National Risk Index

Discover the landscape of natural hazard risk

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Natural Hazards Risk Assessment Program

Natural Hazards Risk Assessment Program

The NHRAP will provide a common understanding of hazard and consequence data to reduce disaster suffering

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Natural Hazards Risk Assessment Program Goals

1. Institutionalize an innovative and integrated risk assessment process to link risk with policy and program implementation
2. Leverage partnerships with hazard identification experts and other FEMA program areas to promote use of credible risk assessment data and practices
3. Empower states, local governments, tribes, and territories to reduce disaster suffering and to contribute to a more resilient nation

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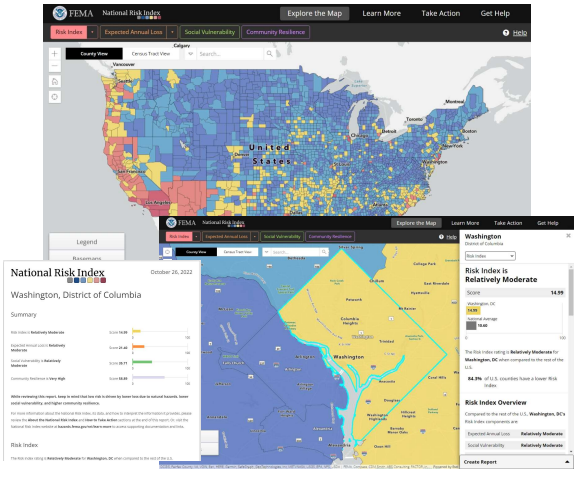
FEMA National Risk Index

Discover the landscape of natural hazard risk

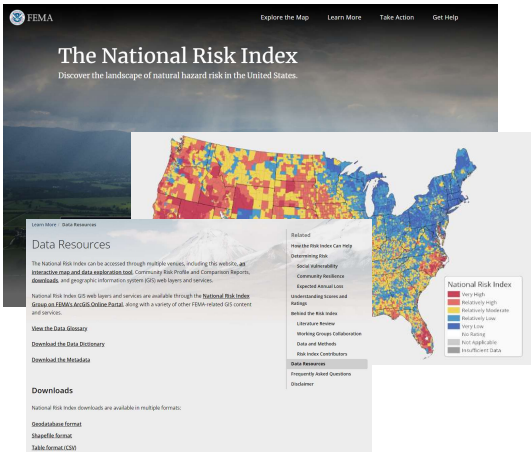
National Risk Index

- Began as a strategy for reducing cost and eliminating inconsistent risk assessments in planning
- Identifies areas that offer high return on mitigation investment
- Reduces the cost of risk assessment allowing community planners to prioritize action
- Provides pre-calculated, top- down national baseline risk assessment



National Risk Index

- A free, consistent, and comprehensive nation-wide risk assessment that is multi-hazard and inclusive of social vulnerability and community resilience did not exist.
- Successful FEMA, state and local program implementation can be enhanced with credible risk assessment information.
- Provides a mechanism by which social equity and future conditions can be explored
- Allows for easy and effective dialogue around all hazards risk for a community.



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National Risk Index Timeline

2008

2016-2017

FEMA Region 8 developed the Vulnerability Index to identify and prioritize flood mitigation projects

2018-2019

Refined risk methodology based on additional review and updated backend database

2020

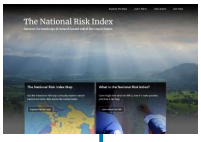
Phase 1 Release of the National Risk Index data v1.17.0 released in October 2020

2021

Data updated to v.1.18.0/1 and full National Risk Index application released in August 2021

2022-2023

Data updated to v.1.19.0 and enhancements to National Risk Index application released in March 2023



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National Risk Index Contributors

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US Army Corps of Engineers
STARR II Strategic Alliance for Risk Reduction
Stantec
FACTOR
University of South Carolina
compass Identify, Interpret, Integrate
CDM Smith
ABS Group
AECOM
ATKINS
University of Denver
Colorado Avalanche Information Center
University of Central Florida
Arizona State University
SSEC
Argonne National Laboratory
UNISDR
NOAA
The Polis Center
University of Colorado Boulder
Chris D. Poland Consulting Engineer
nehrp Wildfire Planning International
FLASH
NIST National Institute of Standards and Technology U.S. Department of Commerce
Insurance Institute for Business & Home Safety
Coulbourne Consulting
NDMC
USGS science for a changing world
NHMA
WATER WORKS
Smithsonian Institution National Museum of Natural History Global Volcanism Program
University of Colorado Denver
HINMAN
Swiss Re
PDC | GLOBAL
ILLINOIS
LSU
THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL
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National Risk Index Contributors (Region 10)

Idaho National Laboratory

University of Idaho

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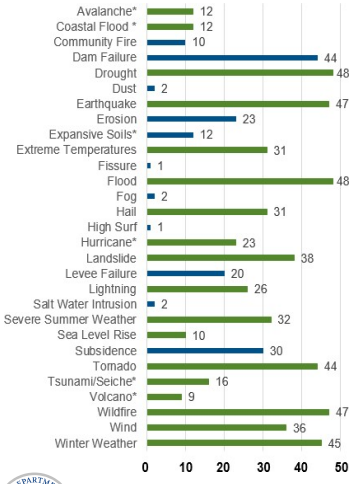
National Risk Index Hazard Selection



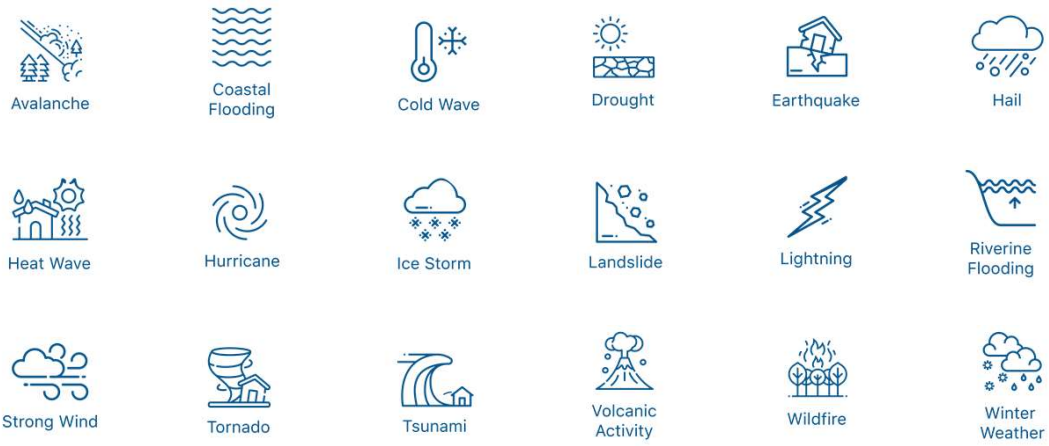
- Reviewed the 50 State Hazard Mitigation Plans
  - Initial list developed from rate of occurrence in each state plan
- Natural hazards only
  - Man-made hazards or hazards related to anthropogenic activities not included

Hazard Included in Analysis
Hazard Excluded from Analysis
★ Significant Regional Hazard for Consideration

NOTES:
- Coastal Flood and Sea Level Risk Hazards were combined
- Extreme Temperature is both Hot and Cold
- Severe Summer Weather is covered by Wind, Hail, Tornado, and Lightning
- Winter Weather is both Snow and Ice

National Hurricane Center
Storm Prediction Center
NOAA
FEMA
USGS science for a changing world
national avalanche center
US Army Corps of Engineers
Smithsonian Institution National Museum of Natural History Global Volcanism Program

National Risk Index - Hazards



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Social Vulnerability and Community Resilience

Social Vulnerability Index: SoVI 2010-2014

- Developed by the University of South Carolina's HVRI
- Grouped into 7 components with 29 variables (SoVI 2010):
  - Race and class (7 variables), Wealth (5 variables), Elderly residents (6 variables), Hispanic ethnicity (5 variables), Special needs individuals (2 variables), Native American ethnicity (1 variables), and Service industry employment (2 variables)
- Comparative index at the county or subcounty level
- Positive and negative component loading

Baseline Resilience Indicators for Communities: BRIC 2010-2014

- Developed by the University of South Carolina's HVRI
- 6 resilience category scores, plus total score
  - Social, Economic, Community capital, Institutional, Infrastructural, Environmental
- Comparative indicators at the county level
- Indicators analyze the relationship between resilience, vulnerability, and the relative impact of disasters on rural and urban places

HVRI HAZARDS & VULNERABILITY RESEARCH INSTITUTE

UNIVERSITY OF SOUTH CAROLINA

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Determining Risk

National Risk Index = Expected Annual Loss **x** Social Vulnerability ÷ Community Resilience

Expected Annual Loss = Natural Hazard Exposure **x** Natural Hazard Frequency **x** Historical Loss

- Risk is defined as the potential for negative impacts as a result of a natural hazard
- Considers the probabilities or frequencies of 18 natural hazards, and the population and property value exposed within hazard extents
- Expected Annual Loss is calculated separately for each natural hazard, then summed to generate a composite score for all 18 natural hazards
- Equation supports traditional hazards risk approach of risk being defined as the product of Hazard Frequency, Vulnerability, and Exposure

Spatial Hazard Events and Losses Database for the United States

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Arizona State University

Calculating Risk

Risk = Expected Annual Loss x Social Vulnerability ÷ Community Resilience

where Expected Annual Loss (EAL) =

Annual Frequency		Exposure		Historic Loss Ratio
Rate of occurrence	**X**	• **Property Value** • **People** • **Agriculture**	**X**	**Percentage of property/people/crop losses**
How likely is hazard to occur?		How many people & how much property are potentially at risk?		What percent of property/people have historically been lost from hazard in a given area?

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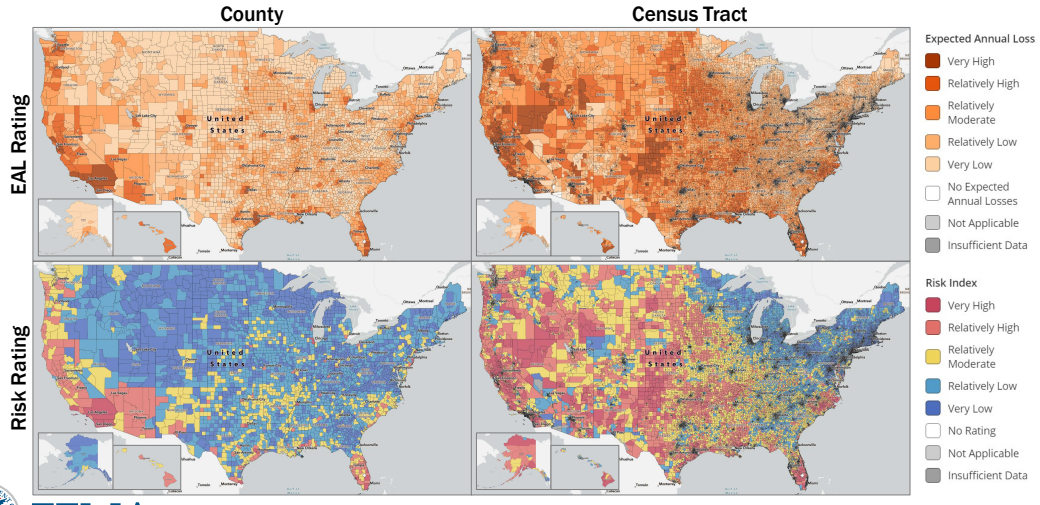
National Risk Index Scores



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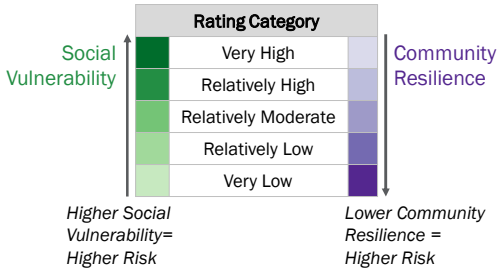
Updated Top 20 Highest Risk Counties in Region 10

#	County	EAL	SV	CR	Risk
1	Grays Harbor, WA	38			39
2	Clatsop, OR	33			34
3	Multnomah, OR	40			30
4	King, WA	62			29
5	Marion, OR	28			27
6	Pacific, WA	21			25
7	Coos, OR	23			25
8	Pierce, WA	40			25
9	Lane, OR	29			25
10	Yakima, WA	23			25
11	Curry, OR	19			24
12	Lincoln, OR	20			23
13	Jackson, OR	22			22
14	Skagit, WA	27			22
15	Cowlitz, WA	25			22
16	Douglas, OR	22			21
17	Wahkiakum, WA	19			21
18	Tillamook, OR	22			21
19	Clallam, WA	19			20
20	Washington, OR	36			20

Risk = Expected Annual Loss x Social Vulnerability / Community Resilience



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Top 5 Highest Risk Counties for Select Hazard Types in Region 10

AVALANCHE

#	County	Score
1	Lewis, WA	75
2	Valdez-Cordova, AK	67
3	Kenai Peninsula, AK	60
4	Pierce, WA	56
5	Clark, ID	52

COASTAL FLOODING

#	County	Score
1	Grays Harbor, WA	84
2	Clatsop, OR	75
3	Pacific, WA	52
4	Wahkiakum, WA	50
5	Skagit, WA	44

COLD WAVE

#	County	Score
1	Yakima, WA	100
2	Grant, WA	76
3	Okanogan, WA	64
4	Bingham, ID	61
5	Adams, WA	60

DROUGHT

#	County	Score
1	Gooding, ID	32
2	Twin Falls, ID	30
3	Jerome, ID	29
4	Yakima, WA	27
5	Cassia, ID	27

EARTHQUAKE

#	County	Score
1	Multnomah, OR	31
2	Marion, OR	28
3	Lane, OR	26
4	King, WA	25
5	Pierce, WA	24

HAIL

#	County	Score
1	Yakima, WA	20
2	Adams, WA	15
3	Okanogan, WA	12
4	Deschutes, OR	11
5	Franklin, WA	10

HEAT WAVE

#	County	Score
1	Josephine, OR	14
2	Douglas, OR	14
3	Marion, OR	12
4	Coos, OR	12
5	Multnomah, OR	12

ICE STORM

#	County	Score
1	Umatilla, OR	31
2	Lane, OR	29
3	Multnomah, OR	26
4	Wasco, OR	24
5	Lincoln, OR	24

Top 5 Highest Risk Counties for Select Hazard Types in Region 10

LANDSLIDE

#	County	Score
1	Wheeler, OR	100
2	Curry, OR	91
3	Douglas, OR	73
4	Coos, OR	69
5	Tillamook, OR	69

LIGHTNING

#	County	Score
1	Canyon, ID	23
2	Yakima, WA	16
3	Ada, ID	15
4	Chelan, WA	15
5	Jackson, OR	15

RIVERINE FLOODING

#	County	Score
1	Curry, OR	24
2	Yukon-Koyukuk, AK	23
3	Douglas, OR	23
4	Coos, OR	22
5	Tillamook, OR	21

STRONG WIND

#	County	Score
1	Yakima, WA	16
2	Jackson, OR	14
3	Umatilla, OR	14
4	Minidoka, ID	12
5	Bannock, ID	11

TORNADO

#	County	Score
1	Multnomah, OR	17
2	Marion, OR	15
3	King, WA	13
4	Washington, OR	13
5	Spokane, WA	12

TSUNAMI

#	County	Score
1	Coos, OR	56
2	Curry, OR	53
3	Grays Harbor, WA	46
4	Clatsop, OR	46
5	Lincoln, OR	44

VOLCANO

#	County	Score
1	Pierce, WA	100
2	King, WA	95
3	Yakima, WA	95
4	Clark, WA	89
5	Lewis, WA	85

WILDFIRE

#	County	Score
1	Okanogan, WA	34
2	Chelan, WA	33
3	Yakima, WA	32
4	Wasco, OR	30
5	Valley, ID	30

Top 5 Highest Risk Counties for Select Hazard Types in Region 10

WINTER WEATHER

#	County	Score
1	Nome, AK	41
2	Kusilvak, AK	40
3	Bethel, AK	37
4	Northwest Arctic, AK	31
5	Marion, OR	25

National Risk Index Placemat

	FREQUENCY			EXPOSURE					HISTORIC LOSS RATIO					Bayesian Levels			
Hazard Type	Data Source	Period of Record	Hazard Occurrence Basis	Consequence Types			Exposure Area	Method for Exposure Value Estimation	Data Source	Period of Record	Event Duration Cap	Loss Aggregation	Zero-Loss Padding	County	Area	Region	National
Avalanche	ASU	1960-2019	Event	✓	✓		**Representative Exposure**	Default population & building exposure	ASU	1996-2019		Timeframe		✓			✓
Coastal Flooding	NOAA NCEI	Annualized probability	Event	✓	✓		**Susceptible Area:** Developed area in the unioned sub-type layers	Developed area density	ASU	1996-2019		Consecutive day		✓	✓	✓	
Cold Wave	ASU	2005-2017	Event day	✓	✓	✓	**Widespread:** Average hazard occurrence size	Developed area & agriculture value densities	NOAA	1996-2019	*31 days*	Single day	✓	✓	✓	✓	✓
Drought	NCEI	2000-2017	Event day			✓	**Widespread:** Average agricultural area hazard occurrence size	Agriculture value density	ASU	1996-2019	*365 days*	Single day	✓	✓	✓	✓	
Earthquake	USGS FEMA	Annualized probability	Event	✓	✓		Expected annual loss & exposure from the FEMA P-366 study: *Hazus® Estimated Annualized Earthquake Losses for the U.S.*		ASU	1960-2019		Timeframe		✓	✓		✓
Hail	ASU	1986-2017	Event	✓	✓	✓	**Widespread:** County/Census Tract	Total value	ASU	1996-2019		Single day	✓	✓	✓	✓	✓
Heat Wave	ASU	2005-2017	Event day	✓	✓	✓	**Widespread:** Average hazard occurrence size	Developed area & agriculture value densities	ASU	1996-2019	*31 days*	Single day	✓	✓	✓	✓	✓
Hurricane	NOAA	ATL: 1851-2017 PAC: 1949-2017	Event	✓	✓	✓	**Widespread:** Average hazard occurrence size	Developed area & agriculture value densities	ASU	1996-2019		Consecutive day	✓	✓	✓	✓	
Ice Storm	NCEI	1946-2014	Event day	✓	✓		**Widespread:** Average hazard occurrence size	Developed area density	ASU	1996-2019	*31 days*	Single day	✓	✓	✓	✓	✓
Landslide	USGS	2010-2019	Event	✓	✓		**Susceptible Area:** Landslide susceptible area	Developed area density	ASU	1996-2019				✓			
Lightning	NOAA	1991-2012	Event	✓	✓		**Widespread:** County/Census Tract	Total value	ASU	1996-2019		Single day	✓	✓	✓		✓
Riverine Flooding	NOAA	1996-2019	Event day	✓	✓	✓	**Susceptible Area:** Land use area within 100-yr floodplain area	Developed area & agriculture value densities	ASU	1996-2019	*31 days*	Single day	✓	✓		✓	
Strong Wind	ASU	1986-2017	Event	✓	✓	✓	**Widespread:** County/Census Tract	Total value	ASU	1996-2019		Single day	✓	✓	✓	✓	✓
Tornado	NOAA	1986-2019	Event	✓	✓	✓	**Representative Exposure:** Average historical damage size by sub-type	Average density	ASU	1996-2019			✓	✓	✓	✓	✓
Tsunami	NOAA	1800-2018	Event	✓	✓		**Susceptible Area:** Developed area within inundation zone area	Developed area density	ASU	1996-2019		Consecutive day	✓	✓	✓	✓	✓
Volcanic Activity	USGS	9310 BCE-2018	Event	✓	✓		**Susceptible Area:** 100-km buffer around active volcano locations	Developed area density	ASU	1960-2019		Timeframe		✓	✓		✓
Wildfire	USFS	Annualized probability	Event	✓	✓	✓	**Susceptible Area:** Areas where modeled flame length > 8'	Average density	ASU	1996-2019		Timeframe		✓	✓		✓
Winter Weather	ASU	2005-2017	Event day	✓	✓	✓	**Widespread:** Average hazard occurrence size	Developed area & agriculture value densities	ASU	1996-2019	*31 days*	Single day	✓	✓	✓	✓	

Stakeholder Use

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- Multiple states, including, New York, Virginia, Florida, and Pennsylvania, want to use the NRI for local planning efforts to increase community resilience
- Online real estate tools are exploring incorporating NRI data into their interfaces to increase risk awareness to potential home buyers and renters
- Support continued baseline hazard risk assessments for both public and private planning and awareness campaigns

Next Steps for the NRI

Email FEMA-NRI@fema.dhs.gov for more information

- **U.S. Territory Expansion** – Include EAL for as many hazards as possible for PR, VI, AS, GU, and MP
- **Census 2020 Update** – Update all baseline data, geographies, and Census assumptions throughout the application
- **Social Vulnerability Metric Review** – Stand-up working group to provide direction on Social Vulnerability metric
- **Coastal Flooding Data Update** – Work with NOAA on updating Coastal Flood Hazard with Sea Level Rise Report data
- **Hazard Data Update** – Review and prioritize hazard data updates for Frequency and Exposure

☑ **Alternative Risk Metrics and State NRI Scores** – Develop and make available EAL Rate and State NRI scores

☑ **NRI Data Version Archive** – Make all historic versions of NRI data and documentation available via Data Archive

- **Climate Change/Future Conditions** – Identify path and prototype solution

☑ **GIS Version Control** – Produce an evergreen GIS service for users to prevent data version disconnects

☑ Update Completed and Implemented

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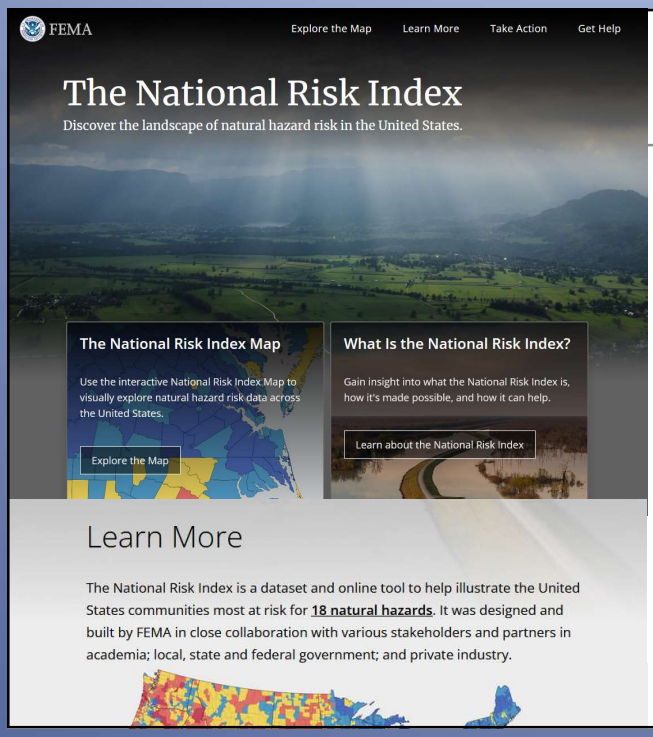

Access the National Risk Index

- Full Application - https://www.fema.gov/nri
- Data Archive and Rates - https://nri-data-downloads.s3.amazonaws.com/webpages/home.html

Thank You

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