

Provisional Report on the Belize 2011 Wildfires

Aftermath of Hurricane Richard

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The Hurricane.

On October 24 Hurricane Richard ploughed through central Belize. Although Richard was only a category 1 hurricane, the damage to forest was extensive. It was estimated that the total affected area by the hurricane Richard was approximately 968,000 ha or 2,391,000 acres. More specifically for forest, within this area approximately 163,000 ha or 400,000 acres of forest has been severely affected.

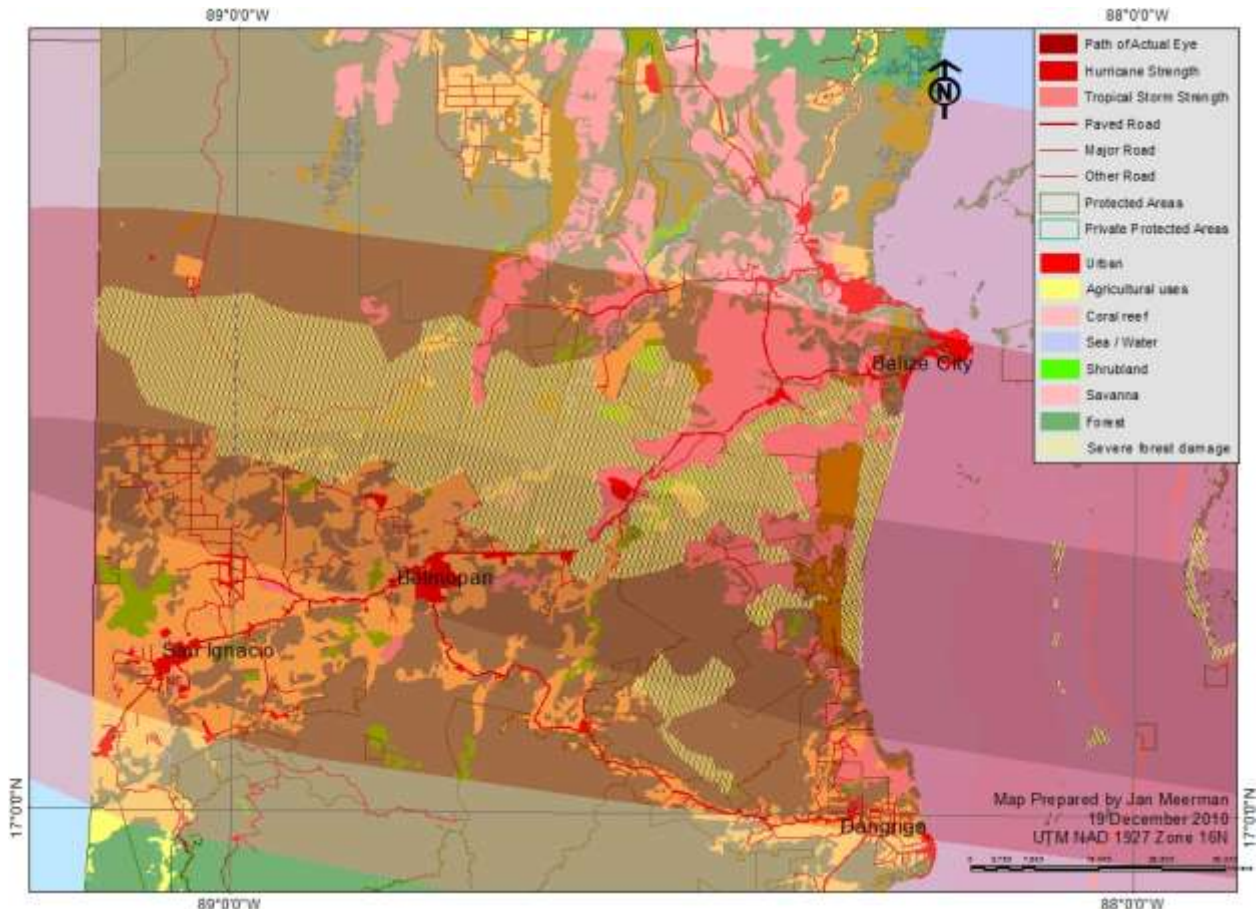
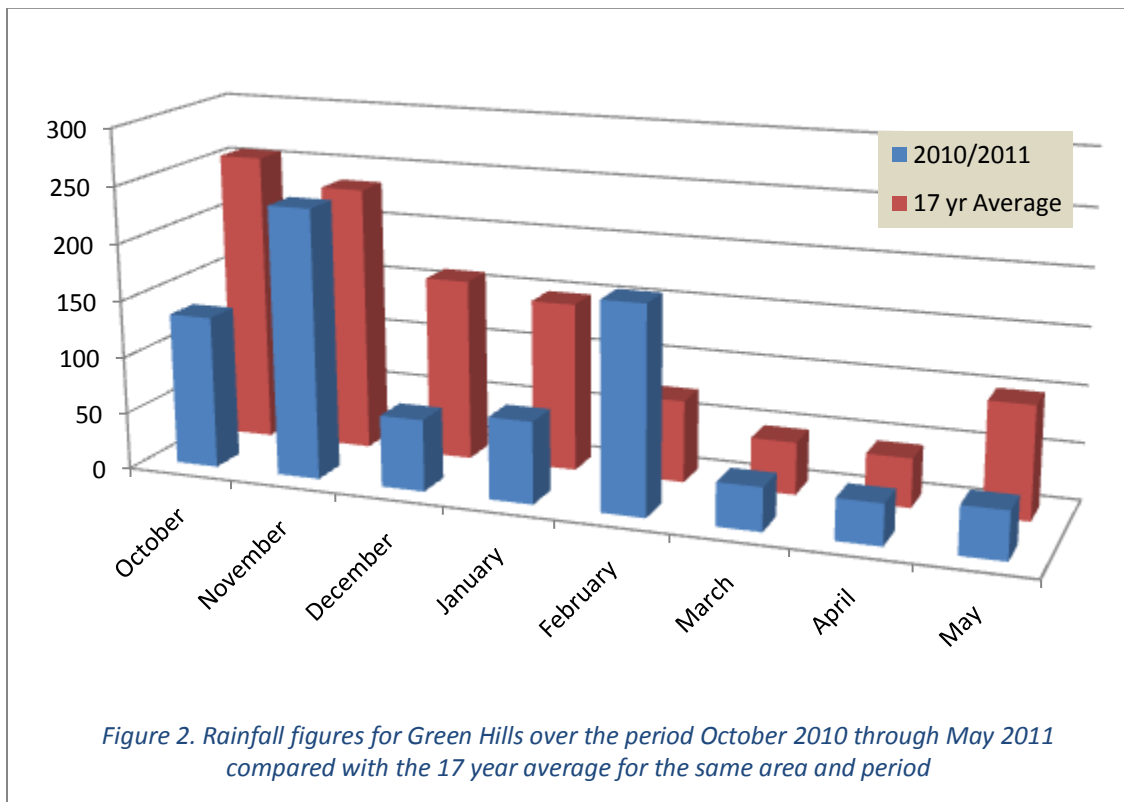


Figure 1. Approximate path of Hurricane Richard over Belize. The darker shaded zone in the center is the path of the actual eye. The medium shaded area is the area with hurricane force winds causing considerable damage to natural vegetation. The lighter shaded area is a tropical storm force zone. The yellow barred zone is the zone of apparent highest impact. Notice that this does not exactly follow the path of the eye. The distinction between the zones is indicative only and based on very limited ground truthing.

The hurricane left a lot of woody debris in its wake (see: http://biological-diversity.info/Hurricane_Richard.htm) creating ideal circumstances for the propagation of wildfires. This condition was further reinforced by the following dry season which was somewhat dryer than average. Hurricane Richard in itself was not a "wet" hurricane and at least at Green Hills (El Progreso, Cayo District) the month of October even ended with a remarkable water deficit (figure 2). While November was about average, the following months, with the exception of February were dryer than average. Effectively the dry season started in December,

2 months early, extending the dry season from about 4 months to 6 months. The total period of October 2010 through May 2011 ended with an amount of rainfall which was only 76% of a 17 year average (again at Green Hills, El Progreso, Cayo District).



The Fires:

Already in February the first fires started to appear, but the situation turned real ugly during the month of April 2011. Apart from the obvious damage to forests and wildlife, the inhabitants of the Cayo district lived in smoke for much of that month. Nationally the fires did not receive much attention until some of that smoke actually drifted into Belize City (<http://www.7newsbelize.com/sstory.php?nid=19574&frmsrch=1>) which led to a flurry of media attention and health warnings. Landowners and other stakeholders such as the Forest Department, Yalbac Ranch, Belize Zoo, Blancaneaux Lodge, Belize Natural Energy Ltd., Five Sisters Lodge, Bull Run and Hidden Valley Inn, TIDE and many others, at that stage had already been involved in weeks of silent firefighting efforts.

A flight donated by Lighthawk <http://www.lighthawk.org> revealed the seriousness of the situation from the air (figs 3-7).



Figure 3: Fire in Forest Fragment in the direction of Valley of Peace looking north (May 20, 2011). Large expanses have burned as indicated by the browner leaf cover. The fire is low burning, creeping over the ground with few or no flames visible.



Figure 4. May 20, 2011: Burned Cohune forest inside the Yalbac. Notice the fire break that was bulldozed around the lake in an attempt to stop the fire



Figure 5: May 20, 2011: Yalbac Road (to Gallon Jug) Notice forest previously affected by hurricane Richard now nearly 80 or 90% burned. Areas with abundant cohune sustained the hottest fires.



Figure 6. May 20, 2011: Close up. Near Yalbac Road (to Gallon Jug) Notice forest previously affected by hurricane Richard now nearly 80 or 90% burned. Areas with abundant cohune sustained the hottest fires.



Figure 7. May 20, 2011. Herbaceous wetland south of the Yalbac Lagoon. The fire going through the herbaceous swamp forms a very distinct and visible fire front. Fire is moving to the east (left in the picture), once it passed through the swamp it will venture in the broadleaf forest again.



Figure 8. June 1, 2011. Broadleaf forest in the east of Yalbac, the day after a fire went through



Figure 9. June 1, 2011. Hot fire in Broadleaf forest in the Yalbac



Figure 10. June 1, 2011. Hot fire in Broadleaf forest in the east of Yalbac. Cohune trees present much of the problem in lowland broadleaf forest as they produce large amounts of fuel.

Following the start of the fire season, active fire data was obtained from the Fire Information for Resource Management System (FIRMS) <http://maps.geog.umd.edu/firms/> Through this system Modis Active Fire Data are collected. The MODIS active fire product detects fires in 1km pixels that are burning at the time of overpass under relatively cloud-free conditions using a contextual algorithm, where thresholds are first applied to the observed middle-infrared and thermal infrared brightness temperature and then false detections are rejected by examining the brightness temperature relative to neighboring pixels (Giglio, L. et al. 2003). See http://modis-fire.umd.edu/AF_methodology.html for further details.

These data are obtained by two satellites "Terra" and "Aqua", each of which make one overpass over the area each day. In other words, fires that are active outside these actual over passes are not recorded by the system. These may be short lived fires (such as well managed agricultural fires) but it does pick up long lasting fires such as actual wildfires that rage on for more than one day. Also based on field experience, low burning fires, such as slow fires under a broadleaf forest canopy tend not to be picked up by the system. Overall, in my experience, the system under-represents the actual fire situation on the ground.

The combined active fire data (February, March, April, May 2011) were projected over the ecosystems map of Belize (<http://biological-diversity.info/Ecosystems.htm>) and using ArcGIS, polygons were created over concentrations of fire-points. Two types of polygons were thus created :

Wild fires: Including all areas with natural vegetation apart from Savanna, Most will be fires in broad-leaf forest but some are in shrub and wetland ecosystems. To a small degree these may include a number of new clearings for agriculture. Broadleaf forest fires should be considered to be the most damaging as the Belizean broadleaf forests are not fire adapted. Principal source of broadleaf forest fires are anthropogenic fires starting as agricultural fires. In addition to that several observers have reported that clearing and burning vegetation around wooden power line post were a significant source of wildfires this year.

Savanna fires: Referring to savannas and pine forests which are fire induced anyway. These are somewhat natural as these ecosystem are certainly fire induced. While some fires may be the result of lightning strikes (particularly in the hills, including the Mountain Pine Ridge), many will still be the result of deliberate or accidental anthropogenic fires. In the Mountain Pine Ridge a potential source would include military training.

Agricultural fires: Which are fires in an agricultural matrix such as shifting cultivation have not been assessed as these don't constitute a direct impact to ecosystems and biodiversity. However it should be noted that these same agricultural fires typically insufficiently (or not at all) managed and are probably the single most important source of wildfires.

Outcome:

Based on the thus created polygons, very tentative calculations could be made.

Forest fires: A combined area of approximately 86,400 ha / 213,500 acres was burned nationwide. The bulk of the fires though were centered in the center of the country in the path of Hurricane Richard (figs. 11 & 12).

Savanna fires: Nationwide approximately 61,200 ha / 151,200 acres of savanna and pine forest burned. This includes on the Mountain Pine Ridge where these fires were the most dramatic.

Agricultural fires: Fires in the agricultural matrix have not been assessed!

Inevitably, protected areas were among those areas with distinct fire impacts (table 1):

Table 1. Belize Protected Areas affected by wildfires in 2011

Extreme damage	Moderate damage	Minor damage
Aguacaliente WS	Deep River FR	Bladen NR
Crooked Tree WS	Elijo Panti NP	Chiquibul FR
Jaguar Corridor Preserve	Five Blues Lake NP	Chiquibul NP
Manatee FR	Hidden Valley - Private	Columbia River FR
Mountain Pine Ridge FR	Mango Creek FR	Freshwater Creek FR
Peccary Hills NP (including Hwatchy)	Mayflower Bocawina NP	Gallon Jug - Private
Rio Bravo CMA - Private	Swasey-Bladen FR	Honey Camp NP
Runaway Creek - Private	Tapir Mountain NR	Maya Mountain FR
Spanish Creek WS	Vaca FR	
Yalbac - Private	1000 ft Falls NM	

No attempt will be made to give affected area for each protected area. The national data presented here and should be verified using recent satellite imagery. In the past CATHALAC <http://www.cathalac.org/> has been very instrumental in providing such disaster analysis and possibly assistance could be requested from this organization for this purpose.

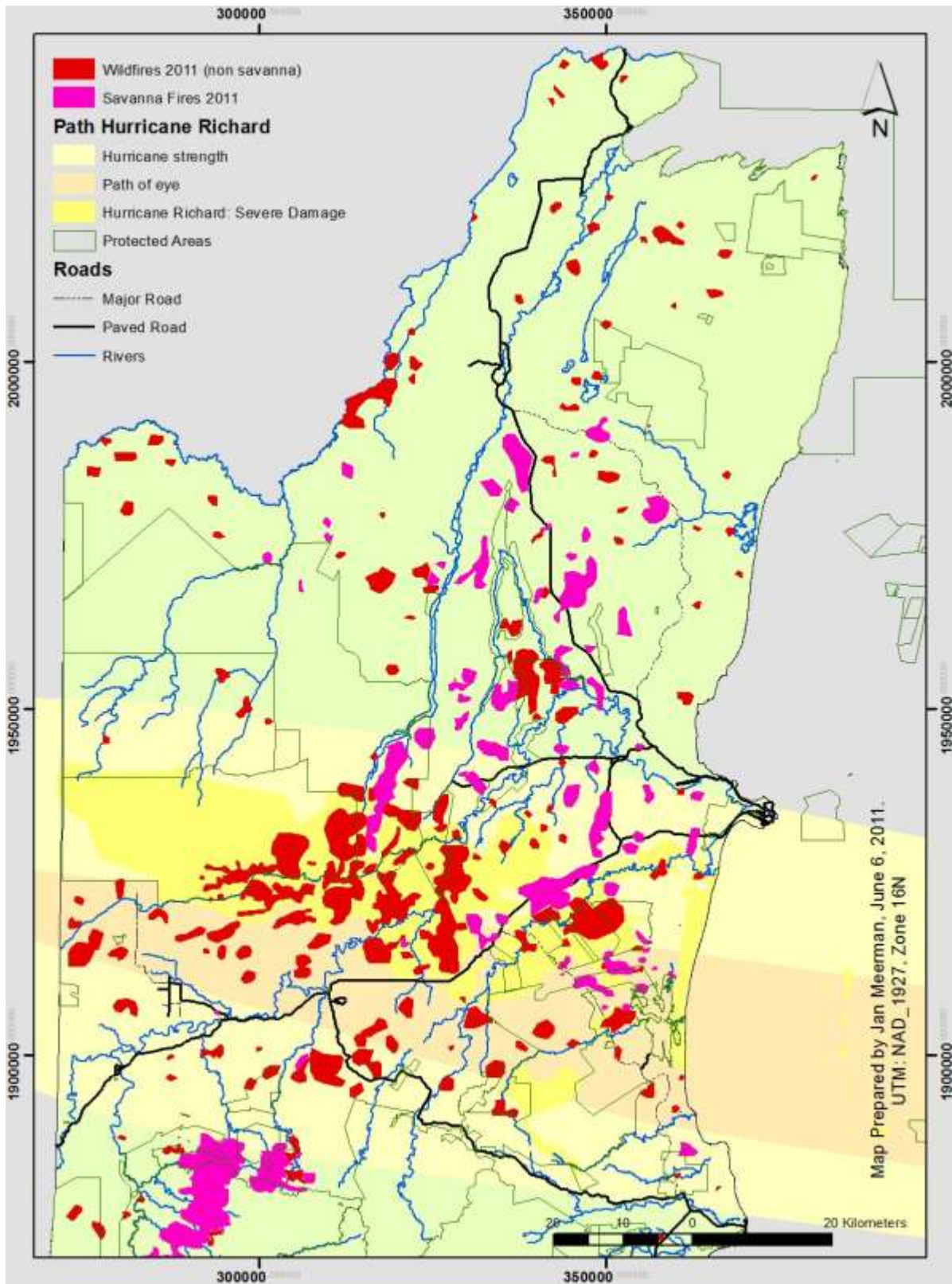


Figure 11. Wildfires recorded in Northern Belize over the period February through May 2011. See text for further explanation.

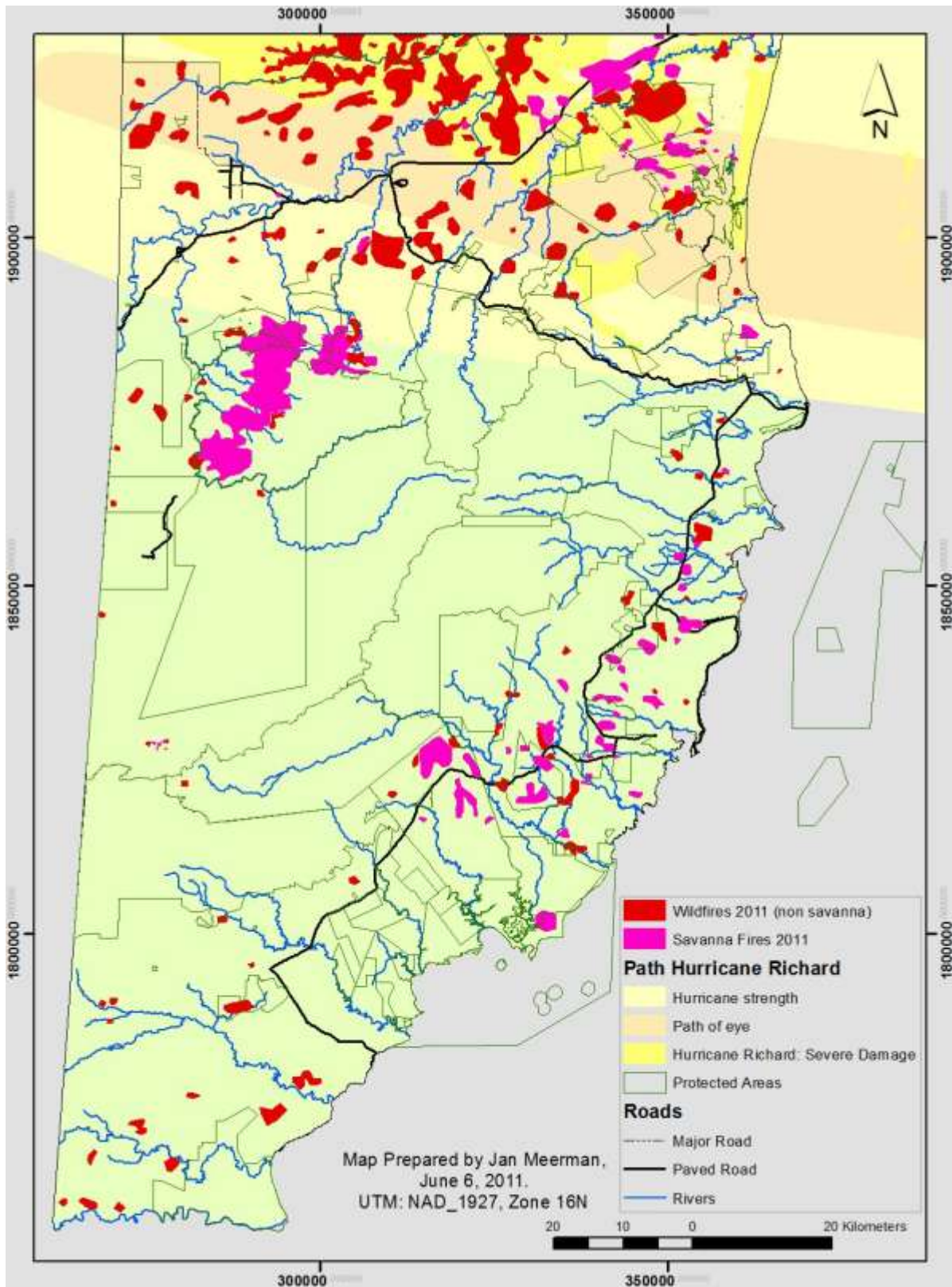


Figure 12. Wildfires recorded in Northern Belize over the period February through May 2011. See text for further explanation.