



# Flood Hazard Vulnerability in Vermont's Mobile Homes

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A VISUAL ESSAY BY WRIGHT FROST

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# *Introduction*

Hurricane Irene was one of the most significant flooding events in Vermont's history, causing hundreds of millions of dollars of damage to infrastructure and homes. Among the most affected structures were mobile homes, hundreds of which were damaged or destroyed. Whether such devastation could have been predicted is a question worth considering. The standard method of assessing risk uses FEMA flood zones, but this does not take into consideration the ways a river's path can change during a flooding event, or even just change naturally over the course of time. Perhaps assessing risk using river corridors (the 50 foot zone surrounding a river's natural path) rather than these FEMA flood zones may prove a more accurate method of anticipating flood damage.

**Table 1**

County	Total Mobile Homes (ACS)	Mobile Homes at Risk (ACS)	Mobile Homes at Risk (e911 and FEMA)	Mobile Homes at Risk (e911 and River Corridors)	Average Number of Mobile Homes at-risk
Bennington	1277	65.199	189	130	128
Rutland	1992	188.433	164	204	185
Windham	1833	125.605	298	298	241
Windsor	2427	133.899	198	353	228

Table 1 shows total mobile homes at-risk in each county according to 3 different methods of calculation, as well as an average of the three. The first method, which assumes an even distribution of mobile homes throughout the county, gives low values for at-risk homes in Windham and Windsor counties; the other methods, which use the specific locations of mobile homes, suggest that homes in these counties are actually most at-risk of flooding (particularly when calculating risk based on proximity to river corridors). This is reflected in the final average, where Windham and Windsor counties have the most at-risk homes. The difference between using FEMA flood zones or river corridors to determine whether homes are at-risk must also be noted; in general, the latter method designates many more homes as at-risk because of the wider path it allows for river overflow and bank erosion.

# *Risk of flooding in Southern VT*

Figure 1 shows the percent of at-risk mobile homes (calculated as at-risk mobile homes divided by total mobile homes) by county, calculated using e911 point data compared to river corridors to determine which mobile homes are at-risk. It is clear that mobile homes in Windsor and Windham counties have the greatest likelihood of being at-risk, a precarious position exacerbated by the fact that, during Hurricane Irene, these two counties received 2+ inches more rainfall in places than Bennington and Rutland counties (Baker et al., p. 30)

Figure 2 shows the same category as Figure 1 – the percent of mobile homes considered at-risk – but calculated with two important differences: first, assuming an even distribution of mobile homes throughout the county, and second, using FEMA flood zones instead of river corridors to determine whether a home is at-risk. These two distinctions result in all four counties having fewer at-risk mobile homes than when calculated using river corridors, and the county with the highest proportion of at-risk homes, Rutland, is still comparatively lower.

Figure 1

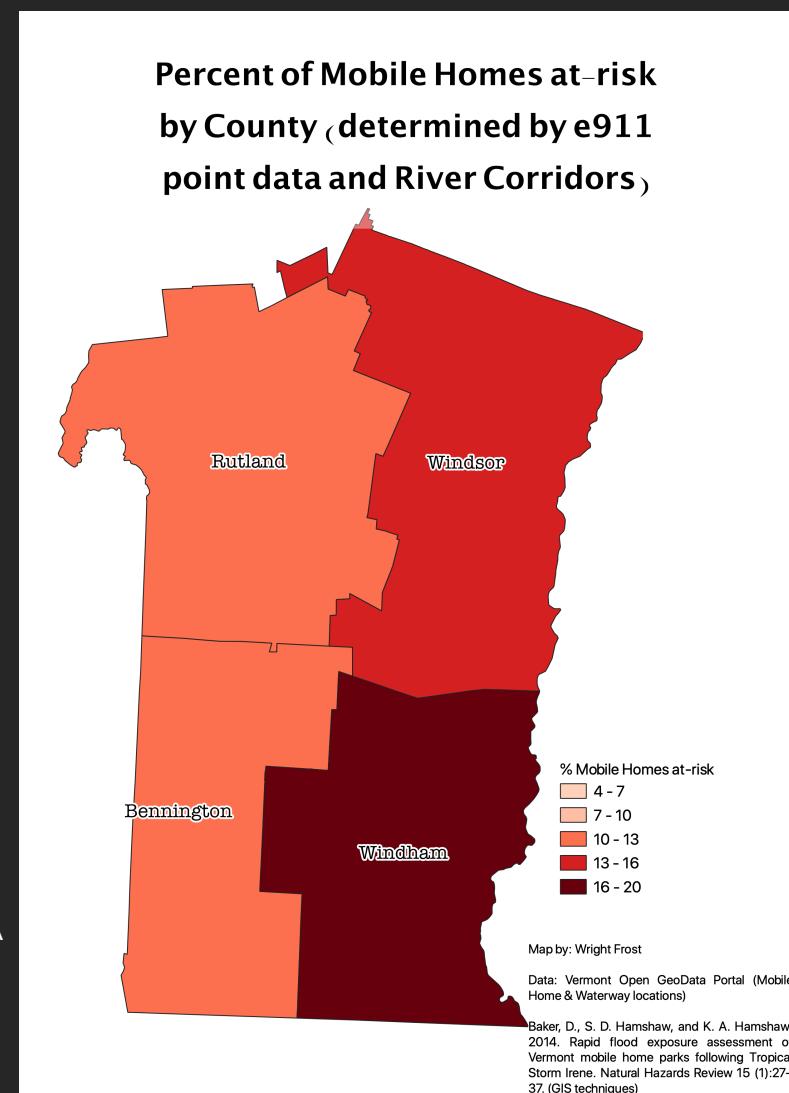
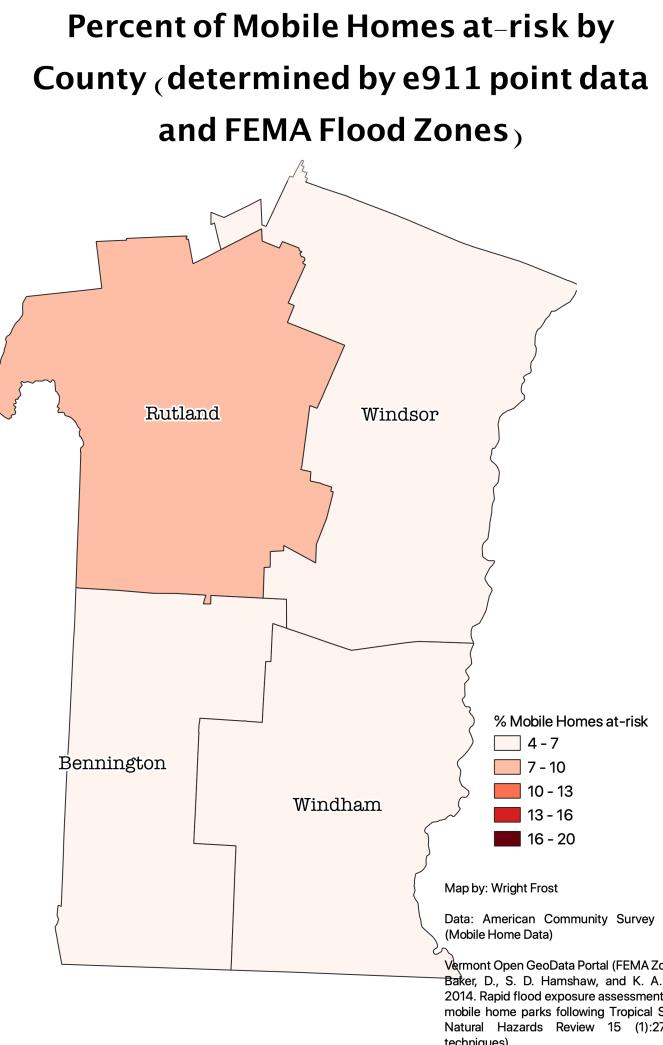
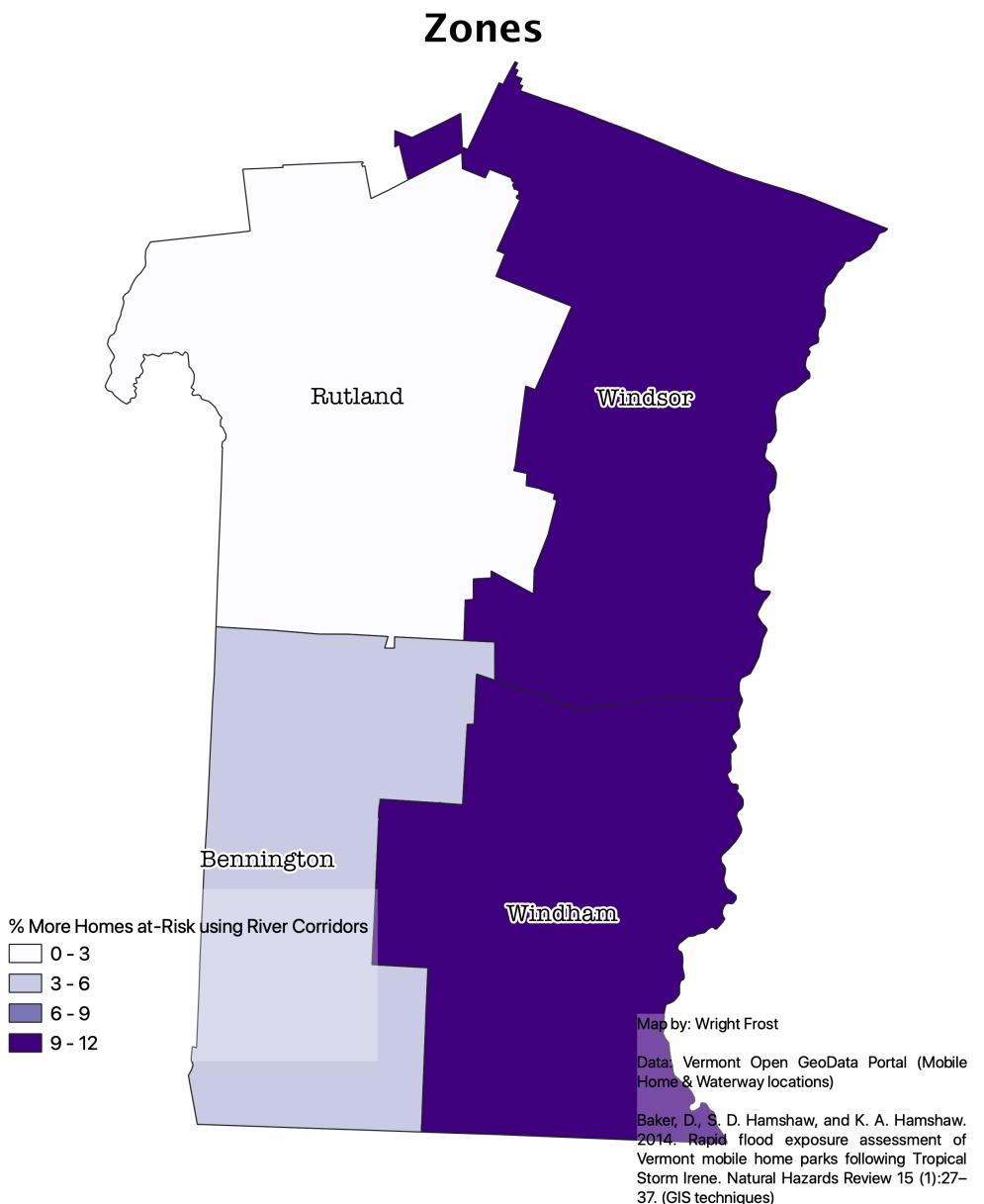


Figure 2



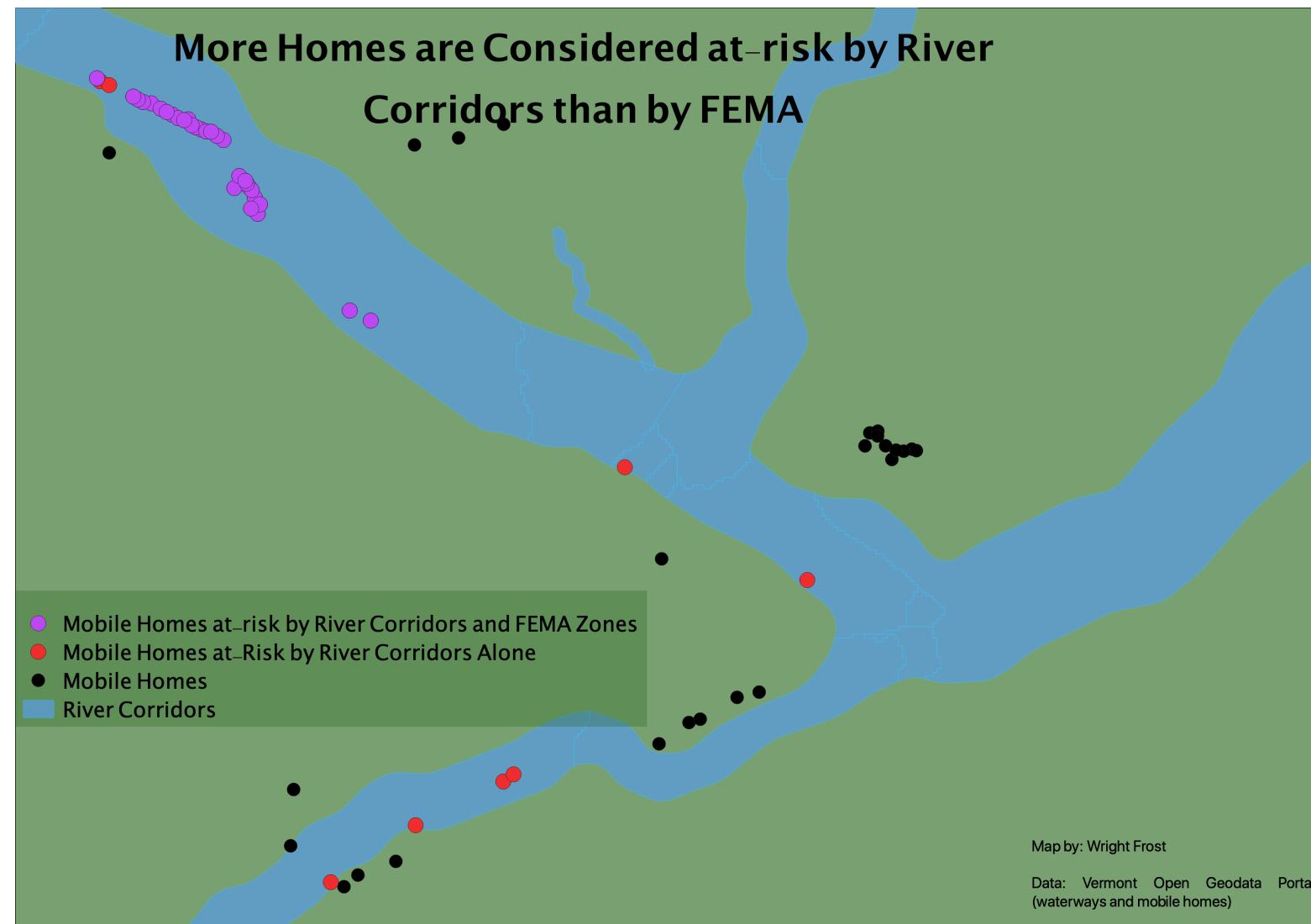
**Figure 3**  
**Discrepancies between Calculating at-risk  
Homes using River Corridors vs. FEMA Flood**



*e911 & River  
Corridors estimate  
at-risk homes more  
liberally than ACS  
& FEMA Zones*

**Figure 3** highlights the differences between using e911+River Corridors and ACS+FEMA flood zones to calculate at-risk homes by showing what % more homes were considered at-risk using the former method compared to the latter method. In other words, this map displays % at-risk (River Corridors) minus % at-risk (FEMA flood zones). In the eastern counties, River Corridors overestimated FEMA zones' predictions of at-risk homes by more than 9% – due in part to the fact that mountainous regions are largely unaccounted for by FEMA zones (see Figures 4 and 5).

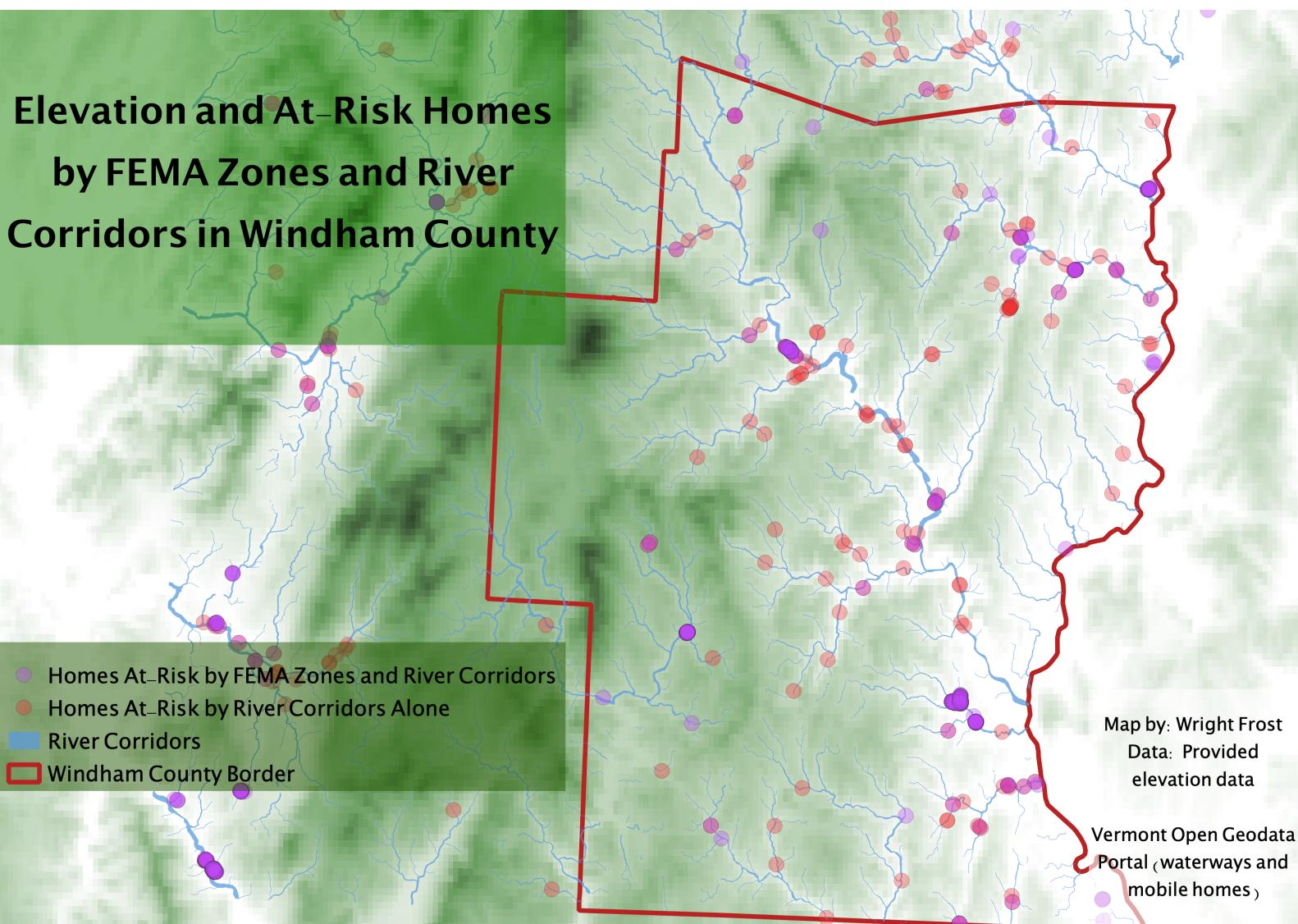
Figure 4



*Smaller streams  
aren't covered by  
FEMA zones*

Figure 4 shows one of the main differences between FEMA zones and River Corridors: while River Corridors consider homes near small streams and tributaries – often in mountainous regions – to be at-risk, FEMA Zones generally only consider homes near major rivers to be at-risk. Every home (from e911 dataset) in this map deemed at-risk using FEMA Zones is also considered at-risk by River Corridors, but the reverse is *not* true, as many homes near the small tributary in the bottom of the map are not covered by FEMA zones.

Figure 5



*Windham  
County is a case  
study in all  
trends*

Figure 5 shows the elevation profile of Windham County, the county with the highest average number of homes-at-risk across all three methods. It confirms a trend suggested by data from Figures 1 and 2: that a high number of mobile homes are at-risk of flooding because they are situated in valleys along floodplains rather than along ridgelines. This trend is shown through the contrast between the mountainous western portion of Windham County, where there are very few mobile homes, and the low-lying eastern Connecticut River Valley, which has many more mobile homes. Additionally, it is clear in this map that homes near mountainous streams are often considered at-risk by River Corridors but not by FEMA Zones.

# References

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Baker, D., S. D. Hamshaw, and K. A. Hamshaw. 2014. Rapid flood exposure assessment of Vermont mobile home parks following Tropical Storm Irene. *Natural Hazards Review* 15 (1):27–37.

Flood Ready Vermont. River Corridors. Vermont.gov. Available online at:  
[https://floodready.vermont.gov/flood\\_protection/river\\_corridors\\_floodplains/river\\_corridors](https://floodready.vermont.gov/flood_protection/river_corridors_floodplains/river_corridors)

Provided elevation data (used for figure 5), and USGS Earth Explorer. GMTED 2010 Raster Map. Available online at: <https://earthexplorer.usgs.gov/>. (Used for personal visualization and data interpretation),

Vermont Open GeoData Portal. Available online at: <https://geodata.vermont.gov/>.