

Table 1. Data sources for analyzing and mapping coastal resilience actions in Great Lakes coastal states. (<http://resilientgreatlakescoast.org/>) (As of 01/2021)

Type	Resilience Solution	Dataset	Data Source	Data Format	Description	Advantages	Disadvantages
Preparation	Shoreline Armoring (and other hard infrastructure)	U.S. Great Lakes Hardened Shorelines Classification 2019 ¹	NOAA Office for Coastal Management	GIS layer	This dataset is a GIS polyline layer that identifies the shoreline classification. The data were created by digitizing the shoreline using the National Agriculture Imagery Program imagery from 2014 through 2017 and comparing it with oblique imagery. The dataset provides updated shoreline classifications.	Free dataset. Shoreline armoring and other artificial shoreline types can be identified and selected based on attributes like which state the Shoreline belongs to. This makes it easier to quickly map shoreline armoring locations, as well as calculate the percentage of the shoreline that is armored.	The dataset is not updated frequently. The previous version was developed in 2012 for 1990s data.
Preparation	Beach Nourishment	U.S. Great Lakes Hardened Shorelines Classification 2019	NOAA Office for Coastal Management	GIS layer	This dataset is a GIS polyline layer that identifies the shoreline classification. The data were created by digitizing the shoreline using the National Agriculture Imagery Program imagery from 2014 through 2017 and comparing it with oblique imagery. The dataset provides updated shoreline classifications.	Free dataset. The most recently available data.	Although the dataset identifies beach nourishment projects, the dataset appears to be incomplete. Almost no beach nourishment projects are recorded in Michigan from 2014 to 2017.
		Beach Nourishment Activity along the Great Lakes' Shoreline 1955-1996	Journal of Coastal Research	PDF with table	This research study compiled data from over 50 sources to map Beach Nourishment projects in the Great Lakes region. A table is included summarizing the locations, the date(s) of nourishment episodes, and the number of nourishment episodes.	Requires journal subscription or to pay for the article. Comprehensive dataset that can be geocoded to understand where beach nourishment episodes have occurred regularly.	The data are out-of-date, but it is likely that these sites are still receiving nourishment. Also, it is time intensive to geocode the sites from the table provided in the journal article.
Preparation	Habitat Restoration	Great Lakes Restoration Initiative Project Map ²	Great Lakes Restoration Initiative	GIS layer	The Great Lakes Restoration Initiative is a multi-agency program that provides funding for environmental restoration projects throughout the Great Lakes Region. One of the five types of projects funded are 'Habitats and Species' (mainly coastal wetlands and other habitat restoration projects). Most of the funding comes from the EPA, and these projects represent a large portion of restoration projects occurring in the Great Lakes. Data are available in a downloadable GIS point layer.	Free dataset. Comprehensive dataset that is easy to work with in GIS. Projects can be sorted by the type of project, and detailed project descriptions are available online through the online web viewer.	None.

¹ <https://coast.noaa.gov/digitalcoast/data/hardened-shorelines.html>

² <https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=329f1bb23cc84a65b213d83e64574548>

Type	Resilience Solution	Dataset	Data Source	Data Format	Description	Advantages	Disadvantages
Accommodation	Structural Improvements (e.g., building elevation, floodproofing)	OpenFEMA Dataset: Hazard Mitigation Assistance Mitigated Properties ³	FEMA	csv, json, or jsona file	FEMA provides a dataset with hazard mitigation assistance (HMA) grants. These data can be geocoded to determine where grants were provided. Two of the categories cover structural improvements: building elevations and floodproofing.	Free dataset. Comprehensive dataset that can be sorted by type of hazard mitigation solution and year.	There used to be a GIS layer of HMA mitigated properties available online, but this has recently been removed. Now mapping the locations requires working with a large dataset that will need to be cleaned in a program like R and geocoded/converted to a point layer in GIS. This dataset also does not capture structural improvements made by individual properties owners.
Accommodation	Flood Insurance	OpenFEMA Dataset: FIMA NFIP Redacted Policies -- v1 ⁴	FEMA	csv	FEMA provides a dataset with NFIP policies.	Free dataset. Comprehensive dataset that is updated regularly and can be sorted by several fields. NFIP policies comprise approx. 90% of all flood insurance policies in the U.S.	Large dataset that must be cleaned in a program like R. Limited granularity—measured at the county, zip code, or census tract levels.
Relocation	Voluntary Property Buyouts	OpenFEMA Dataset: Hazard Mitigation Assistance Mitigated Properties	FEMA	csv, json, or jsona file	FEMA provides a dataset with Hazard Mitigation Assistance (HMA) grants. These data can be geocoded to determine where grants were provided. One category includes voluntary property buyouts: acquisitions.	Free dataset. Comprehensive dataset that can be sorted by type of hazard mitigation solution and year.	There used to be a GIS layer of HMA Mitigated Properties available online, but this has recently been removed. Now mapping the locations requires working with a large dataset that will need to be cleaned in a program like R and geocoded/converted to a point layer in GIS.

³ <https://www.fema.gov/openfema-data-page/hazard-mitigation-assistance-mitigated-properties>

⁴ <https://www.fema.gov/openfema-data-page/openfema-dataset-fima-nfip-redacted-policies--v1>

Type	Resilience Solution	Dataset	Data Source	Data Format	Description	Advantages	Disadvantages
Relocation	Structure Relocation	OpenFEMA Dataset: Hazard Mitigation Assistance Mitigated Properties ⁵	FEMA	csv, json, or jsona file	FEMA provides a dataset with hazard mitigation assistance (HMA) grants. These data can be geocoded to determine where grants were provided. One category includes relocation.	Free dataset. Comprehensive dataset that can be sorted by type of hazard mitigation solution and year.	There used to be a GIS layer of HMA mitigated properties available online, but this has recently been removed. Now mapping the locations requires working with a large dataset that will need to be cleaned in a program like R and geocoded/converted to a point layer in GIS. This dataset also does not capture home relocation by individual property owners.
Relocation	Conservation Easements	Protected Areas Database of the United States (PAD-US) ⁶	USGS	GIS layer	The USGS provides a GIS layer showing the locations of public lands. Conservation easements are one category that can be selected.	Free dataset. Easy to work with in GIS. National and regional/state shapefiles are available.	The GIS data are somewhat dated – from 2018. The dataset is not updated annually.
Preparation, Accommodation, & Relocation	Green and grey infrastructure, community response plans, NFIP community rating system scores, managed retreat, and floodplain ordinances	Flood Factor Resilience Solutions ⁷	First Street Foundation	xls	First street foundation has collected data on adaptation solutions for preparation, accommodation, and retreat. Can be disaggregated or aggregated by census tract, zip code, county, or state.	One-stop-shop for data on adaptation actions. Includes community and individual household adaptation actions.	Dataset must be purchased. Dataset quality or completeness for adaptation actions is unclear without accessing it.

⁵ <https://www.fema.gov/openfema-data-page/hazard-mitigation-assistance-mitigated-properties>

⁶ https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/pad-us-data-download?qt-science_center_objects=0#qt-science_center_objects

⁷ <https://floodfactor.com/solutions>