



USAID
FROM THE AMERICAN PEOPLE

ASIA

Probabilistic Risk Assessment In Climate Change Adaptation

Present by:

Bradford R. Philips, P.E.

Regional Climate Change Adaptation Advisor
USAID Regional Development Mission for Asia

bphilips@usaid.gov



USAID | ASIA

FROM THE AMERICAN PEOPLE





Risk

Risk: The combination of the probability of an event and its negative consequences.

$$\text{Risk} = \text{Hazard} \times \text{Vulnerability}$$

$$\text{Risk} = \text{Hazard} \times ((\text{Exposure} \times \text{Sensitivity}) / \text{Capacity})$$

Risks are site specific



Probabilistic risk assessment (PRA)

Probabilistic risk assessment (PRA) is a systematic and comprehensive methodology to evaluate risks associated with a complex system

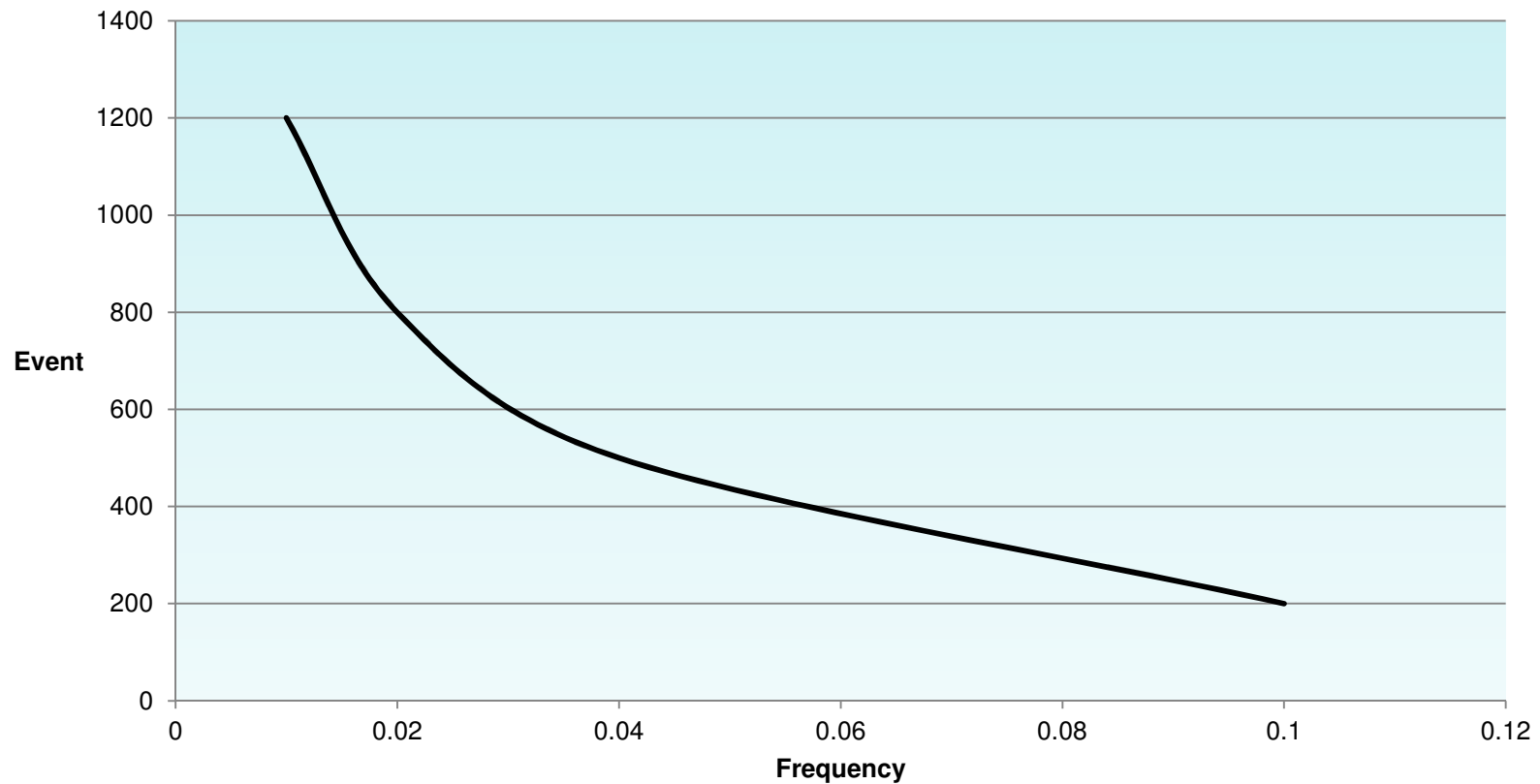
(adapted from *Wikipedia*)

- Hazard relationship: event frequency curve
- Event (precipitation, storm surge, wind speed, etc.)
- Loss exceedance curve
- Expected annual loss (EAL)



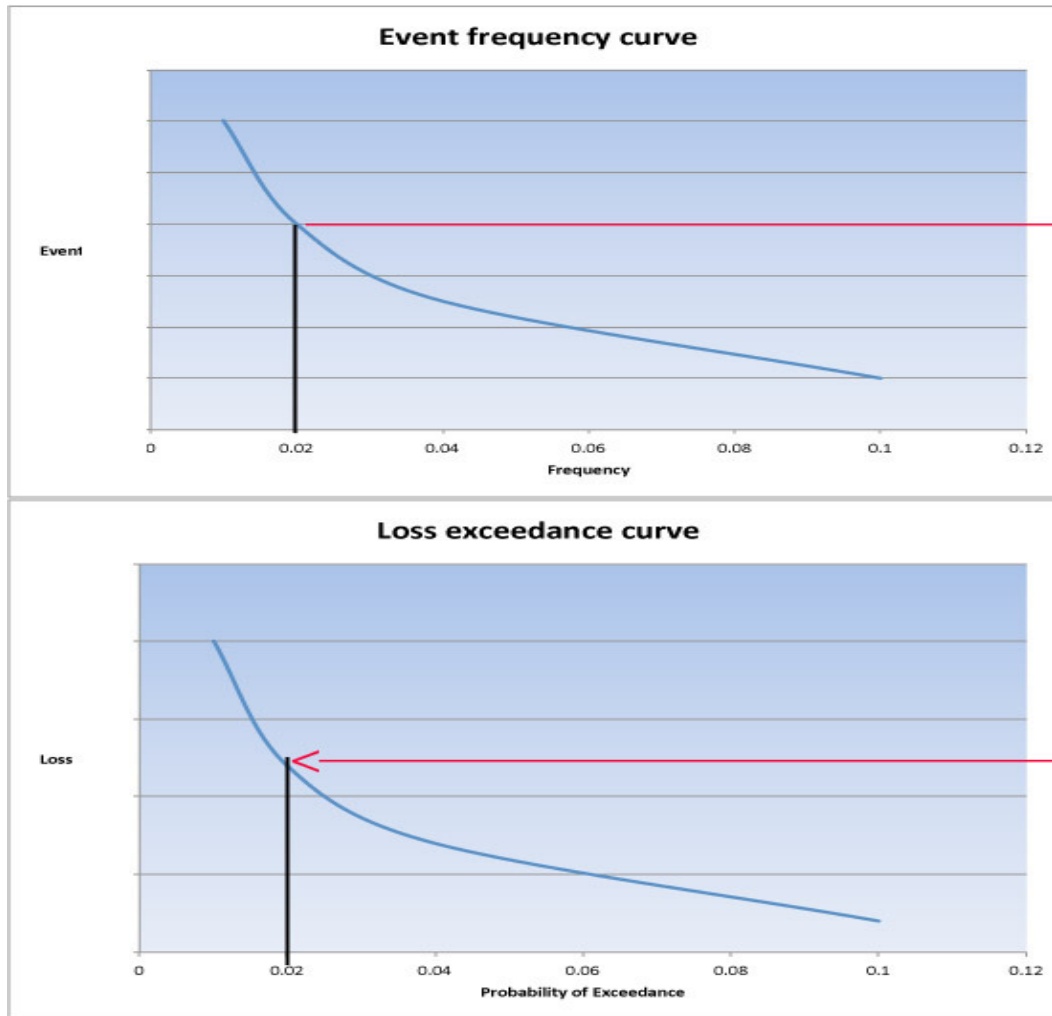
Hazard relationship

Event frequency curve





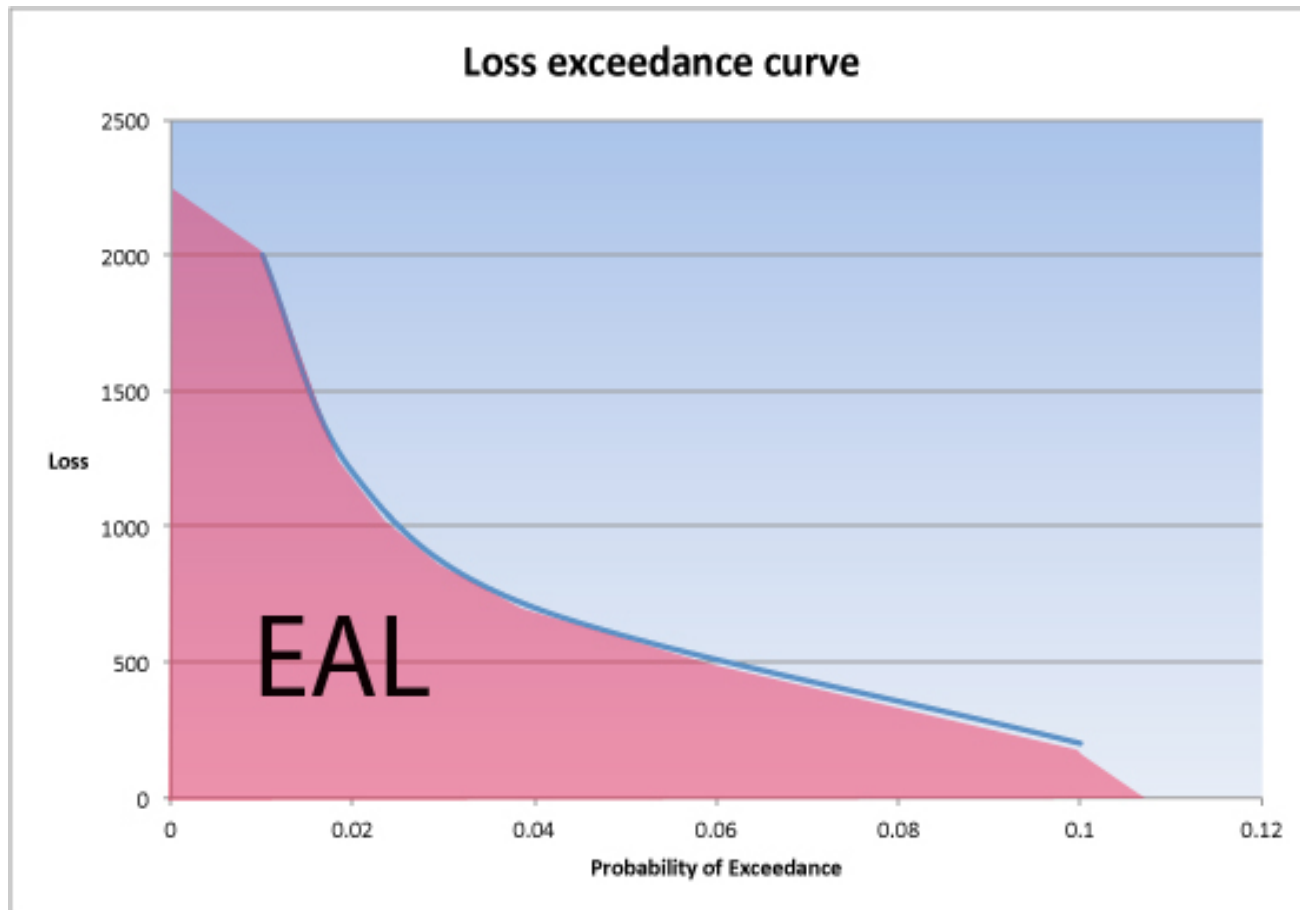
Constructing a loss exceedance curve



Hazard Module
Hydrologic Modeling Rainfall-runoff River/reservoir routing Flood plain depth mapping
Vulnerability Module
Exposure Land use mapping Sensitivity Damage stage relationships Capacity Early warning
Financial Module
Damage loss relationships Summation of losses



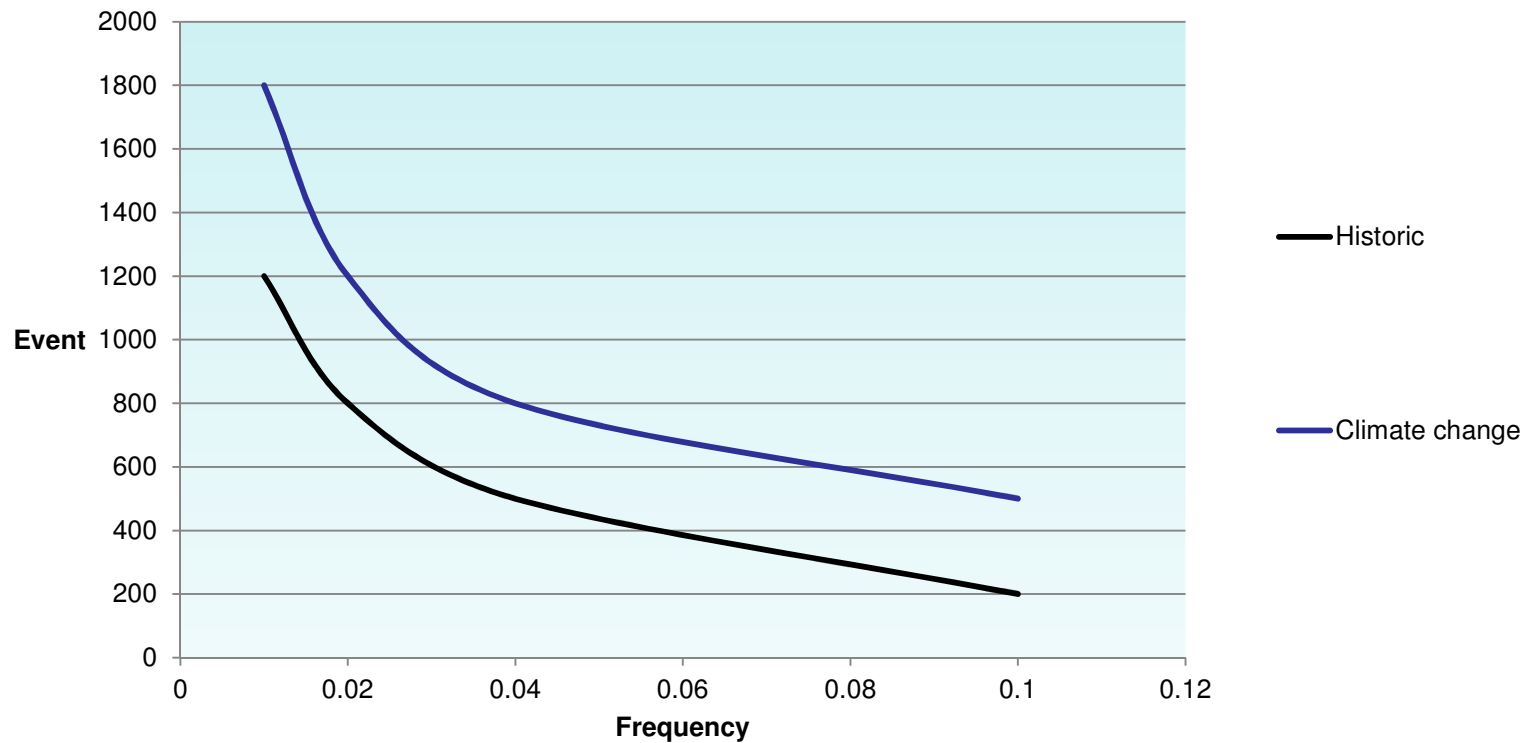
Expected annual loss (EAL)





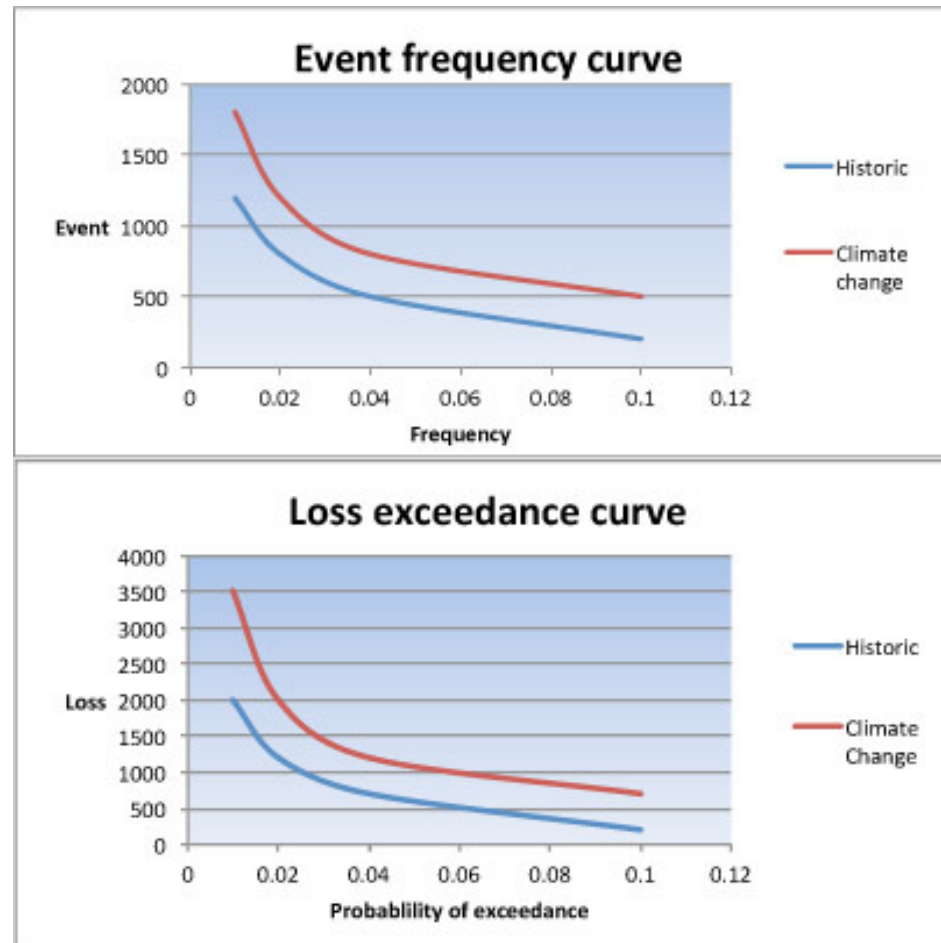
Downscaling: Assessing Impact of climate change on hazards relation

Event frequency curve



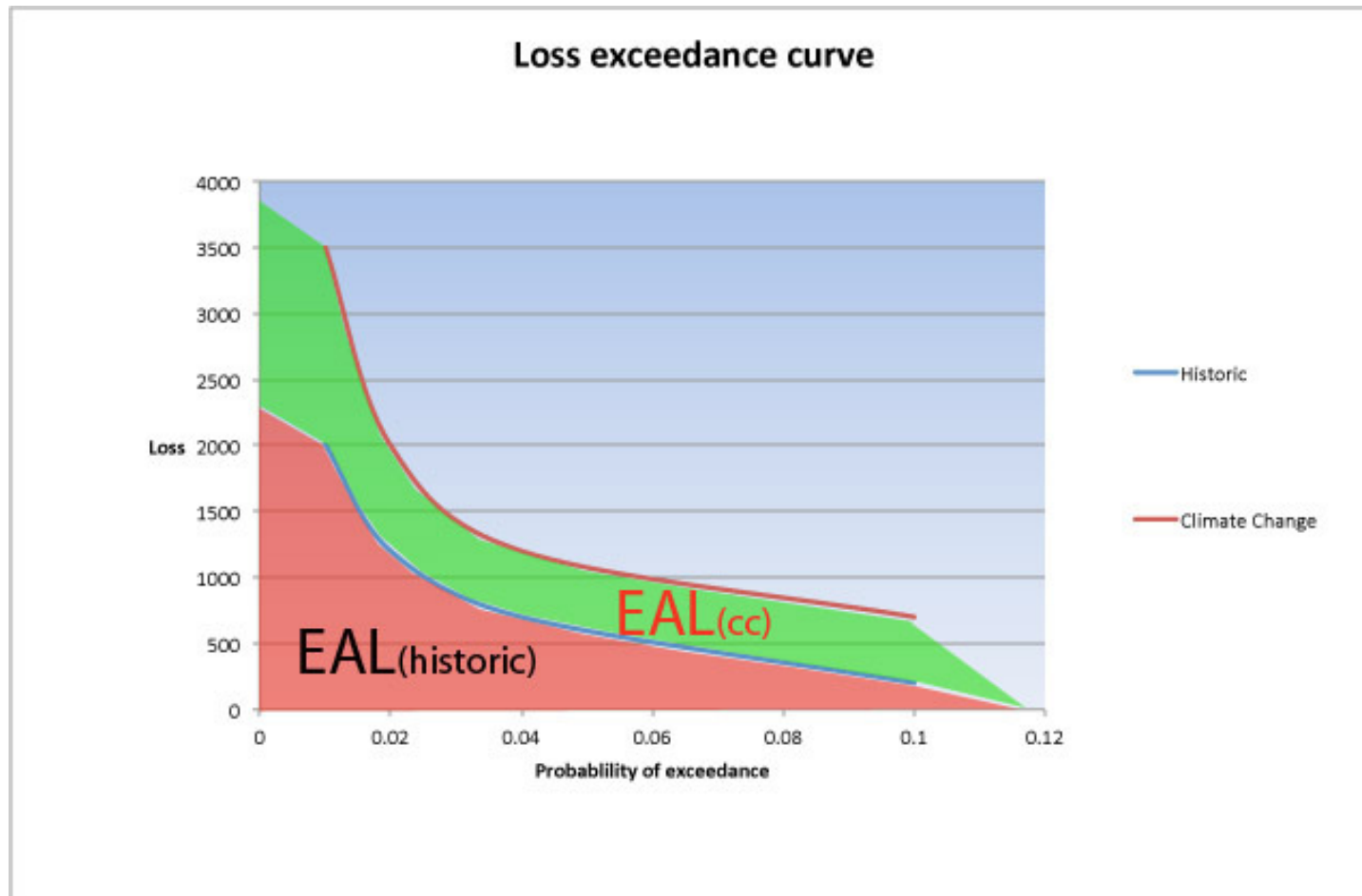


Probabilistic risks assessment with climate change





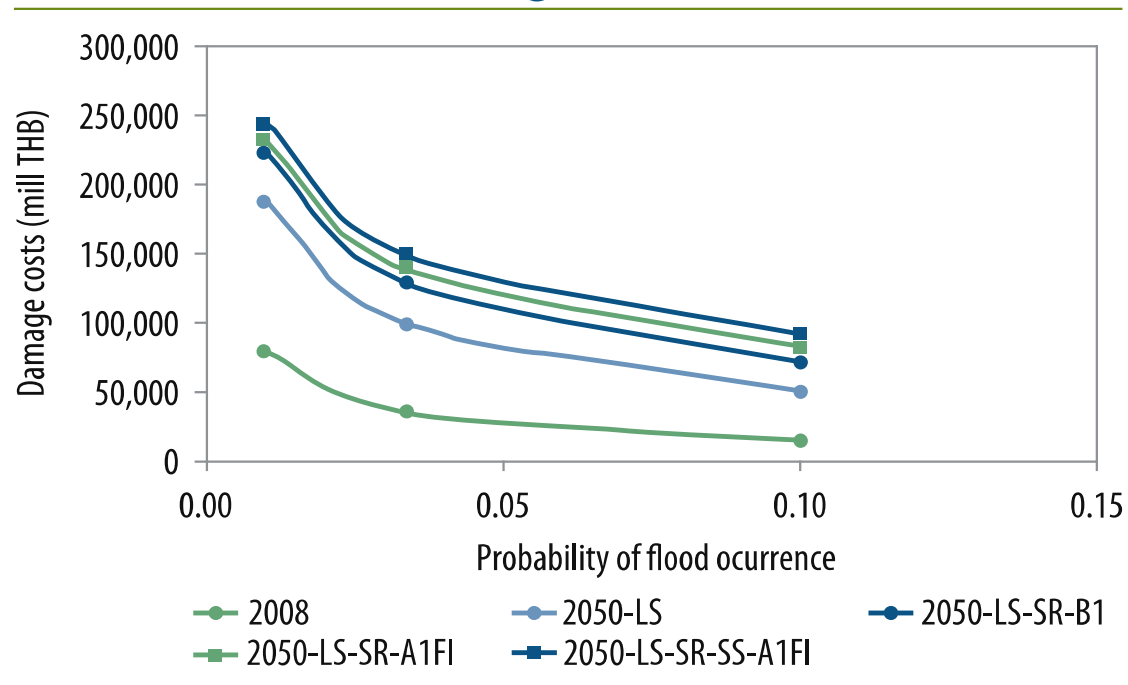
Increased risk due to climate change





Climate Change PRA: Bangkok

FIGURE 4.2 ■ Loss Exceedance Curves, Bangkok



Source: Based on calculations in Panya Consultants (2009).

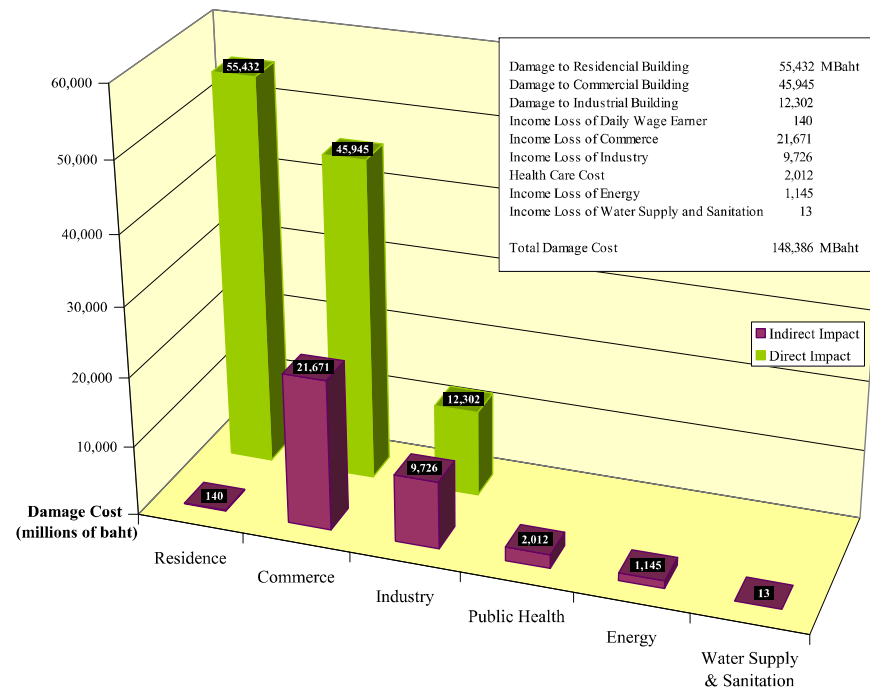


World Bank Study: Bangkok

Bangkok Expected Annual Loss (losses in million Baht)	
Scenario	EAL
2008	4,931
2050 B1 Scenario	18,996
2050 A1FI Scenario	21,379
2050 w/ adaptation	10,996



Direct & Indirect Losses by Sector



Source: Panya Consultants' calculation

Figure 4.2-1 Damage Cost of Case C2050-LS-SR-SS-A1F1-T30



References and resources

Climate Risks and Adaptation in Asian Coastal Megacities: A Synthesis Report; World Bank (2010);
http://siteresources.worldbank.org/EASTASIAPACIFICEXT/Resources/226300-1287600424406/coastal_megacities_fullreport.pdf

Climate Change Impact and Adaptation Study for the Bangkok Metropolitan Region, World Bank, 2009;
<http://beta.worldbank.org/climatechange/node/5360>

Flood risk assessment and flood risk management: An introduction and guidance, FLOODsite Consortium, 2009;
http://www.floodsite.net/html/partner_area/project_docs/T29_09_01_Guidance_Screen_Version_D29_1_v2_0_P02.pdf

Earthquake Vulnerability Reduction Program in Colombia, A Probabilistic Cost-benefit Analysis, World Bank Policy Research Working Paper 3939, June 2006;
http://www.preventionweb.net/files/1172_wps3939.pdf



References and resources (continued)

Handbook for Estimating Socio-economic and Environmental Effects of Disasters; Economic Commission for Latin America and the Caribbean (ECLAC). 2003;

<http://www.unisdr.org/eng/library/Literature/7578.pdf>

Economics of Climate Adaptation: Shaping Climate Resilient Development; McKinsey Report, 2009.

http://www.mckinsey.com/clientservice/Social_Sector/our_practices/Economic_Development/Knowledge_Highlights/Economics_of_climate_adaptation.aspx

Risk-Based Analysis for Flood Damage Reduction Studies, Manual No. 11110-2-1619, US Army Corps of Engineers, 1996; <http://140.194.76.129/publications/eng-manuals/em1110-2-1619/entire.pdf>

Photos: Reuters from the 2011 Bangkok Flood



USAID | **ASIA**
FROM THE AMERICAN PEOPLE

Thank you!

