

Resilient Infrastructure

LPESA Spring 2022 Conference

Carol Friedland, PhD, PE, CFM

LaHouse Director and Associate Professor



Flood Resilience

In the 100-year floodplain:

- 65% of Louisiana's land area
- 25% of Louisiana's population and structures

The 100-year flood has a 50% probability of occurring at least once in 70 years



Individualized Analysis & Recommendations

 **Flood Safe Home**

HomeAboutFreeboard ProjectDecision Making MapSurveyHelp Center

Building Information

User Type

☐ Homeowner ☐ Tenant

☐ Landlord ☐ Community official

Average Building Size (Livable Square Footage)

Type your building's square footage

Number of Stories

☐ One-story ☐ Two or more stories

Advanced parameters

Get results

Freeboard Cost Analysis Report

Summary

Monthly Savings

Monthly Freeboard Cost

Monthly Insurance Premium Savings

Monthly Savings from Flood Loss Reduction

Save the outcome as a

Freeboard Cost Analysis Report

For your home, **3 ft** of freeboard is recommended resulting in monthly savings of **\$178**



3ft freeboard

When you add **3 ft** of freeboard,

Savings from Mitigation

\$143 insurance savings per month

\$92 reduced flood losses per month

Cost of Mitigation

\$57 amortized cost per month

(based on **\$12760** additional construction cost)

Total Monthly Savings

\$178 savings per month (flood insurance and flood loss reduction)



Homeowners Save Money by Building Higher

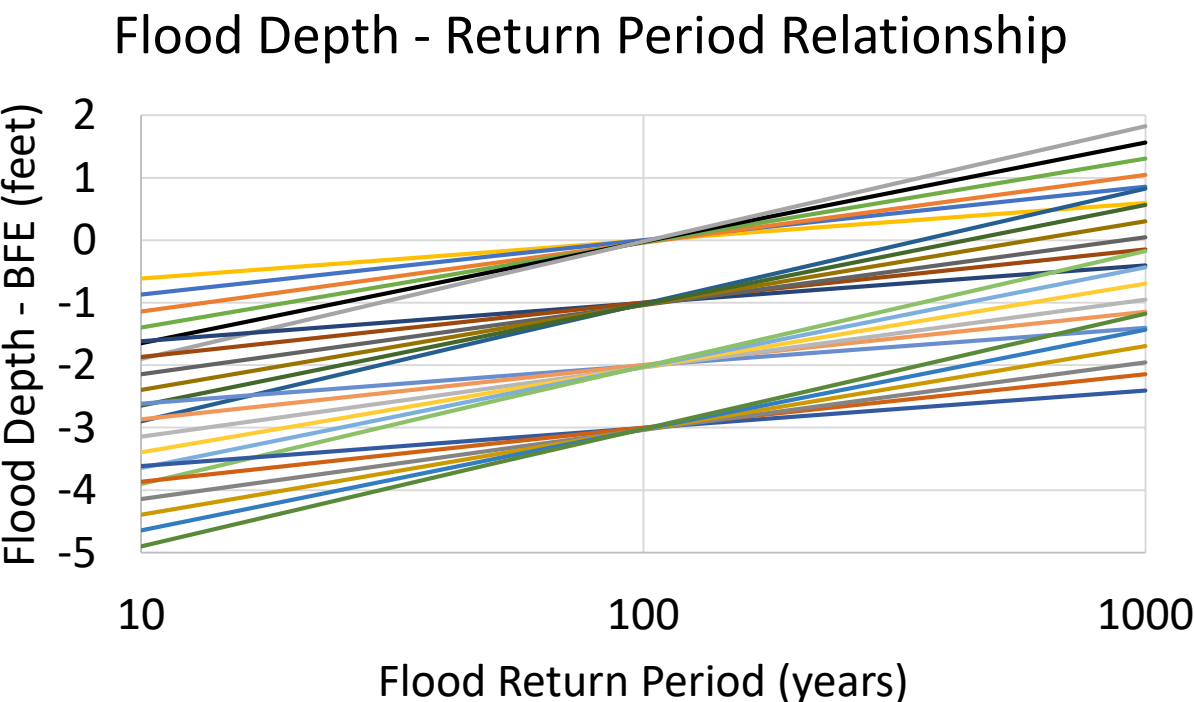
- Average savings of \$1,000 per year (A Zone, direct cost)
- Flood insurance premiums are lower
- Flood risk is reduced



03/06/2018

Calculating Avoided Average Annual Flood Loss

2000 sf home with estimated construction cost of \$210,000 (\$105/sf) built to BFE (A Zone loss functions)



BFE Reduction (ft.)	Avg. Annual Loss** (no insurance)	Avg. Annual Loss*** (with insurance)
0 (BFE)	\$1,100 - \$2,500	\$30 - \$85
-1'	\$50 - \$330	\$2 - \$10
-2'	~\$0 - 80	~\$0 - \$2
-3'	~\$0 - \$25	~\$0
-4'	~\$0 - 5	~\$0

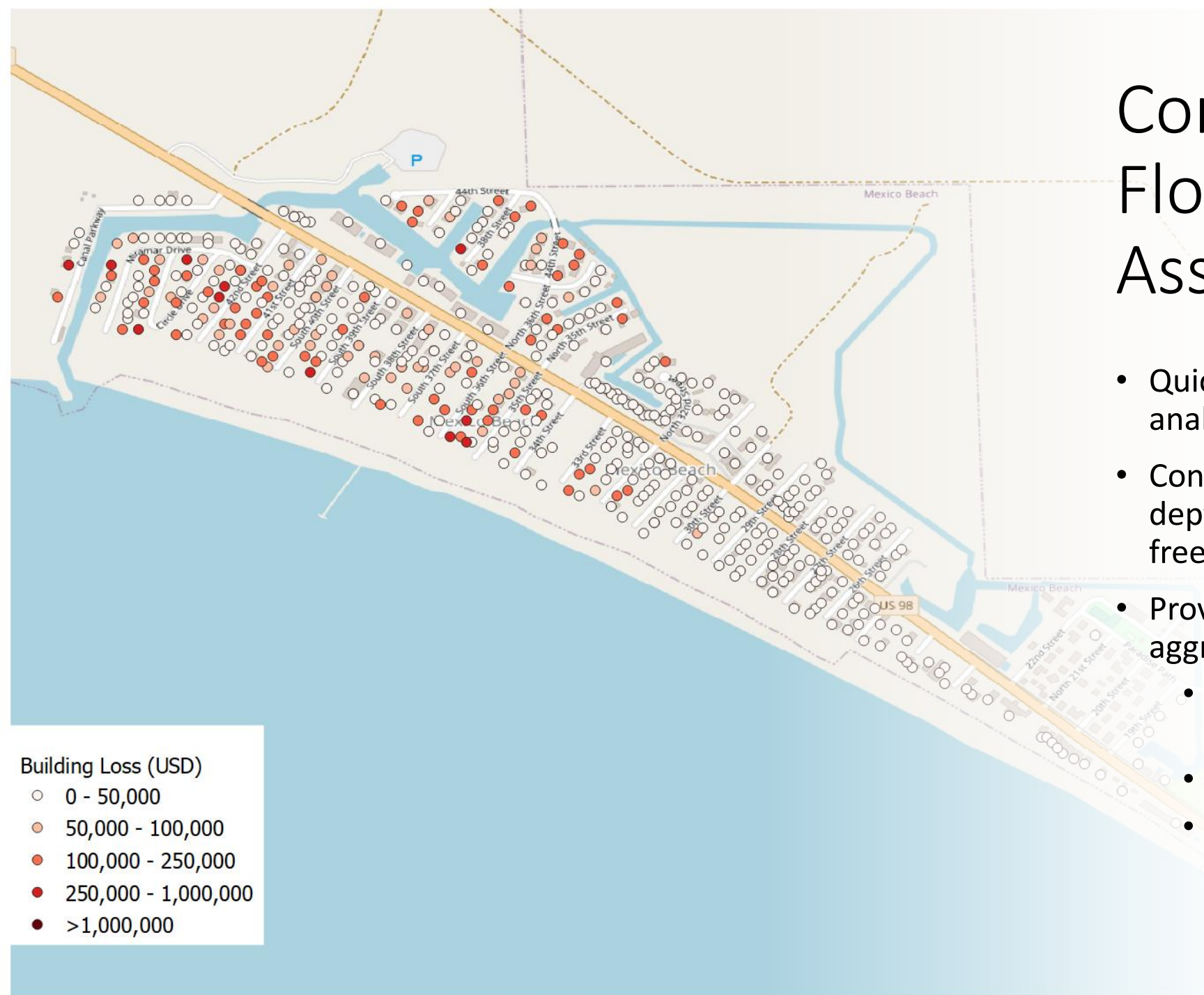
*Flood Depth-BFE represents depth of water in the building for the 100-year event. Negative values indicate no flood in the building for the given return period.

**Considers building, contents, and loss of use based on USACE depth-damage functions.

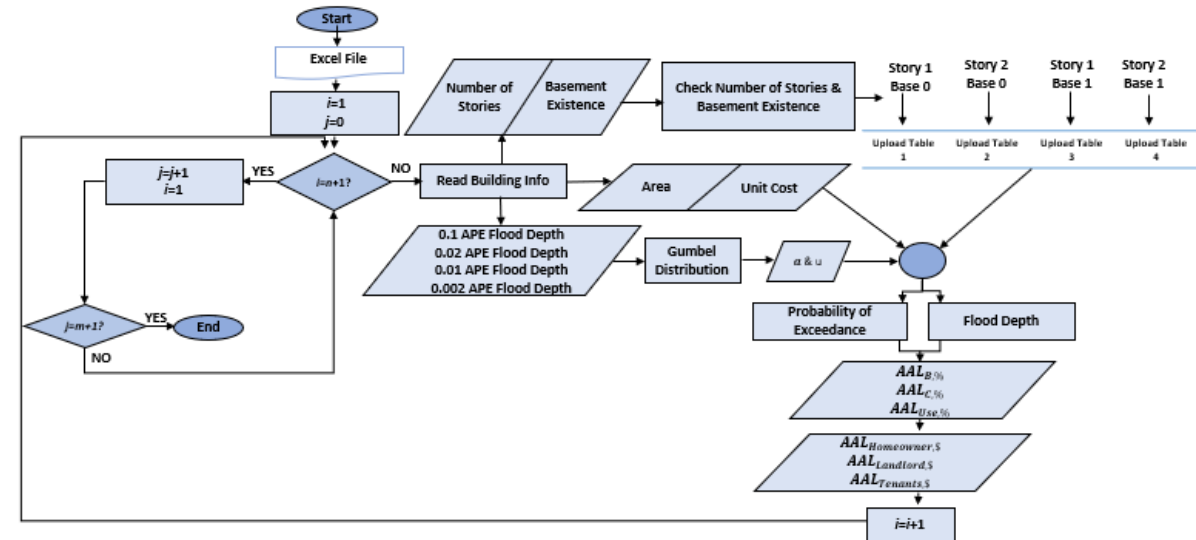
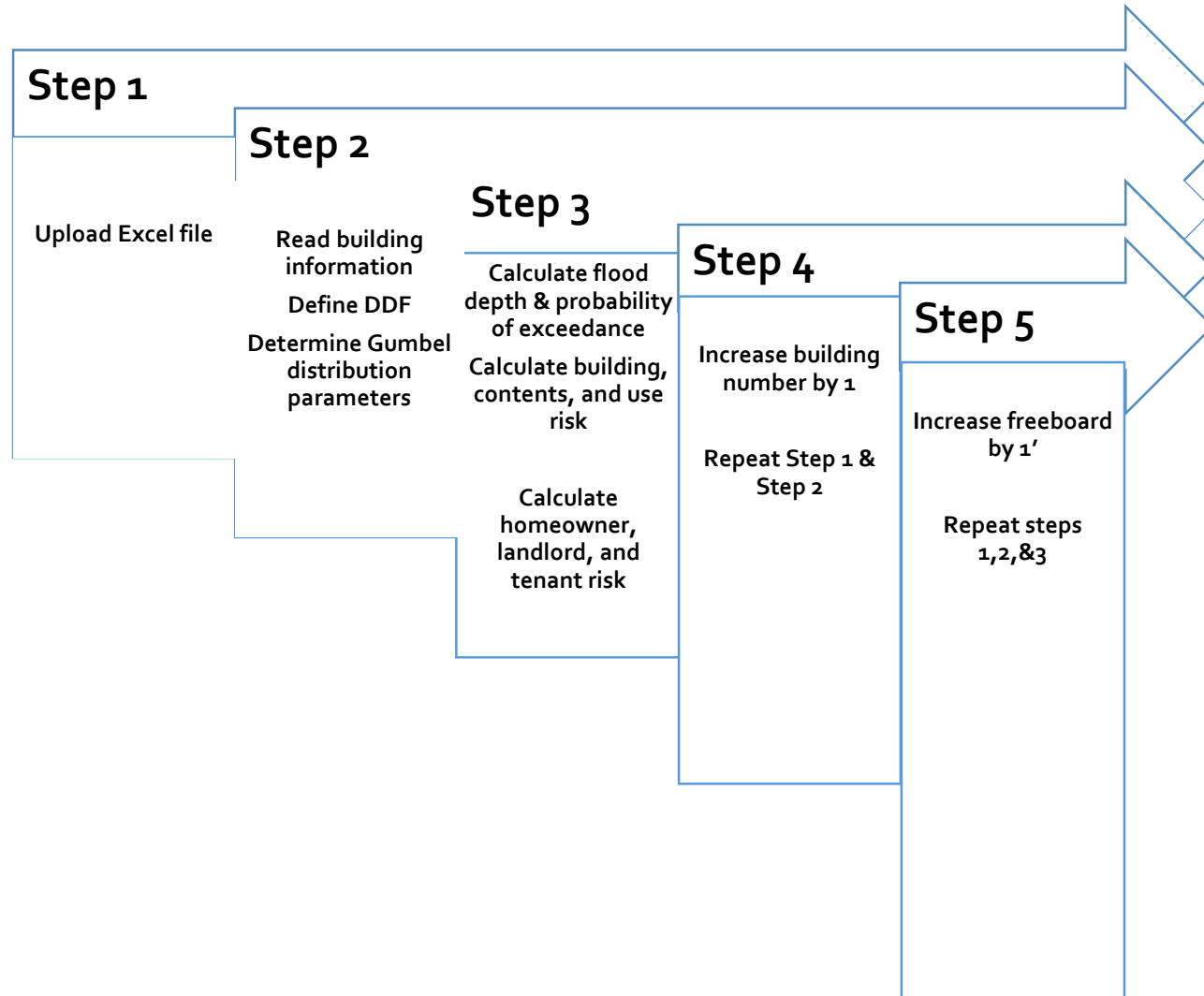
***Calculations reflect \$210,000 building coverage and \$100,000 contents coverage, with deductible of \$2,000 for both structure and contents. Range depends on slope of flood occurrence probability function.

Community-Level Flood Risk Assessment

- Quickly performs building-level analysis for a community
- Considers either reduction in flood depth/elevation or increase in freeboard requirements
- Provides building-level and aggregated outputs
 - Flood risk – building, contents, loss of use
 - Flood insurance
 - Owner/occupant types

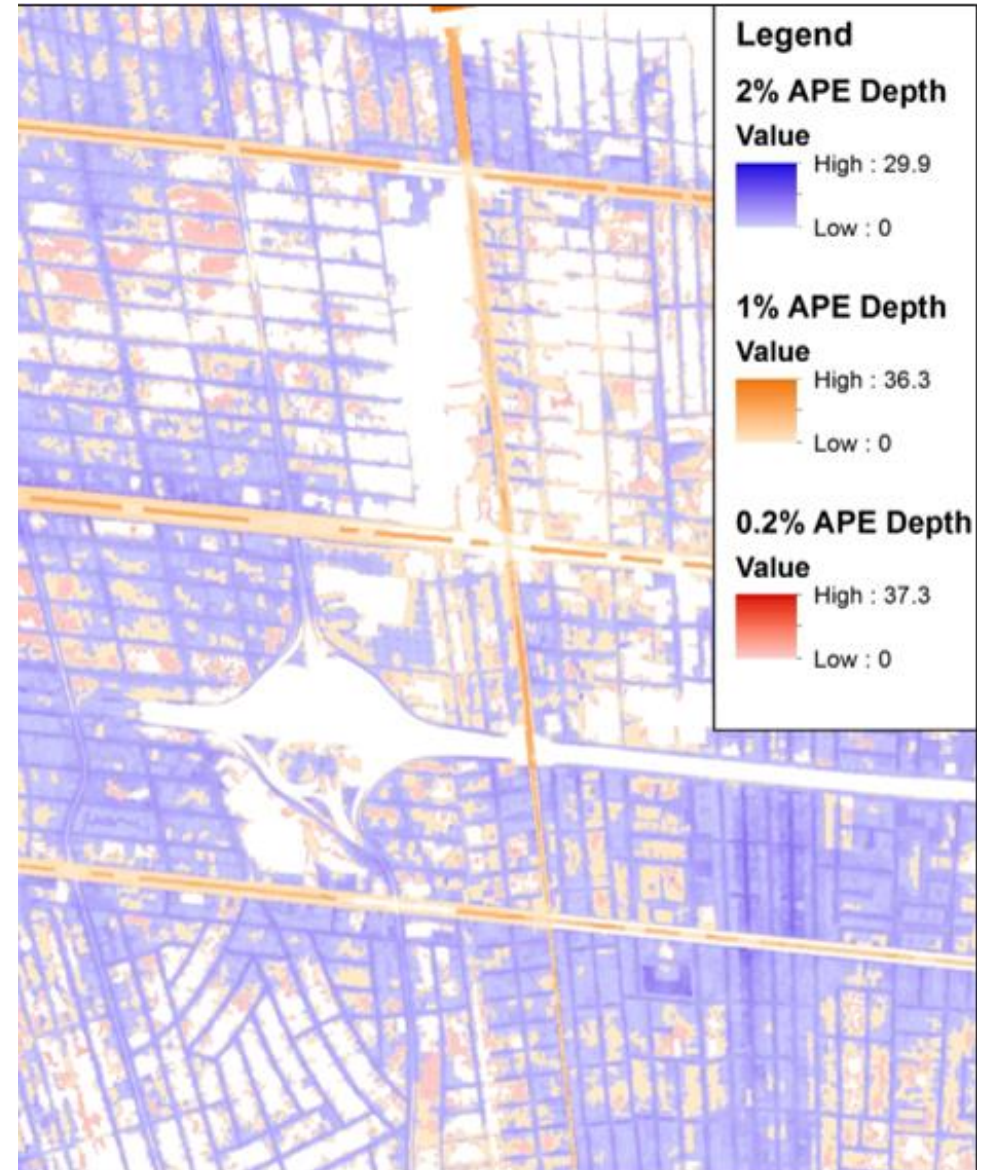


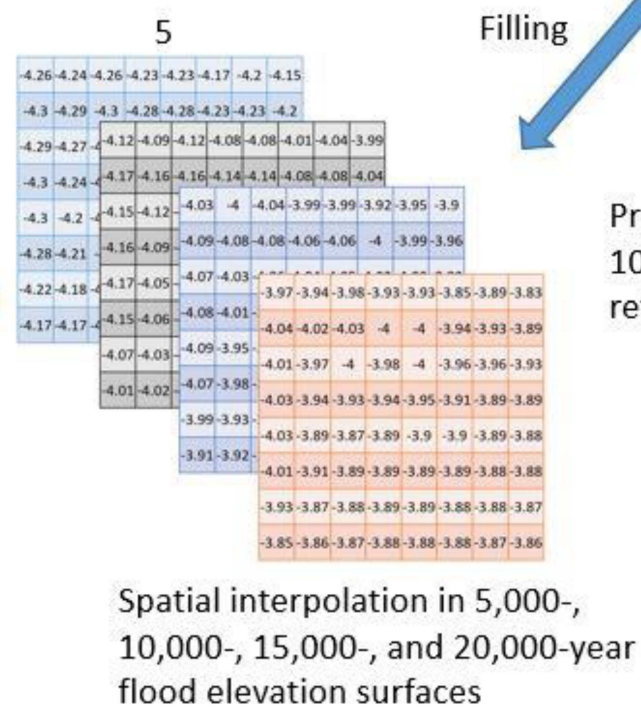
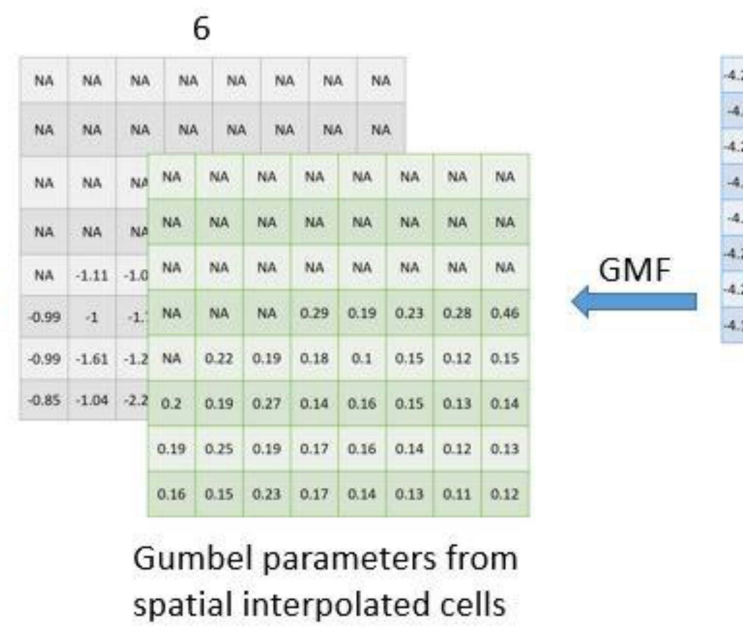
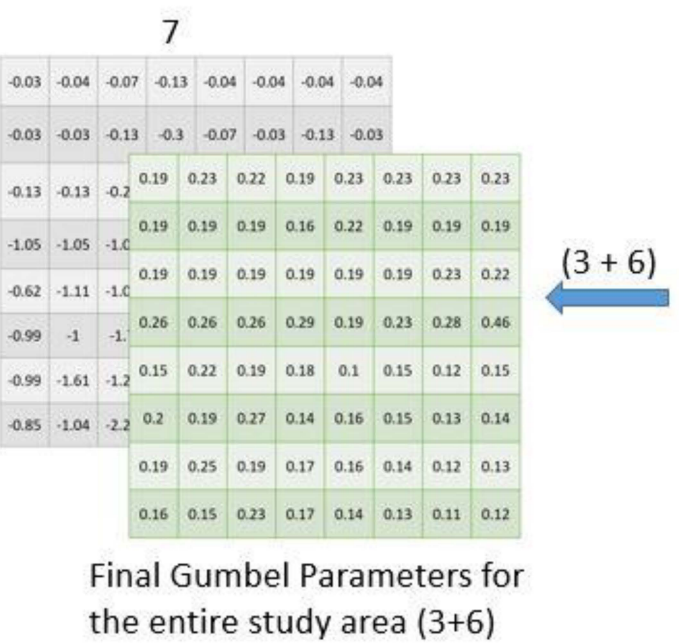
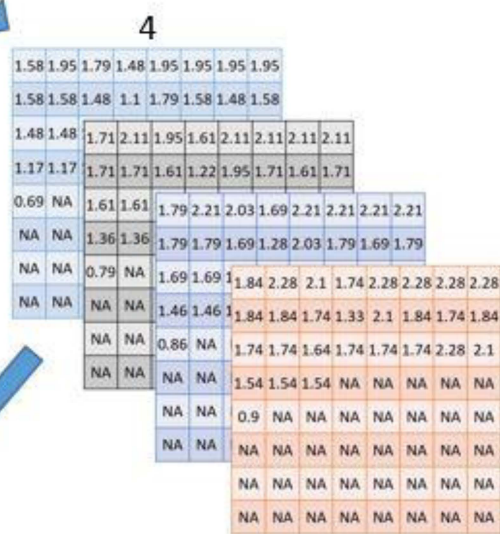
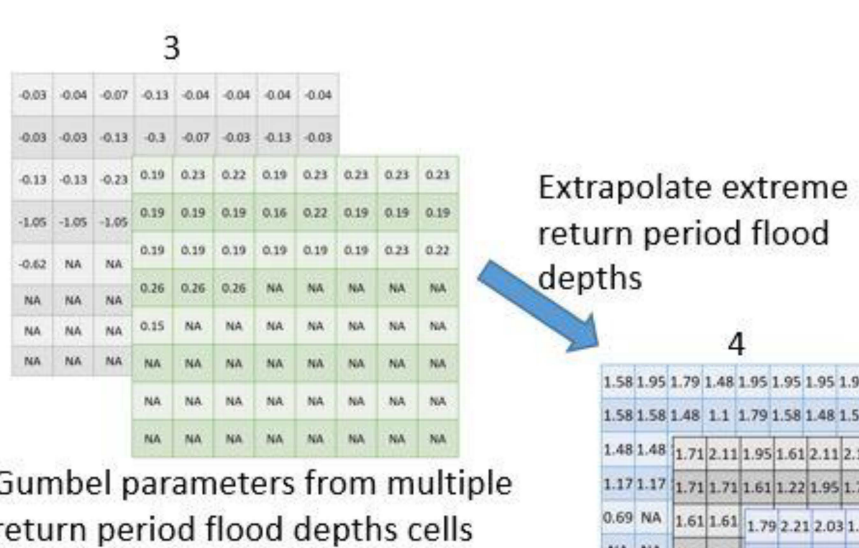
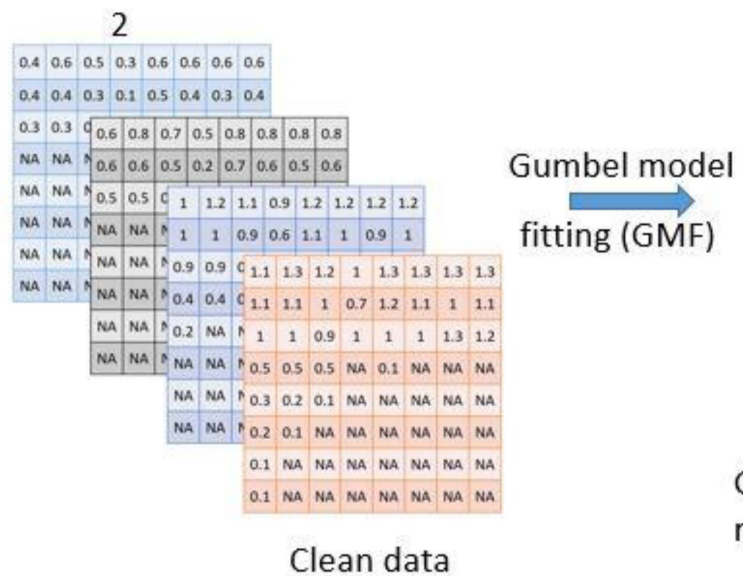
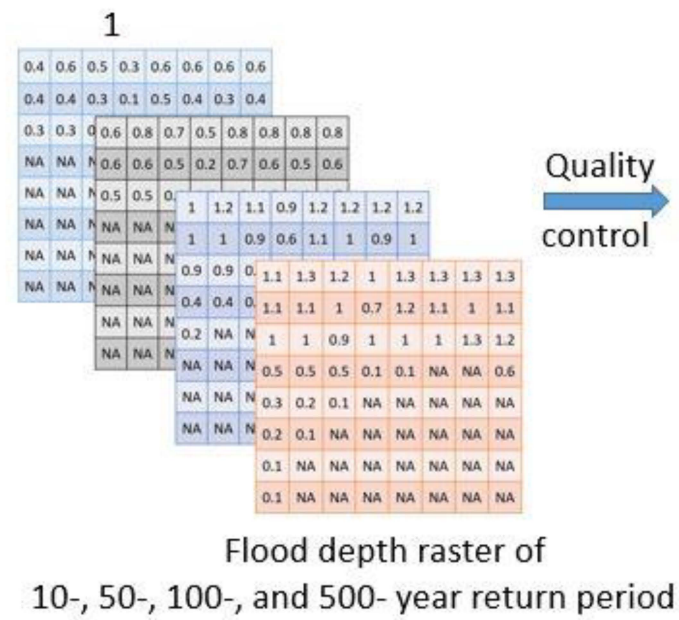
General Methodology



Input Data

- Multiple return period flood depth grids (rasters): 10-, 50-, 100-, 500-year return periods
- Building Information
 - Basement information (yes/no)
 - Number of stories
 - Building size (SF)
 - Unit replacement cost (\$/SF)





Flood Loss Risk Reduction Case Study

- Census block 220510220012004 in Metairie with 29 buildings with different attributes
- Input parameters provided in Excel file

MATLAB App

1- General Information

Date: 13-Apr-2022

Community Zone ☒ AE ☐ X

Created By: Dr.Friedland

2- Buildings Properties

☒ Flood depth ☐ a&u Parameters

Browse

3- Outputs as a mean value

FFE	0	+1	+2	+3	+4
AAL_Building	4240	447.5	31.56	2.612	0.2627
AAL_Content	3112	343.1	23.12	1.809	0.1726
Total AAL Homeowner	7952	832.4	58.23	4.785	0.4783
Total AAL Landlord	4906	494	35.5	3.016	0.3105
Total AAL Tenants	3212	350.2	23.74	1.874	0.1804
Annual Avoided Loss	0	7119	7894	7894	7894

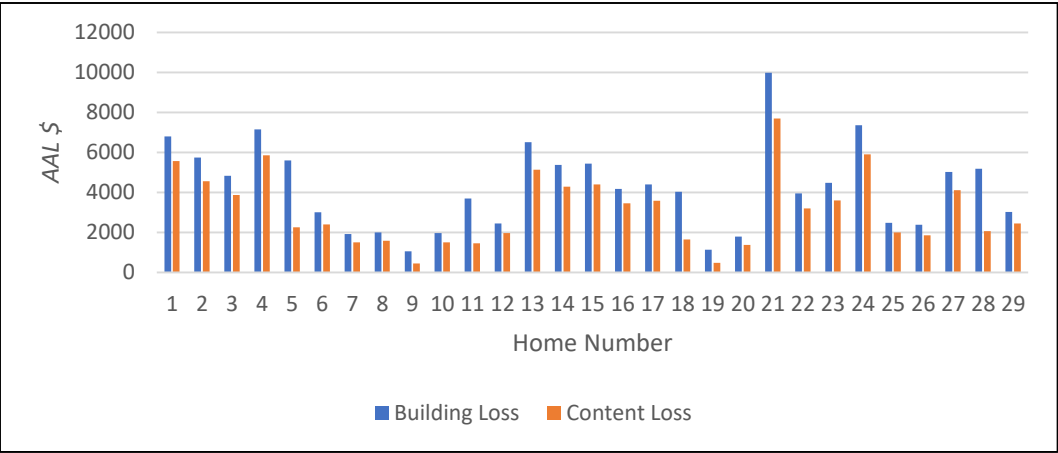
	A	B	C	D	E	F	G	H	I	J
1	BLDG_ID	SFT	Basement	num_stor_1	FFE	0.1	0.02	0.01	0.002	RepairCost
2	458014	2791	0	1	1	0.2	0.6	1	1.4	110.343822
3	458004	2436	0	1	1.4	0.6	1.3	1.4	2.1	110.343822
4	456884	2028	0	1	0.9	0.1	0.7	0.9	1.5	110.343822
5	456844	2938	0	1	1.4	0.6	1	1.4	1.8	110.343822
6	456854	2181	0	2	1.2	0.5	1.1	1.2	1.9	106.222029
7	457824	2420	0	1	2	1.1	1.7	2	2.4	110.343822
8	457664	1677	0	1	2.1	1.2	1.8	2.1	2.6	110.343822
9	457644	1749	0	1	2.1	1.2	1.8	2.1	2.5	110.343822
10	455474	1695	0	1	1.8	0.7	1.5	1.8	2.3	110.343822
11	455464	1951	0	1	0.7	0.1	0.5	0.7	1.3	110.343822
12	455454	1914	0	1	0.8	0.1	0.6	0.8	1.4	110.343822
13	458974	1757	0	1	2.2	1.5	1.9	2.2	2.7	110.343822
14	456874	1645	0	1	1.3	0.5	1	1.3	1.8	110.343822
15	456864	3090	0	1	1.1	0.3	0.9	1.1	1.7	110.343822
16	455494	1590	0	1	1.8	1	1.5	1.8	2.3	110.343822
17	455504	2073	0	1	2.1	1.5	1.8	2.1	2.6	110.343822
18	455524	2062	0	1	1	0.2	0.6	1	1.4	110.343822
19	455444	1490	0	1	1.5	0.6	1.2	1.5	2	110.343822
20	455484	1837	0	2	2.7	1.8	2.3	2.7	3.1	106.222029
21	459054	2308	0	1	2.4	1.6	2.1	2.4	2.9	110.343822
22	455854	2582	0	2	1.8	1	1.4	1.8	2.3	106.222029
23	455874	2258	0	1	1.3	0.5	1	1.3	1.8	110.343822
24	455514	2306	0	1	1.6	0.8	1.1	1.6	1.9	110.343822

	A	B	C	D	E	F	G	H
1	OBJECTID_1	SFT	Basement	Number of Story	FFH	a_Slope	u_Intercep	Repair Cost
2	4	2466	0	1	0.5	1.52632	-7.03847	110.343822
3	5	890	0	1	0.5	1.49935	-6.96123	110.343822
4	6	1535	0	1	0.5	1.49995	-6.96433	110.343822
5	7	1874	0	1	0.5	1.52632	-7.03847	110.343822
6	8	1948	0	1	0.5	1.49664	-6.94745	110.343822
7	9	1448	0	1	0.5	1.18944	-5.50096	110.343822
8	10	2394	0	1	0.5	1.18944	-5.50096	110.343822
9	11	1447	0	1	0.5	1.4157	-6.53452	110.343822
10	12	1427	0	1	0.5	1.57109	-7.26688	110.343822
11	13	2347	0	1	0.5	1.60015	-7.41518	110.343822
12	14	1984	0	1	0.5	1.49995	-6.96433	110.343822
13	15	811	0	1	0.5	1.51686	-6.99025	110.343822
14	16	939	0	1	0.5	1.46338	-6.77777	110.343822
15	17	2112	0	1	0.5	1.37084	-6.36603	110.343822
16	18	2261	0	1	0.5	1.63335	-7.52417	110.343822
17	19	1294	0	1	0.5	1.18715	-5.48927	110.343822
18	20	1313	0	1	0.5	1.35155	-6.26759	110.343822
19	21	1488	0	1	0.5	1.35155	-6.26759	110.343822
20	22	4238	0	1	0.5	1.45687	-6.74456	110.343822
21	23	1257	0	1	0.5	1.62506	-7.54222	110.343822

Flood Loss Risk Reduction Case Study

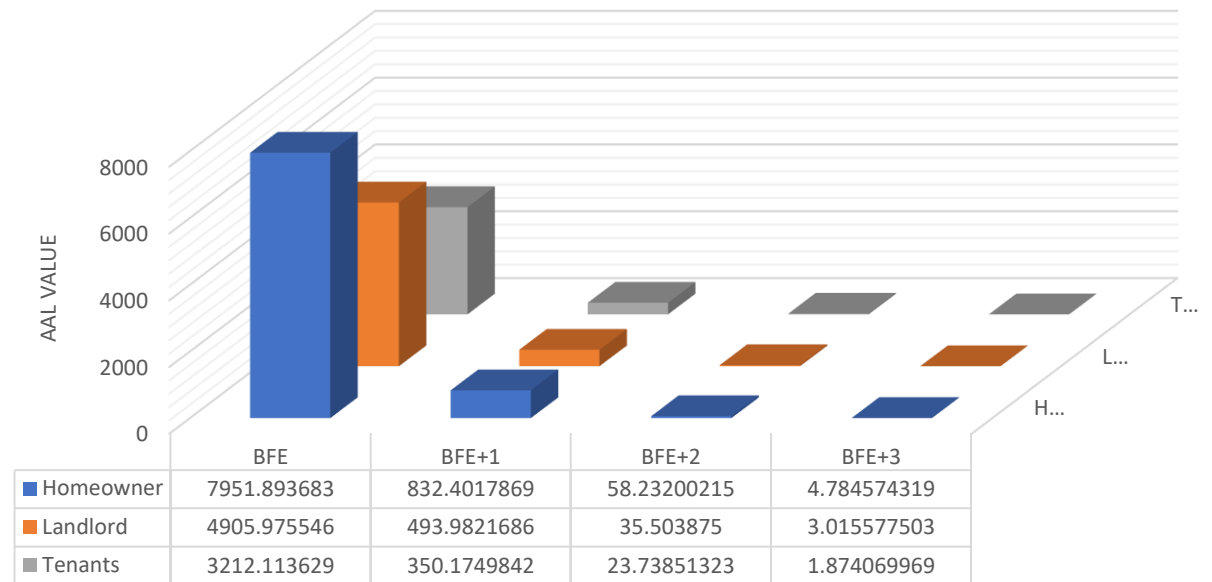
	A	B	C	D	E	F	G	H	I	J
1	BLDG_ID	SFT	Basement	num_stor_1	FFE	0.1	0.02	0.01	0.002	RepairCost
2	458014	2791	0	1	1	0.2	0.6	1	1.4	110.343822
3	458004	2436	0	1	1.4	0.6	1.3	1.4	2.1	110.343822
4	456884	2028	0	1	0.9	0.1	0.7	0.9	1.5	110.343822
5	456844	2938	0	1	1.4	0.6	1	1.4	1.8	110.343822
6	456854	2181	0	2	1.2	0.5	1.1	1.2	1.9	106.222029
7	457824	2420	0	1	2	1.1	1.7	2	2.4	110.343822
8	457664	1677	0	1	2.1	1.2	1.8	2.1	2.6	110.343822
9	457644	1749	0	1	2.1	1.2	1.8	2.1	2.5	110.343822
10	455474	1695	0	1	1.8	0.7	1.5	1.8	2.3	110.343822
11	455464	1951	0	1	0.7	0.1	0.5	0.7	1.3	110.343822
12	455454	1914	0	1	0.8	0.1	0.6	0.8	1.4	110.343822
13	458974	1757	0	1	2.2	1.5	1.9	2.2	2.7	110.343822
14	456874	1645	0	1	1.3	0.5	1	1.3	1.8	110.343822
15	456864	3090	0	1	1.1	0.3	0.9	1.1	1.7	110.343822
16	455494	1590	0	1	1.8	1	1.5	1.8	2.3	110.343822
17	455504	2073	0	1	2.1	1.5	1.8	2.1	2.6	110.343822
18	455524	2062	0	1	1	0.2	0.6	1	1.4	110.343822
19	455444	1490	0	1	1.5	0.6	1.2	1.5	2	110.343822
20	455484	1837	0	2	2.7	1.8	2.3	2.7	3.1	106.222029
21	459054	2308	0	1	2.4	1.6	2.1	2.4	2.9	110.343822
22	455854	2582	0	2	1.8	1	1.4	1.8	2.3	106.222029
23	455874	2258	0	1	1.3	0.5	1	1.3	1.8	110.343822
24	455514	2306	0	1	1.6	0.8	1.1	1.6	1.9	110.343822

Mean Value for 29 Buildings	0	+1'	+2'	+3'	+4'
AAL Building	\$4240	\$445	\$32	\$3	\$0.26
AAL Contents	\$3112	\$345	\$25	\$2	\$0.17

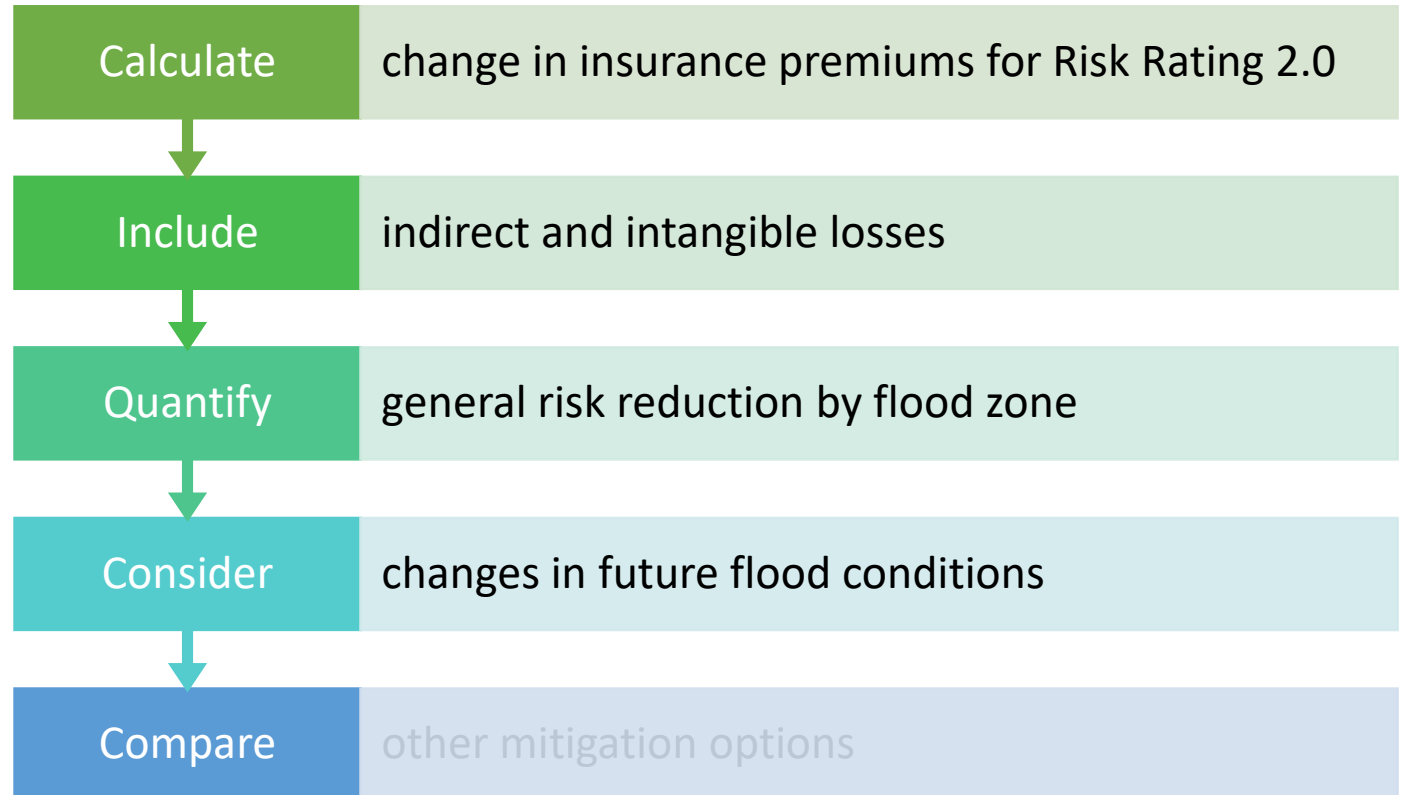


Flood Loss Risk Reduction Case Study

Mean Value for 29 Buildings	0	+1'	+2'	+3'	+4'
AAL Homeowner	\$7950	\$832	\$58	\$5	~\$0
AAL landlord	\$4905	\$495	\$35	\$3	~\$0
AAL tenants	\$3212	\$350	\$23	\$2	~\$0



Future Elements to Incorporate



LaHouse: Research-based Solutions for Resilient, Sustainable, Healthy Homes and Communities

2858 Gourrier Ave

Baton Rouge, LA 70820

Across the street from LSU
baseball stadium





LaHouse: Showcase of Home and Landscape Solutions



Wealth of Online Resources

Search

PRODUCERS CONSUMERS RESEARCHERS 4-H STORE GIVE

AgCenter
Research · Extension · Teaching

Topics ▾ Services ▾ Publications ▾ News & Events ▾ About ▾ Our Offices ▾

LSU
College of
Agriculture

Home > LaHouse Resource Center



LaHouse Resource Center

A high-performance home showcase of solutions and more...



My House, My Home

Enjoy the benefits of high efficiency, comfort, durability and a healthy home.



Housing Professionals

Continuing education and building science resources for the south.

LaHouse Highlights



Flood Recovery



Housing Publications



LaHouse Visiting Hours



Map and Directions



Photo Gallery

Acknowledgements

- This research was funded by the U.S. Department of Homeland Security (Award Number: 2015-ST-061-ND0001-01), the Louisiana Sea Grant College Program (Omnibus cycle 2020–2022; Award Number: NA18OAR4170098; Project Number: R/CH-03), the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine under the Grant Agreement number: 200010880 “The New First Line of Defense: Building Community Resilience through Residential Risk Disclosure,” the U.S. Department of Housing and Urban Development (HUD; 2019–2022; Award No. H21679CA, Subaward No. S01227-1), and the Federal Emergency Management Agency via GOHSEP (Award Number: 2000301135).
- Any opinions, findings, conclusions, and recommendations expressed in this manuscript are those of the author and do not necessarily reflect the official policy or position of the funders.

