

KENTUCKY FLOOD RISK ASSESSMENT

This Risk Assessment will be used to understand Kentucky's overall flood risk and to help identify potential mitigation actions that can be implemented to reduce this overall flood risk.

2018 Update



2018 Kentucky Hazard Mitigation Plan Update – Flood Risk Assessment

Flood Risk Assessment

Type and Location of Flooding Hazards

Description

Flooding is the most frequent and costly natural hazard within the Commonwealth, with an average annual loss of greater than \$40,000,000. Flood events occur within the state every year with several substantial floods occurring annually. Kentucky's topography contains 13 major drainage basins to accommodate 40-50 inches of average rainfall (maximum during winter and spring, minimum during late summer and fall). The state contains 89,431 miles of rivers and streams, 637,000 acres of wetlands, 18 reservoirs over 1,000 acres in size, and 228,382 acres of publicly-owned lakes and reservoirs.

FEMA defines a flood as "A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties" (Federal Emergency Management Agency, 2017). The US Army Corps of Engineers states that a flood as an "abnormally high water flow or water level that overtops the natural or artificial confining boundaries of a waterway" (US Army Corps of Engineers, 2006).

The primary factors that determine the severity of a flood include:

- Rainfall intensity and duration
 - A large amount of rain over a short time can result in flash flooding.
 - Small amounts may cause flooding where the soil is already saturated.
- Topography
 - Water runoff is greater in areas with steep slopes and little vegetation.

Rainfall and topography may vary considerably across the Commonwealth. Eastern Kentucky generally has steep slopes and narrow valleys throughout, making it susceptible to flash flooding events. The speed with which these events develop gives little time for warning and can potentially lead to loss of life. Central Kentucky has rolling hills and several medium to large river systems and their associated small tributaries. These areas tend to have increased warning times but the smaller tributaries are still susceptible to flash flooding events. Northern Kentucky along the Ohio River and western Kentucky are generally flatter with larger, well defined floodplains. These areas tend to have the greatest amount of warning time in the Commonwealth which provides communities and citizens the time to get out of the way. These areas are less vulnerable to loss of life due to flooding but have a higher risk of economic losses.

Other factors that contribute to flood impacts include storm types, soil types, channel slope, karst areas, soil saturation, infrastructure development, impervious surfaces, and emergency response capabilities. These variations in local conditions can cause extreme variability in flood levels, duration, and impacts.



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Types of Flooding

There are a multitude of reasons that lead to a flooding event. These factors can lead to a variety of different types of flooding with each type of flooding having different effects on communities. The types of floods can be grouped into eight (8) categories:

- 1) Regional flooding can occur when seasonal rain events, coupled with melting snow, fill river basins with too much water too quickly. Extended rain events during any time of the year may also saturate the soil, after which any additional rain runs off into streams and rivers until the rivers' capacities are exceeded. Regional flood events are often associated with low-pressure storm fronts, either stationary or slow moving, which include decaying hurricanes or tropical storms.
- 2) Riverine flooding is a high flow or overflow of water from a river, stream, or similar body of water, occurring over a long period of time. The time periods associated with these floods are too long to be considered a flash flood. The dynamics of riverine flooding can vary greatly depending on differences in topography. Areas of the Commonwealth with hilly or mountainous terrain can experience floods with large depths, high velocities, and with short notices. These floods can last anywhere from a couple of hours to several days. Areas of the Commonwealth with relatively flat terrain can encounter deep or shallow flooding depending on site conditions. These floods also tend to be slower moving with longer notices and can last for days or weeks at a time. These riverine overbank floods are the most common type of flood even in the U.S. and are generally the type of event people associate with the term “flood or flooding”.
- 3) Flash floods are quick-rising floods that occur as the result of heavy rains over a short period of time. The National Weather Service states that the rains events causing flash floods occur for “...generally less than 6 hours” and “...are usually characterized by raging torrents after heavy rains that rip through river beds, urban streets, or mountain canyons sweeping everything before them” (National Weather Service: Jackson Office , 2016). Flash floods can occur within several seconds to several hours and with little warning and can be deadly due to the rapid rise in water levels and devastating flow velocities produced. Flash floods can also occur even when no rain has fallen after events such as a levee or dam failure, or after the release of water by a debris or ice-jam. Areas with narrow valleys and/or steep topography, or areas that experience an intense, localized rainfall event are especially vulnerable to flash flood events in the Commonwealth.
- 4) Dam and levee failure poses some of the most significant potential losses to flooding in the Commonwealth. A dam failure is usually the result of neglect, poor design, or structural damage caused by a major event such as an earthquake. When a dam fails, an excess amount of water is suddenly released downstream, destroying anything in its path. Dams and levees are often built for flood protection and are engineered to withstand a flood with a computed



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risk of occurrence. For example, a dam or levee may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If a larger flood occurs, then that structure will be overtopped. If during the overtopping, the dam or levee fails or is washed out, the water behind it is released and becomes a flash flood. Failed dams or levees can create floods that are catastrophic to life and property because of the tremendous energy of the released water.

- 5) Debris flooding can occur on rivers or streams that are either totally or partially blocked due to buildup of debris or ice, causing a rapid rise in stream stage both at the point of the jam and upstream. Debris flooding may occur depending on the weather and the physical condition of the river. These jams create a dam across the channel over which the water and debris mixture continues to flow, allowing for more jamming to occur. Once the jam fails, the water stored behind the impromptu dam is released and takes on the characteristics of a flash flood with the added danger of the debris mixture. The energy of the flood-wave carrying debris can inflict serious damage on structures.
- 6) Storm-surge flooding occurs when water is pushed up onto otherwise dry land by offshore winds. This flooding is generally due to wind action associated with large storms over an open body of water. Storm surges can cause water to rise for hours or even days depending on the storm conditions and topography of the area affected. Depending upon the distance of water (fetch) and the velocity of the wind, water can pile up to depths greater than 20 feet. Intense, low-pressure systems and hurricanes can create storm-surge flooding. The storm surge is unquestionably the most dangerous part of a hurricane as pounding waves create very hazardous flood currents. Kentucky does not have a body of water large enough for this type of flooding to occur.
- 7) Mudflows originate as sheet flow across a land area that cannot retain runoff, such as areas that have been deforested by wildfires. The mudflow starts when sheet flow picks up soil and debris, and once wet enough, begins flowing in mass. This mudflow can cause more damage than riverine or flash flooding due the increased force this additional mass can create carried in floodwaters. Eventually, this mud and debris can then build up in a channel, forming a temporary dam. Flooding occurs upstream as water becomes stored behind the temporary dam and then becomes a flash flood when the dam is breached and rapidly washes away. Related to mudflows are flooding caused by landslides. Landslide flooding occurs when areas with steep slopes become saturated and areas move in mass downslope, depositing debris into bodies of water such as lakes or rivers. This sudden movement can force a large wave to flow downstream inflicting serious damage to structures.
- 8) Urban drainage (stormwater) flooding is a combination of both natural and man-made elements. Increased urbanization across the Commonwealth has required artificial drainage systems to quickly and effectively eliminate excess surface water after a rainfall event.



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Urban flooding occurs where there has been high levels of development in and adjacent to floodplains. Artificial straightening of streams, lining stream channels with artificial materials such as concrete, installation of mechanisms to control runoff, and the construction of streets, curbs, and stormwater inlets have contributed to reductions in the time required for water to reach the stream or river channel. These artificial drainage systems reduce infiltration of stormwater into the groundwater system and increase flood frequency and magnitude downstream. The largest effects of urban flooding is often greatest in small streams where urban development can prevent the falling precipitation from becoming groundwater flow.

Of the above listed types of flooding, riverine, flash, and urban flooding are the most common flood events in Kentucky; however, dam or levee failure may pose the greatest potential for damages or loss of life on a local level due to sudden and catastrophic nature of the event.

Historical Occurrences

A number of significant flooding incidences occurred in the 20th and early 21st centuries within the Commonwealth. Table 1 shows all of the presidentially declared disasters in Kentucky Since 1970 and the number of counties affected in each declaration. Several major flood events stand out due to their high damage totals and their widespread effects in the Commonwealth. The flood of 1937 is one of the most devastating floods in Kentucky's recorded history. In the month of January the state experienced four times the normal amount of precipitation. With the river cresting at over 57 feet in Louisville, 75% percent of the city was underwater and over 175,000 residents were evacuated. Further downstream in Paducah, where the river crested at over 60 feet, residents were evacuated as well. The damages incurred by the entire state were estimated at \$250 million, an extremely large sum for the economic climate of the 1930s.

On March 1, 1997, Louisville set a record for the highest amount of precipitation to fall in a single day at 10.48 inches. That March was also the wettest March on record for Louisville, with 17.52 inches of rain for the month. This was part of more widespread rain in central Kentucky and the surrounding areas that led to massive flooding of the Ohio River unlike any in many decades. The crest of the river reached 70.47 feet in Louisville, causing about \$200 million in damages with 50,000 homes affected and the closing of Interstates 64 and 65. One hundred and one counties in Kentucky were declared disaster areas with approximately \$400 million in damages, tens of thousands of people evacuated from their homes, and seven deaths occurred. Record flood stages were reached at numerous streams throughout the state.

In August 2009, a record high rainfall for a single day in August occurred in the Louisville area; a record unbroken since 1879. During this event 4.53 inches of rain fell at Louisville International Airport, with 3 inches falling within one hour. The Louisville Free Public library sustained \$1 million dollars in damages and the University of Louisville alone sustained upward of \$20 million in damages.



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The Commonwealth has identified numerous Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties which both KYEM and KDOW considered to be of high priority for mitigation measures. A Repetitive Loss Analysis was conducted as a standalone section of this assessment. See Repetitive Loss Analysis section and [Appendix B](#) for RL/SRL by county.

Table 2 lists all declared disasters from January 2000 through Present by the Incident Period. Table 2 further identifies the type of event associated with each disaster declaration. Figure 1 shows that from 1970-2016, Kentucky had 59 Presidential disaster declarations with 35 of the declarations occurring since 2000. From 2000-2016, Kentucky averaged 1.9 disaster declarations per year. The trend line shown in Figure 1 indicates that Presidential disasters are being declared more frequently over time. Based on these trends, the Commonwealth may expect an average of 1-2 disaster declarations per year for the foreseeable future.

*Table 1. Summary of Presidentially declared disasters and number of counties affected (1970-2018).**

Disaster Number	Declaration Date	Counties Affected
282	February 2, 1970	12
288	June 5, 1970	13
332	May 15, 1972	10
461	March 29, 1975	17
529	April 6, 1977	15
568	December 12, 1978	37
705	May 15, 1984	28
821	February 24, 1989	67
834	June 30, 1989	12
846	October 30, 1989	11
893	January 29, 1991	19
1163	March 3, 1997	101
1388	August 15, 2001	20
1407	April 4, 2002	37
1414	May 7, 2002	29
1471	June 3, 2003	44
1475	July 2, 2003	23
1523	June 6, 2004	77
1537	August 6, 2004	27
1703	May 25, 2007	9
1746	February 21, 2008	23
1757	May 19, 2008	15
1818	February 5, 2009	102



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Disaster Number	Declaration Date	Counties Affected
1841	May 29, 2009	24
1855	August 14, 2009	2
1912	May 11, 2010	83
1925	July 23, 2010	7
4008	July 25, 2011	7
4057	March 6, 2012	23
4196	September 30, 2014	4
4216	April 30, 2015	41
4217	May 1, 2015	29
4218	May 12, 2015	59
4239	Aug 12, 2015	35
4278	August 26, 2016	20
5158	November 8, 2016	1
5166	November 20, 2016	4
4358	April 12, 2018	22
4361	April 26, 2018	34

Table 2. Summary of Presidentially declared disasters by type (2006-2018).*

Disaster Declaration Number	Incident Period	Dam Failure	Draught	Earthquake	Extreme Temp.	Flood	Forest Fire	Hailstorm	Karst/Sinkhole	Landslide	Severe Storm	Severe Winter	Tornado
DR-1310	Jan 3 - 4, 2000					X					X		X
DR-1320	Feb 18 - Mar 2, 2000					X					X		
DR-1388	July 27 - Aug 21, 2001					X					X		
FSA-2386	Nov 2-21, 2001						X						
DR-1407	Mar 17 - 21, 2002					X					X		
DR-1414	Apr 27 - May 10, 2002					X							X
DR-1454	Feb 15 - 26, 2003											X	



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Disaster Declaration Number	Incident Period	Dam Failure	Draught	Earthquake	Extreme Temp.	Flood	Forest Fire	Hailstorm	Karst/Sinkhole	Landslide	Severe Storm	Severe Winter	Tornado
DR-1471	May 4 - 27, 2003					X				X	X		X
DR-1475	June 14 - 27, 2003					X				X			X
DR-1523	May 26, Jun 18, 2004					X				X	X		X
DR-1537	July 13-15, 2004					X					X		
DR-1578	Dec 21-23, 2004											X	
DR-1617	Nov 15, 2005										X		X
DR-1703	Apr 14 - 15, 2007					X				X	X		
DR-1746	Feb 5 - 6, 2008					X					X		X
DR-1757	Apr 3 - 4, 2008					X				X	X		X
DR-1802	Sept 12 - 14, 2008										X		
DR-1818	Jan 26 - Feb 13, 2009					X						X	
DR-1841	May 3 - 20, 2009					X				X	X		X
DR-1855	Aug 4, 2009					X					X		
DR-1912	May 1 - June 1, 2010					X				X	X		X
DR-1925	July 17 - 30, 2010					X				X	X		
DR-1976	Apr 12 - May 20, 2011					X					X		X
DR-4008	June 19 - 23, 2011					X					X		X
DR-4057	Feb 29 - Mar 3, 2012					X					X		X
DR-4196	Aug 18 - 23, 2014					X					X		X
DR-4216	Feb 15 - 22, 2015					X				X		X	
DR-4217	Apr 2 - 17, 2015					X				X	X		X
DR-4218	Mar 3 - 9, 2015					X				X		X	
DR-4239	July 11 - 20, 2015					X				X	X		X

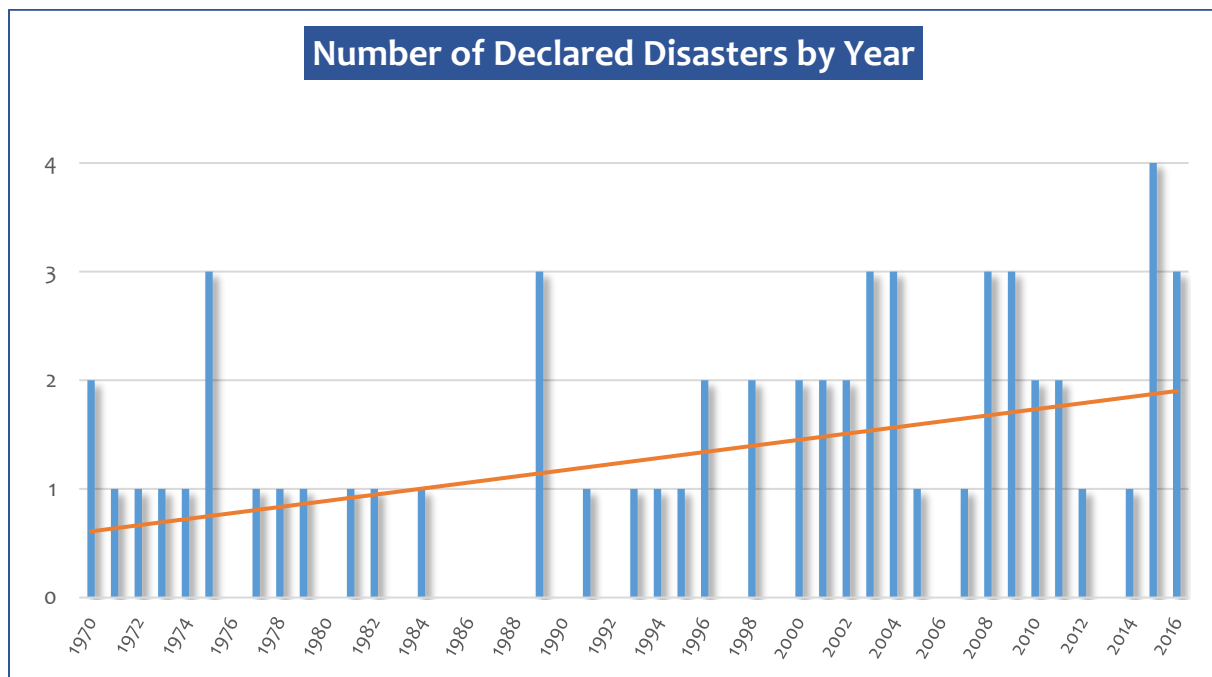


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Disaster Declaration Number	Incident Period	Dam Failure	Draught	Earthquake	Extreme Temp.	Flood	Forest Fire	Hailstorm	Karst/Sinkhole	Landslide	Severe Storm	Severe Winter	Tornado
DR-4278	July 2 - 9, 2016					X				X	X		X
FM-5158	Nov 2, 2016						X						
FM-5166	Nov 1, 2016						X						
DR-4358	Feb 9 - 14, 2018					X				X			
DR-4361	Feb 21-Mar 21, 2018					X				X			X

* Source: Federal Emergency Management Agency, Department of Homeland Security
<https://www.fema.gov/disasters>

Figure 1. Summary of Presidentially declared disasters by year (1970-2016).





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Probabilities of Future Flood Events

Analysis of past flooding was used to generate the probability of future flooding. Based on this analysis of past flooding events, this flood risk assessment assumes an increase in flooding events over time. Given the uncertainty of future rainfall, temperature trends, and future development, future flood conditions and costs from flood damages will likely continue to increase unless considerable actions are undertaken by stakeholders at all levels of government, the private sector, and by private citizens. A study by the US Army Corps of Engineers (USACE) and the Ohio River Basin Alliance states that “Recent meteorological records show both significant drought conditions resulting in water supply emergencies, and extreme precipitation events resulting in major flood events” (Drum et al, 2017). This report further states that the Ohio River basin “...already suffers from flooding and these recurring events are expected to increase in several sub-basins under future climate and land use changes” (Drum et al, 2017).

Increased variation in the frequency and modeling to project future conditions forecasts that these trends will continue, and, more specifically, that the mean and maximum of peak spring flood flows will increase, and that autumn minimum flows will decrease while autumn maximum flows will increase. In other words, variability and extreme events are projected to increase, resulting in more frequent and severe droughts and floods events.

“The anticipated climate-induced increases in the Annual Mean flows, Annual Maximum flows, and March Maximum flows indicate a potential change in the recurrence probability of several mapped flood events as well as areal coverage of those floods” (Drum et al, 2017). Changing climatic and weather patterns may render datasets that are used for forecasting flood events inaccurate. Investments should be made to update and keep climactic data as current as possible. This will likely require a strategic implementation approach among many stakeholders but data such as NOAA Atlas 14 rainfall indices, Probable Maximum Precipitation (PMP) analyses, peak flow analyses, and depth/damage functions should be reviewed and updated if needed. Much of the nation’s flood hazard datasets are using the latest and greatest terrain data and hydraulic computations, but climatic science updates are direly needed.

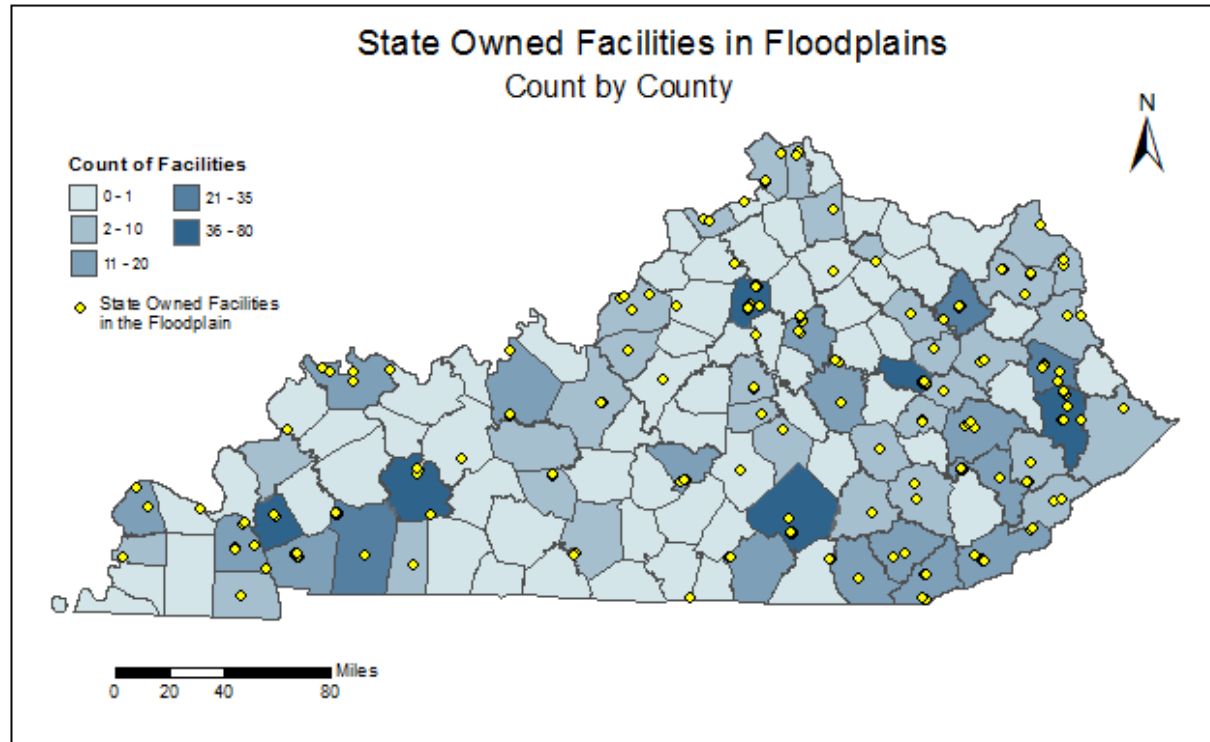
Vulnerability of State Assets

The flood risk analysis of state owned assets was conducted using a ‘State Assets’ list provided by the Kentucky Department of Finance. The State Assets list records structures by community name and provides values for each structure. To assess flood risk, all state owned assets were first geolocated using a provided latitude and longitude or geocoded using an associated street address. An intersect was conducted in ArcMap using this location data set. Any location that was within the Special Flood Hazard Area was designated as having flood risk. The total value of the at-risk structures was then calculated to assess total risk to state assets.



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Figure 2. State owned facilities vulnerable to flooding.



A State Assets list detailed 8,173 total state owned structures, of which, 1,515 were excluded from the analysis. These excluded structures were not analyzed for the following reasons: 1) no value was provided for the listed structure, or 2) the facility could not be located, often because only a partial address was provided.

Of the remaining 6,658 state owned structures, 754 were determined to be at risk during the 1% chance flood event based on the National Flood Hazard Layer. These 754 structures shown in Figure 2 have a combined Replacement Cost Value totaling \$656,742,856.40. The remaining 5,904 structures were determined to have minimal flood risk levels based on this analysis.

Annualized Average Loss (AAL) and Annualized Average Percent Loss (AAPL)

For state-owned assets, first finished floor elevations (FFE) were estimated using a specialized ArcMap application that simultaneously viewed each structure in GIS and Google Street View. While viewing each structure, building characteristics were verified and the foundation height was calculated by either counting the number of steps near the front door or by estimation using other visible features and surrounding structures. If the foundation height was calculated using the



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Figure 3. State owned facilities Annualized Average Loss (AAL) risk score.

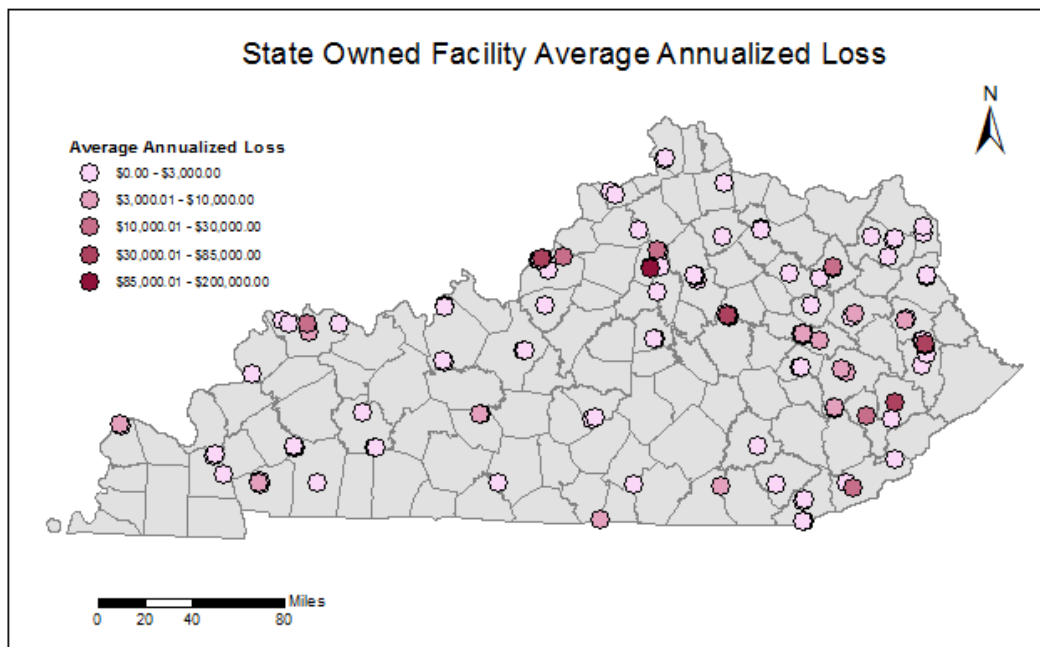
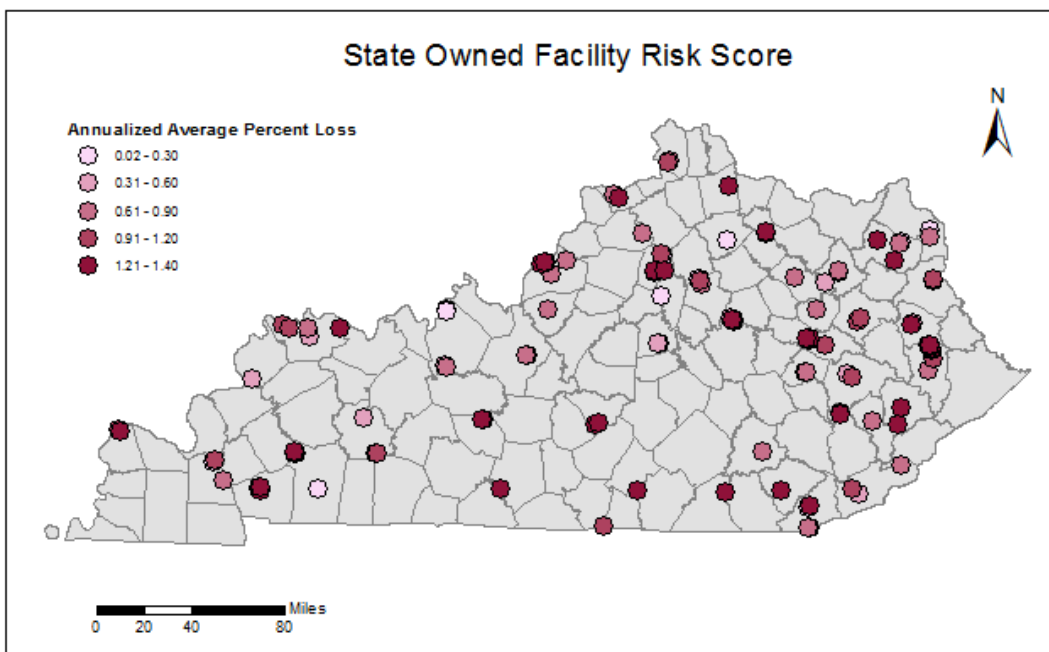


Figure 4. State owned facilities Annualized Average Percent Loss (AAPL) risk score.





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number of steps, a standard 7” or 0.6’ was assumed for each step. Additionally, a point was placed on the map where each foundation height was calculated. The FFE was calculated for every structure by adding the estimated foundation height to the ground elevation interpolated from LiDAR elevation data.

AAL is defined by FEMA as the anticipated annual loss to a structure. AAL calculations for state-owned facilities were performed leveraging FEMA methodology by measuring the potential flood losses over a defined period and comparing the estimated damage across multiple flood intervals. This function can also be used to communicate the estimated damage over a particular period such as 30 years. A limitation of this methodology is the potential overestimation of flood risk based on a structure’s value. In order to normalize the flood risk assessment for individual structures, KDOW created a new methodology to define risk scores for individual structures independent of value. The result of this assessment has been named Average Annualized Percent Loss or AAPL. The AAPL risk scores leverage USACE depth/damage curves for structure and contents for 17 different building types. The risk scores developed using this methodology result in a risk coefficient for each structure assessed and may be directly applied to the building value to calculate AAL, if desired. See Figures 3 and 4 for AAL and AAPL risk scores for state-owned facilities with identified flood risk.

Vulnerability of Jurisdictions to Flooding

The Commonwealth is notable in its diversity of land forms. Consequently, risks of flooding and vulnerability to losses are variable across the Commonwealth. Flooding creates a wide range of adverse impacts including physical damage, economic losses, and social impacts to the community affected.

Assessing Kentucky’s vulnerability to flood was determined using FEMA’s HAZUS tool and methodology to estimate potential losses from flood damage. The tool was used to create a set of study regions to predict flood losses, economic effects, and to assess community vulnerability to the 1% chance flood. In this case the study, the regions chosen were at the county level. Other Commonwealth specific inputs include the Repetitive Loss & Severe Repetitive Loss structures, critical structures, state owned assets, and flood depth grids to create a statewide Level 2 HAZUS analysis.

This assessment addresses the most significant losses: casualties, displacement and the need for shelter, general building loss, debris generation, and agricultural losses. This section will give an overview of statewide vulnerabilities, while [Appendix A](#) delves into more detail of these losses for each county. County flood impact projections were then aggregated and shown on the Area Development District (ADD) to allow for future incorporation of the data into future regional and local hazard mitigation plans.

Vulnerability to flooding tends to be greatest in counties that have large built environments in identified floodplains. This can be seen in counties with high displaced populations, shelter



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requirements, and building losses shown in Table 3. Some of the notable counties with high flood risk include Jefferson (which includes Louisville Metro), Franklin, Pike, Daviess, and Floyd Counties. These counties, with significant built environments, also have high anticipated debris totals associated with them.

Table 3. Summary of flooding impacts for counties sorted by Total Building Loss for the 1% annual chance event.

County	Total Building Loss	Building Loss	Contents Loss	Total Crop Loss-7days	Debris in Tons	Displaced Population	Short-Term Shelter Population
Jefferson	\$3,215,879	\$814,757	\$917,720	\$3,883,359	100537	41225	33710
Franklin	\$927,428	\$486,935	\$429,519	\$17,978,361	178660	4425	2876
Pike	\$579,061	\$281,963	\$288,679	-	65946	10573	6217
Floyd	\$474,042	\$227,770	\$239,514	\$797,689	62055	8502	5213
Daviess	\$458,953	\$211,281	\$236,699	\$113,748,265	21333	16206	12565
Fayette	\$360,466	\$151,065	\$199,523	\$17,505,632	8768	7568	4912
Perry	\$351,738	\$161,327	\$185,175	-	31582	3475	1896
Bullitt	\$348,225	\$189,392	\$154,331	\$9,102,044	23362	9257	8022
Butler	\$341,033	\$158,584	\$131,458	\$105,671,543	31312	4374	2398
Campbell	\$323,984	\$163,139	\$154,531	-	30167	3294	2054
Warren	\$323,196	\$172,405	\$146,390	\$33,325,655	28203	3307	2286
Knox	\$320,714	\$131,604	\$183,901	-	26156	5924	3915
Johnson	\$309,768	\$135,402	\$169,680	\$255,176	27682	5008	2672
Greenup	\$308,257	\$151,005	\$151,911	\$2,329,784	35823	5010	2825
Henderson	\$297,092	\$142,782	\$146,969	\$104,580,862	25504	4879	3169
Boyd	\$277,849	\$128,544	\$144,633	-	52911	3429	1689
Kenton	\$274,569	\$139,730	\$131,266	\$2,144,295	33281	2654	1599
Bell	\$267,714	\$104,635	\$154,377	-	16491	5118	3089
Harlan	\$252,712	\$116,706	\$132,060	-	15675	7354	4112
Webster	\$232,746	\$109,948	\$116,532	\$22,408,353	37395	3672	1274
Clay	\$175,003	\$81,456	\$90,325	-	14196	2860	1323
Powell	\$173,367	\$81,939	\$86,656	\$1,797,582	14499	2909	1971
Hopkins	\$172,657	\$84,199	\$85,921	\$41,809,107	19436	4028	2110
McCracken	\$163,929	\$81,172	\$79,463	\$15,548,708	19194	3215	1659
Christian	\$161,505	\$76,197	\$82,995	\$43,942,513	11975	4200	2701
Breathitt	\$159,053	\$83,807	\$73,518	\$398,998	22493	3169	2159
Hardin	\$146,216	\$77,010	\$67,097	\$13,420,884	13094	2896	1356
Estill	\$134,012	\$74,713	\$57,912	\$17,285,783	35189	2084	1363



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County	Total Building Loss	Building Loss	Contents Loss	Total Crop Loss-7days	Debris in Tons	Displaced Population	Short-Term Shelter Population
Carroll	\$133,248	\$65,493	\$64,714	\$7,572,378	20457	1493	873
Boone	\$132,076	\$70,794	\$59,448	\$1,731,233	6284	1603	798
Oldham	\$128,103	\$78,503	\$48,933	\$4,546,735	7936	1023	543
Marshall	\$125,799	\$58,018	\$63,719	\$14,040,401	9951	2610	893
Carter	\$124,215	\$59,535	\$62,604	-	11471	2772	961
Pendleton	\$124,037	\$55,632	\$66,481	\$8,698,314	13535	1808	972
Letcher	\$123,124	\$59,688	\$62,198	-	18386	2878	1120
Logan	\$120,981	\$52,800	\$64,160	\$60,157,578	9263	2893	1078
Whitley	\$116,065	\$59,493	\$54,761	-	20406	2719	1119
Casey	\$114,626	\$48,621	\$62,866	\$22,930,684	15487	1468	404
Martin	\$111,532	\$55,349	\$55,003	\$844	11872	2890	1792
Madison	\$109,119	\$58,816	\$49,178	\$10,616,777	7794	2908	1552
Muhlenberg	\$97,460	\$49,564	\$46,289	\$30,760,736	12566	2288	1105
McLean	\$96,606	\$51,967	\$42,900	\$98,798,138	10942	1977	821
Mercer	\$96,201	\$42,939	\$48,825	\$7,018,204	4859	1317	568
Morgan	\$95,043	\$45,121	\$48,737	-	10671	1668	682
Scott	\$93,385	\$51,962	\$40,413	\$17,659,683	3346	1956	1167
Hancock	\$93,308	\$36,913	\$53,456	\$28,621,011	10809	1740	656
Ohio	\$91,993	\$46,440	\$44,321	\$56,045,329	10229	2299	715
Clark	\$87,812	\$40,993	\$44,898	\$10,048,519	4495	1588	813
Magoffin	\$87,301	\$42,292	\$43,417	-	9884	3458	2455
Nelson	\$87,159	\$45,000	\$40,748	\$28,652,840	7171	1503	570
Livingston	\$85,854	\$46,463	\$38,532	\$12,163,978	17033	1269	475
Rowan	\$85,360	\$41,781	\$41,409	\$5,455,951	5927	2478	1376
Bourbon	\$79,182	\$39,483	\$37,791	\$5,572,477	9003	1186	562
Trigg	\$77,513	\$43,187	\$33,157	\$19,954,466	12492	1136	448
Boyle	\$76,107	\$30,463	\$43,362	\$4,875,743	2496	1019	387
Union	\$74,904	\$36,888	\$35,975	\$92,331,256	11719	1139	327
Lewis	\$74,898	\$36,457	\$37,218	\$885,534	9568	1874	749
Lawrence	\$69,468	\$35,894	\$32,959	-	9720	2701	1092
Barren	\$66,680	\$34,226	\$31,109	\$26,125,312	9537	1107	217
Knott	\$64,665	\$33,123	\$30,807	-	7263	1722	971
Bracken	\$63,466	\$30,531	\$31,698	\$1,375,119	8020	758	373
Leslie	\$63,233	\$33,749	\$28,955	-	7858	895	223
Lee	\$62,541	\$29,524	\$32,240	-	5348	625	301



2018 Kentucky Hazard Mitigation Plan Update – Flood Risk Assessment

County	Total Building Loss	Building Loss	Contents Loss	Total Crop Loss-7days	Debris in Tons	Displaced Population	Short-Term Shelter Population
Harrison	\$62,160	\$27,706	\$33,445	\$18,649,959	3725	1311	610
Jessamine	\$60,650	\$31,717	\$27,685	\$1,240,129	5850	1207	502
Spencer	\$60,297	\$32,014	\$27,676	\$12,697,354	1889	754	353
Menifee	\$60,272	\$20,467	\$38,095	.	6036	628	250
Ballard	\$56,489	\$24,311	\$29,392	\$17,600,320	5689	743	242
Wolfe	\$55,632	\$24,702	\$30,014	\$1,411,845	10973	1512	410
Calloway	\$55,593	\$25,878	\$28,483	\$12,319,521	5123	1530	525
Pulaski	\$54,263	\$26,242	\$27,019	\$12,413,753	6374	845	144
Adair	\$54,209	\$26,701	\$26,824	\$16,150,610	8643	744	140
Hart	\$53,969	\$28,407	\$24,644	\$9,384,619	7942	885	231
Lyon	\$52,696	\$29,192	\$23,101	\$10,139,066	9466	934	354
Caldwell	\$51,399	\$28,696	\$22,110	\$23,924,067	6570	1138	362
Marion	\$50,934	\$29,471	\$20,873	\$19,849,240	5678	1011	155
Owen	\$49,150	\$30,181	\$18,699	\$12,339,444	9384	611	179
Larue	\$47,935	\$22,788	\$23,845	-	4645	766	359
Green	\$47,898	\$25,321	\$21,895	\$20,249,779	10842	559	138
Graves	\$45,299	\$23,044	\$21,452	\$22,009,560	3865	2176	466
Fleming	\$45,243	\$20,367	\$23,608	\$7,376,401	4556	662	69
Bath	\$44,340	\$22,550	\$21,099	\$8,508,699	4452	1216	631
Mason	\$42,930	\$18,236	\$23,594	\$4,748,959	3848	513	141
Jackson	\$41,535	\$16,077	\$24,883	\$295,303	2227	669	240
Trimble	\$40,150	\$18,302	\$21,481	\$5,579,089	7182	413	124
Rockcastle	\$39,466	\$20,084	\$18,489	\$3,028,838	4741	913	170
Gallatin	\$38,052	\$16,599	\$20,431	\$535,110	3350	337	84
Garrard	\$37,871	\$16,378	\$20,160	\$6,504,054	4452	442	49
Washington	\$37,773	\$16,811	\$19,896	\$12,782,116	2432	508	183
Laurel	\$36,625	\$17,823	\$17,990	\$3,501,765	6144	1356	242
Taylor	\$35,976	\$17,431	\$18,021	\$11,716,514	3406	721	186
Simpson	\$35,325	\$18,180	\$16,518	\$13,895,769	3670	523	154
Shelby	\$35,011	\$15,144	\$19,260	\$11,458,339	1463	694	233
Montgomery	\$34,944	\$18,733	\$15,824	-	2200	1668	682
Fulton	\$34,186	\$13,081	\$20,179	\$18,221,924	3046	504	174
Breckinridge	\$33,992	\$19,904	\$13,837	\$5,303,889	6483	405	44
Allen	\$32,606	\$18,952	\$13,457	\$11,566,437	4207	557	113
Metcalfe	\$32,055	\$14,461	\$17,264	\$8,165,208	4873	536	89



2018 Kentucky Hazard Mitigation Plan Update – Flood Risk Assessment

County	Total Building Loss	Building Loss	Contents Loss	Total Crop Loss-7days	Debris in Tons	Displaced Population	Short-Term Shelter Population
Owsley	\$31,993	\$18,911	\$12,925	\$1,330,892	5222	685	229
Todd	\$30,386	\$14,199	\$15,410	\$29,550,662	3255	879	292
Wayne	\$28,961	\$16,708	\$12,042	\$4,441,941	3725	720	308
Grayson	\$28,957	\$16,560	\$12,035	\$4,383,393	6568	471	87
Henry	\$28,695	\$15,641	\$12,772	\$11,534,031	3112	513	110
Crittenden	\$26,492	\$16,155	\$10,126	\$40,274,346	5743	540	62
Meade	\$25,691	\$14,911	\$10,571	\$2,446,228	4889	312	163
Monroe	\$23,210	\$12,174	\$10,441	\$8,755,494	4892	442	86
Lincoln	\$22,663	\$11,249	\$11,214	\$10,731,779	1934	785	130
Carlisle	\$22,026	\$11,495	\$10,215	\$14,588,432	2836	710	205
Nicholas	\$21,457	\$11,913	\$9,350	\$3,694,722	1748	456	68
Woodford	\$20,634	\$12,064	\$8,445	\$1,095,645	1772	585	282
Elliott	\$20,432	\$11,617	\$8,772	\$1,682,061	5123	570	201
Hickman	\$19,923	\$10,115	\$9,357	\$17,552,283	3364	416	48
Grant	\$19,257	\$10,189	\$8,783	-	2731	341	32
Cumberland	\$17,040	\$9,684	\$7,030	\$3,839,911	2850	636	171
Edmonson	\$16,630	\$10,027	\$6,489	\$5,927,656	4201	243	66
Clinton	\$14,735	\$7,359	\$7,111	\$1,352,111	1714	314	86
Anderson	\$14,267	\$8,606	\$5,544	\$3,419,426	743	393	61
Russell	\$13,002	\$7,778	\$5,149	\$1,859,843	2966	150	11
McCreary	\$6,043	\$3,782	\$2,232	\$155,519	1548	194	15
Robertson	\$4,741	\$2,967	\$1,733	\$1,879,969	1291	85	5



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Figure 5. Number of flood insurance policies by county.

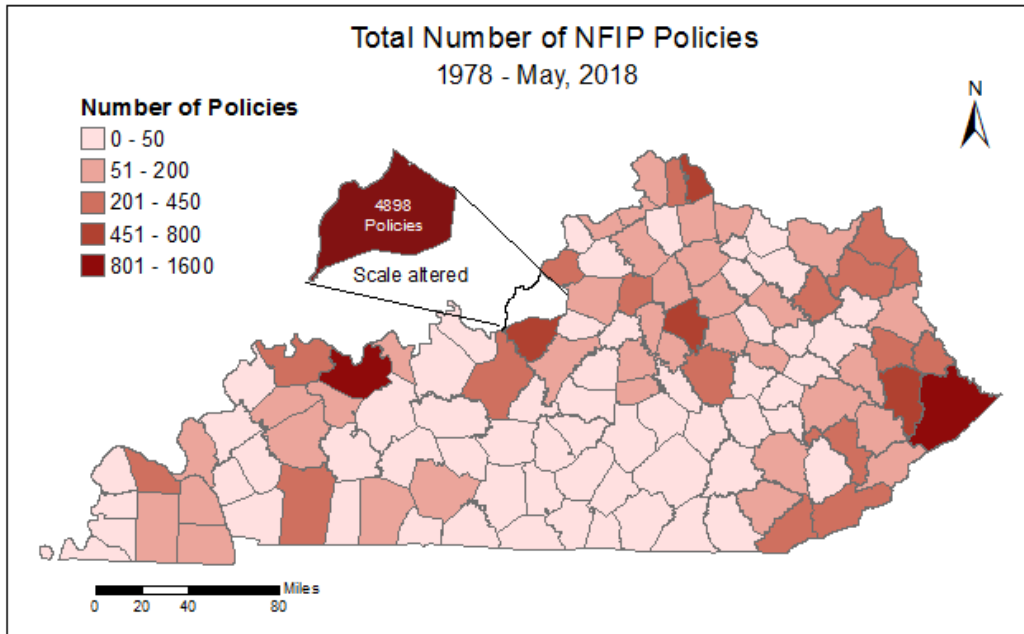
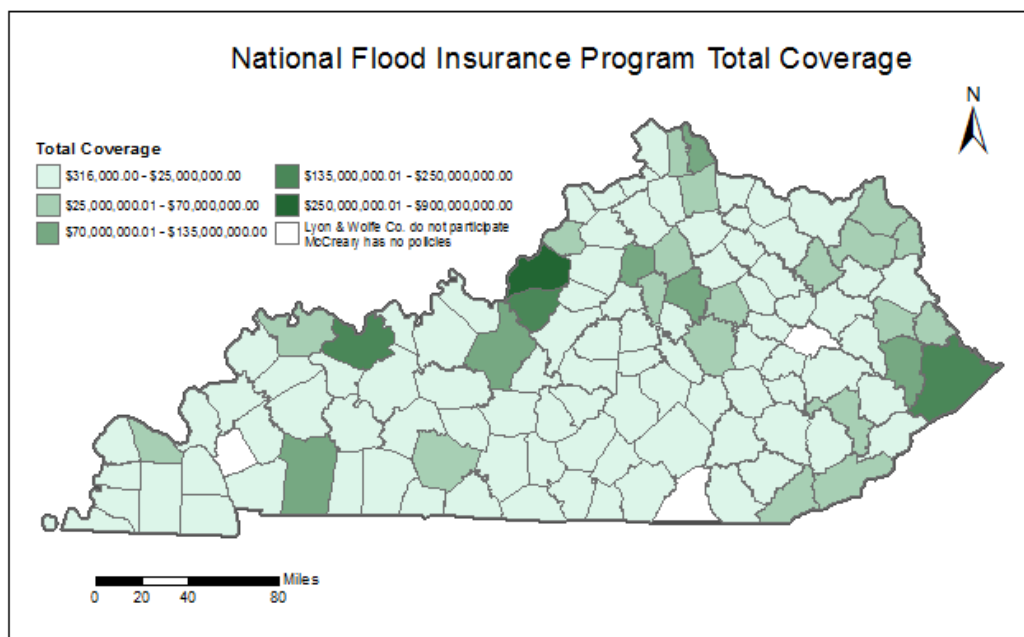


Figure 6. Number of flood insurance claims by county.





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Casualties

Limited data are available for injuries from flooding, therefore the HAZUS model could not forecast injuries. Fatalities from flooding vary from year to year, as indicated in Table 4, with most deaths occurring in vehicles during flash floods. According to the National Weather Service office in Jackson, Kentucky, over the 20 year period from 1996-2026, Kentucky experienced 77 flood related deaths averaging 3.85 deaths per year. Of those 77 deaths, 48 were vehicle related, 13 were already in the water, 7 in mobile homes, 6 were outside, and 3 were in permanent structures.

Advanced warning systems via weather radio, TV and internet news notifications, and mobile alerts are now commonplace and give residents additional time to plan for flooding hazards, but an increase in urban development has caused the monetary losses associated with flooding to increase drastically.

Table 4. Fatalities from flooding for the last available 10 years.

Year	Kentucky	United States
2006	6	76
2007	0	89
2008	1	82
2009	2	56
2010	6	103
2011	7	113
2012	0	29
2013	5	82
2014	3	40
2015	10	176
2016	1	126

Building Losses

The largest economic impacts from flooding come from damage to buildings in the floodplain. Total building losses on an annual basis are projected to be in excess of \$16,000,000 during the 1% chance flood. The greatest losses are projected to occur in Jefferson County due to the concentration of built environment and flood risk. Jefferson County also can experience several types of flooding concurrently, such as riverine flooding from the Ohio River, flash flooding from the many streams and artificial drainage systems present, and backwater flooding behind the levees and floodwalls. Another county greatly affected by building losses is Franklin County, which includes Frankfort, the capital of Kentucky. Large portions of the capital's downtown area are protected by levees and floodwalls, however several residential neighborhoods and a bourbon distillery complex are at risk of building losses during the 1% chance flood.

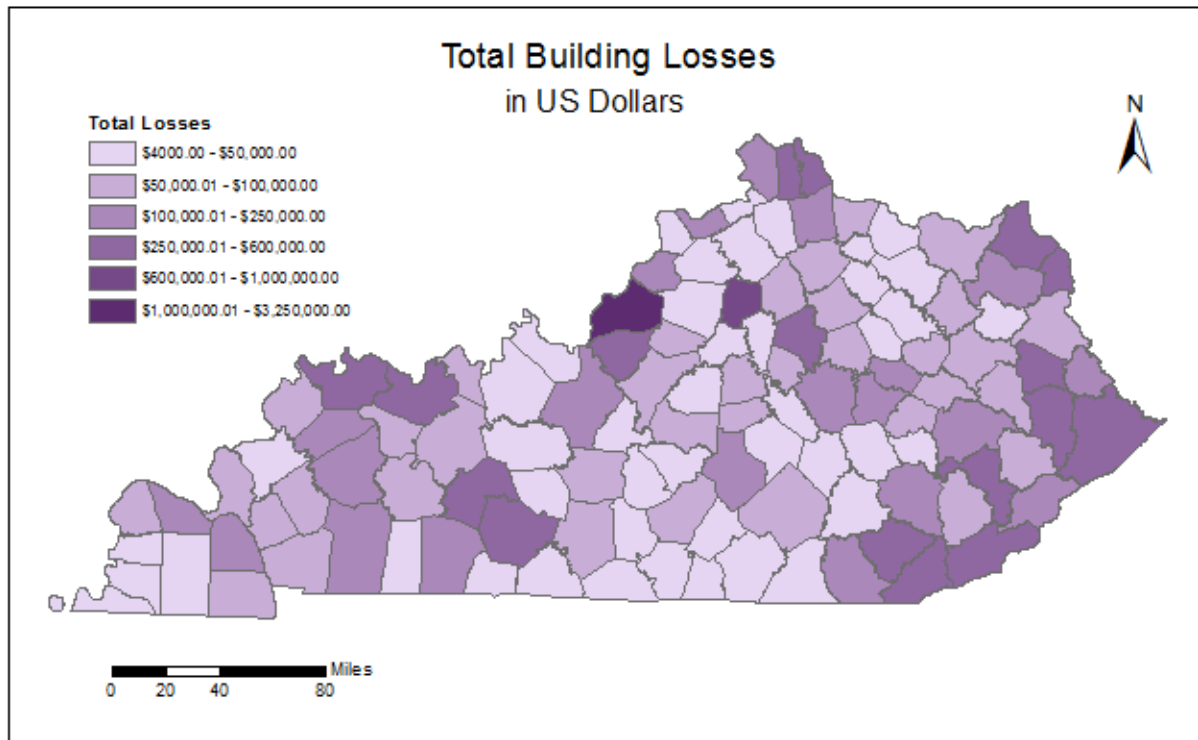
Other areas of the Commonwealth with high projected losses were in population centers and in eastern Kentucky where development is forced to occur in areas of high risk of flooding due to steep topography and limitations on suitable building sites. These areas are frequently located along streams and are susceptible to flash and riverine flooding events.

Figure 7 gives projections by county for building losses. [Appendix A](#) expands on these losses, detailing each county within an ADD with the loss for the building itself and its contents.



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Figure 7. Total building losses by county.



Displaced Population and Shelter Needs

During a flooding event, rising waters may force people in flood prone areas to be displaced from their homes. Evacuations, either voluntary or mandatory, may be used as a preemptive measure to prevent citizens from being trapped in their homes and structures by rising flood waters. While some may be able to find temporary lodging on their own volition, other, more socially vulnerable people, may either require assistance or need shelter. Large scale flood events may also cause mass relocation events after a disaster which can lead to hardship for the citizens displaced and bring them into conflict with existing populations and communities.

Figure 8 shows the statewide projection of displaced population by county. Not surprisingly, population centers, particularly along large rivers have the largest populations displaced. The largest displacement is projected in Jefferson County, which includes the Louisville Metro area. Approximately 41,225 people are expected to be displaced during a 1% chance flood event and is more than 3 times the next highest projection (Daviess County).

Other notable counties with high projections of displaced people include Daviess, Pike, Bullitt, Floyd, Fayette, Harlan, Knox, Bell, Greenup, and Johnson. These counties include communities with significant population centers and flood risk. In Eastern Kentucky, where a significant percentage of



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homes are built in the narrow valleys near streams due to topographic limitations, also have larger numbers of displaced individuals.

Figure 8. Displaced population by county.

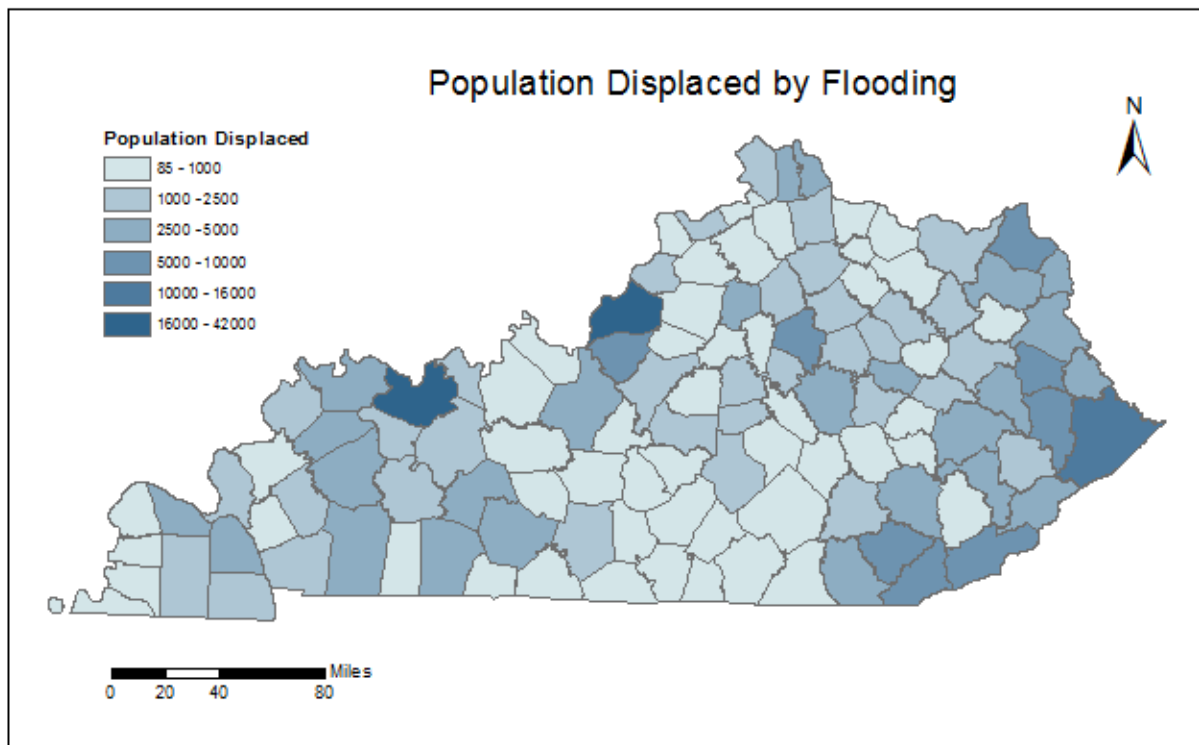


Figure 9 shows the statewide projection for those that will need shelter due to a flooding event. Areas showing high populations of people displaced due to flooding also tend to show high populations of people needing shelter. As with the population displaced by flooding, Jefferson County has the largest population needing shelter, projected at 33,710 people. This projection is 81.77% of the entire population that was displaced by the 1% chance flood event.

Other counties with significant shelter requirements include Daviess, Bullitt, Pike, Floyd, Fayette, Harland, Knox, Henderson, Bell, and Franklin. These counties are almost identical to the counties with the highest displaced populations, showing that these counties have a significant population located in areas at high risk of flooding. The only differences are that Henderson County was added to the list, while Greenup County was removed.

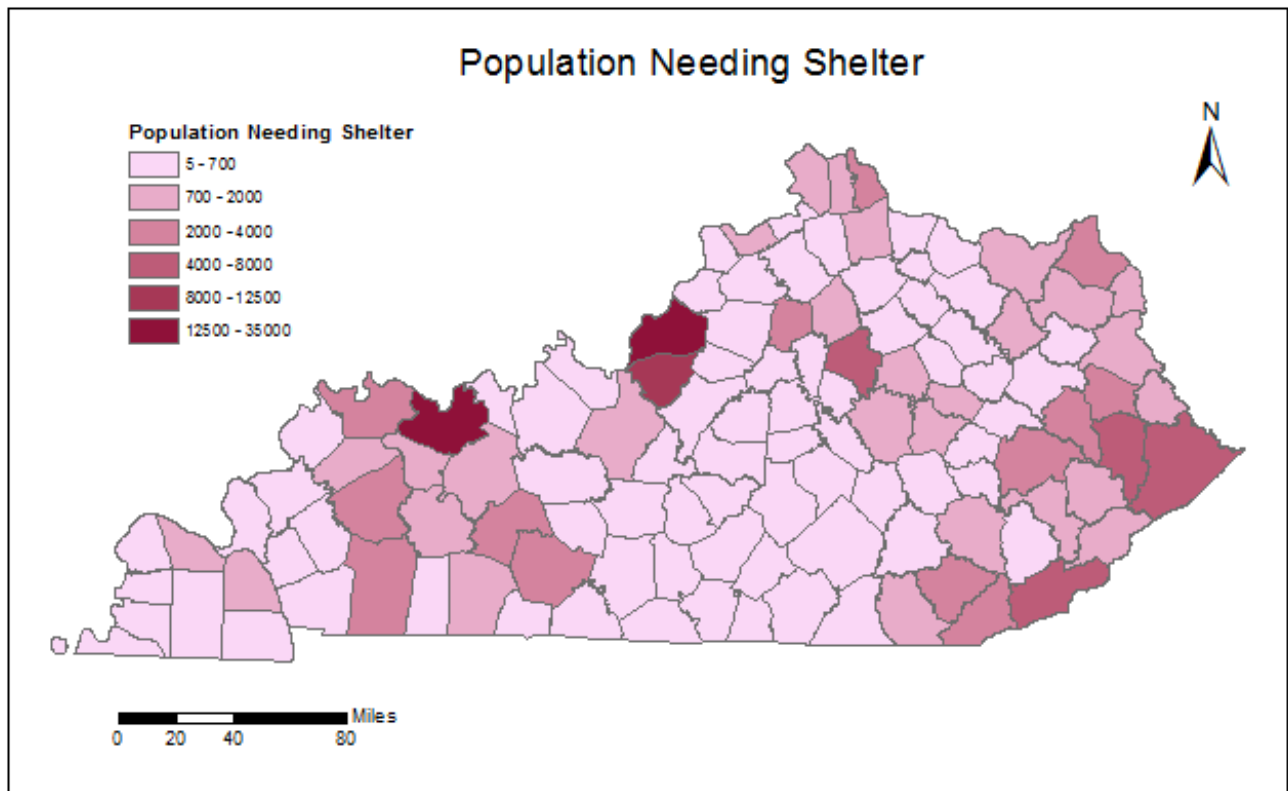
Comparing the percent ratio of number of people needing shelter to the number of people displaced, a curious change appears. The three largest ratios of counties needing shelter are Bullitt (86.7%), Jefferson (81.8%), and Daviess (77.5%). Several communities not in the top 10 in total shelter needs have a high percentage of their population needing shelter during the 1% chance flood event



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including Magoffin (71%), Warren (69.1%), Breathitt (68.1%), Powell (67.8%), Estill (65.4%), and Franklin (65%).

Figure 9. Shelter needs by county.



Debris

Floodwaters can move with surprising power. Massive amounts of debris from washed out trees, damaged structures, and any loose materials on the ground may be picked up and transported to another location. The cleanup, transportation, and disposal of this debris is another cost associated with flood events. The communities with the largest tonnage of debris associated with the 1% chance flood are Franklin and Jefferson Counties. Both of these counties have a large built environment in areas that are at high risk of flooding that contribute to these large debris totals.

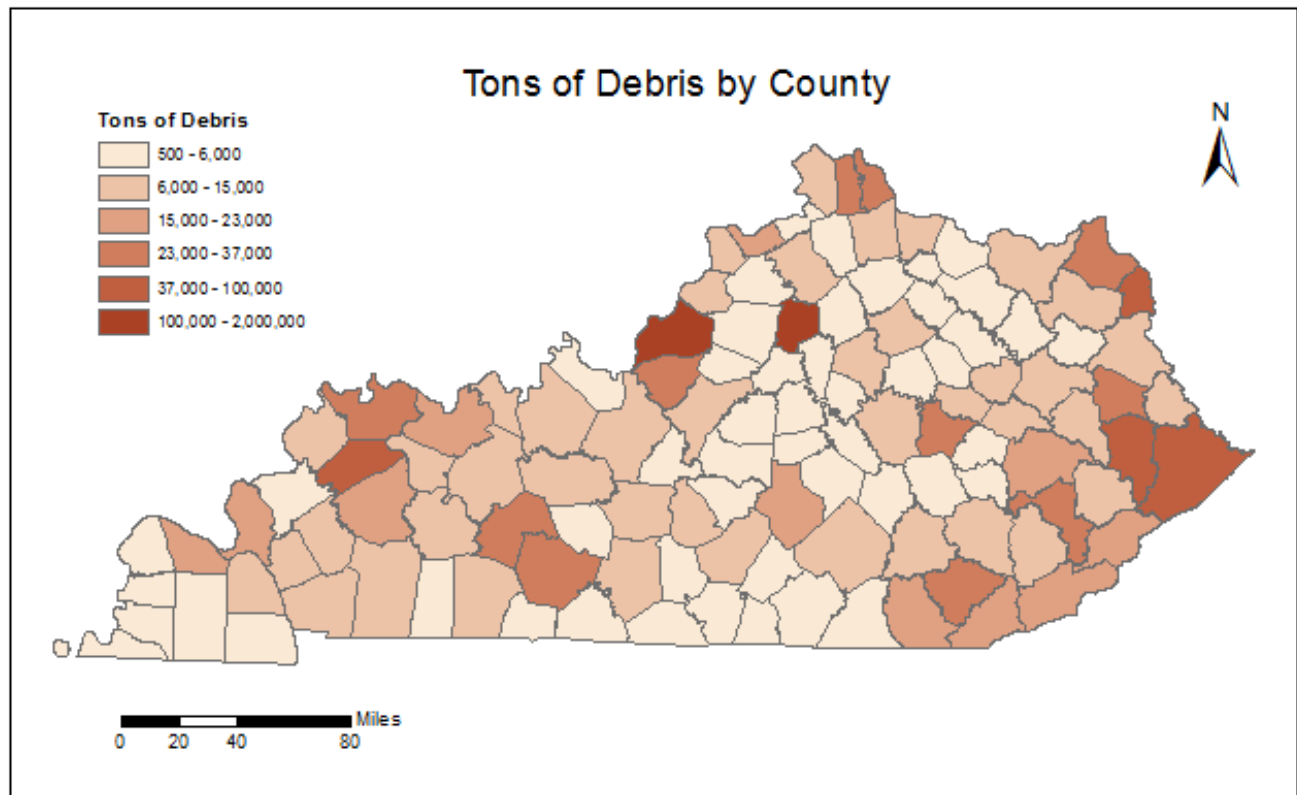
Counties in eastern Kentucky also have higher debris totals due to the topography forcing development in areas more frequently located along streams and susceptible to flash and riverine flooding events. Other areas of significance include Warren County, Butler County, and northern Kentucky, which have major river systems flowing through them or along their borders. In this case it is the Barren, Green, and Ohio Rivers respectively.



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Figure 10 shows the forecasted debris creation from a 1% chance flood for the counties. [Appendix A](#) expands on these losses, detailing debris totals each county within an ADD.

Figure 10. Tons of debris generated by county.



Agricultural Losses

Agriculture is an economic driver in the Commonwealth, although it varies widely across the state. While livestock is the largest agricultural sector, crop sales easily surpass \$2 billion each year with corn and soybeans as the largest, most prevalent crops (Knopf, 2015). HAZUS models project approximately \$1.7 billion in losses during the 1% chance flood event. Corn and corn silage are the largest agricultural losses projected accounting for 74.78% of the projected total losses. Soybeans and wheat are the next largest accounting for \$372.8 million in projected losses. Other projected losses for winter wheat and alfalfa/hay total \$98.6 million.

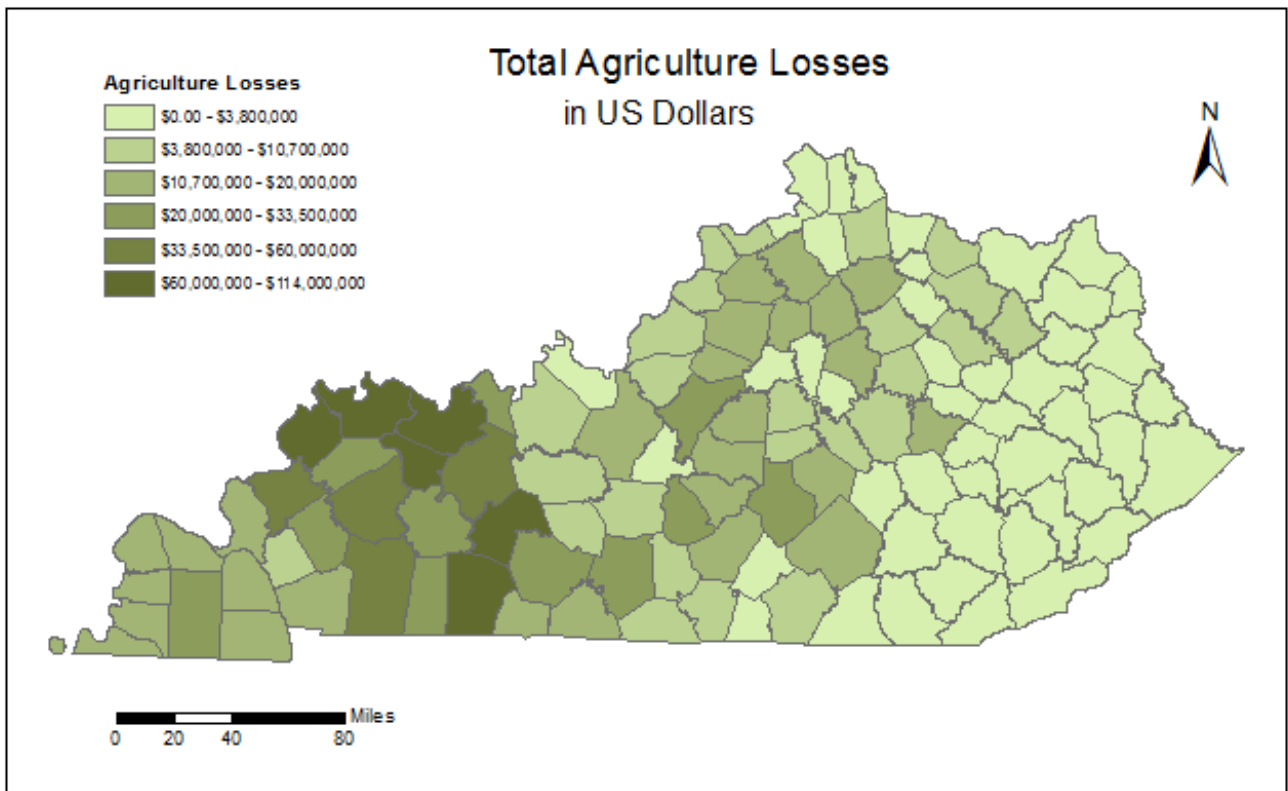
The counties with the largest projected crop loss totals are Daviess, Butler, Henderson, McLean, and Union, with each of these counties having more than \$90 million in total crop losses during the 1% chance flood event. Fourteen of the top 15 counties in terms of total projected losses are located in the western portion of the state. This is expected due to these areas, known as the Pennyroyal Plateau and the Shawnee Hills, having large, fertile bottomlands that are excellent for agriculture.



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Figure 11 shows the total agricultural losses in dollars expected from a 1% chance flood for a flood with a 7 day duration. [Appendix A](#) gives further details by ADD, breaking down the losses by crop.

Figure 11. Total crop losses by county.



Risk of Flooding with Trends in Development

Development continually occurs within the Commonwealth, with some new developments occurring in areas at risk of flooding. Although 116 of Kentucky's 120 counties and 237 of Kentucky's 419 incorporated communities participate in the National Flood Insurance Program (NFIP) and have ordinances that manage development in flood prone areas, some at-risk development is still occurring. Trends in development were analyzed using the National Land Cover Database and mapping the percent increase in impervious cover from 2006 to 2011, which is the latest land cover information available.

The counties that saw the largest percent increase in impervious surface in the Commonwealth tended to be areas with considerable urban populations and associated development. Jefferson County had the largest population in the Commonwealth and also saw the largest percent increase in



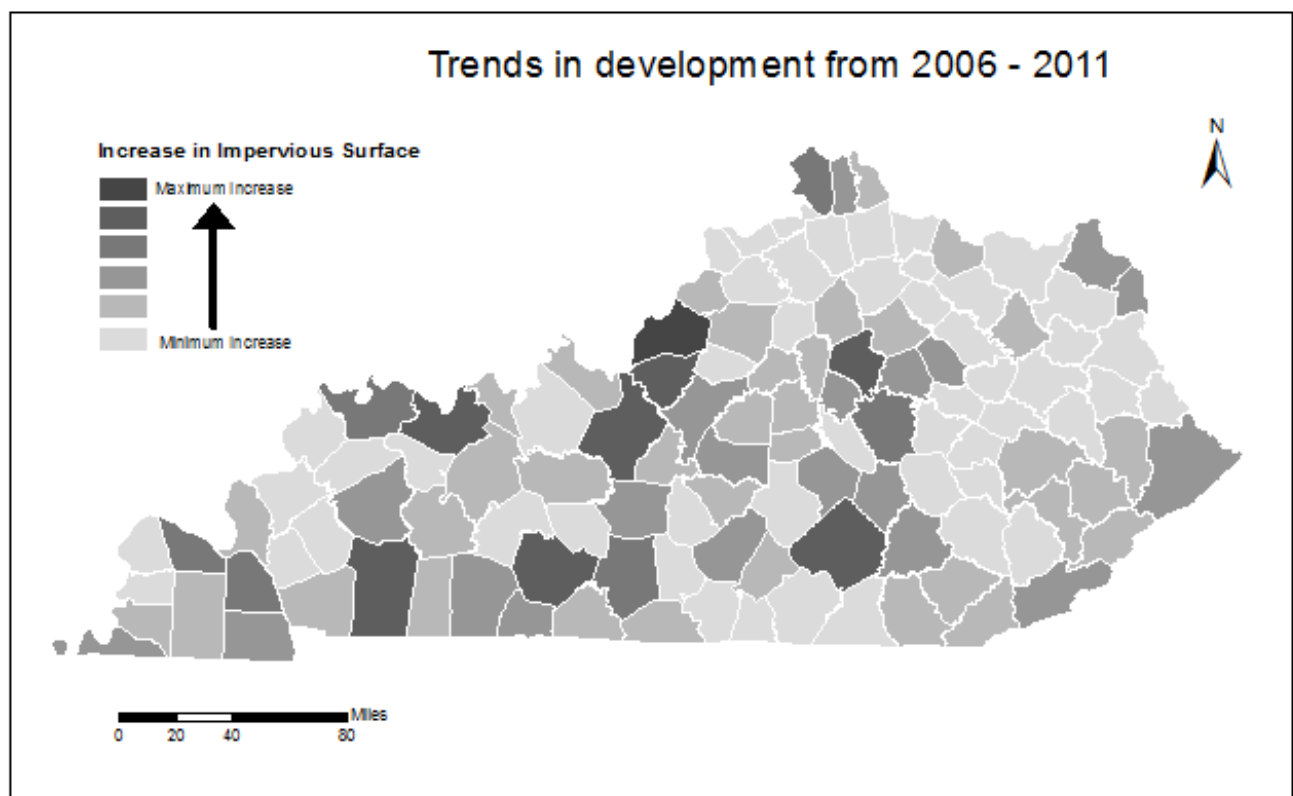
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impervious surface. Other counties with considerable percent increases include Fayette, Pulaski, Bullitt, Hardin, Warren, Daviess, and Christian counties.

Another observed trend is the increase in impervious surfaces in counties that have controlled-access highways passing through them. In Kentucky, these are the interstate and parkway systems. Studies suggest that transportation networks and improvements in accessibility stimulate economic activities in communities. These stimulated economic activities are associated with increases to impervious groundcover.

Figure 12 shows the percent increase in impervious surfaces in the Commonwealth. [Appendix A](#) gives further details by county, breaking down the impervious surface increase at the ADD level.

Figure 12. Amount of growth reflected by increases in impervious surfaces.



Mitigation Actions

One of the primary goals of the State Hazard Mitigation Plan is to identify actions that can be taken to reduce current flood risks and to avoid future risks. These mitigation actions are an effort to reduce future flood damages and reduce the chances of loss of life to lessen the impacts of disasters.



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Mitigation actions may be divided into four main categories: 1) Actions that reduce the size or shape of the flood hazard, 2) Actions that reduce the risk or impact of the flood hazard on life and property, 3) Policies or regulations that protect life and property from flooding, and 4) Outreach to communities, residents, businesses, and other stakeholders that are at risk of flooding.

Table 5. Mitigation strategies and associated mitigation actions.

Strategy	Mitigation Action
1) Reduce the size or shape of the flood hazard	Construct flood control measures such as levees, floodwalls, dams, berms, and other structural controls
	Conduct proper maintenance and inspection of existing structural flood control measures to ensure
	Engineer or retrofit roads and transportation structures to withstand flooding
2) Reduce the risk or impact of the flood hazard on life and property	Conduct acquisition/relocations of high risk or repetitive loss structures
	Improve and maintain stormwater drainage capabilities to ensure proper function of the infrastructure
	Elevate, retrofit, or relocate structures and utilities
	Floodproof non-residential structures
	Protect and restore natural floodplain functions
	Protect critical facilities by locating them outside of flood hazard areas
	Relocate vulnerable populations outside the flood hazard areas
	Develop and implement evacuation plans for areas at risk of flash flooding, riverine flooding, and/or dam/levee failure
	Assess community flood warning systems and implement improvements to increase their reach
3) Policies or regulations that protect life and property from flooding	Assess and improve the Repetitive Loss/Severe Repetitive Loss data to prioritize structures with the greatest flood risk
	Continue to map community flood risk to ensure accuracy and credibility
	Incorporate flood mitigation into local and regional planning activities
	Form partnerships with federal, state, regional, and local agencies, non-profits, and the private sector to share and coordinate resources to manage and reduce flood risk
	Assess and implement strategies to minimize risks related to the types of flooding Kentucky endures (Regional, riverine, flash, dam and levee failure, debris, and urban)
	Adopt and enforce higher regulatory development standards
	Conduct regular Community Assistance Visits, including after flood-related disasters, to assess & improve local program management and ownership, and to improve community compliance with regulations



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Strategy	Mitigation Action
3) Policies or regulations that protect life and property from flooding	Continue to improve and update Kentucky’s inventory of flood risk data and assessments to better understand & communicate flood risks
	Incorporate stormwater management planning and higher regulatory standards to manage and reduce stormwater runoff
	Increase NFIP participation of communities in the Commonwealth
	Increase CRS participation and rating of communities in the Commonwealth
	Develop state, regional, and local funding sources to implement flood mitigation actions
	Protect critical facilities that are at risk of flooding
4) Outreach to communities, residents, businesses, and other stakeholders that are at risk of flooding	Promote the purchase and retention of flood insurance
	Provide outreach to citizens and local officials about flooding and repetitive losses
	Educate local floodplain coordinators and community officials about the NFIP and its benefits
	Conduct training to provide local officials the programmatic and technical understanding to manage flood risks
	Promote improved data acquisition and retention by state and regional agencies, and by local communities to facilitate and enhance floodplain management
	Educate community officials on the benefits of CRS; encourage participation in the CRS program.
	Educate stakeholders about flood mitigation techniques and best practices

Mitigation actions do not solely fall under the purview of any one entity. The identified mitigation actions may be implemented by multiple levels of government, private citizens, or other stakeholders to help reduce flood risk and build community resilience. The intent of the mitigation analysis conducted herein was to provide knowledge and direction on the Commonwealth’s flood risks, with a goal to serve as a communication tool for all stakeholders to understand options for reducing those risks.

Several factors can greatly affect the successful implementation of the above flood mitigation actions. These factors include political, technical, and financial factors that have the potential to impact the success or failure of the implementation actions. Having a favorable local climate is critical to successful mitigation activities. The major factors that lead to successful mitigation include: awareness of flood risks, where floodplain management ranks with other local priorities, having a local champion, legislative support, and trusted relationships with state and federal officials.



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Technical factors and the ability to implement and manage the mitigation actions also affect the successful implementation of projects. Technical factors include: project benefits, disaster and data management records, flood map age and quality, local mitigation capacity, and whether or not the project is viable.

Favorable financial factors are also critical to successful implementation of mitigation actions. A project may have political backing and can be technically viable, but if there are no funding options available, the project has a low likelihood of being successful. Financial factors include: grant management capabilities, availability of financing option such as grants, whether the proposed project is cost effective, and local investments or availability of matching funds.

To succeed in realizing these mitigation actions, the Commonwealth of Kentucky must facilitate and actively empower stakeholders to identify, prioritize, and implement actions to best suited to meet local needs.



2018 Kentucky Hazard Mitigation Plan Update – Flood Risk Assessment

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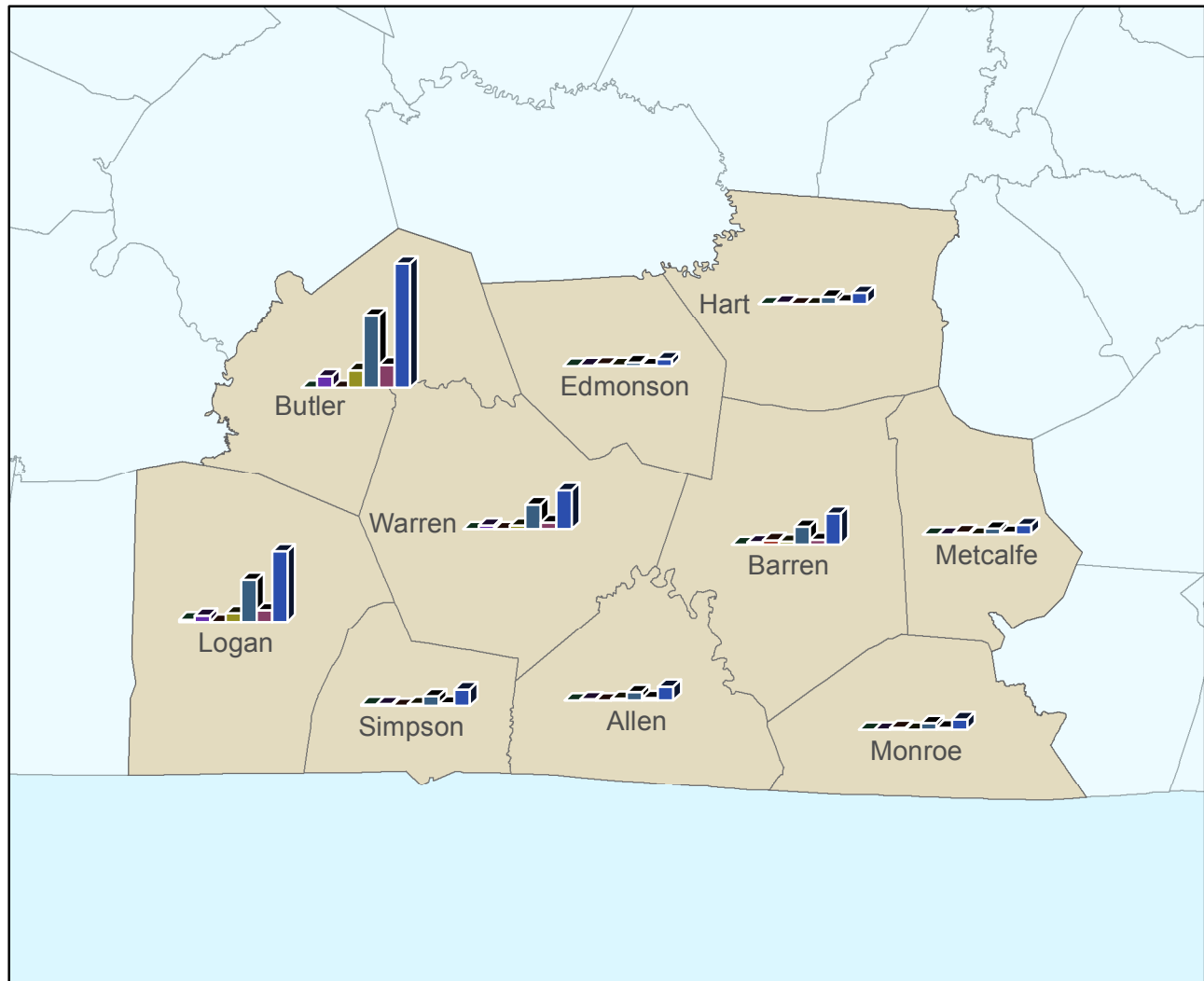
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Appendix A: Detailed Vulnerabilities by Area Development District

Appendix A: Detailed Vulnerabilities by Area Development District



0 5 10 20 Miles



Agriculture Losses by County

Winter Wheat
Wheat
Alfalfa-Hay

Soybeans
Corn Silage
Corn

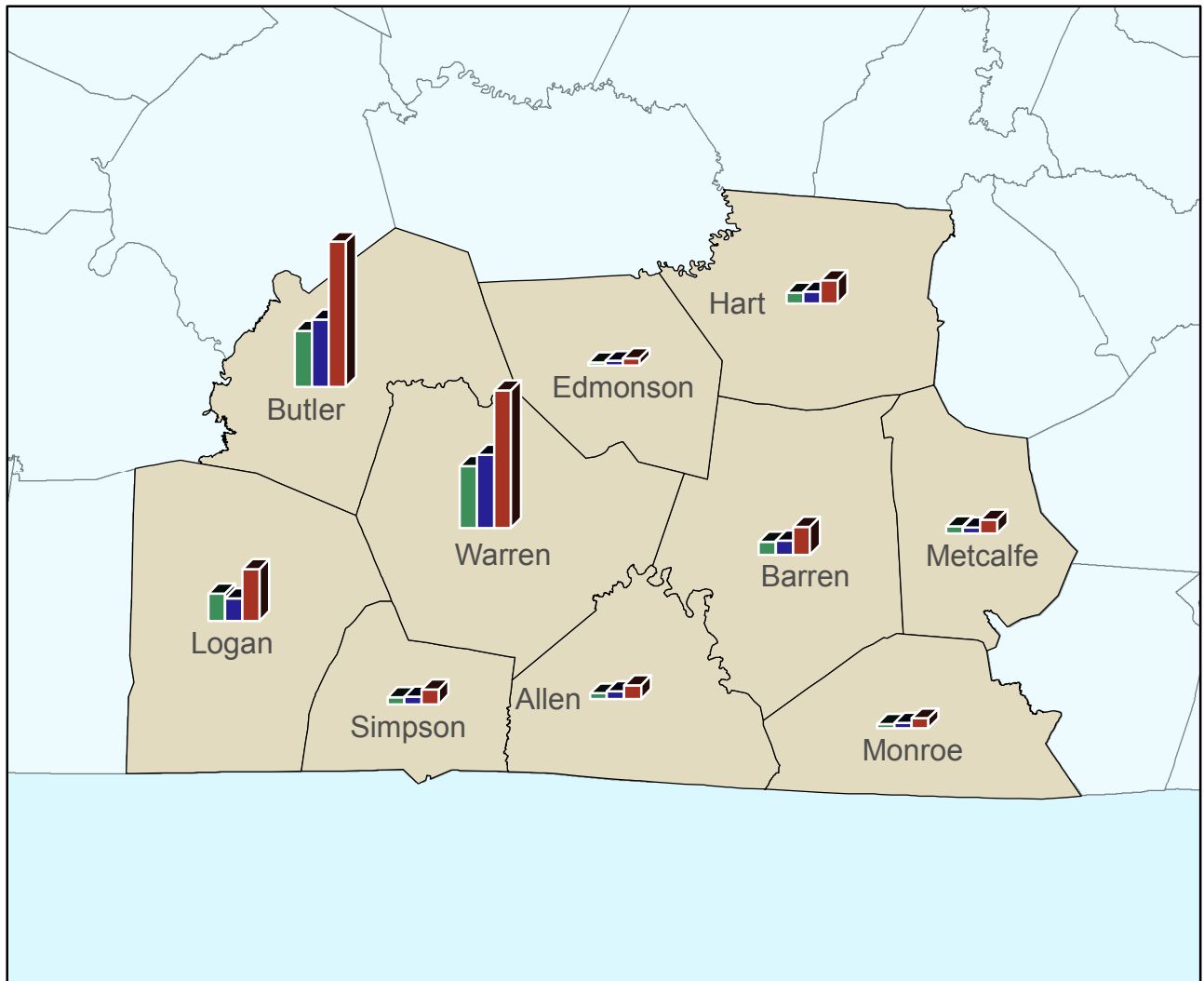
= \$53,000,000¹
 Total Losses

*Counties with no bars indicate no losses

Barren River Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Allen	\$0.00	\$0.00	\$1,168,894.8	\$1,431,233.7	\$6,928,972.76	\$2,037,335.9	\$11,566,437.23
Barren	\$0.00	\$3,491,484.61	\$1,891,723.9	\$2,130,541.3	\$14,852,248.95	\$3,759,313.5	\$26,125,312.42
Butler	\$0.00	\$0.00	\$9,693,979.1	\$14,906,019.	\$61,518,618.30	\$19,552,926.	\$105,671,542.72
Edmonson	\$0.00	\$1,083,126.42	\$517,064.59	\$496,822.69	\$2,986,063.47	\$844,578.63	\$5,927,655.80
Hart	\$0.00	\$0.00	\$1,115,187.0	\$0.00	\$6,185,389.23	\$2,084,043.0	\$9,384,619.31
Logan	\$2,006,731.64	\$0.00	\$5,308,189.6	\$7,400,825.0	\$35,752,055.35	\$9,689,776.6	\$60,157,578.30
Metcalfe	\$0.00	\$1,770,181.02	\$0.00	\$0.00	\$5,019,106.78	\$1,375,919.8	\$8,165,207.60
Monroe	\$0.00	\$1,467,537.91	\$0.00	\$0.00	\$5,537,748.60	\$1,750,207.9	\$8,755,494.48
Simpson	\$1,101,067.60	\$0.00	\$1,333,439.7	\$1,322,558.4	\$8,102,428.48	\$2,036,275.0	\$13,895,769.40
Warren	\$0.00	\$0.00	\$3,080,049.7	\$3,227,972.0	\$21,148,749.52	\$5,868,883.5	\$33,325,654.85

¹The program generating the maps automatically calculates the scale for the range of data represented and creates reasonably sized bars for the scale of the map. The scale differs for the different ADDs because the range of data varies between ADDs.



0 5 10 20 Miles



General Building Loss

Contents Loss

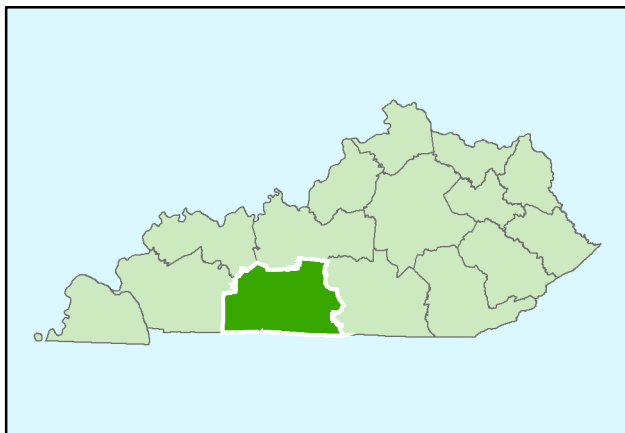
Building Loss

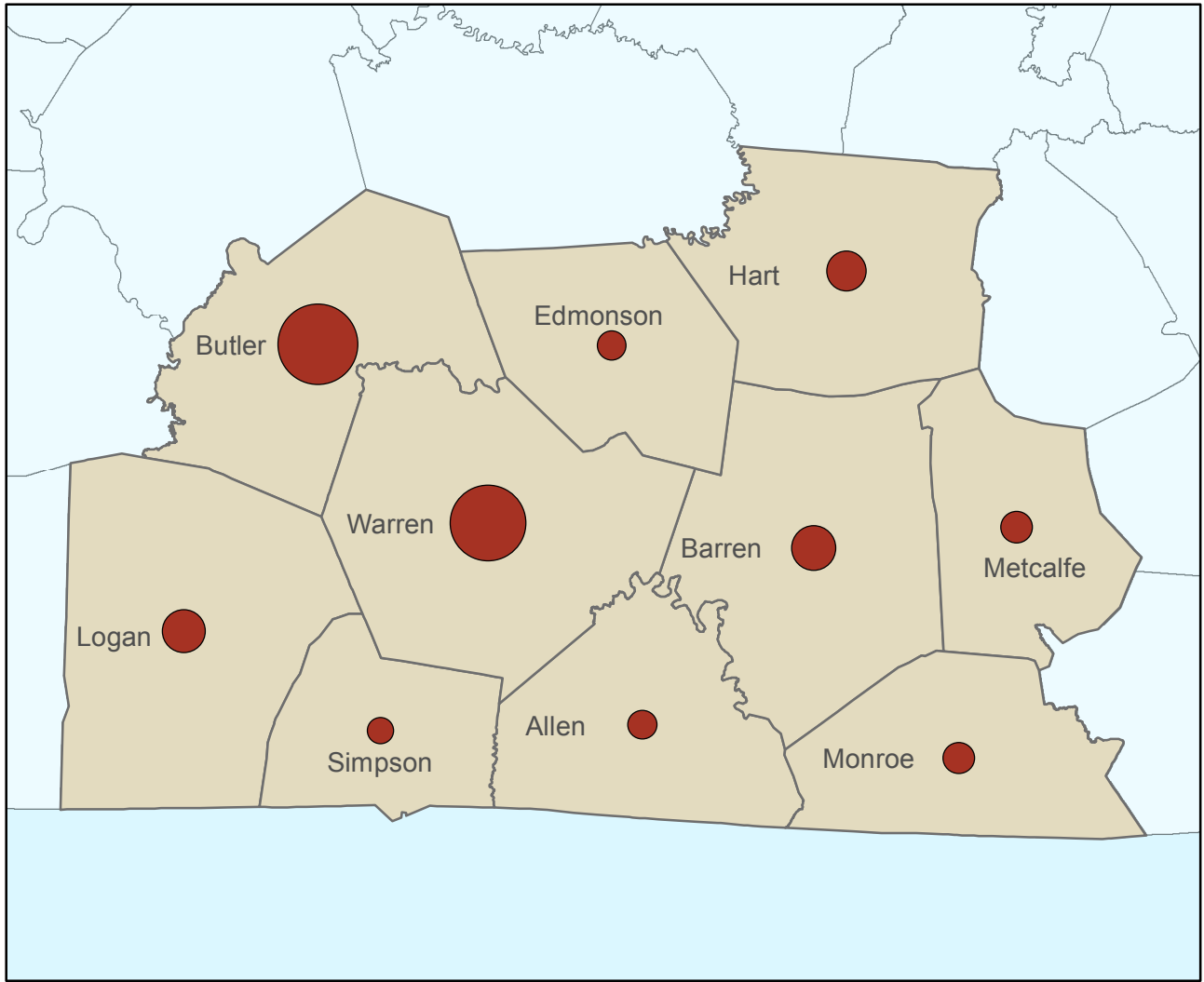
Total Loss

= \$160,000

Barren River Area Development District

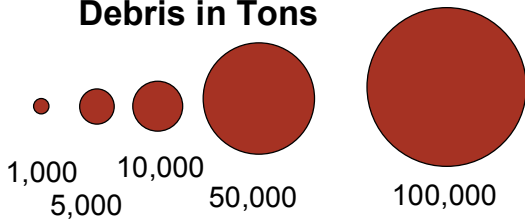
County	Total Loss	Bldg Loss	Contents Loss
Allen	\$32,606.00	\$18,952.00	\$13,457.00
Barren	\$66,680.00	\$34,226.00	\$31,109.00
Butler	\$341,033.00	\$158,584.00	\$131,458.00
Edmonson	\$16,630.00	\$10,027.00	\$6,489.00
Hart	\$53,969.00	\$28,407.00	\$24,644.00
Logan	\$120,981.00	\$52,800.00	\$64,160.00
Metcalfe	\$32,055.00	\$14,461.00	\$17,264.00
Monroe	\$23,210.00	\$12,174.00	\$10,441.00
Simpson	\$35,325.00	\$18,180.00	\$16,518.00
Warren	\$323,196.00	\$172,405.00	\$146,390.00





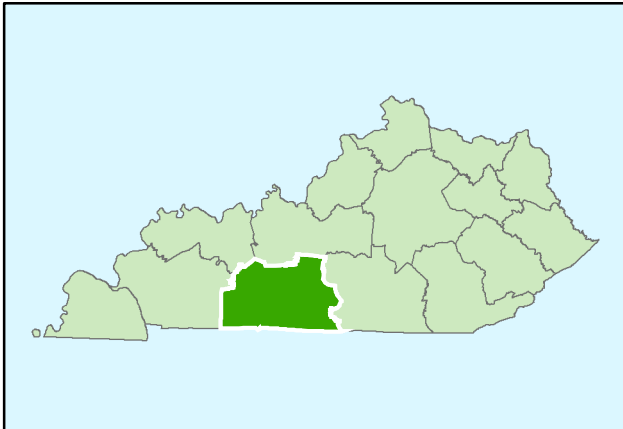
0 5 10 20 Miles

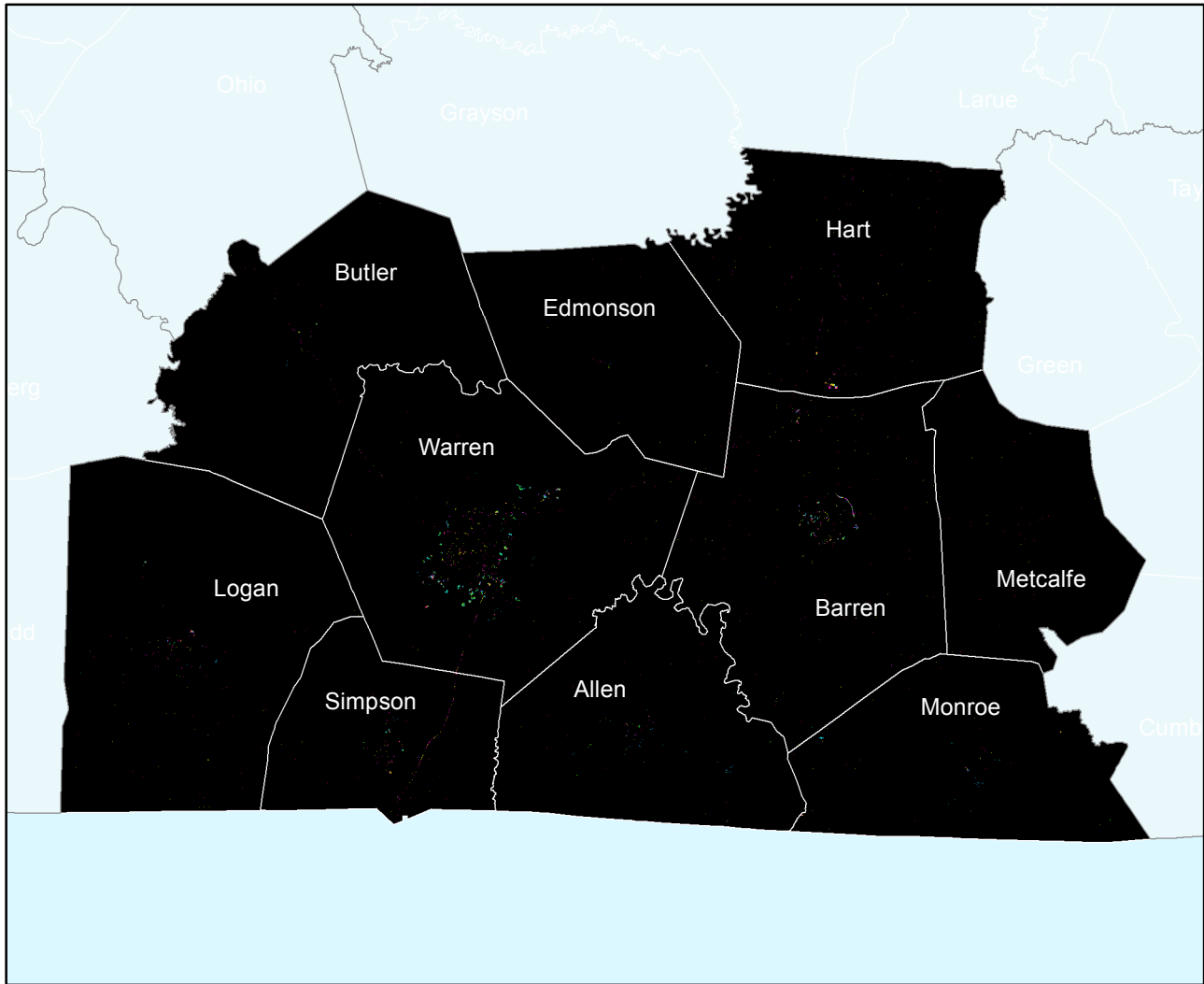
Debris in Tons



Barren River Area Development District

County	Debris Tons
Allen	4207
Barren	9537
Butler	31312
Edmonson	4201
Hart	7942
Logan	9263
Metcalfe	4873
Monroe	4892
Simpson	3670
Warren	28203



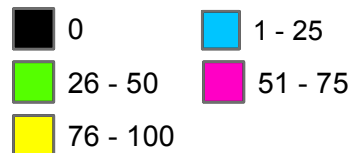


0 5 10 20 Miles

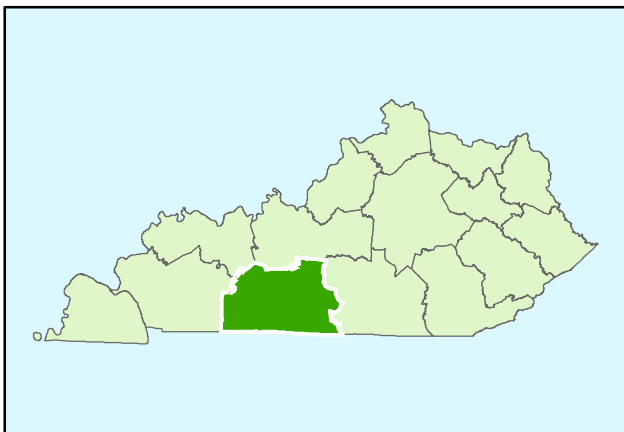


BARREN RIVER Area Development District

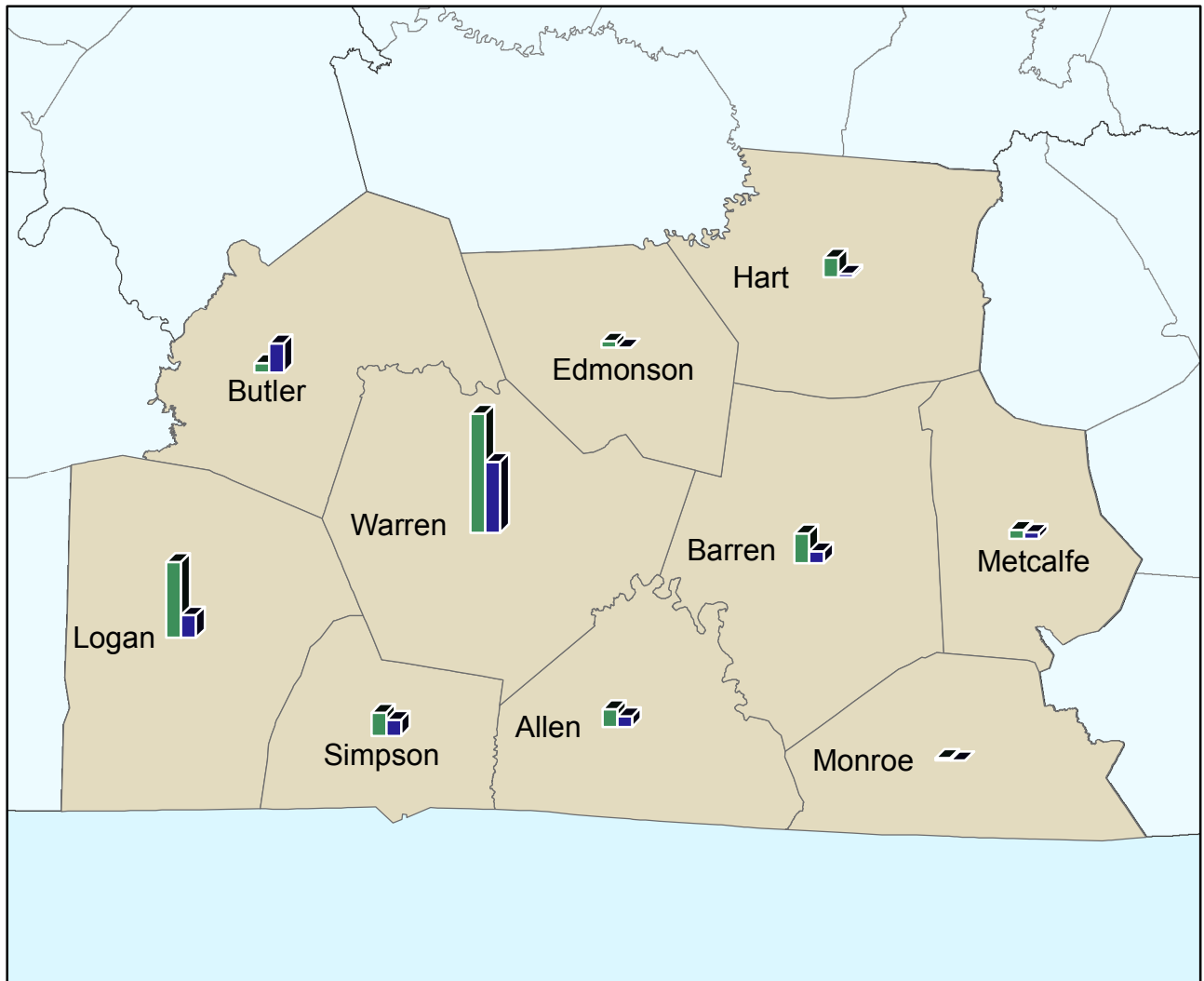
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**



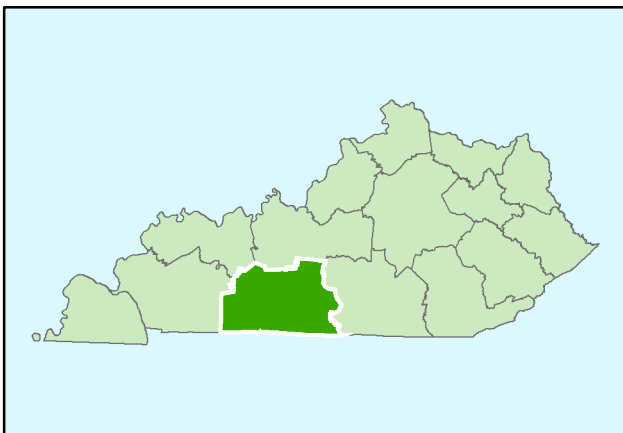
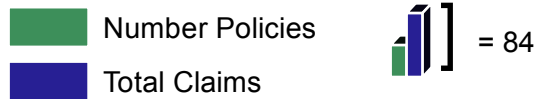
Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



0 5 10 20 Miles

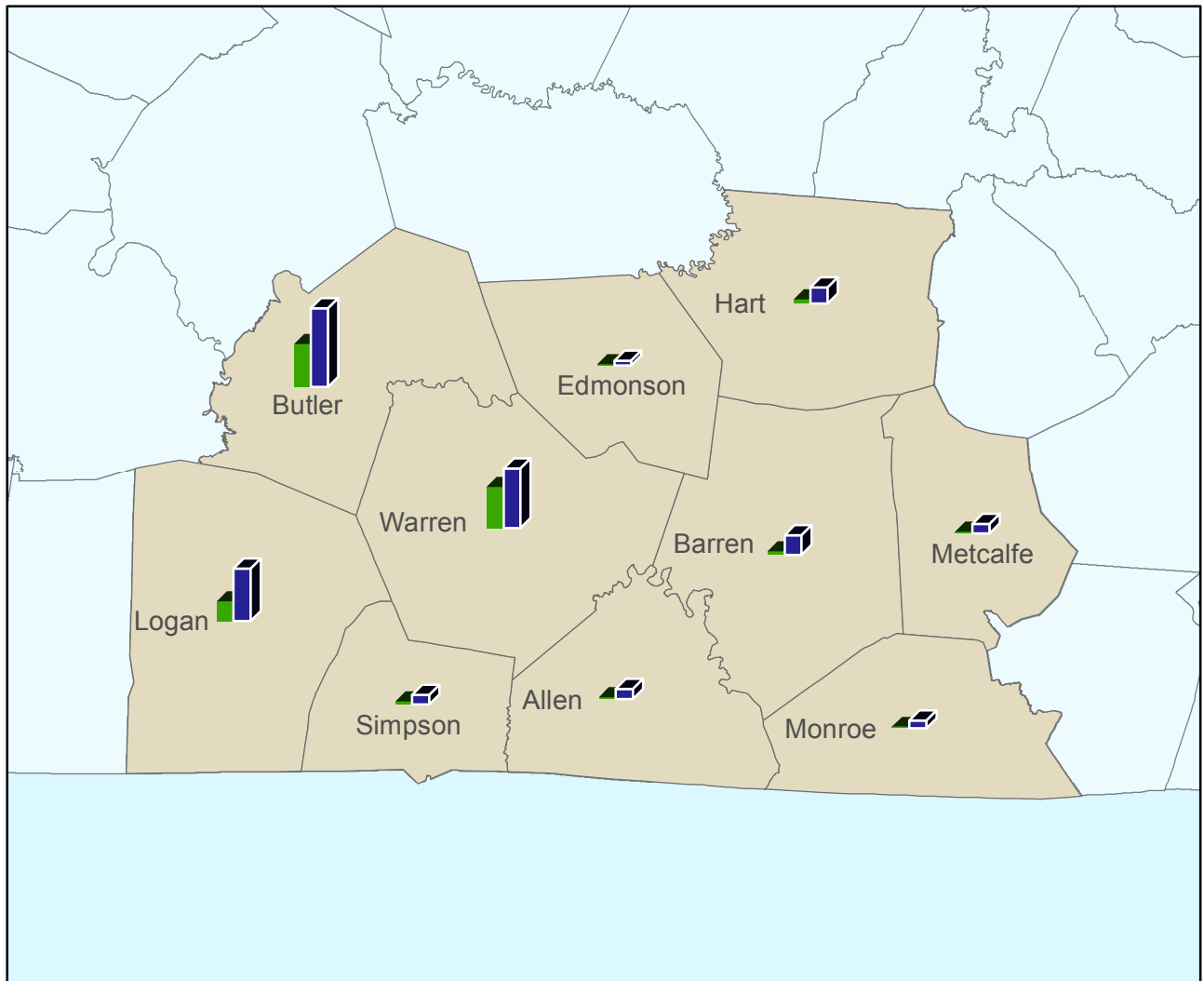
Barren River Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)




County	Number Policies	Total Claims
Allen	25	15
Barren	42	17
Butler	13	41
Edmonson	9	0
Hart	28	5
Logan	107	32
Metcalfe	13	9
Monroe	3	0
Simpson	33	23
Warren	168	100





0 5 10 20 Miles

 = 3,800 people

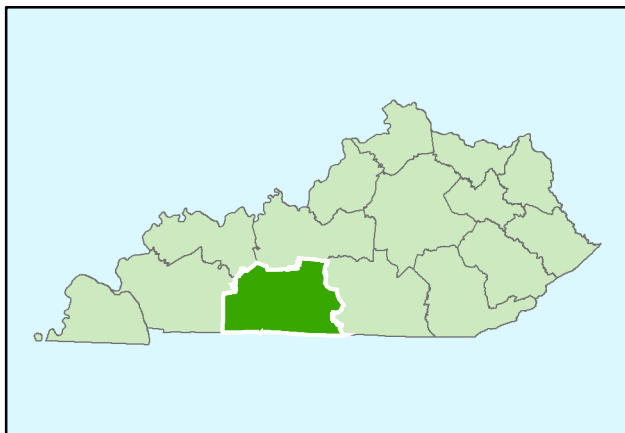
 Need Shelter

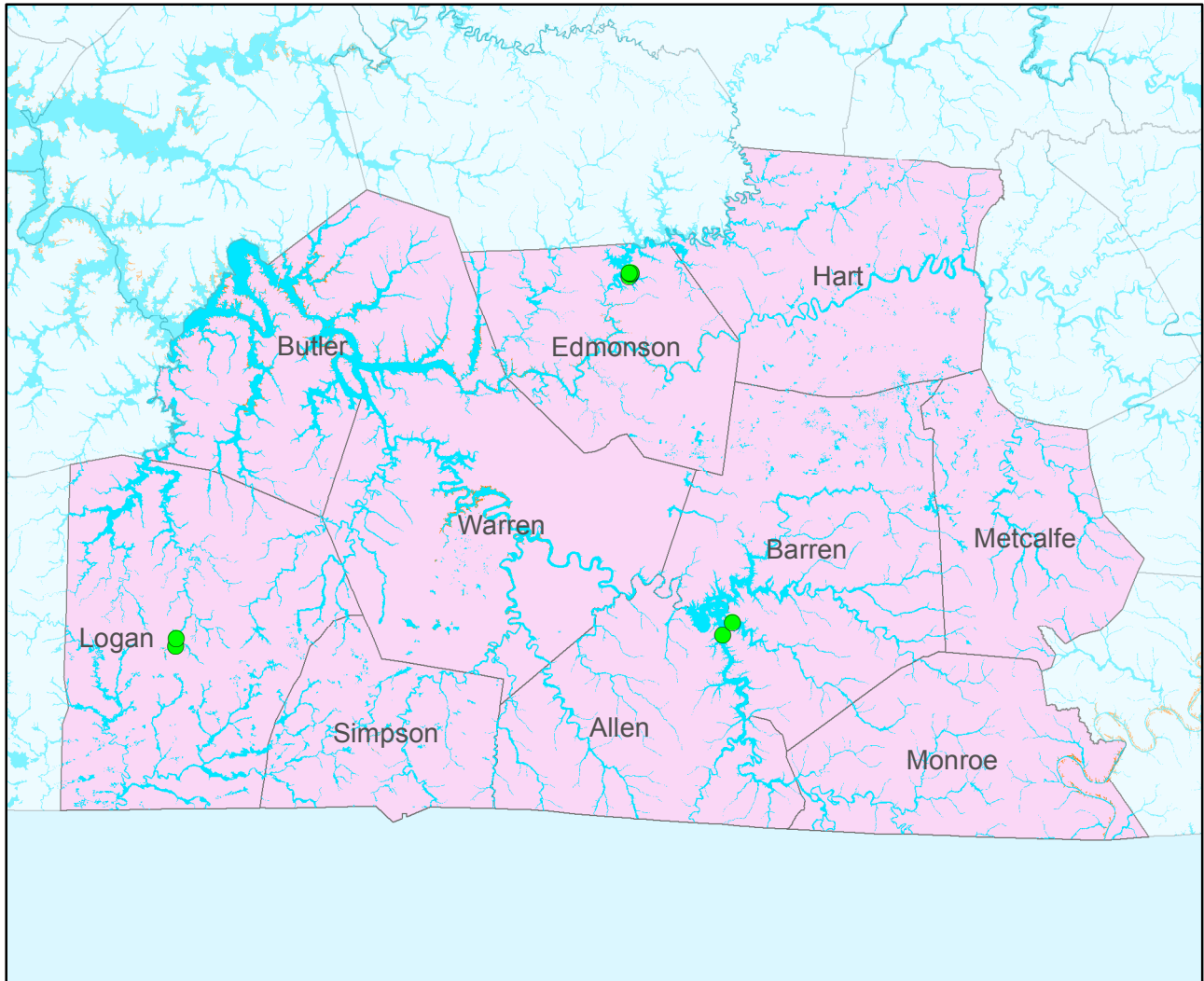
 Displaced



Barren River Area Development District

County	Displaced	Need Shelter
Allen	557	113
Barren	1107	217
Butler	4374	2398
Edmonson	243	66
Hart	885	231
Logan	2893	1078
Metcalfe	536	89
Monroe	442	86
Simpson	523	154
Warren	3307	2286



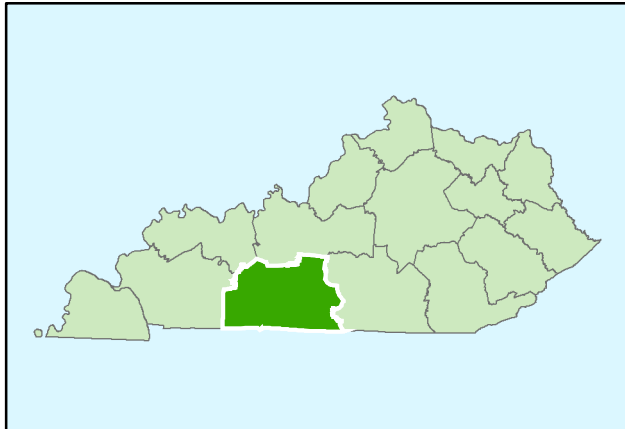
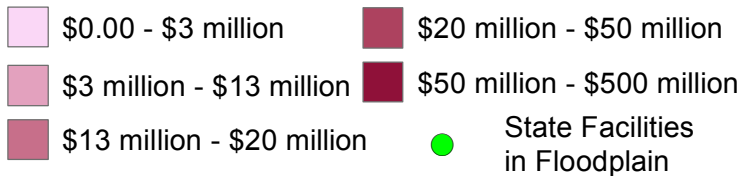


0 5 10 20 Miles

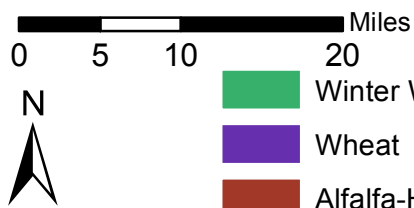
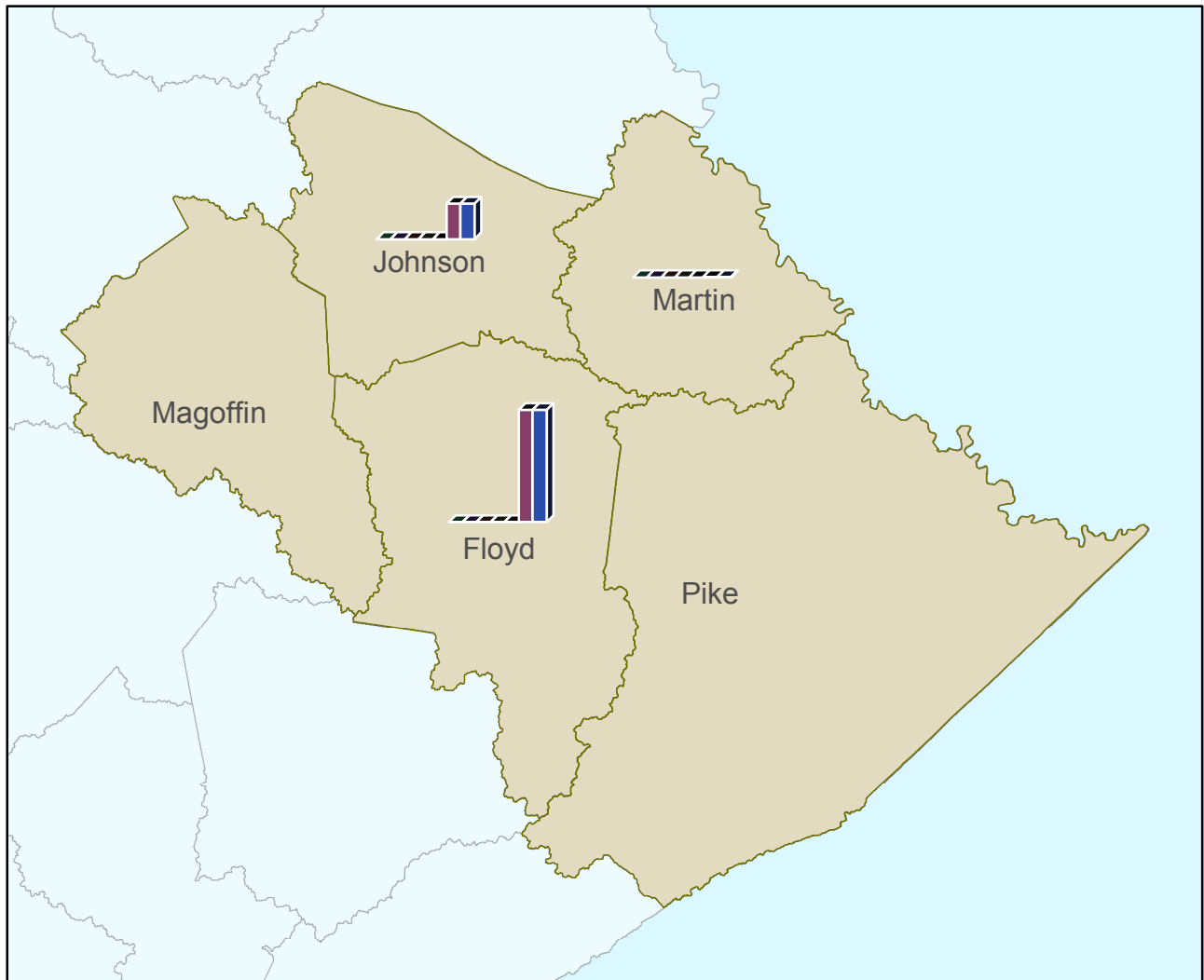


Barren River Area Development District

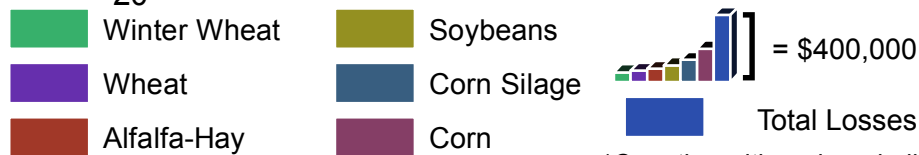
Replacement Cost Value



County	No. Vulnerable State Facilities	Replacement Cost Value
Barren	2	\$314,280.00
Edmonson	4	\$404,902.00
Logan	2	\$1,934,289.35
Allen	0	\$0.00
Butler	0	\$0.00
Hart	0	\$0.00
Metcalfe	0	\$0.00
Monroe	0	\$0.00
Simpson	0	\$0.00
Warren	0	\$0.00



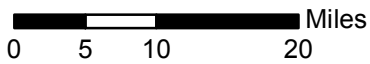
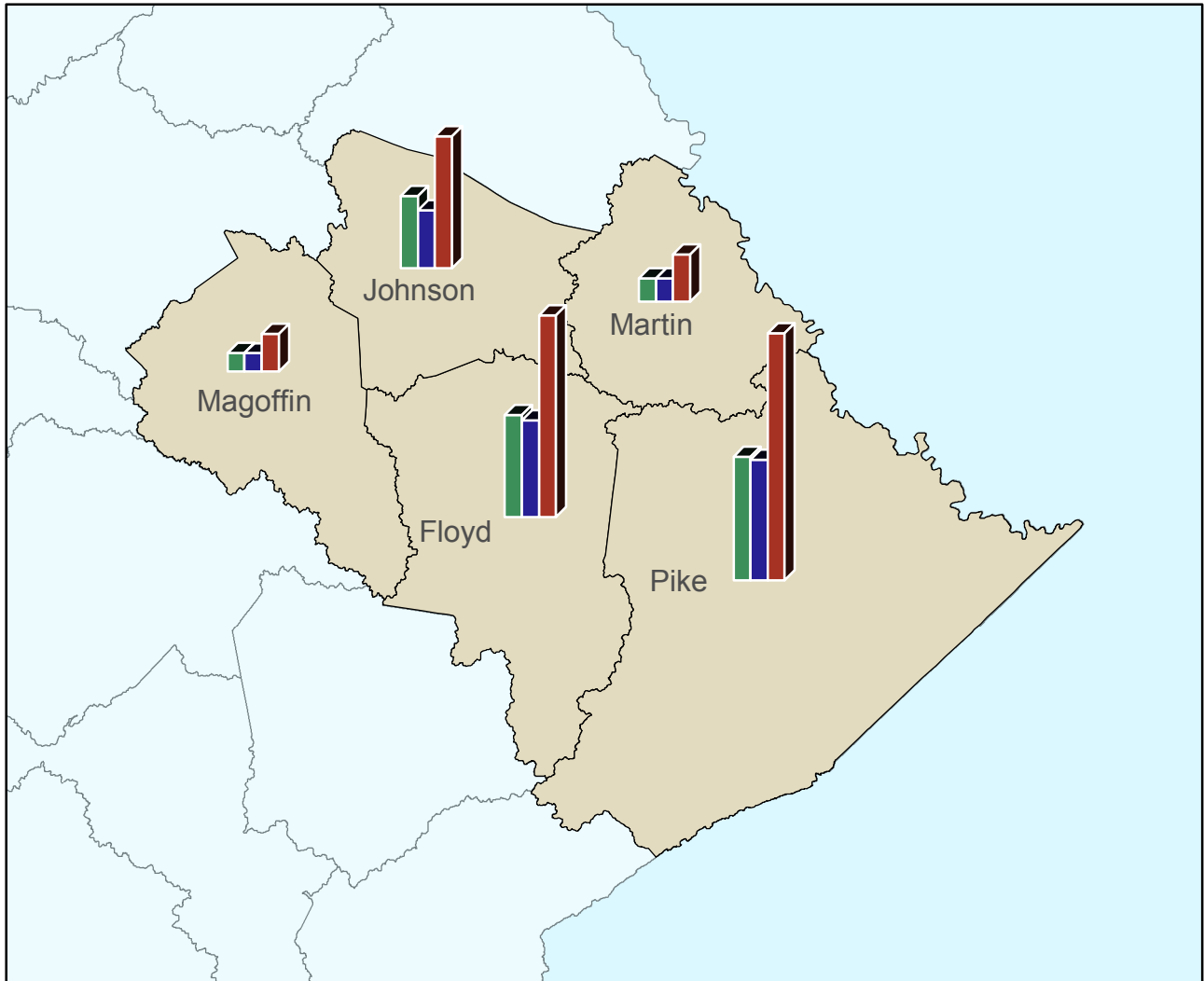
Agriculture Losses by County



*Counties with no bars indicate no losses.

BigSandy Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Floyd	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$797,688.91	\$797,688.91
Johnson	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$255,175.76	\$255,175.76
Martin	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$844.28	\$844.28
Magoffin	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pike	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

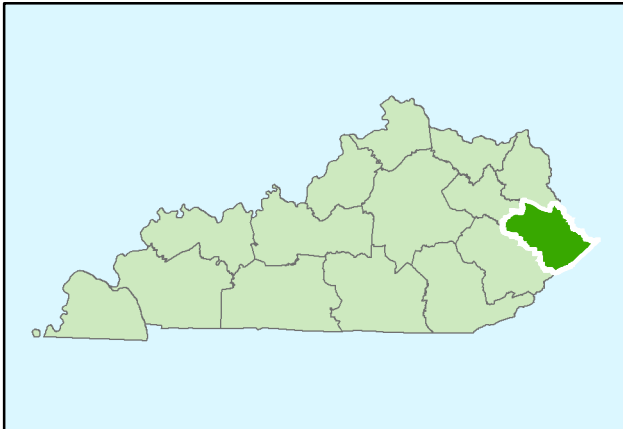


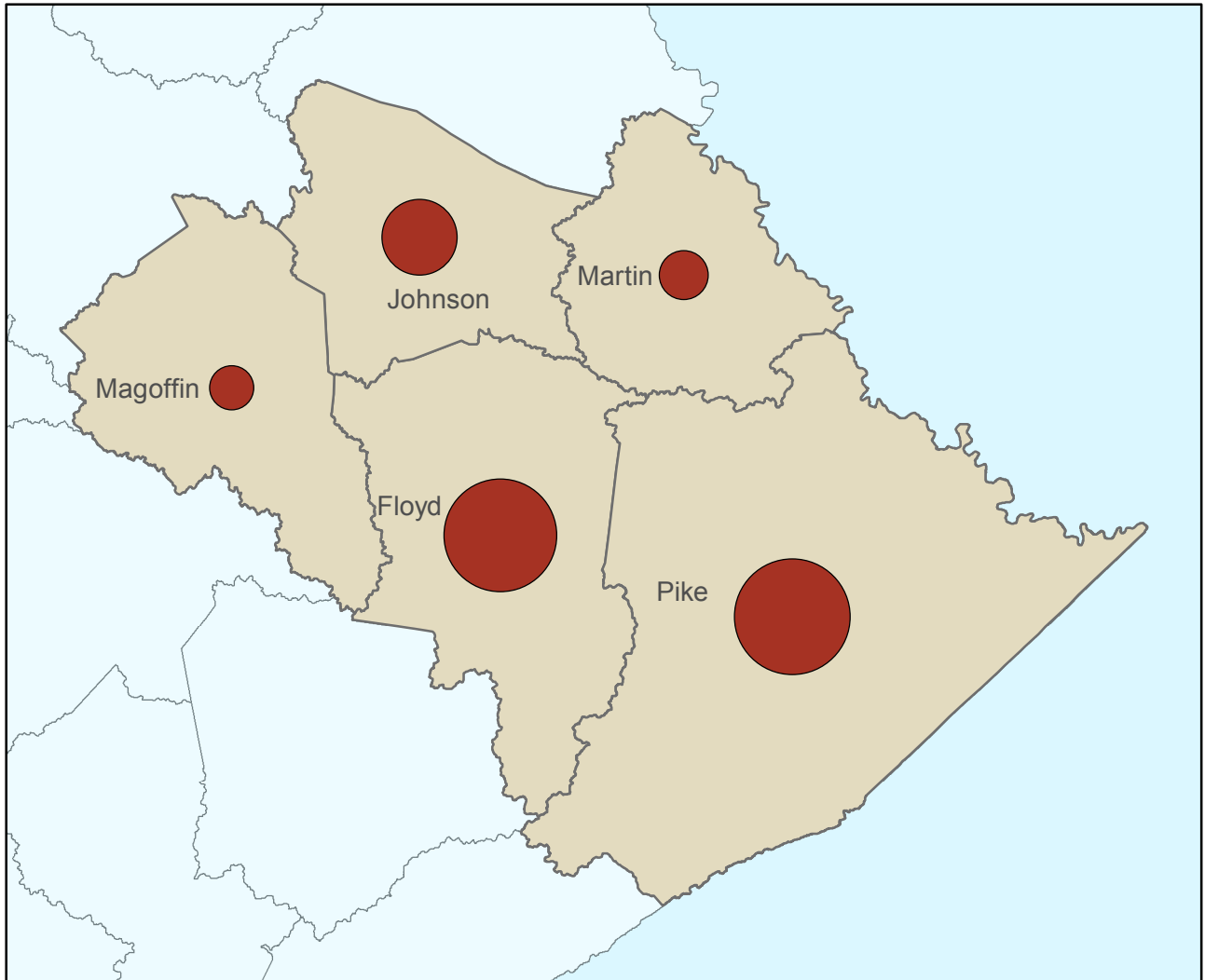
General Building Loss



Big Sandy Area Development District

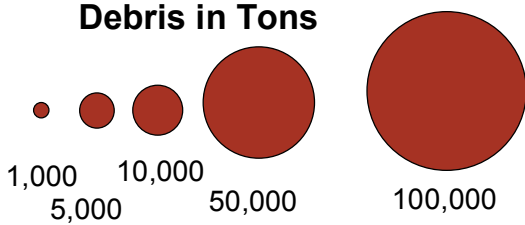
County	Total Loss	Bldg Loss	Contents Loss
Floyd	\$474,042.00	\$227,770.00	\$239,514.00
Johnson	\$309,768.00	\$135,402.00	\$169,680.00
Magoffin	\$87,301.00	\$42,292.00	\$43,417.00
Martin	\$111,532.00	\$55,349.00	\$55,003.00
Pike	\$579,061.00	\$281,963.00	\$288,679.00





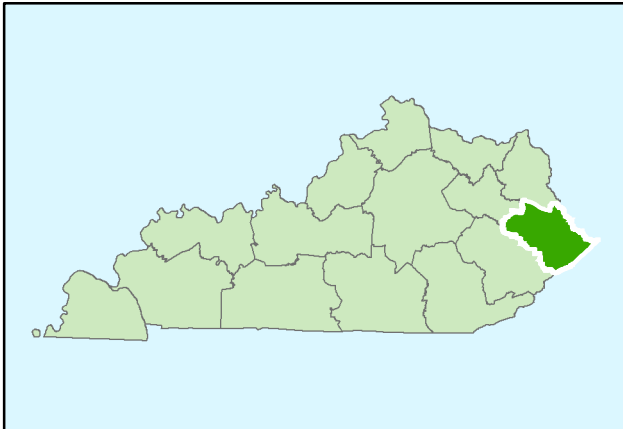
0 5 10 20 Miles

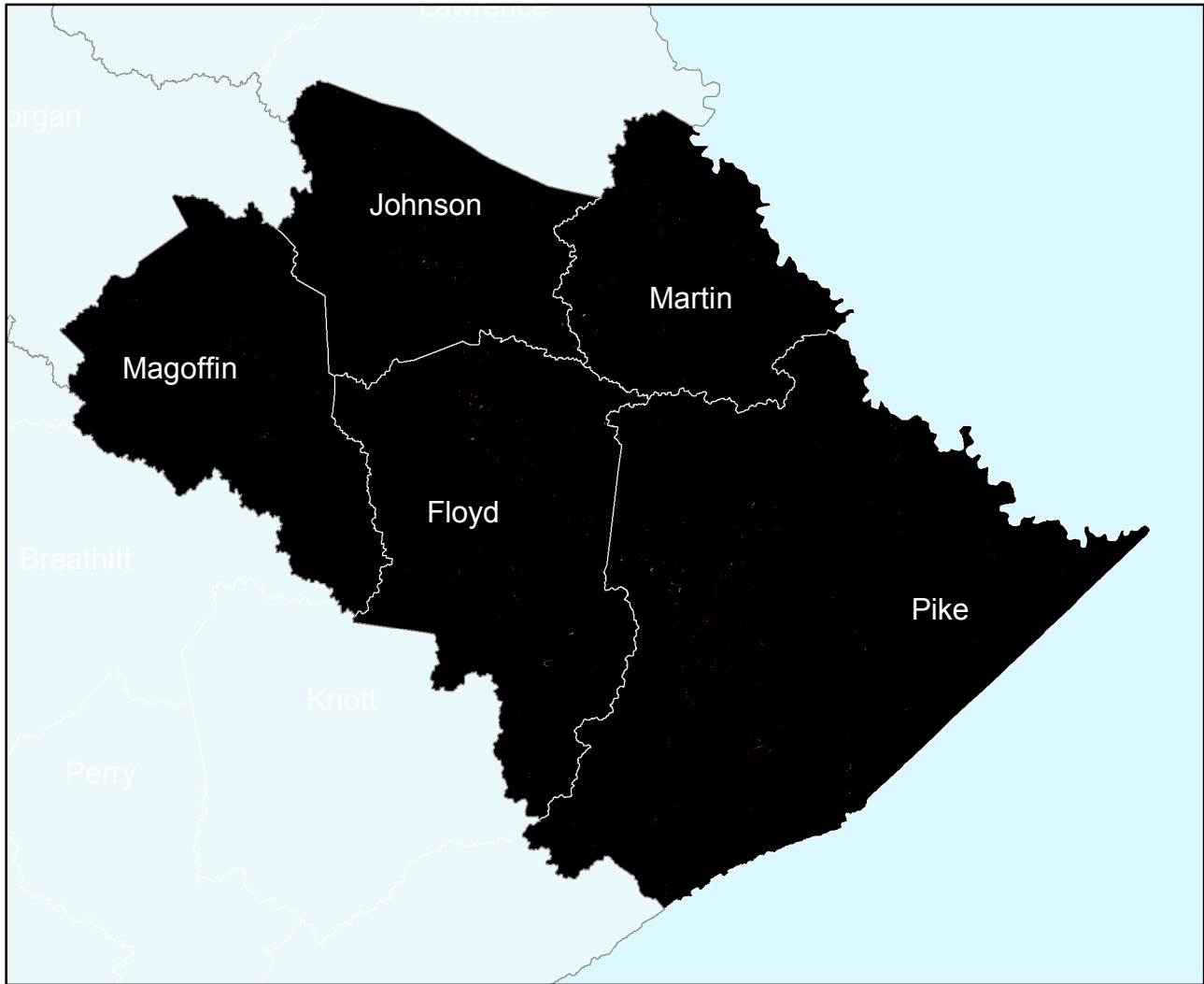
Debris in Tons



Big Sandy Area Development District

County	Debris Tons
Floyd	62055
Johnson	27682
Magoffin	9884
Martin	11872
Pike	65946



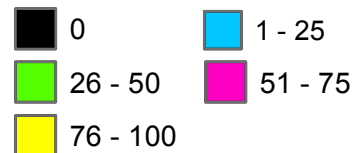


0 5 10 20 Miles

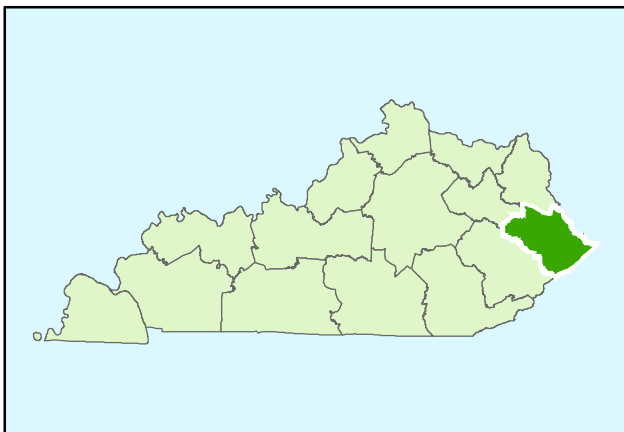


BIG SANDY Area Development District

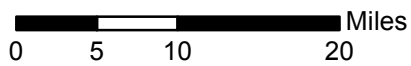
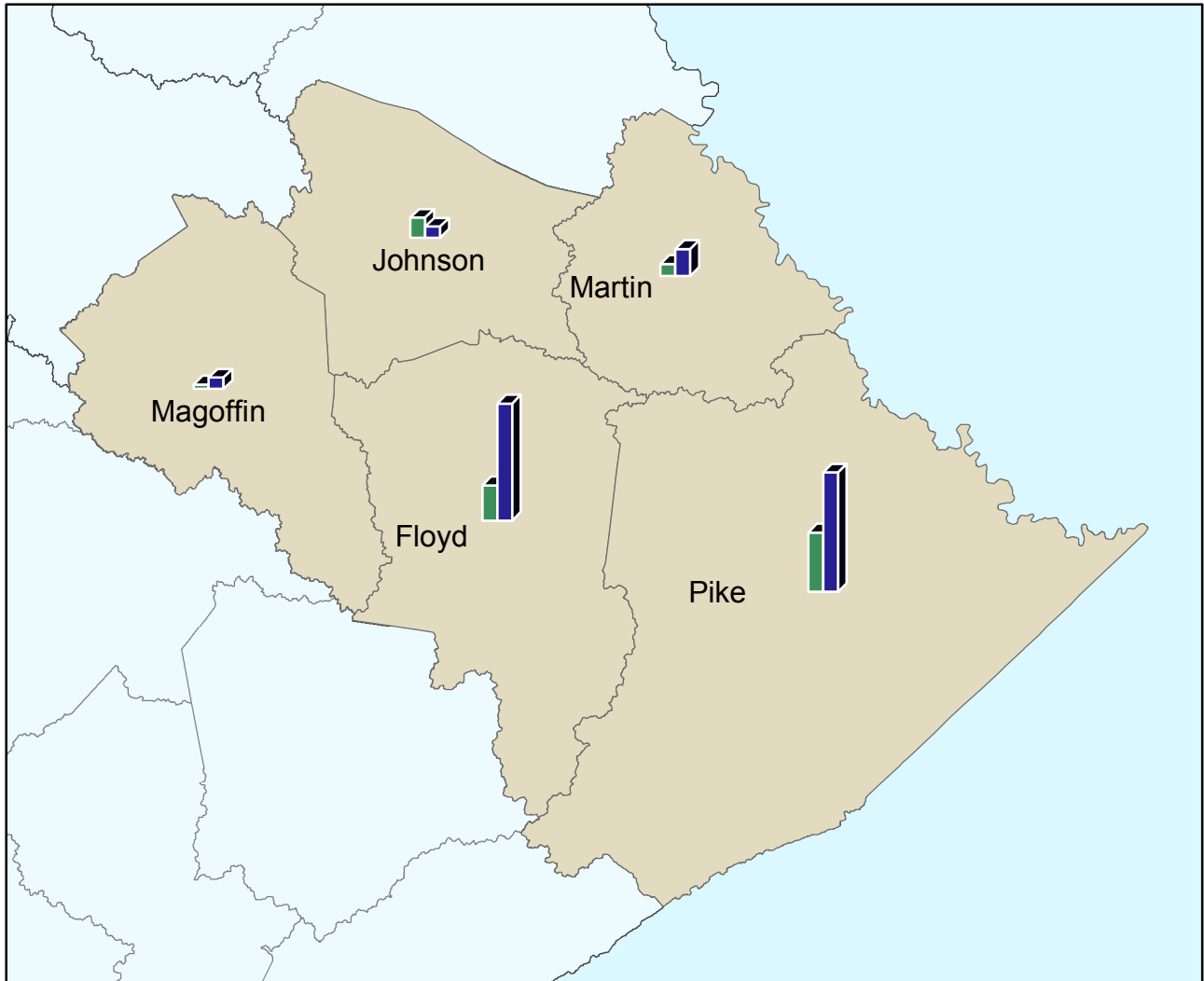
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**

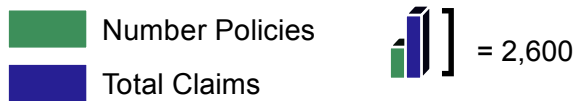


Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.

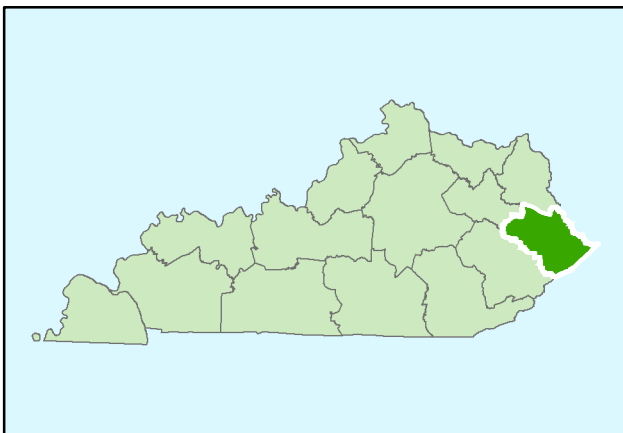


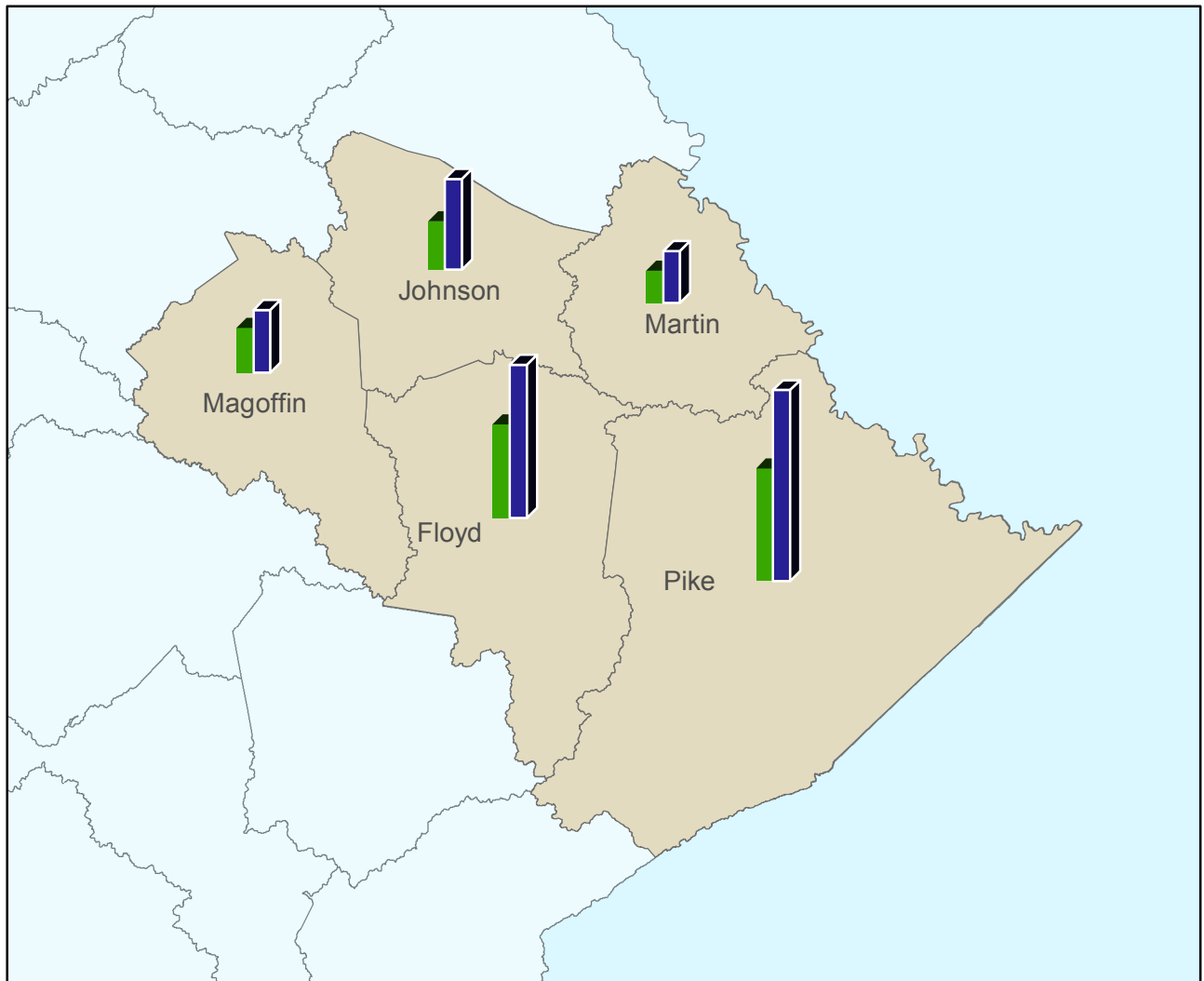
Big Sandy Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)



County	Number Policies	Total Claims
Floyd	697	2321
Johnson	393	217
Magoffin	92	228
Martin	231	529
Pike	1177	2373





0 5 10 20 Miles



= 3,800 people



Need Shelter

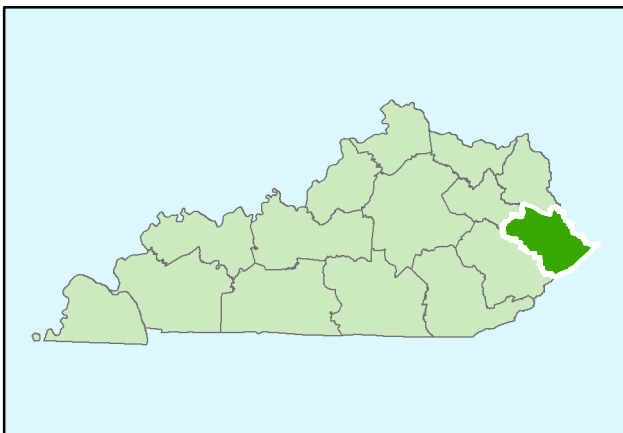


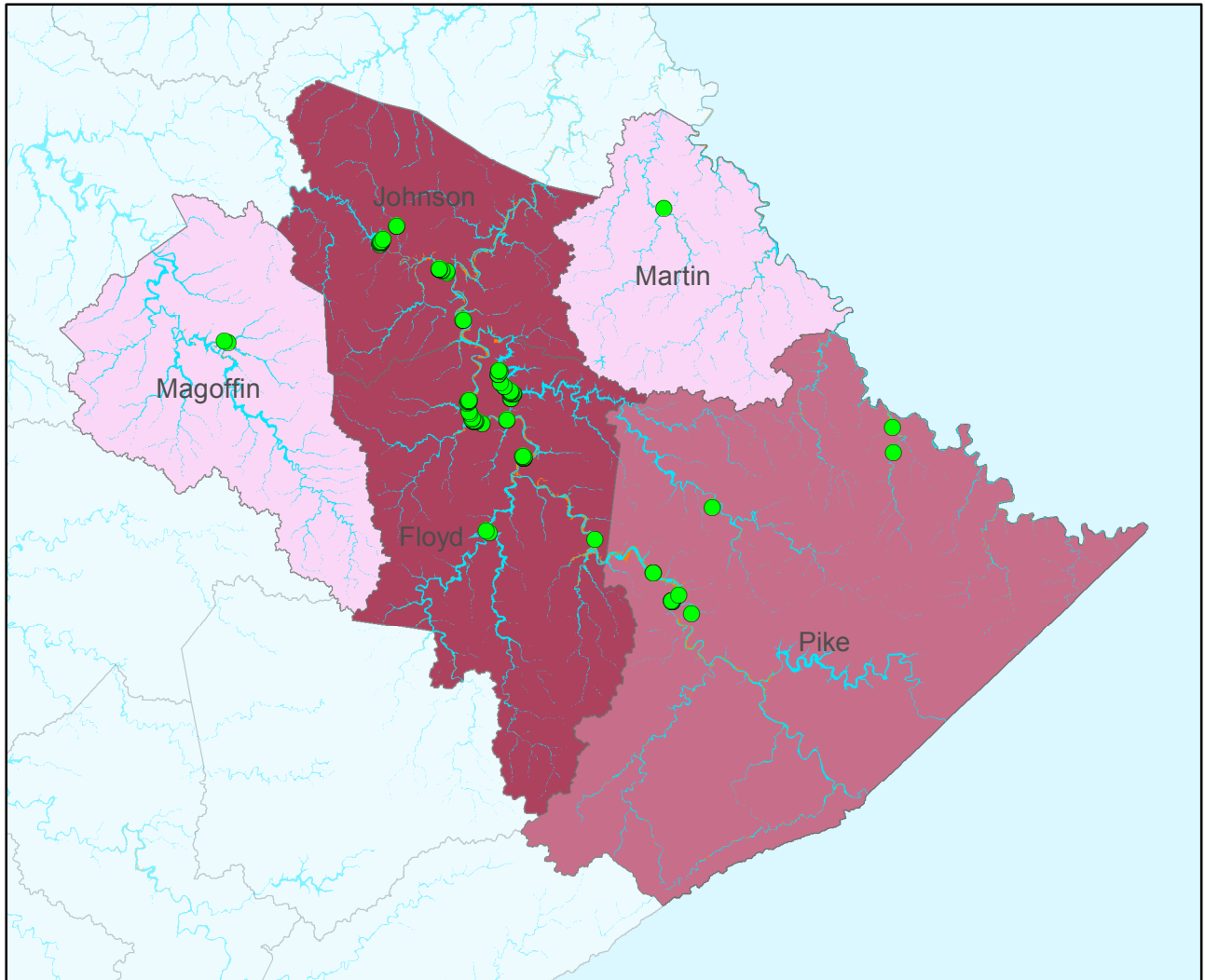
Displaced



Big Sandy Area Development District

County	Displaced	Need Shelter
Floyd	8502	5213
Johnson	5008	2672
Magoffin	3458	2455
Martin	2890	1792
Pike	10573	6217





0 5 10 20 Miles

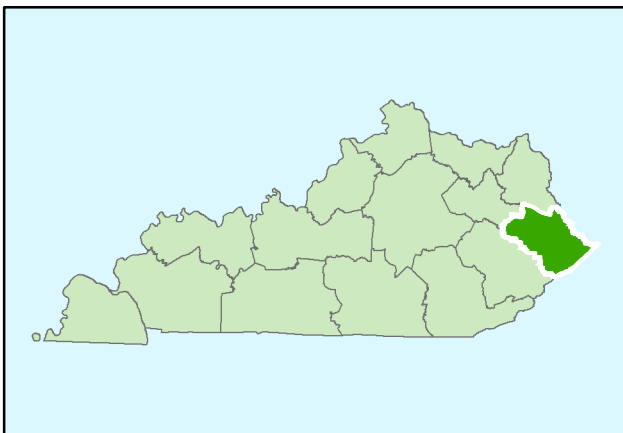


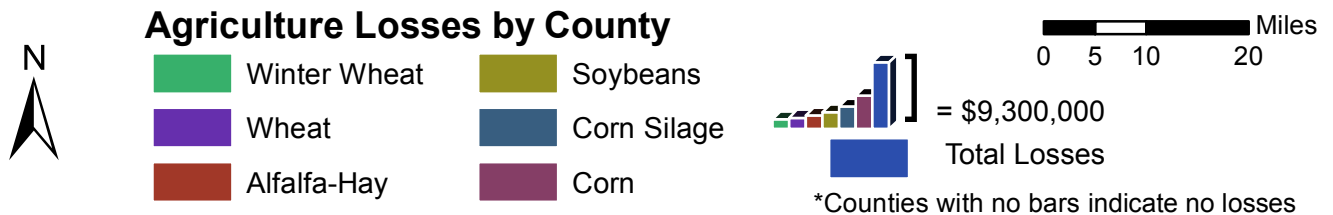
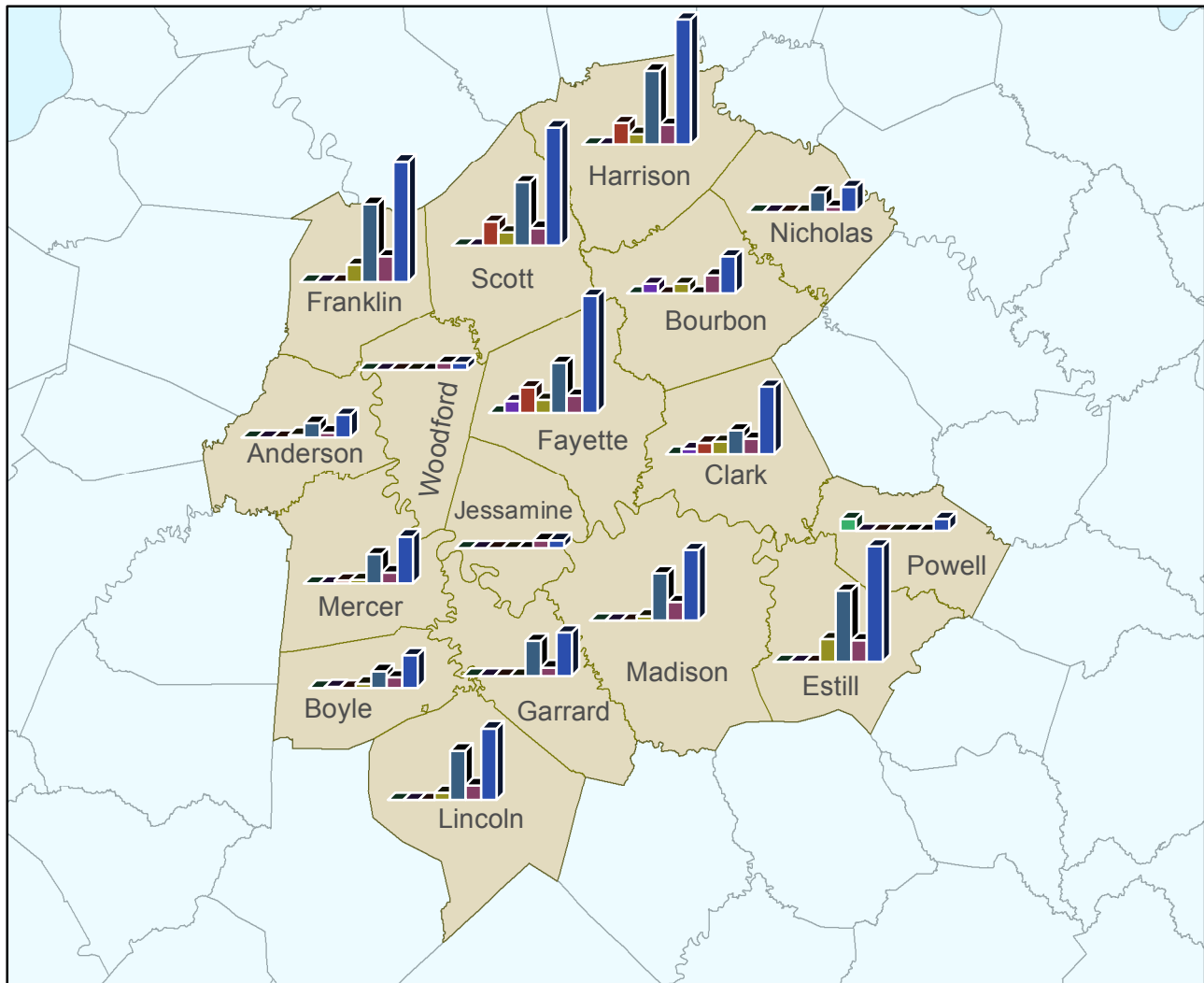
Big Sandy Area Development District

Replacement Cost Value

\$0.00 - \$3 million	\$20 million - \$50 million
\$3 million - \$13 million	\$13 million - \$20 million
State Facilities in Floodplain	

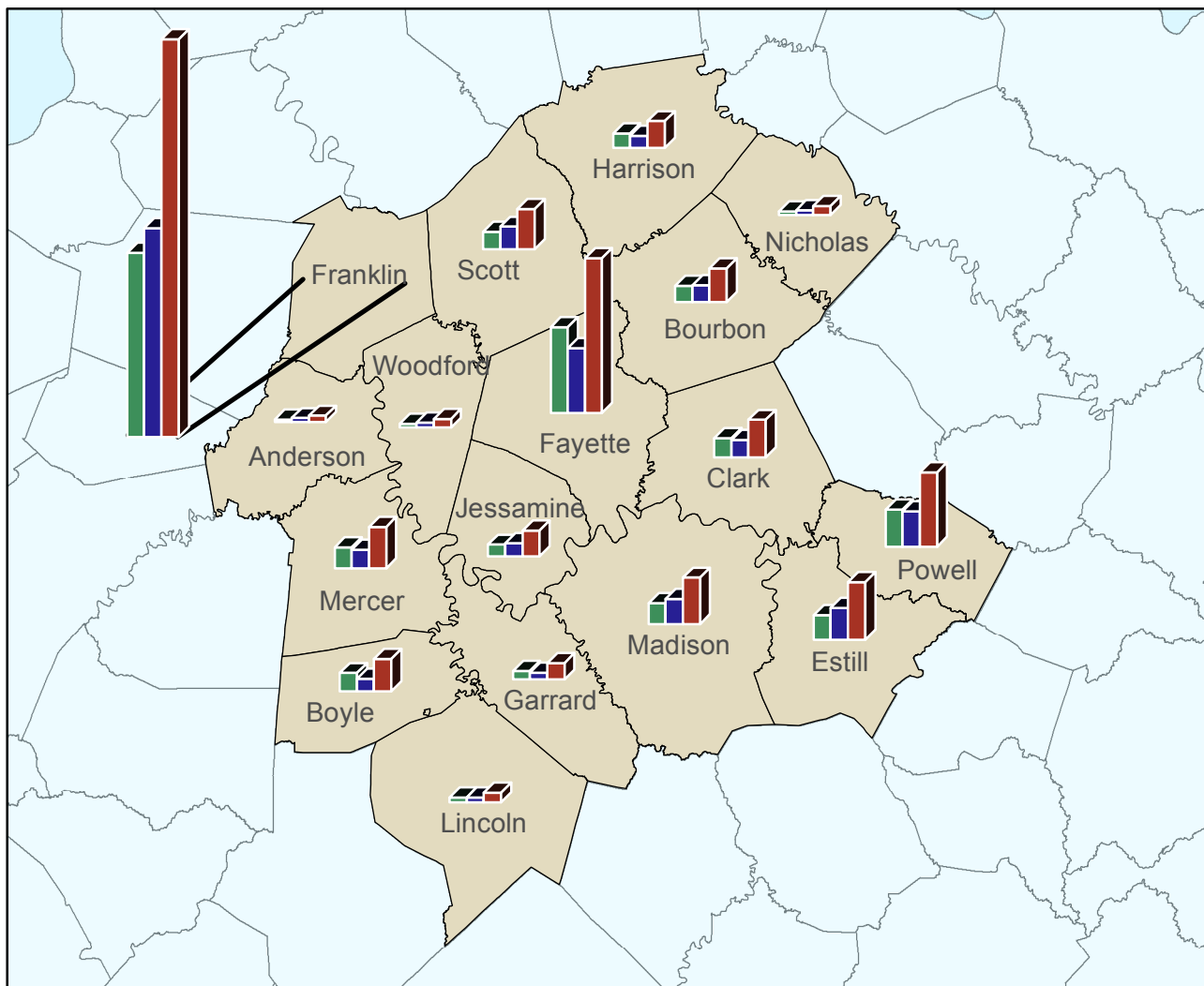
County	No. Vulnerable State Facilities	Replacement Cost Value
Floyd	59	\$47,903,525.72
Johnson	24	\$33,988,742.34
Magoffin	2	\$0.00
Martin	1	\$0.00
Pike	19	\$19,009,301.00





Bluegrass Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Anderson	\$0.00	\$0.00	\$0.00	\$418,739.40	\$2,223,321.26	\$777,364.94	\$3,419,425.60
Bourbon	\$0.00	\$0.00	\$1,430,834.9	\$1,442,964.5	\$0.00	\$2,698,676.9	\$5,572,476.51
Boyle	\$0.00	\$0.00	\$158,517.22	\$642,481.47	\$2,521,023.66	\$1,553,720.6	\$4,875,743.04
Clark	\$0.00	\$1,682,133.34	\$770,945.16	\$1,799,133.6	\$3,522,306.39	\$2,274,000.1	\$10,048,518.69
Estill	\$0.00	\$0.00	\$0.00	\$3,425,952.1	\$10,648,031.41	\$3,211,799.2	\$17,285,782.86
Fayette	\$0.00	\$3,781,583.66	\$1,736,329.7	\$1,916,643.4	\$7,497,377.12	\$2,573,697.8	\$17,505,631.81
Franklin	\$0.00	\$0.00	\$0.00	\$2,561,145.4	\$11,626,761.10	\$3,790,454.7	\$17,978,361.32
Garrard	\$0.00	\$0.00	\$0.00	\$0.00	\$5,243,127.96	\$1,260,925.8	\$6,504,053.83
Harrison	\$0.00	\$3,180,042.40	\$0.00	\$1,531,234.6	\$11,015,275.29	\$2,923,406.1	\$18,649,958.50
Jessamine	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1,240,128.9	\$1,240,128.96
Lincoln	\$0.00	\$0.00	\$0.00	\$1,112,131.3	\$7,401,573.26	\$2,218,074.9	\$10,731,779.49
Madison	\$0.00	\$0.00	\$0.00	\$677,861.20	\$7,125,935.39	\$2,812,980.7	\$10,616,777.37
Mercer	\$0.00	\$437,161.73	\$0.00	\$559,688.13	\$4,362,337.66	\$1,659,016.0	\$7,018,203.57
Nicholas	\$0.00	\$0.00	\$0.00	\$0.00	\$2,917,029.81	\$777,691.72	\$3,694,721.53
Powell	\$1,797,582.32	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1,797,582.32
Scott	\$0.00	\$3,585,501.05	\$0.00	\$1,961,685.5	\$9,499,103.43	\$2,613,392.6	\$17,659,682.62
Woodford	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1,095,645.0	\$1,095,645.08



0 5 10 20 Miles



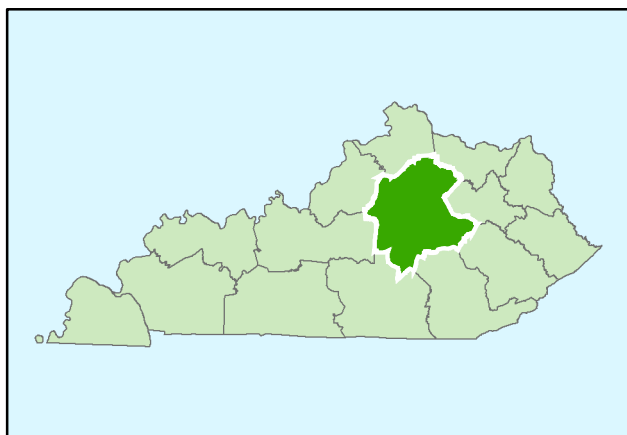
General Building Loss

■ Contents Loss

■ Building Loss

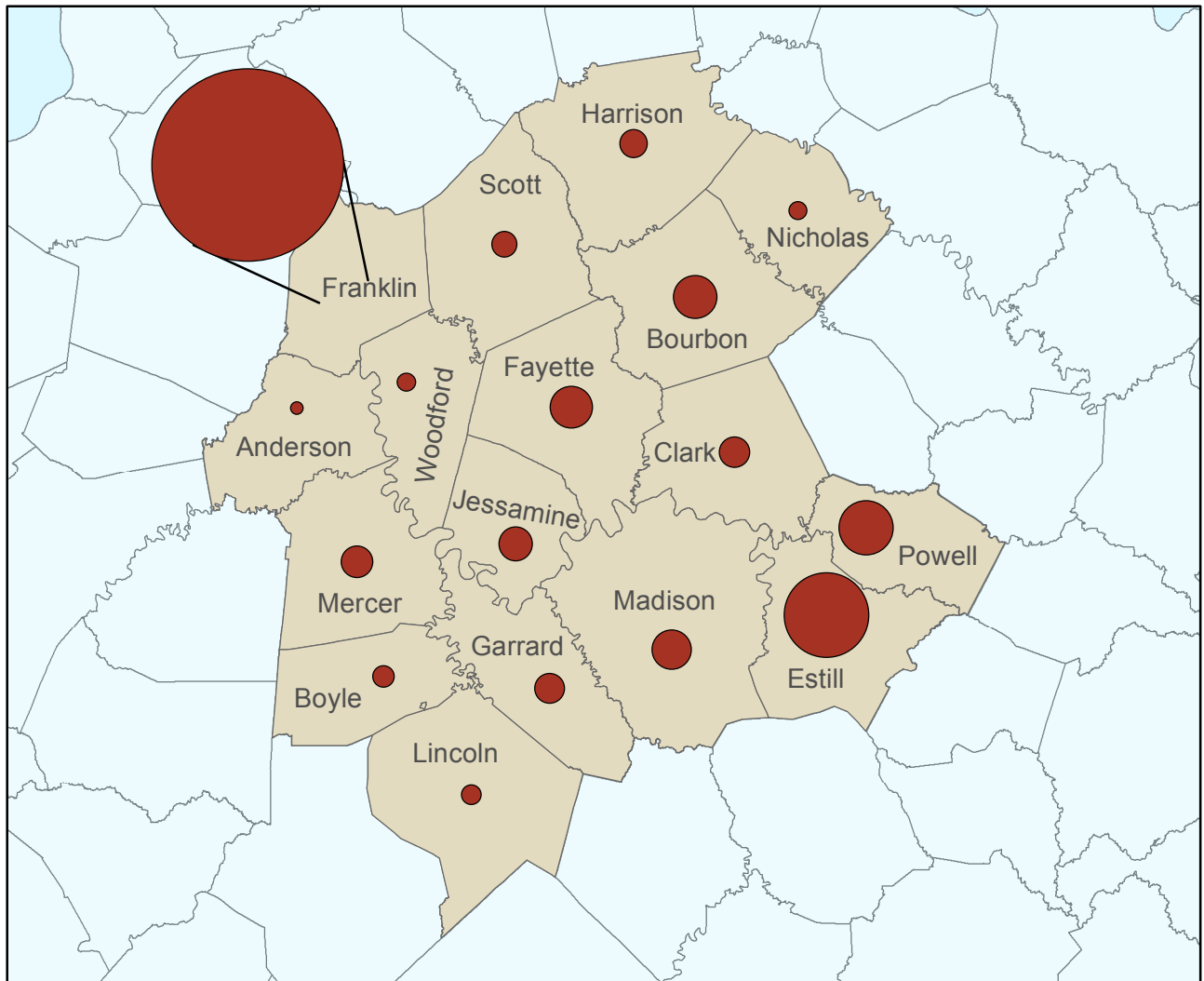
■ Total Loss

= \$160,000



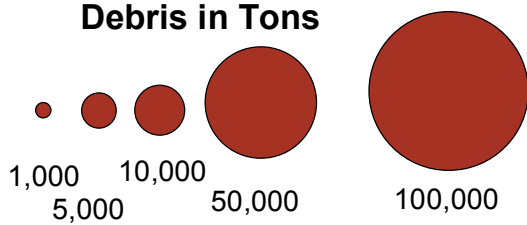
Bluegrass Area Development District

County	Total Loss	Bldg Loss	Contents Loss
Anderson	\$14,267.00	\$8,606.00	\$5,544.00
Bourbon	\$79,182.00	\$39,483.00	\$37,791.00
Boyle	\$76,107.00	\$30,463.00	\$43,362.00
Clark	\$87,812.00	\$40,993.00	\$44,898.00
Estill	\$134,012.00	\$74,713.00	\$57,912.00
Fayette	\$360,466.00	\$151,065.00	\$199,523.00
Franklin	\$927,428.00	\$486,935.00	\$429,519.00
Garrard	\$37,871.00	\$16,378.00	\$20,160.00
Harrison	\$62,160.00	\$27,706.00	\$33,445.00
Jessamine	\$60,650.00	\$31,717.00	\$27,685.00
Lincoln	\$22,663.00	\$11,249.00	\$11,214.00
Madison	\$109,119.00	\$58,816.00	\$49,178.00
Mercer	\$96,201.00	\$42,939.00	\$48,825.00
Nicholas	\$21,457.00	\$11,913.00	\$9,350.00
Powell	\$173,367.00	\$81,939.00	\$86,656.00
Scott	\$93,385.00	\$51,962.00	\$40,413.00
Woodford	\$20,634.00	\$12,064.00	\$8,445.00



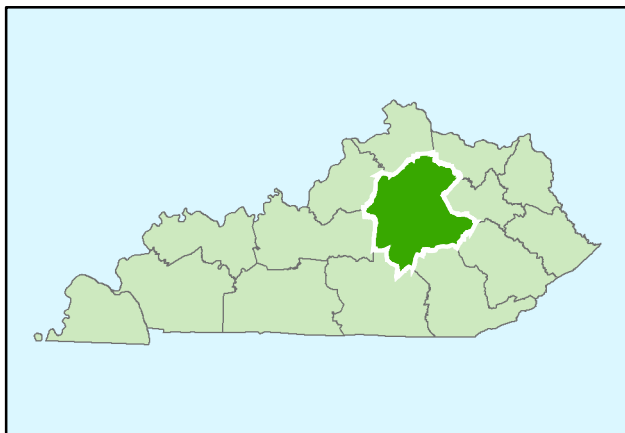
0 5 10 20 Miles

Debris in Tons



Bluegrass Area Development District

County	Debris Tons
Anderson	743
Bourbon	9003
Boyle	2496
Clark	4495
Estill	35189
Fayette	8768
Franklin	178660
Garrard	4452
Harrison	3725
Jessamine	5850
Lincoln	1934
Madison	7794
Mercer	4859
Nicholas	1748
Powell	14499
Scott	3346
Woodford	1772



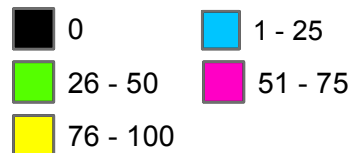


0 5 10 20 Miles

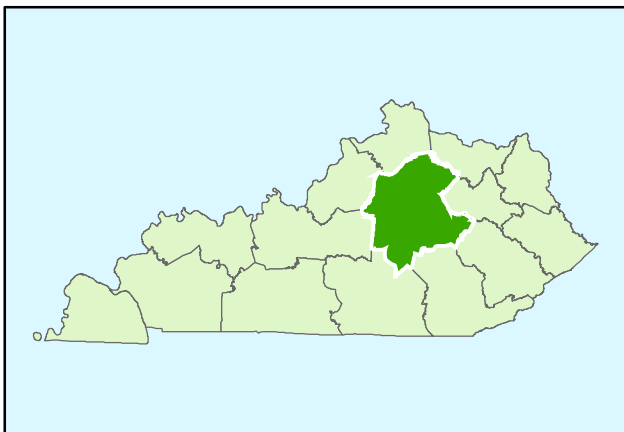


BLUEGRASS Area Development District

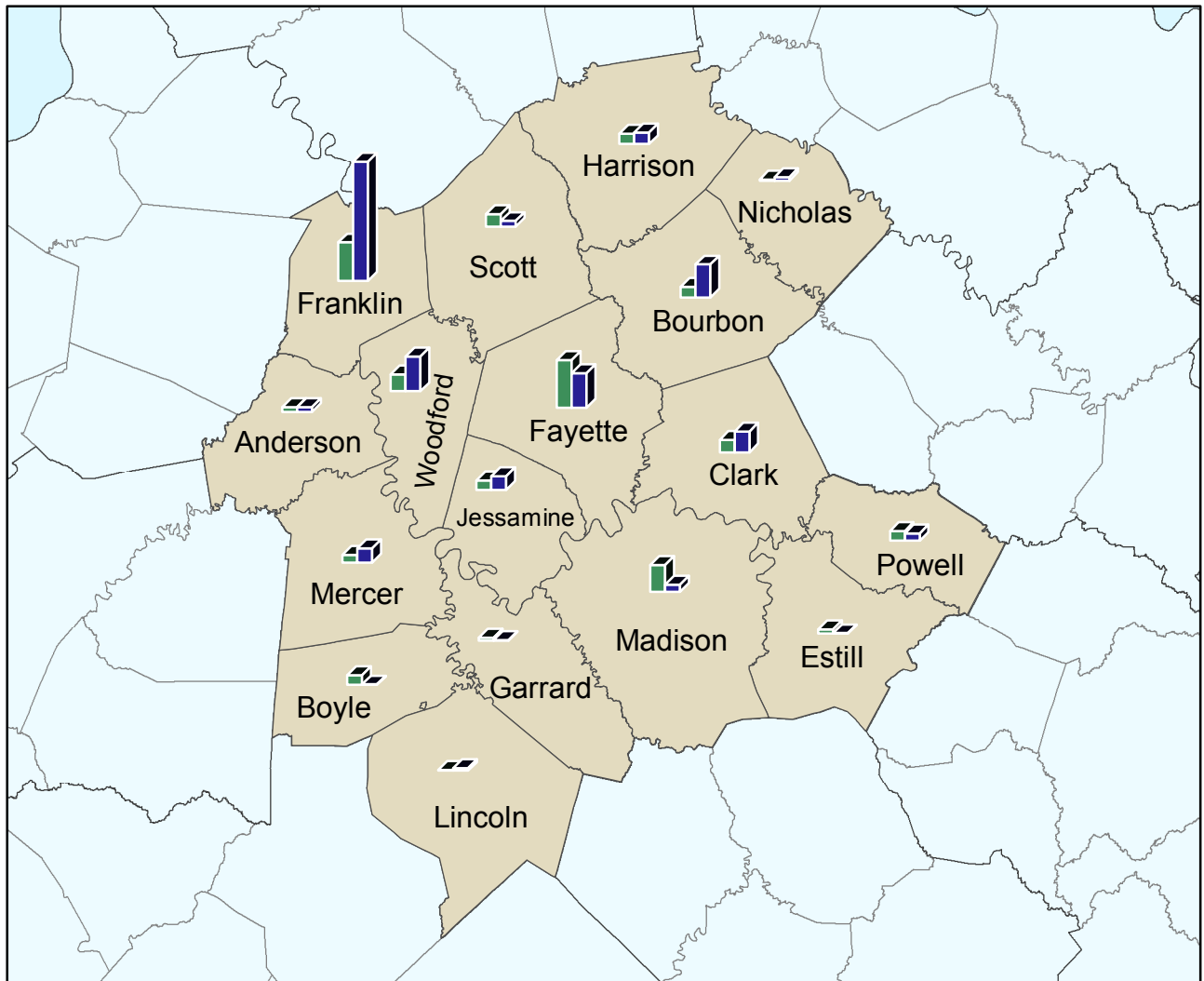
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**





Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.




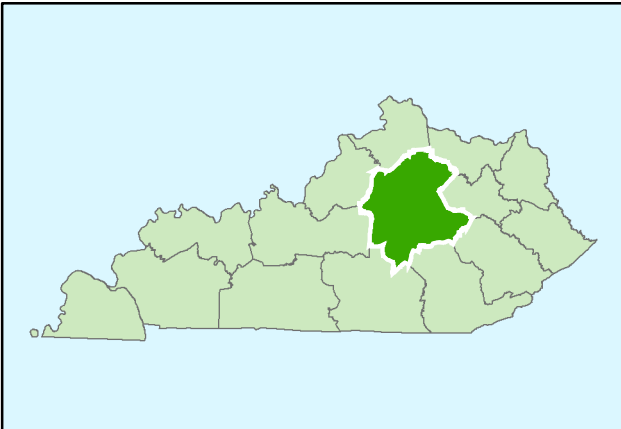
0 5 10 20 Miles

Bluegrass Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)

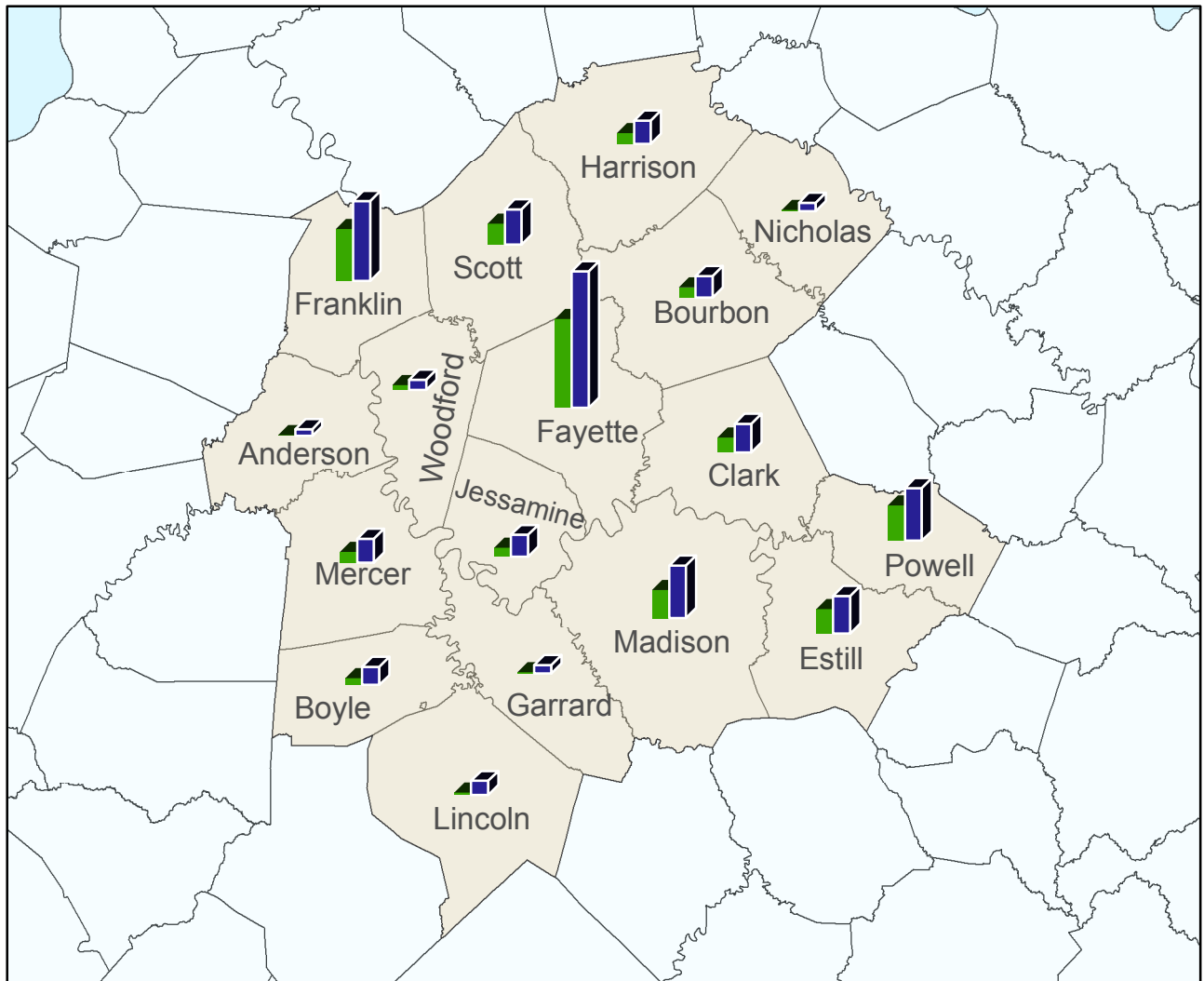
 Number Policies
 Total Claims

 = 670



County	Number Policies	Total Claims
Anderson	49	49
Bourbon	121	376
Boyle	111	8
Clark	142	233
Estill	49	5
Fayette	541	393
Franklin	434	1347
Garrard	32	9
Harrison	116	131
Jessamine	112	157
Lincoln	12	29
Madison	304	83
Mercer	83	160
Nicholas	13	41
Powell	114	84
Scott	138	62
Woodford	190	392





0 5 10 20 Miles



= 3,800 people



Need Shelter

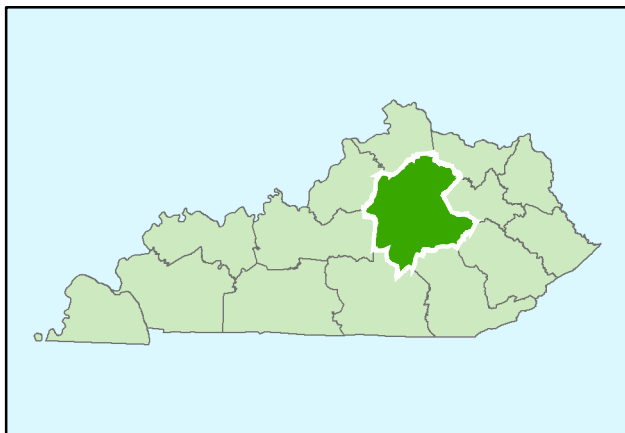


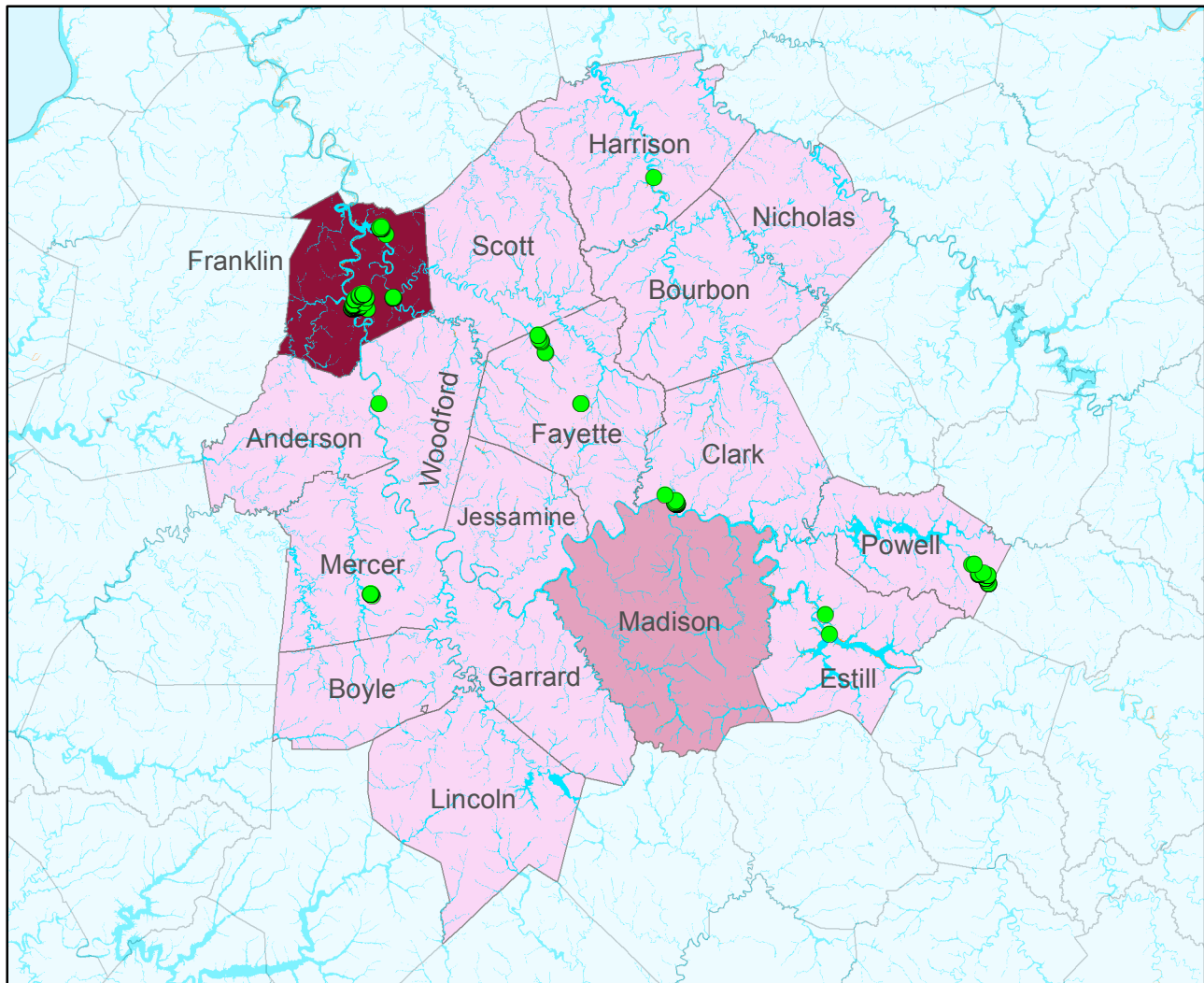
Displaced



Bluegrass Area Development District

County	Displaced	Need Shelter
Anderson	393	61
Bourbon	1186	562
Boyle	1019	387
Clark	1588	813
Estill	2084	1363
Fayette	7568	4912
Franklin	4425	2876
Garrard	442	49
Harrison	1311	610
Jessamine	1207	502
Lincoln	785	130
Madison	2908	1552
Mercer	1317	568
Nicholas	456	68
Powell	2909	1971
Scott	1956	1167
Woodford	585	282

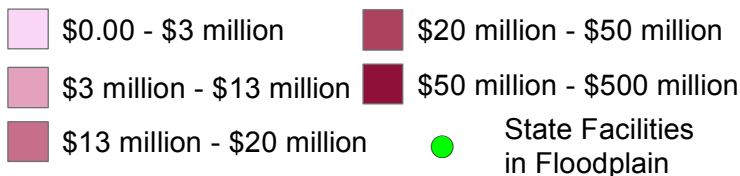




0 5 10 20 Miles



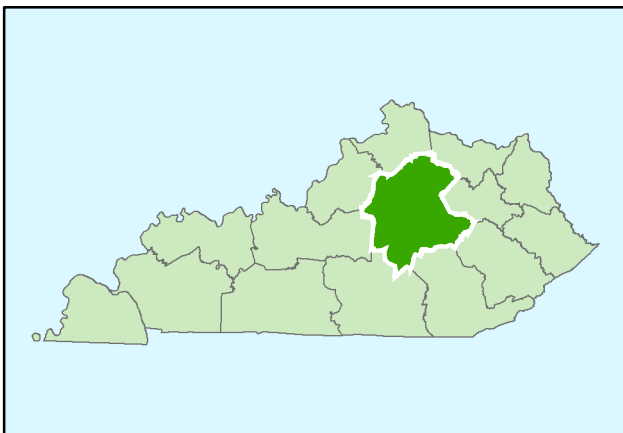
Replacement Cost Value

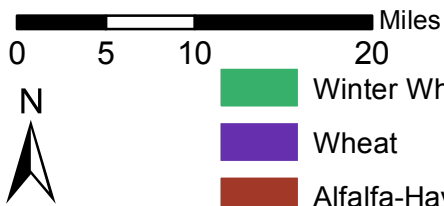
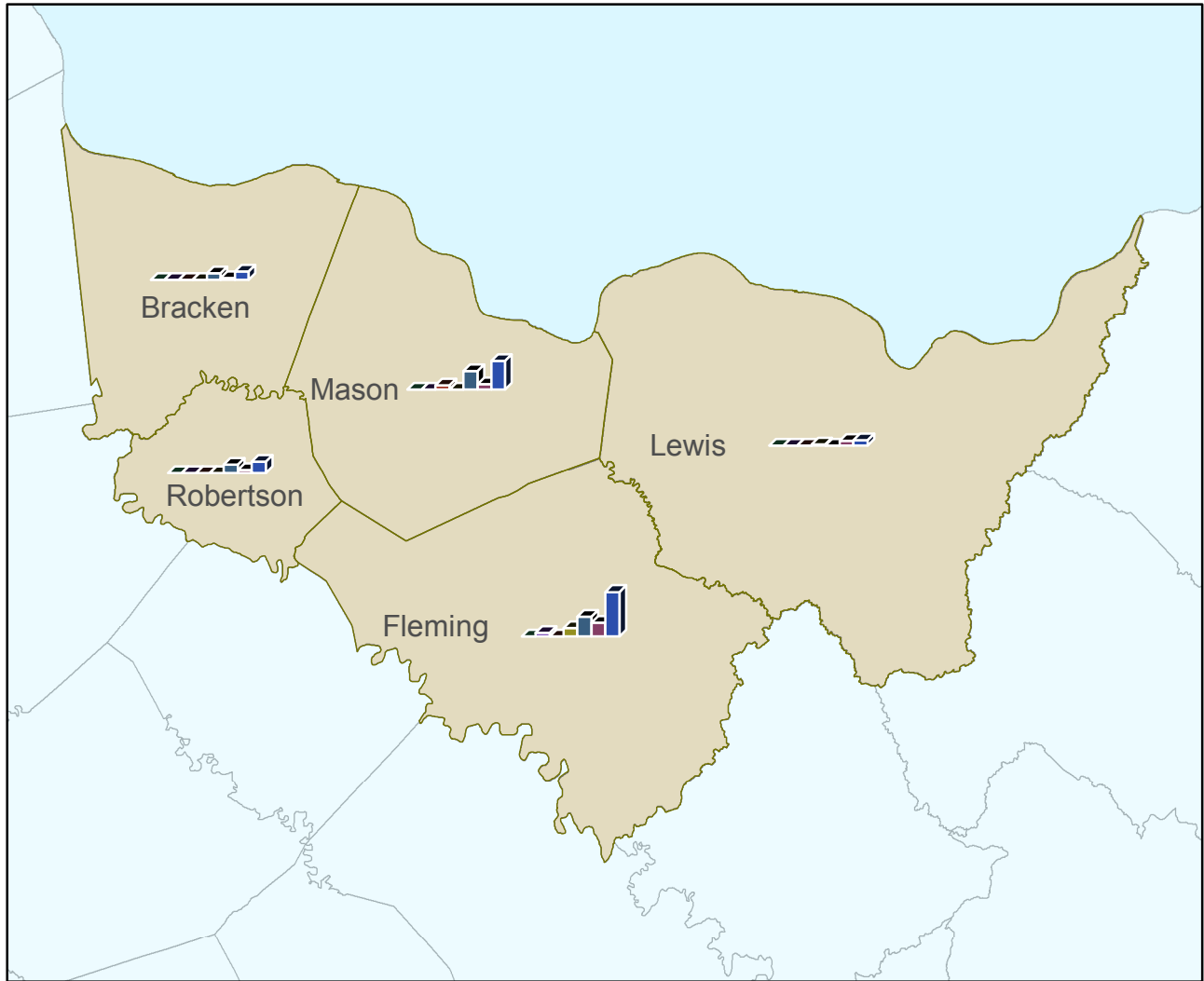


Bluegrass Area Development District

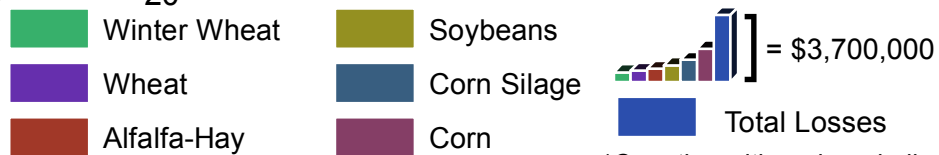
County	No. Vulnerable State Facilities	Replacement Cost Value
Anderson	1	\$64,974.00
Bourbon	0	\$0.00
Boyle	0	\$0.00
Clark	0	\$0.00
Estill	2	\$0.00
Fayette	10	\$135,028.00
Franklin	121	\$461,092,966.72
Garrard	0	\$0.00
Harrison	1	\$0.00
Jessamine	0	\$0.00
Lincoln	0	\$0.00
Madison	23	\$12,851,791.58
Mercer	7	\$681,699.00
Nicholas	0	\$0.00
Powell	25	\$1,980,270.46
Scott	0	\$0.00
Woodford	0	\$0.00

KDOW - 50





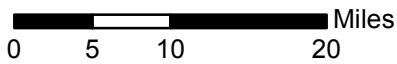
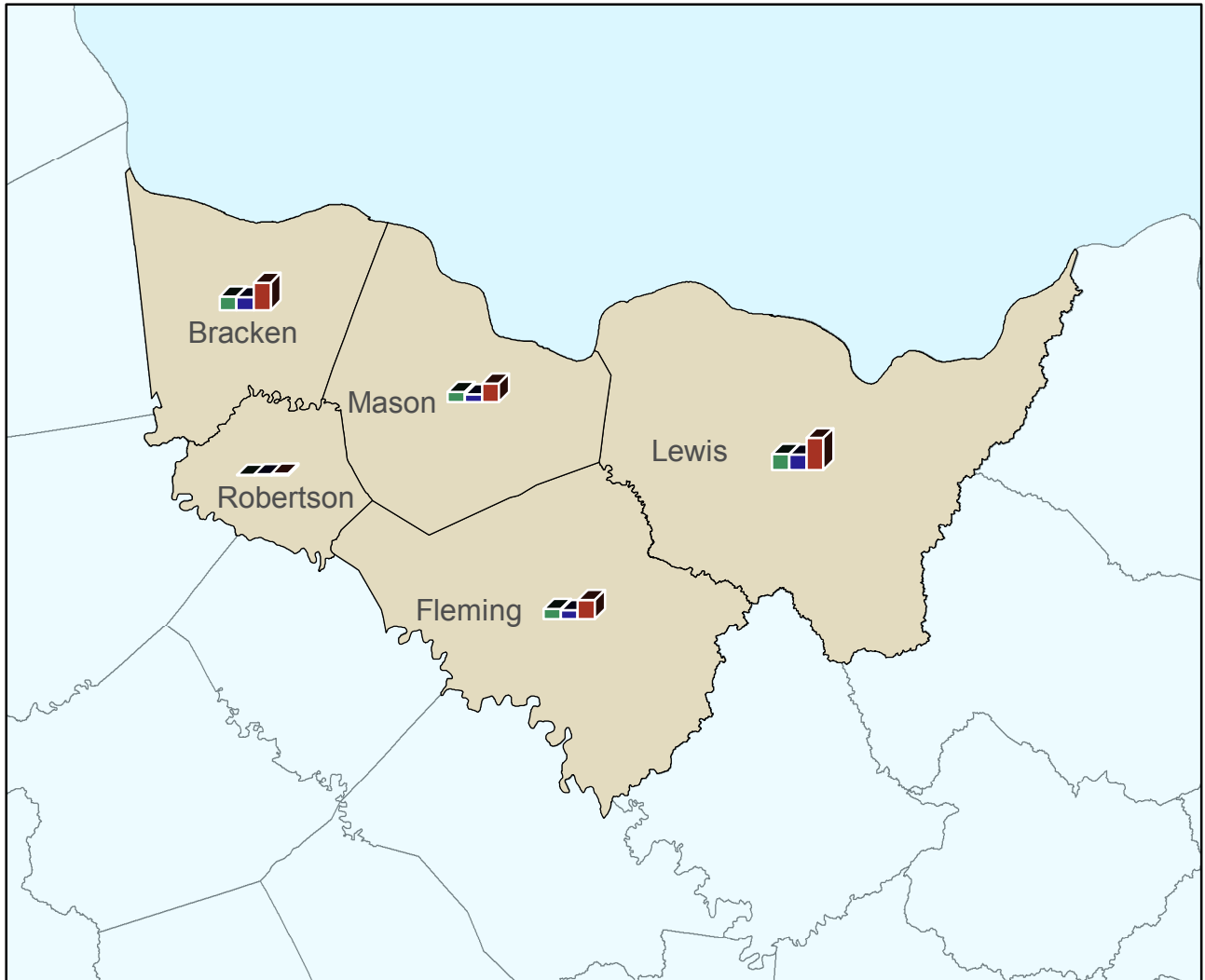
Agriculture Losses by County



*Counties with no bars indicate no losses.

Buffalo Trace Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Bracken	\$0.00	\$0.00	\$0.00	\$0.00	\$1,095,279.87	\$279,839.04	\$1,375,118.91
Fleming	\$0.00	\$0.00	\$551,816.97	\$1,354,945.16	\$3,216,868.86	\$2,252,769.57	\$7,376,400.56
Lewis	\$0.00	\$0.00	\$0.00	\$147,270.53	\$0.00	\$738,262.98	\$885,533.51
Mason	\$0.00	\$707,517.92	\$0.00	\$0.00	\$3,134,814.23	\$906,627.27	\$4,748,959.42
Robertson	\$0.00	\$0.00	\$0.00	\$0.00	\$1,380,521.90	\$499,447.40	\$1,879,969.30

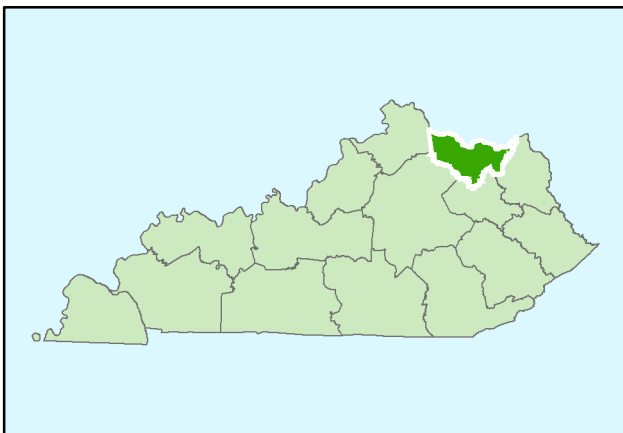


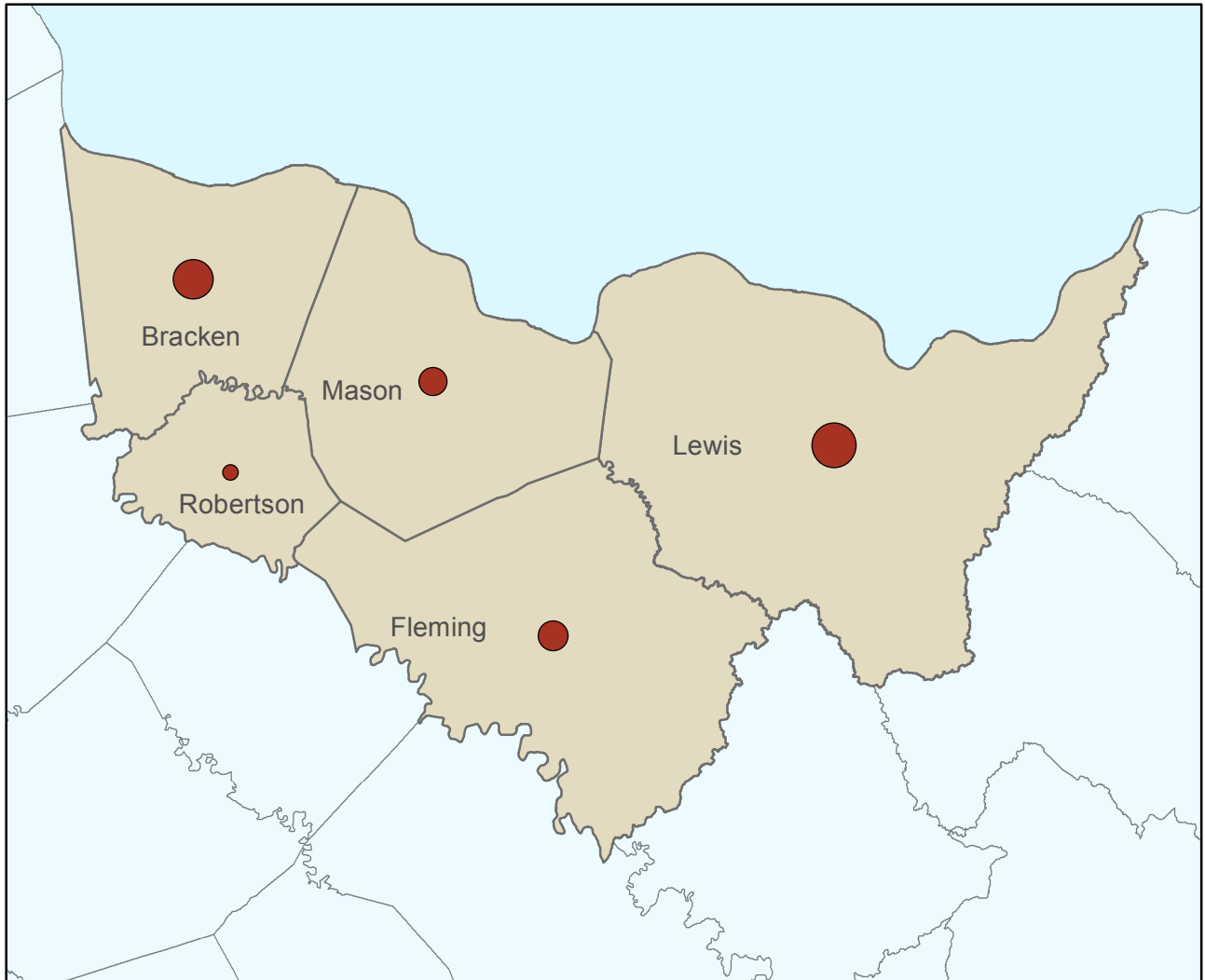
General Building Loss



Buffalo Trace Area Development District

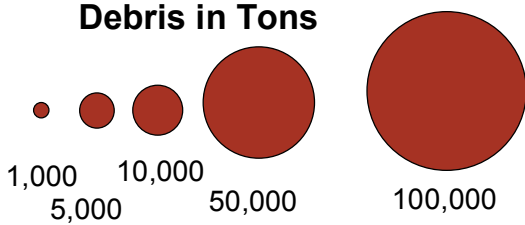
County	Total Loss	Bldg Loss	Contents Loss
Bracken	\$63,466.00	\$30,531.00	\$31,698.00
Fleming	\$45,243.00	\$20,367.00	\$23,608.00
Lewis	\$74,898.00	\$36,457.00	\$37,218.00
Mason	\$42,930.00	\$18,236.00	\$23,594.00
Robertson	\$4,741.00	\$2,967.00	\$1,733.00





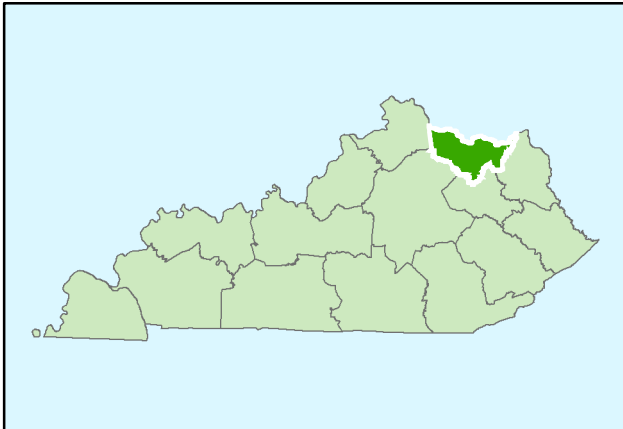
0 5 10 20 Miles

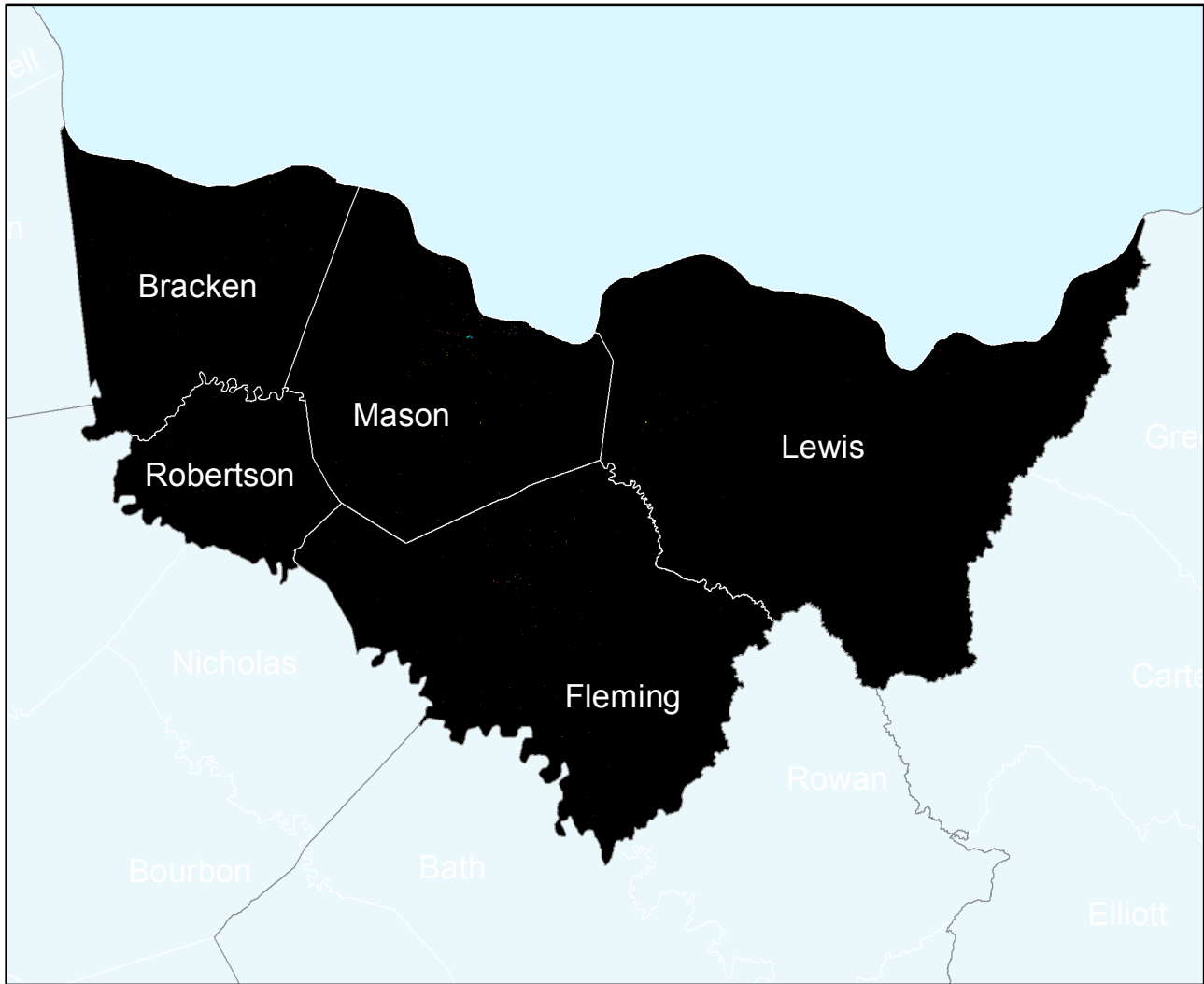
Debris in Tons



Buffalo Trace Area Development District

County	Debris Tons
Bracken	8020
Fleming	4556
Lewis	9568
Mason	3848
Robertson	1291



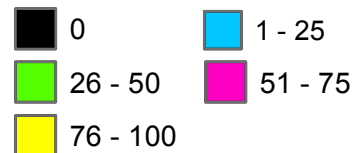


0 5 10 20 Miles

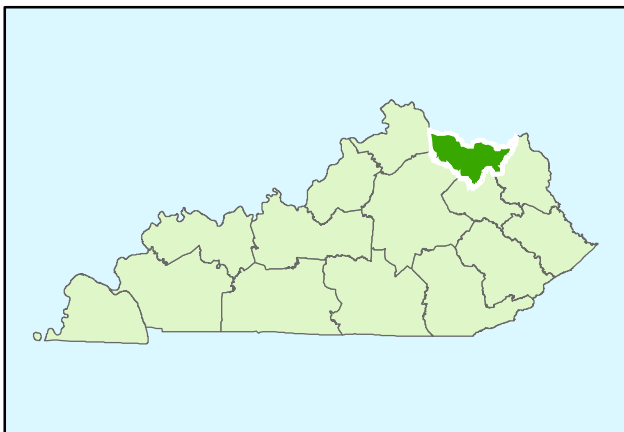


BUFFALO TRACE Area Development District

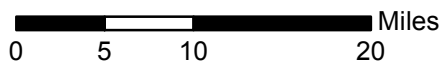
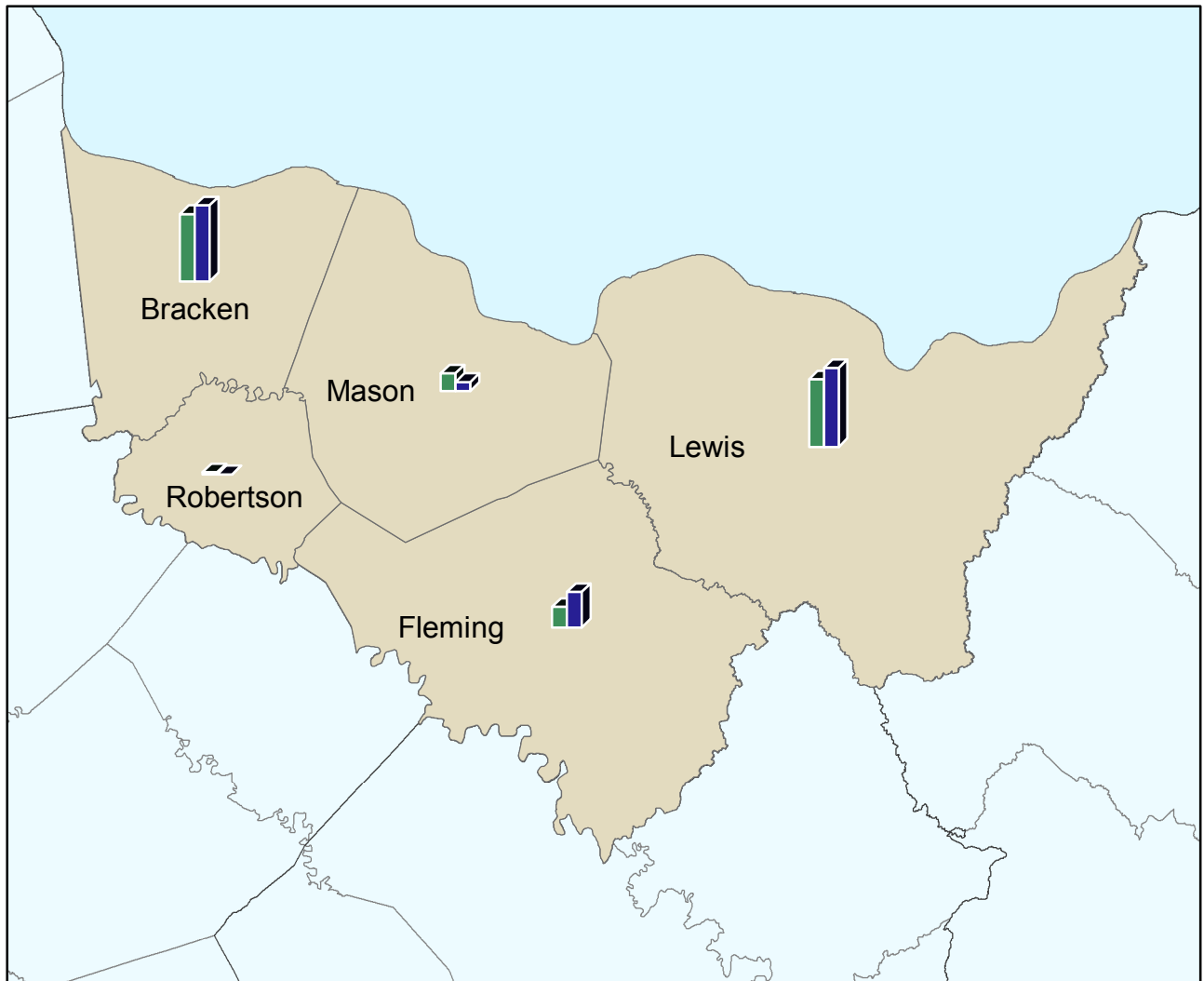
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**

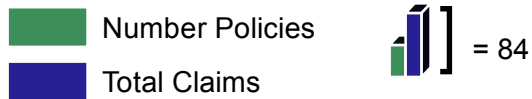


Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.

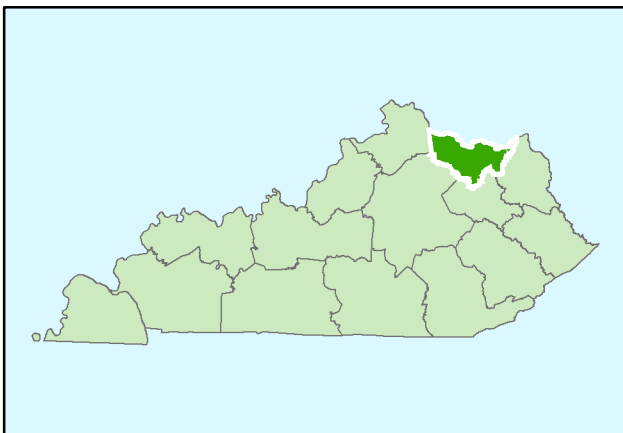


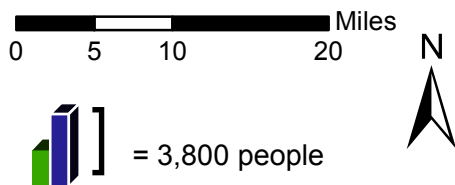
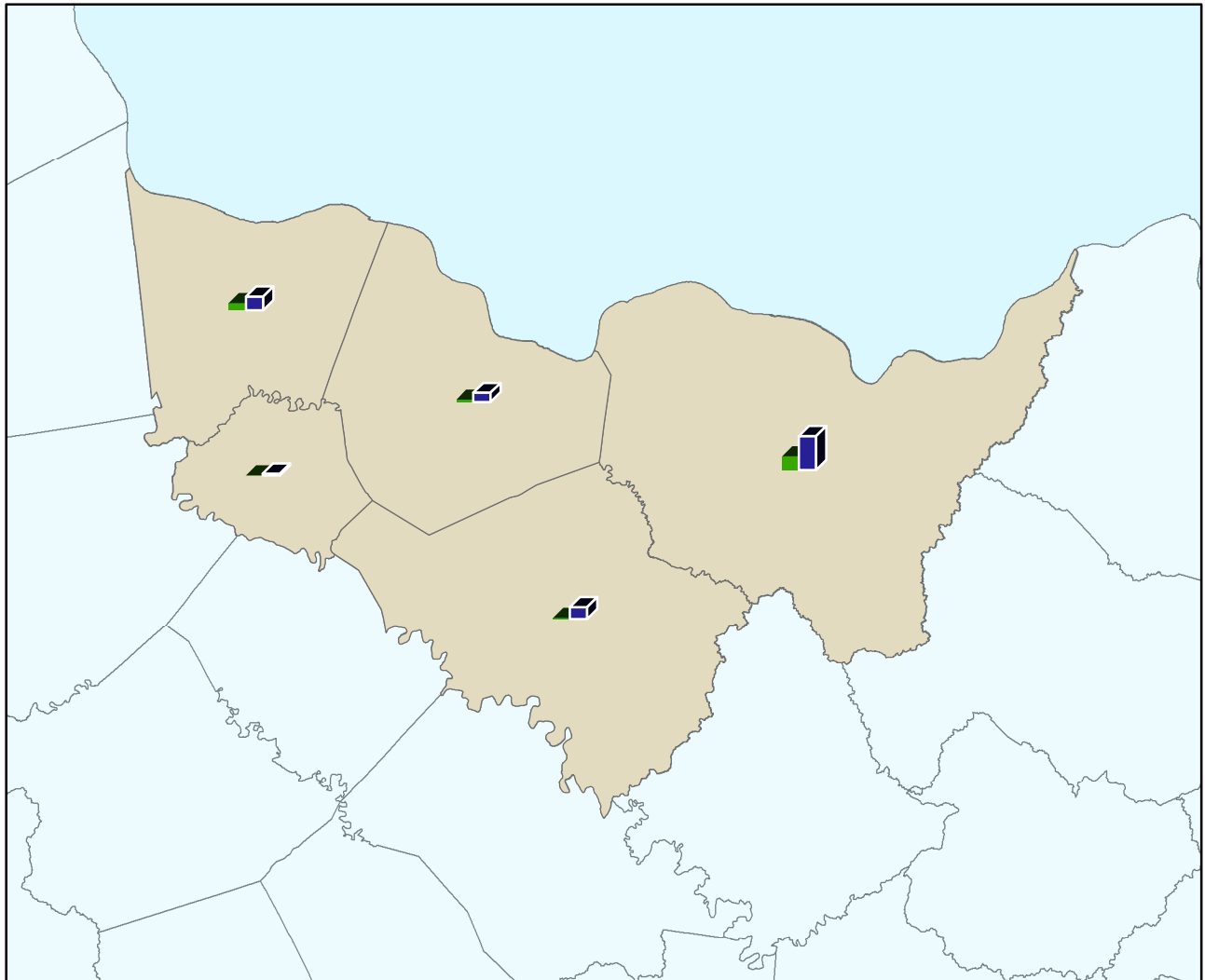
Buffalo Trace Area Development District


National Flood Insurance Program Policies and Claims (1978 - May 2018)




County	Number Policies	Total Claims
Bracken	95	107
Fleming	29	50
Lewis	95	111
Mason	25	13
Robertson	3	0





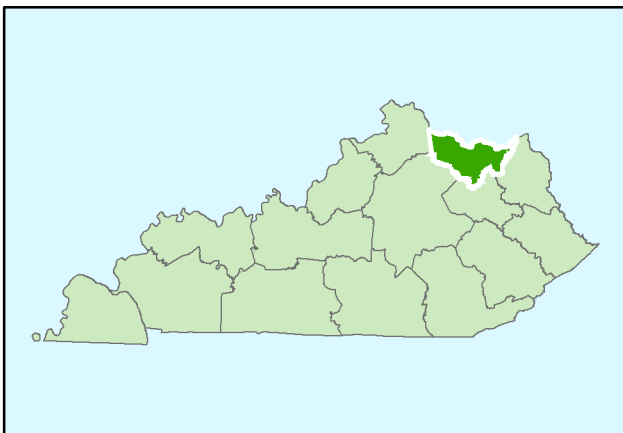
 = 3,800 people

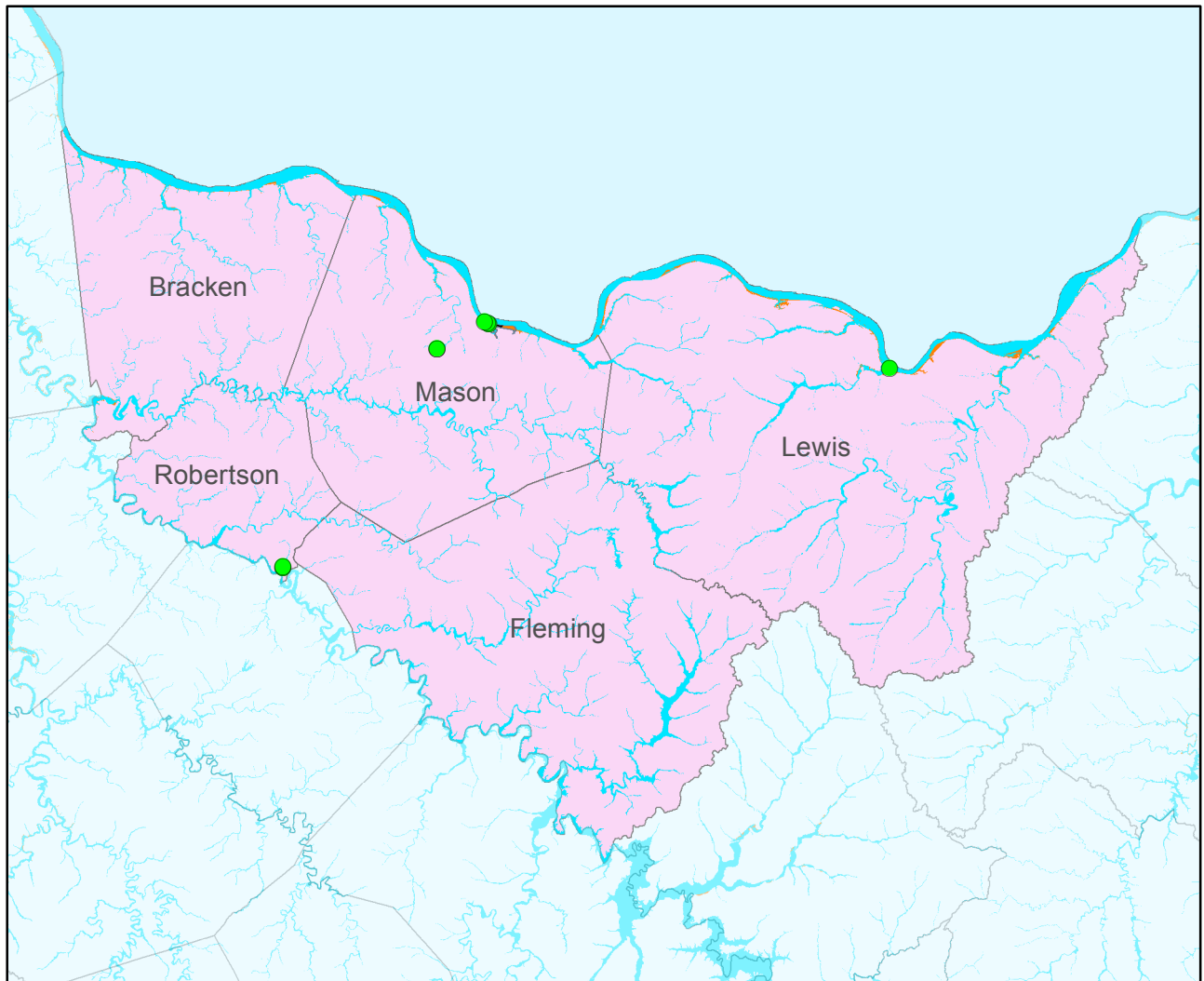
 Need Shelter

 Displaced

Buffalo Trace Area Development District

County	Displaced	Need Shelter
Bracken	758	373
Fleming	662	69
Lewis	1874	749
Mason	513	141
Robertson	85	5



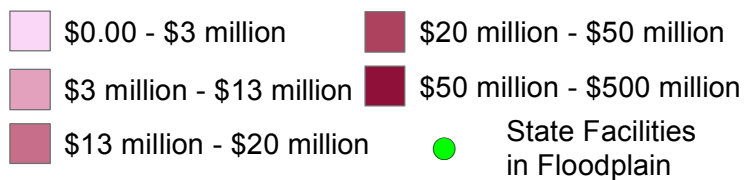


0 5 10 20 Miles

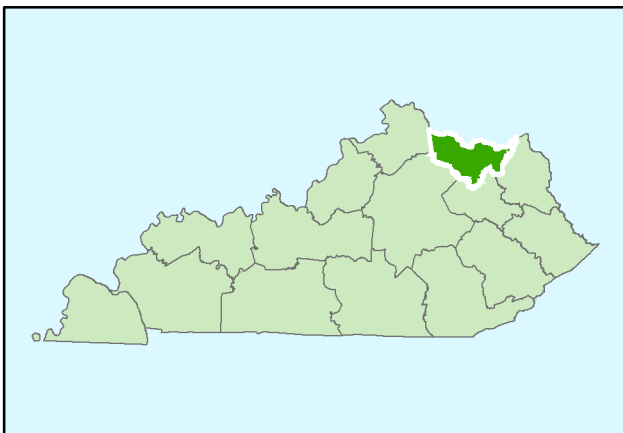


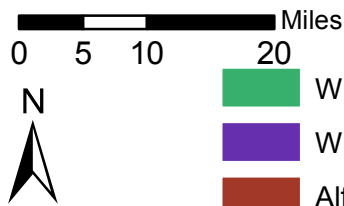
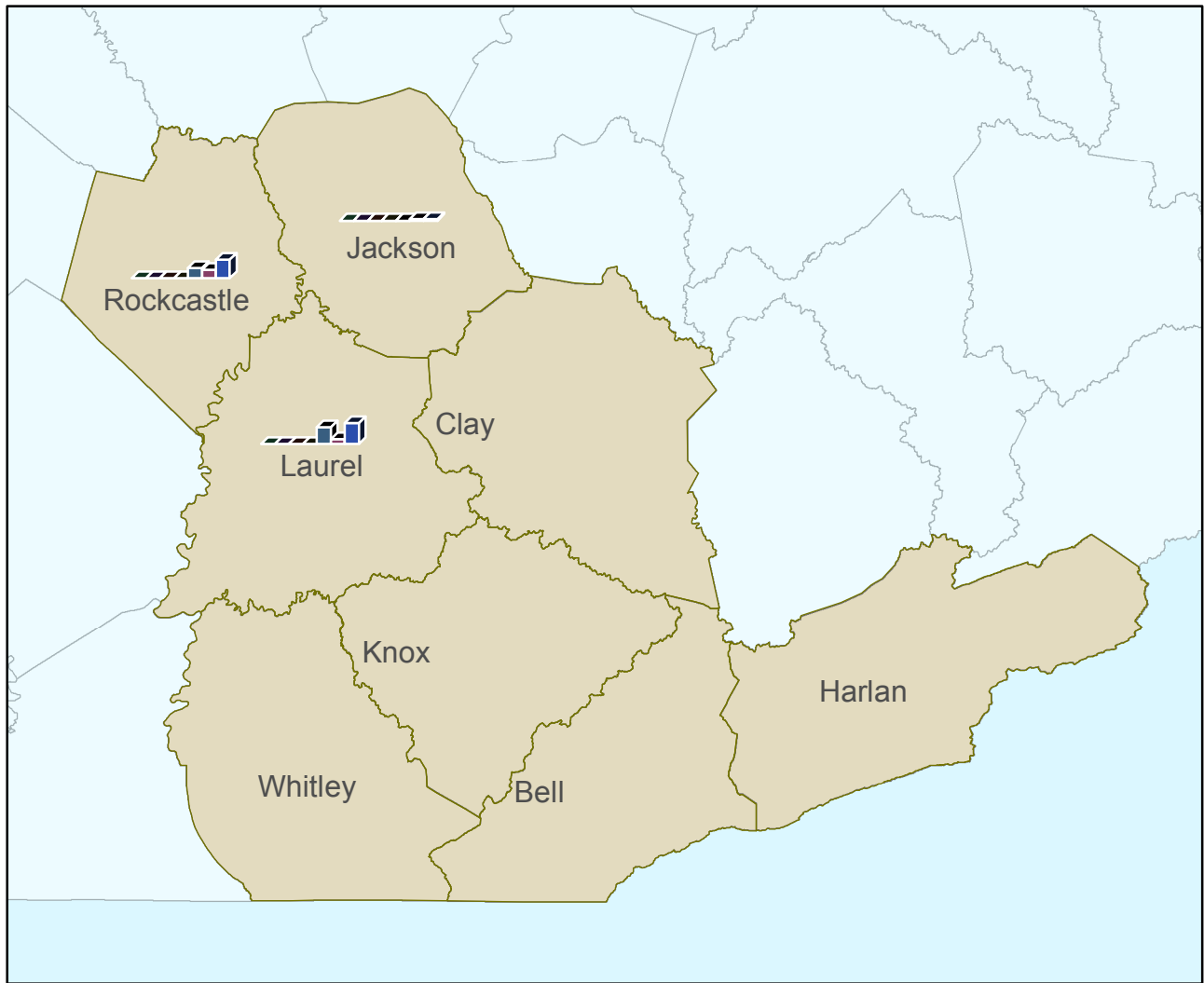
Buffalo Trace Area Development District

Replacement Cost Value



County	No. Vulnerable State Facilities	Replacement Cost Value
Bracken	0	\$0.00
Fleming	0	\$0.00
Lewis	1	\$0.00
Mason	5	\$61,976.00
Robertson	2	\$305,449.00





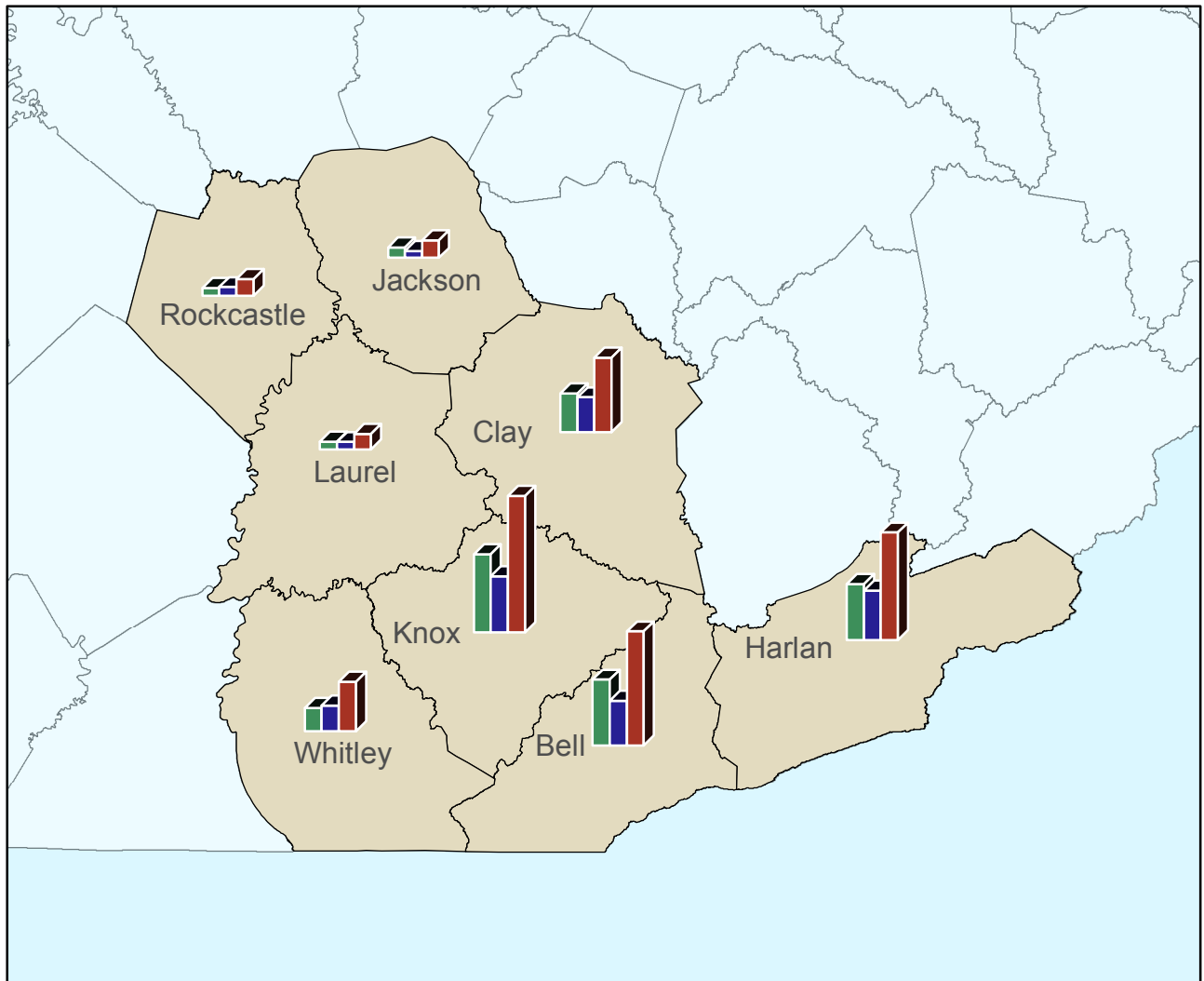
Agriculture Losses by County



*Counties with no bars indicate no losses.

Cumberland Valley Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN
Jackson	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$295,302.83
Laurel	\$0.00	\$0.00	\$0.00	\$0.00	\$2,764,688.17	\$737,076.83
Rockcastle	\$0.00	\$0.00	\$0.00	\$0.00	\$1,698,611.46	\$1,330,226.39
Bell	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Clay	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Harlan	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Knox	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Whitley	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00



0 5 10 20 Miles



Cumberland Valley Area Development District

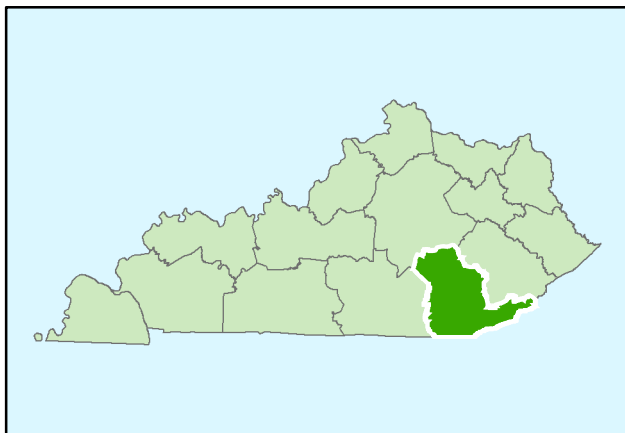
General Building Loss

Contents Loss

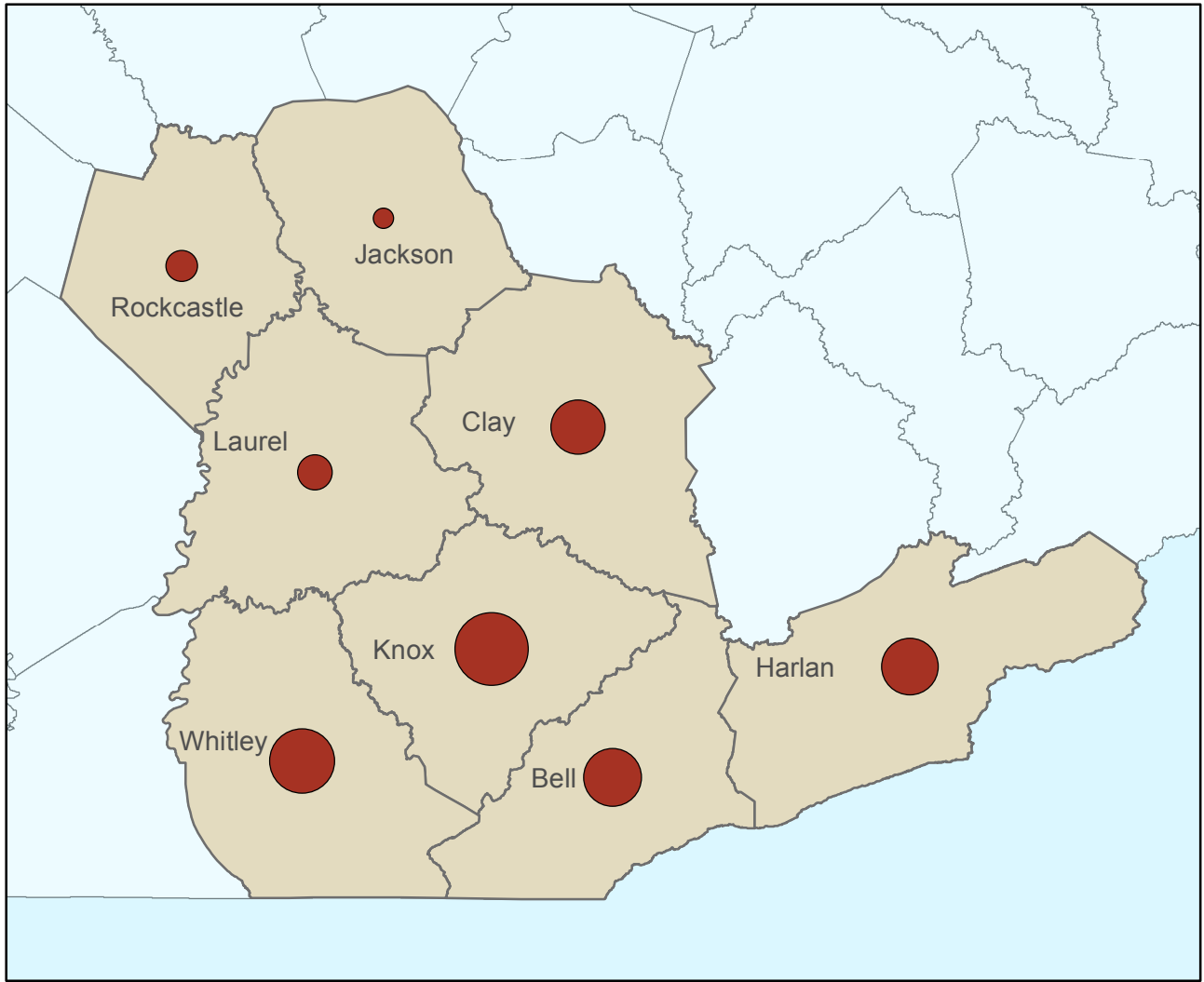
Building Loss

Total Loss

= \$160,000

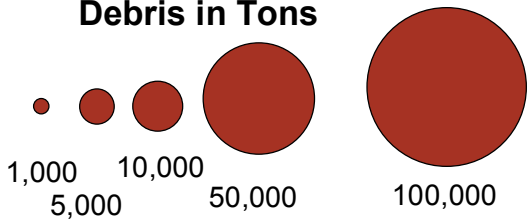


County	Total Loss	Bldg Loss	Contents Loss
Bell	\$267,714.00	\$104,635.00	\$154,377.00
Clay	\$175,003.00	\$81,456.00	\$90,325.00
Harlan	\$252,712.00	\$116,706.00	\$132,060.00
Jackson	\$41,535.00	\$16,077.00	\$24,883.00
Knox	\$320,714.00	\$131,604.00	\$183,901.00
Laurel	\$36,625.00	\$17,823.00	\$17,990.00
Rockcastle	\$39,466.00	\$20,084.00	\$18,489.00
Whitley	\$116,065.00	\$59,493.00	\$54,761.00



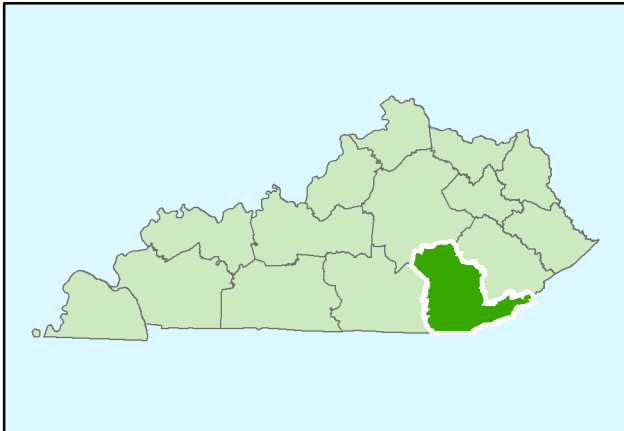
0 5 10 20 Miles

Debris in Tons



Cumberland Valley Area Development District

County	Debris Tons
Bell	16491
Clay	14196
Harlan	15675
Jackson	2227
Knox	26156
Laurel	6144
Rockcastle	4741
Whitley	20406



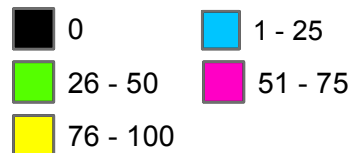


0 5 10 20 Miles

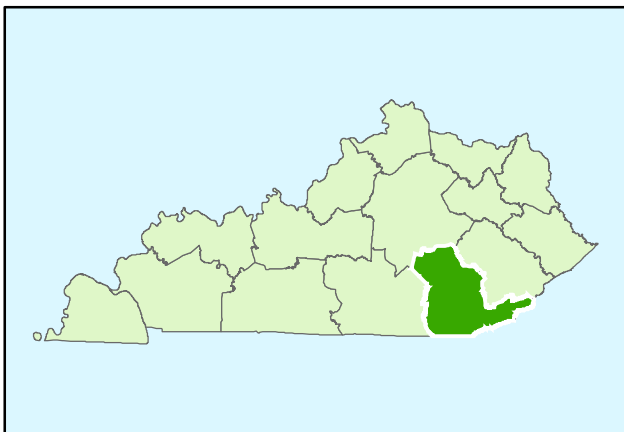


CUMBERLAND VALLEY Area Development District

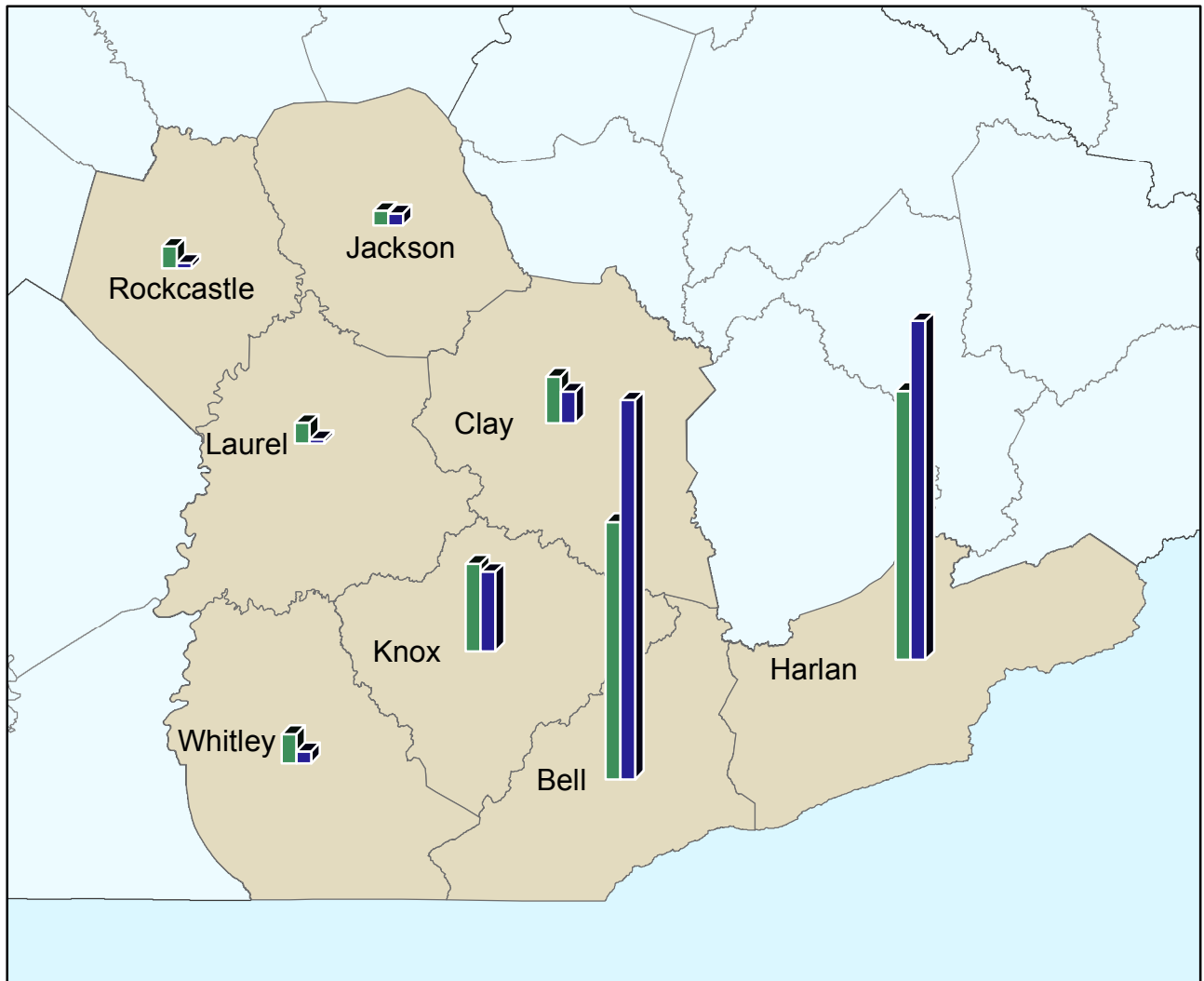
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**



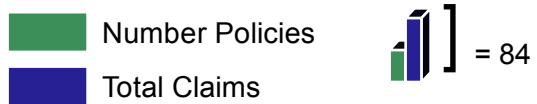
Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



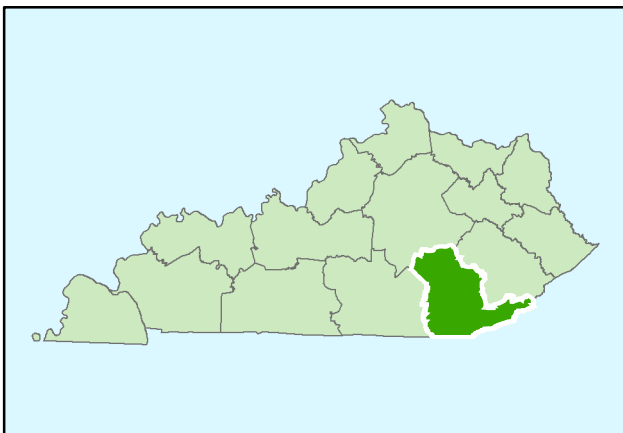
0 5 10 20 Miles

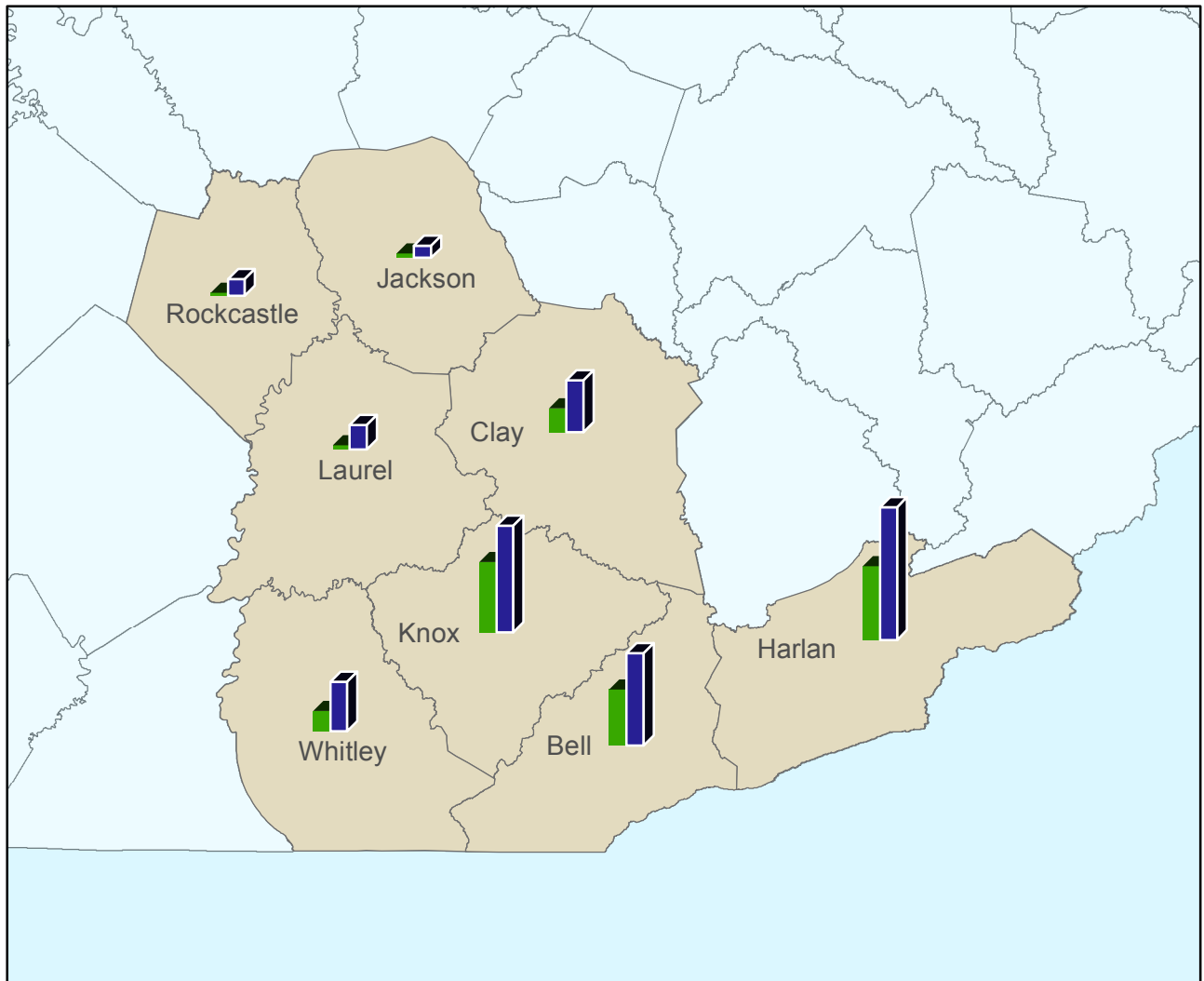
Cumberland Valley Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)



County	Number Policies	Total Claims
Bell	363	535
Clay	66	45
Harlan	379	478
Jackson	21	17
Knox	123	112
Laurel	29	6
Rockcastle	31	8
Whitley	41	17





0 5 10 20 Miles



= 3,800 people



Need Shelter

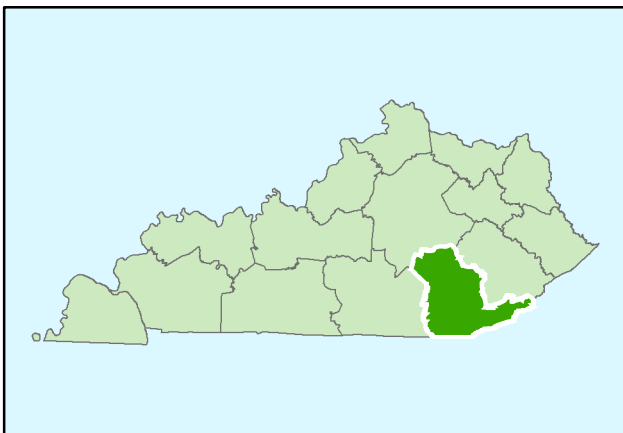


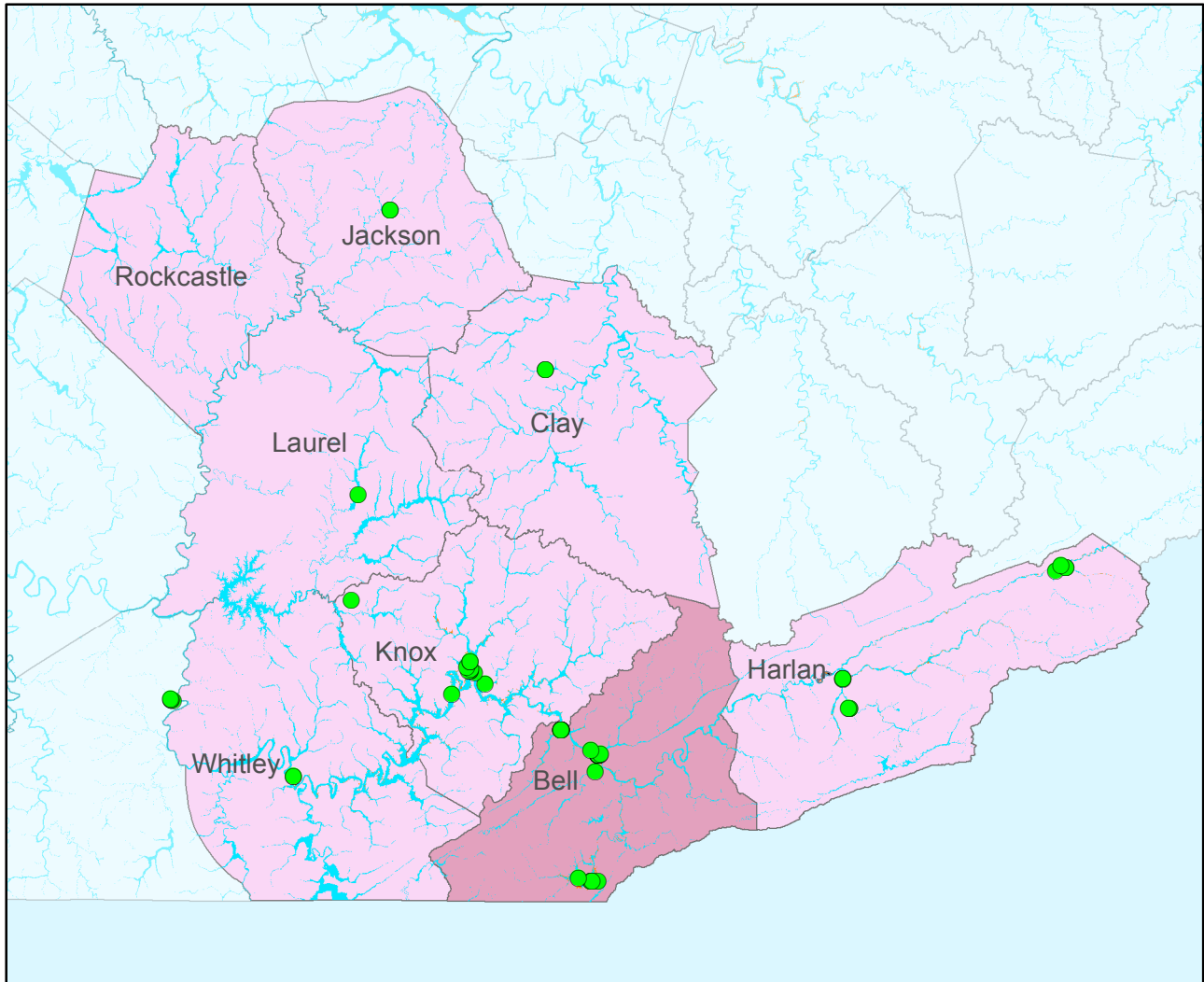
Displaced



Cumberland Valley Area Development District

County	Displaced	Need Shelter
Bell	5118	3089
Clay	2860	1323
Harlan	7354	4112
Jackson	669	240
Knox	5924	3915
Laurel	1356	242
Rockcastle	913	170
Whitley	2719	1119



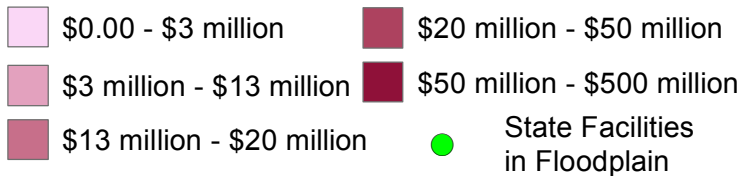


0 5 10 20 Miles



Cumberland Valley Area Development District

Replacement Cost Value

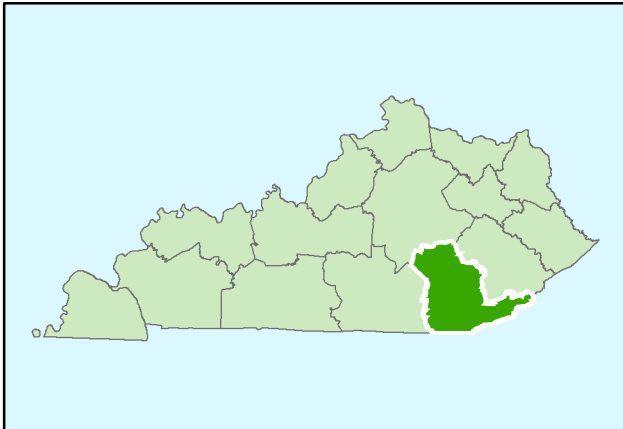


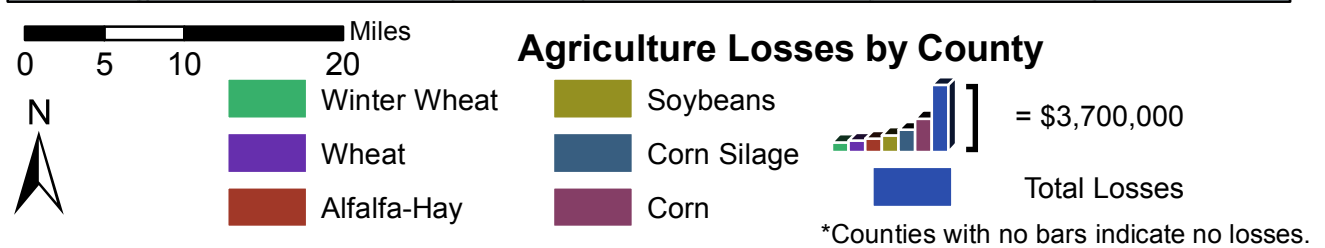
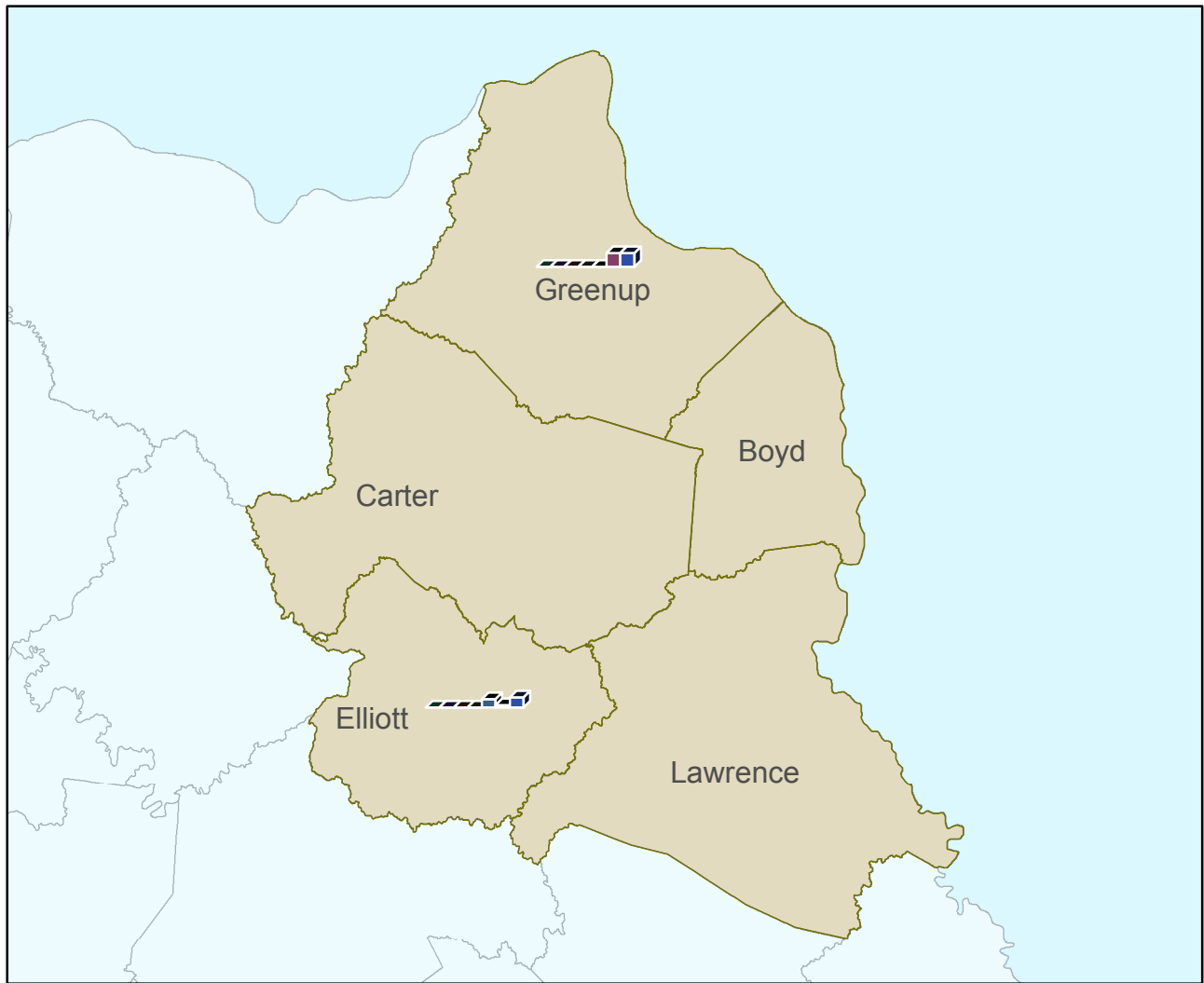
County

No. Vulnerable State Facilities

Replacement Cost Value

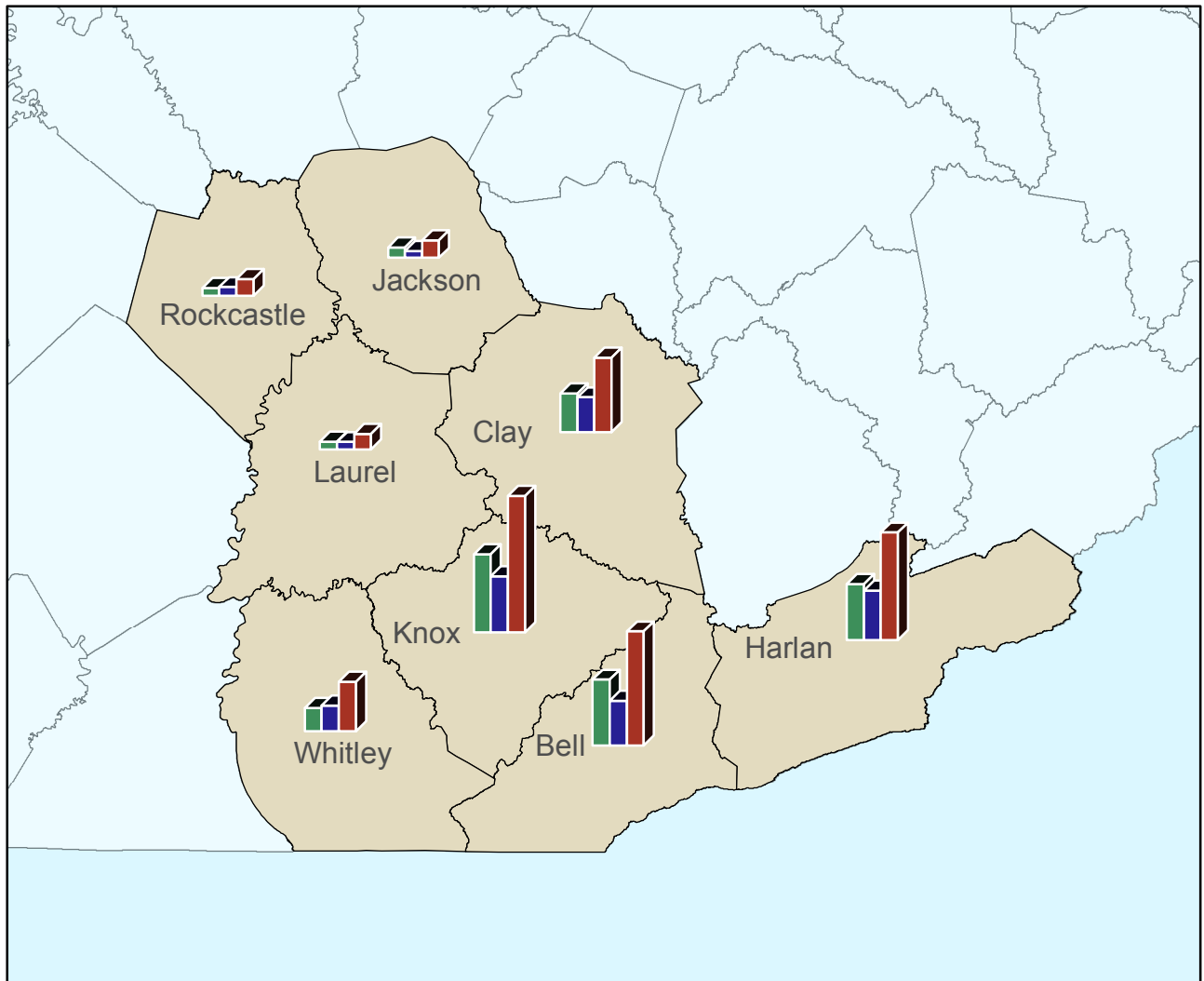
Bell	27	\$6,154,935.46
Clay	2	\$0.00
Harlan	11	\$1,639,304.60
Jackson	2	\$0.00
Knox	11	\$2,107,870.98
Laurel	1	\$131,971.00
Rockcastle	0	\$0.00
Whitley	6	\$876,719.00





FIVCO Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Elliott	\$0.00	\$0.00	\$0.00	\$0.00	\$1,336,525.01	\$345,536.00	\$1,682,061.01
Greenup	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$2,329,783.90	\$2,329,783.90
Boyd	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Carter	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Lawrence	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00



0 5 10 20 Miles



Cumberland Valley Area Development District

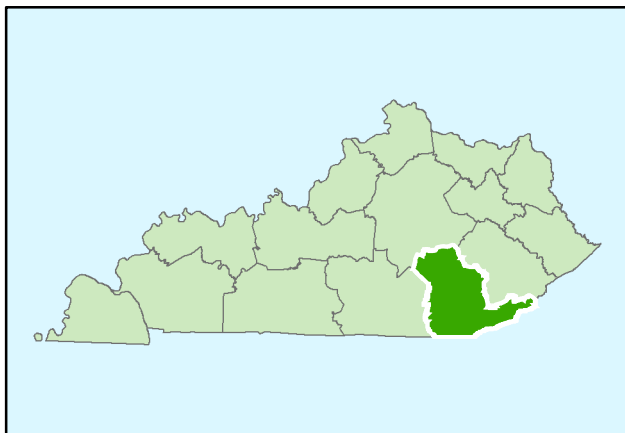
General Building Loss

Contents Loss

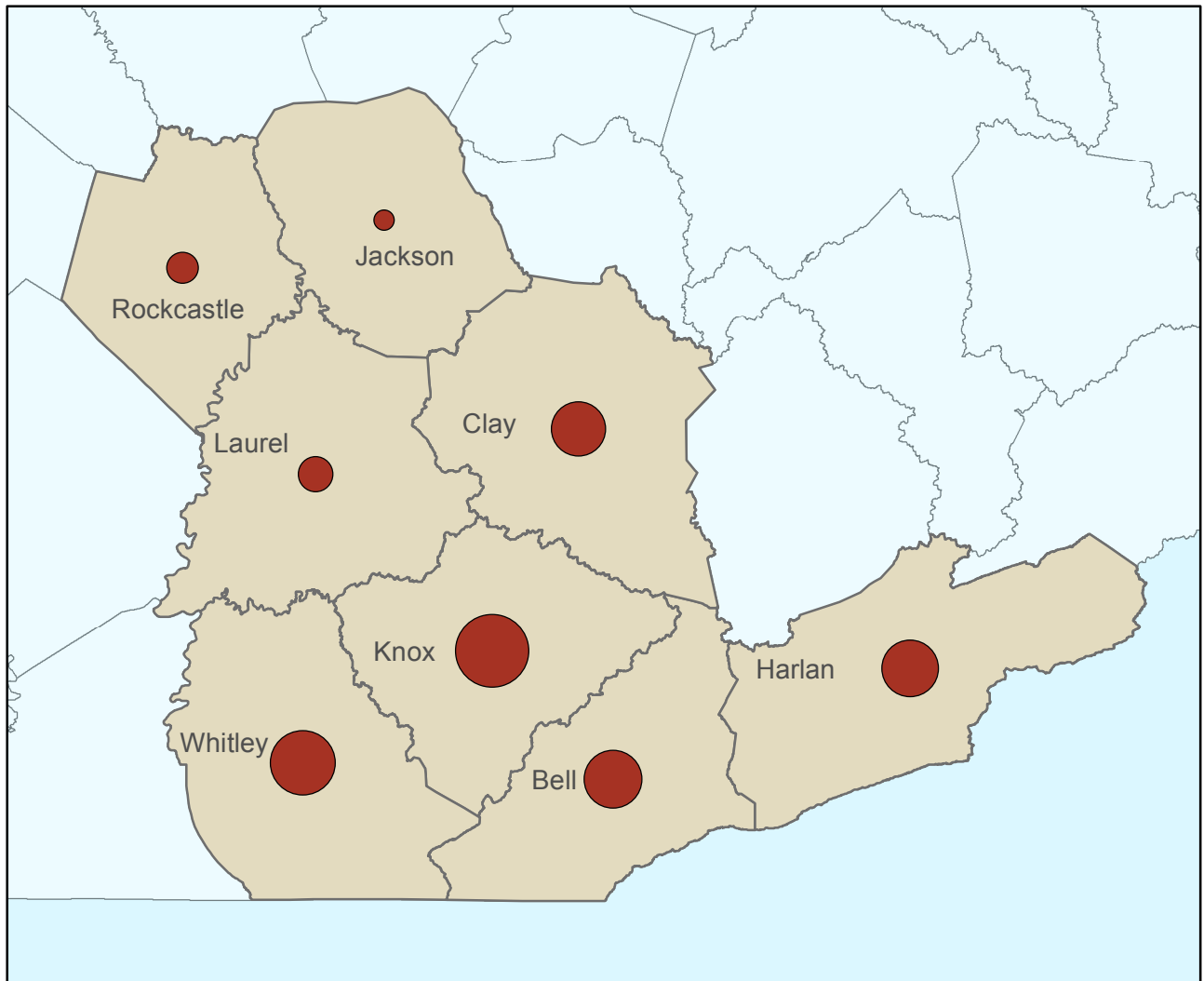
Building Loss

Total Loss

= \$160,000

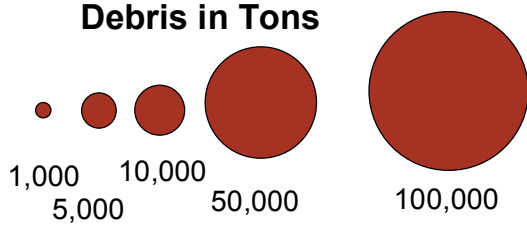


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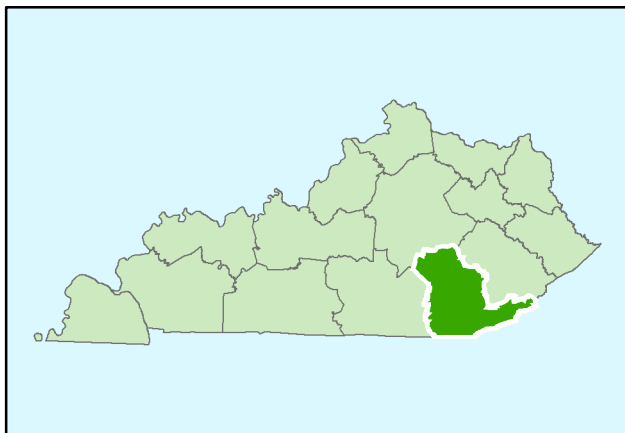
0 5 10 20 Miles

Debris in Tons



Cumberland Valley Area Development District

County	Debris Tons
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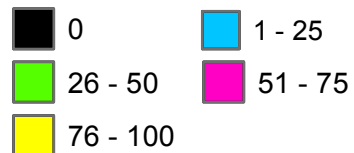


0 5 10 20 Miles

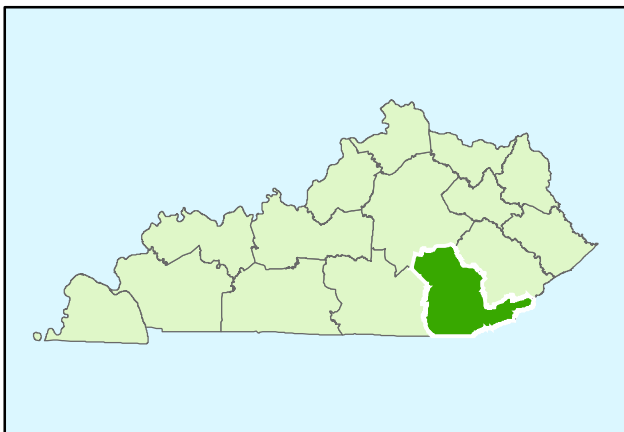


CUMBERLAND VALLEY Area Development District

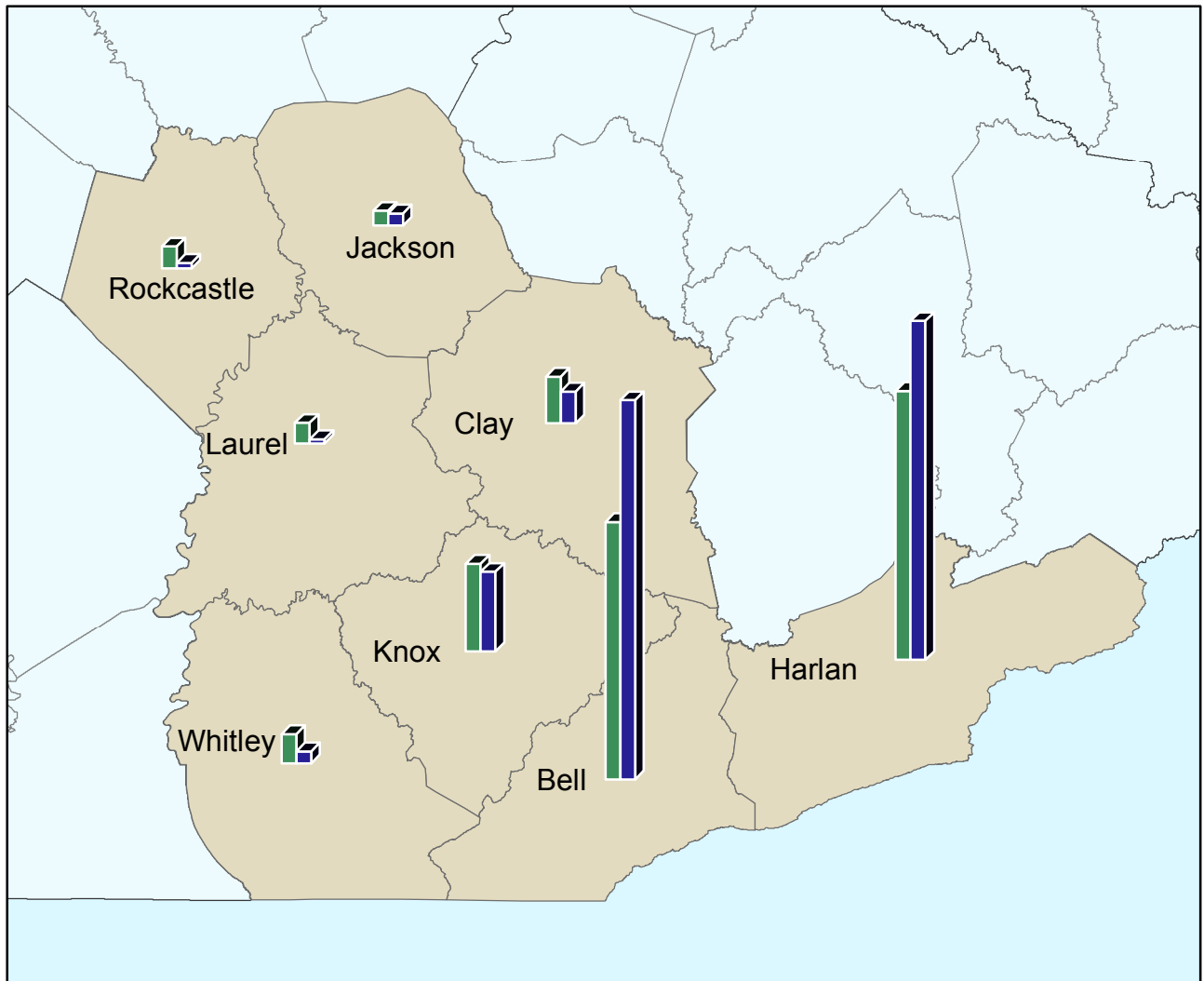
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**



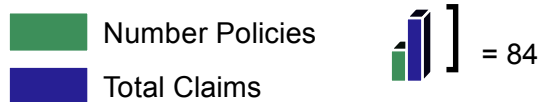
Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



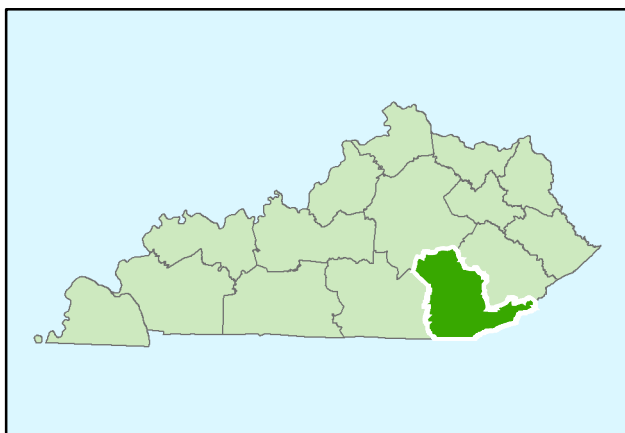
0 5 10 20 Miles

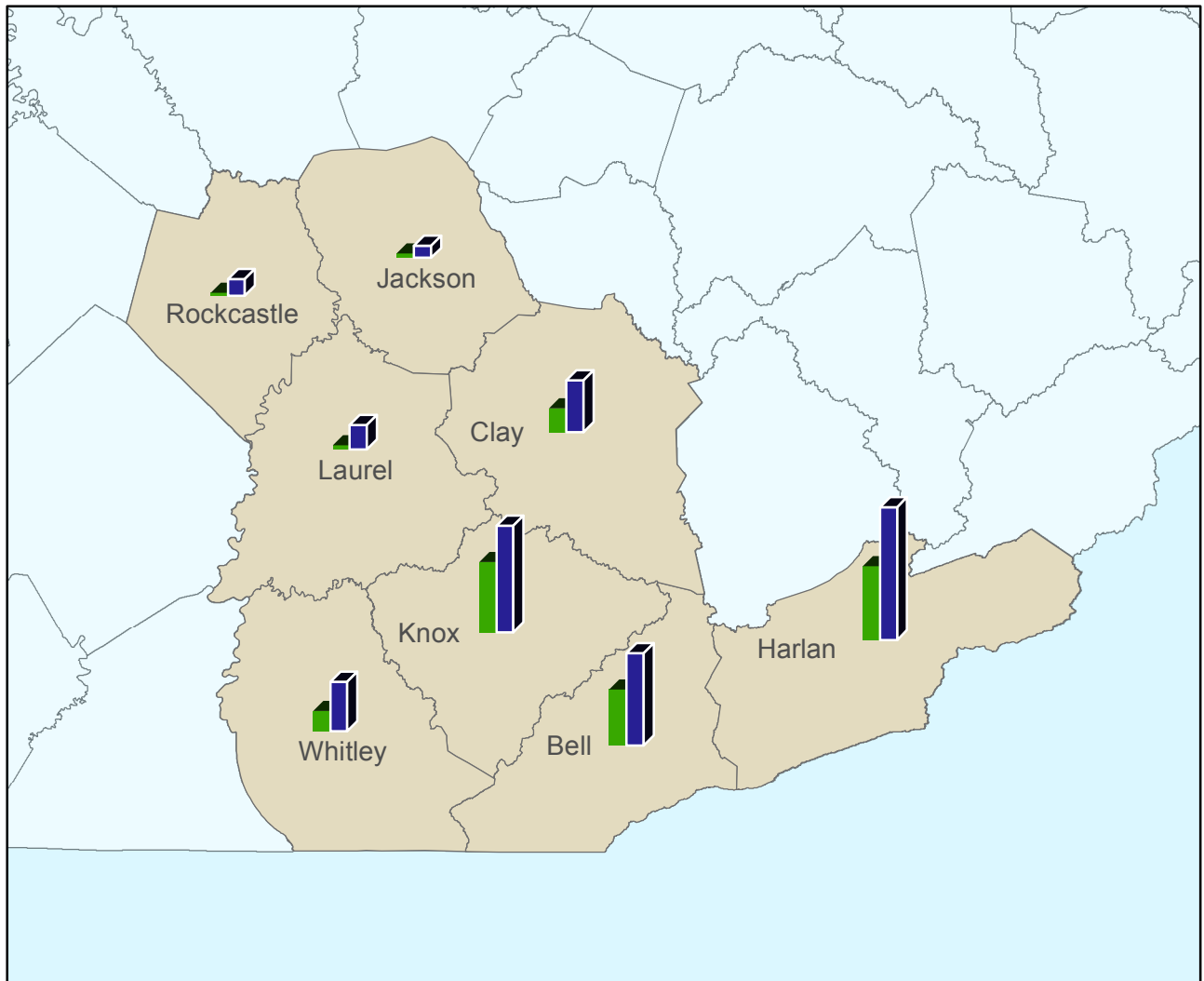
Cumberland Valley Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)




County	Number Policies	Total Claims
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Clay	66	45
Harlan	379	478
Jackson	21	17
Knox	123	112
Laurel	29	6
Rockcastle	31	8
Whitley	41	17





0 5 10 20 Miles

 = 3,800 people

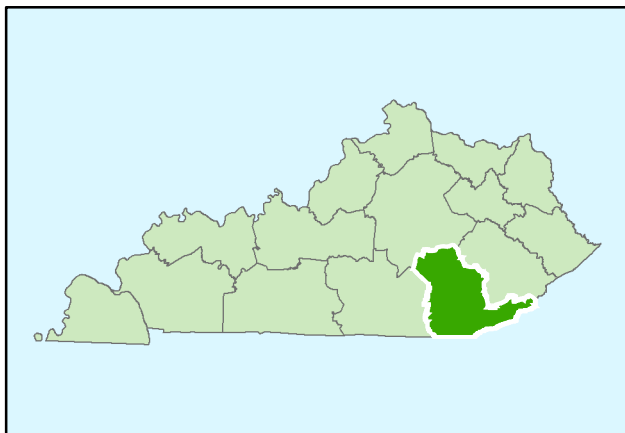
 Need Shelter

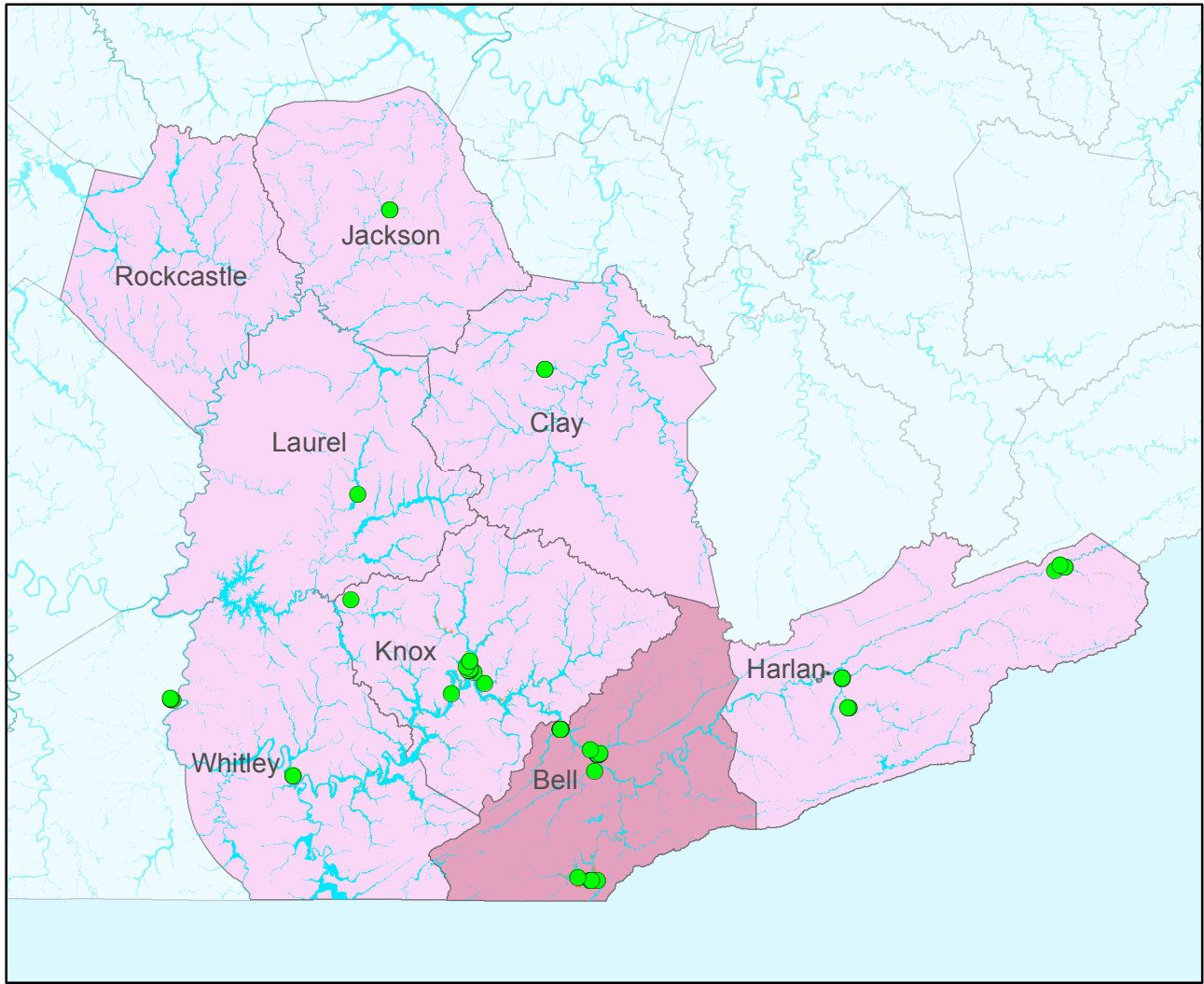
 Displaced



Cumberland Valley Area Development District

County	Displaced	Need Shelter
Bell	5118	3089
Clay	2860	1323
Harlan	7354	4112
Jackson	669	240
Knox	5924	3915
Laurel	1356	242
Rockcastle	913	170
Whitley	2719	1119



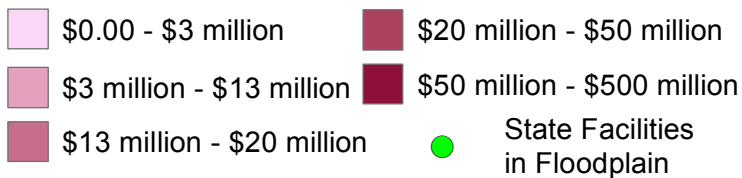


0 5 10 20 Miles



Cumberland Valley Area Development District

Replacement Cost Value

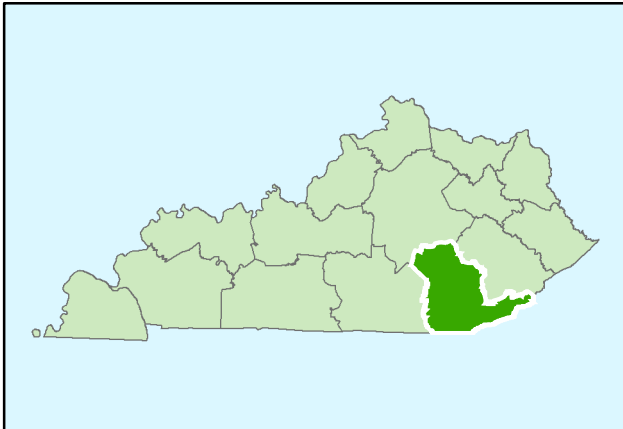


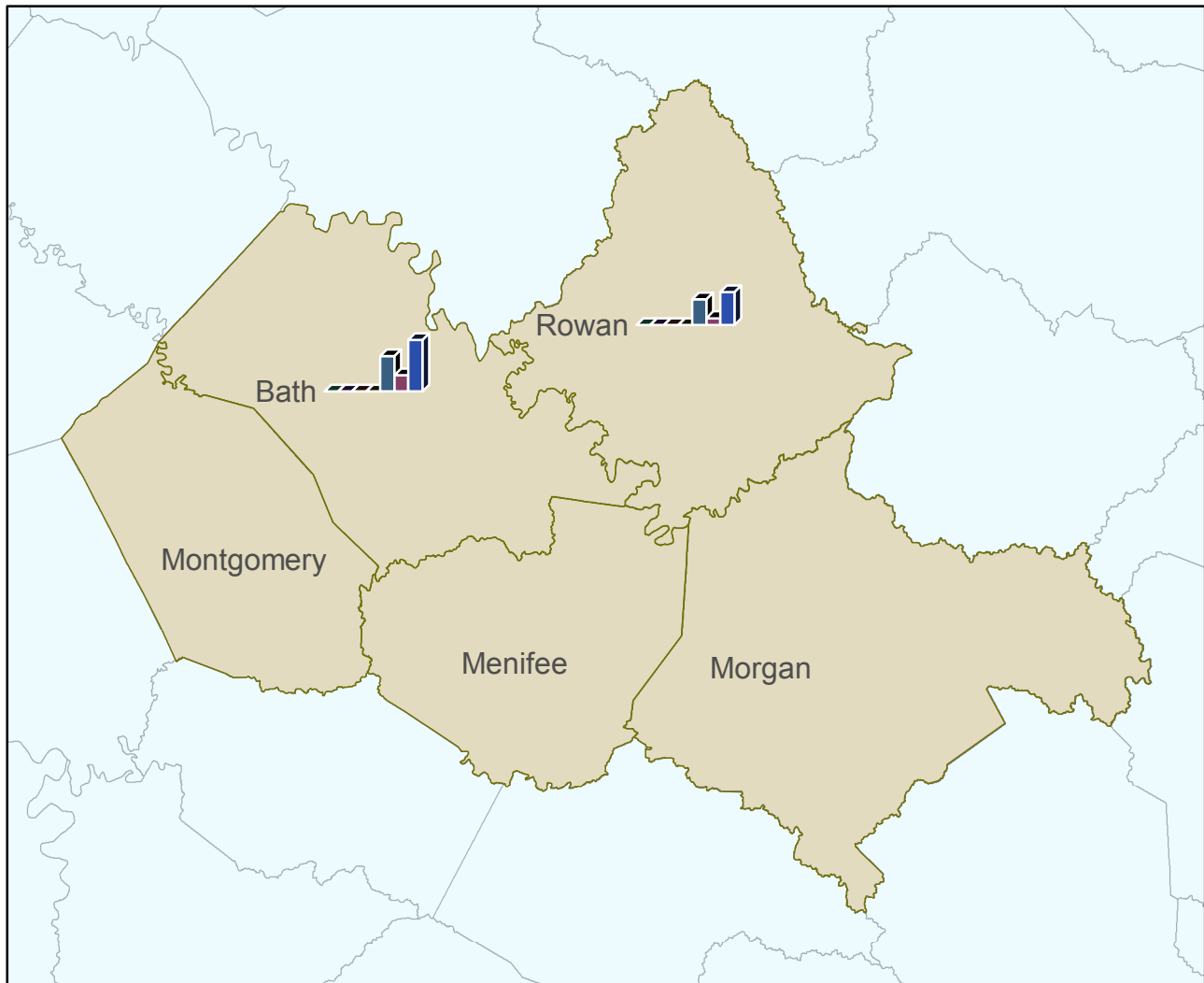
County

No. Vulnerable State Facilities

Replacement Cost Value

Bell	27	\$6,154,935.46
Clay	2	\$0.00
Harlan	11	\$1,639,304.60
Jackson	2	\$0.00
Knox	11	\$2,107,870.98
Laurel	1	\$131,971.00
Rockcastle	0	\$0.00
Whitley	6	\$876,719.00





0 4.5 9 18 Miles



Winter Wheat
Wheat
Alfalfa-Hay

Agriculture Losses by County

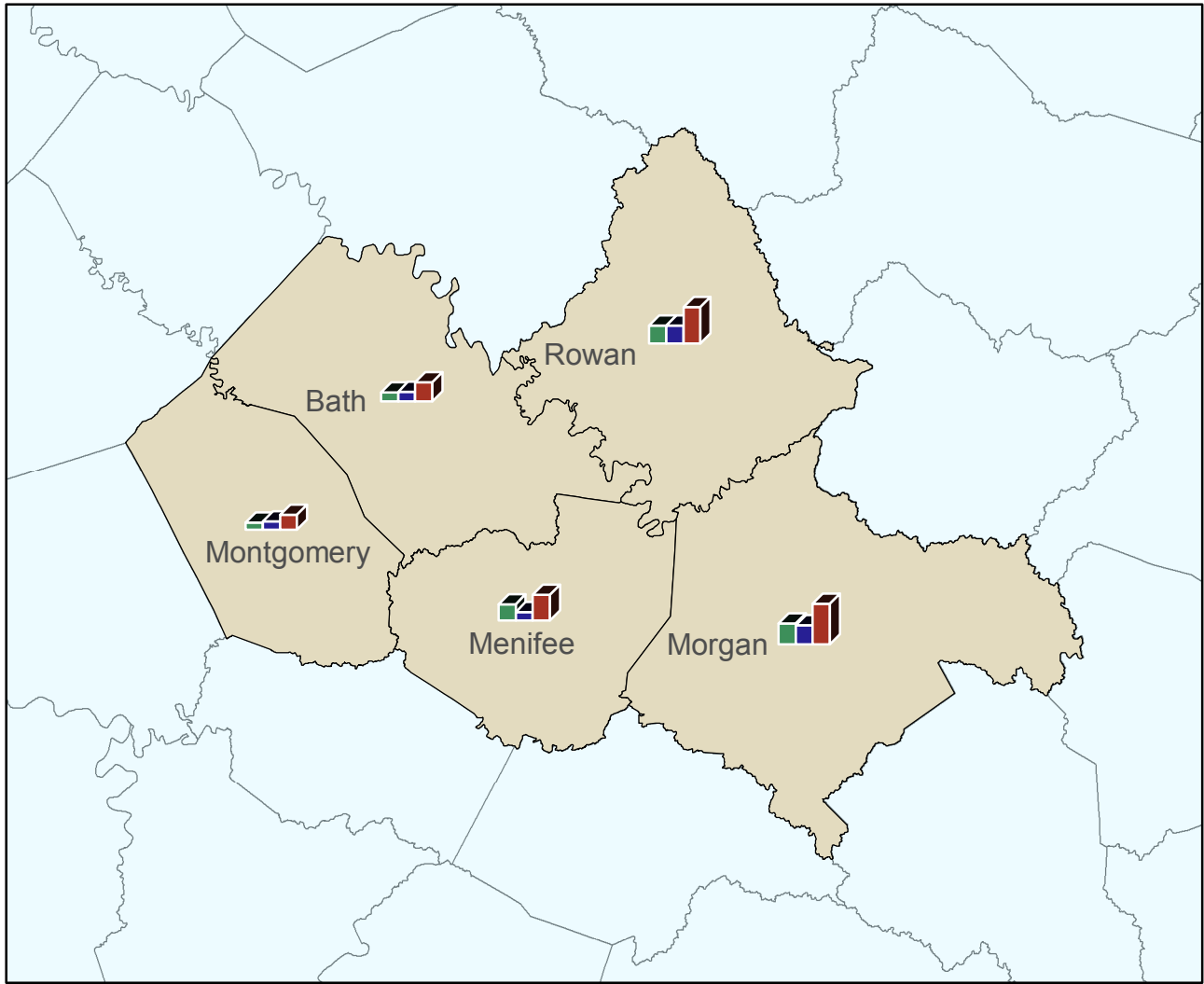
Soybeans
Corn Silage
Corn

= \$3,700,000
Total Losses

*Counties with no bars indicate no losses.

Gateway Area Development District


County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Bath	\$0.00	\$0.00	\$0.00	\$0.00	\$5,825,684.47	\$2,683,014.31	\$8,508,698.78
Row an	\$0.00	\$0.00	\$0.00	\$0.00	\$4,285,293.91	\$1,170,657.43	\$5,455,951.34
Meniffee	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Montgomery	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Morgan	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00



0 5 10 20 Miles




General Building Loss

 Contents Loss

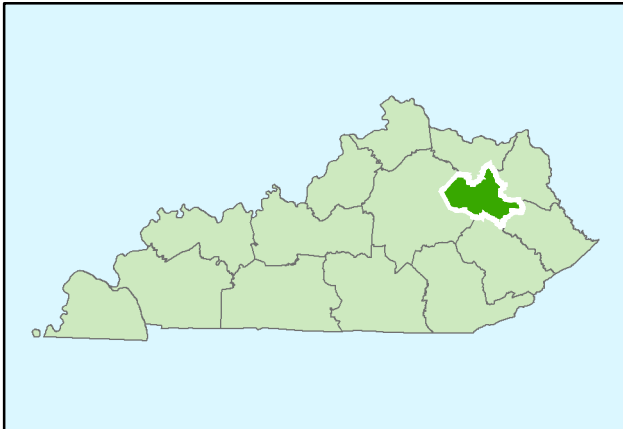
 Building Loss

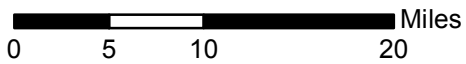
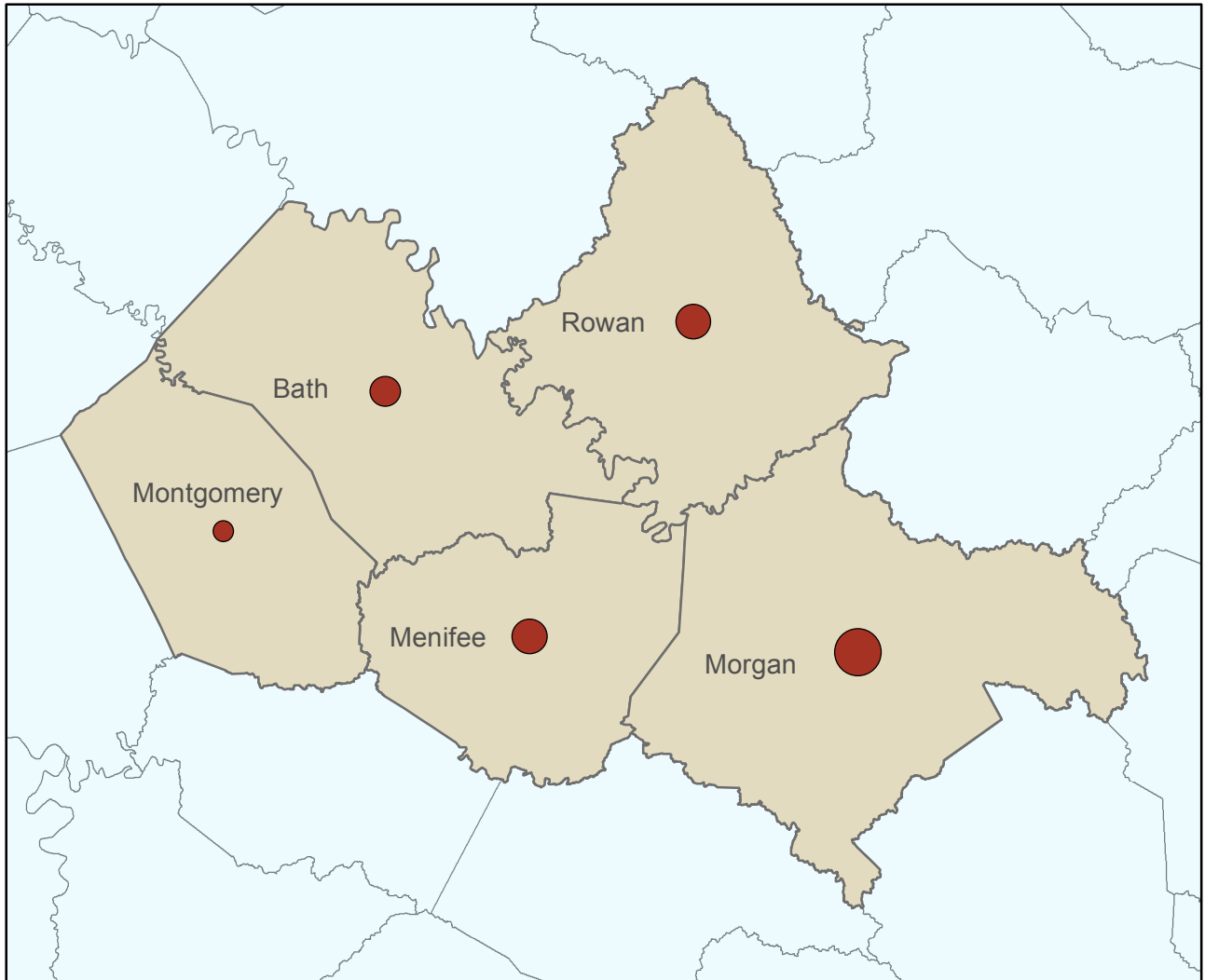
 Total Loss

 = \$160,000

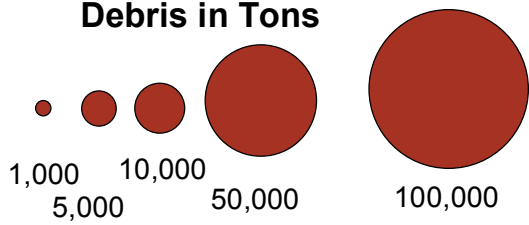
Gateway Area Development District

County	Total Loss	Bldg Loss	Contents Loss
Bath	\$44,340.00	\$22,550.00	\$21,099.00
Meniffee	\$60,272.00	\$20,467.00	\$38,095.00
Montgomery	\$34,944.00	\$18,733.00	\$15,824.00
Morgan	\$95,043.00	\$45,121.00	\$48,737.00
Rowan	\$85,360.00	\$41,781.00	\$41,409.00



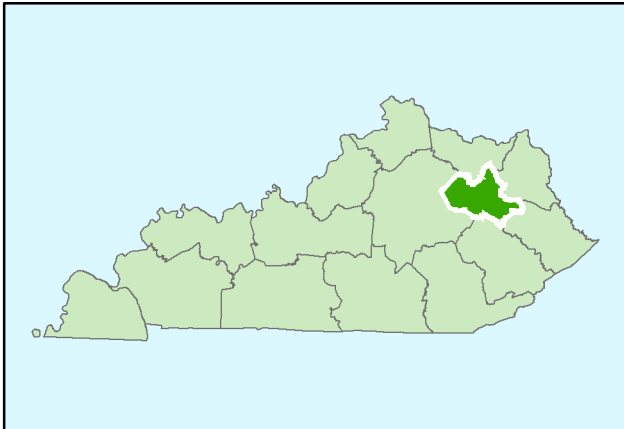


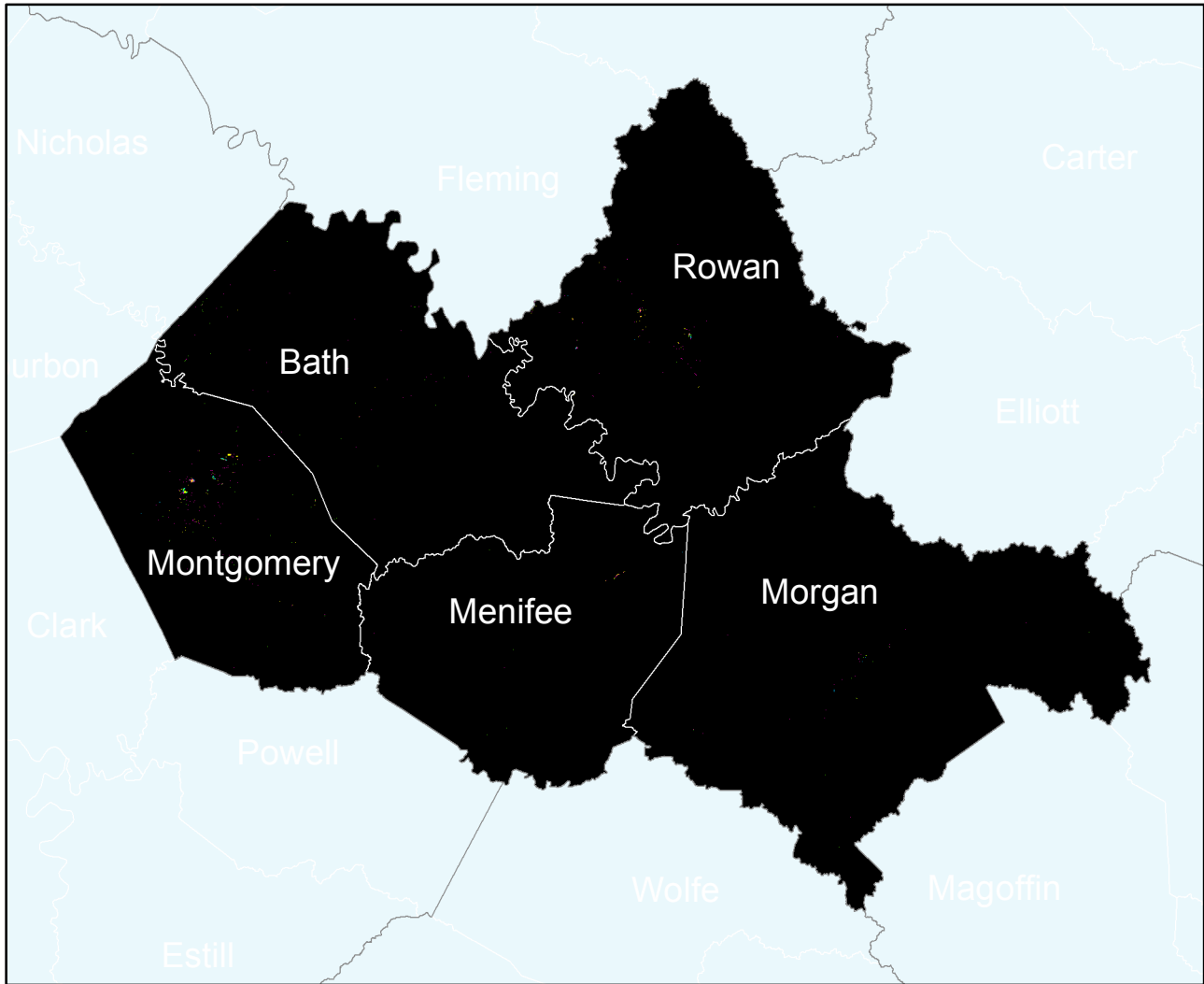
Debris in Tons



Gateway Area Development District

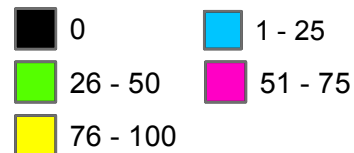
County	Debris Tons
Bath	4452
Meniffee	6036
Montgomery	2200
Morgan	10671
Rowan	5927



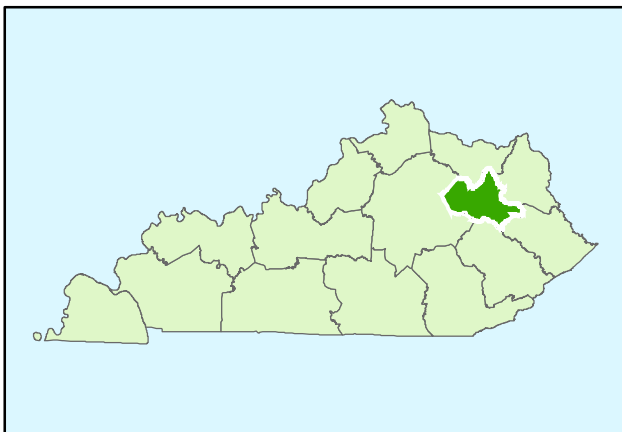


GATEWAY Area Development District

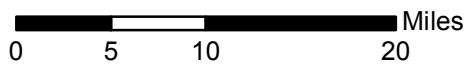
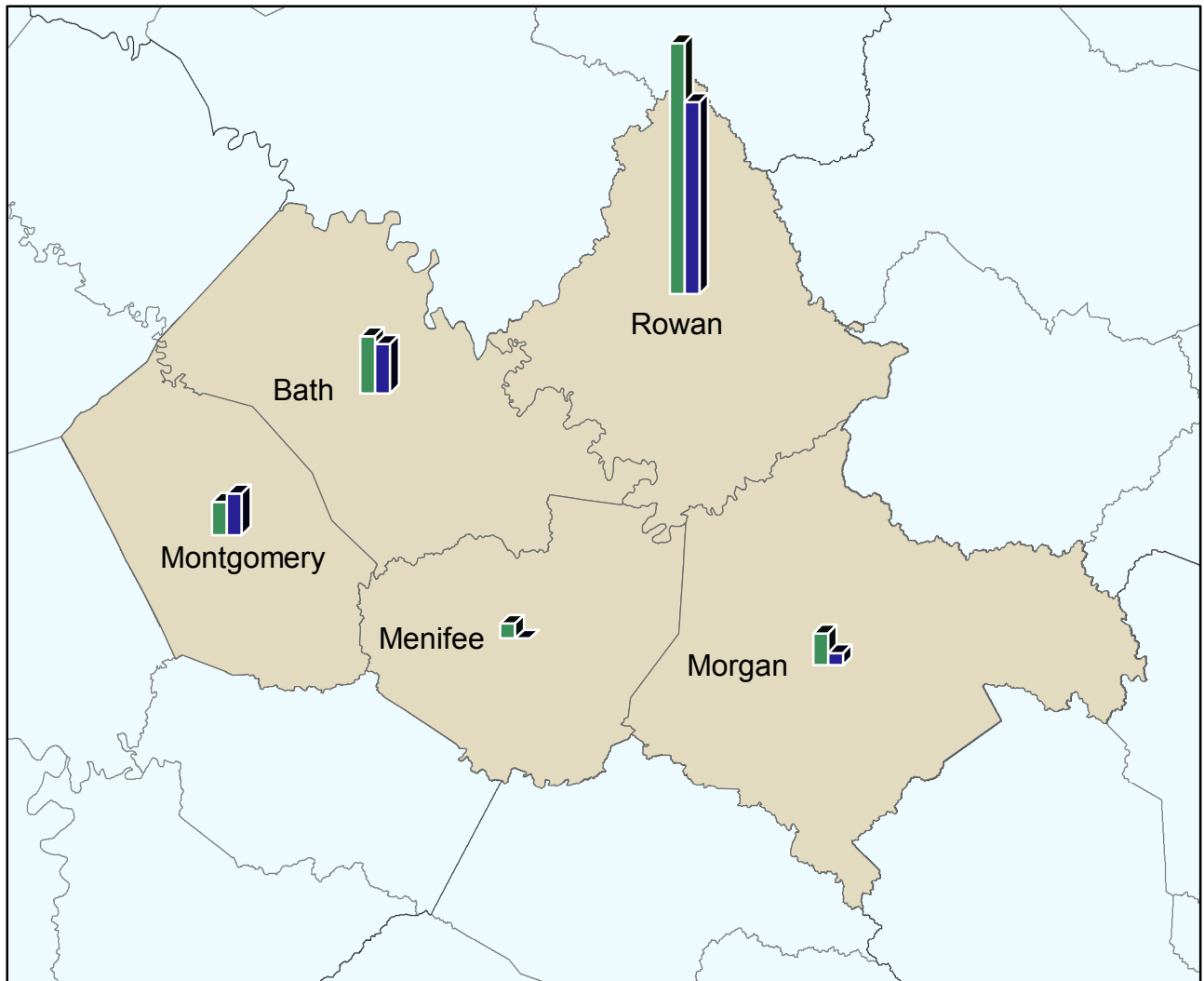
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**

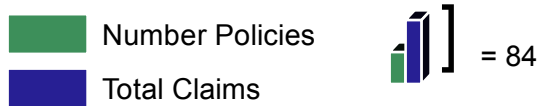


Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.

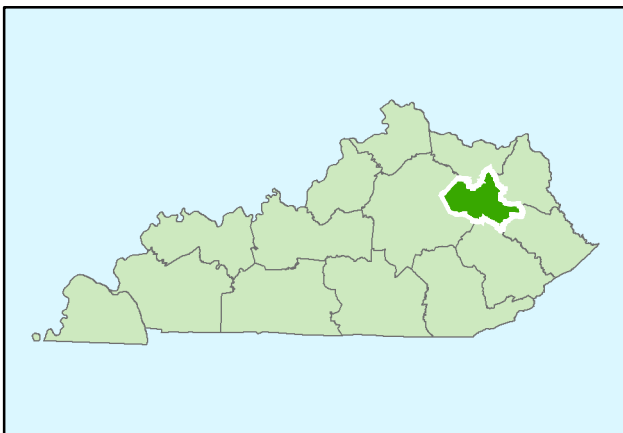


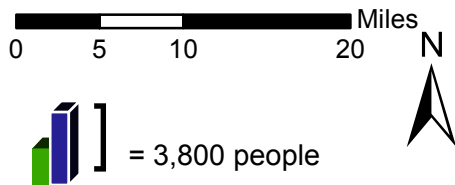
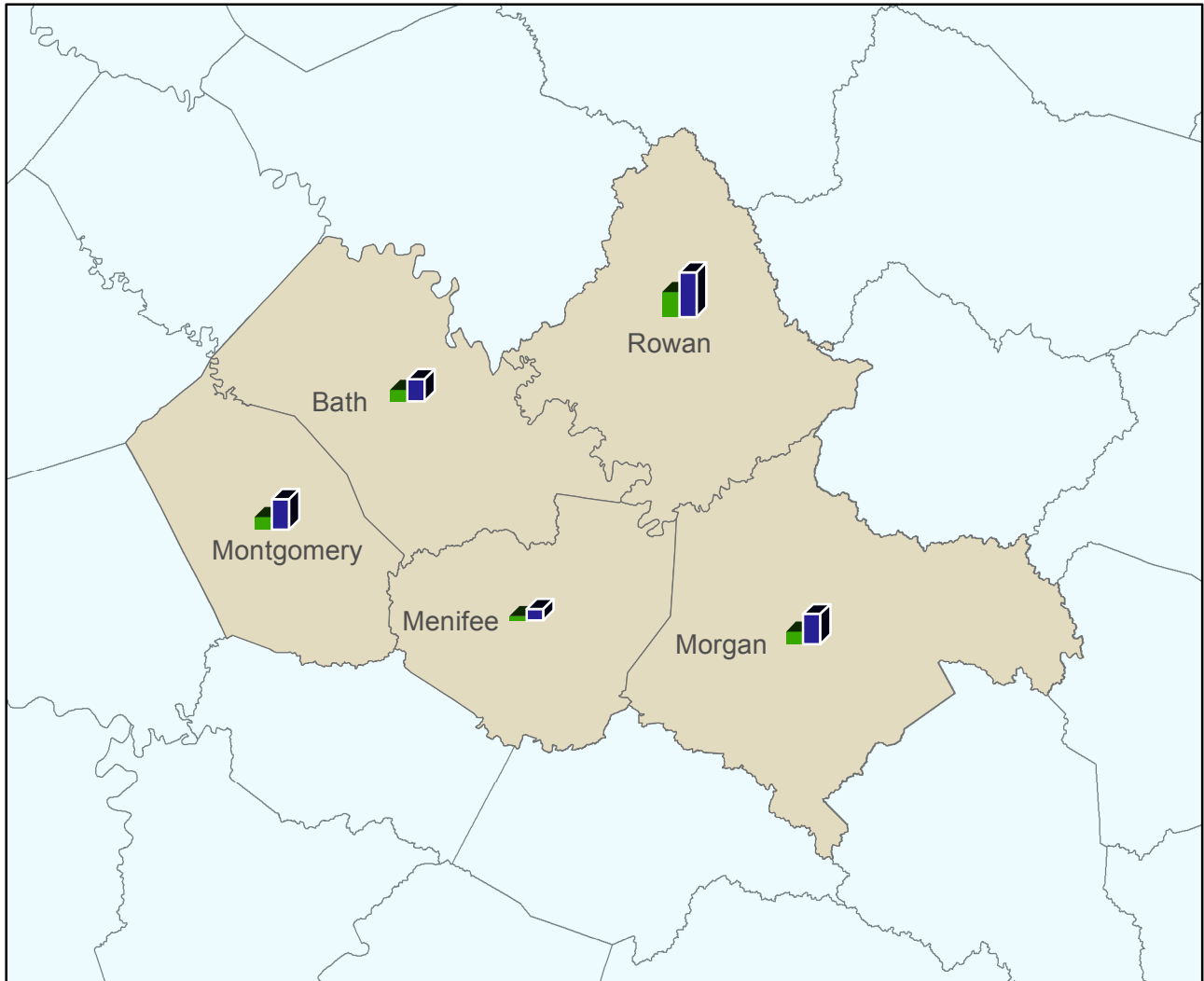
Gateway Area Development District



National Flood Insurance Program Policies and Claims (1978 - May 2018)



County	Number Policies	Total Claims
Bath	81	70
Menifee	21	0
Montgomery	47	59
Morgan	45	17
Rowan	354	271

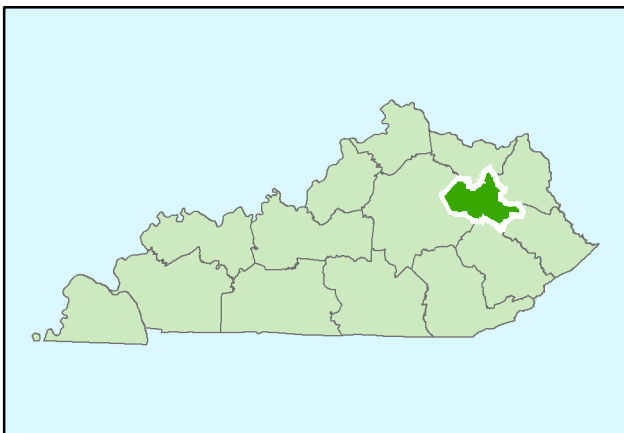


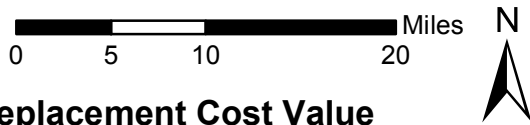
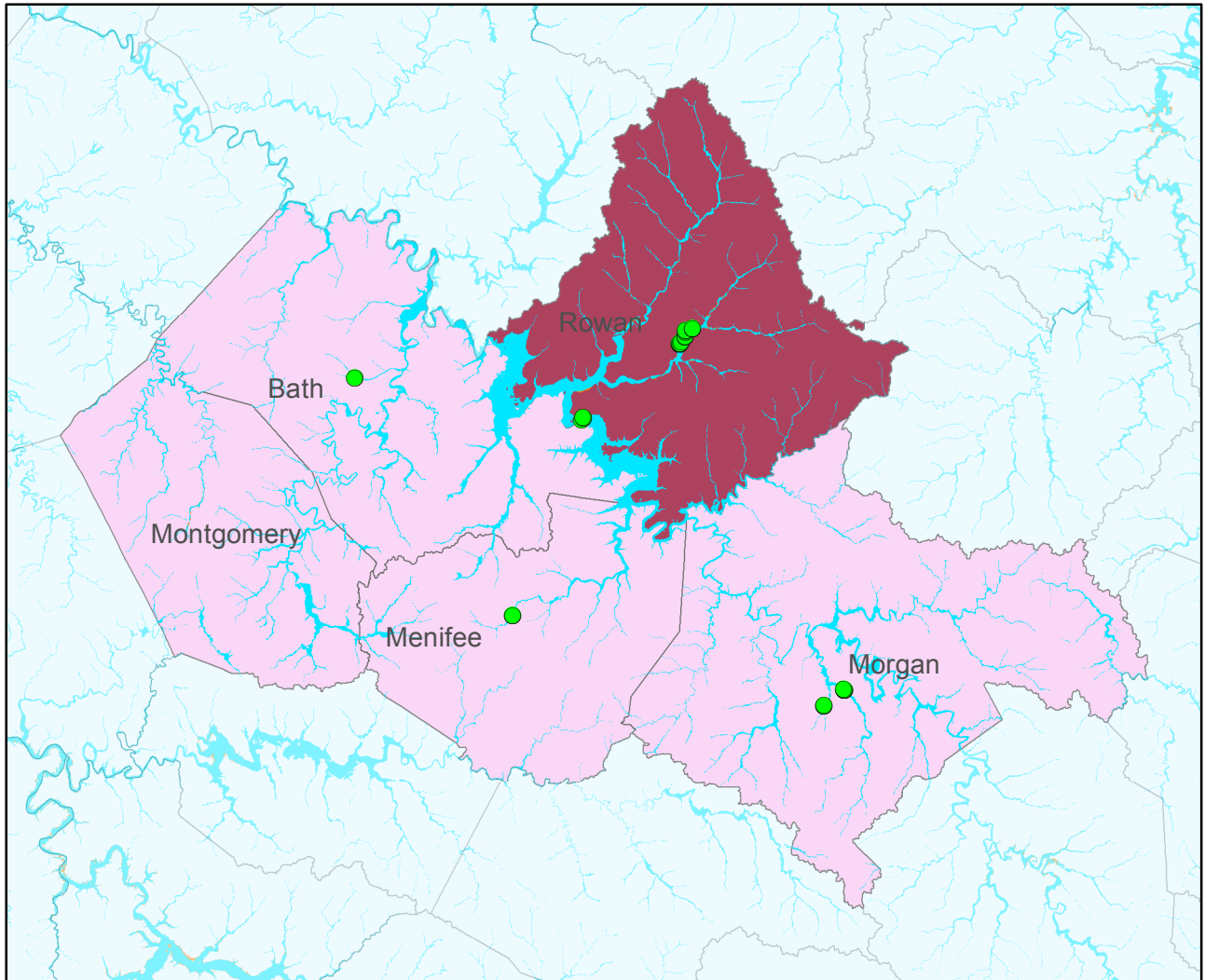


 Need Shelter
 Displaced

Gateway Area Development District

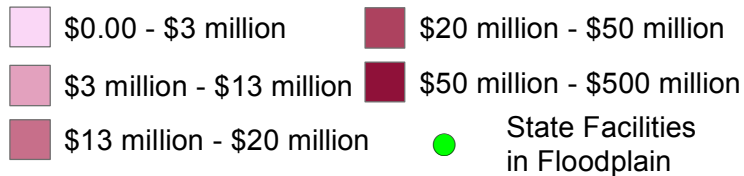
County	Displaced	Need Shelter
Bath	1216	631
Meniffee	628	250
Montgomery	1668	682
Morgan	1668	682
Rowan	2478	1376



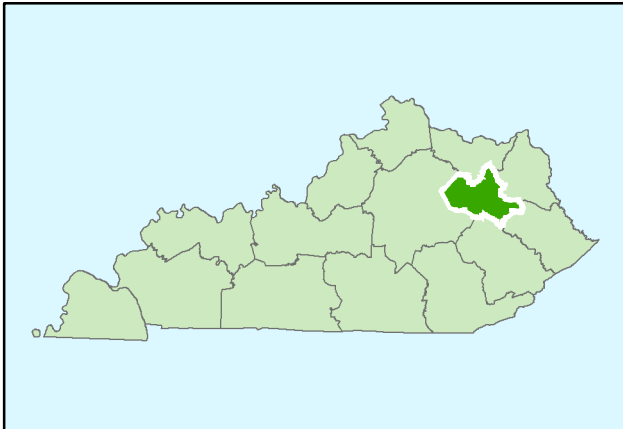


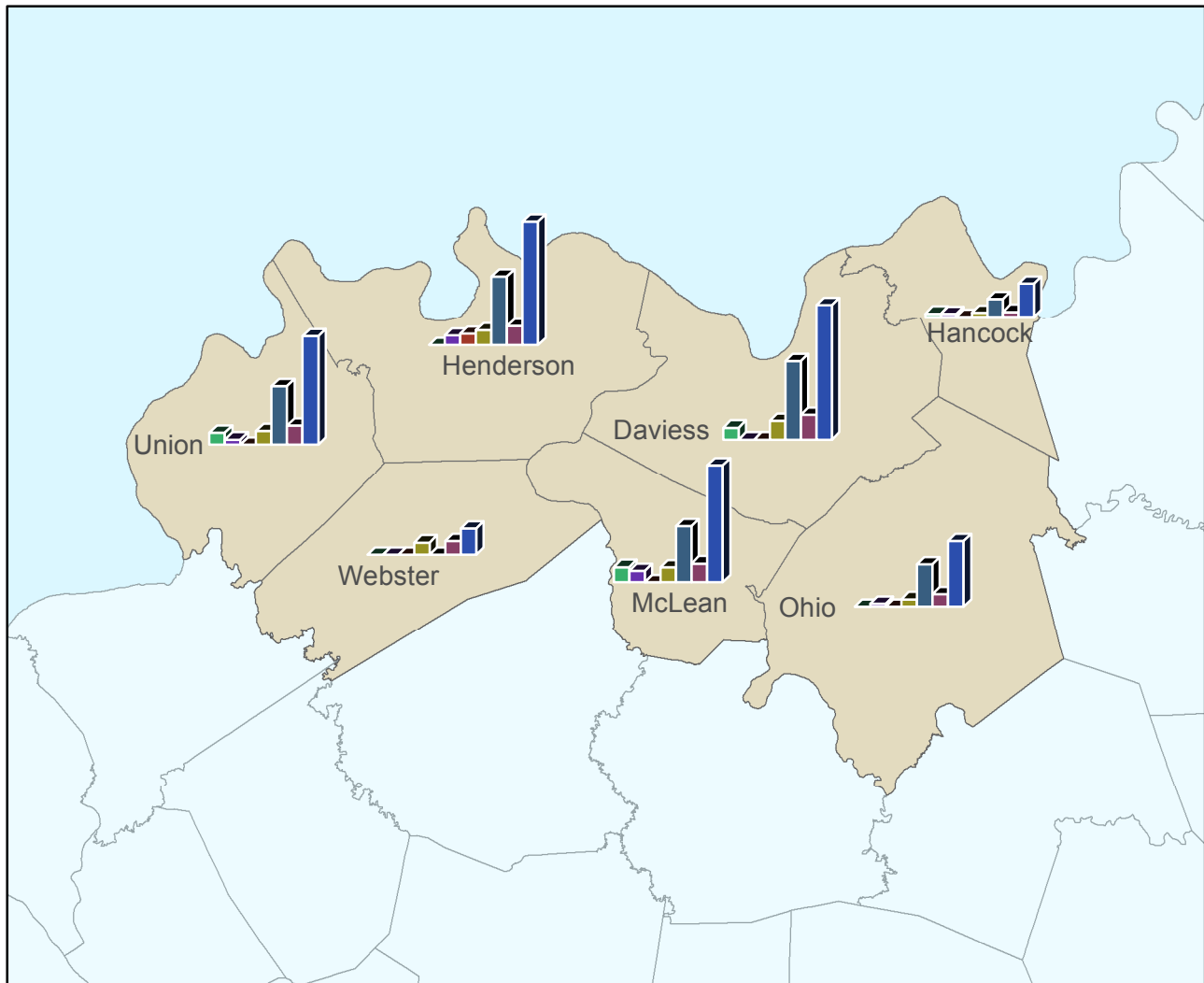
Gateway Area Development District

Replacement Cost Value



County	No. Vulnerable State Facilities	Replacement Cost Value
Bath	2	\$371,298.00
Meniffee	3	\$282,609.00
Montgomery	0	\$0.00
Morgan	10	\$545,348.00
Rowan	20	\$36,372,327.37





0 5 10 20 Miles



Agriculture Losses by County

Winter Wheat
Wheat
Alfalfa-Hay

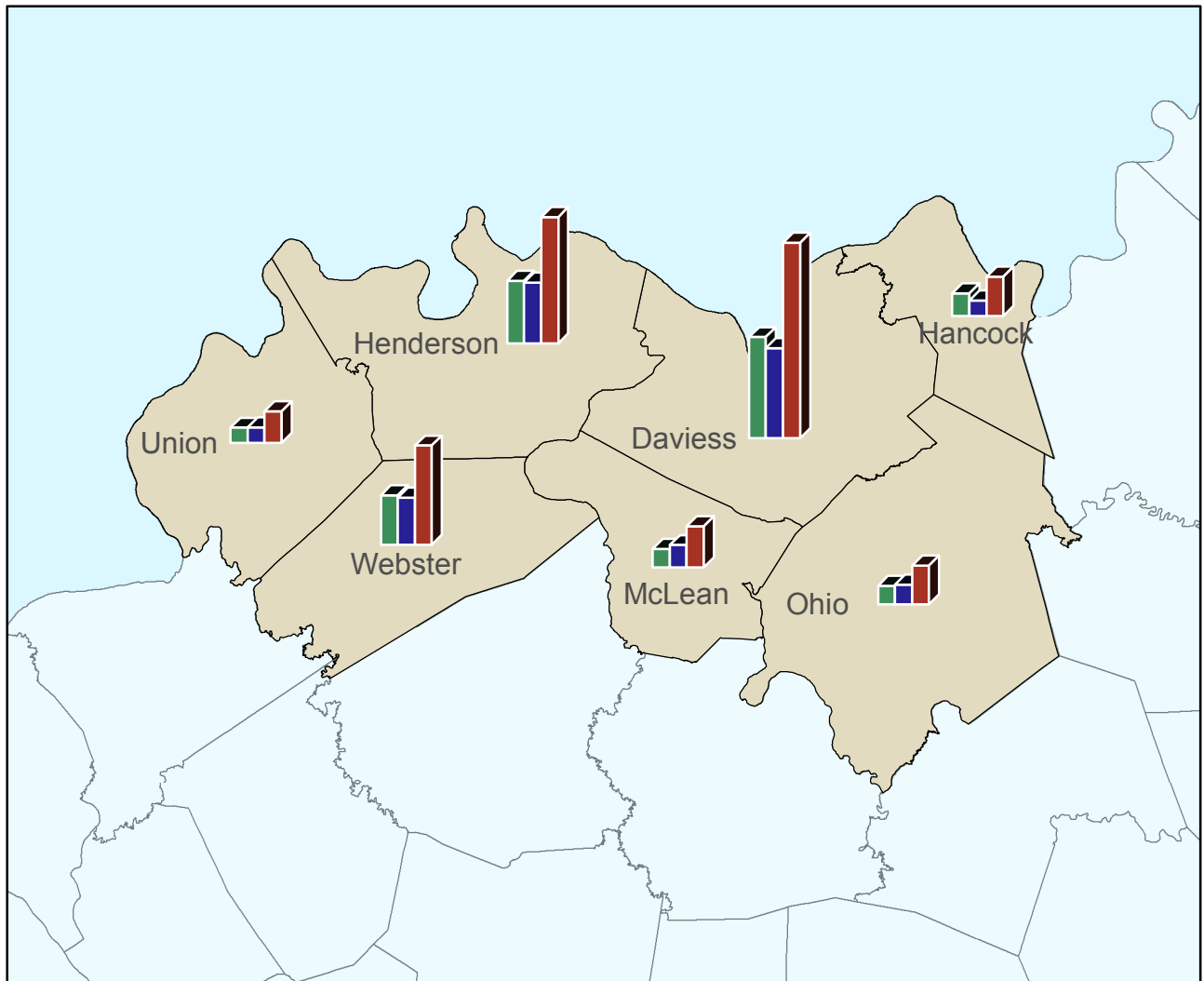
Soybeans
Corn Silage
Corn

= \$53,000,000
Total Losses

*Counties with no bars indicate no losses

Green River Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Daviess	\$10,125,804.12	\$0.00	\$0.00	\$15,827,799.	\$66,806,275.34	\$20,988,386.	\$113,748,264.54
Hancock	\$2,886,578.71	\$0.00	\$2,743,129.3	\$3,433,817.4	\$15,130,044.96	\$4,427,440.3	\$28,621,010.78
Henderson	\$0.00	\$9,494,264.04	\$8,268,411.2	\$12,742,250.	\$57,682,787.22	\$16,393,148.	\$104,580,861.56
McLean	\$12,948,545.58	\$0.00	\$9,637,022.9	\$12,690,651.	\$47,532,162.82	\$15,989,755.	\$98,798,138.30
Ohio	\$0.00	\$0.00	\$2,740,215.5	\$6,456,412.4	\$36,092,610.89	\$10,756,090.	\$56,045,329.05
Union	\$10,102,936.68	\$0.00	\$4,372,735.1	\$11,782,348.	\$49,645,712.12	\$16,427,523.	\$92,331,255.62
Webster	\$0.00	\$0.00	\$0.00	\$10,537,873.	\$0.00	\$11,870,478.	\$22,408,352.50



0 5 10 20 Miles




General Building Loss

Contents Loss

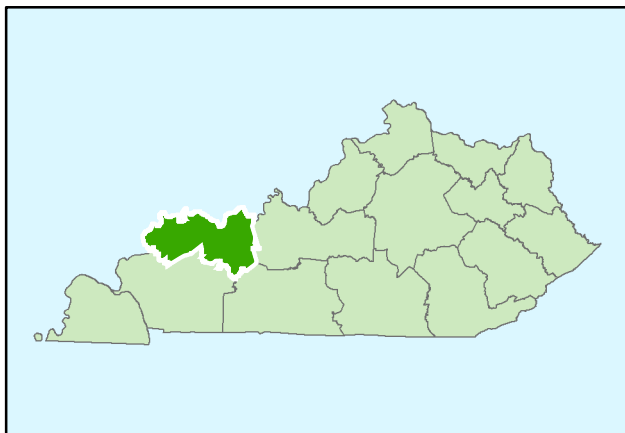
Building Loss

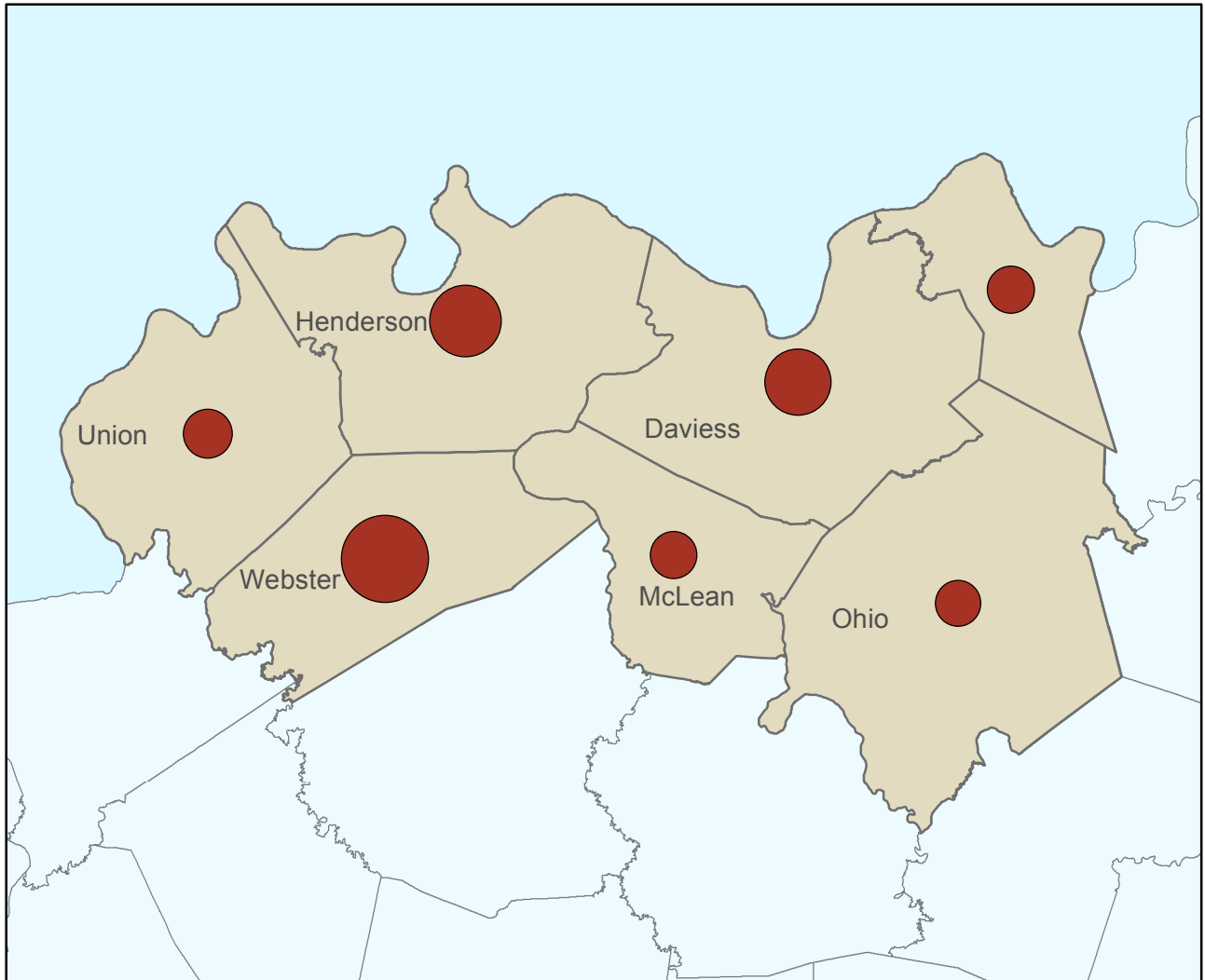
Total Loss

 = \$160,000

Green River Area Development District

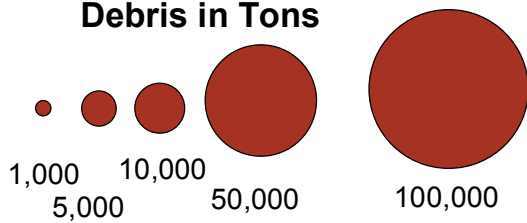
County	Total Loss	Bldg Loss	Contents Loss
Daviess	\$458,953.00	\$211,281.00	\$236,699.00
Hancock	\$93,308.00	\$36,913.00	\$53,456.00
Henderson	\$297,092.00	\$142,782.00	\$146,969.00
McLean	\$96,606.00	\$51,967.00	\$42,900.00
Ohio	\$91,993.00	\$46,440.00	\$44,321.00
Union	\$74,904.00	\$36,888.00	\$35,975.00
Webster	\$232,746.00	\$109,948.00	\$116,532.00





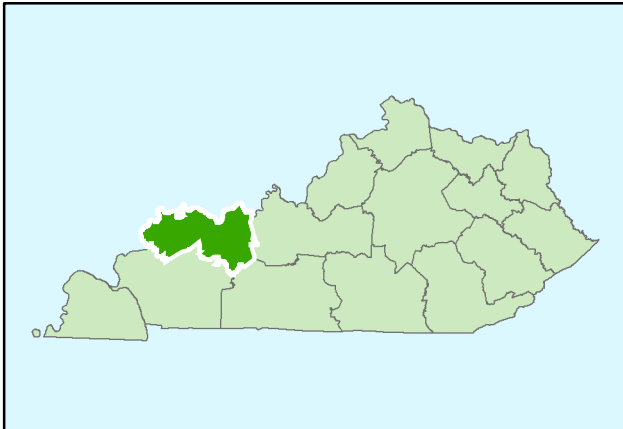
0 5 10 20 Miles

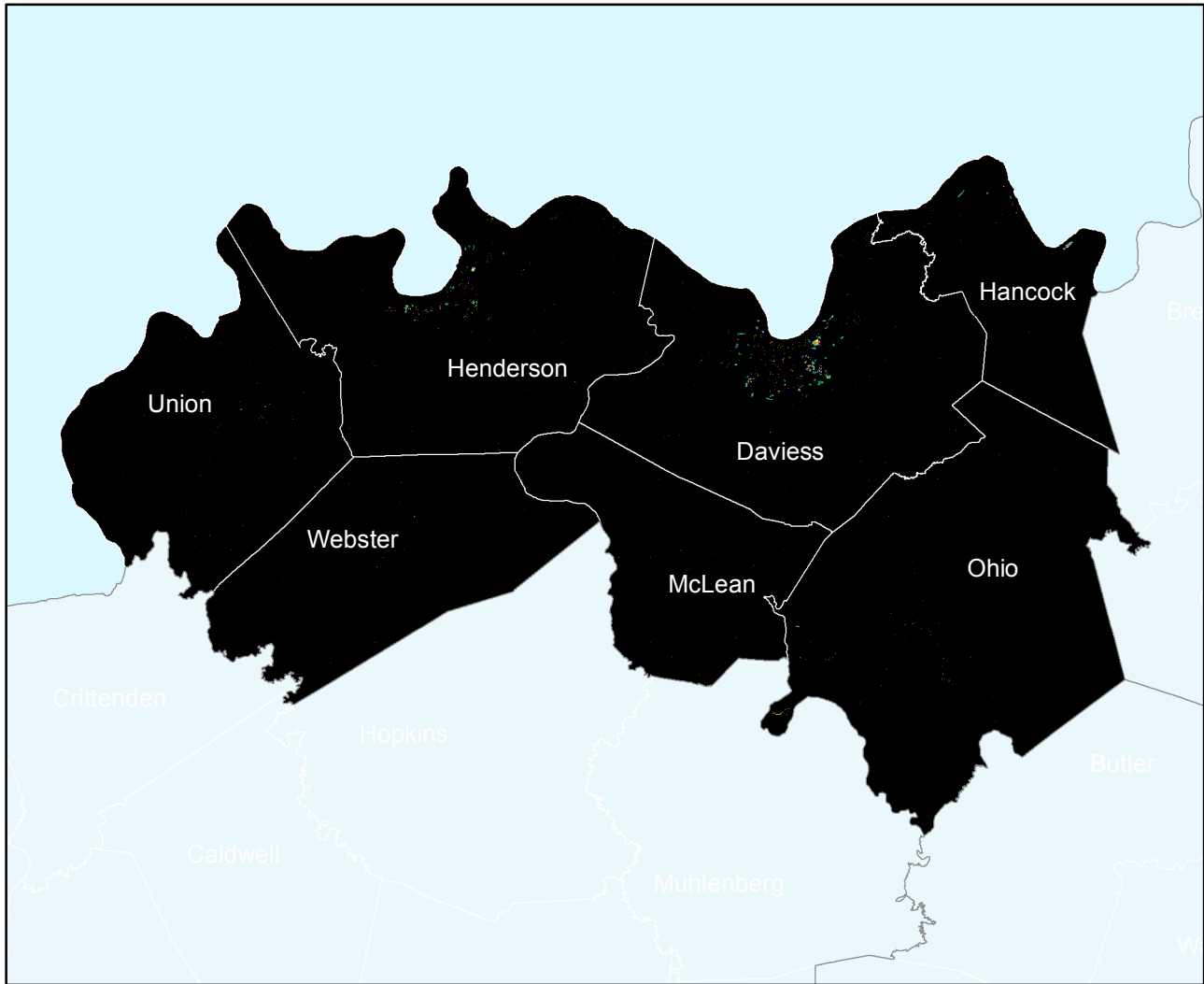
Debris in Tons



Green River Area Development District

County	Debris Tons
Daviess	21333
Hancock	10809
Henderson	25503
McLean	10942
Ohio	10229
Union	11719
Webster	37395



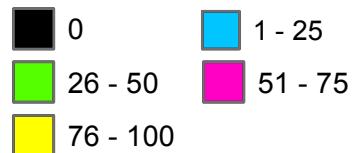


0 5 10 20 Miles

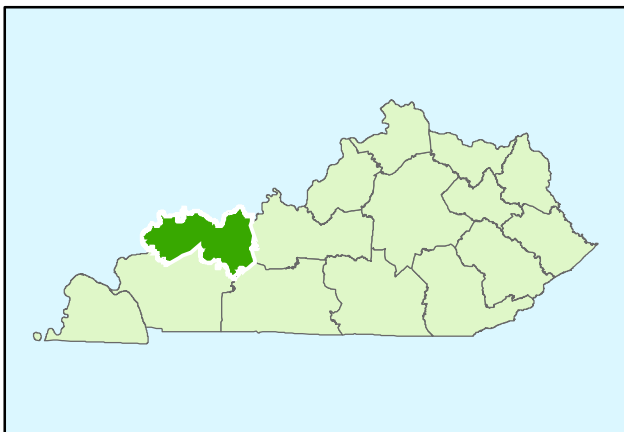


GREEN RIVER Area Development District

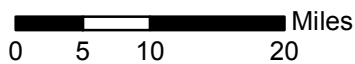
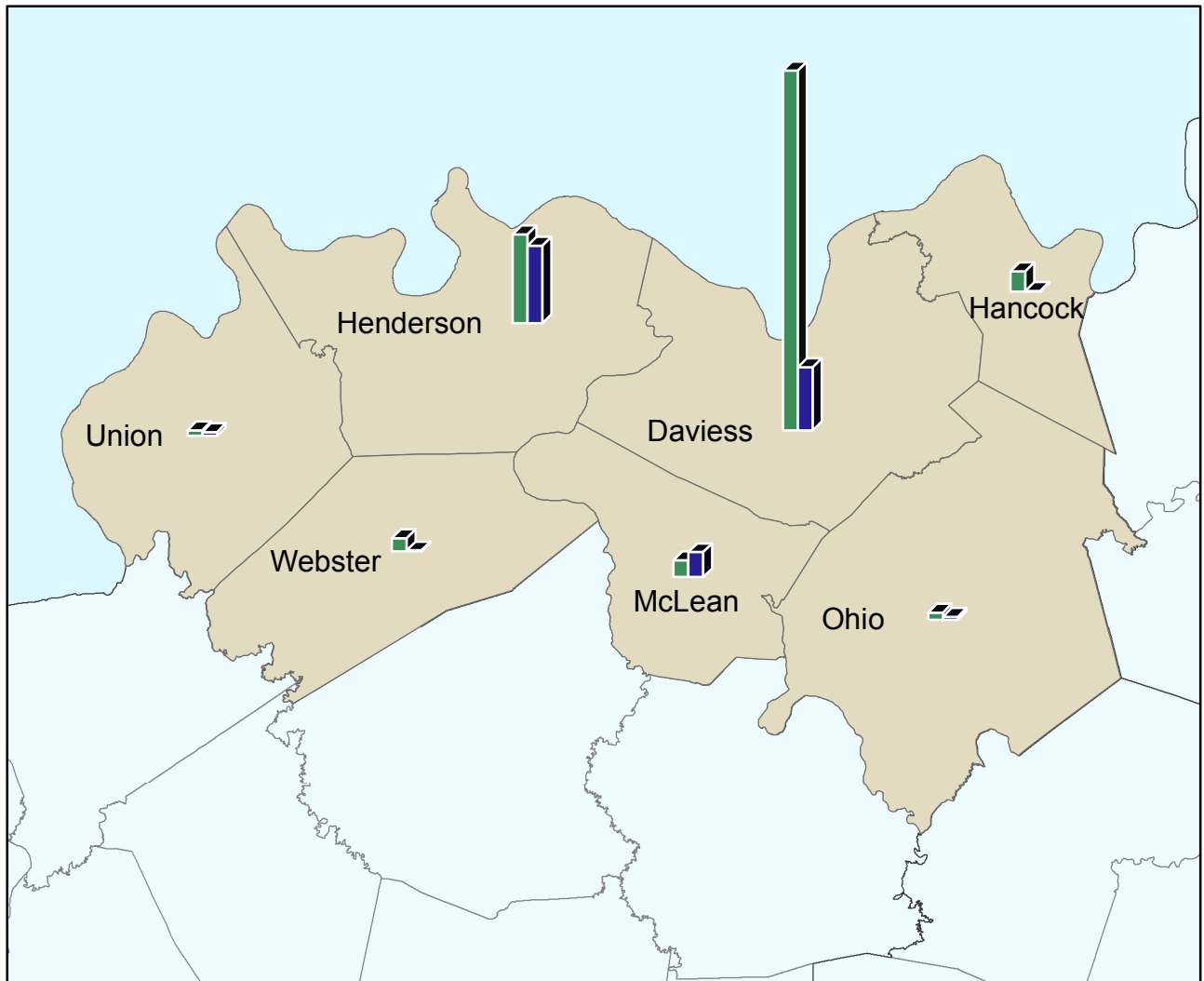
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**

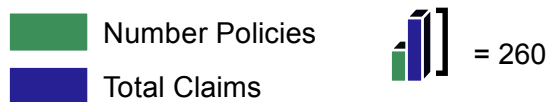


Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.

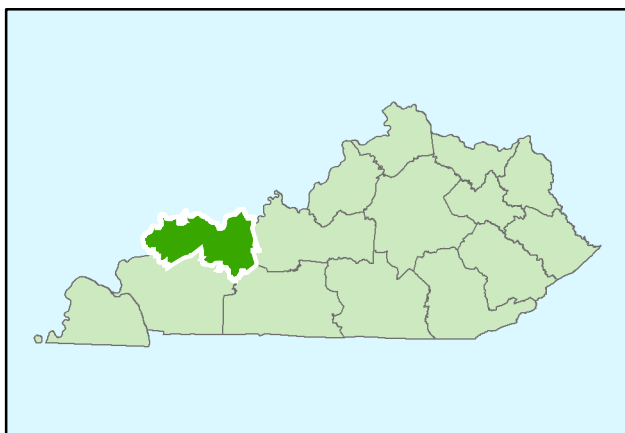


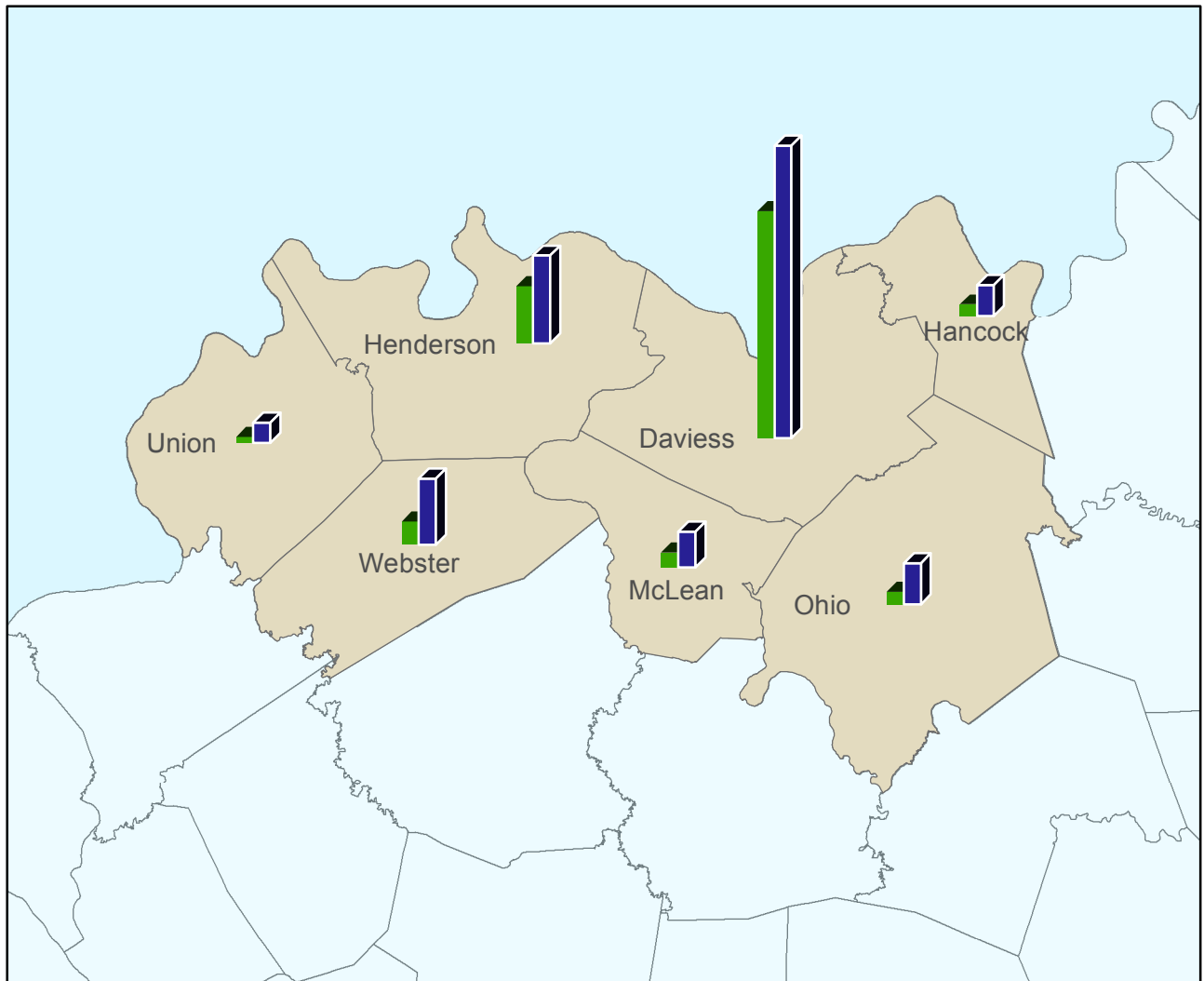
Green River Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)




County	Number Policies	Total Claims
Daviess	1561	274
Hancock	89	5
Henderson	385	336
McLean	74	108
Ohio	31	12
Union	24	16
Webster	58	5





0 5 10 20 Miles

 = 3,800 people

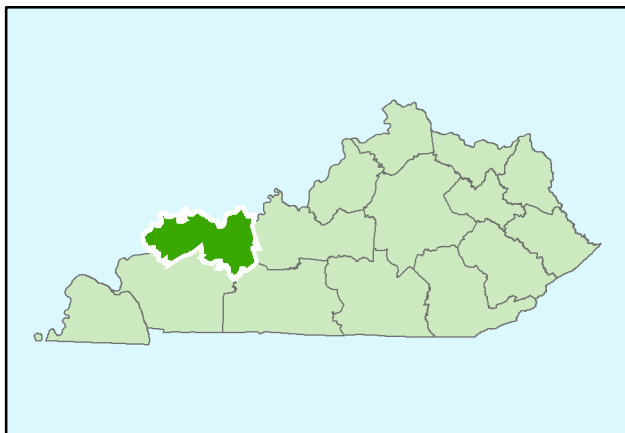
 Need Shelter

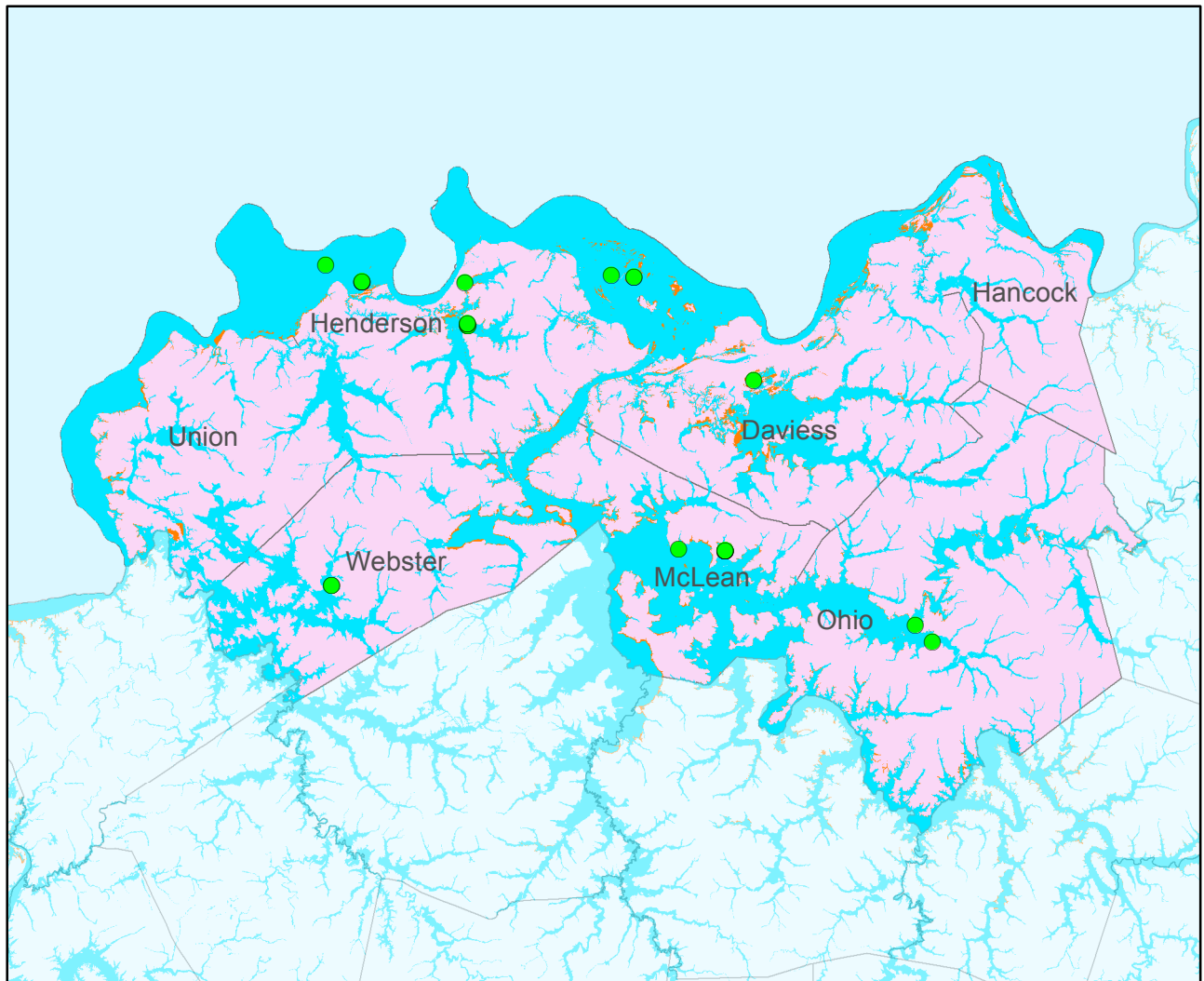
 Displaced



Green River Area Development District

County	Displaced	Need Shelter
Daviess	16206	12565
Hancock	1740	656
Henderson	4879	3169
McLean	1977	821
Ohio	2299	715
Union	1139	327
Webster	3672	1274



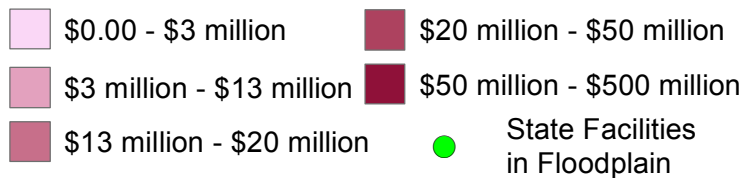


0 5 10 20 Miles

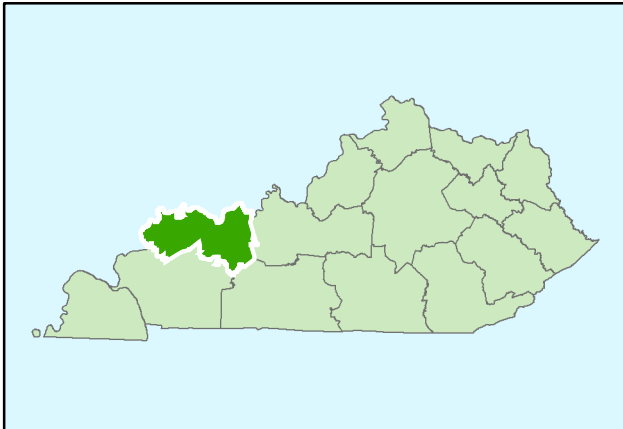


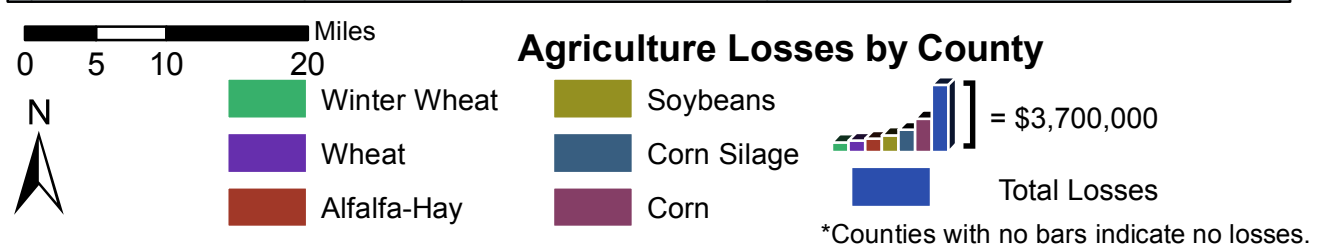
Green River Area Development District

Replacement Cost Value



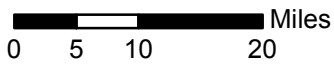
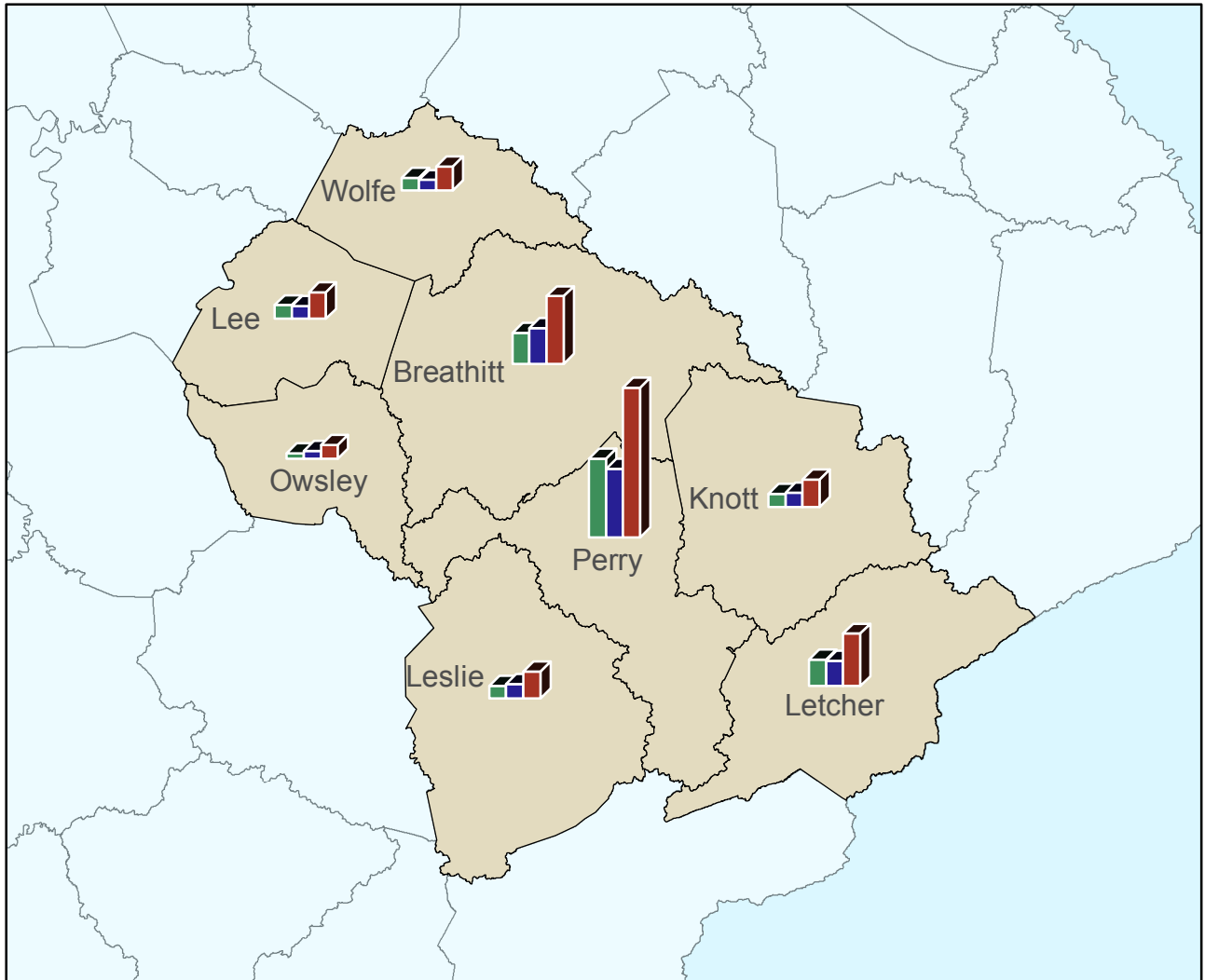
County	No. Vulnerable State Facilities	Replacement Cost Value
Daviess	1	\$0.00
Hancock	0	\$0.00
Henderson	13	\$2,995,885.63
McLean	8	\$349,351.00
Ohio	2	\$0.00
Union	0	\$0.00
Webster	2	\$0.00





Kentucky River Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Breathitt	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$398,997.56	\$398,997.56
Owsley	\$0.00	\$0.00	\$0.00	\$0.00	\$382,438.46	\$948,453.31	\$1,330,891.77
Wolfe	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1,411,845.34	\$1,411,845.34
Knott	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Lee	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Leslie	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Letcher	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Perry	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

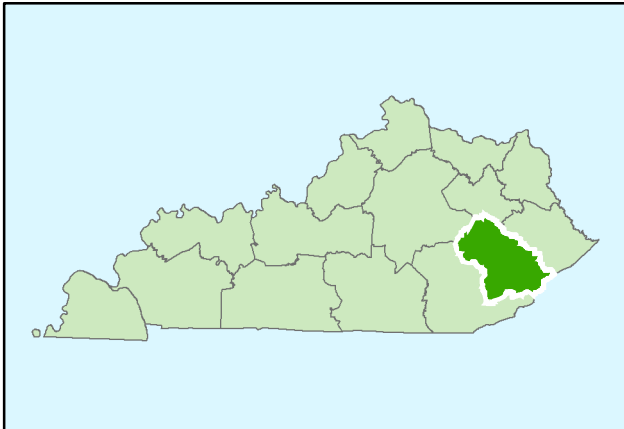


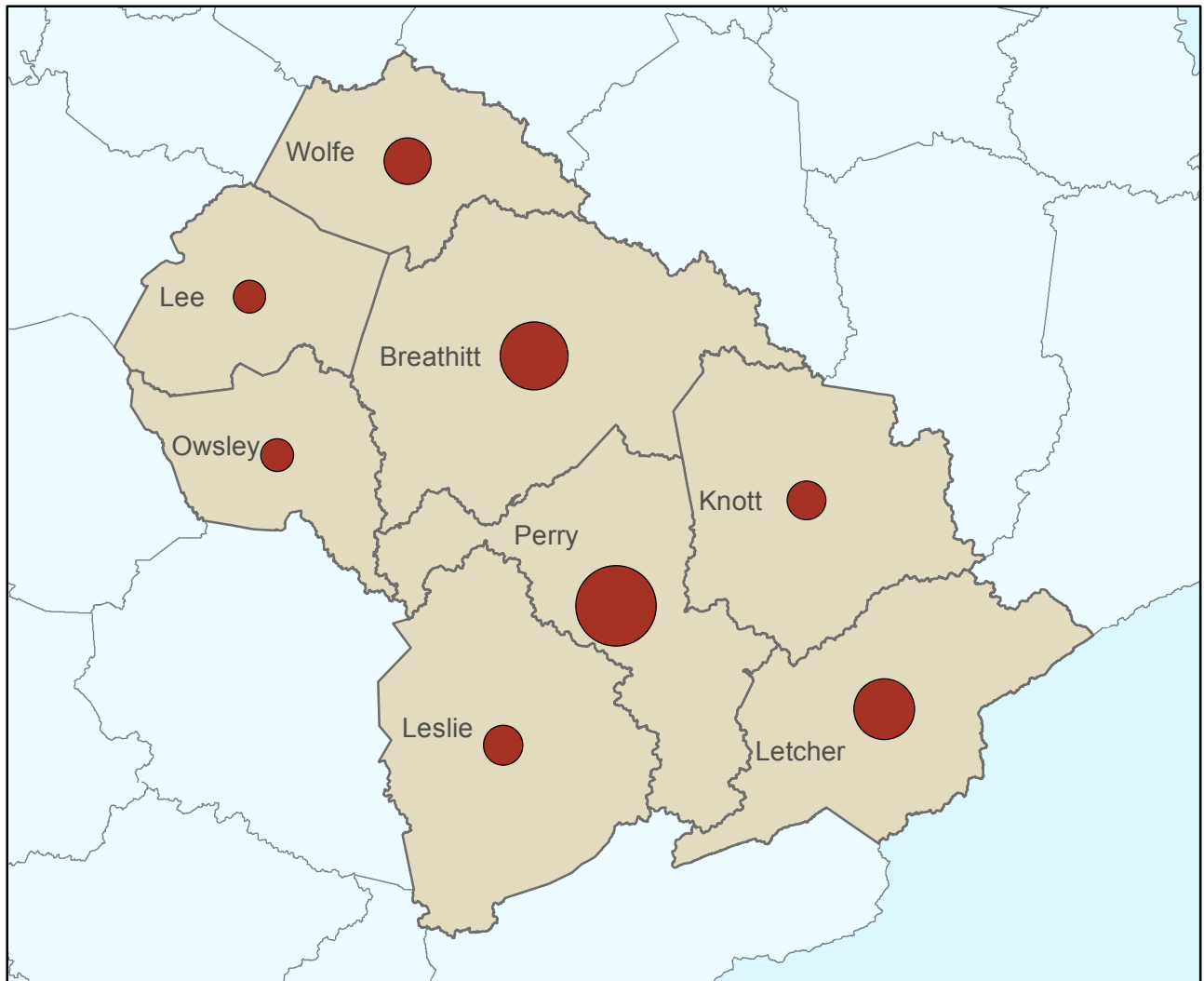
General Building Loss



Kentucky River Area Development District

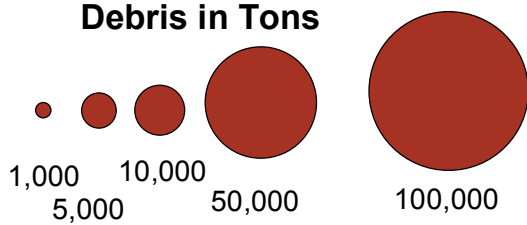
County	Total Loss	Bldg Loss	Contents Loss
Breathitt	\$159,053.00	\$83,807.00	\$73,518.00
Knott	\$64,665.00	\$33,123.00	\$30,807.00
Lee	\$62,541.00	\$29,524.00	\$32,240.00
Leslie	\$63,233.00	\$33,749.00	\$28,955.00
Letcher	\$123,124.00	\$59,688.00	\$62,198.00
Owsley	\$31,993.00	\$18,911.00	\$12,925.00
Perry	\$351,738.00	\$161,327.00	\$185,175.00
Wolfe	\$55,632.00	\$24,702.00	\$30,014.00





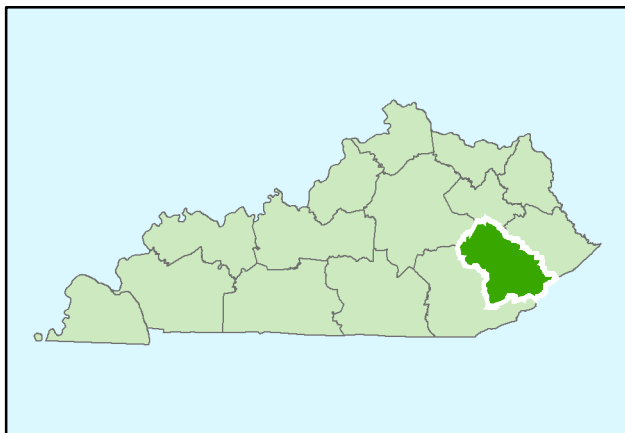
0 5 10 20 Miles

Debris in Tons



Kentucky River Area Development District

County	Debris Tons
Breathitt	22493
Knott	7263
Lee	5348
Leslie	7858
Letcher	18386
Owsley	5222
Perry	31582
Wolfe	10973



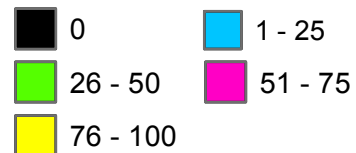


0 5 10 20 Miles

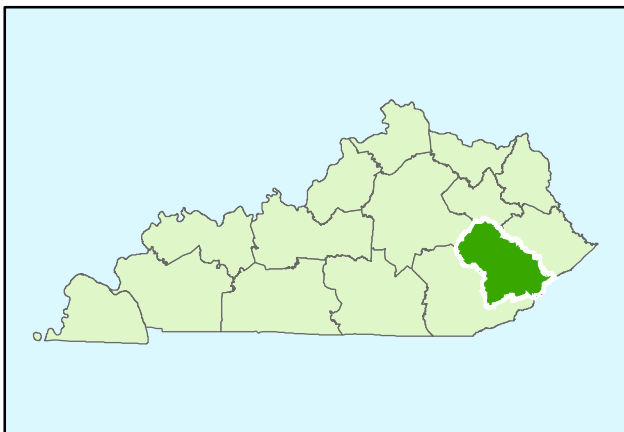


KENTUCKY RIVER Area Development District

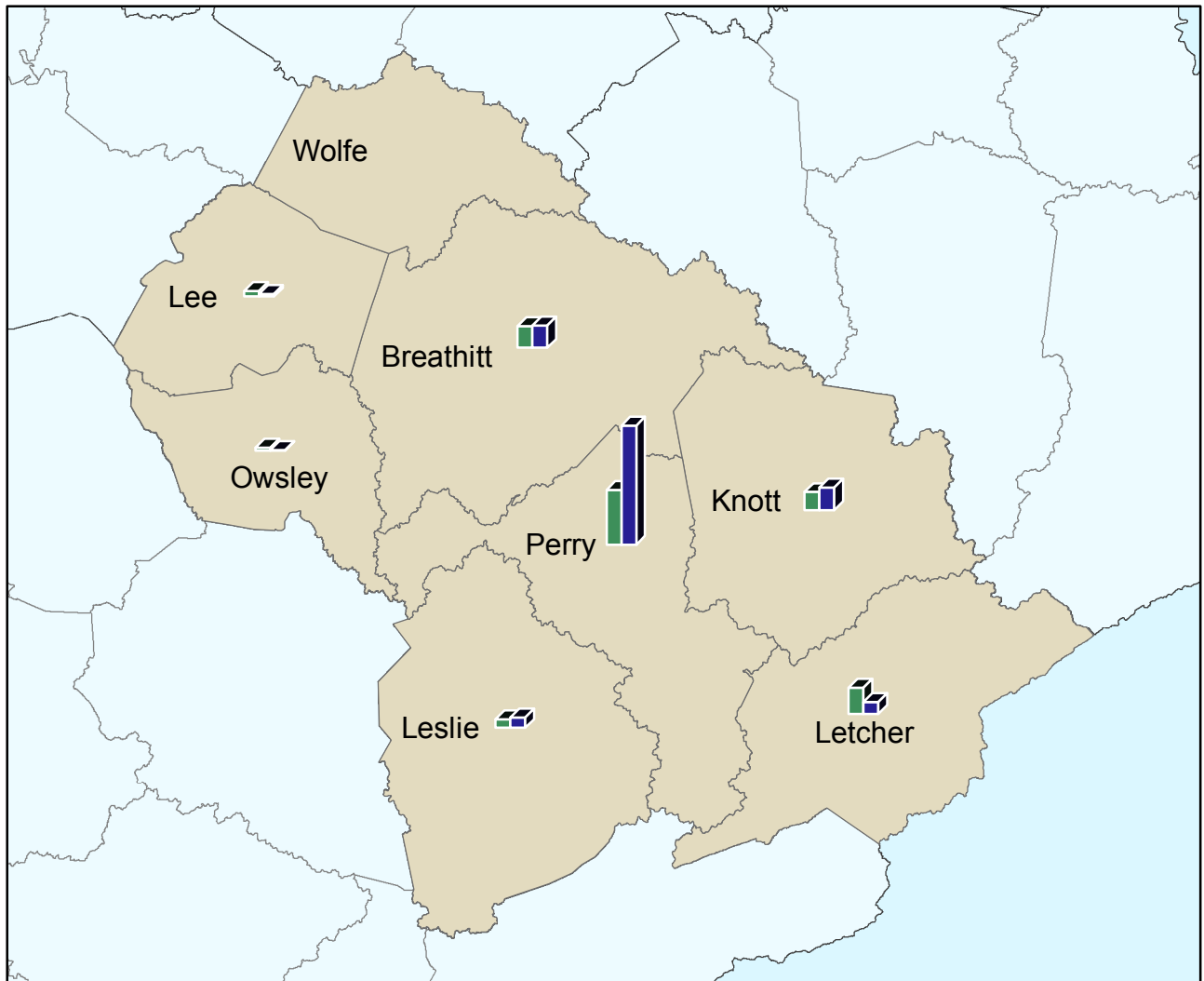
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**



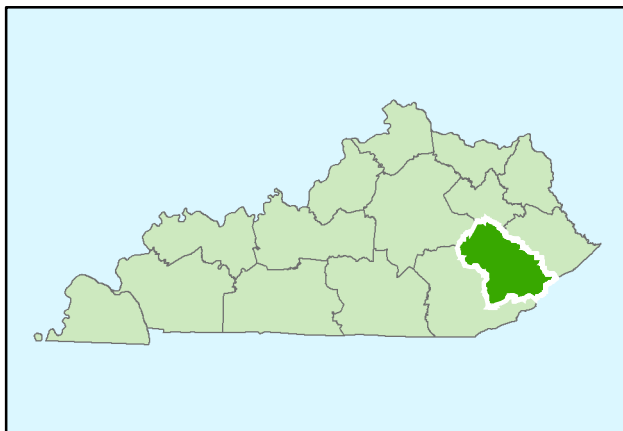
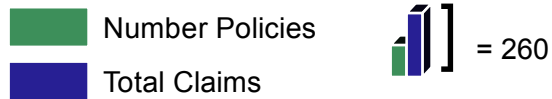
Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



0 5 10 20 Miles

Kentucky River Area Development District

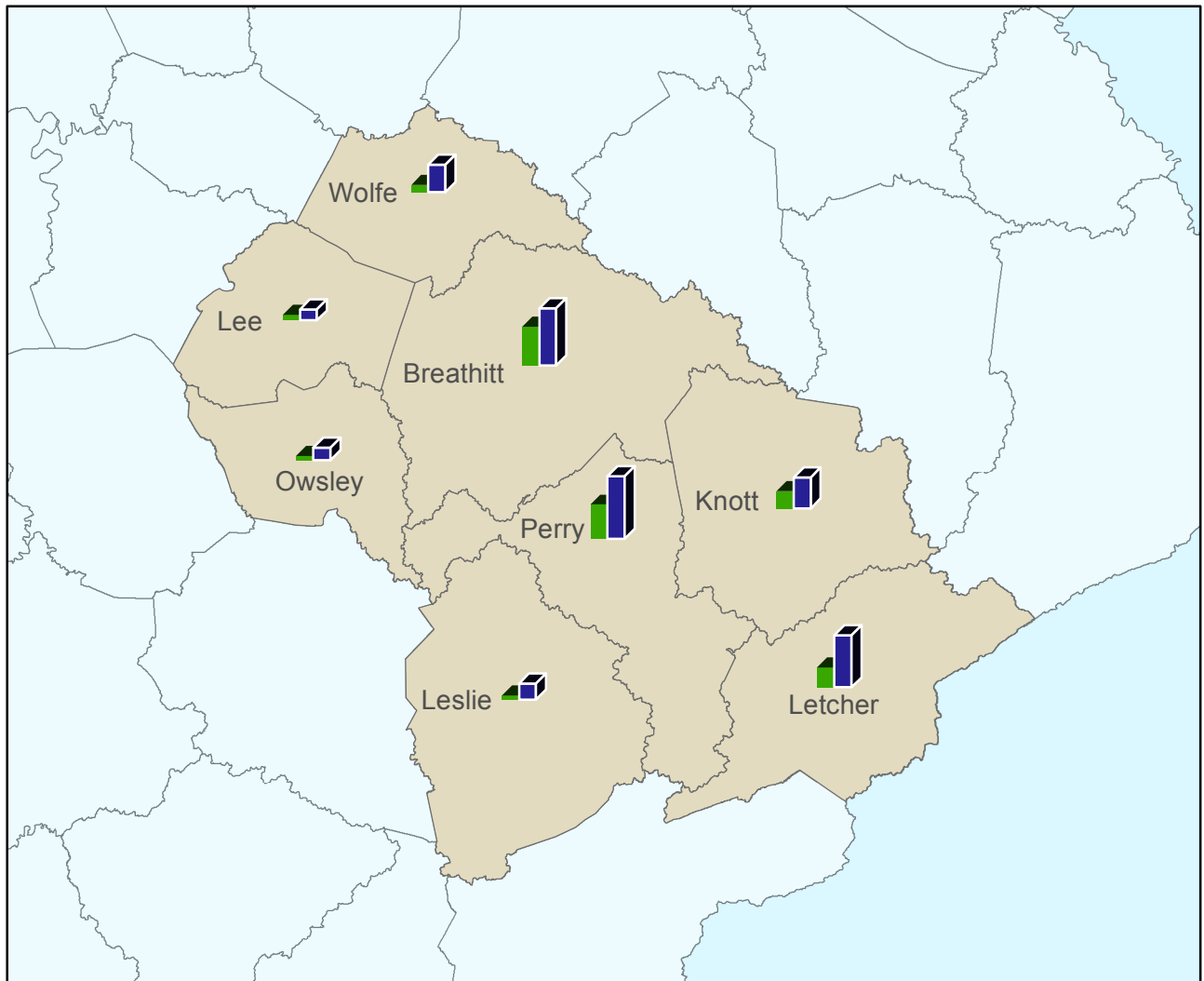
National Flood Insurance Program Policies and Claims (1978 - May 2018)



County	Number Policies	Total Claims
Breathitt	94	97
Knott	80	99
Lee	24	11
Leslie	37	45
Letcher	115	52
Owsley	13	3
Perry	238	517
Wolfe	0	0



*Wolfe County does not participate in NFIP.



0 5 10 20 Miles



= 3,800 people



Need Shelter

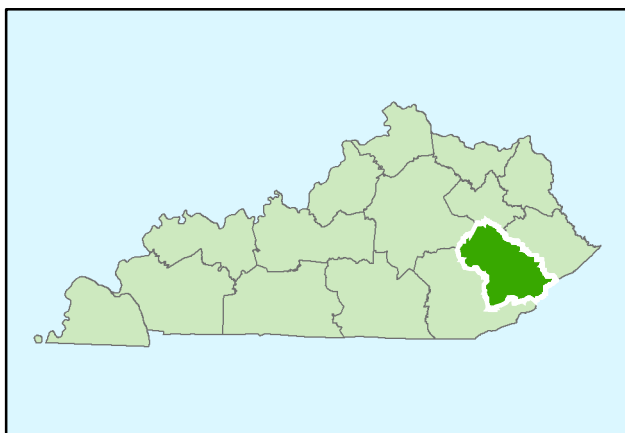


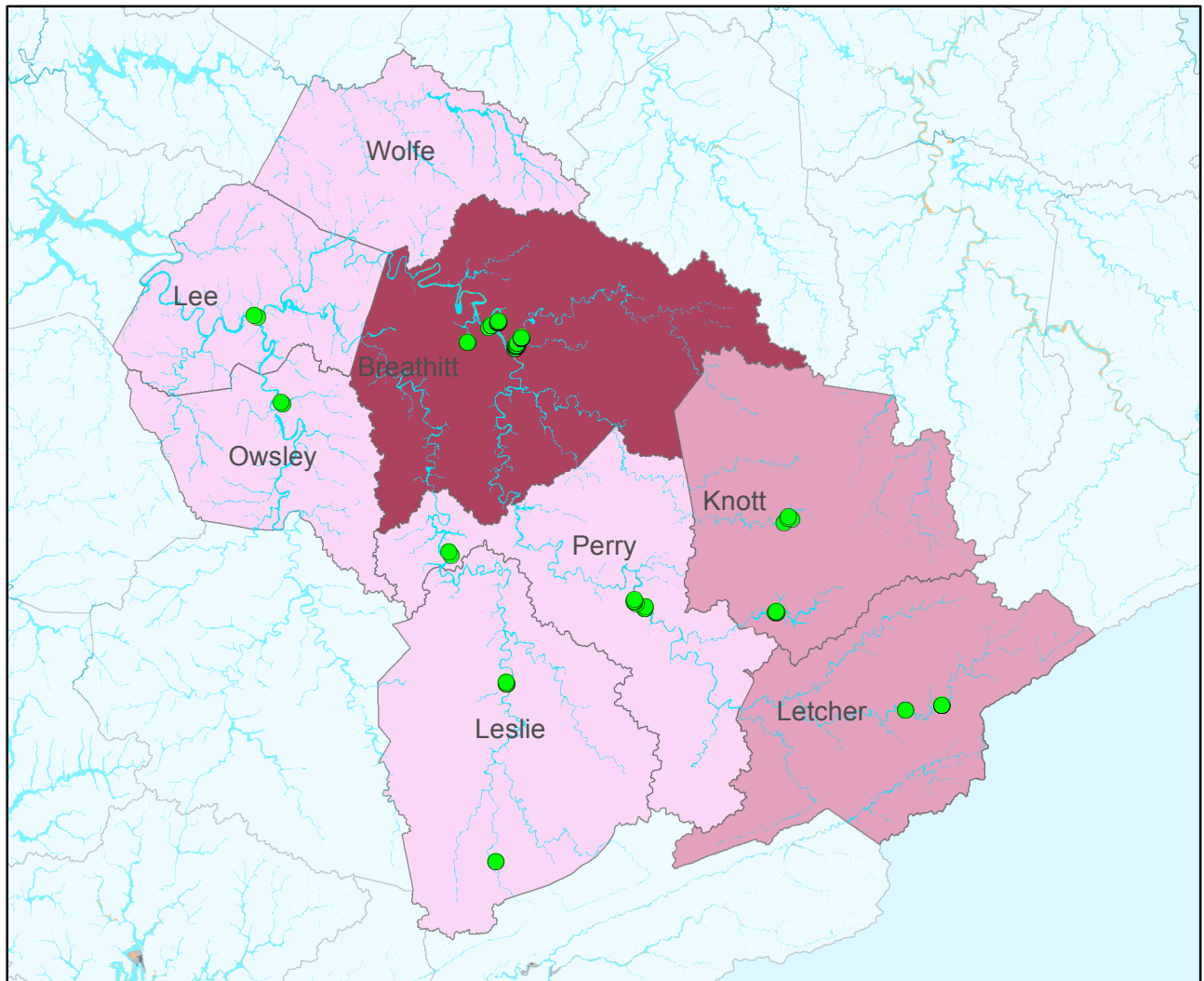
Displaced



Kentucky River Area Development District

County	Displaced	Need Shelter
Breathitt	3169	2159
Knott	1722	971
Lee	625	301
Leslie	895	223
Letcher	2878	1120
Owsley	685	229
Perry	3475	1896
Wolfe	1512	410





0 5 10 20 Miles

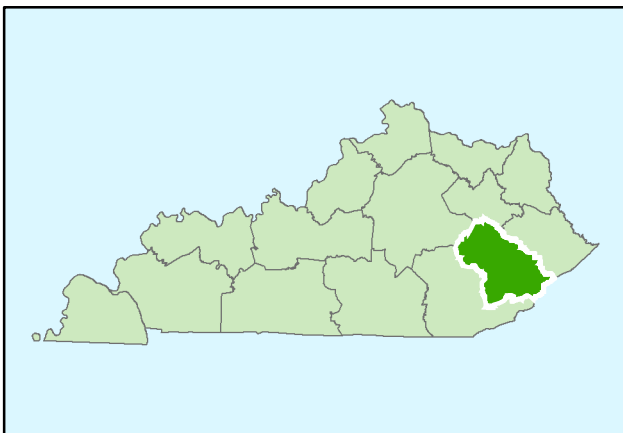


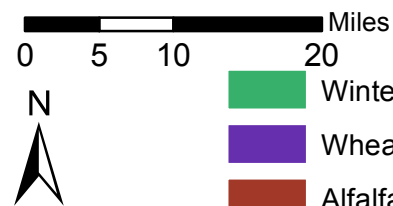
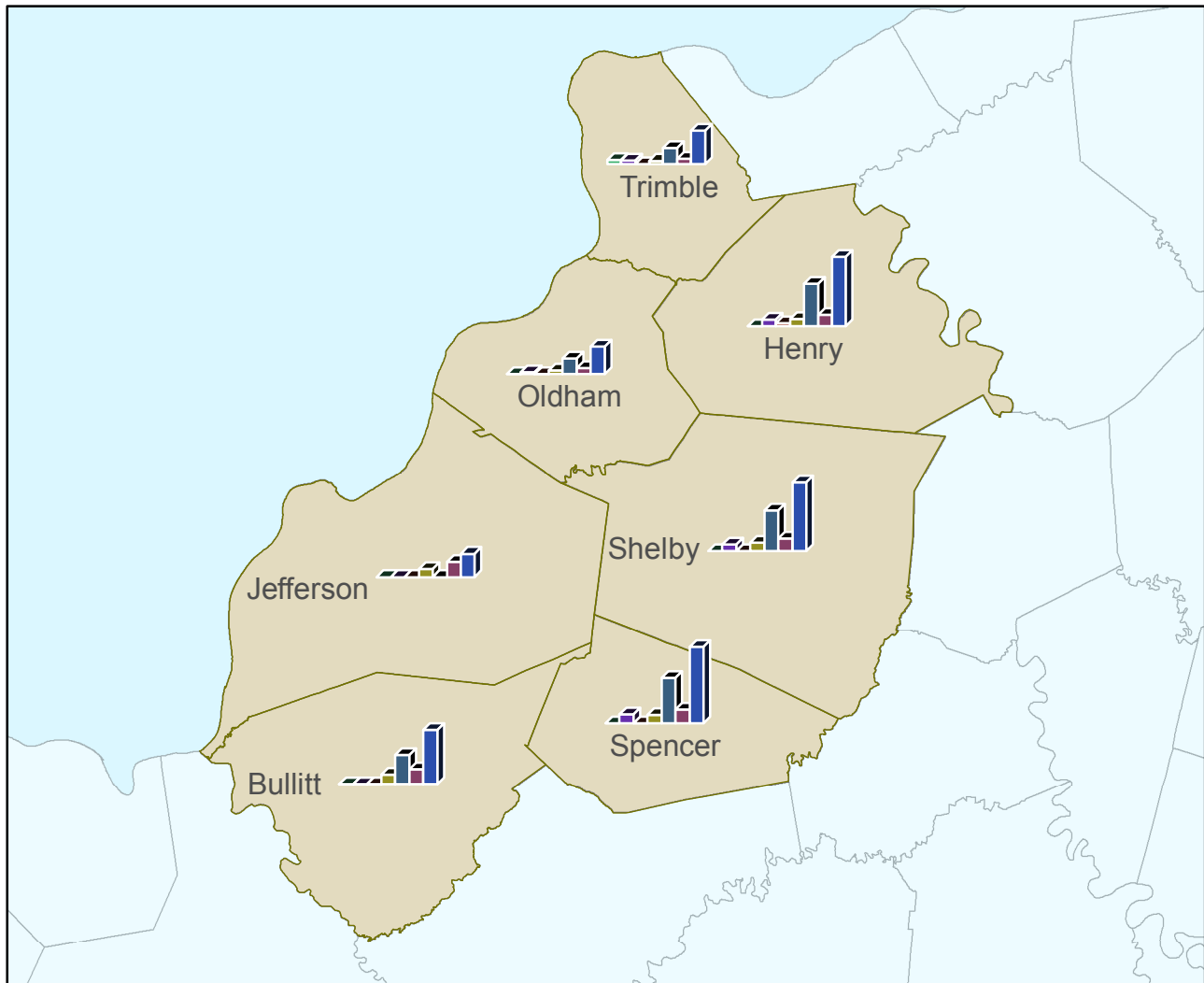
Kentucky River Area Development District

Replacement Cost Value

\$0.00 - \$3 million	\$20 million - \$50 million
\$3 million - \$13 million	\$50 million - \$500 million
\$13 million - \$20 million	State Facilities in Floodplain

County	No. Vulnerable State Facilities	Replacement Cost Value
Breathitt	44	\$20,274,995.20
Knott	11	\$5,258,962.75
Lee	2	\$0.00
Leslie	6	\$1,838,018.56
Letcher	7	\$6,966,424.31
Owsley	2	\$0.00
Perry	11	\$2,901,777.83
Wolfe	0	\$0.00





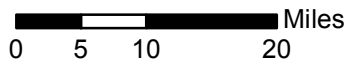
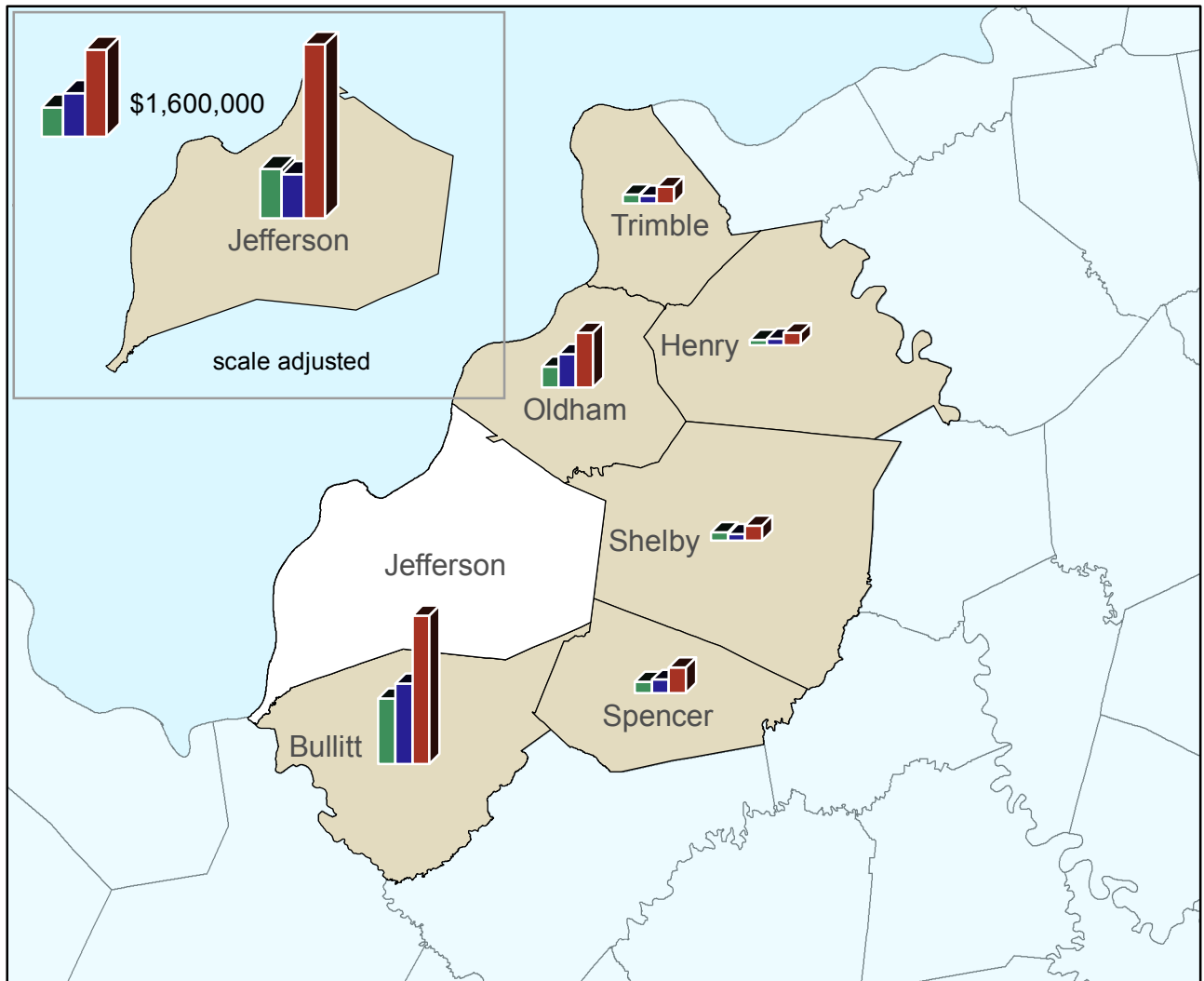
Agriculture Losses by County



*Counties with no bars indicate no losses.

KIPDA Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Bullitt	\$0.00	\$0.00	\$0.00	\$1,637,751.16	\$4,944,767.07	\$2,519,526.18	\$9,102,044.41
Henry	\$0.00	\$499,715.08	\$1,030,598.8	\$1,111,942.50	\$7,054,452.79	\$1,837,321.41	\$11,534,030.63
Jefferson	\$0.00	\$0.00	\$0.00	\$1,389,986.04	\$0.00	\$2,493,372.58	\$3,883,358.62
Oldham	\$0.00	\$0.00	\$325,990.72	\$626,964.47	\$2,594,466.65	\$999,313.55	\$4,546,735.39
Shelby	\$0.00	\$0.00	\$1,143,373.0	\$1,407,076.00	\$6,764,605.84	\$2,143,284.27	\$11,458,339.20
Spencer	\$0.00	\$0.00	\$1,468,330.7	\$1,372,604.59	\$7,594,559.73	\$2,261,859.26	\$12,697,354.34
Trimble	\$717,960.19	\$0.00	\$582,991.57	\$578,717.42	\$2,727,102.96	\$972,316.84	\$5,579,088.98

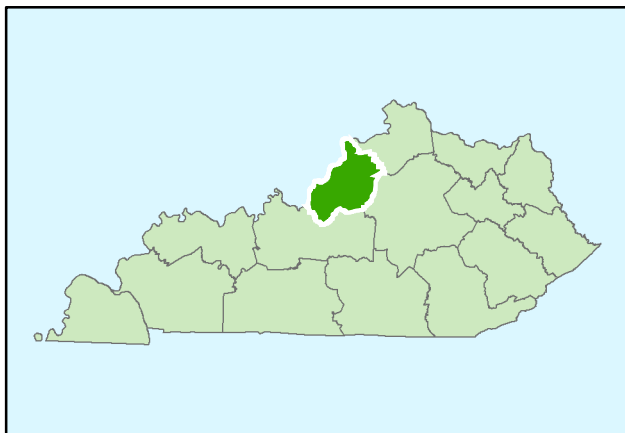


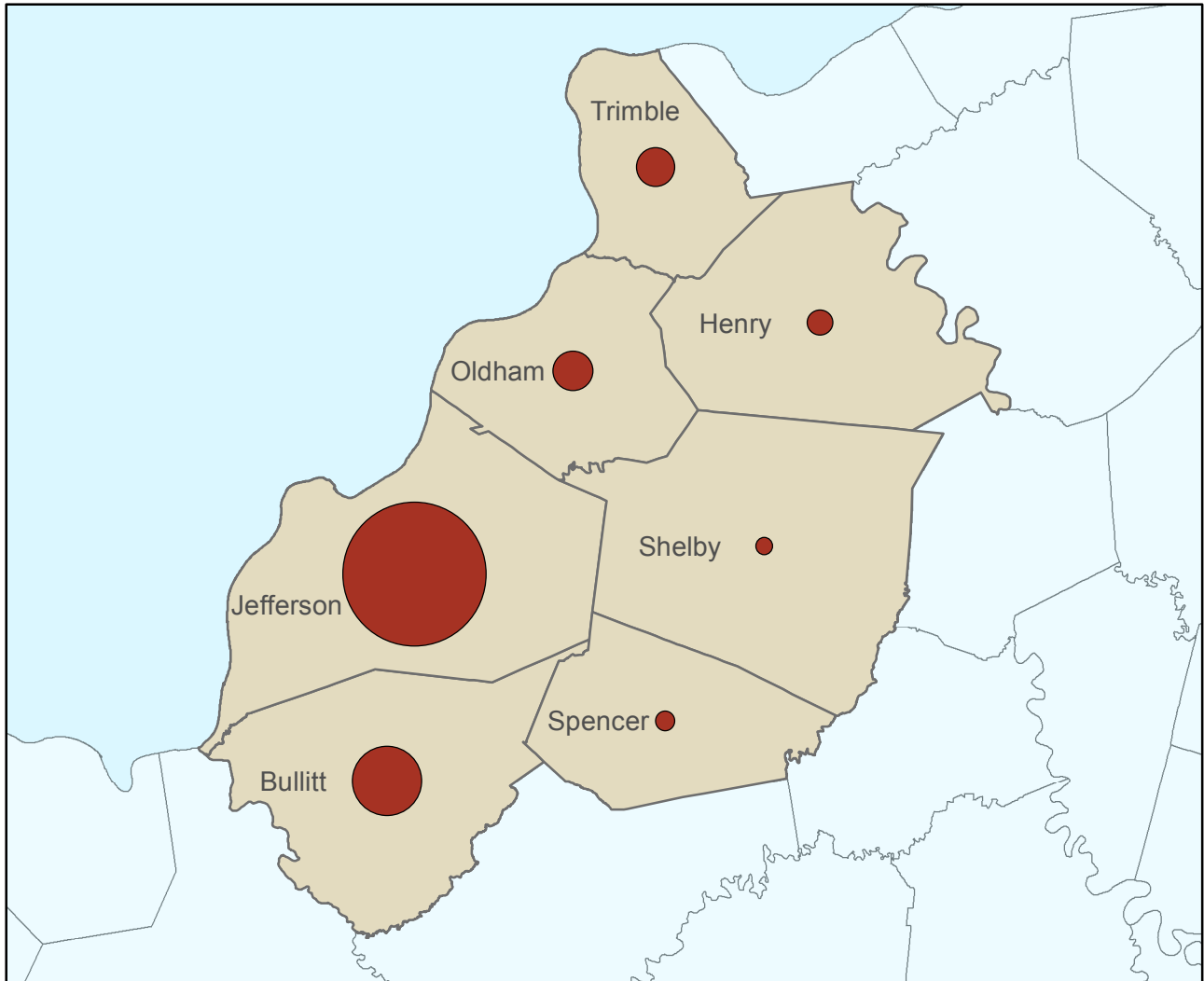
KIPDA Area Development District

General Building Loss



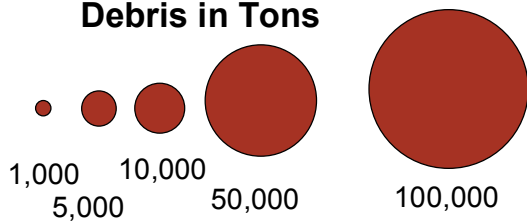
County	Total Loss	Bldg Loss	Contents Loss
Bullitt	\$348,225.00	\$189,392.00	\$154,331.00
Henry	\$28,695.00	\$15,641.00	\$12,772.00
Jefferson	\$3,215,879.00	\$814,757.00	\$917,720.00
Oldham	\$128,103.00	\$78,503.00	\$48,933.00
Shelby	\$35,011.00	\$15,144.00	\$19,260.00
Spencer	\$60,297.00	\$32,014.00	\$27,676.00
Trimble	\$40,150.00	\$18,302.00	\$21,481.00





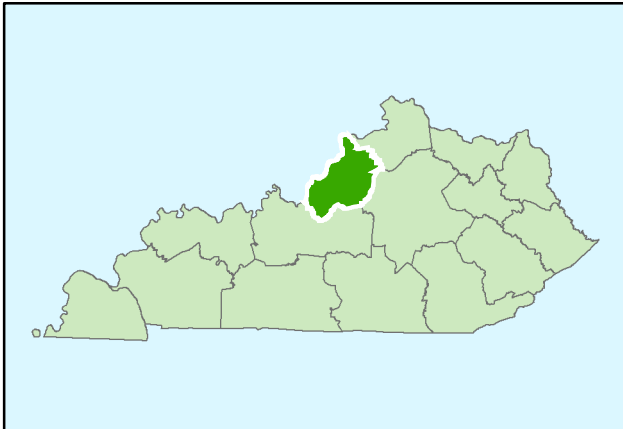
0 5 10 20 Miles

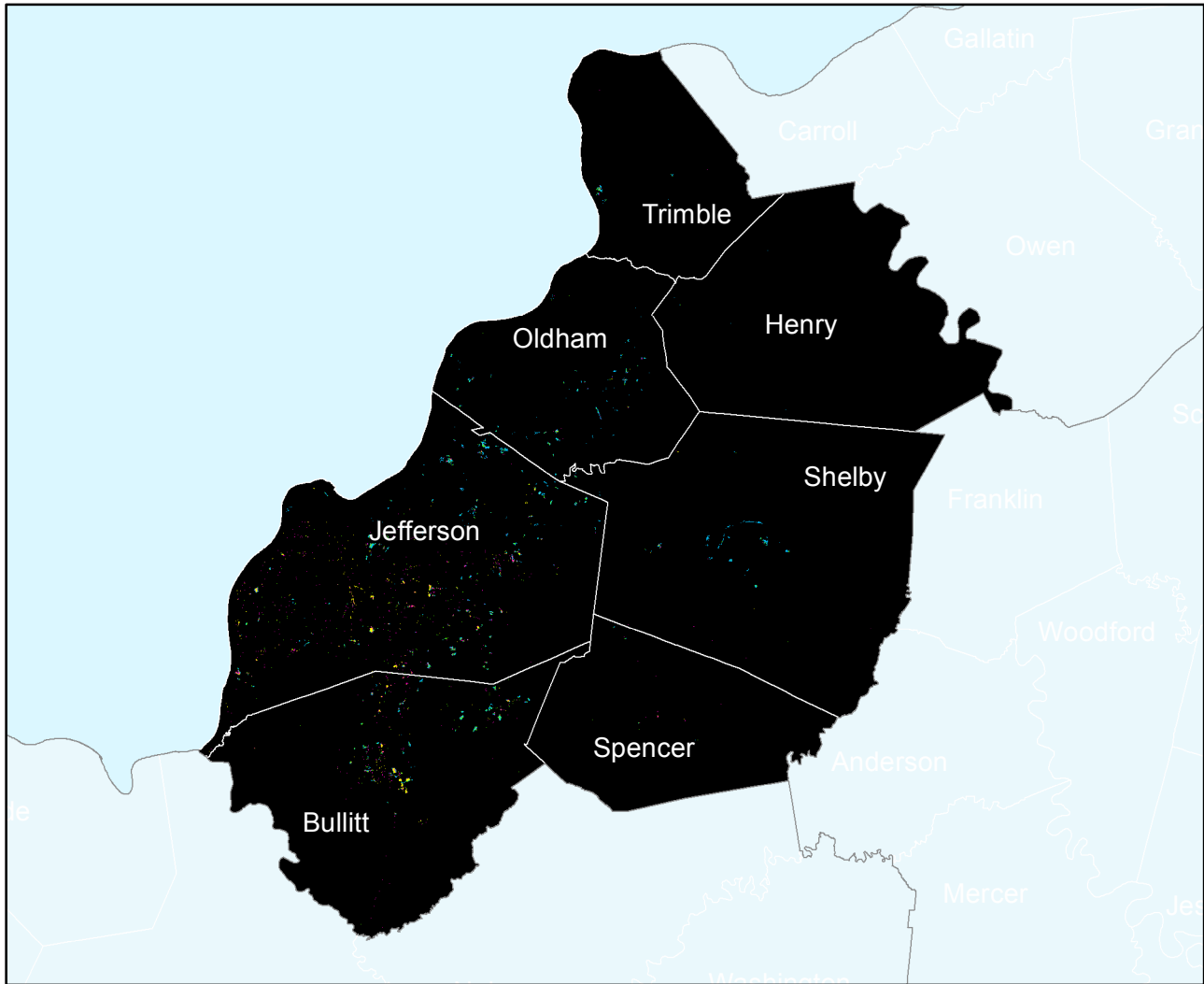
Debris in Tons



KIPDA Area Development District

County	Debris Tons
Bullitt	23362
Henry	3112
Jefferson	100537
Oldham	7936
Shelby	1463
Spencer	1889
Trimble	7182



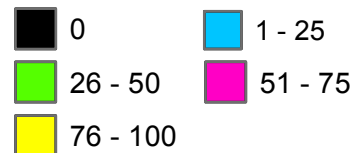


0 5 10 20 Miles

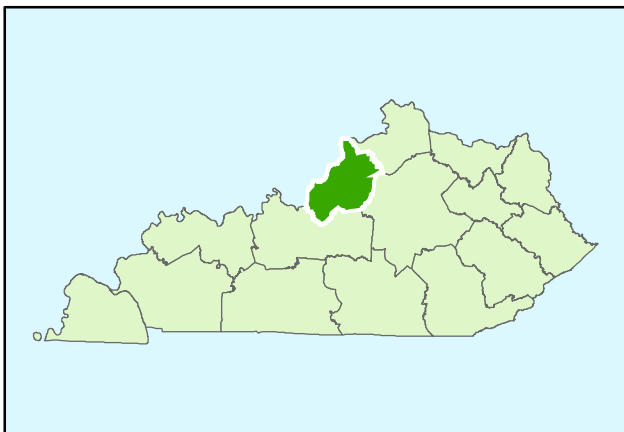


KIPDA Area Development District

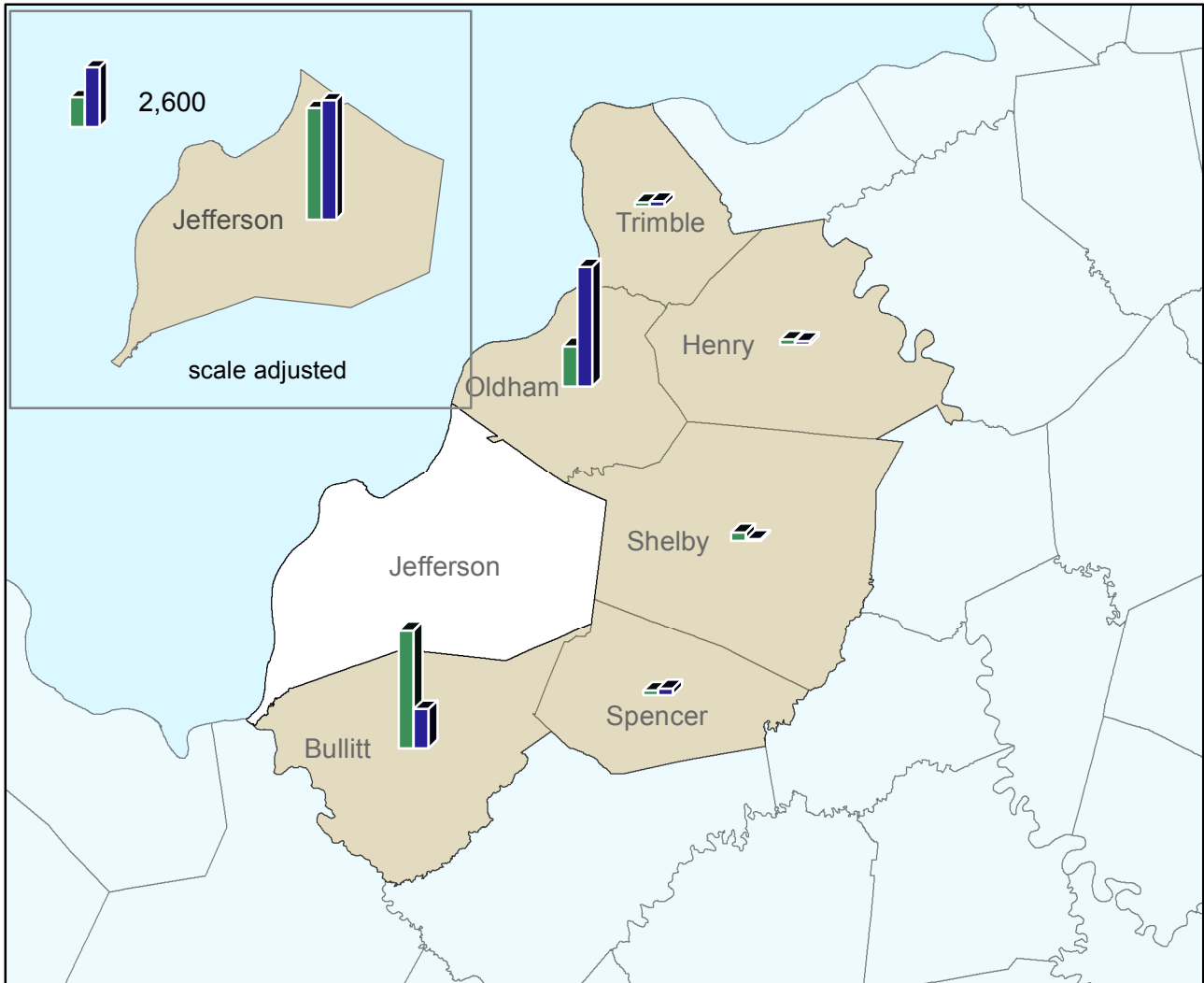
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**



Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.

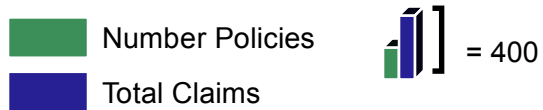


0 5 10 20 Miles

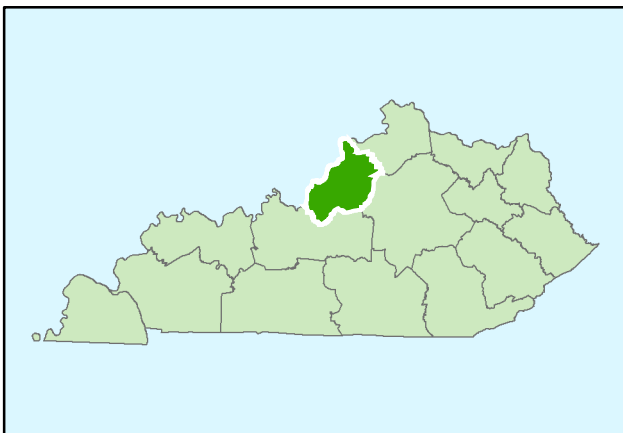
KIPDA Area Development District

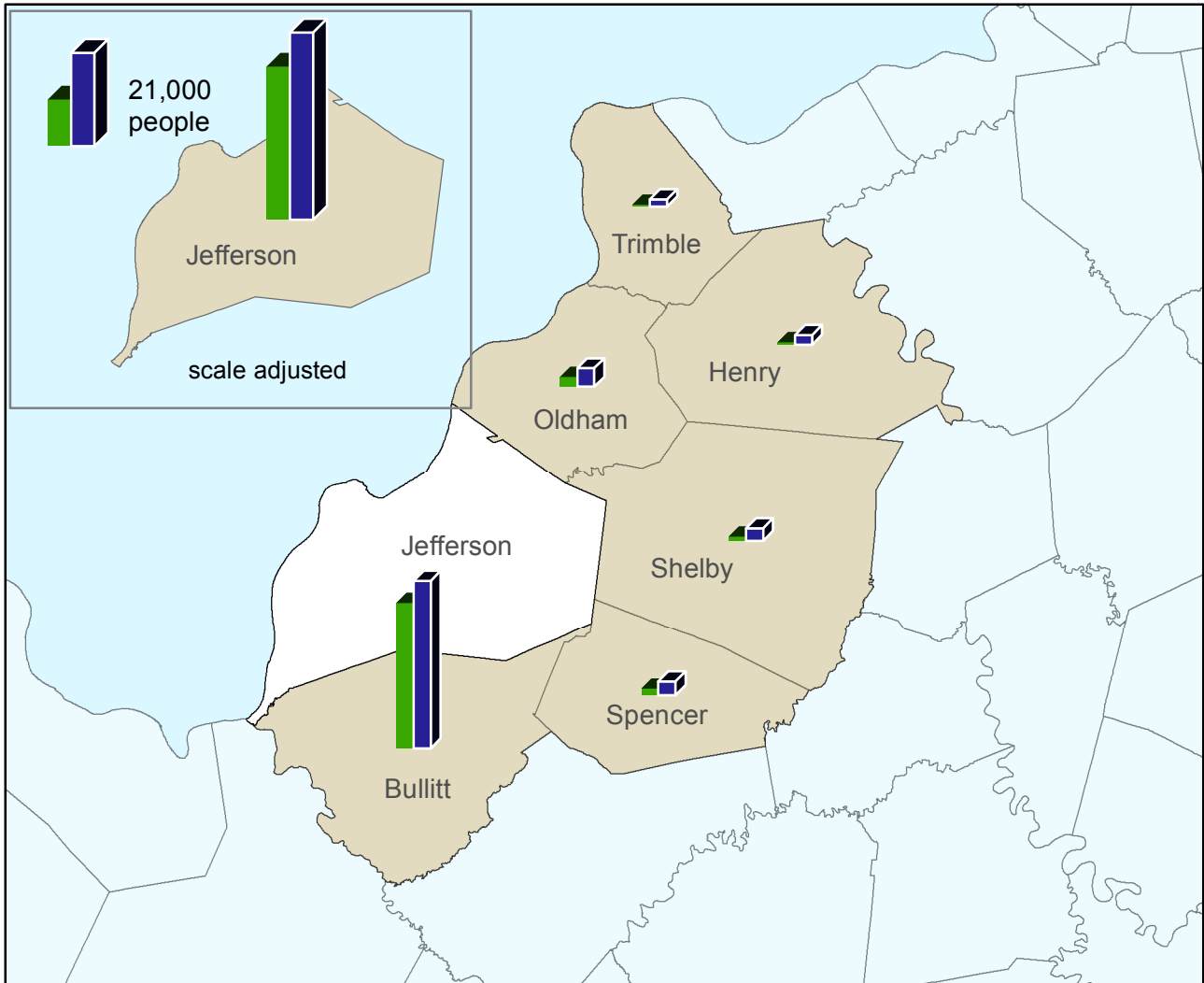


National Flood Insurance Program Policies and Claims (1978 - May 2018)



County	Number Policies	Total Claims
Bullitt	790	263
Henry	33	24
Jefferson	4898	5249
Oldham	271	801
Shelby	56	12
Spencer	31	46
Trimble	29	38





0 5 10 20 Miles



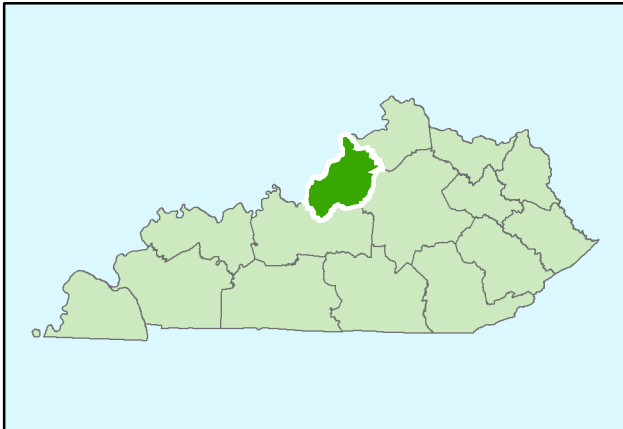
= 3,800 people

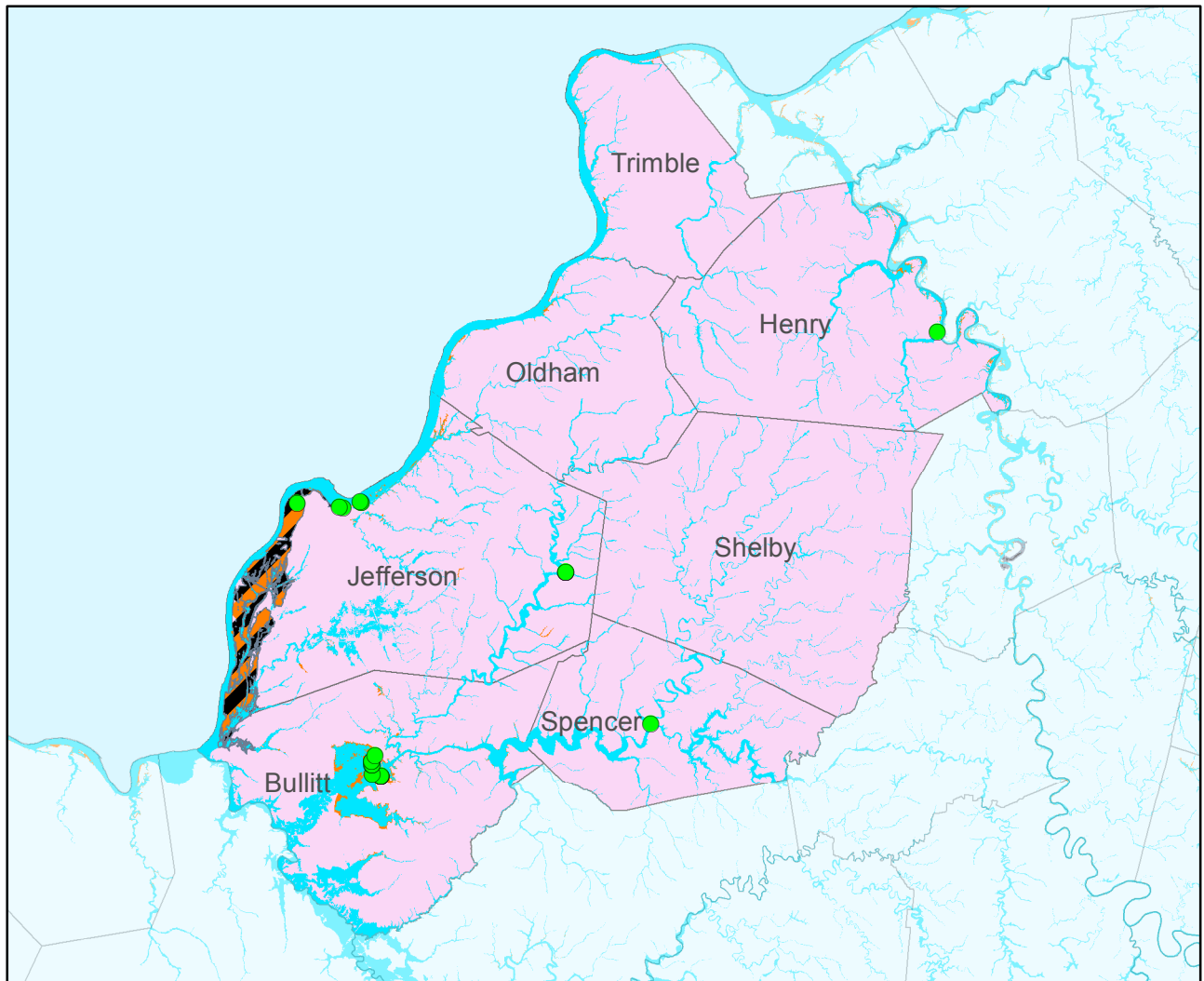
Need Shelter

Displaced

KIPDA Area Development District

County	Displaced	Need Shelter
Bullitt	9257	8022
Henry	513	110
Jefferson	41225	33710
Oldham	1023	543
Shelby	694	233
Spencer	754	353
Trimble	413	124





0 5 10 20 Miles

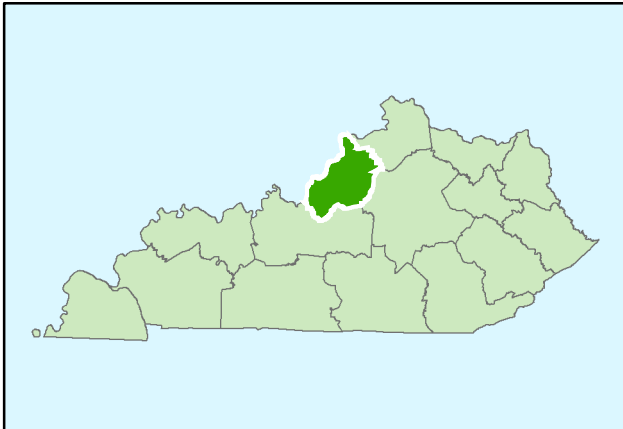


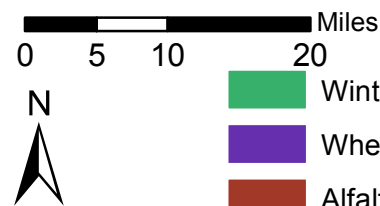
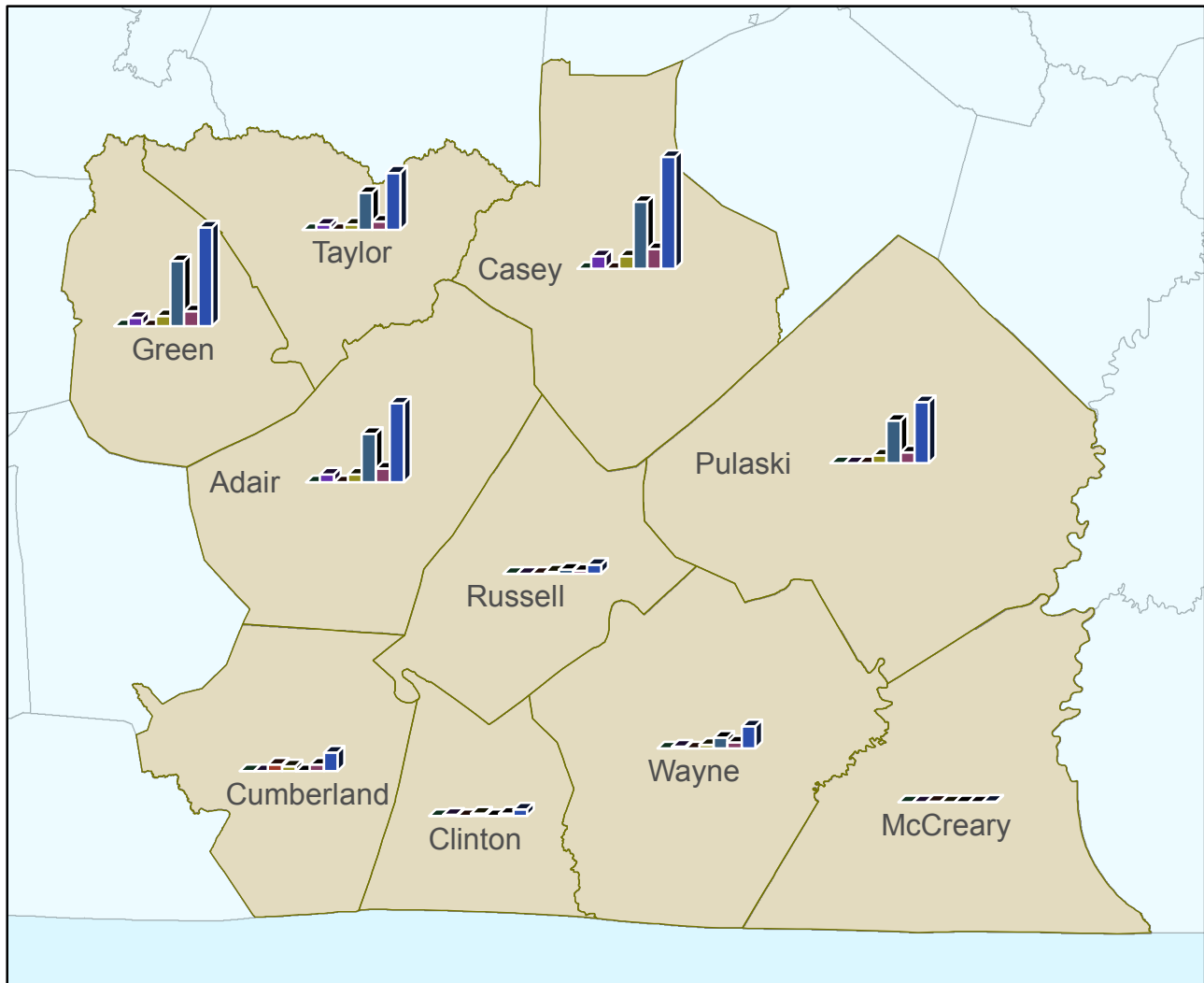
KIPDA Area Development District

Replacement Cost Value

\$0.00 - \$3 million	\$20 million - \$50 million
\$3 million - \$13 million	\$50 million - \$500 million
\$13 million - \$20 million	State Facilities in Floodplain

County	No. Vulnerable State Facilities	Replacement Cost Value
Bullitt	11	\$2,007,768.00
Henry	1	\$0.00
Jefferson	8	\$2,803,003.60
Oldham	0	\$0.00
Shelby	0	\$0.00
Spencer	1	\$0.00
Trimble	0	\$0.00





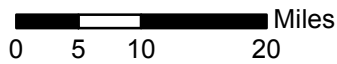
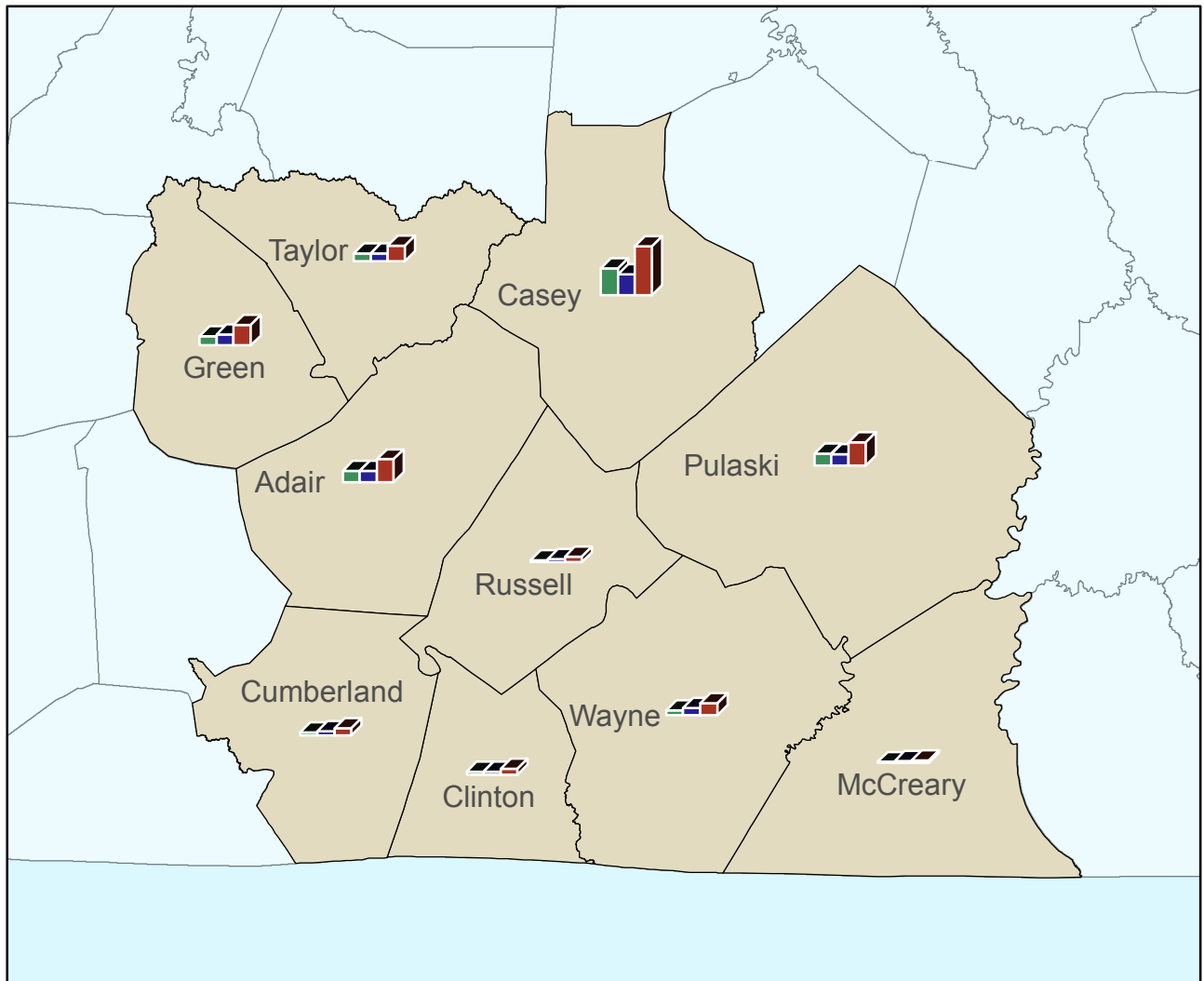
Agriculture Losses by County



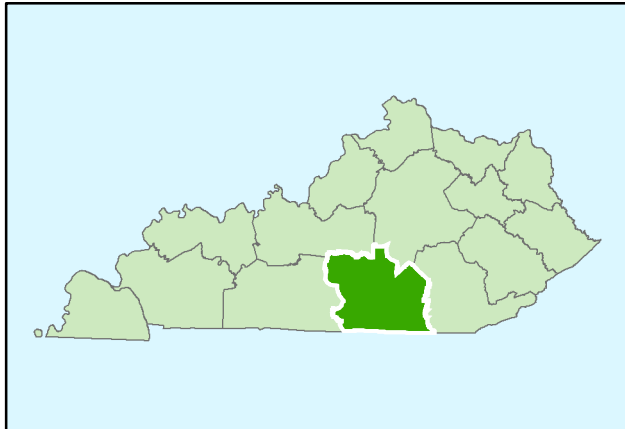
*Counties with no bars indicate no losses.

Lake Cumberland Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Adair	\$0.00	\$0.00	\$1,602,601.7	\$1,673,071.99	\$9,995,479.13	\$2,879,457.31	\$16,150,610.21
Casey	\$0.00	\$0.00	\$2,565,633.1	\$2,592,467.29	\$13,739,518.05	\$4,033,065.12	\$22,930,683.62
Clinton	\$0.00	\$0.00	\$335,050.36	\$508,441.80	\$0.00	\$508,619.30	\$1,352,111.46
Cumberland	\$0.00	\$1,366,862.65	\$0.00	\$1,038,030.73	\$0.00	\$1,435,018.05	\$3,839,911.43
Green	\$0.00	\$0.00	\$1,774,520.1	\$2,076,973.19	\$13,327,402.87	\$3,070,882.90	\$20,249,779.09
McCreary	\$0.00	\$155,518.58	\$0.00	\$0.00	\$0.00	\$0.00	\$155,518.58
Pulaski	\$0.00	\$0.00	\$0.00	\$1,547,782.02	\$8,706,140.53	\$2,159,830.56	\$12,413,753.11
Russell	\$0.00	\$0.00	\$0.00	\$423,687.98	\$875,736.24	\$560,418.64	\$1,859,842.86
Taylor	\$0.00	\$0.00	\$1,171,413.8	\$1,161,652.39	\$7,618,701.19	\$1,764,746.72	\$11,716,514.10
Wayne	\$0.00	\$0.00	\$364,542.04	\$657,411.37	\$2,229,717.21	\$1,190,270.26	\$4,441,940.88

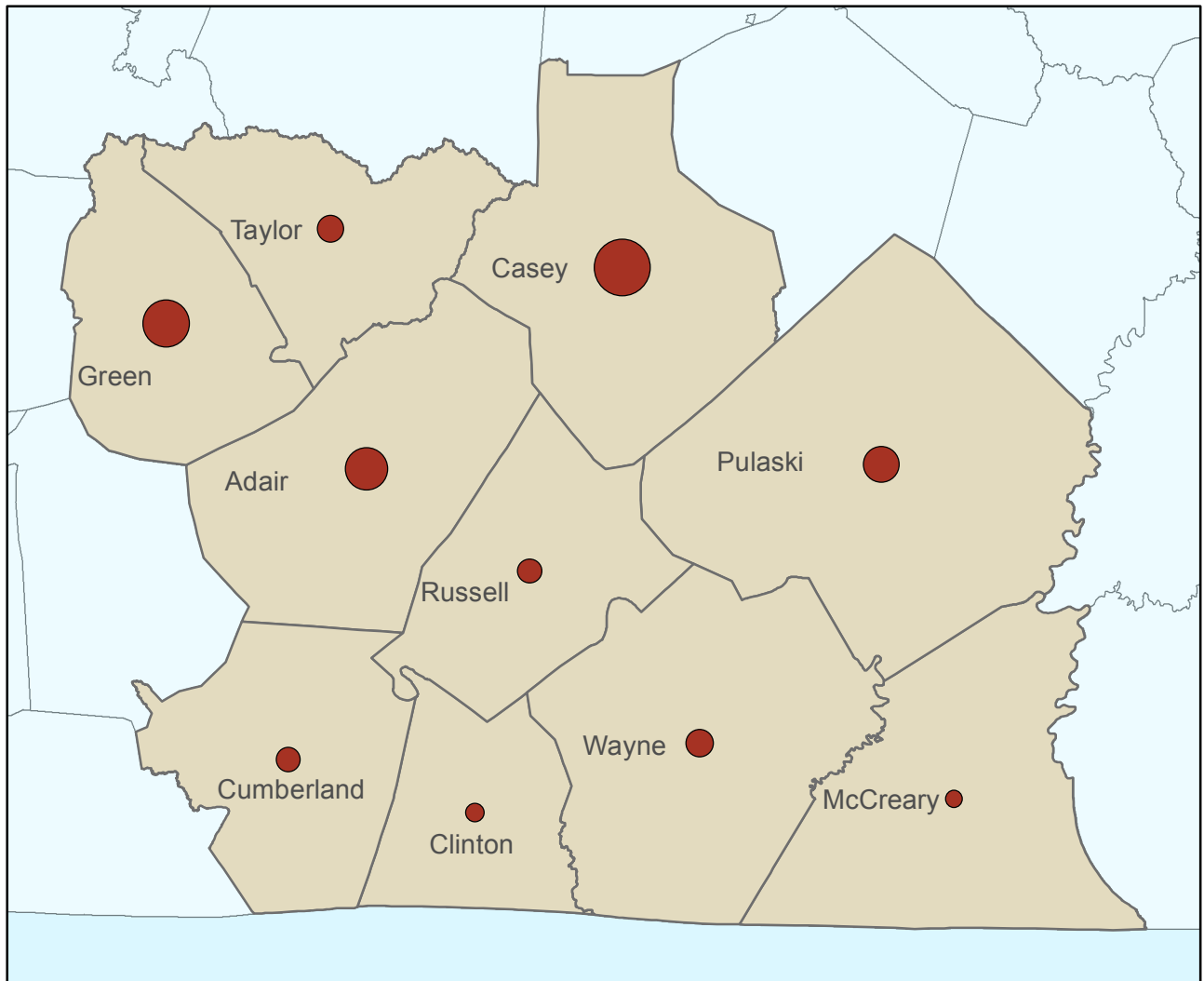


General Building Loss



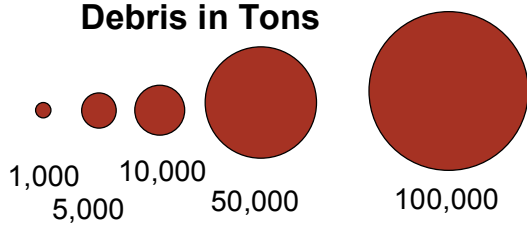
Lake Cumberland Area Development District

County	Total Loss	Bldg Loss	Contents Loss
Adair	\$54,209.00	\$26,701.00	\$26,824.00
Casey	\$114,626.00	\$48,621.00	\$62,866.00
Clinton	\$14,735.00	\$7,359.00	\$7,111.00
Cumberland	\$17,040.00	\$9,684.00	\$7,030.00
Green	\$47,898.00	\$25,321.00	\$21,895.00
McCreary	\$6,043.00	\$3,782.00	\$2,232.00
Pulaski	\$54,263.00	\$26,242.00	\$27,019.00
Russell	\$13,002.00	\$7,778.00	\$5,149.00
Taylor	\$35,976.00	\$17,431.00	\$18,021.00
Wayne	\$28,961.00	\$16,708.00	\$12,042.00



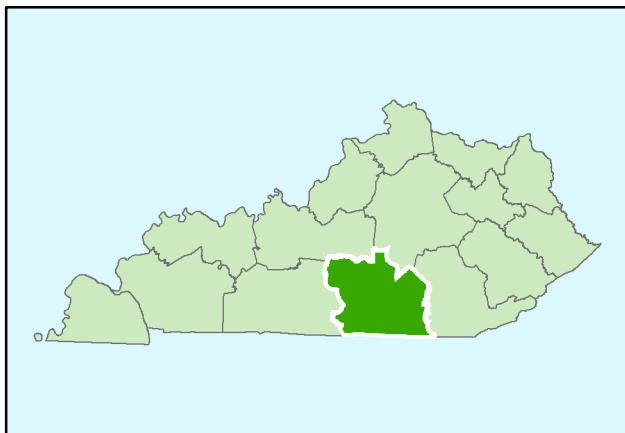
0 5 10 20 Miles

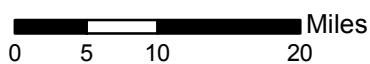
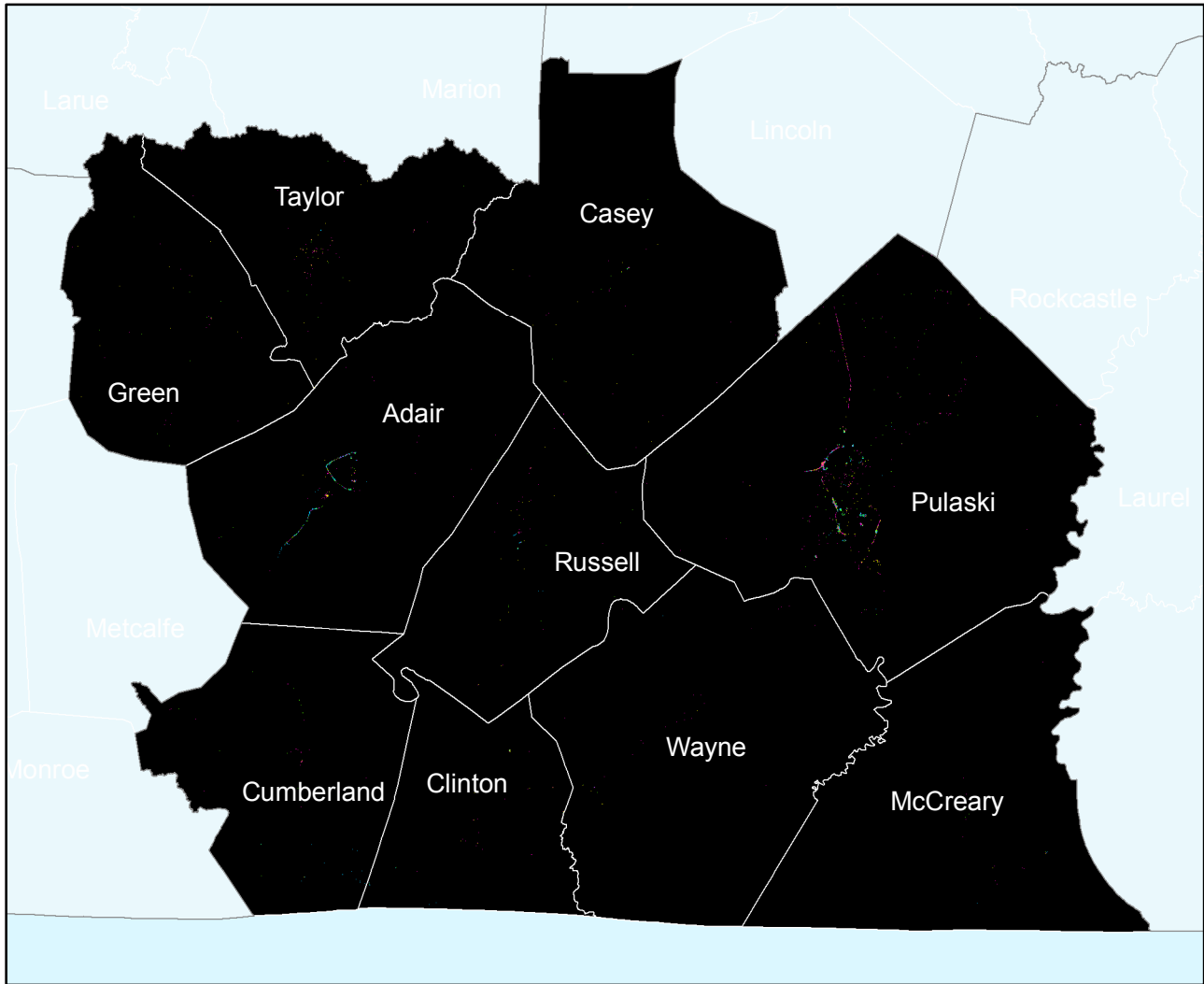
Debris in Tons



Lake Cumberland Area Development District

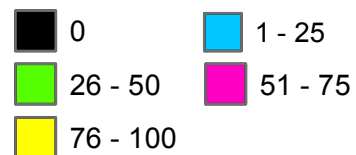
County	Debris Tons
Adair	8643
Casey	15487
Clinton	1714
Cumberland	2850
Green	10842
McCreary	1548
Pulaski	6374
Russell	2966
Taylor	3406
Wayne	3725



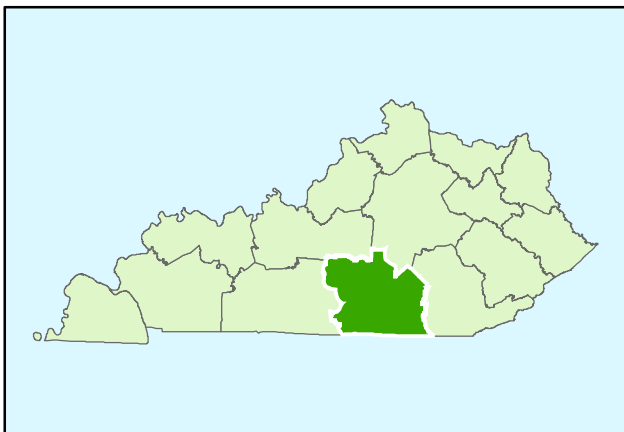


LAKE CUMBERLAND Area Development District

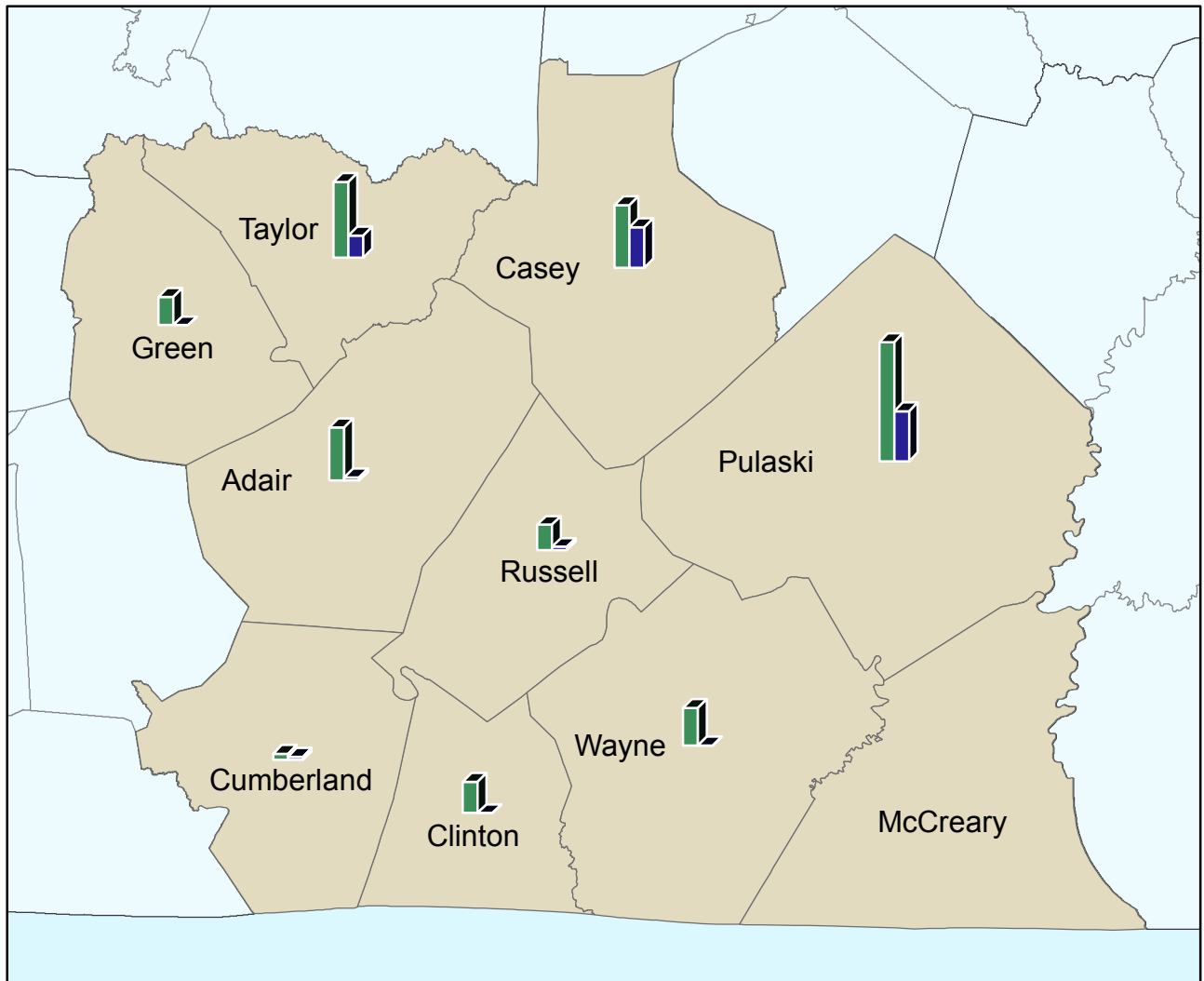
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**



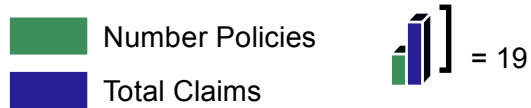
Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



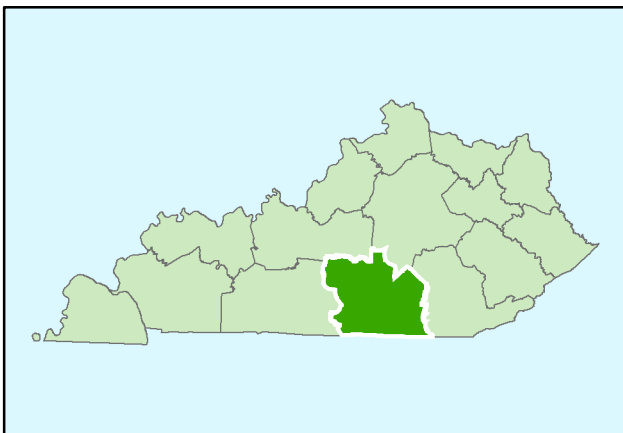
0 5 10 20 Miles

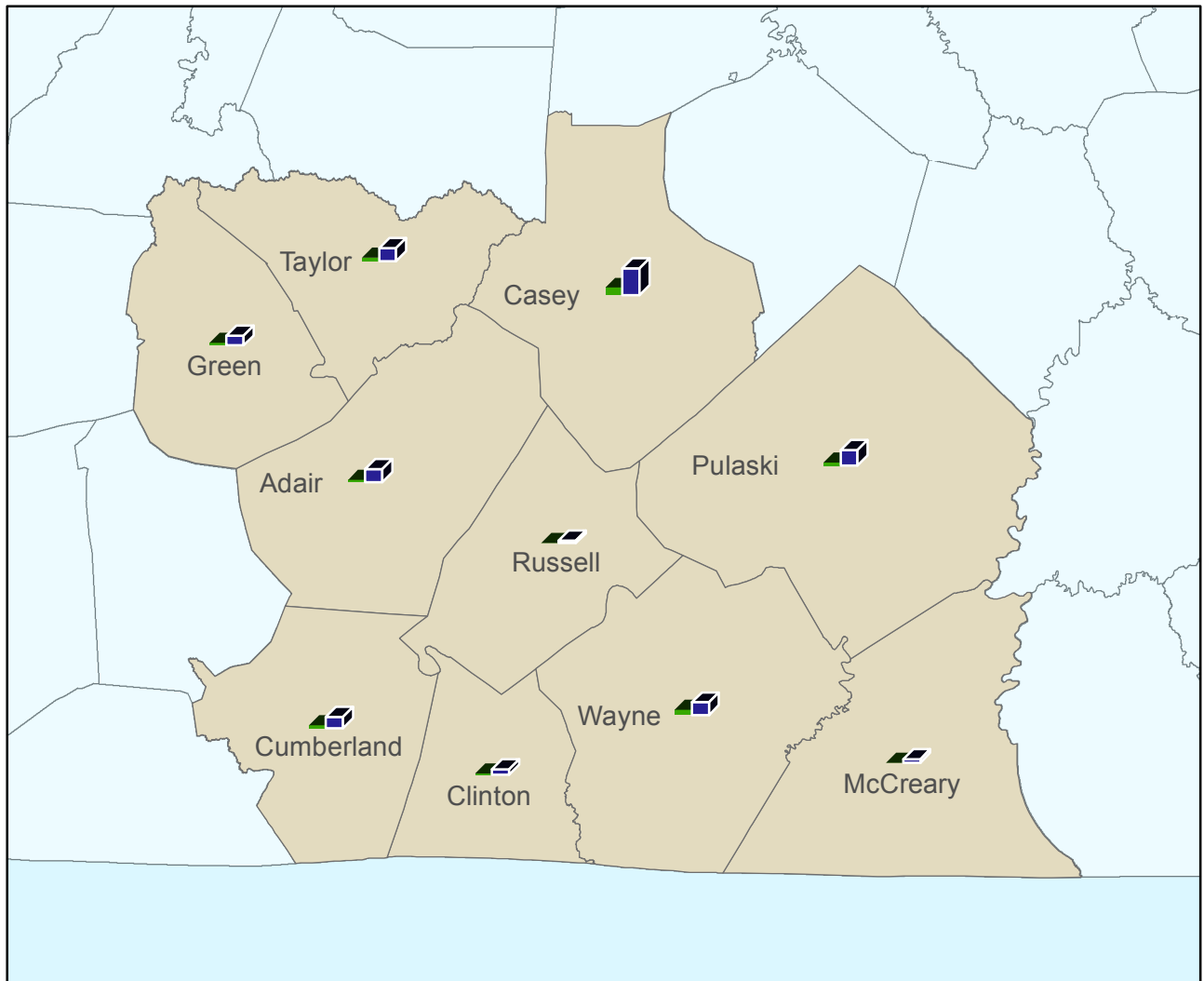
Lake Cumberland Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)




County	Number Policies	Total Claims
Adair	17	1
Casey	20	13
Clinton	10	0
Cumberland	2	1
Green	9	0
Pulaski	38	16
Russell	8	1
Taylor	24	7
Wayne	12	0
McCreary	0	0





0 5 10 20 Miles

 = 3,800 people

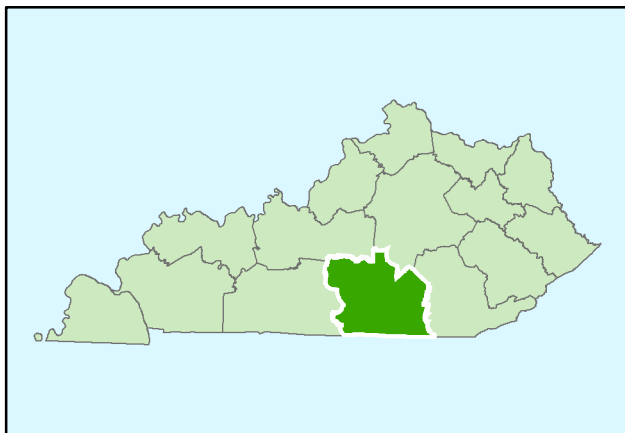
 Need Shelter

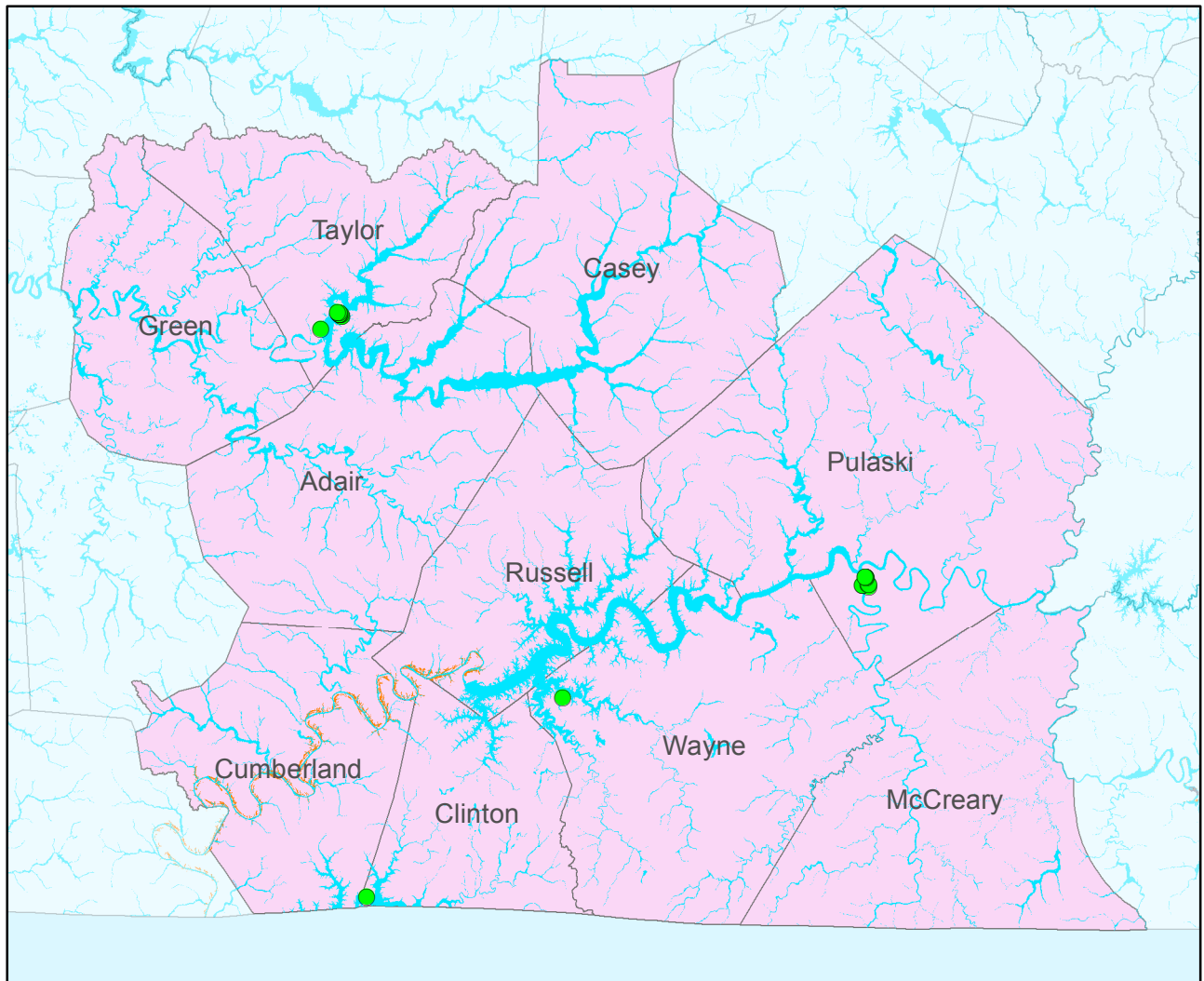
 Displaced



Lake Cumberland Area Development District

County	Displaced	Need Shelter
Adair	744	140
Casey	1468	404
Clinton	314	86
Cumberland	636	171
Green	559	138
McCreary	194	15
Pulaski	845	144
Russell	150	11
Taylor	721	186
Wayne	720	308

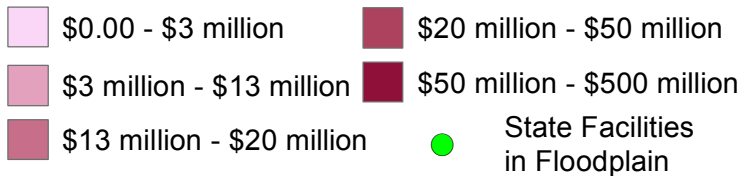




0 5 10 20 Miles

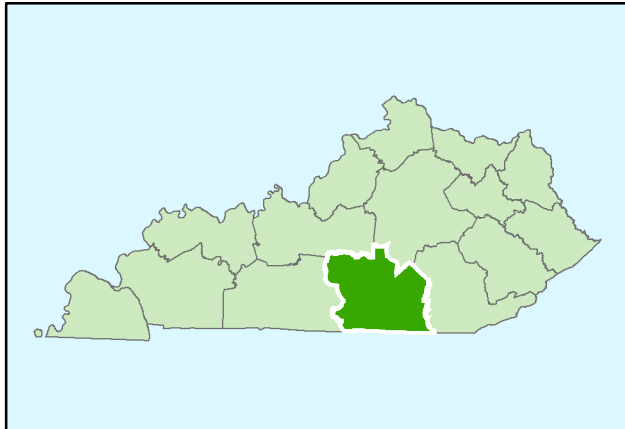


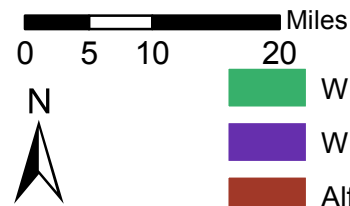
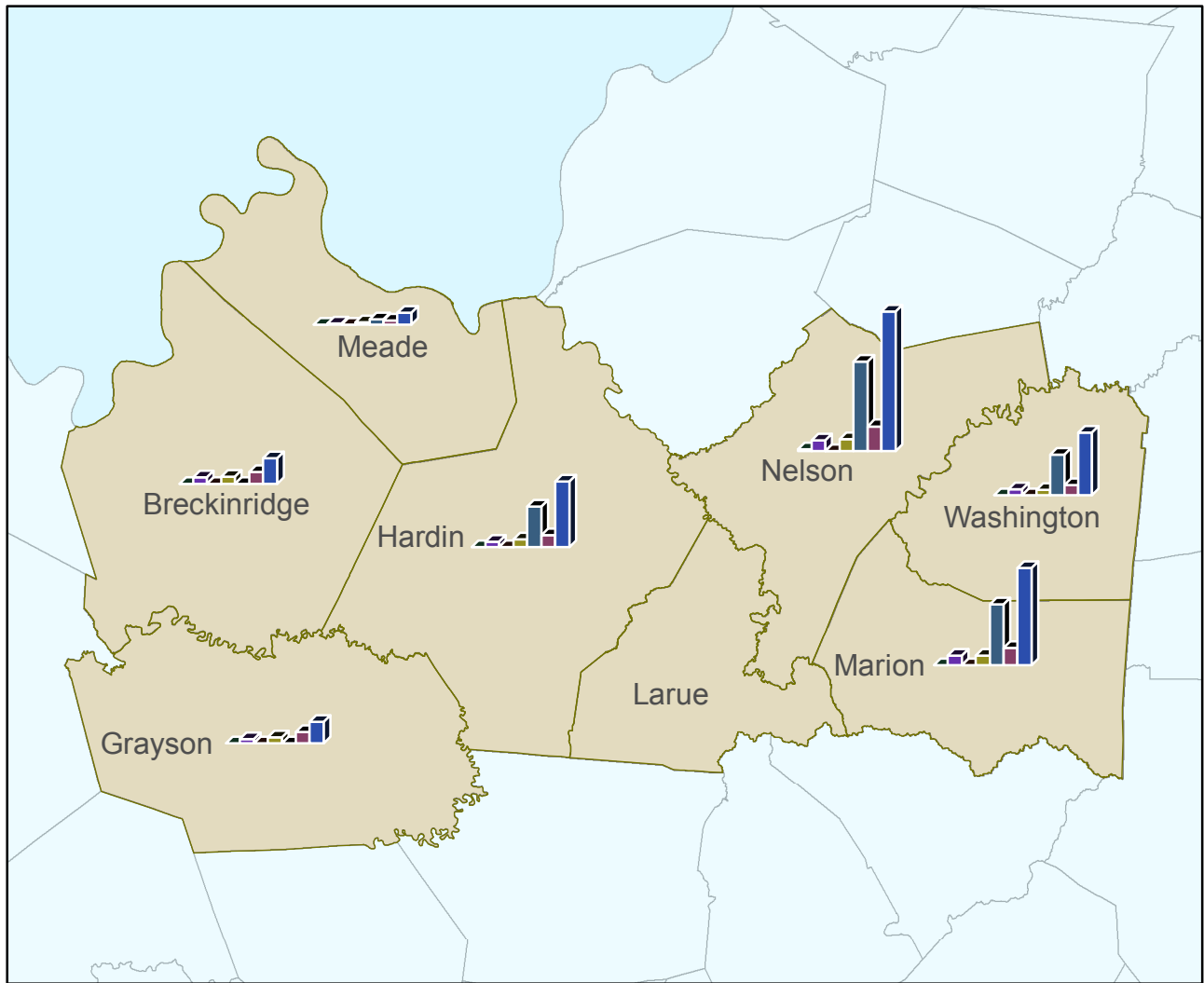
Replacement Cost Value



Lake Cumberland Area Development District

County	No. Vulnerable State Facilities	Replacement Cost Value
Adair	0	\$0.00
Casey	0	\$0.00
Clinton	1	\$473,954.00
Cumberland	0	\$0.00
Green	0	\$0.00
McCreary	0	\$0.00
Pulaski	10	\$866,956.00
Russell	0	\$0.00
Taylor	10	\$600,314.00
Wayne	1	\$0.00





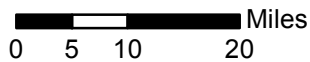
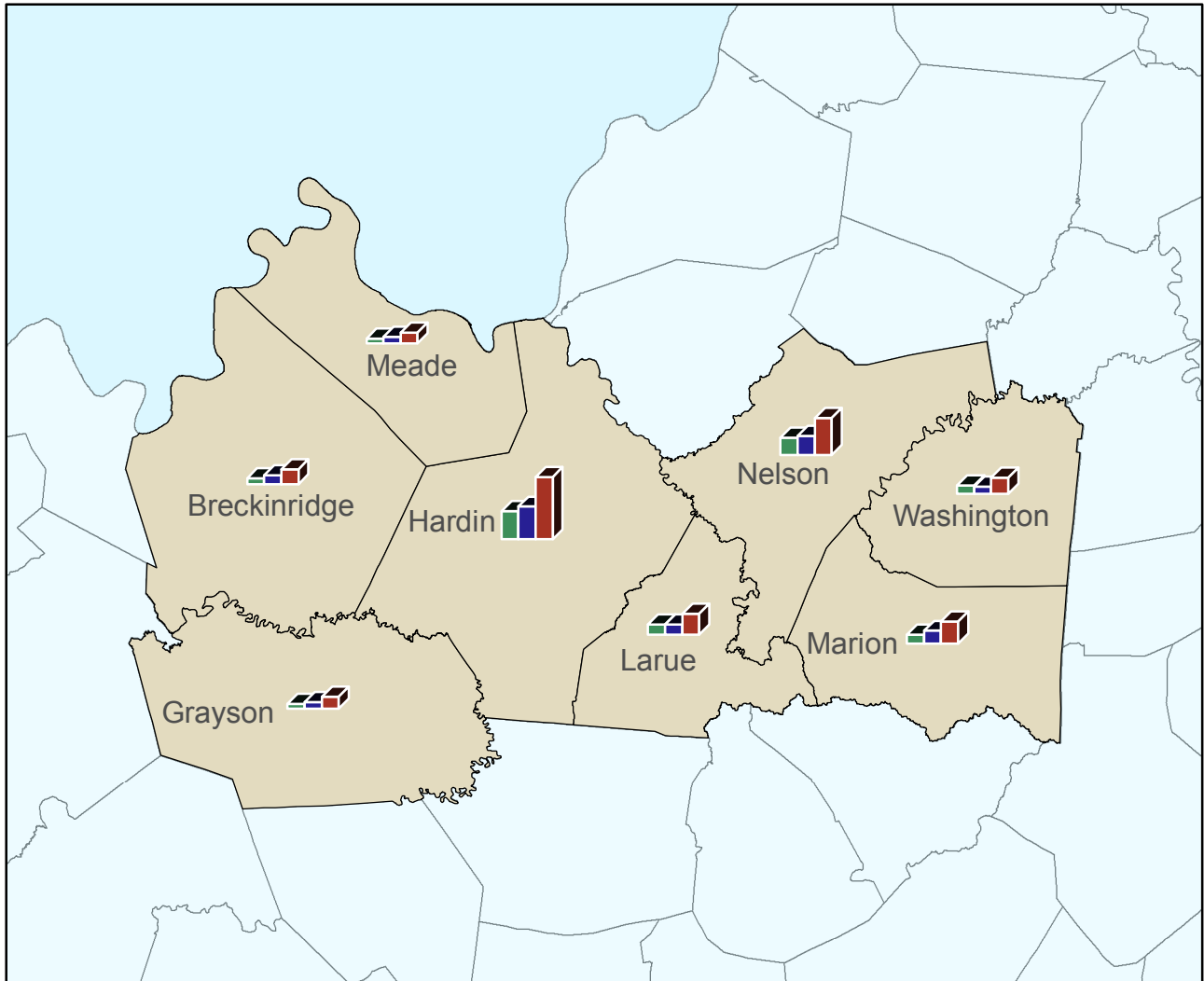
Agriculture Losses by County



*Counties with no bars indicate no losses.

Lincoln Trail Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Breckinridge	\$0.00	\$0.00	\$1,342,318.8	\$1,512,975.68	\$0.00	\$2,448,594.26	\$5,303,888.82
Grayson	\$0.00	\$0.00	\$834,482.09	\$1,200,262.97	\$0.00	\$2,348,647.45	\$4,383,392.51
Hardin	\$0.00	\$0.00	\$1,143,134.8	\$1,530,622.72	\$8,290,556.58	\$2,456,570.33	\$13,420,884.46
Marion	\$0.00	\$0.00	\$1,891,417.0	\$1,965,770.10	\$12,448,526.73	\$3,543,525.81	\$19,849,239.68
Meade	\$0.00	\$0.00	\$169,427.91	\$461,888.80	\$1,008,443.90	\$806,467.27	\$2,446,227.88
Nelson	\$413,910.32	\$0.00	\$2,235,294.1	\$2,541,865.12	\$18,339,695.83	\$5,122,074.30	\$28,652,839.70
Washington	\$0.00	\$0.00	\$1,251,499.4	\$1,131,671.84	\$8,274,665.78	\$2,124,278.46	\$12,782,115.53
Larue	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

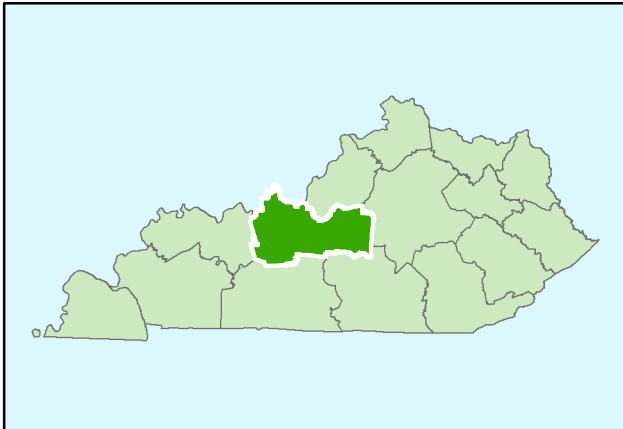


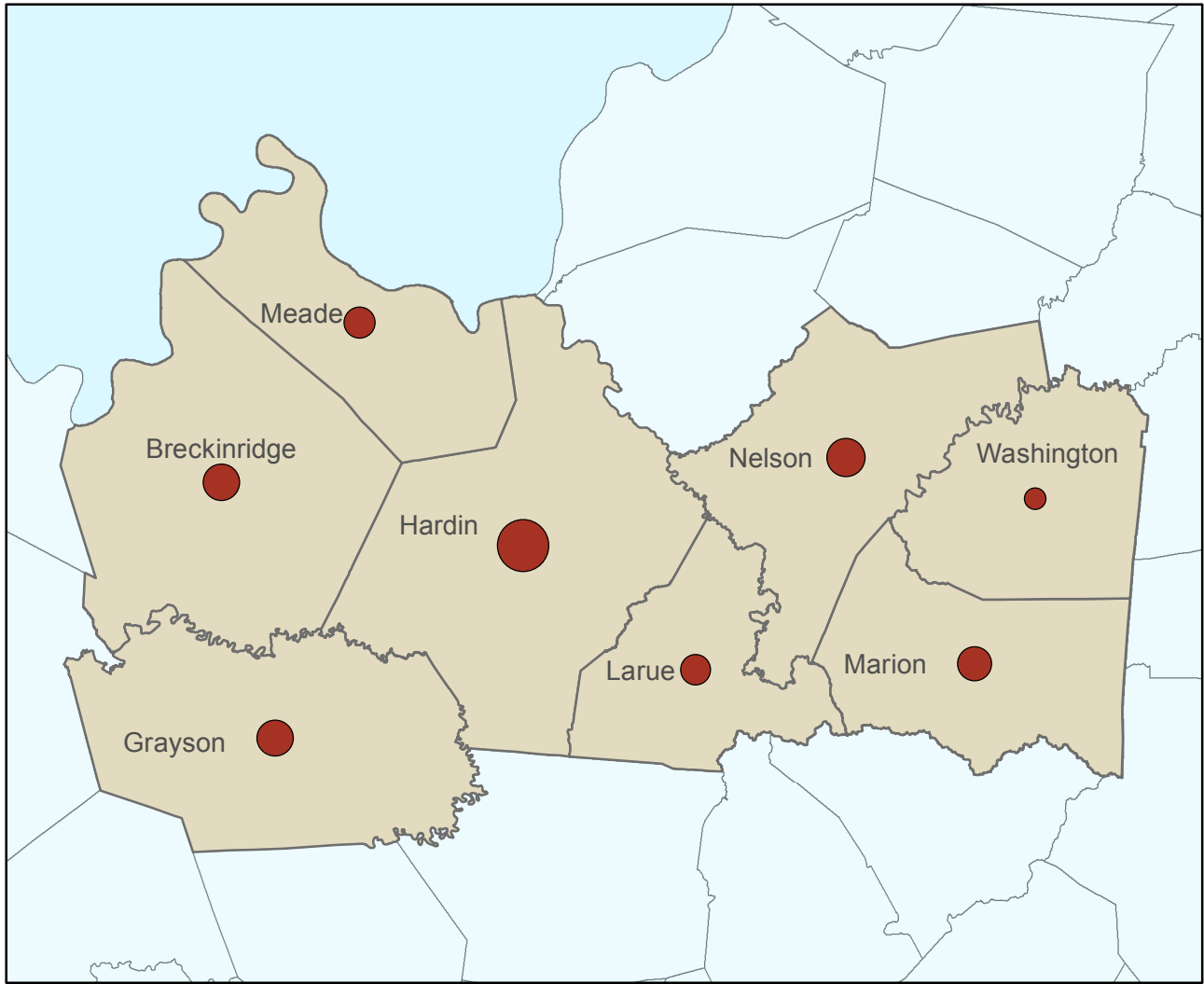
General Building Loss



Lincoln Trail Area Development District

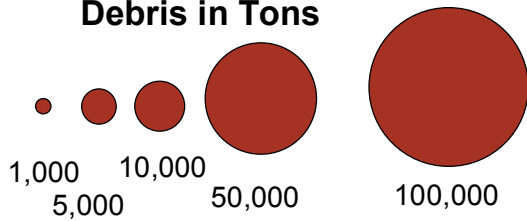
County	Total Loss	Bldg Loss	Contents Loss
Breckinridge	\$33,992.00	\$19,904.00	\$13,837.00
Grayson	\$28,957.00	\$16,560.00	\$12,035.00
Hardin	\$146,216.00	\$77,010.00	\$67,097.00
Larue	\$47,935.00	\$22,788.00	\$23,845.00
Marion	\$50,934.00	\$29,471.00	\$20,873.00
Meade	\$25,691.00	\$14,911.00	\$10,571.00
Nelson	\$87,159.00	\$45,000.00	\$40,748.00
Washington	\$37,773.00	\$16,811.00	\$19,896.00





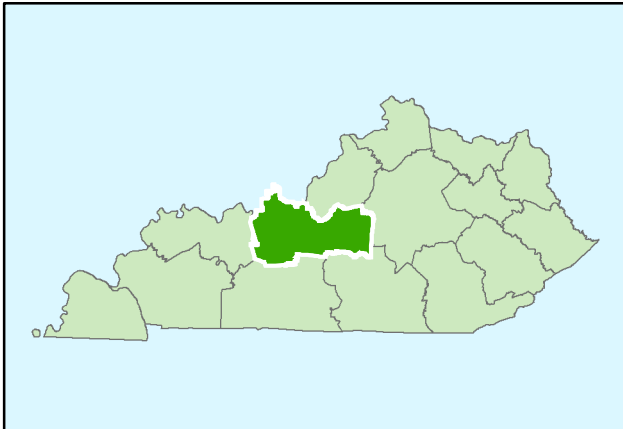
0 5 10 20 Miles

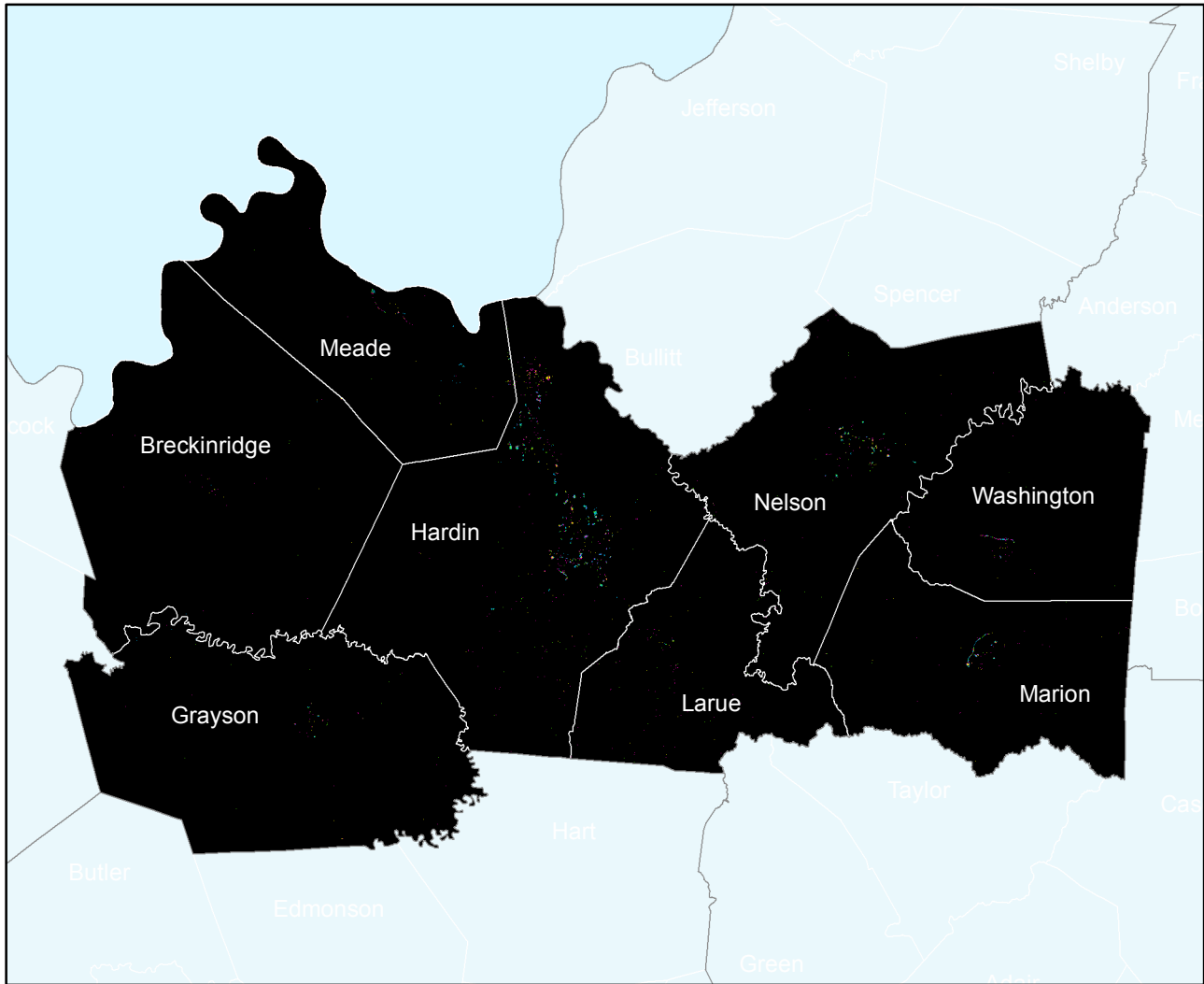
Debris in Tons



Lincoln Trail Area Development District

County	Debris Tons
Breckinridge	6483
Grayson	6568
Hardin	13094
Larue	4645
Marion	5678
Meade	4889
Nelson	7171
Washington	2432



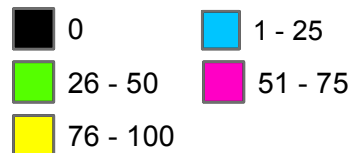


0 5 10 20 Miles

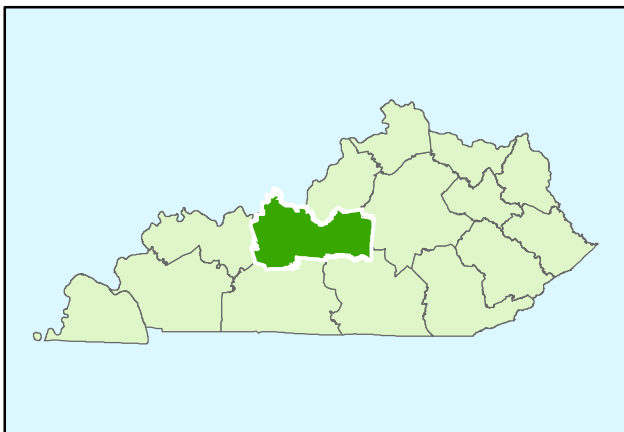


LINCOLN TRAIL Area Development District

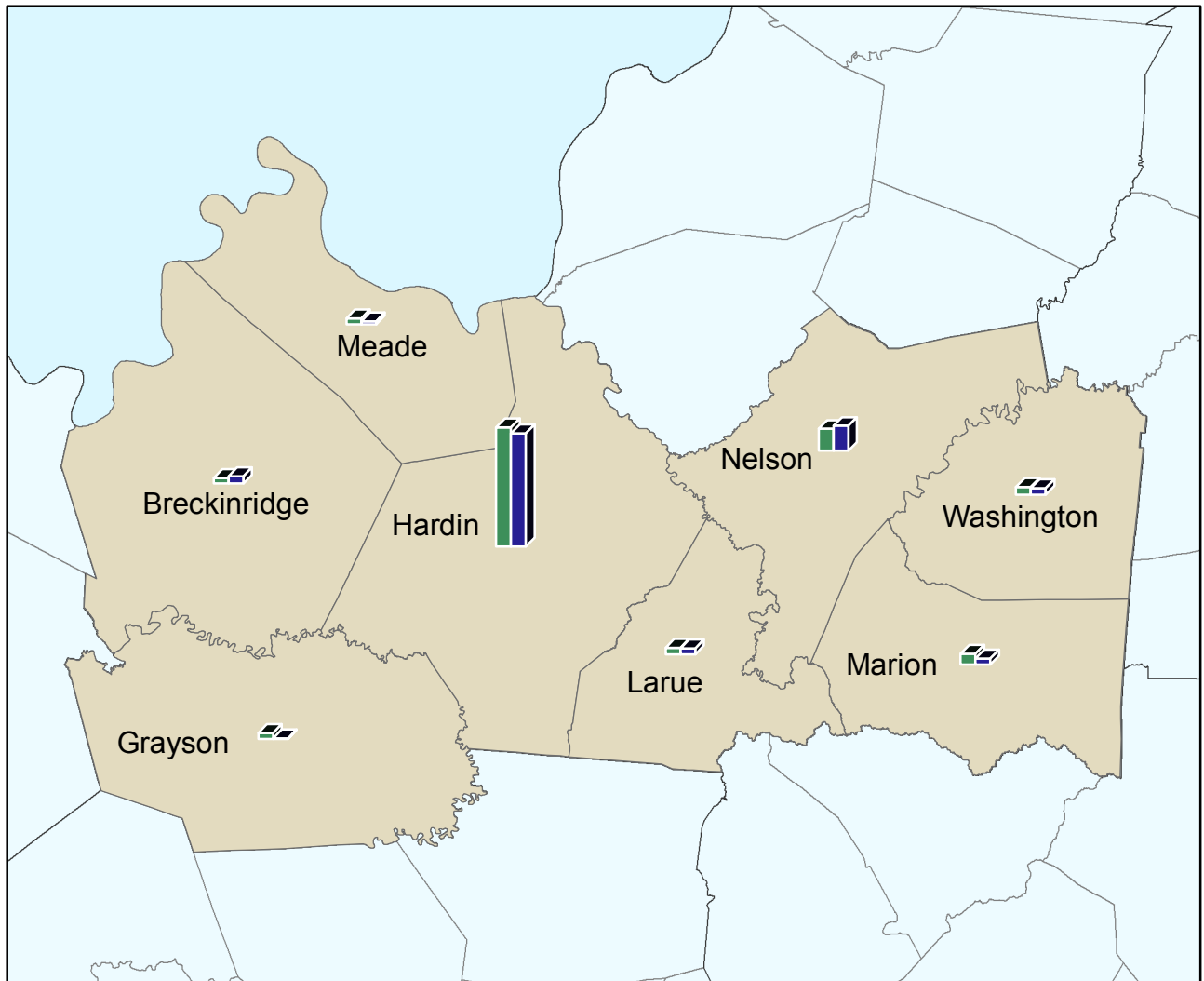
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**



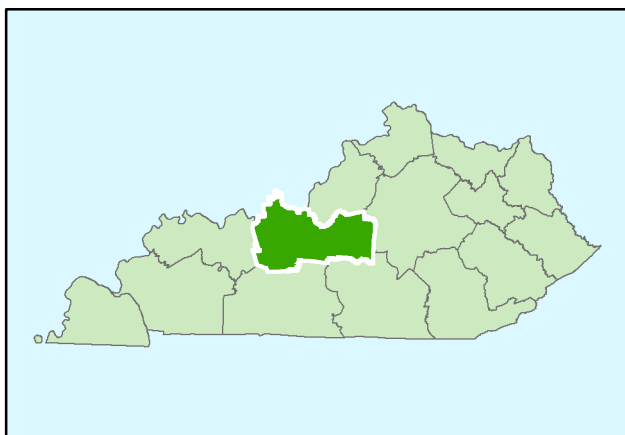
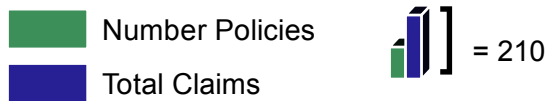
Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



0 5 10 20 Miles

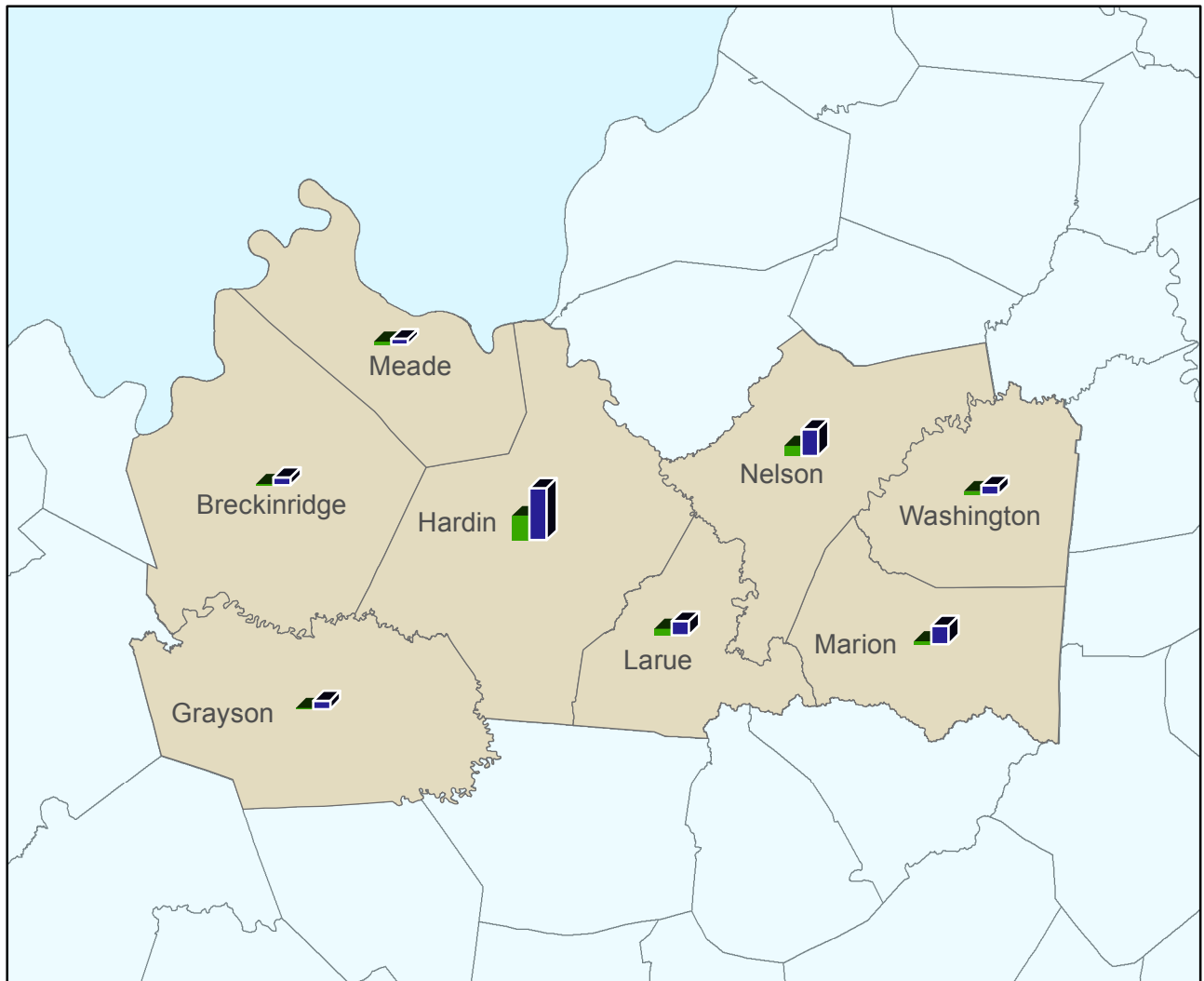
Lincoln Trail Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)




County	Number Policies	Total Claims
Breckinridge	19	26
Grayson	20	2
Hardin	410	390
Larue	22	21
Marion	36	21
Meade	20	9
Nelson	76	86
Washington	27	22





0 5 10 20 Miles

 = 3,800 people

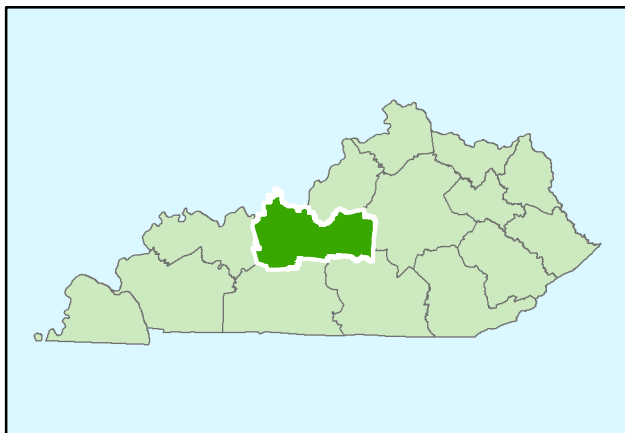
 Need Shelter

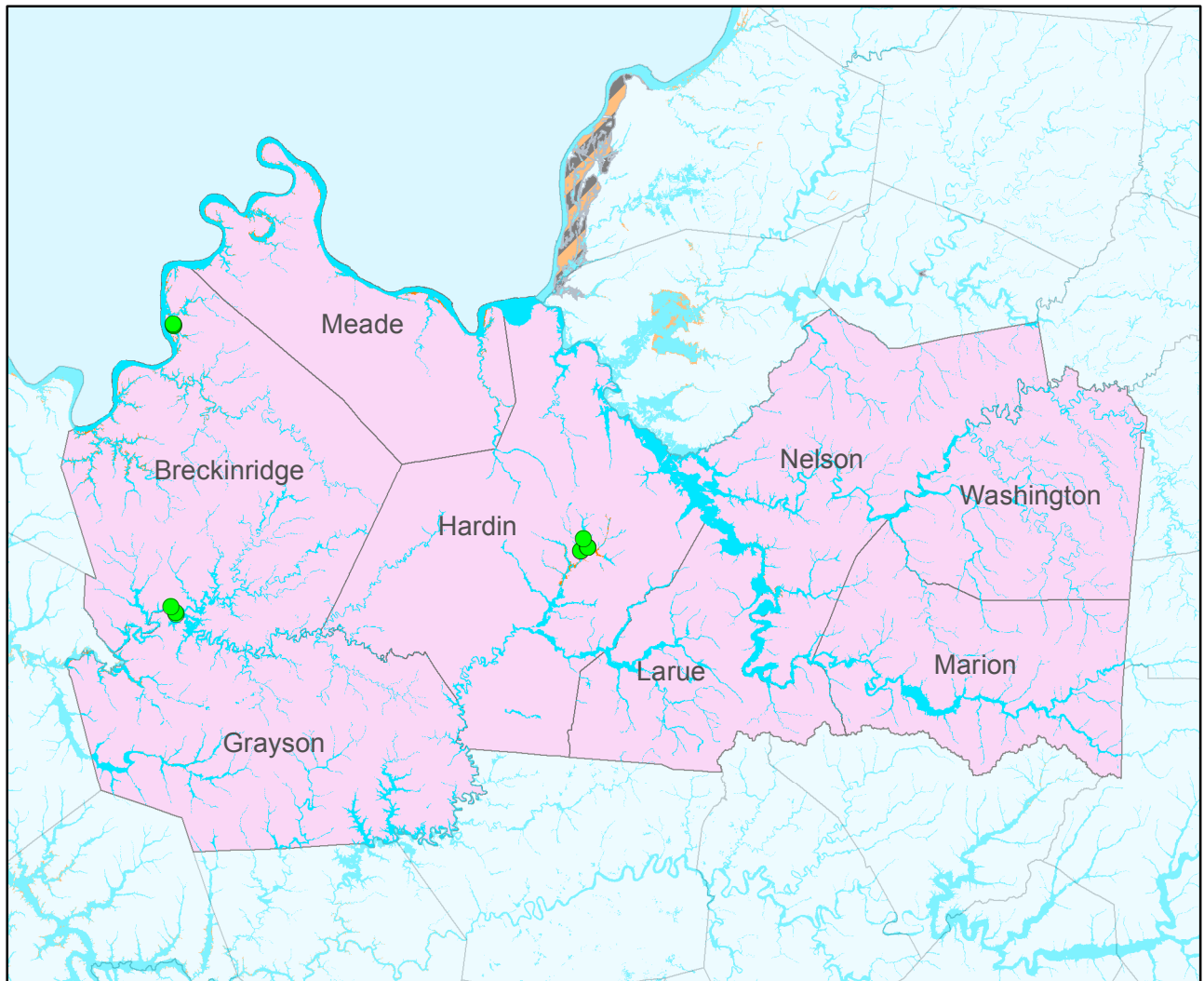
 Displaced



Lincoln Trail Area Development District

County	Displaced	Need Shelter
Breckinridge	405	44
Grayson	471	87
Hardin	2896	1356
Larue	766	359
Marion	1011	155
Meade	312	163
Nelson	1503	570
Washington	508	183





0 5 10 20 Miles

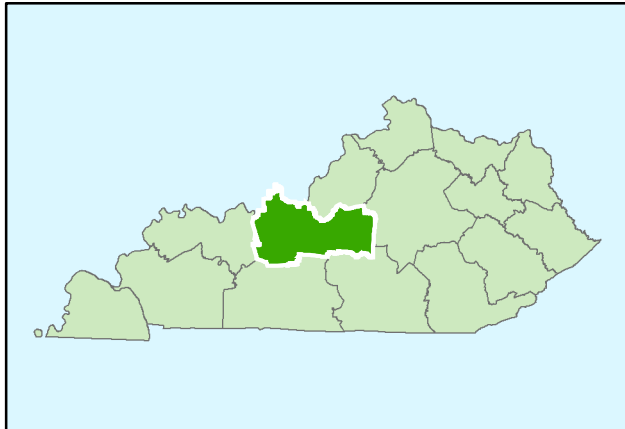


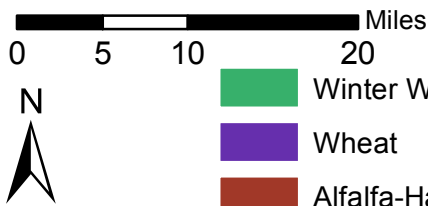
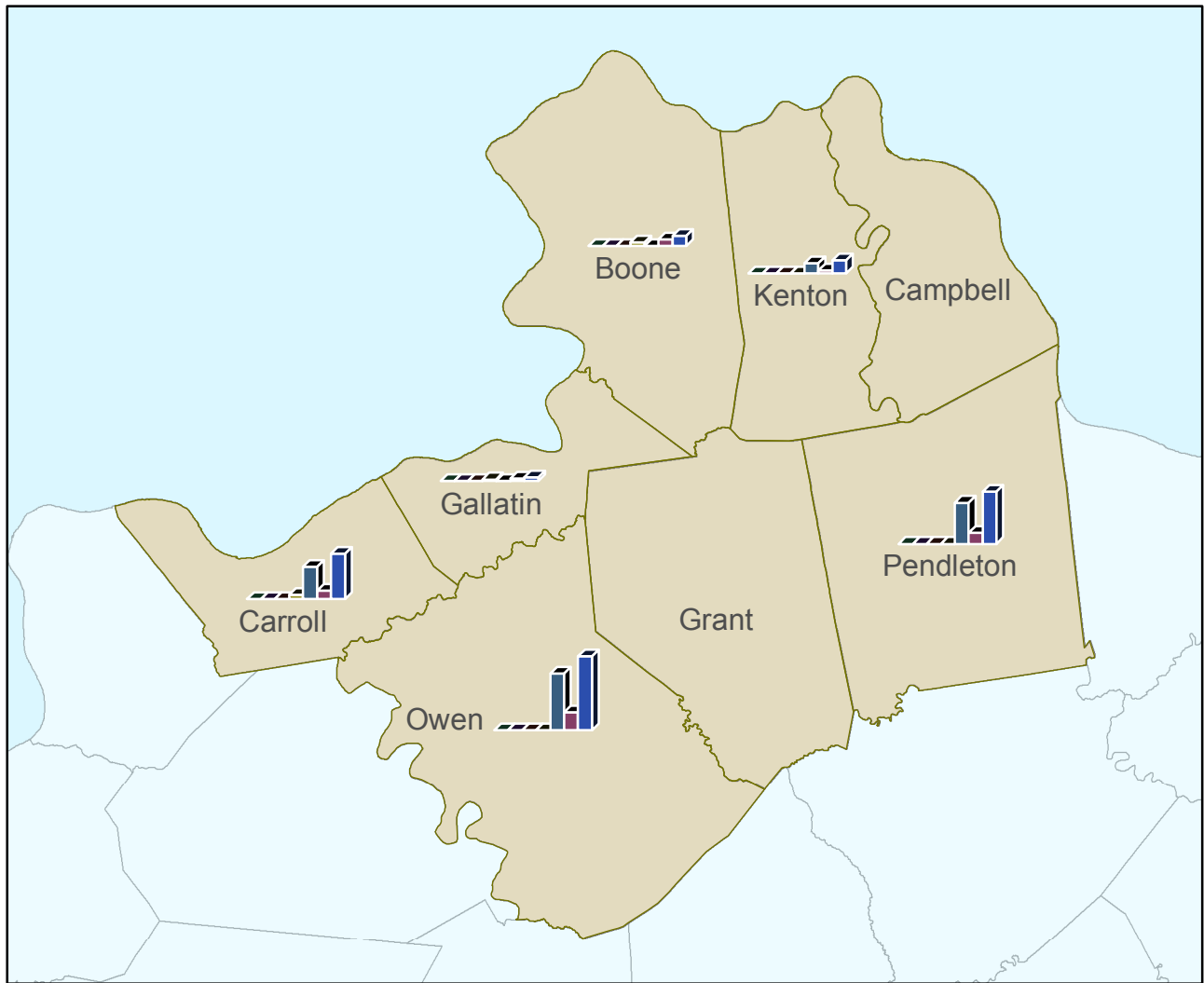
Lincoln Trail Area Development District

Replacement Cost Value

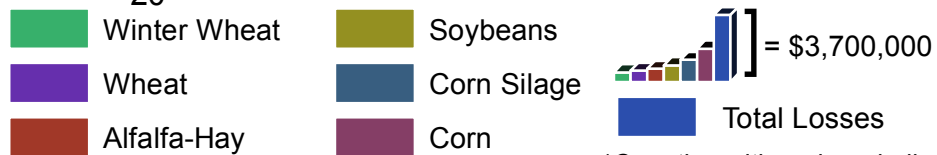
\$0.00 - \$3 million	\$20 million - \$50 million
\$3 million - \$13 million	\$50 million - \$500 million
\$13 million - \$20 million	● State Facilities in Floodplain

County	No. Vulnerable State Facilities	Replacement Cost Value
Breckinridge	3	\$92,011.00
Grayson	3	\$302,279.00
Hardin	6	\$48,984.22
Larue	0	\$0.00
Marion	0	\$0.00
Meade	0	\$0.00
Nelson	0	\$0.00
Washington	0	\$0.00





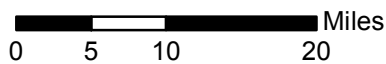
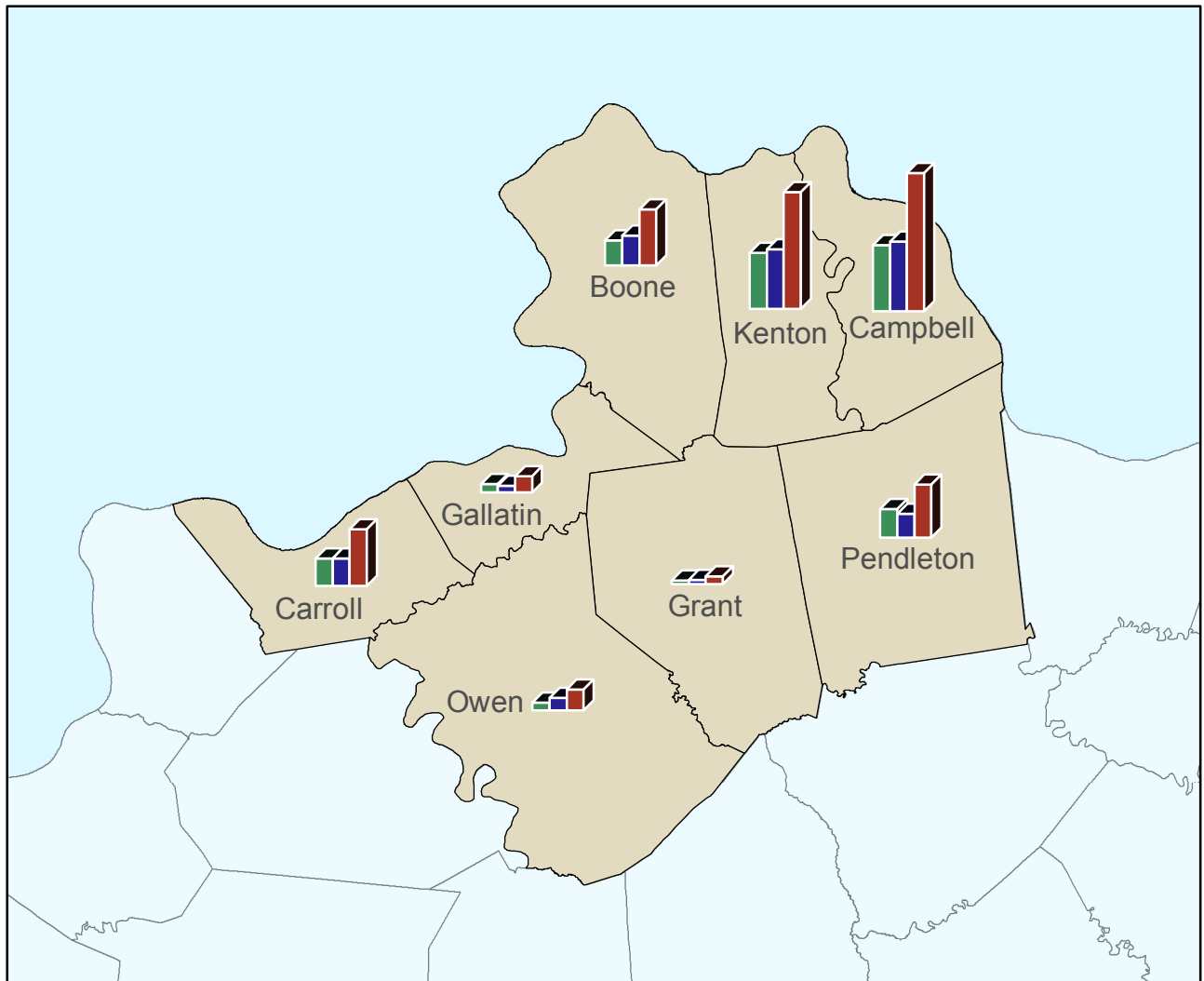
Agriculture Losses by County



*Counties with no bars indicate no losses.

Northern Kentucky Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Boone	\$0.00	\$0.00	\$0.00	\$596,522.20	\$0.00	\$1,134,710.38	\$1,731,232.58
Carroll	\$0.00	\$0.00	\$0.00	\$728,523.92	\$5,416,630.50	\$1,427,223.69	\$7,572,378.11
Gallatin	\$0.00	\$0.00	\$0.00	\$202,656.24	\$0.00	\$332,453.44	\$535,109.68
Kenton	\$0.00	\$0.00	\$0.00	\$0.00	\$1,696,668.22	\$447,626.62	\$2,144,294.84
Owen	\$0.00	\$0.00	\$0.00	\$0.00	\$9,407,728.46	\$2,931,715.26	\$12,339,443.72
Pendleton	\$0.00	\$0.00	\$0.00	\$0.00	\$6,867,656.09	\$1,830,657.70	\$8,698,313.79
Campbell	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Grant	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

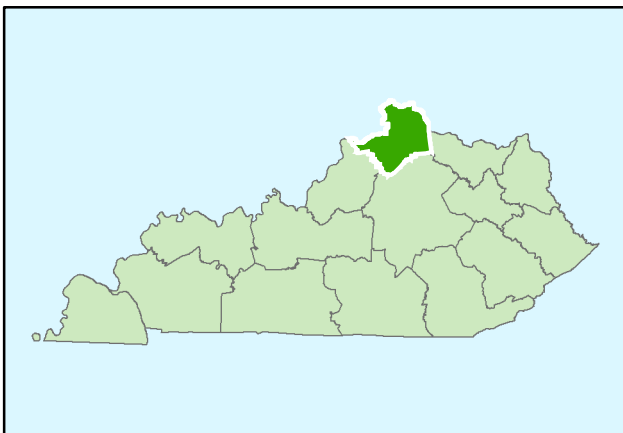


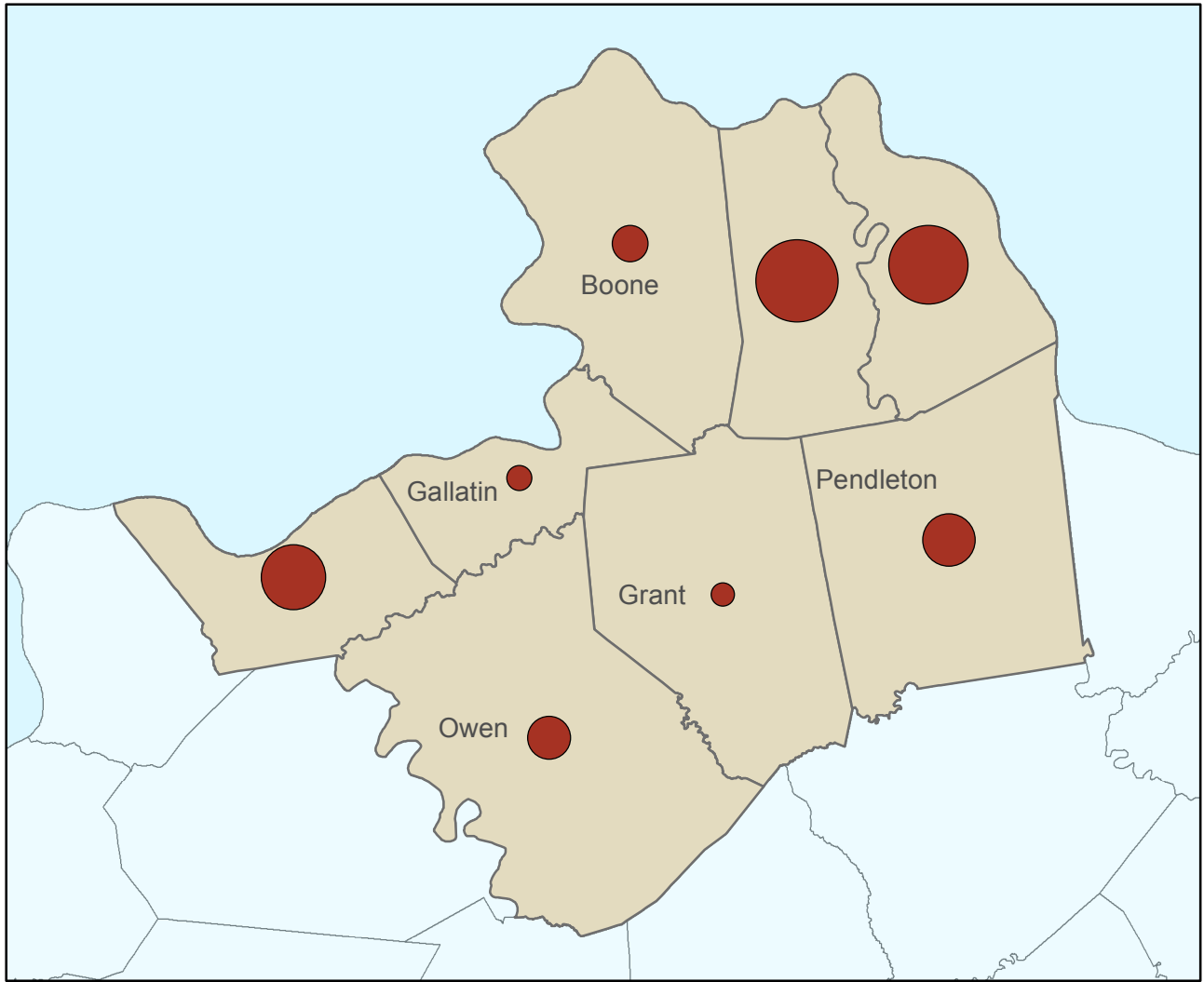
Northern Kentucky Area Development District

General Building Loss



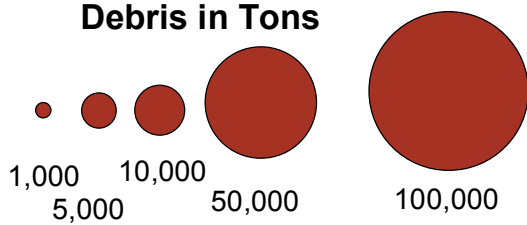
County	Total Loss	Bldg Loss	Contents Loss
Boone	\$132,076.00	\$70,794.00	\$59,448.00
Campbell	\$323,984.00	\$163,139.00	\$154,531.00
Carroll	\$133,248.00	\$65,493.00	\$64,714.00
Gallatin	\$38,052.00	\$16,599.00	\$20,431.00
Grant	\$19,257.00	\$10,189.00	\$8,783.00
Kenton	\$274,569.00	\$139,730.00	\$131,266.00
Owen	\$49,150.00	\$30,181.00	\$18,699.00
Pendleton	\$124,037.00	\$55,632.00	\$66,481.00





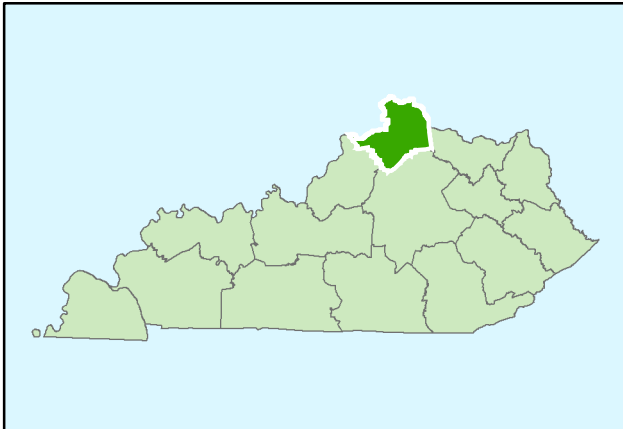
0 5 10 20 Miles

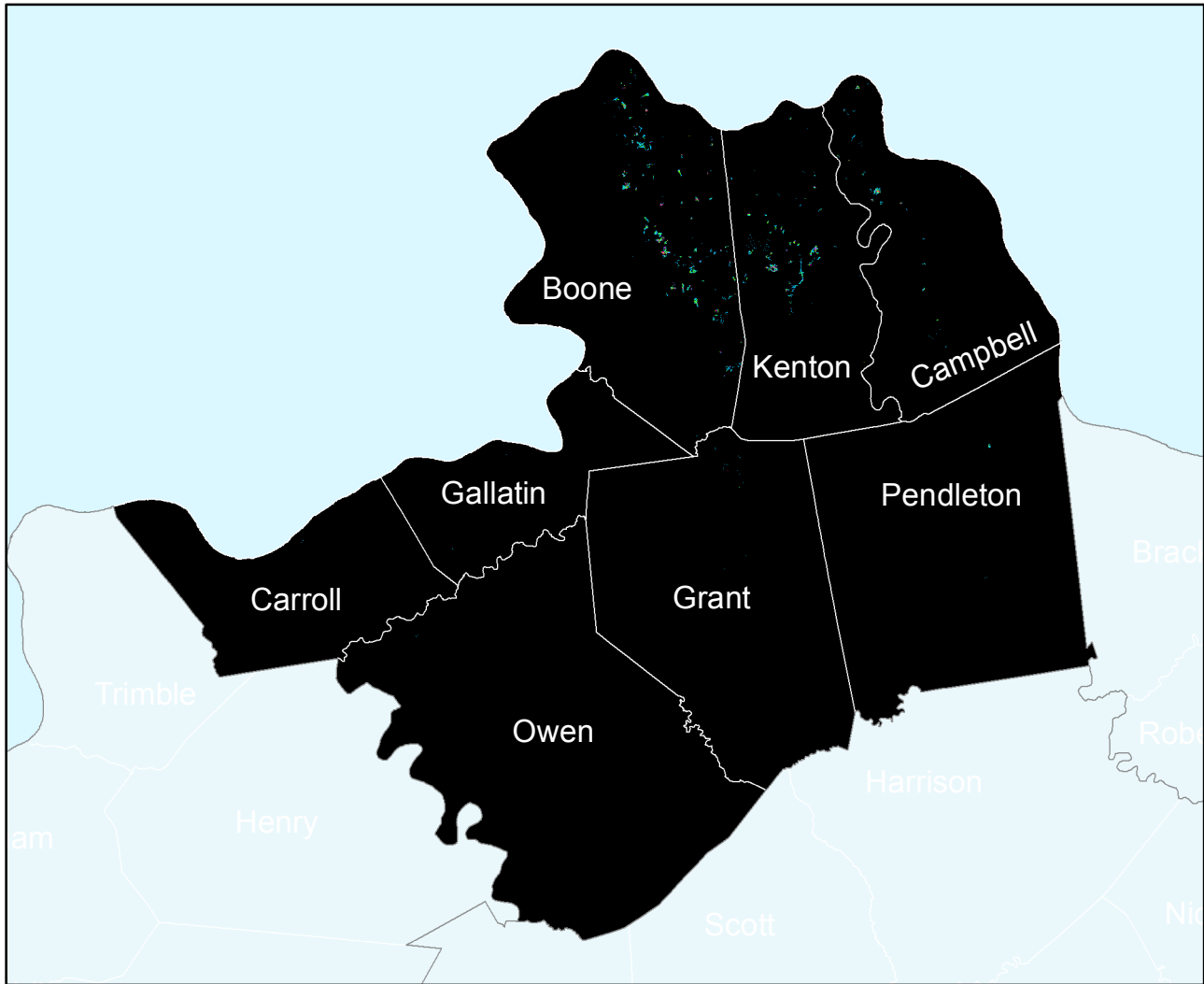
Debris in Tons



Northern Kentucky Area Development District

County	Debris Tons
Boone	6284
Campbell	30167
Carroll	20457
Gallatin	3350
Grant	2731
Kenton	33281
Owen	9384
Pendleton	13535



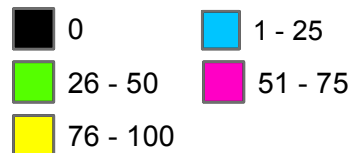


0 5 10 20 Miles

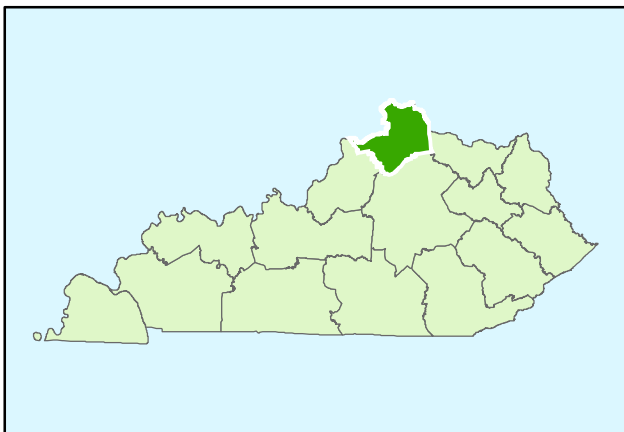


NORTHERN KENTUCKY Area Development District

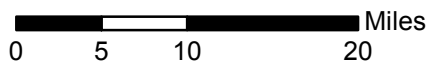
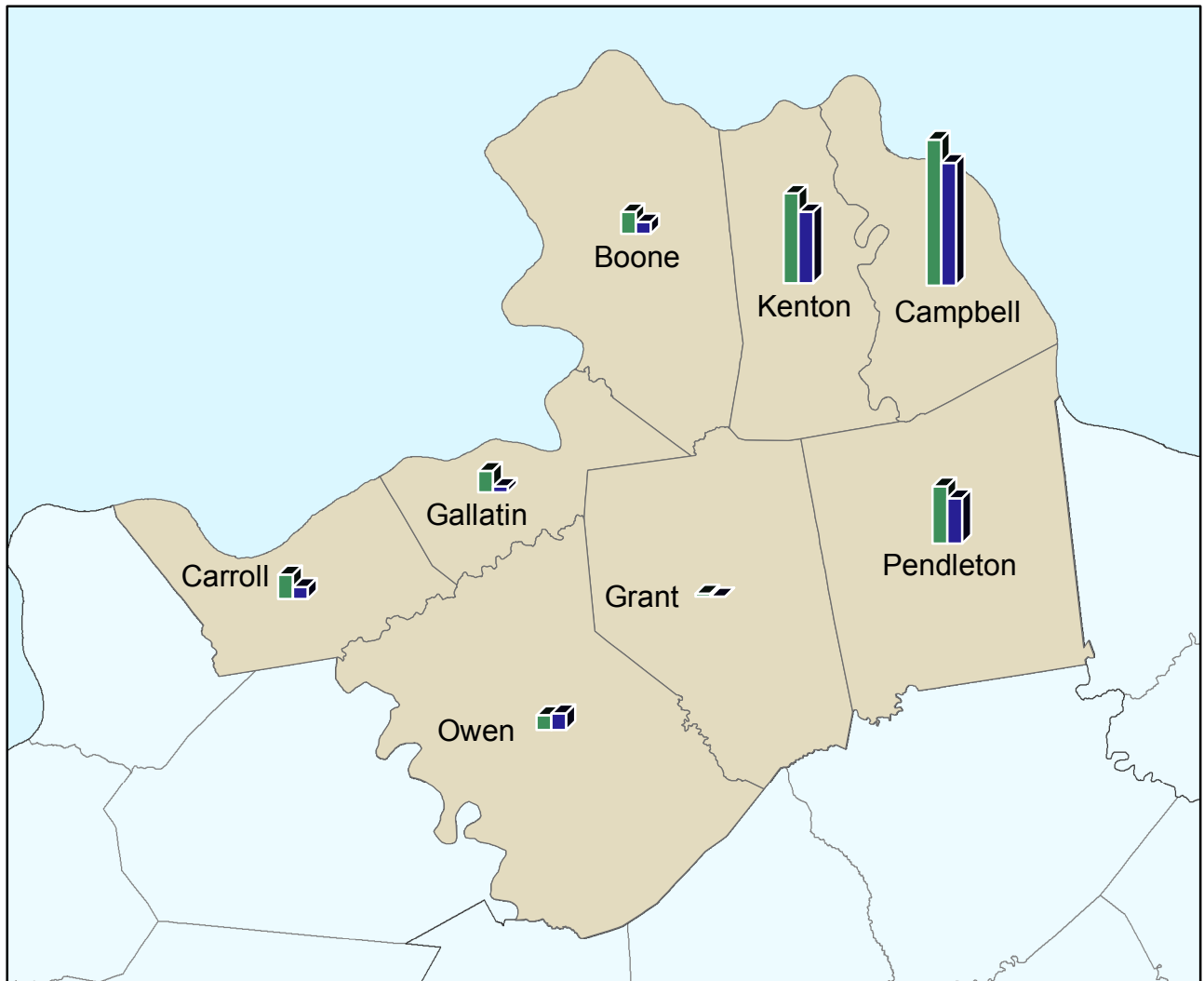
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**

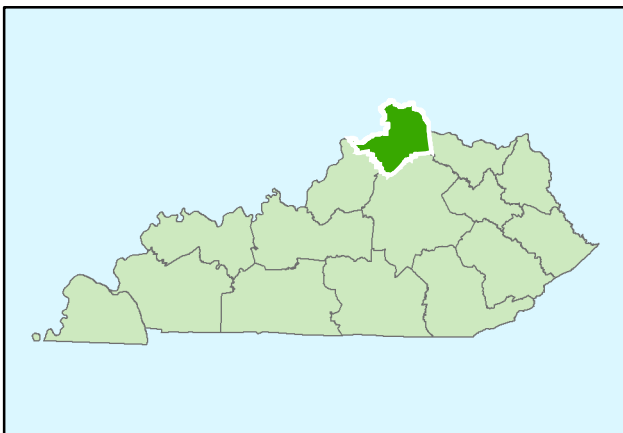
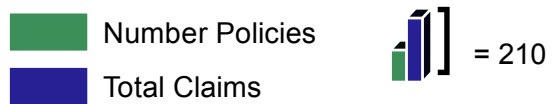


Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



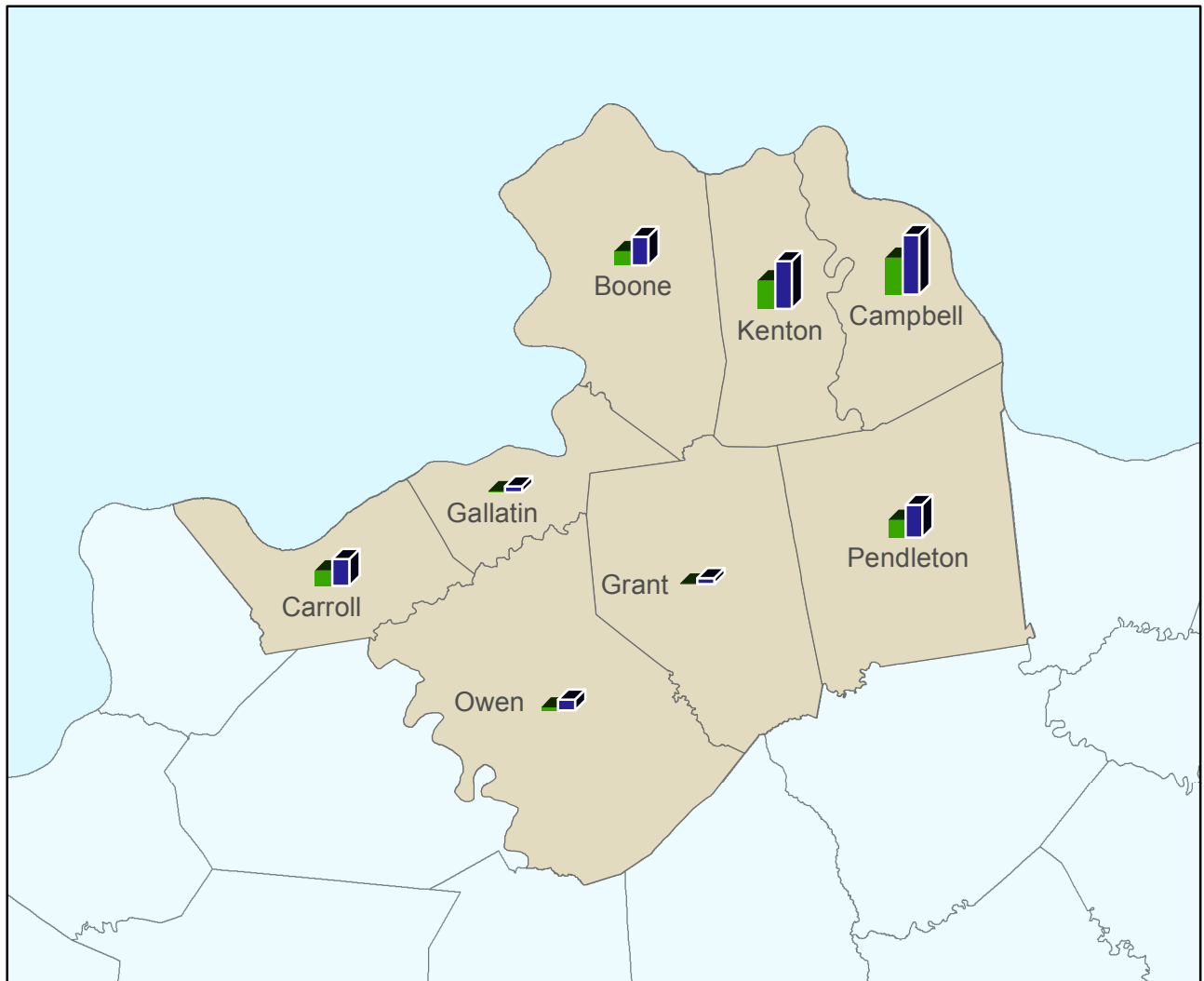
Northern Kentucky Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)



County	Number Policies	Total Claims
Boone	76	41
Campbell	503	423
Carroll	83	41
Gallatin	74	20
Grant	11	0
Kenton	309	245
Owen	51	57
Pendleton	196	156





0 5 10 20 Miles



= 3,800 people



Need Shelter

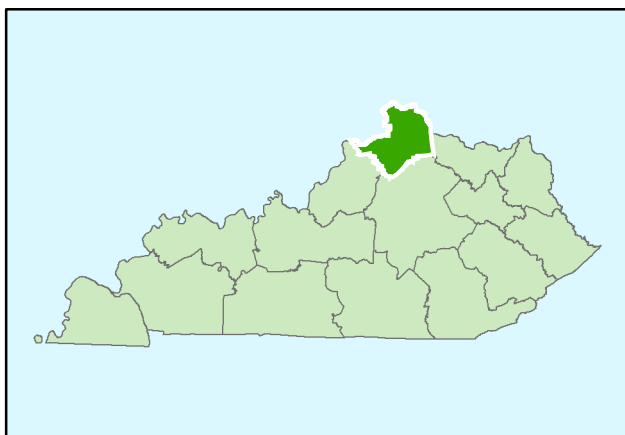


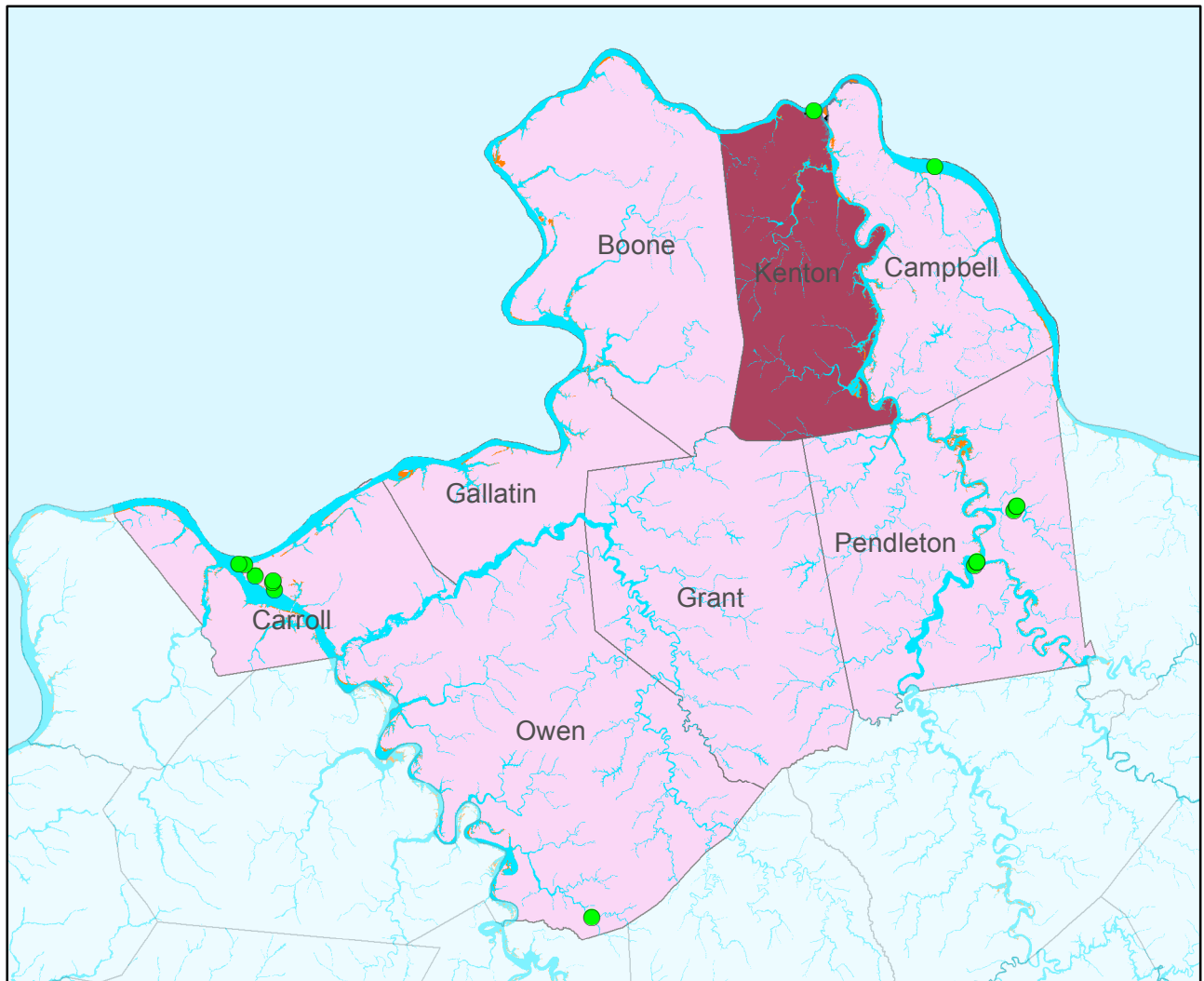
Displaced



Northern Kentucky Area Development District

County	Displaced	Need Shelter
Boone	1603	798
Campbell	3294	2054
Carroll	1493	873
Gallatin	337	84
Grant	341	32
Kenton	2654	1599
Owen	611	179
Pendleton	1808	972





0 5 10 20 Miles

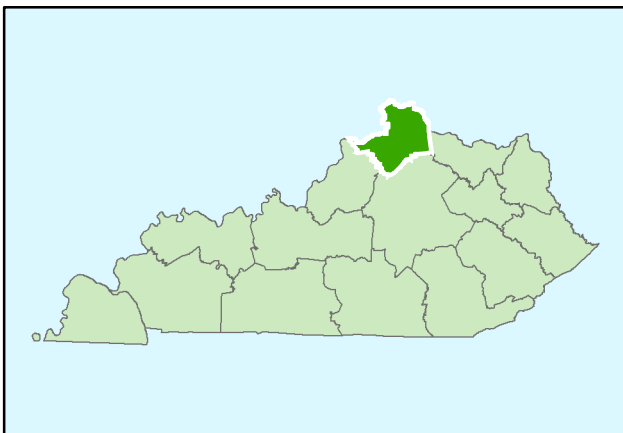


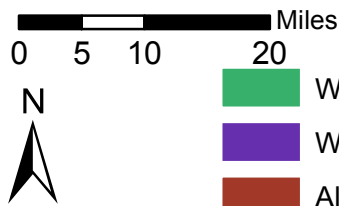
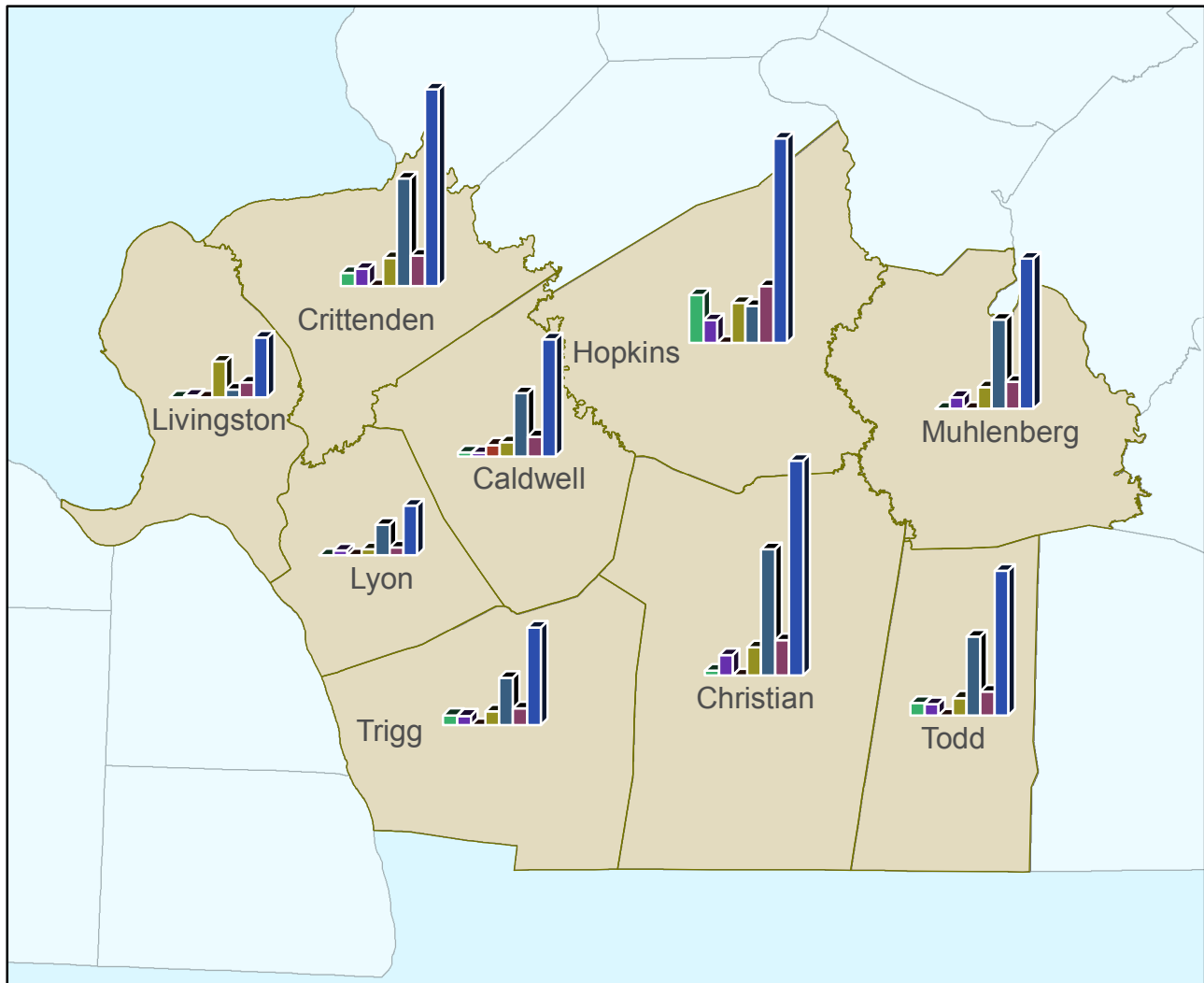
Northern Kentucky Area Development District

Replacement Cost Value

\$0.00 - \$3 million	\$20 million - \$50 million
\$3 million - \$13 million	\$50 million - \$500 million
\$13 million - \$20 million	● State Facilities in Floodplain

County	No. Vulnerable State Facilities	Replacement Cost Value
Boone	0	\$0.00
Campbell	1	\$91,365.00
Carroll	6	\$446,985.00
Gallatin	0	\$0.00
Grant	0	\$0.00
Kenton	1	\$46,958,655.00
Owen	1	\$0.00
Pendleton	6	\$571,125.77





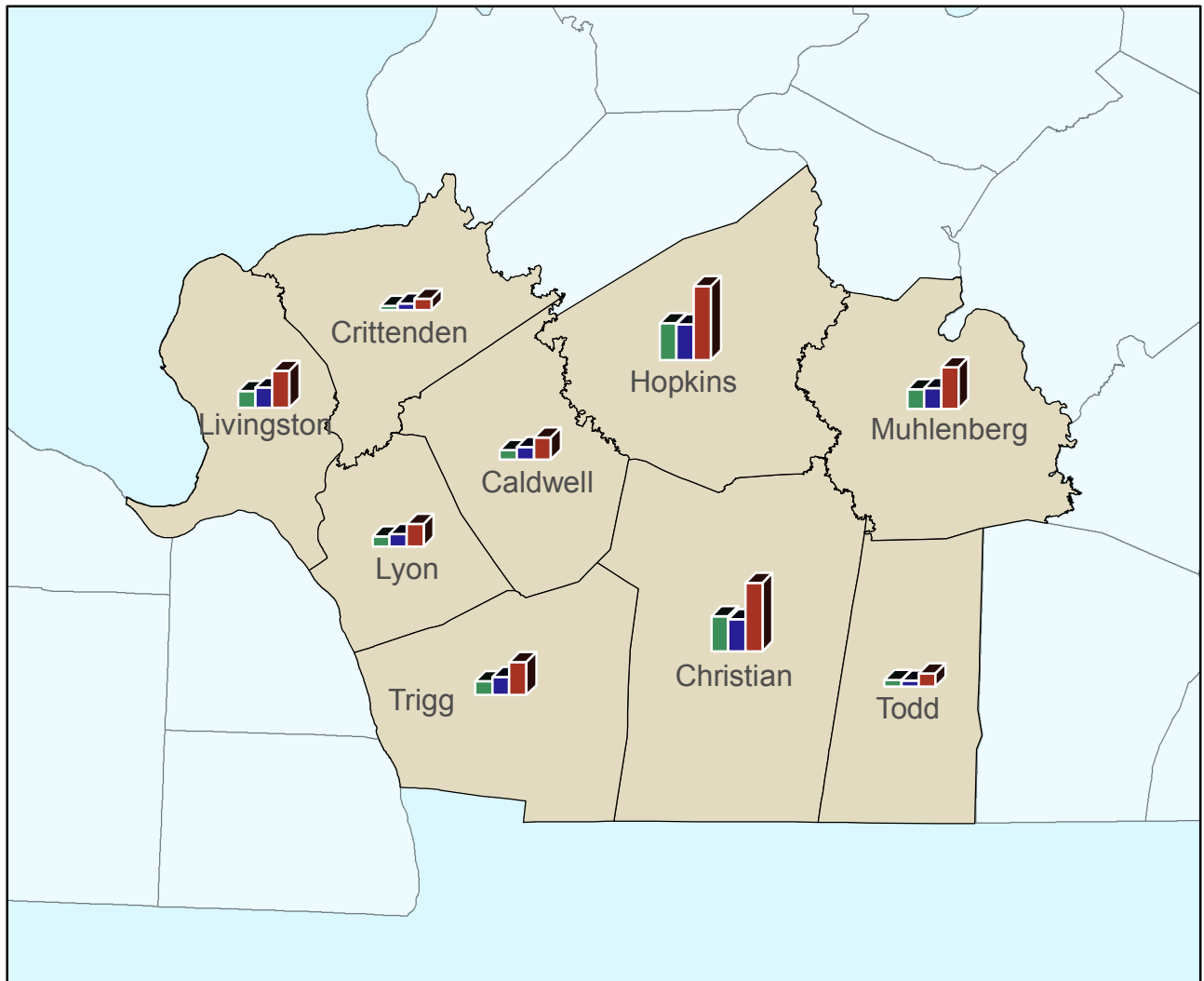
Agriculture Losses by County



*Counties with no bars indicate no losses.

Pennyriple Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Caldw ell	\$863,359.54	\$2,359,392.83	\$693,472.92	\$2,941,644.75	\$12,991,197.58	\$4,074,999.18	\$23,924,066.80
Christian	\$1,018,259.09	\$0.00	\$4,136,171.7	\$5,787,765.28	\$25,759,441.64	\$7,240,875.53	\$43,942,513.32
Crittenden	\$2,730,367.11	\$0.00	\$3,550,876.2	\$5,738,373.91	\$21,992,988.91	\$6,261,740.17	\$40,274,346.34
Hopkins	\$9,763,953.03	\$0.00	\$4,661,846.7	\$8,204,746.26	\$7,543,511.65	\$11,635,049.0	\$41,809,106.72
Livingston	\$0.00	\$0.00	\$298,881.21	\$7,290,908.56	\$1,575,453.30	\$2,998,734.53	\$12,163,977.60
Lyon	\$0.00	\$0.00	\$978,297.18	\$1,251,317.50	\$6,245,561.90	\$1,663,889.33	\$10,139,065.91
Muhlenberg	\$0.00	\$0.00	\$2,431,499.1	\$4,442,557.61	\$18,285,711.60	\$5,600,967.39	\$30,760,735.78
Todd	\$2,498,018.69	\$0.00	\$2,364,036.2	\$3,594,844.15	\$16,159,227.31	\$4,934,535.15	\$29,550,661.51
Trigg	\$2,063,590.02	\$0.00	\$1,941,043.3	\$2,812,544.81	\$9,663,024.51	\$3,474,263.00	\$19,954,465.68



0 5 10 20 Miles

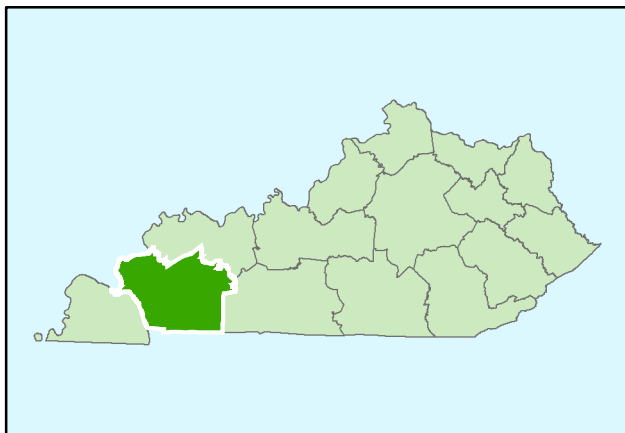


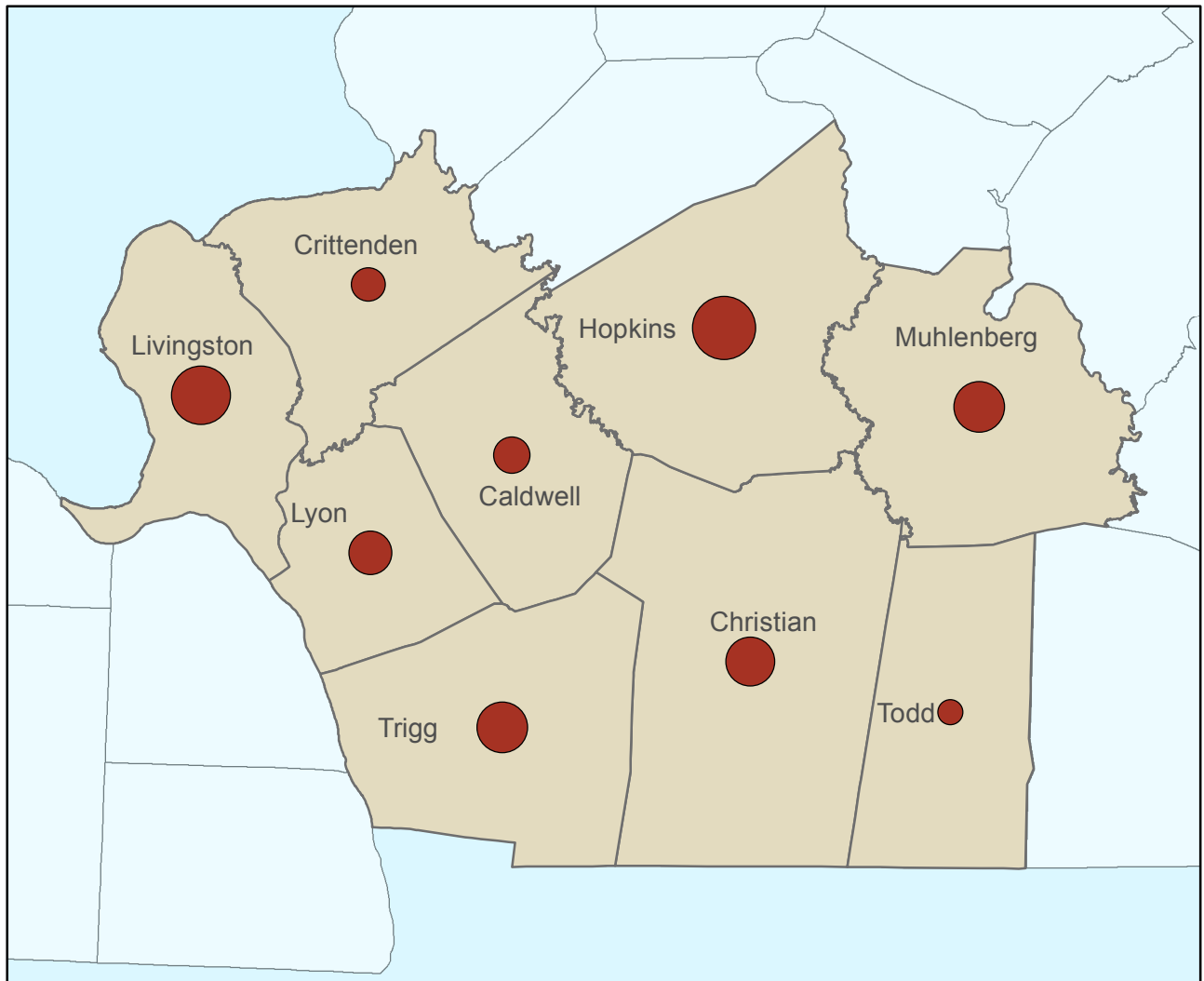
General Building Loss



Pennyryle Area Development District

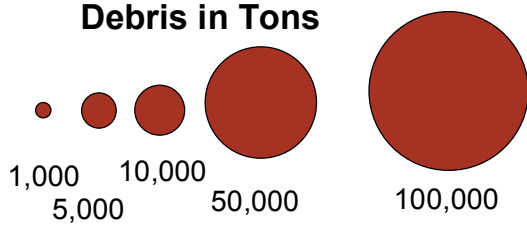
County	Total Loss	Bldg Loss	Contents Loss
Caldwell	\$51,399.00	\$28,696.00	\$22,110.00
Christian	\$161,505.00	\$76,197.00	\$82,995.00
Crittenden	\$26,492.00	\$16,155.00	\$10,126.00
Hopkins	\$172,657.00	\$84,199.00	\$85,921.00
Livingston	\$85,854.00	\$46,463.00	\$38,532.00
Lyon	\$52,696.00	\$29,192.00	\$23,101.00
Muhlenberg	\$97,460.00	\$49,564.00	\$46,289.00
Todd	\$30,386.00	\$14,199.00	\$15,410.00
Trigg	\$77,513.00	\$43,187.00	\$33,157.00





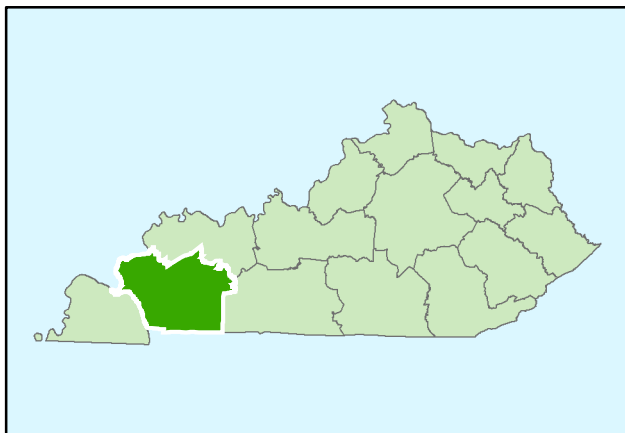
0 5 10 20 Miles

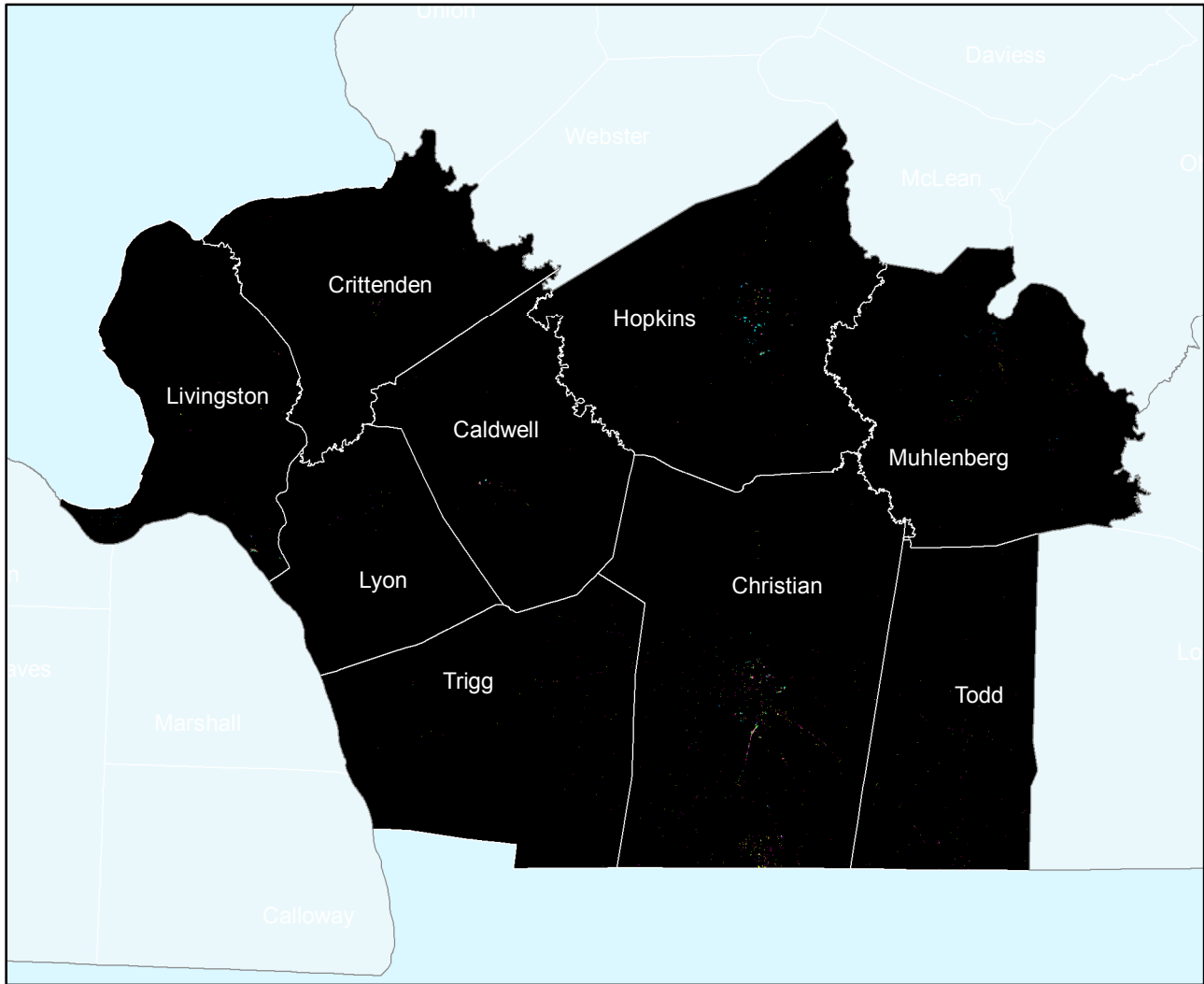
Debris in Tons



Pennyryle Area Development District

County	Debris Tons
Caldwell	6570
Christian	11975
Crittenden	5743
Hopkins	19436
Livingston	17033
Lyon	9466
Muhlenberg	12566
Todd	3255
Trigg	12492



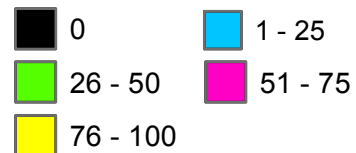


0 5 10 20 Miles

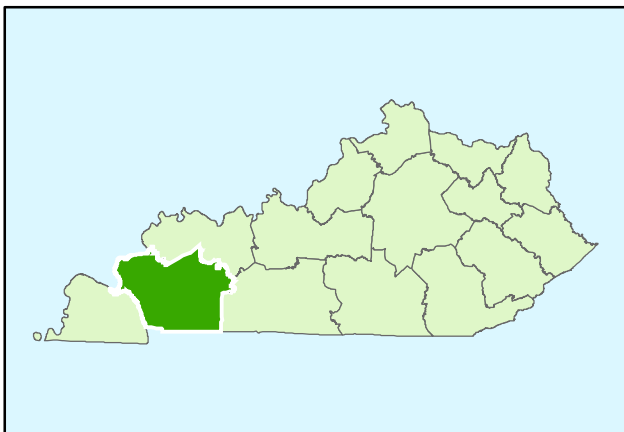


PENNYRILE Area Development District

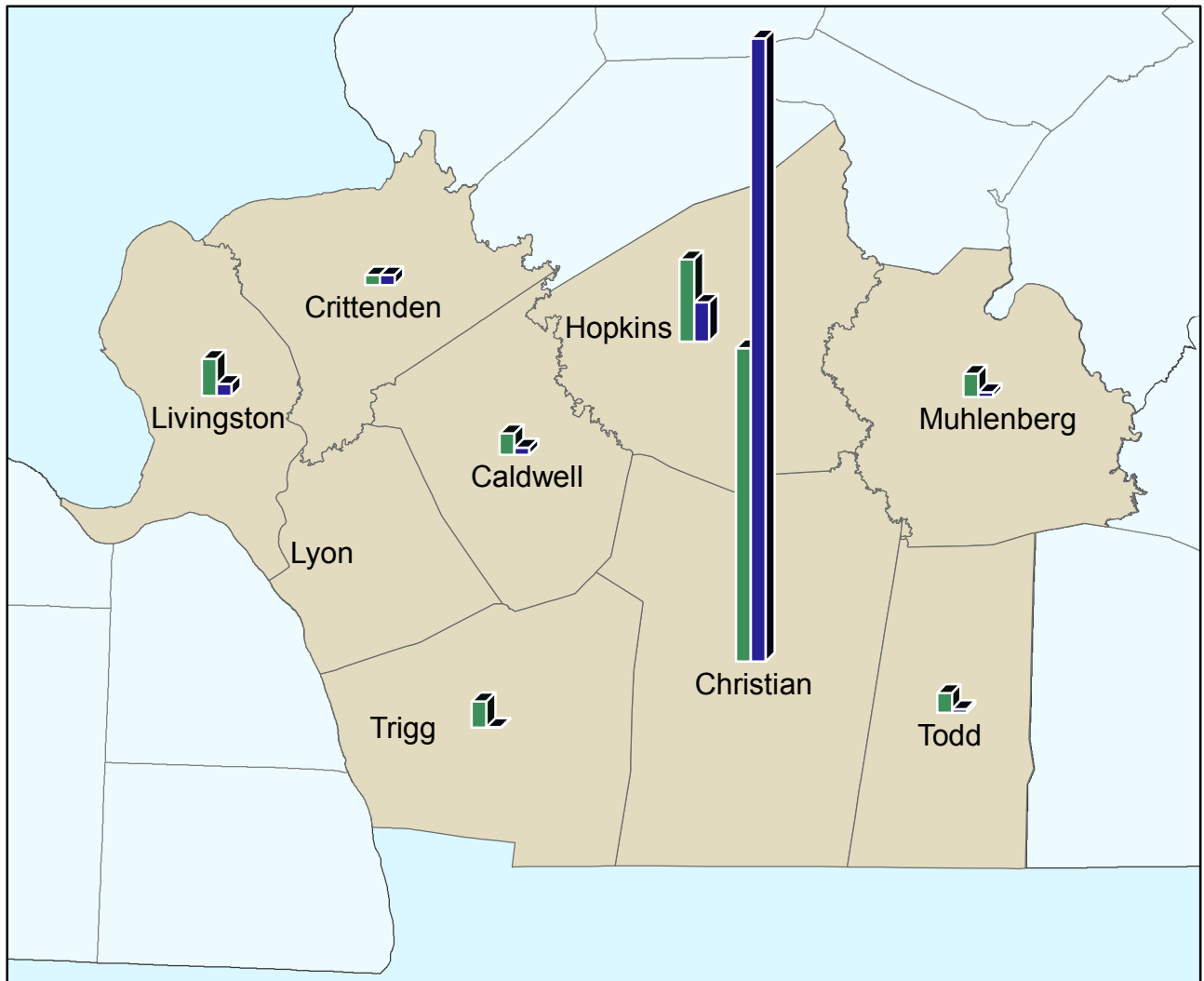
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**



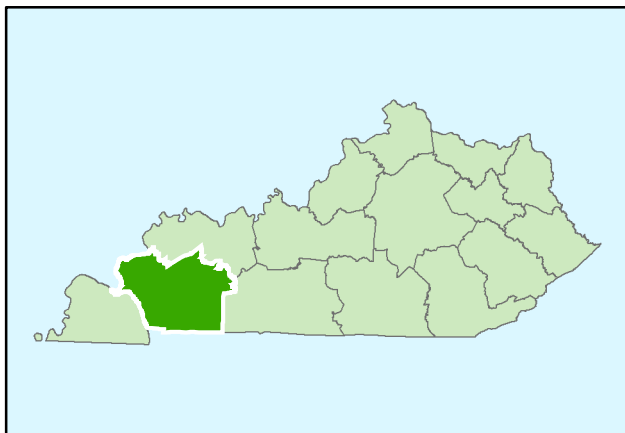
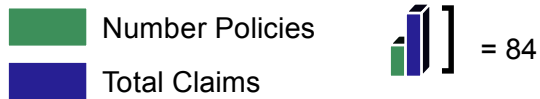
Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



0 5 10 20 Miles

Pennyryle Area Development District

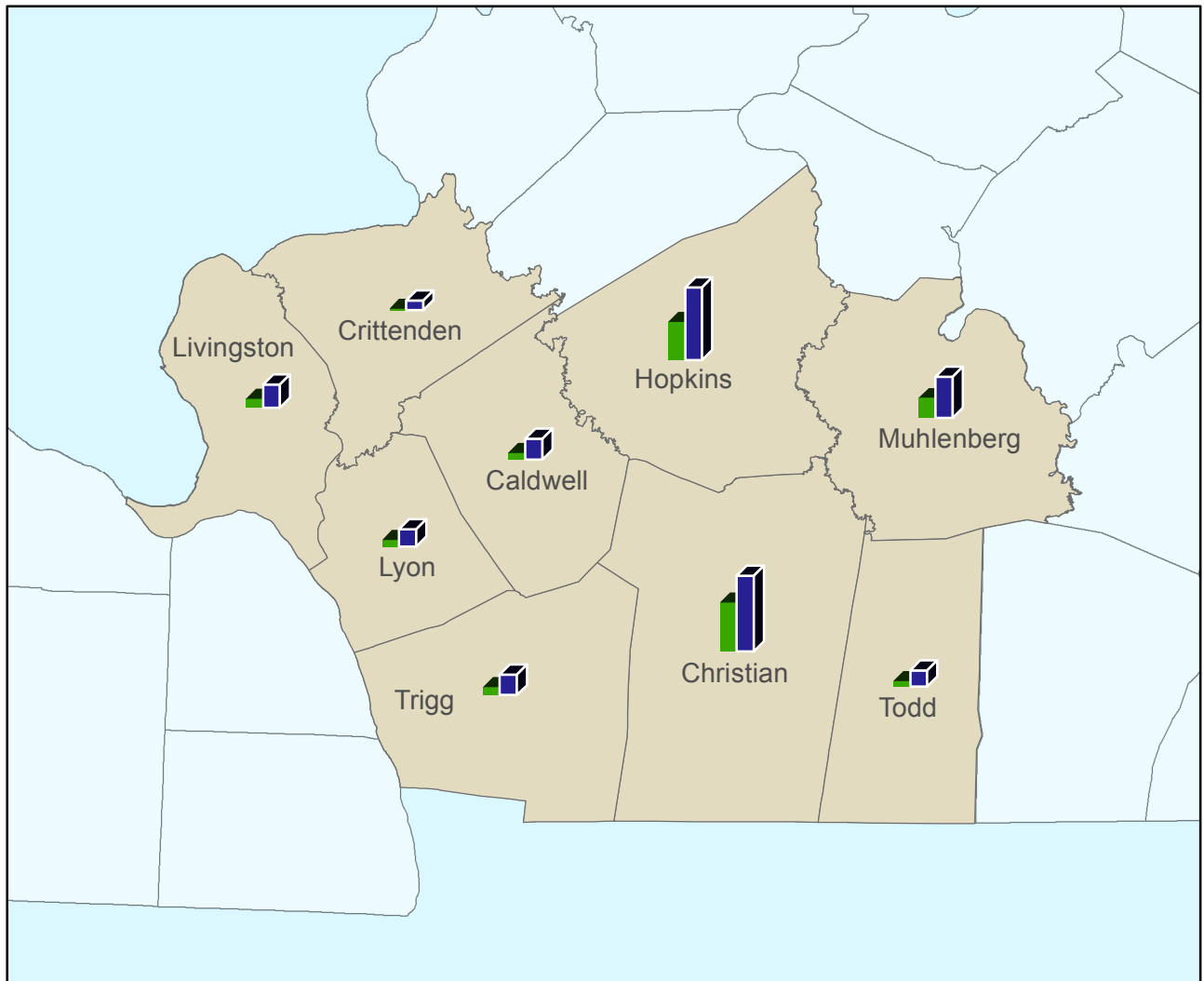
National Flood Insurance Program Policies and Claims (1978 - May 2018)




County	Number Policies	Total Claims
Caldwell	30	10
Christian	442	879
Crittenden	14	14
Hopkins	116	55
Livingston	52	17
Muhlenberg	33	7
Todd	28	5
Trigg	37	1
Lyon	0	0



*Lyon County did not participate in NFIP during time period shown. 125



0 5 10 20 Miles

 = 3,800 people

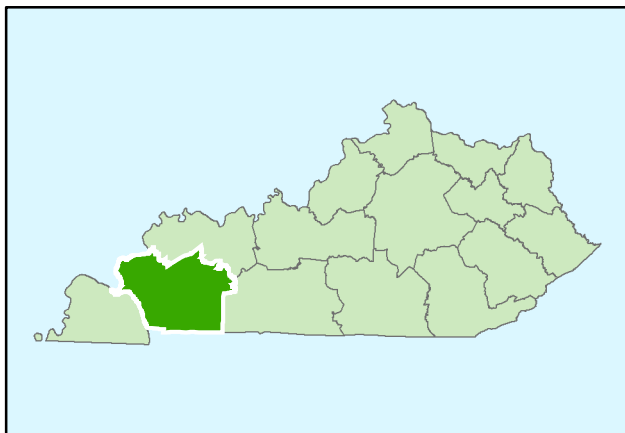
 Need Shelter

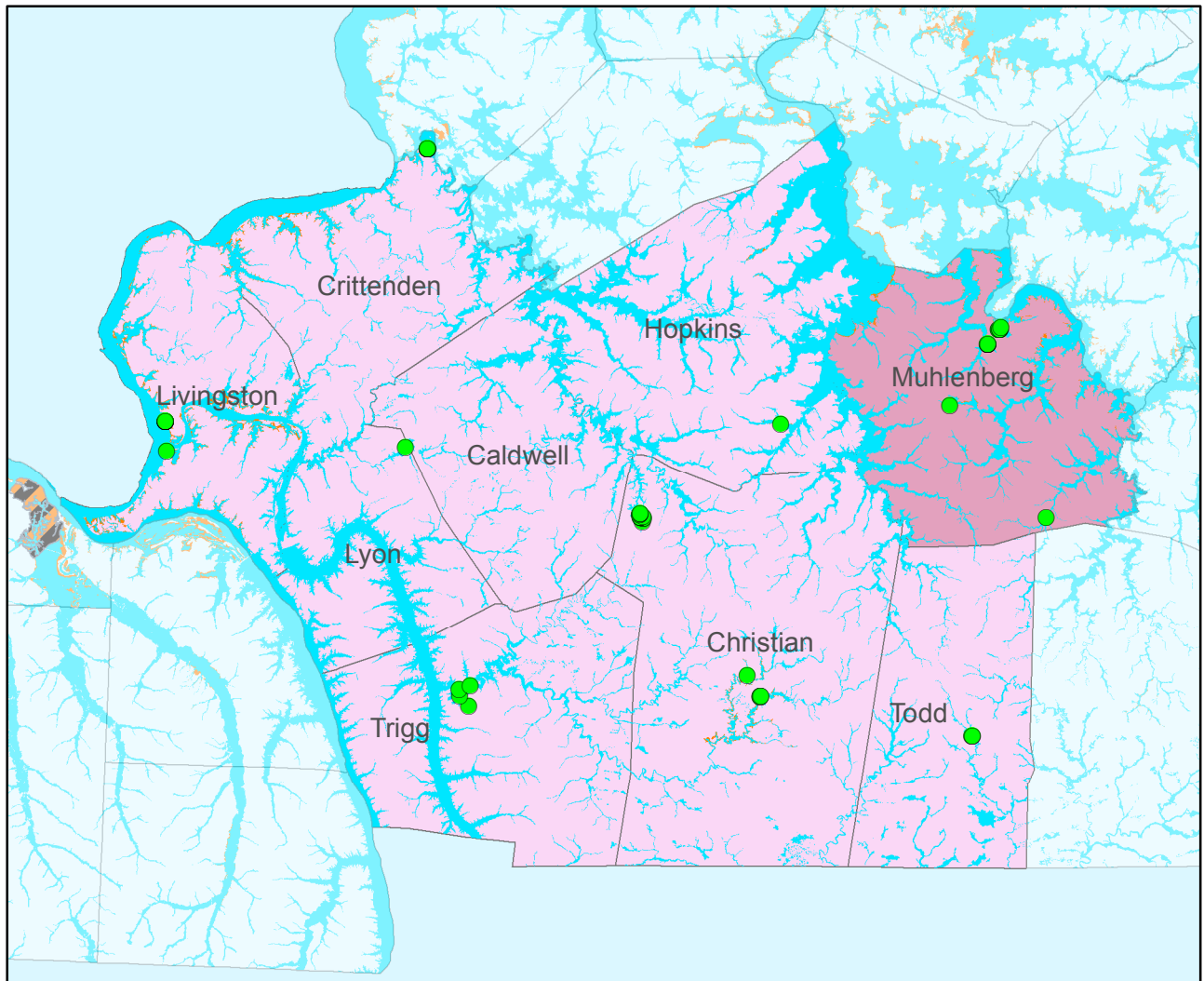
 Displaced



Pennyryle Area Development District

County	Displaced	Need Shelter
Caldwell	1138	362
Christian	4200	2701
Crittenden	540	62
Hopkins	4028	2110
Livingston	1269	475
Lyon	934	354
Muhlenberg	2288	1105
Todd	879	292
Trigg	1136	448

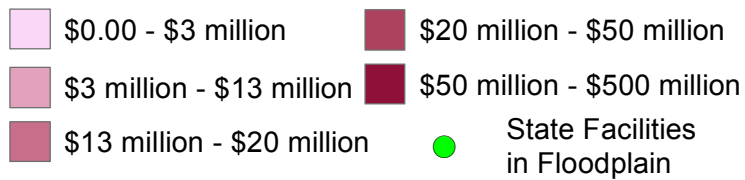




0 5 10 20 Miles

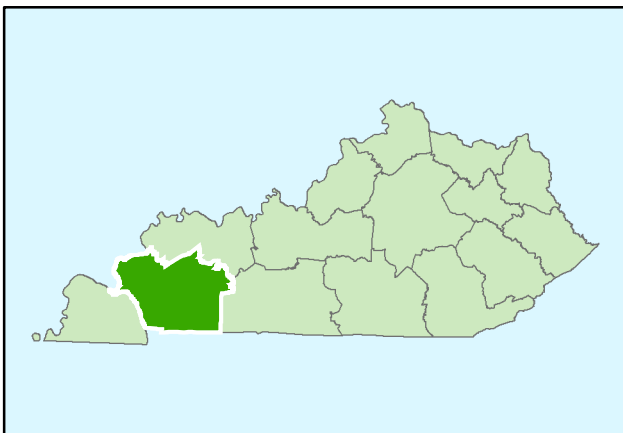


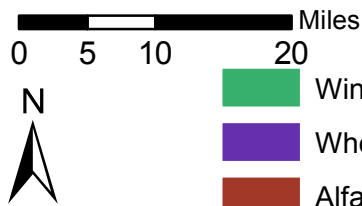
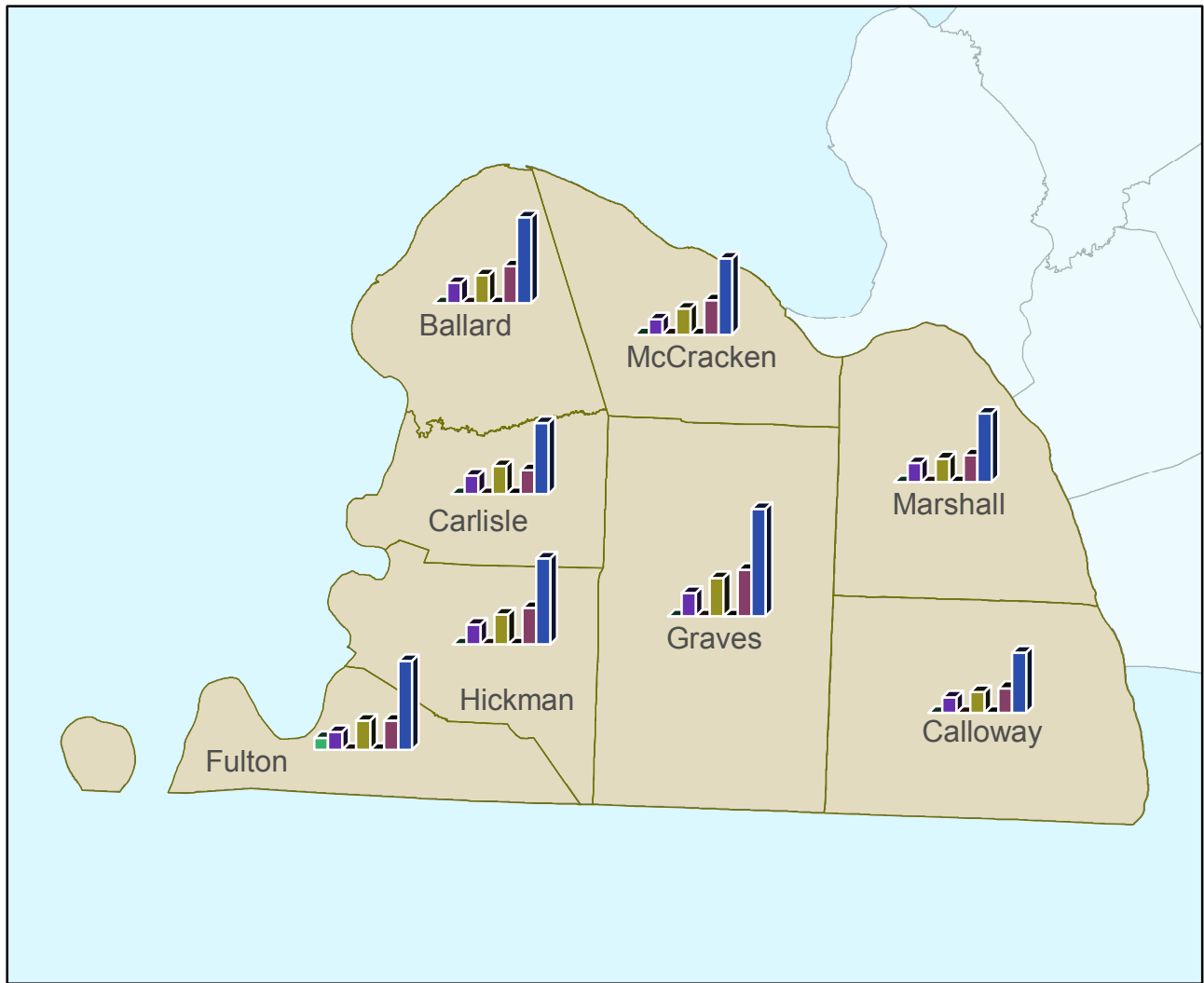
Replacement Cost Value



Pennyryle Area Development District

County	No. Vulnerable State Facilities	Replacement Cost Value
Caldwell	0	\$0.00
Christian	17	\$1,083,100.00
Crittenden	6	\$0.00
Hopkins	1	\$0.00
Livingston	10	\$1,136,851.56
Lyon	1	\$294,138.00
Muhlenberg	14	\$8,574,451.31
Todd	3	\$57,079.00
Trigg	4	\$1,047,355.00



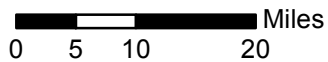
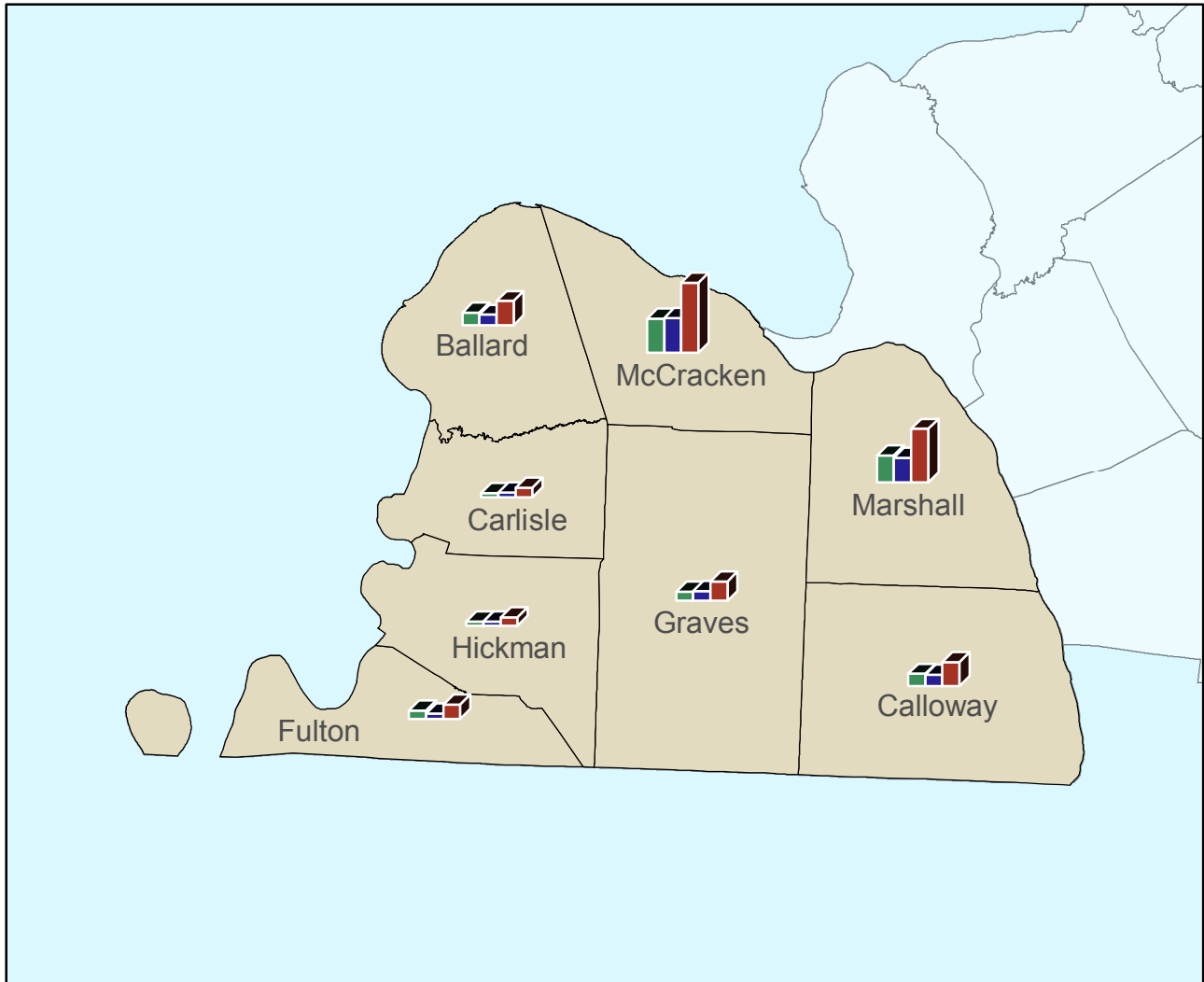


Agriculture Losses by County

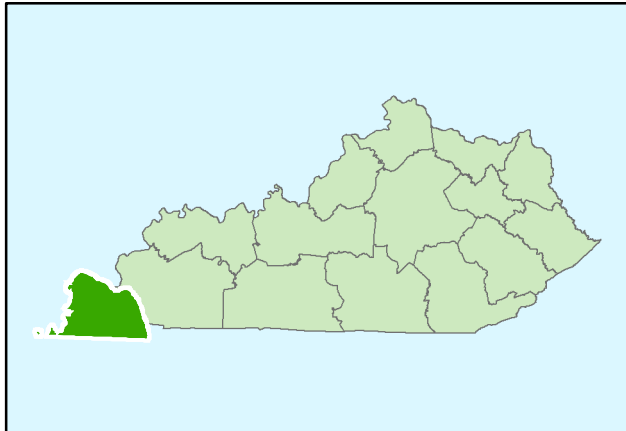


Purchase Area Development District

County	WINTER WHEAT	ALFALFA-HAY	WHEAT	SOYBEANS	CORN SILAGE	CORN	Total Ag Losses
Ballard	\$0.00	\$0.00	\$4,185,777.1	\$5,765,523.43	\$0.00	\$7,649,019.47	\$17,600,320.07
Calloway	\$0.00	\$0.00	\$3,077,745.7	\$4,213,131.25	\$0.00	\$5,028,644.14	\$12,319,521.15
Carlisle	\$0.00	\$0.00	\$3,828,009.5	\$5,843,372.23	\$0.00	\$4,917,049.75	\$14,588,431.56
Fulton	\$2,457,375.81	\$0.00	\$3,660,042.4	\$6,030,940.05	\$0.00	\$6,073,565.45	\$18,221,923.77
Graves	\$0.00	\$0.00	\$4,707,155.5	\$7,836,074.99	\$0.00	\$9,466,329.09	\$22,009,559.61
Hickman	\$0.00	\$0.00	\$4,003,217.6	\$6,063,394.78	\$0.00	\$7,485,670.43	\$17,552,282.88
McCracken	\$0.00	\$0.00	\$3,133,383.6	\$5,346,020.41	\$0.00	\$7,069,304.36	\$15,548,708.37
Marshall	\$0.00	\$0.00	\$3,830,484.1	\$4,795,105.95	\$0.00	\$5,414,810.46	\$14,040,400.52

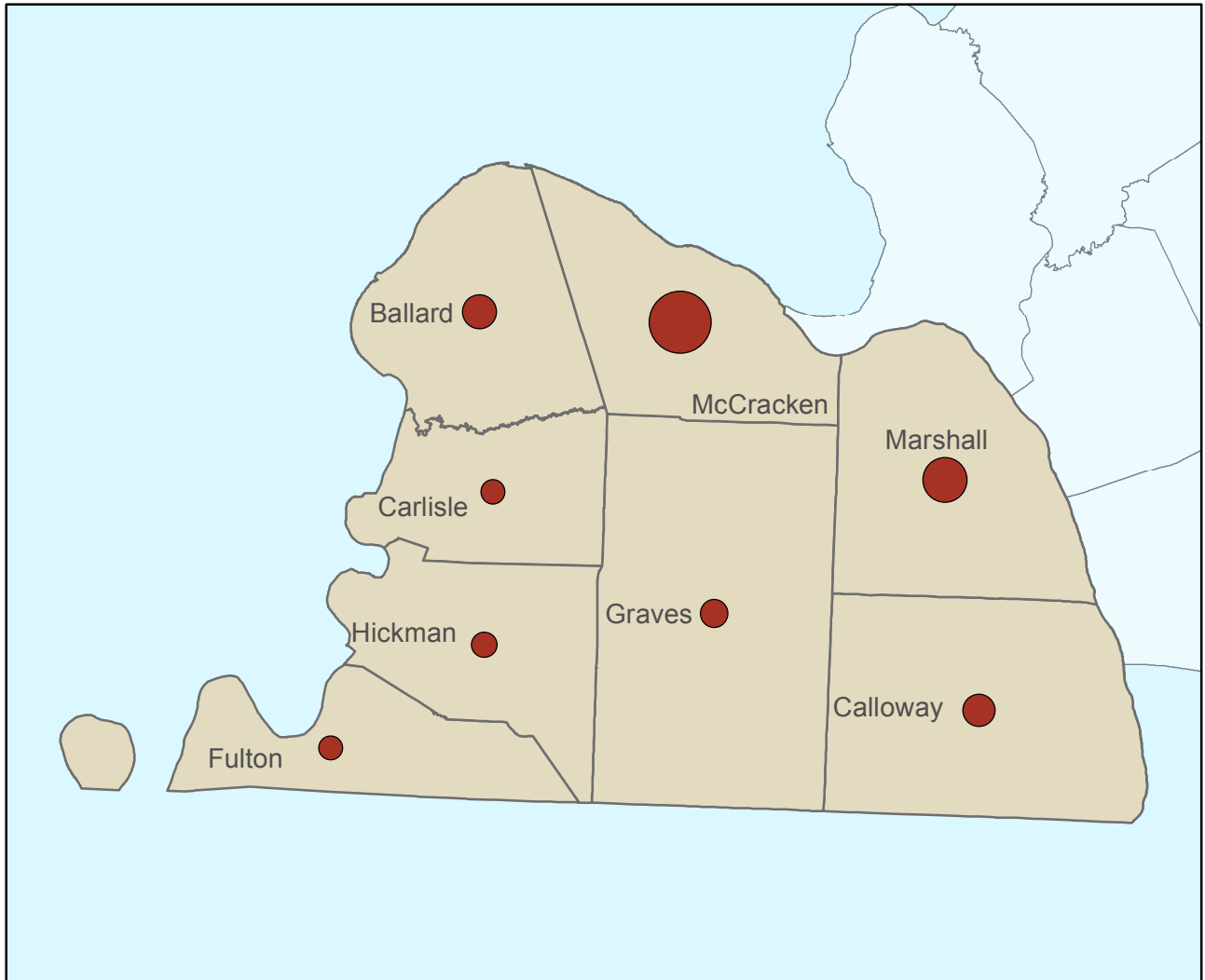


General Building Loss



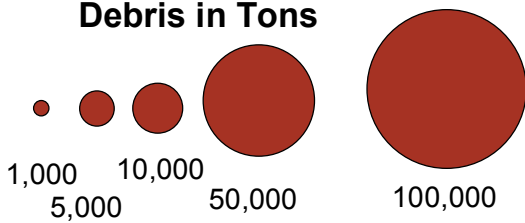
Purchase Area Development District

County	Total Loss	Bldg Loss	Contents Loss
Ballard	\$56,489.00	\$24,311.00	\$29,392.00
Calloway	\$55,593.00	\$25,878.00	\$28,483.00
Carlisle	\$22,026.00	\$11,495.00	\$10,215.00
Fulton	\$34,186.00	\$13,081.00	\$20,179.00
Graves	\$45,299.00	\$23,044.00	\$21,452.00
Hickman	\$19,923.00	\$10,115.00	\$9,357.00
McCracken	\$163,929.00	\$81,172.00	\$79,463.00
Marshall	\$125,799.00	\$58,018.00	\$63,719.00



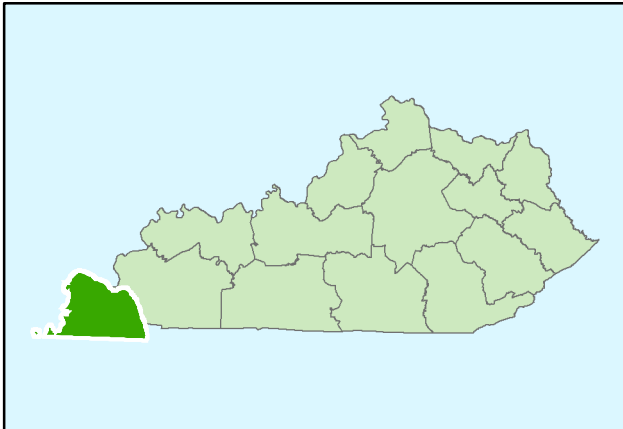
0 5 10 20 Miles

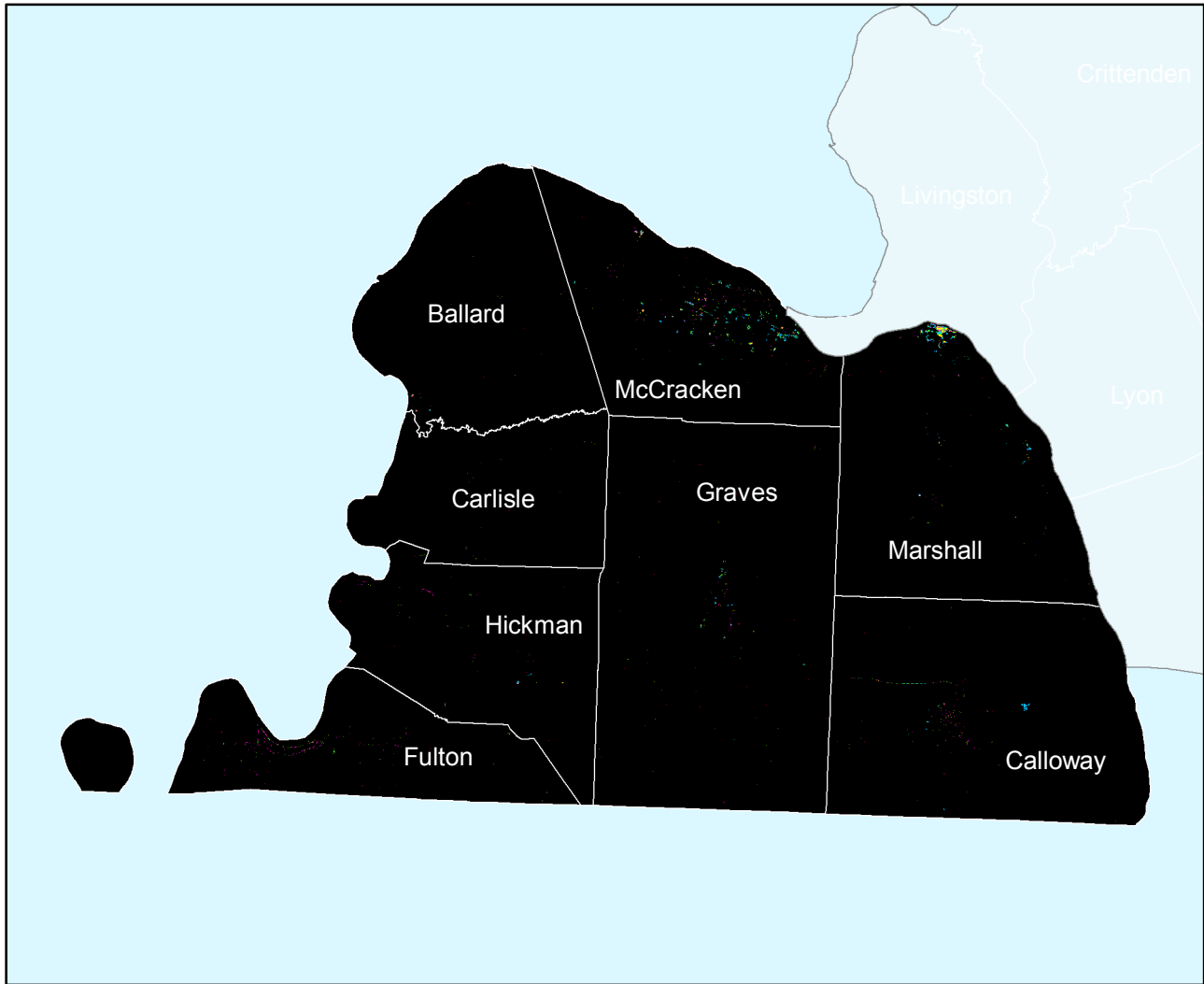
Debris in Tons



Purchase Area Development District

County	Debris Tons
Ballard	5689
Calloway	5123
Carlisle	2836
Fulton	3046
Graves	3865
Hickman	3364
McCracken	19194
Marshall	9951



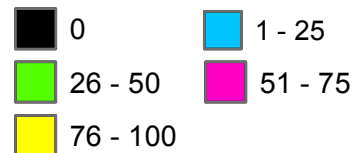


0 5 10 20 Miles

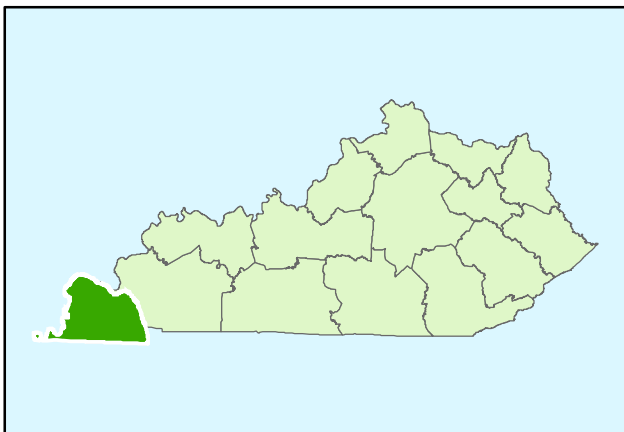


PURCHASE Area Development District

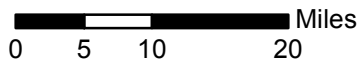
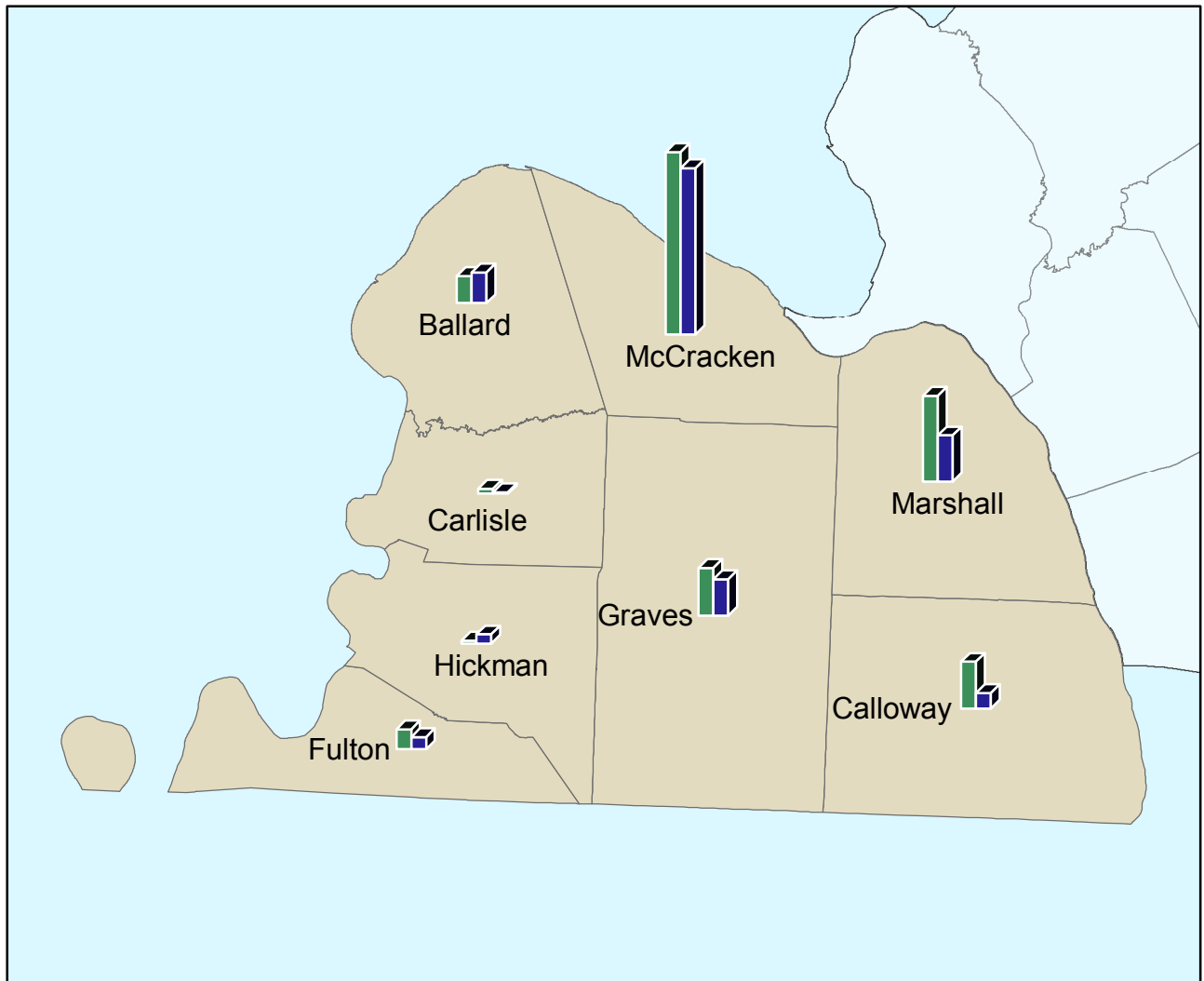
Change in percent impervious surface
from 2006-2011 for each 30x30 m area



**Trends in development as indicated by increased
impervious surfaces.**

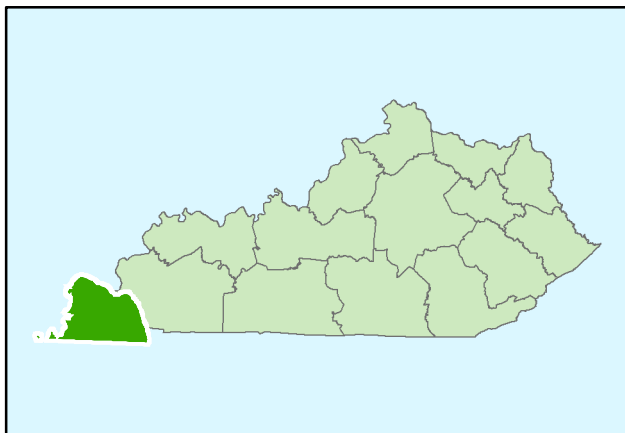
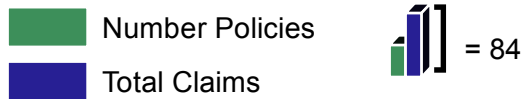


Impervious surface change from the NLCD 2006 to 2011 Percent Developed Imperviousness Change data file (NLCD 2011). Black indicates areas of no change. Colored areas indicate the difference between the percent impervious of each 30x30 m area between 2006 and 2011.



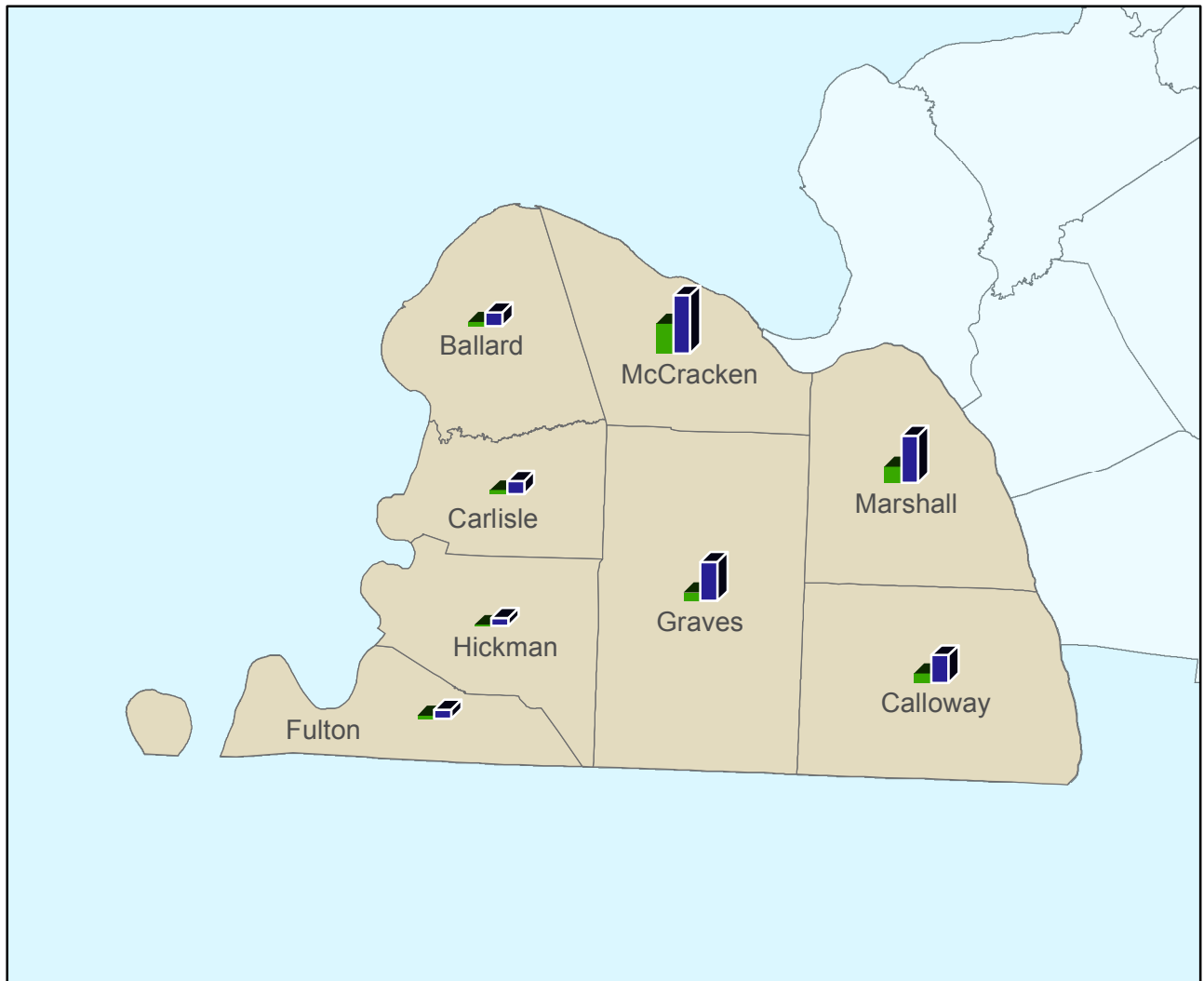
Purchase Area Development District

National Flood Insurance Program Policies and Claims (1978 - May 2018)



County	Number Policies	Total Claims
Ballard	38	43
Calloway	66	22
Carlisle	7	2
Fulton	28	17
Graves	67	51
Hickman	4	13
McCracken	257	234
Marshall	121	65





0 5 10 20 Miles



= 3,800 people



Need Shelter

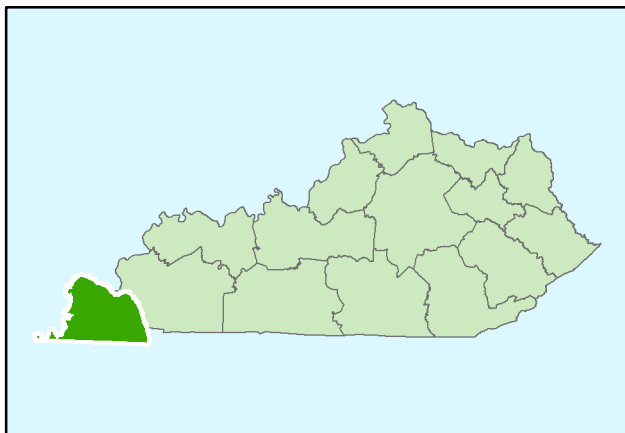


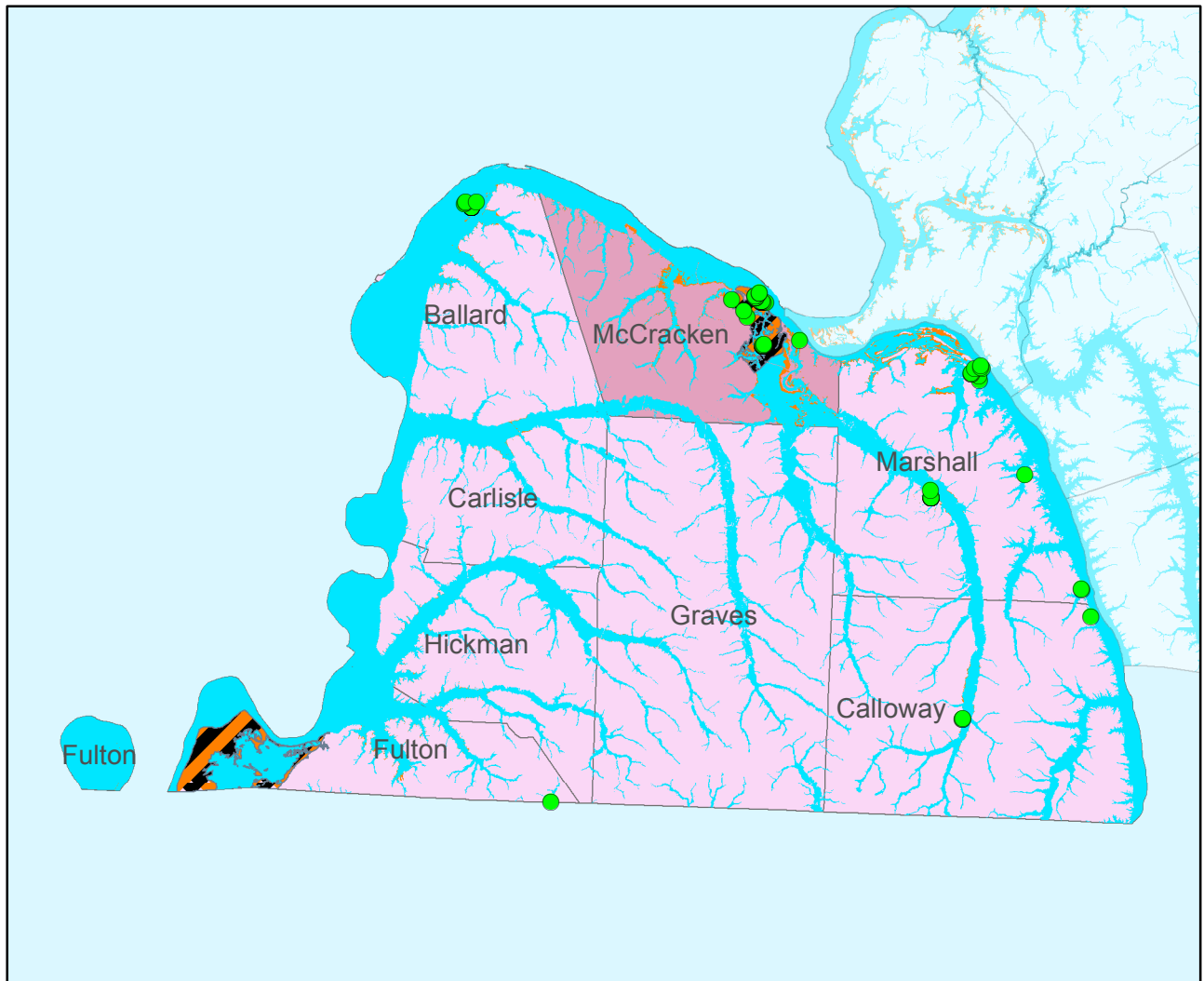
Displaced



Purchase Area Development District

County	Displaced	Need Shelter
Ballard	743	242
Calloway	1530	525
Carlisle	710	205
Fulton	504	174
Graves	2176	466
Hickman	416	48
McCracken	3215	1659
Marshall	2610	893

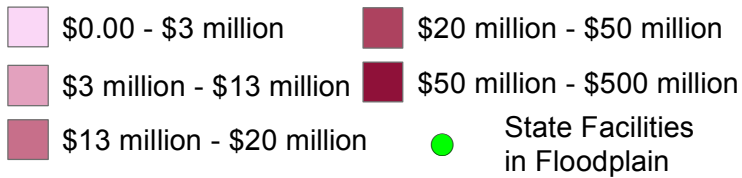




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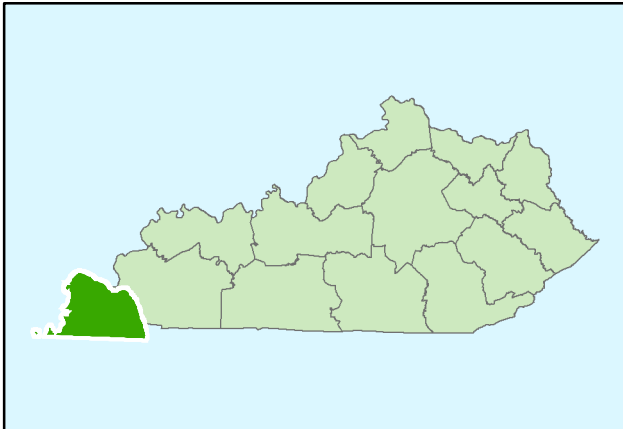


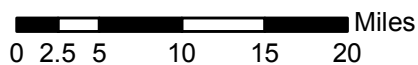
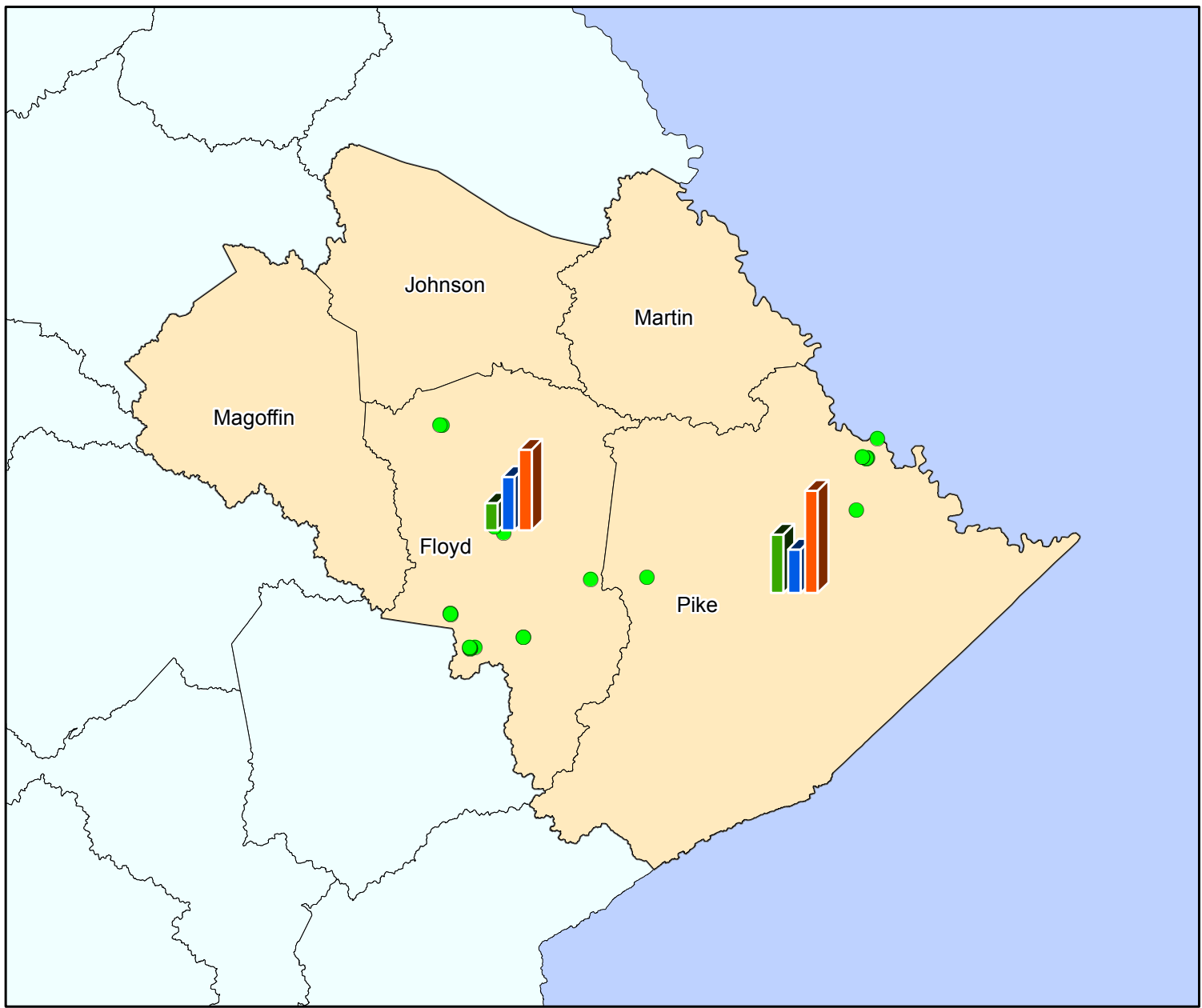
Replacement Cost Value



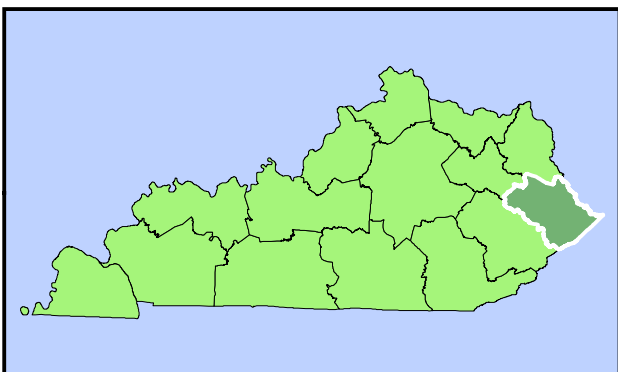
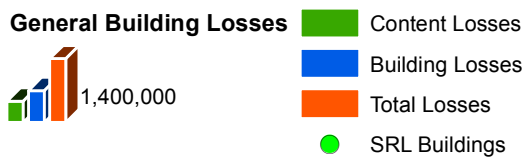
Purchase Area Development District

County	No. Vulnerable State Facilities	Replacement Cost Value
Ballard	15	\$1,080,917.00
Calloway	4	\$109,794.22
Carlisle	0	\$0.00
Fulton	1	\$0.00
Graves	0	\$0.00
Hickman	0	\$0.00
Marshall	21	\$2,090,935.40
McCracken	35	\$8,436,567.53

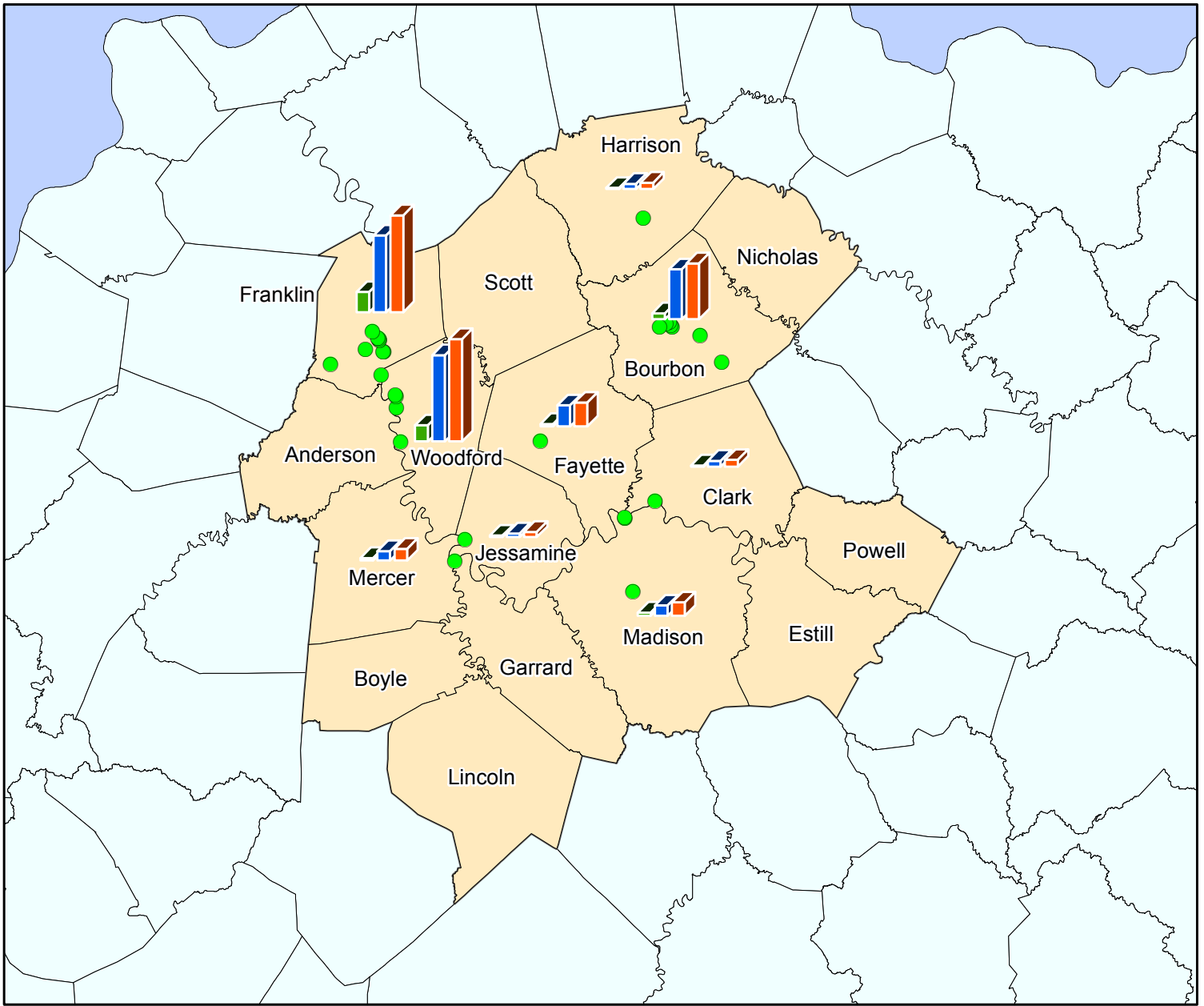




Big Sandy Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals



County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Floyd	Abbott Creek	2	\$257,777.27	\$214,400.22	\$43,377.05
Floyd	Beaver Creek	1	\$92,002.77	\$92,002.77	\$0.00
Floyd	Buck Branch	1	\$149,153.02	\$107,703.22	\$41,449.80
Floyd	Frasure Creek	2	\$672,517.30	\$463,412.71	\$209,104.59
Floyd	Right Fork Beaver Creek	8	\$866,065.79	\$473,764.63	\$392,301.16
Floyd	Steele Creek	1	\$107,616.61	\$77,946.56	\$29,670.05
Floyd	Toler Creek	1	\$96,235.65	\$56,071.26	\$40,164.39
Pike	Levisa Fork	1	\$121,608.62	\$67,826.36	\$53,782.26
Pike	Pond Creek	6	\$2,371,376.29	\$891,935.05	\$1,479,441.24
Pike	Tug Fork	2	\$342,769.09	\$251,926.33	\$90,842.76

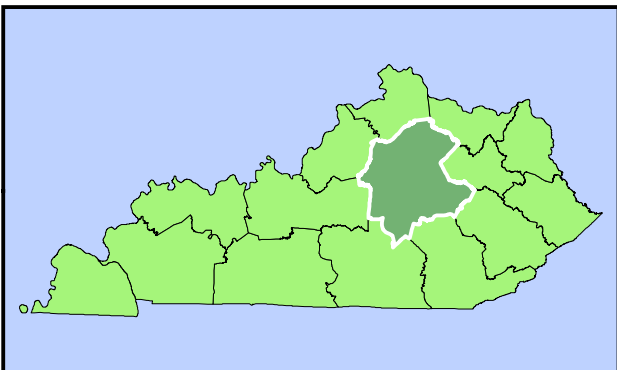


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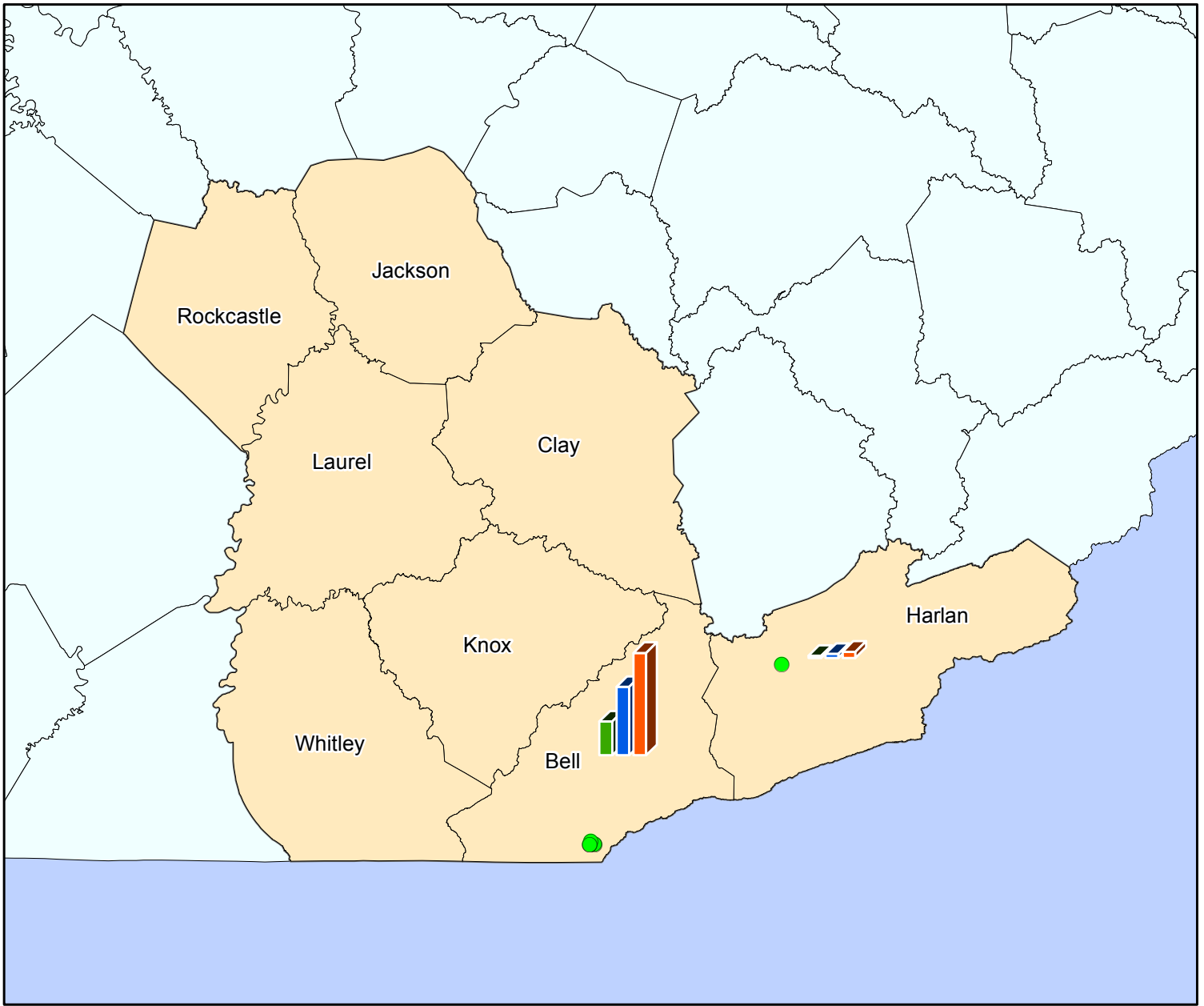
Bluegrass Area Development District Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals

General Building Losses 710,000

- Content Losses
- Building Losses
- Total Losses
- SRL Buildings

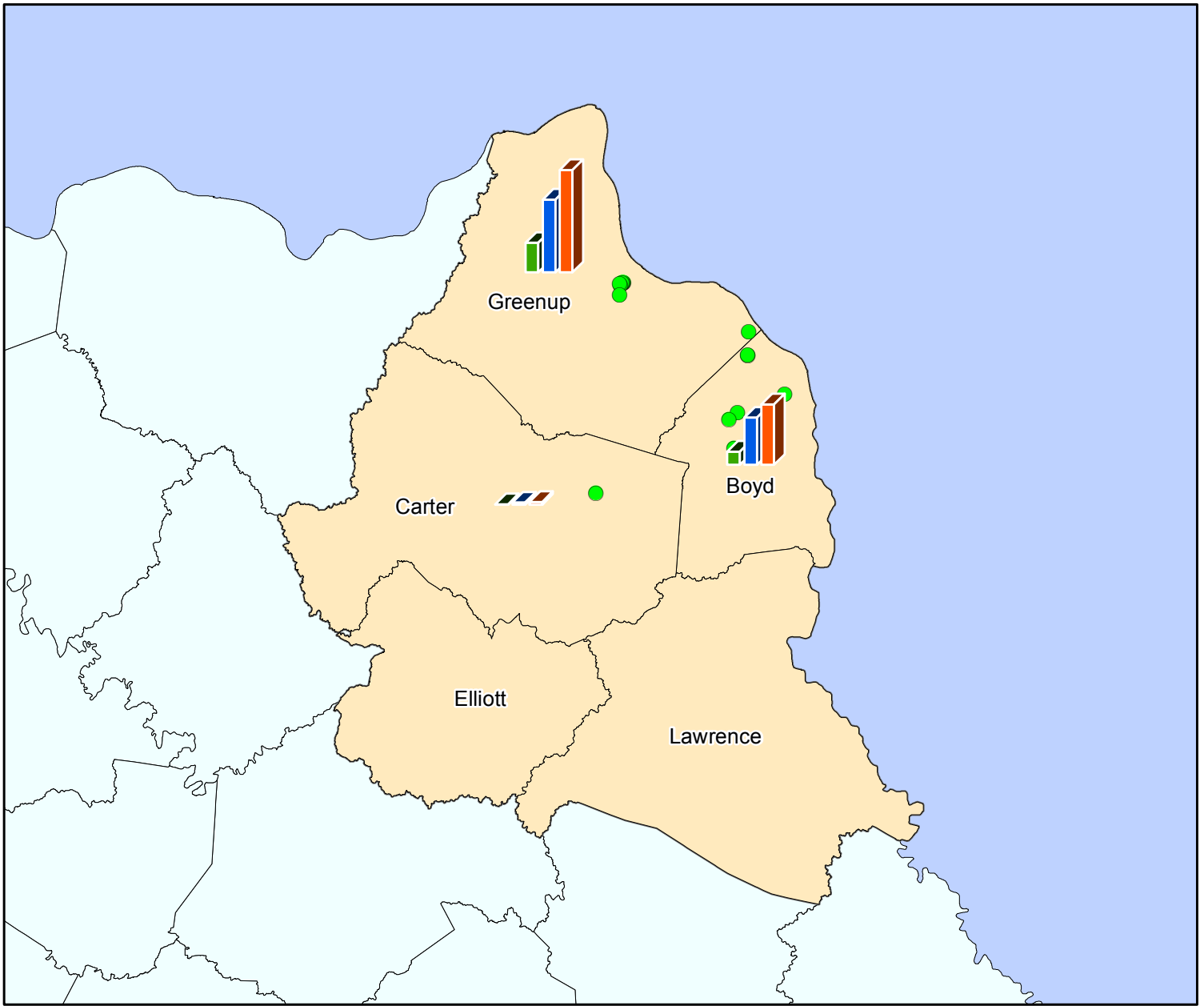


County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Bourbon	Houston Creek	2	\$272,572.68	\$241,053.62	\$31,519.06
Bourbon	Stoner Creek	5	\$506,127.18	\$454,421.31	\$51,705.87
Clark	Kentucky River	1	\$91,911.89	\$77,941.68	\$13,970.21
Fayette	Kentucky River	2	\$238,140.12	\$227,471.72	\$10,668.40
Fayette	Wolf Run	1	\$92,987.54	\$68,706.05	\$24,281.49
Franklin	Kentucky River	7	\$1,111,339.14	\$876,330.50	\$235,008.64
Franklin	South Benson Creek	1	\$135,980.66	\$135,980.66	\$0.00
Franklin	unnamed stream	1	\$102,611.07	\$56,748.47	\$45,862.60
Harrison	South Fork Licking River	1	\$90,130.90	\$72,803.82	\$17,327.08
Jessamine	Kentucky River	1	\$71,293.98	\$50,312.12	\$20,981.86
Madison	Irvine Lick Creek	1	\$187,010.11	\$142,634.84	\$44,375.27
Mercer	Kentucky River	1	\$162,514.70	\$129,730.32	\$32,784.38
Woodford	Kentucky River	6	\$1,427,737.77	\$1,203,317.34	\$224,420.43



Cumberland Valley Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals

County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Bell	Little Yellow Creek	2	\$515,720.74	\$251,968.04	\$263,752.70
Bell	Yellow Creek	3	\$943,308.16	\$724,138.66	\$219,169.50
Clay	none	0	\$0.00	\$0.00	\$0.00
Harlan	Cumberland River	1	\$88,660.69	\$57,174.81	\$31,485.88
Jackson	none	0	\$0.00	\$0.00	\$0.00
Knox	none	0	\$0.00	\$0.00	\$0.00
Laurel	none	0	\$0.00	\$0.00	\$0.00
Rockcastle	none	0	\$0.00	\$0.00	\$0.00
Whitley	none	0	\$0.00	\$0.00	\$0.00

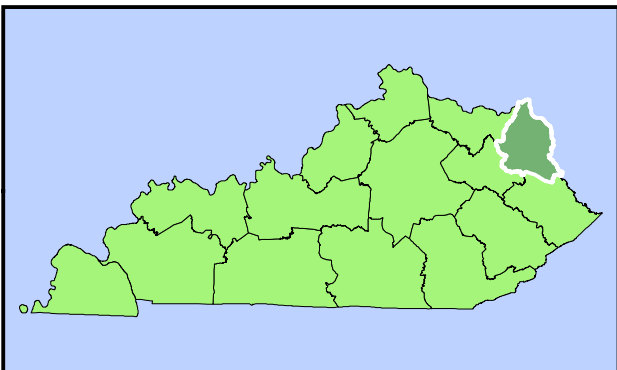


Fivco Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals

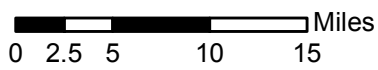
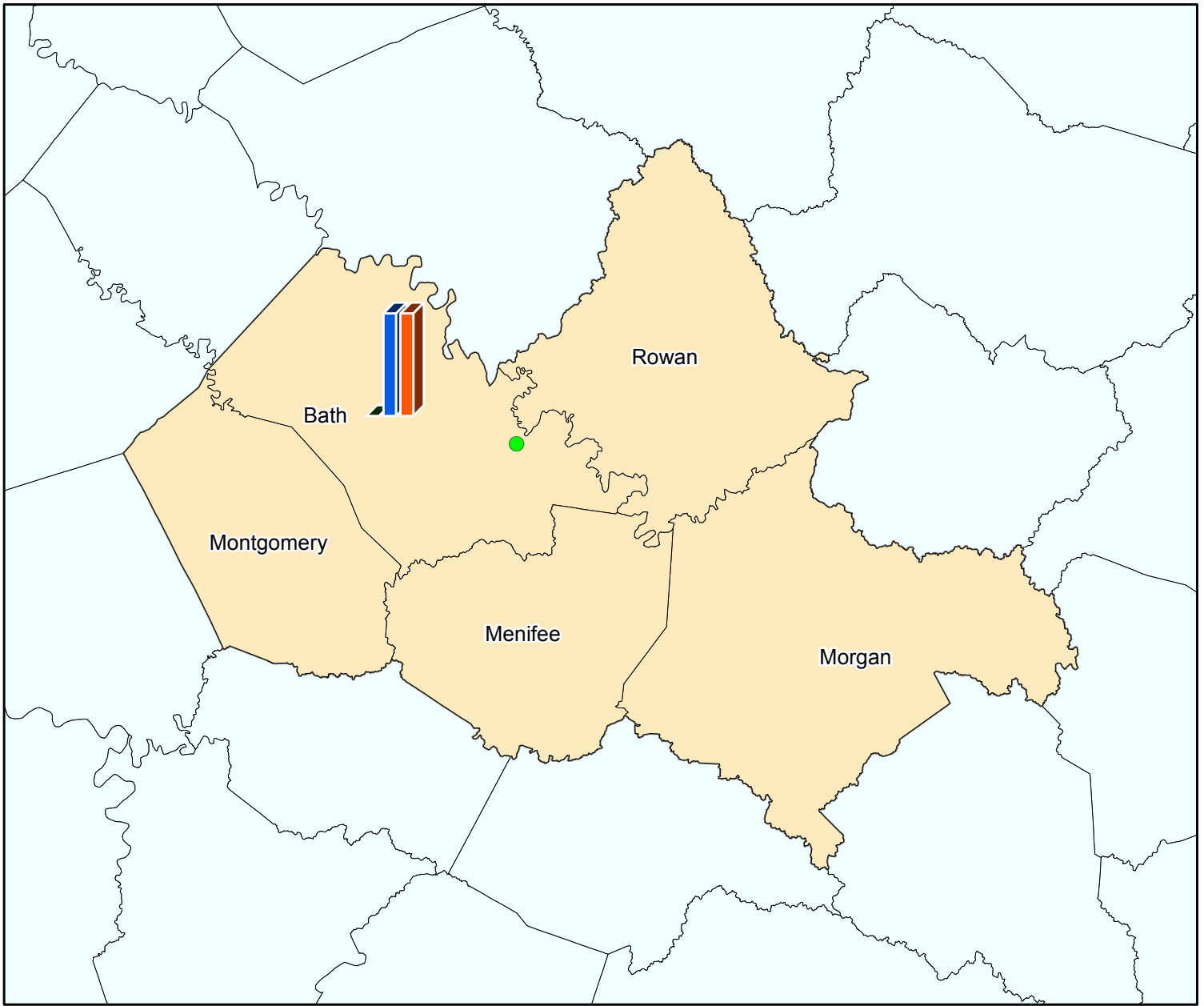
General Building Losses

- Content Losses
- Building Losses
- Total Losses
- SRL Buildings

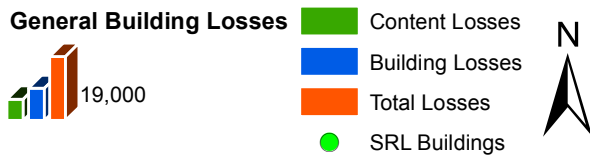
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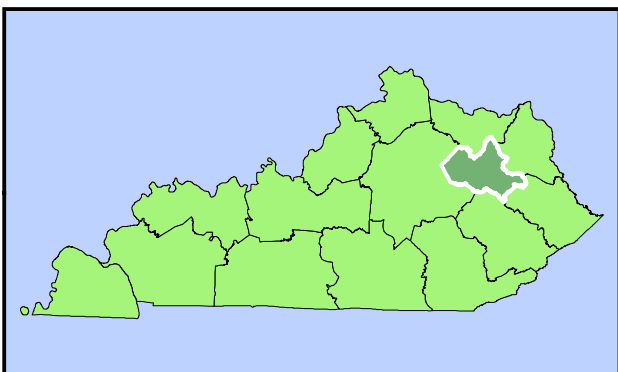
County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Boyd	East Fork Little Sandy River	1	\$798,747.78	\$605,402.03	\$193,345.75
Boyd	Hood Creek	2	\$325,513.31	\$244,084.04	\$81,429.27
Boyd	Keys Creek	1	\$85,662.13	\$74,766.57	\$10,895.56
Boyd	Shope Creek	2	\$257,308.16	\$220,566.09	\$36,742.07
Carter	Lower Stinson Creek	1	\$66,215.06	\$54,175.46	\$12,039.60
Greenup	Little Sandy River	7	\$2,209,580.78	\$1,517,082.18	\$692,498.60
Greenup	Ohio River	1	\$77,412.13	\$63,819.54	\$13,592.59
Greenup	White Oak Creek	1	\$200,190.40	\$186,923.94	\$13,266.46

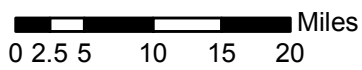
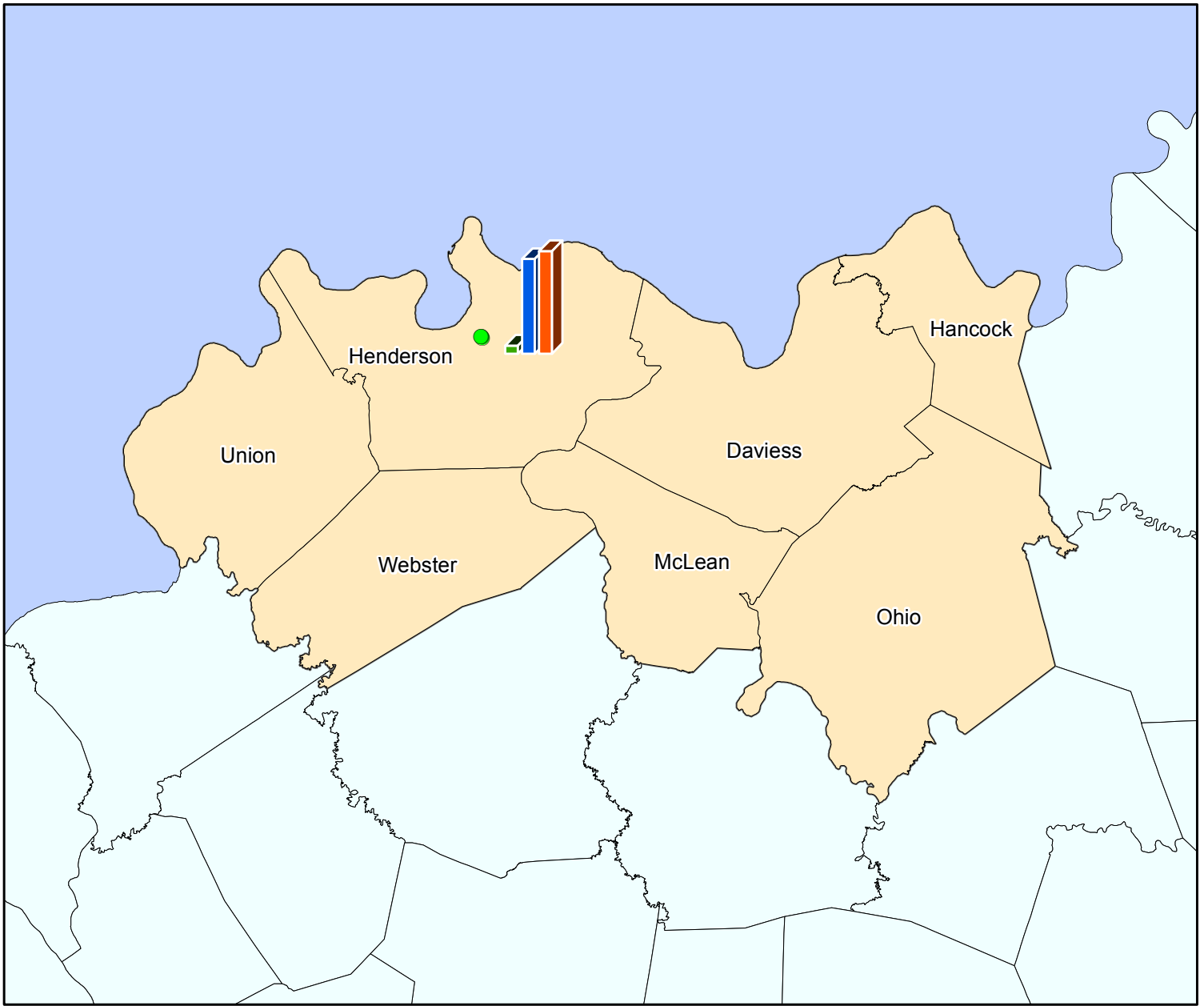


Gateway Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals

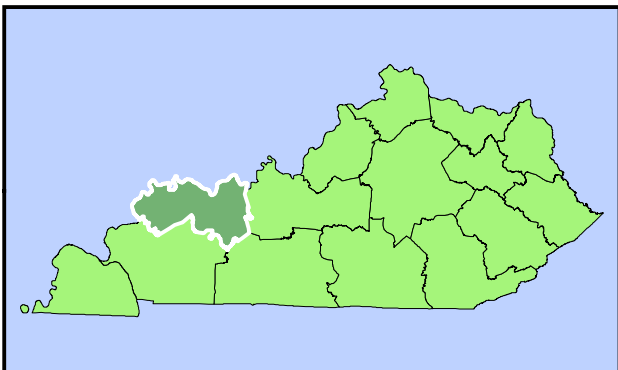
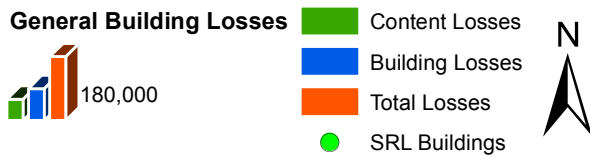


County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Bath	Salt Lick Creek Tributary 13	1	\$38,965.01	\$38,965.01	\$0.00
Menifee	none	0	\$0.00	\$0.00	\$0.00
Montgomery	none	0	\$0.00	\$0.00	\$0.00
Morgan	none	0	\$0.00	\$0.00	\$0.00
Rowan	none	0	\$0.00	\$0.00	\$0.00

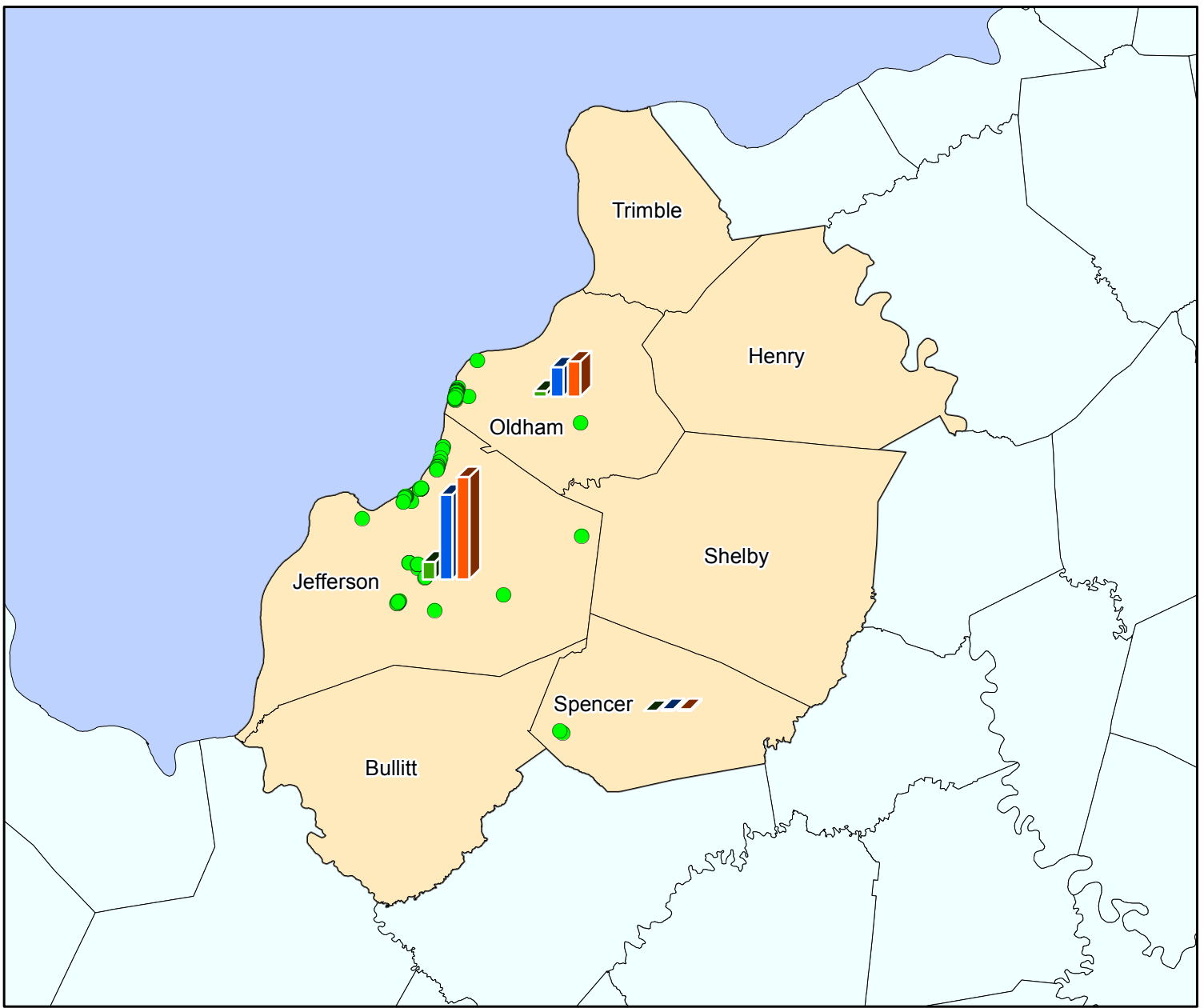




Green River Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals



County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Daviess	none	0	\$0.00	\$0.00	\$0.00
Hancock	none	0	\$0.00	\$0.00	\$0.00
Henderson	North Fork Canoe Creek	3	\$363,848.17	\$335,737.38	\$28,110.79
McLean	none	0	\$0.00	\$0.00	\$0.00
Ohio	none	0	\$0.00	\$0.00	\$0.00
Union	none	0	\$0.00	\$0.00	\$0.00
Webster	none	0	\$0.00	\$0.00	\$0.00



0 2.5 5 10 15 20 Miles

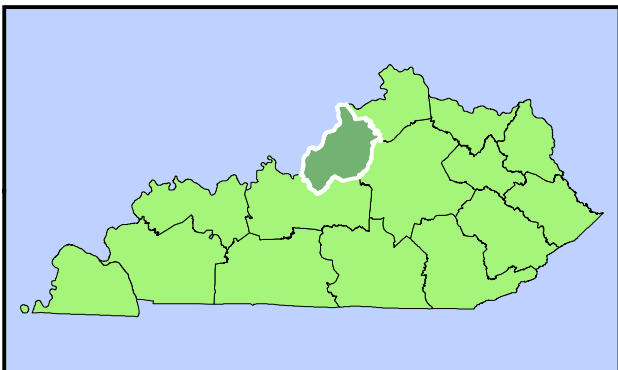
KIPDA Area Development District Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals

General Building Losses

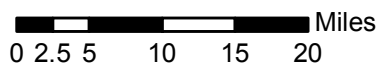
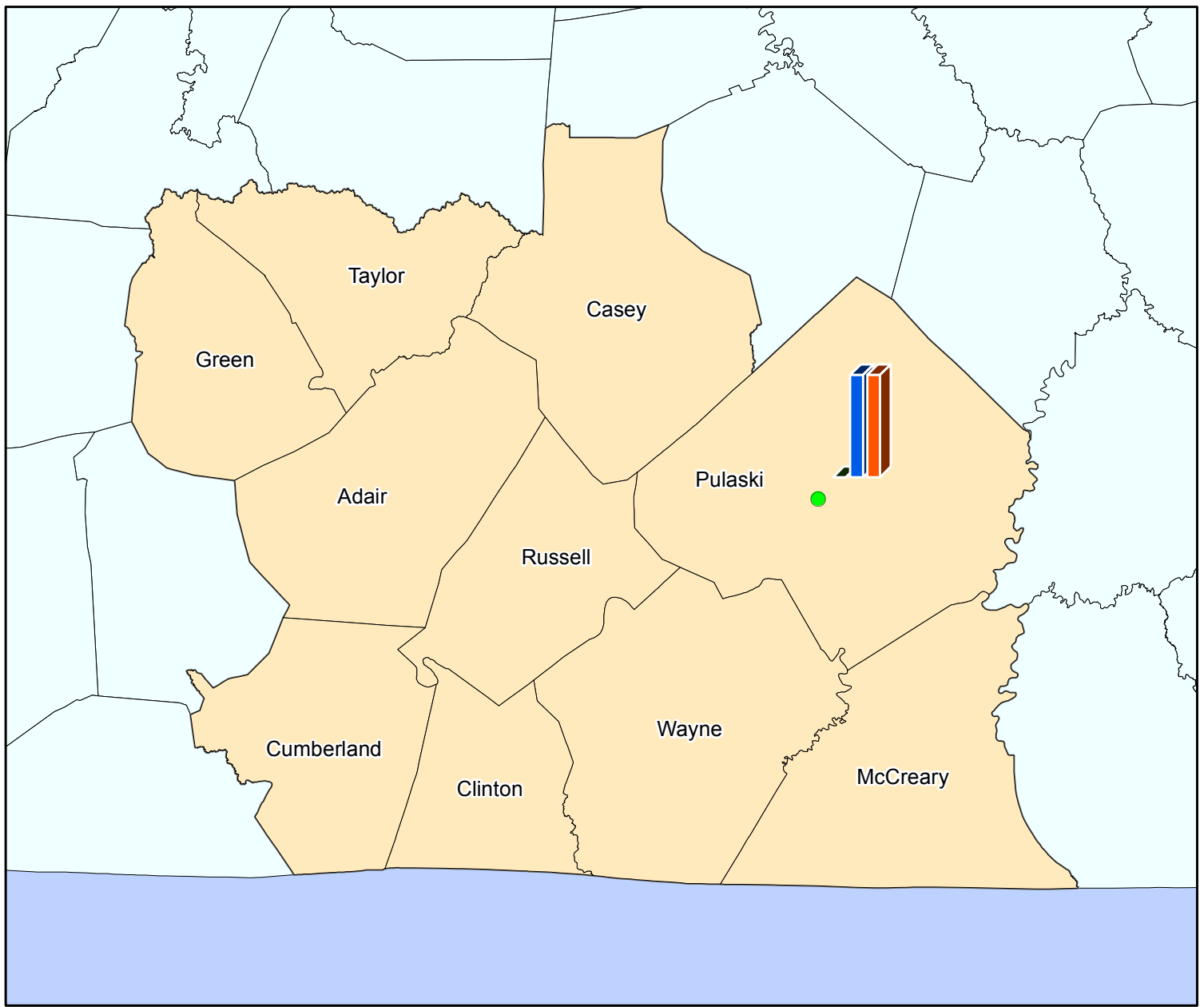
Content Losses
Building Losses
Total Losses

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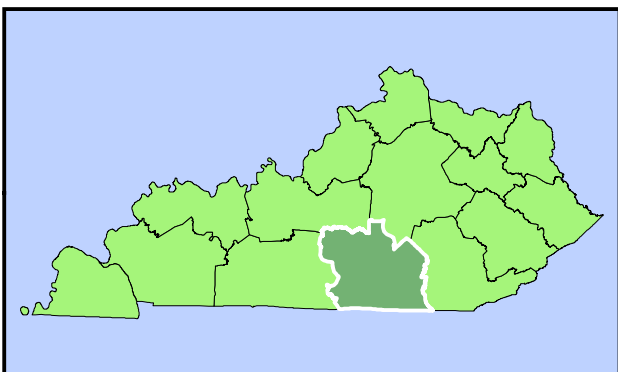
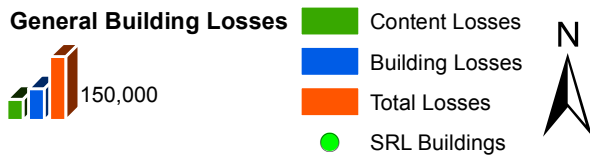
SRL Buildings



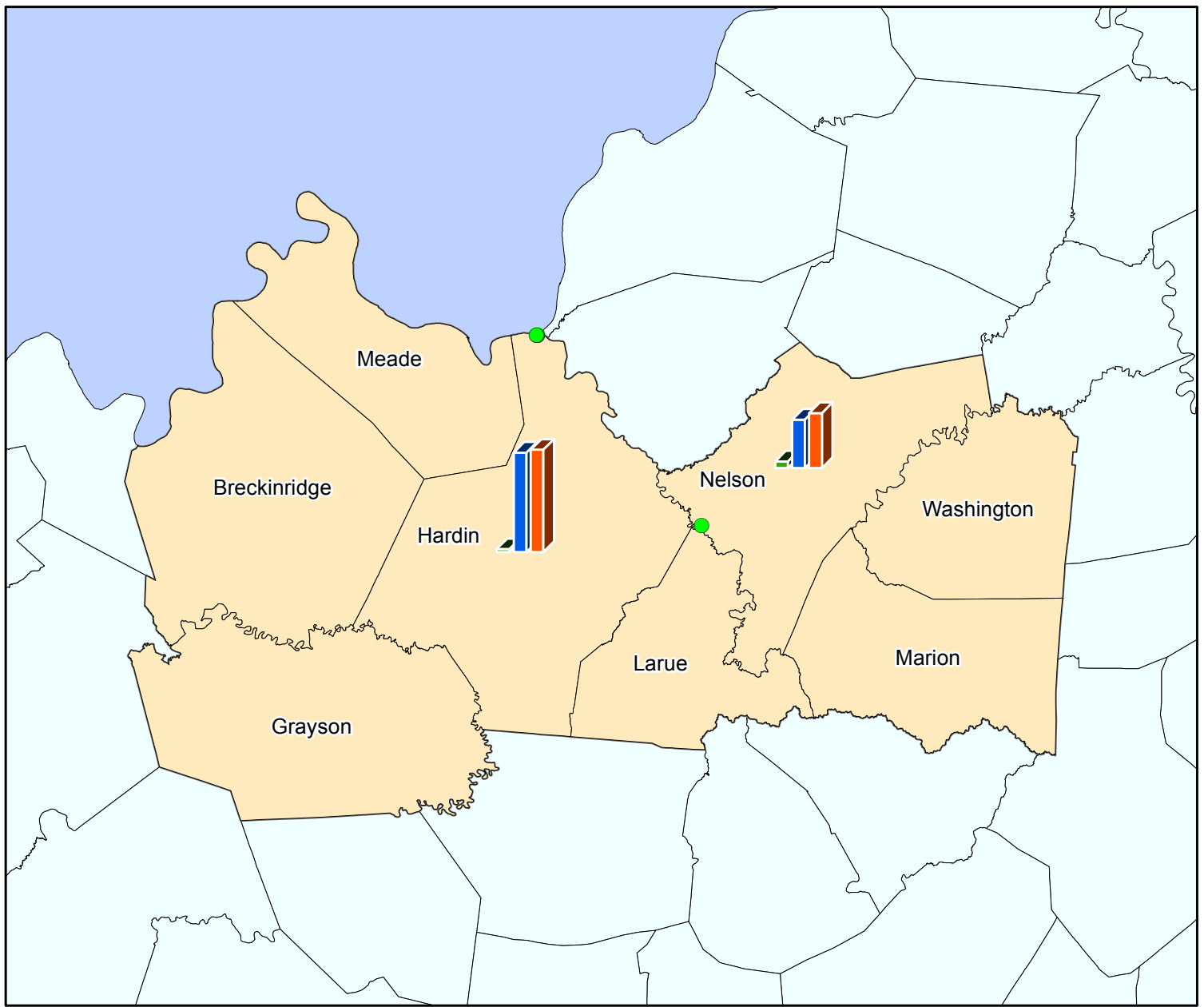
County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Jefferson	Brooklawn Tributary	2	\$324,527.66	\$324,527.66	\$0.00
Jefferson	Buechel Branch	2	\$200,739.63	\$187,939.66	\$12,799.97
Jefferson	Chenoweth Run	1	\$207,687.06	\$192,720.44	\$14,966.62
Jefferson	Fern Creek	1	\$65,087.22	\$65,087.22	\$0.00
Jefferson	Greasy Ditch	8	\$616,575.74	\$595,248.52	\$21,327.22
Jefferson	Long Run Creek	1	\$167,252.97	\$149,632.33	\$17,620.64
Jefferson	Middle Fork Beargrass Creek	1	\$116,081.17	\$107,371.68	\$8,709.49
Jefferson	Ohio River	37	\$9,662,950.40	\$7,810,859.25	\$1,852,091.15
Jefferson	South Fork Beargrass Creek	9	\$883,156.63	\$697,217.91	\$185,938.72
Oldham	North Fork Currys Fork	1	\$127,410.98	\$90,579.30	\$36,831.68
Oldham	Ohio River	26	\$4,006,767.85	\$3,366,095.91	\$640,671.94
Spencer	Salt River	2	\$214,358.75	\$214,358.75	\$0.00



Lake Cumberland Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals



County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Adair	None	0	\$0.00	\$0.00	\$0.00
Casey	None	0	\$0.00	\$0.00	\$0.00
Clinton	None	0	\$0.00	\$0.00	\$0.00
Cumberland	None	0	\$0.00	\$0.00	\$0.00
Green	None	0	\$0.00	\$0.00	\$0.00
McCreary	None	0	\$0.00	\$0.00	\$0.00
Pulaski	unnamed stream	1	\$296,682.42	\$296,682.42	\$0.00
Russell	None	0	\$0.00	\$0.00	\$0.00
Taylor	None	0	\$0.00	\$0.00	\$0.00
Wayne	None	0	\$0.00	\$0.00	\$0.00

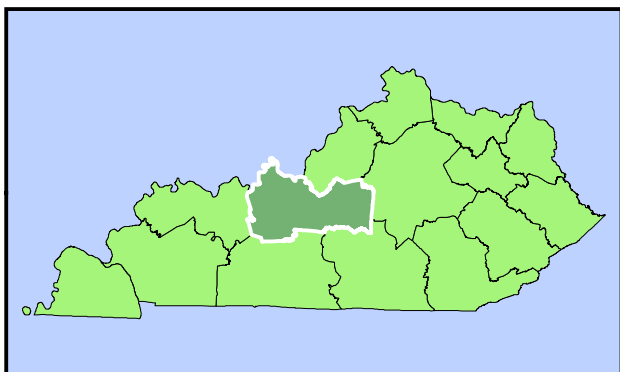


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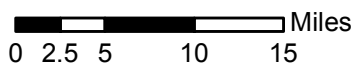
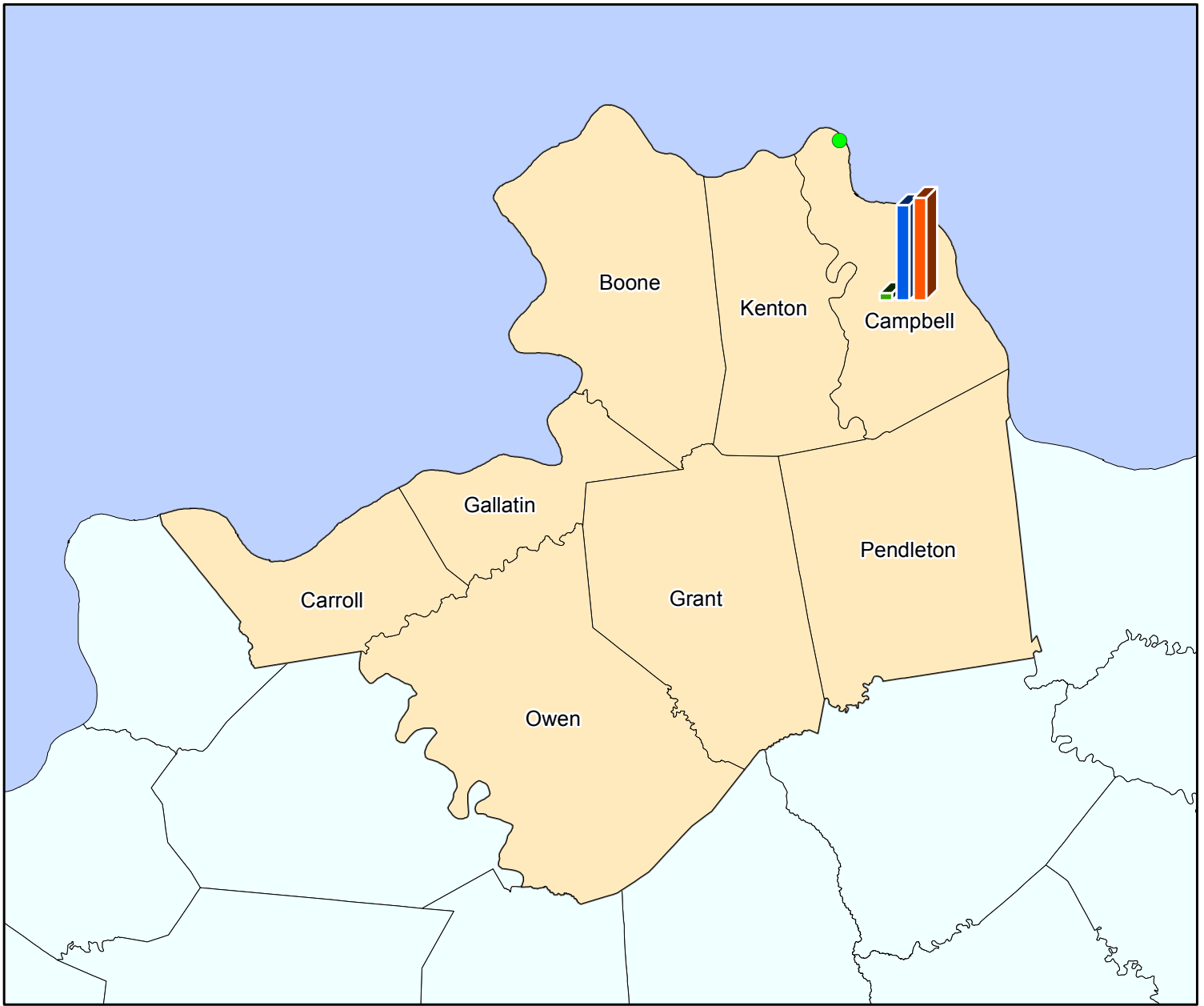
Lincoln Trail Area Development District Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals

General Building Losses

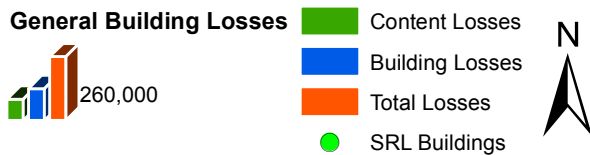
- Content Losses
- Building Losses
- Total Losses
- SRL Buildings



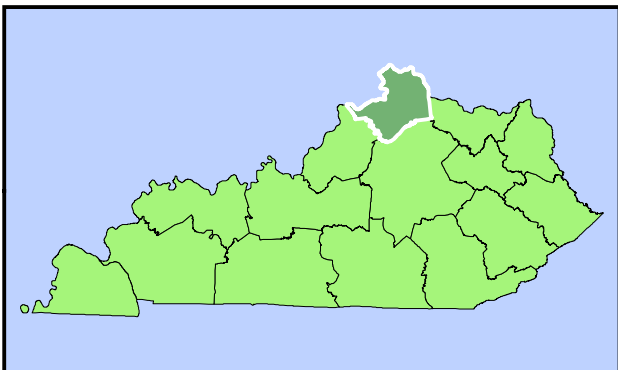
County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Breckinridge	None	0	\$0.00	\$0.00	\$0.00
Grayson	None	0	\$0.00	\$0.00	\$0.00
Hardin	Ohio River	3	\$352,649.12	\$342,513.12	\$10,136.00
Larue	None	0	\$0.00	\$0.00	\$0.00
Marion	None	0	\$0.00	\$0.00	\$0.00
Meade	None	0	\$0.00	\$0.00	\$0.00
Nelson	Rolling Fork	1	\$189,526.08	\$166,839.39	\$22,686.69
Washington	None	0	\$0.00	\$0.00	\$0.00

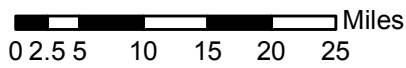
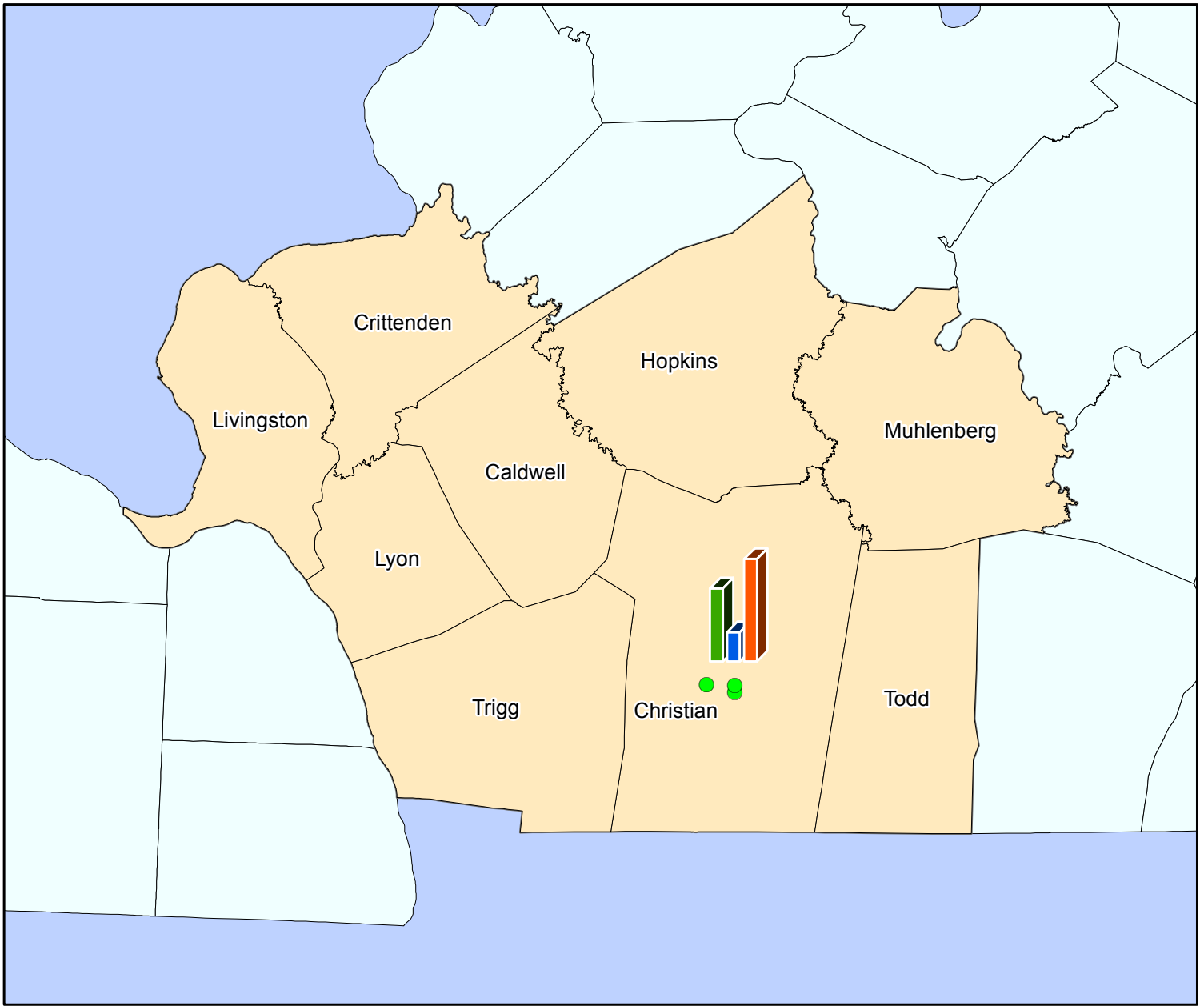


Northern Kentucky Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals

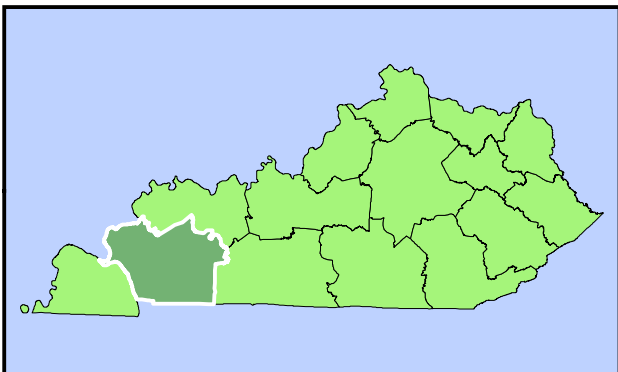
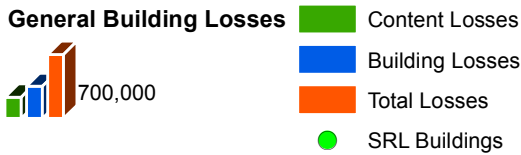


County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Boone	None	0	\$0.00	\$0.00	\$0.00
Campbell	Ohio River	1	\$514,545.47	\$478,098.16	\$36,447.31
Carroll	None	0	\$0.00	\$0.00	\$0.00
Gallatin	None	0	\$0.00	\$0.00	\$0.00
Grant	None	0	\$0.00	\$0.00	\$0.00
Kenton	None	0	\$0.00	\$0.00	\$0.00
Owen	None	0	\$0.00	\$0.00	\$0.00
Pendleton	None	0	\$0.00	\$0.00	\$0.00

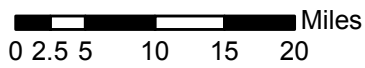
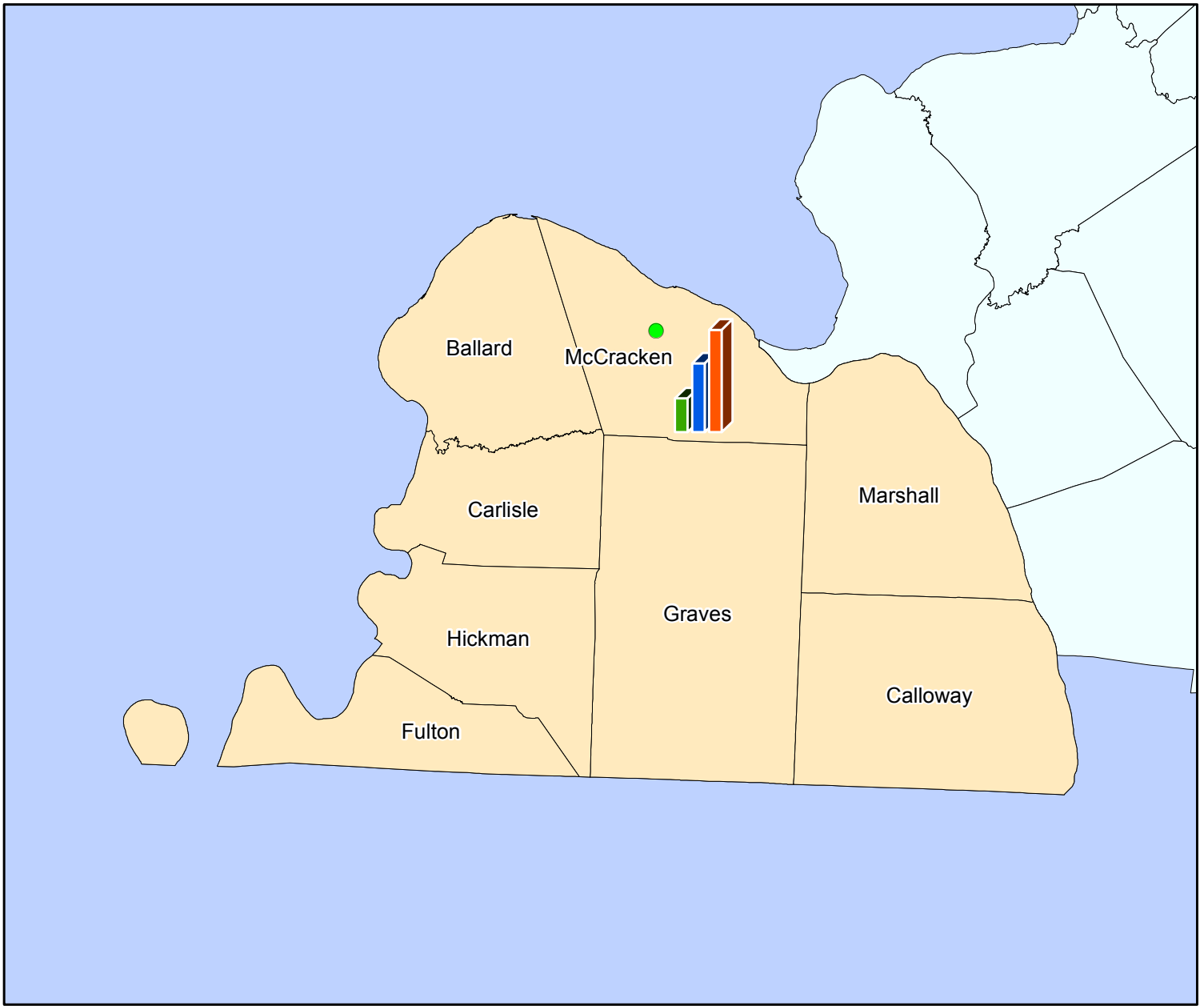




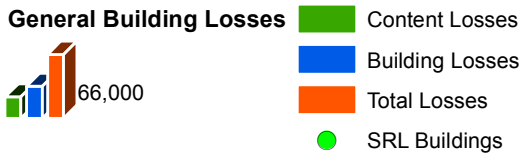
Pennyryle Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals



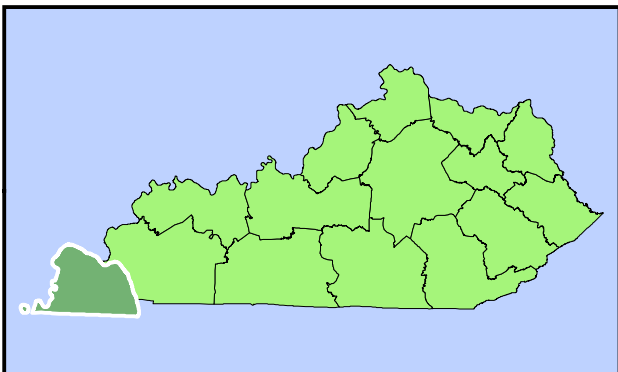
County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Caldwell	None	0	\$0.00	\$0.00	\$0.00
Christian	Sinkhole 18A	1	\$268,897.74	\$222,123.25	\$46,774.49
Christian	South Fork Little River	2	\$1,131,180.11	\$178,240.88	\$952,939.23
Crittenden	None	0	\$0.00	\$0.00	\$0.00
Hopkins	None	0	\$0.00	\$0.00	\$0.00
Livingston	None	0	\$0.00	\$0.00	\$0.00
Lyon	None	0	\$0.00	\$0.00	\$0.00
Muhlenberg	None	0	\$0.00	\$0.00	\$0.00
Todd	None	0	\$0.00	\$0.00	\$0.00
Trigg	None	0	\$0.00	\$0.00	\$0.00



Purchase Area Development District
Severe Repetitive Loss (SRL) and Special Direct Facility (SDF) totals

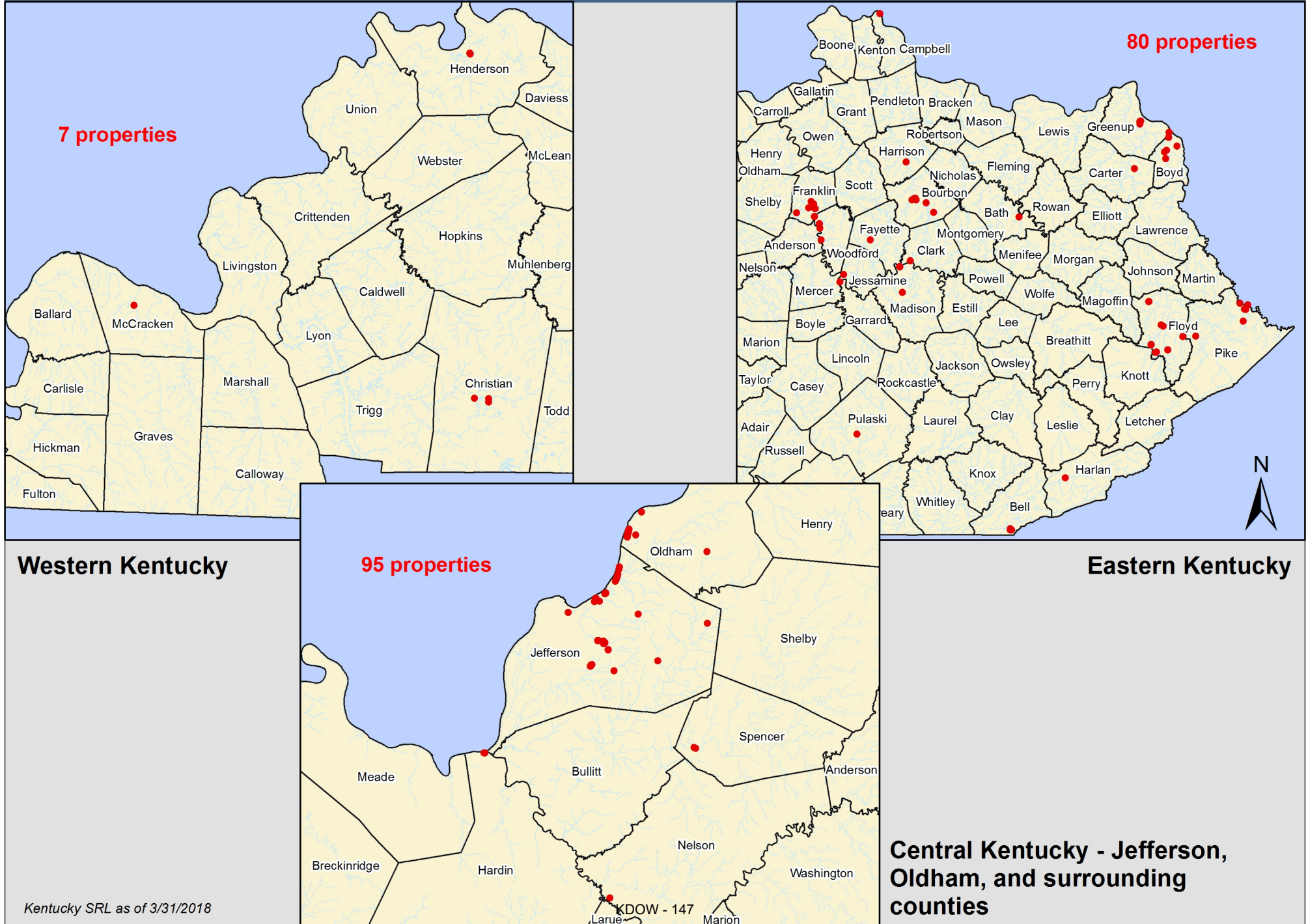


● SRL Buildings



County	Flooding Source	SRL Buildings	Total Losses	Building Losses	Content Losses
Ballard	None	0	\$0.00	\$0.00	\$0.00
Calloway	None	0	\$0.00	\$0.00	\$0.00
Carlisle	None	0	\$0.00	\$0.00	\$0.00
Fulton	None	0	\$0.00	\$0.00	\$0.00
Graves	None	0	\$0.00	\$0.00	\$0.00
Hickman	None	0	\$0.00	\$0.00	\$0.00
Marshall	None	0	\$0.00	\$0.00	\$0.00
McCracken	Massac Creek	1	\$131,305.31	\$88,049.52	\$43,255.79

Locations of 182 SRL Properties





2018 Kentucky Hazard Mitigation Plan Update – Flood Risk Assessment

Appendix C: Average Annual Percent Loss Calculation Methodology

Average Annualized Percent Loss

Introduction

The National Flood Insurance Program (NFIP) regulates insurance requirements for structures using Flood Insurance Rate Maps (FIRM). The insurance requirements for structures are determined according to whether they are in a special flood hazard area as depicted on the FIRM. However, this fails to communicate that structures have varying degrees of flood risk due to characteristics specific to the individual structure, not just its location relative to the floodplain.

New products produced through advancements in the NFIP are providing a more comprehensive look at flood risk. Likewise, technological improvements and vast digital datasets that are now available facilitate the ability to do risk assessments that include structure specific information on a large scale. This type of risk assessment, which was cost prohibitive previously, provides the capability to communicate more information regarding the amount of flood risk associated with each structure.

Average Annualized Percent Loss (AAPL) is a risk score and coefficient that is specific to a structure. AAPL can be produced from datasets created through the NFIP's Risk MAP program and other available public data. AAPL is derived from the relationship of how much damage a structure is projected to sustain during a flood event and the probability of that event happening. Damage to the structure is expressed as the percent of a structure's value is lost during a flood event. The probability is expressed by the magnitudes of flooding and is referred to as the percent annual chance event.

Methodology

Specific data are needed to calculate AAPL, including floodplain elevations, high resolution elevation data, building locations, structure characteristics, and applicable depth-damage curves.

a. Floodplain Elevations

Floodplain elevations are determined at each structure from the FEMA Flood Insurance Studies for the available percent annual chance events. The more events that are included in the flood analysis, the more refined the representation of flood risk the AAPL score becomes. These elevations are most easily taken from the multi-frequency depth grids produced in the FEMA Risk MAP process.

Currently, only the 1% annual chance flood grid is available for the entire state, and therefore only this event was used for the state-owned facilities project. The analysis could be repeated as more detailed multi-frequency depth grid data are published. All 1% annual chance flood grids were produced on LiDAR elevation data, which is available for all of Kentucky. LiDAR data are recommended for structure-based analysis where available.



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Structure Data

Geographic building data are required for structure-based risk analysis. Building footprints are preferred as the most accurate representation of a structure. Many communities can provide these, along with structure characteristic data. For the AAPL designation, structure type is required. Number of floors, basement type, and structure use are used to determine which depth-damage curve should be referenced in calculations. Any assumptions regarding these attributes should be well documented. PVA data, including building value, is not required for AAPL specifically, but is recommended for further risk analyses, such as average annualized loss (AAL).

Surveyed Finished Floor Elevations (FFE)s are preferred for the AAPL calculations. If not available, finished floor elevations can be estimated using remote assessment with LiDAR data, aerial imagery, online mapping, and structure footprints. Alternatively, highest or lowest adjacent grade information may be used to make assumptions for structures where better data are not available.

For this project, the Commonwealth of Kentucky provided a table with building addresses or latitude and longitude coordinates and a description of all state owned structures. These table data were then geolocated to points using ArcGIS and verified on aerial imagery and online mapping tools. To determine the flood depth for each structure, a 50 foot radius around each point was used and the maximum depth value of the 1% chance annual event in that area was selected. The 50 foot radius was chosen to capture the average state-owned facility building size, and the depth maximum was used as it represented the most conservative estimate of risk.

b. Depth Damage Estimation

The comparison of finished floor elevation to flooding depth presents the depth of flooding within the structure. The calculated flood depths within the structure are input into US Army Corps of Engineers (USACE) Depth-Damage Curves to determine the percent damage for each structure for the flooding events considered. Figure 1 shows an example depth-damage curve from the USACE Economic Guidance Memorandum (USACE, 2003). The USACE Depth-Damage curves present standardized relationships for estimating flood damage costs of flooding based on actual flood event losses. They are calculated from major flooding events across the nation from 1996 through 2001. The curve used varies by structure type. Estimated percent damages were calculated for both structure and content for each structure, and totaled as losses for analysis.



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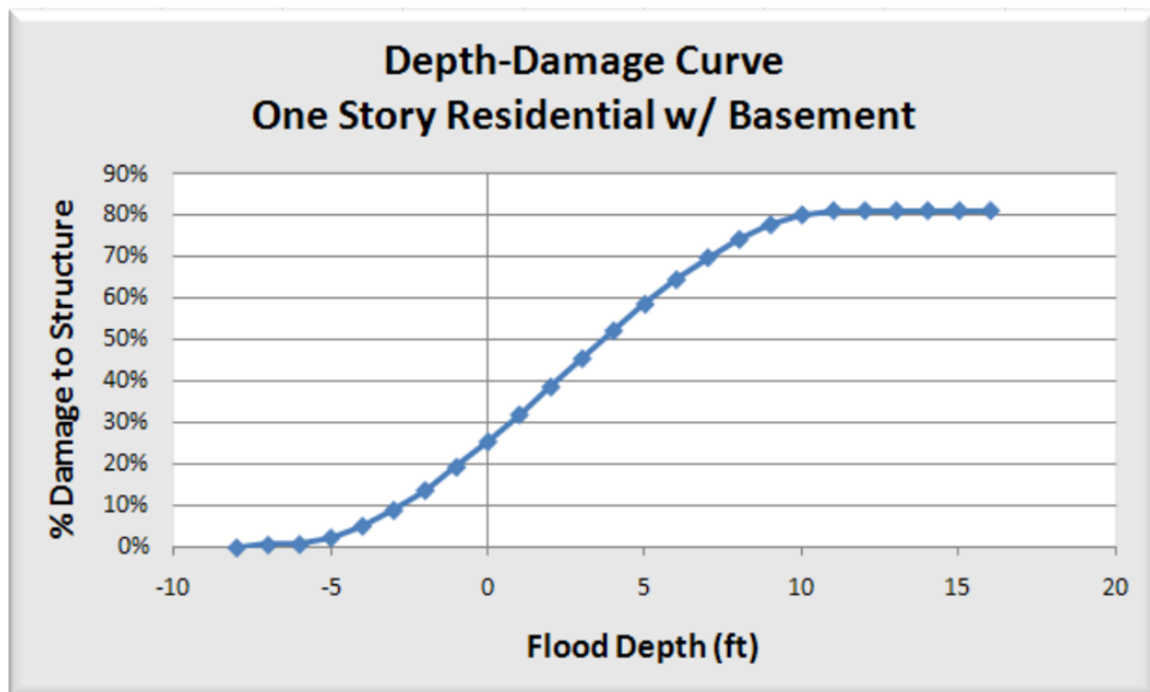


Figure 1. Example Depth-Damage Relationship (USACE, 2003)

For the state-owned facility project, a structure type of “General Non-Residential Structure without Basement” was assumed for all, from IWR Report 96-R-12 (USACE, 1996). Of the provided structure data, approximately 19% were unable to be included in the analysis due to insufficient data. This is an area for improvement for future iterations of this project. Some structures were able to be precluded from being high risk even though they were not specifically located; for example, if that entire street was not in proximity of a floodplain. For structures within a facility complex where specific buildings could not be identified and only some were located in the 1% annual chance floodplain, the structure values for the facility buildings were averaged to best capture the at-risk value.

c. Calculating AAPL

The percent loss from the depth damage curves for each annual chance event can be plotted on a graph to depict each structure’s percent loss probability curve. The X axis represents the percent annual chance events, and the Y axis is the structure’s percent damage from the depth damage curve. In figure 2 below, percent losses are plotted for 5 analyzed events from the flood study to get the structure-specific curve.



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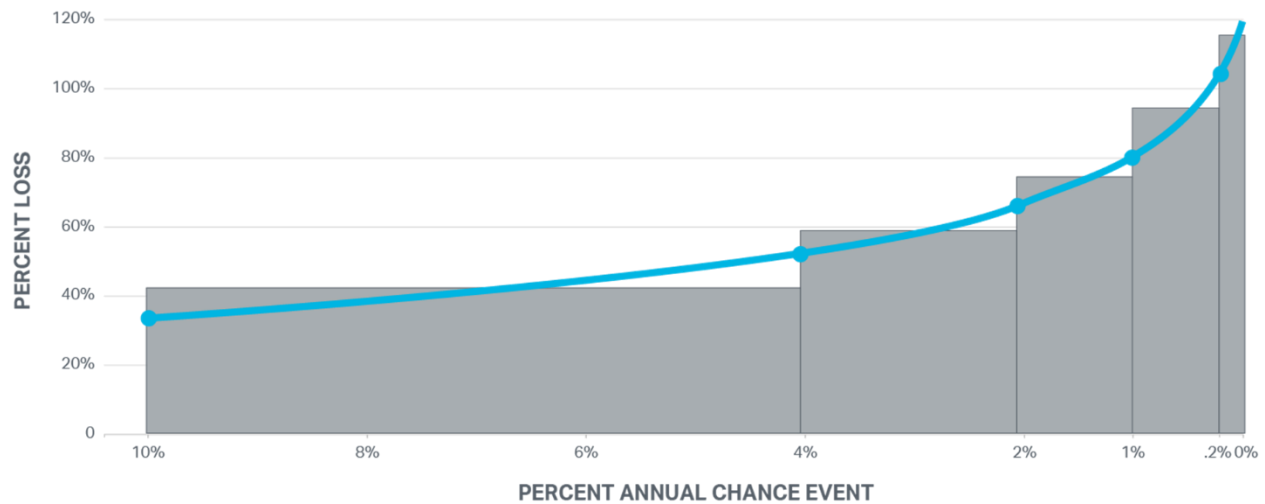


Figure 2. Extreme AAPL example

The AAPL is the area calculated under the percent loss probability curve. The formula for calculating the area under the curve is:

$$\begin{aligned}
 \text{Average Annualized Percent Loss} = & (10\% - 4\%) * (\text{Percent Loss } 10\% + \text{Percent Loss } 4\%) / 2 + \\
 & (4\% - 2\%) * (\text{Percent Loss } 4\% + \text{Percent Loss } 2\%) / 2 + \\
 & (2\% - 1\%) * (\text{Percent Loss } 2\% + \text{Percent Loss } 1\%) / 2 + \\
 & (1\% - 0.2\%) * (\text{Percent Loss } 1\% + \text{Percent Loss } 0.2\%) / 2 + \\
 & 0.2\% * (\text{Percent Loss } 0.2\% + \text{Max Percent Loss}) / 2
 \end{aligned}$$

The grey areas under the curve represent the AAPL score, estimated mathematically in the equation above. This is an example of a structure's AAPL with an extreme AAPL flood risk score of 4.2. The average losses annually for this structure would be 4.2% of the building value. Ex: a \$100,000 value would have an Average Annualized Loss (AAL) of \$4,200. AAL is the expected yearly loss, averaged over many years. AAL is used widely in catastrophe modeling, planning, and actuarial sciences.

Figure 3 below is an example of one structure's AAPL with a high flood risk score of 0.4. This structure is not within the 10%, 4%, nor 2% annual chance floodplains, but gains depth in the 1% annual chance event flood. The average losses annually for this structure is approximately 0.4% of the building value. Ex: a \$100,000 value would have an AAL of \$400.



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Figure 3. High AAPL example

Conclusions

AAPL scores are capable of being continuously refined as more data become available. Improved depth-damage curves, surveyed structure data, more refined elevation data, and more detailed hydraulic models can all be used to recalculate AAPL scores.

AAPL can be used in a variety of ways. It can be used for a structure-specific risk score, analyzing the flood risks of specific properties. It can also be used on larger scale assessments as part of a structure-based risk assessment for a community as a whole, to identify high-risk areas, and formulate a mitigation strategy. AAPL scores can be easily multiplied with property values to assign AAL values in various risk assessment applications. AAPL could be applied in assignment of insurance rates, and to better communicate flood risk as opposed to the traditional “In or Out” floodplain determinations.

The results of the state-owned facility project found 488 structures within the 1% annual chance depth grid in forty-eight different counties of Kentucky. Total Losses calculated for these structures approximated \$85,300,000. AAPL scores ranged from 0.0 to 1.4.



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Sources:

USACE, Analysis of Nonresidential Content Value and Depth-Damage Data for Flood Reduction Studies (IWR Report 96-R-12), May 1996

USACE, Catalog of Residential Depth-Damage Functions (IWR Report 92-R-3), May 1992.
<http://planning.usace.army.mil/toolbox/library/IWRServer/92-R-3.pdf>

USACE, Economic Guidance Memorandum (EGM) 04-01, Generic Depth-Damage Relationships, October 2003. <http://planning.usace.army.mil/toolbox/library/EGMs/egm04-01.pdf>