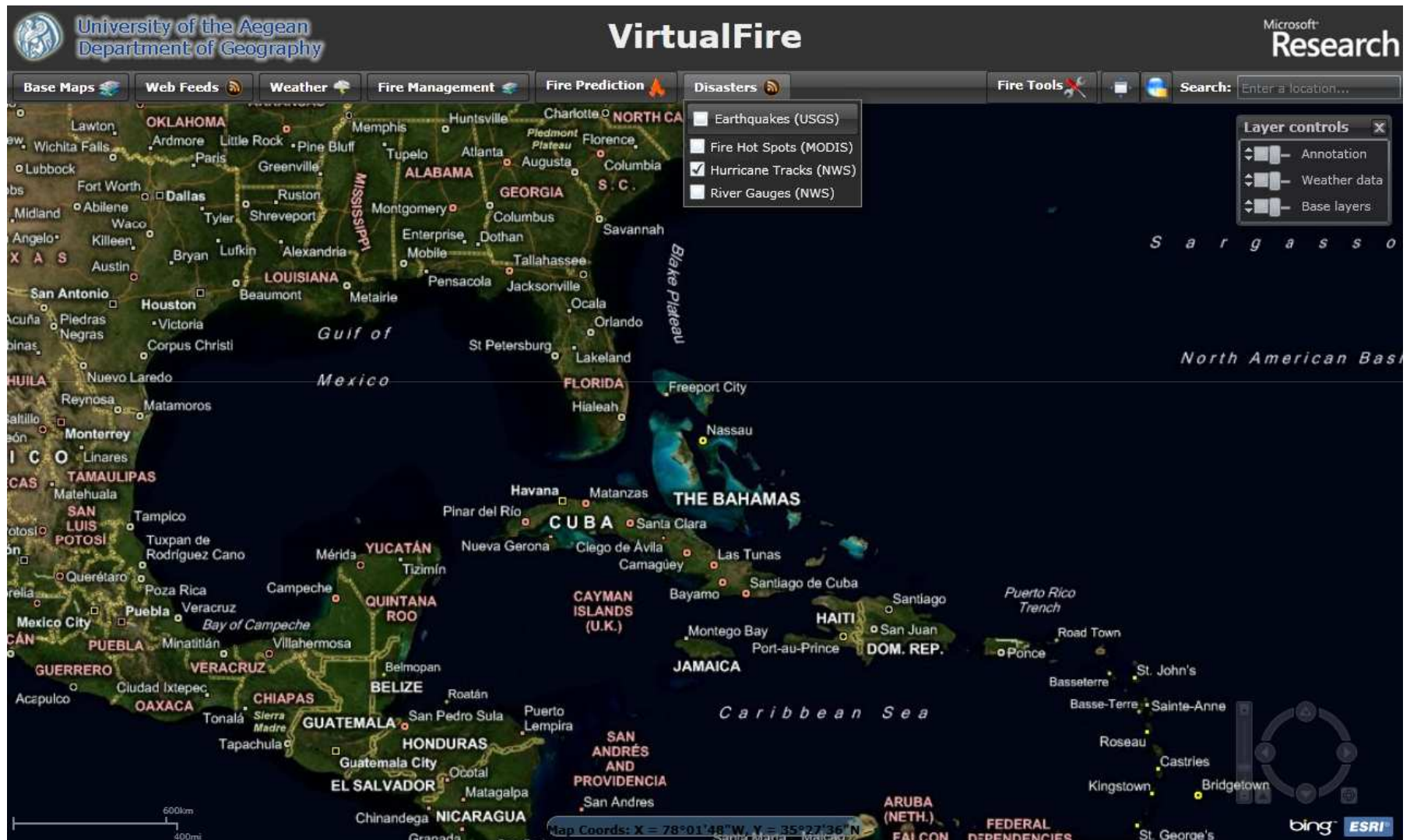
# Live Feeds: Earthquakes (USGS)



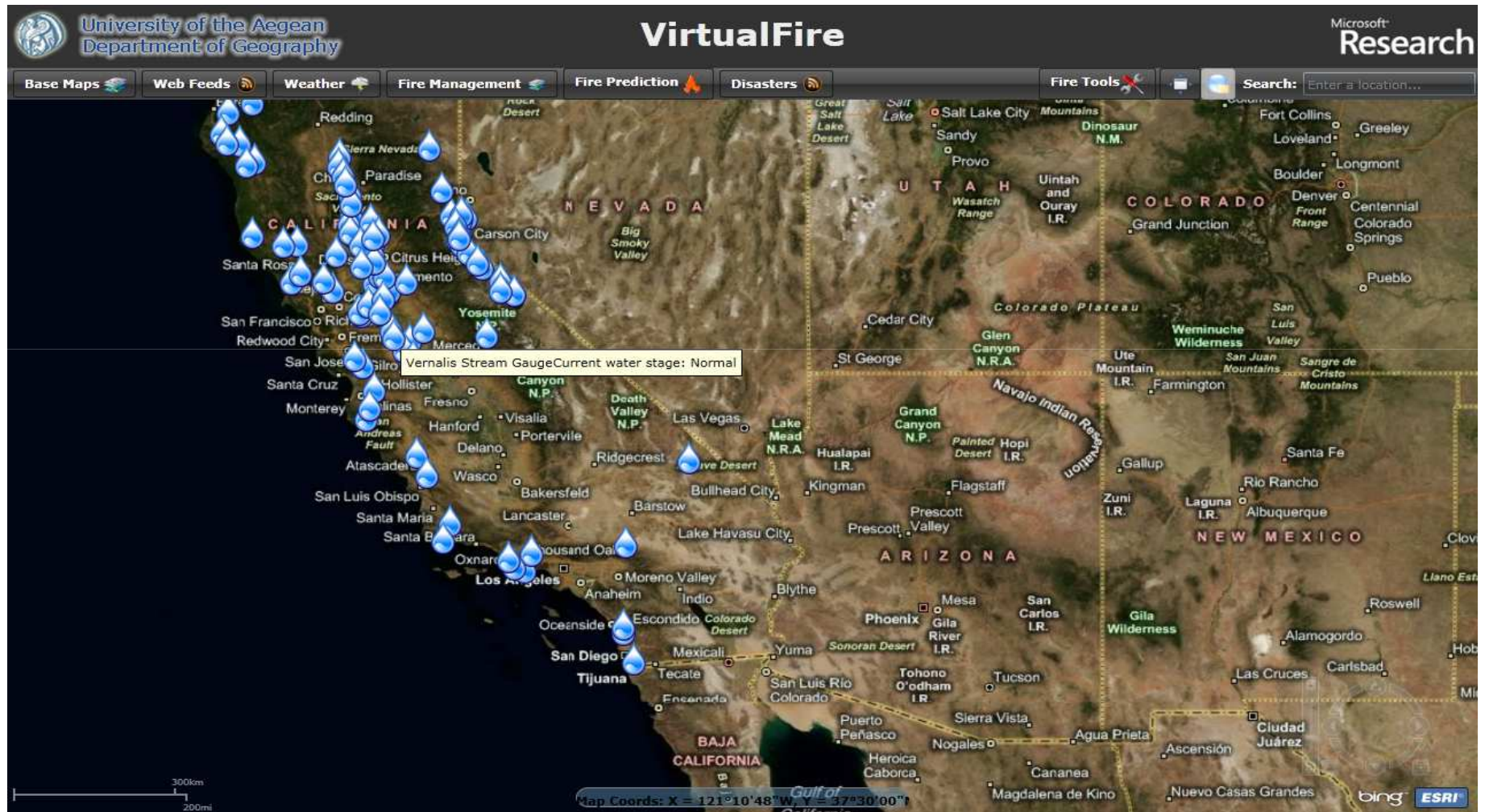
# Live Feeds: Fire Hot Spots (MODIS)



# Live Feeds: Hurricane Tracks (NWS)



# Live Feeds: River Gauges (NWS)

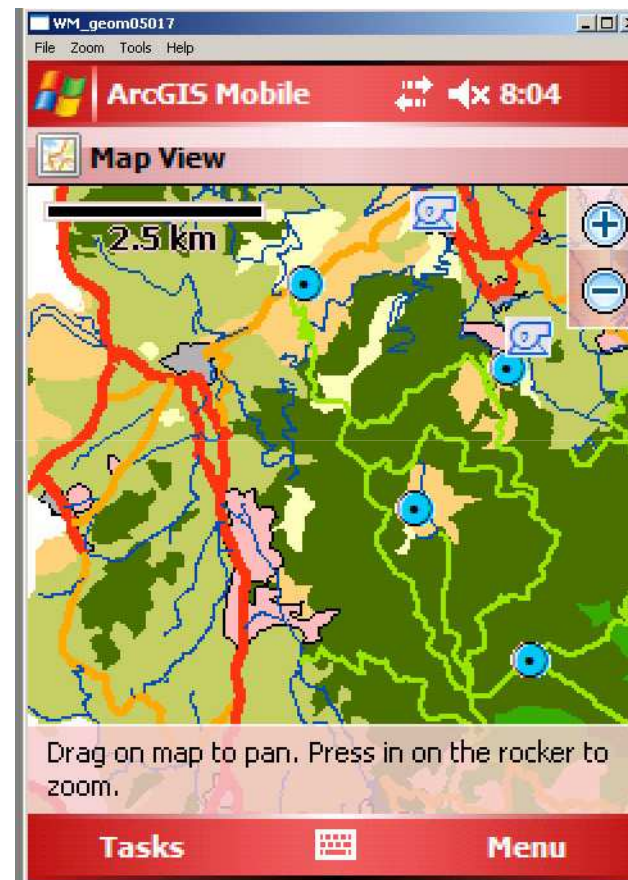
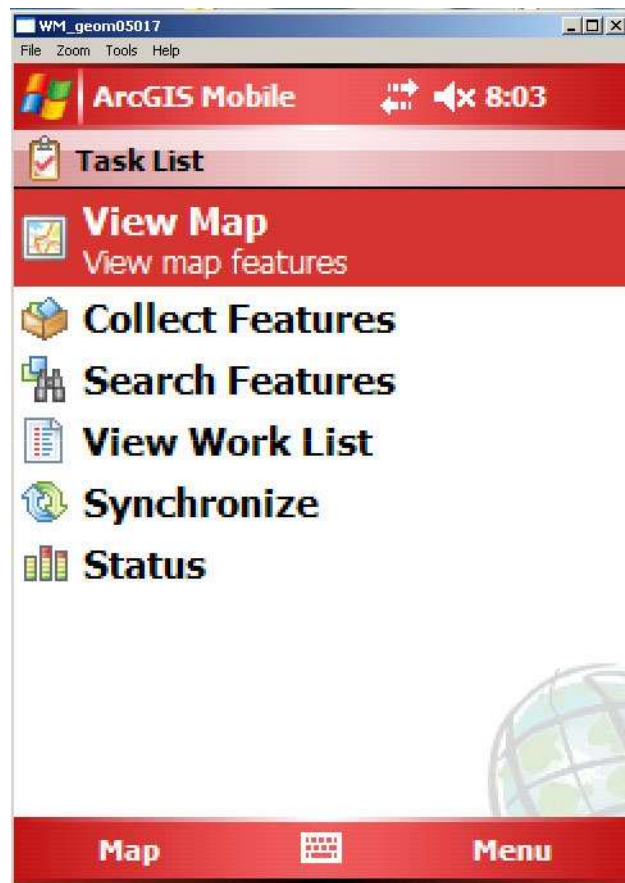




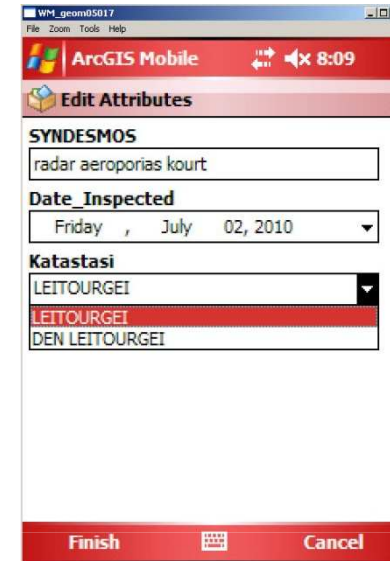
# Overall Project Achievements

1. Ability to select among the *Bing Maps* database and several other layers (high-resolution satellite images, ortho-photos, thematic maps, topographic maps)
2. GeoRSS live data streams for new fire events with ability to add new events
3. Ability to monitor and survey several weather forecasting maps (temperature, relative humidity, cloud cover, rain and wind), with a prediction range of 3 days and update once every day (09:00 am local time)
4. Access to data of 5 Remote Automatic Weather Stations (RAWS) with real-time diagrams and weather monitor graphics
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6. Daily fire risk maps that portray the potential of fire occurrence, based on a high performance computing (HPC) pilot application with Microsoft Windows HPC server
7. On-demand fire behavior modeling
8. A rich toolbox with mapping and other tools that enhance interoperability (shortest routes, closest water tanks, service areas, measurement and digitizing tools, e-mails, fleet tracking, web-cameras, etc.)
9. Daily updated world satellite imagery courtesy of NASA/GSFC/JPL-Caltech, OnEarth, MODIS Terra (WMS map); and other live feeds of worldwide disasters
10. GPS navigation and data collection utility with Windows Mobile Operating System.

# MOBILE GPS DATA NAVIGATION & MAPPING UTILITY



# MOBILE GPS DATA COLLECTION UTILITY



They say that figures rule the world. I do not know if this is true, but I do know that figures tell us if it is well or poorly ruled.

—Goethe 1814, cited in UN Habitat 2001, 114

<http://195.251.137.205/virtualfire>

Questions?

ΕΥΧΑΡΙΣΤΩ