How much risk is too much?

Geographic and economic analysis to support local decisions about flood resilience in a Downeast Community

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Elements of Dignity

(Hicks, 2011)

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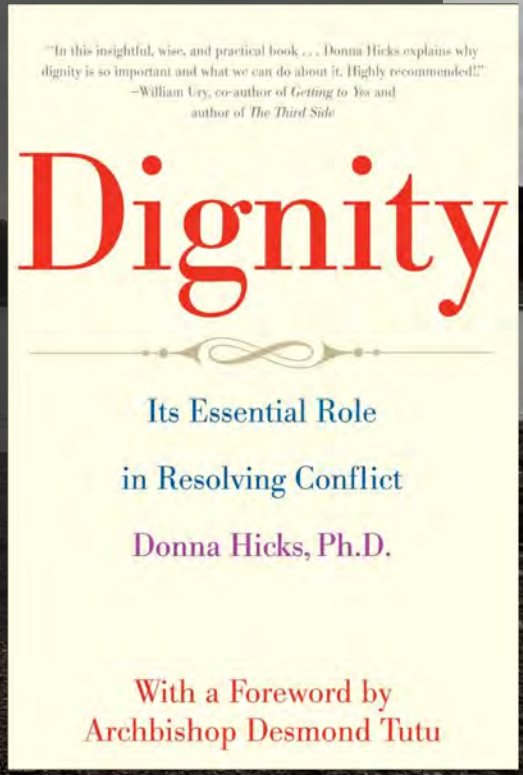
Maine's Coastal University

- Acceptance of Identity
- Inclusion
- Safety
- Acknowledgment
- Recognition
- Fairness
- Benefit of the Doubt
- Understanding
- Independence
- Accountability



By Publius (pseudony
Jay (23 December 1745 – 17 May 1829), James Madison (16 March 1751 – 28 June 1836). (Scanned from an original copy.), Public Domain, via Wikimedia Commons

Best Practices for Supporting Decisions

Align Scales of Action, Information, & Feedback
(Wilbanks & Kates, 2010; Cash et al., 2006; Ostrom 1990)

Identify & Focus on Local Vulnerabilities & Priorities
(Hales, D. et al., 2014; Dunlap, 2010; Molnar 2010)

Support Co-Production of Knowledge in Learning Loops
(Pahl-Wostl, 2009; Cash, 2006; Cash et al., 2003)

Johnson, Tora, "Role of Dignity in Rural Natural Resource Governance" (2015). *Electronic Theses and Dissertations.* Paper 2267.
http://digitalcommons.library.umaine.edu/etd/2267

Background

Downscaling & iterative public meetings to ID vulnerabilities

Machias = Service Center

GROW WASHINGTON AROOSTOOK
Embracing the Future

Climate Change & Infrastructure Resilience

Climate Vulnerability Assessments for Coastal Washington County

The utility of a Climate Vulnerability Assessment (CVA) is not to predict the exact height of water or the date a storm will arrive – they cannot know this. Rather, property owners, municipal officials and first responders can use the town-and bay-specific scenarios in Washington County to review scenarios of possible impacts from severe storms. The scenarios use Geographic Information System (GIS) models that are based on a single modeled storm hitting Penobscot Bay; actual conditions depend on wind speed, direction, and the track of the storm, largely random variables.

ID Local Priorities

Issue Involvement: Community					**Issue Involvement Personal**			
Please indicate the extent to which each problem is significant in the Downeast town where you live or spend the most time.					*Please indicate the extent to which each problem is important to you personally.*			
Issue	**Mean Ranking**	**n**	**Std. Dev.**		**Item**	**Mean Ranking**	**n**	**Std. Dev.**
Unemployment (tie for 1st)	4.18	231	1.04		High property taxes	3.89	218	1.21
School budgets (tie for 1st)	4.18	229	0.98		School budgets	3.79	219	1.32
High price of heating fuel	4.07	226	1.02		High price of heating fuel	3.58	212	1.33
High property taxes	3.89	229	1.16		Aging roads, bridges & culverts	3.54**	217	1.17
Aging roads, bridges & culverts	3.75**	228	1.12		Unusually strong storms	3.32**	209	1.3

Johnson, 2015

Machias Waterfront Resilience & Renewal Study

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- Public Meetings
- Engage w/ Businesses
- MCP grant
- Preliminary engineering
- Economic risk assessment

Machias Hardware
Parking Lot
King Tide 2017
Photo: Shri Verrill

Potential Economic Impacts of Flooding

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Four flooding scenarios:

- Base Flood
- BF +2ft
- BF +4ft
- BF +6ft

Includes:

- Direct Economic Losses to Business, Govt & Residents
- Lost Sales & Earnings
- Cost of Restoration or Rebuilding

Machias Boat Landing
Photo by Bob Farris
King Tide 8.5ft, 2017

Potential Economic Impacts of Flooding

Four flooding scenarios:

Base Flood ~ BF +2ft ~ BF +4ft ~ BF +6ft

Does NOT include:

- Indirect Losses, eg decline in sales for unaffected businesses
- Other areas of Machias coastline
- Loss of cultural or natural resources, eg historic sites & impt habitat
- Damage to utility lines, incl water, wastewater, electricity & comm
- Potential damage to the dike

Sources for Cost & Loss Estimates

Building & Contents: Assessment Records
US ACE 2015 Depth Damage Study
FEMA HAZUS Flood Technical Manual

Business Inventory: Building Footprint Square Footage
EMA HAZUS Flood Technical Manual

Road Damage: MEDOT Replacement Cost per MI
Surveyed Elevations
Global Depth Damage Function (2017)
by Huizinga, Moel & Szewczyk

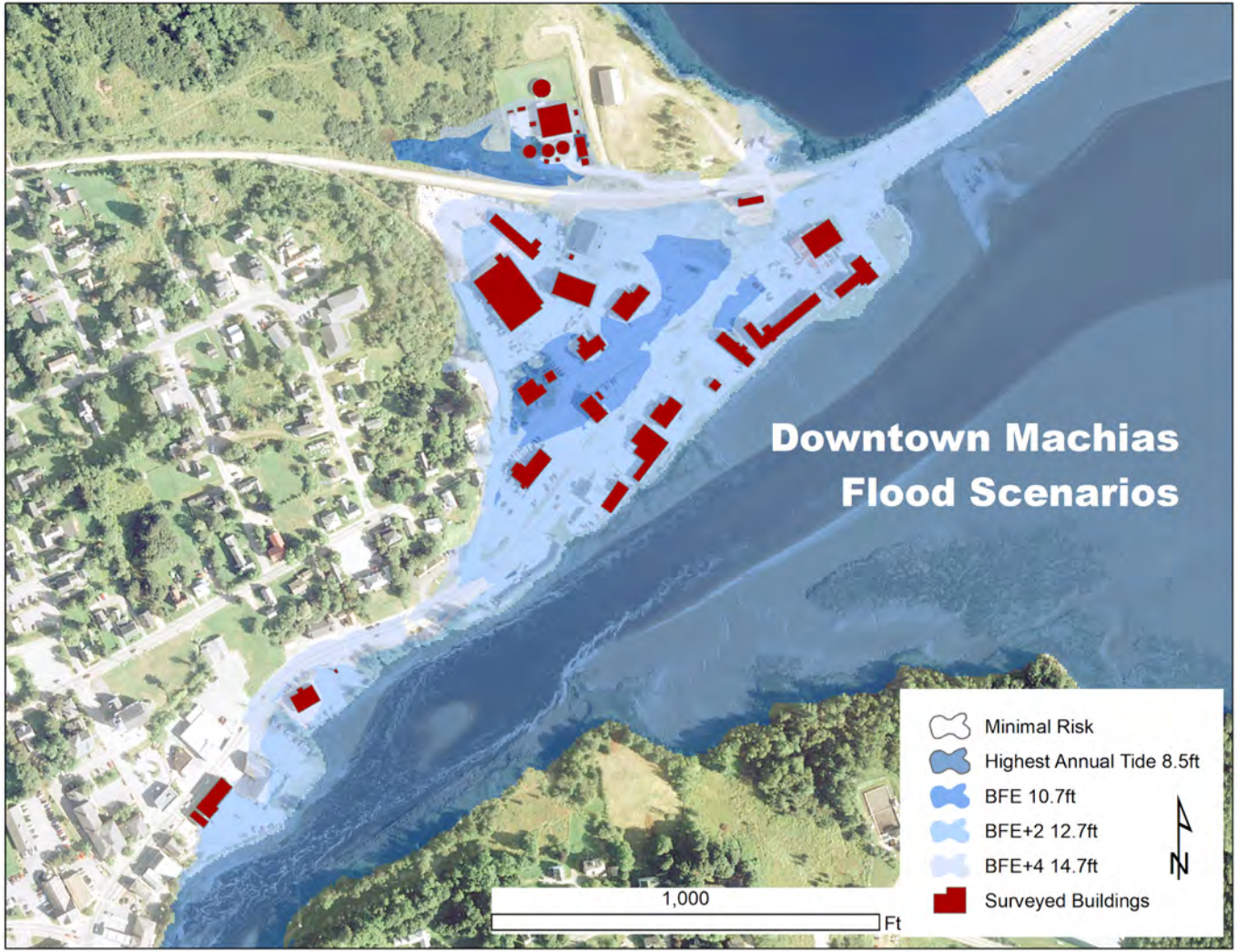
Economic Losses: FEMA HAZUS Flood Technical Manual

Shellfish: 2016 Machias Bay study by Evans, Athearn, Chen, Bell & Johnson

Flood Scenarios

Base Flood
BF +2ft
BF +4ft
BF +6ft

Map shows flood scenarios with surveyed buildings at risk.



Flood Scenarios

Highest
Annual
Tide 2017 8.6 ft

Based on king tide images provided by participating citizens.

Flood Scenarios

BFE = 10.7 ft

Flood Scenarios

BFE +2 = 12.7 ft

Flood Scenarios

BFE + 4 = 14.7 ft

Flood Scenarios

BFE + 6 = 16.7 ft

Economic Picture of Vulnerable Area

18 Businesses, 5 Other Bldgs, & many Outbuildings

Annual Sales: $5,546,336

Business Inventory: $721,024

Annual Earnings: $5,566,213

Jobs: ~115

Machias Hardware
Parking Lot
King Tide, 8.5ft 2017
Photo: Shri Verrill

Cost/ Loss Estimates for a Single Flood Event

Scenario	Economic Impact	Buildings w/ Loss	Jobs Impacted	Avg Months to Rebuild
BFE (10.7ft)	$713,297	8	22	2
BFE +2 (12.7ft)	$7,918,338	17	92	6
BFE+4 (14.7ft)	$16,889,819	21	108	11
BFE+6 (16.7ft)	$23,699,916	23	115	15

Average Annual Shellfish Landings for Machias Bay: $1,000,000

(Evans, et al 2016)

- BFE+4 & BFE+6 scenarios pose significant risk to shellfish
- Depending on pollutants, impact could close fisheries for many years

Cost/ Loss Estimates for a Flood Event

Loss/ Cost Category	BFE (10.7ft)	BFE+2 (12.7ft)	BFE+4 (14.7ft)	BFE+6 (16.7ft)
Bldg Damage	$82,046	$716,783	$1,671,945	$2,128,439
Business Inventory	$12,005	$108,855	$273,313	$386,857
Non-Perishable Contents	$49,208	$432,974	$1,203,169	$1,861,448
Road Damage Cost	$91,682	$1,004,120	$1,841,925	$2,343,768
Lost Sales	$194,831	$2,349,784	$4,970,364	$7,115,035
Lost Earnings	$195,529	$2,358,205	$4,988,176	$7,140,533
Rental Cost	$78,632	$884,273	$1,859,844	$2,634,963
Disruption Cost	$9,365	$63,345	$81,082	$88,873
TOTAL ECONOMIC IMPACT	**$713,297**	**$7,918,338**	**$16,889,819**	**$23,699,916**
Buildings with Loss	8	17	21	23
Average Months to Rebuild	2	6	11	15
Jobs Impacted	22	92	108	115

Next Steps

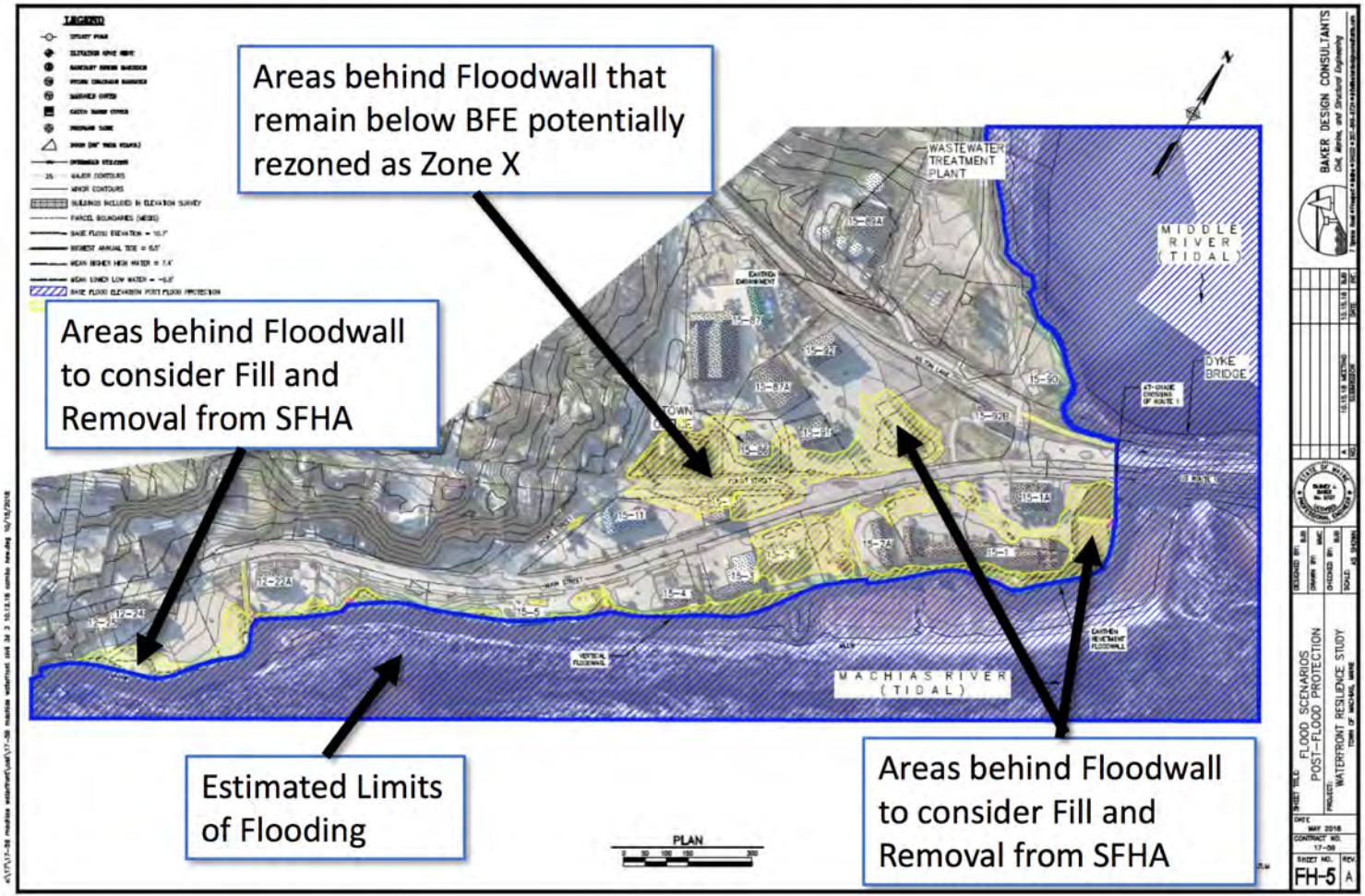
Machias River Walk

Engineering & design

Assess risk vs. cost

Best practices

Potential Flood Mapping, Post-Floodwall Construction



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