

Integration of Flood Risk Assessment into Urban planning



IC INCLAM
G R O U P

October 2018

This is not an ADB material. The views expressed in this document are the views of the author/s and/or their organizations and do not necessarily reflect the views or policies of the Asian Development Bank, or its Board of Governors, or the governments they represent. ADB does not guarantee the accuracy and/or completeness of the material's contents, and accepts no responsibility for any direct or indirect consequence of their use or reliance, whether wholly or partially. Please feel free to contact the authors directly should you have queries.



Overall Approach

FLOOD MODELING

**Prevent, control & mitigate negative impacts
of flood events**

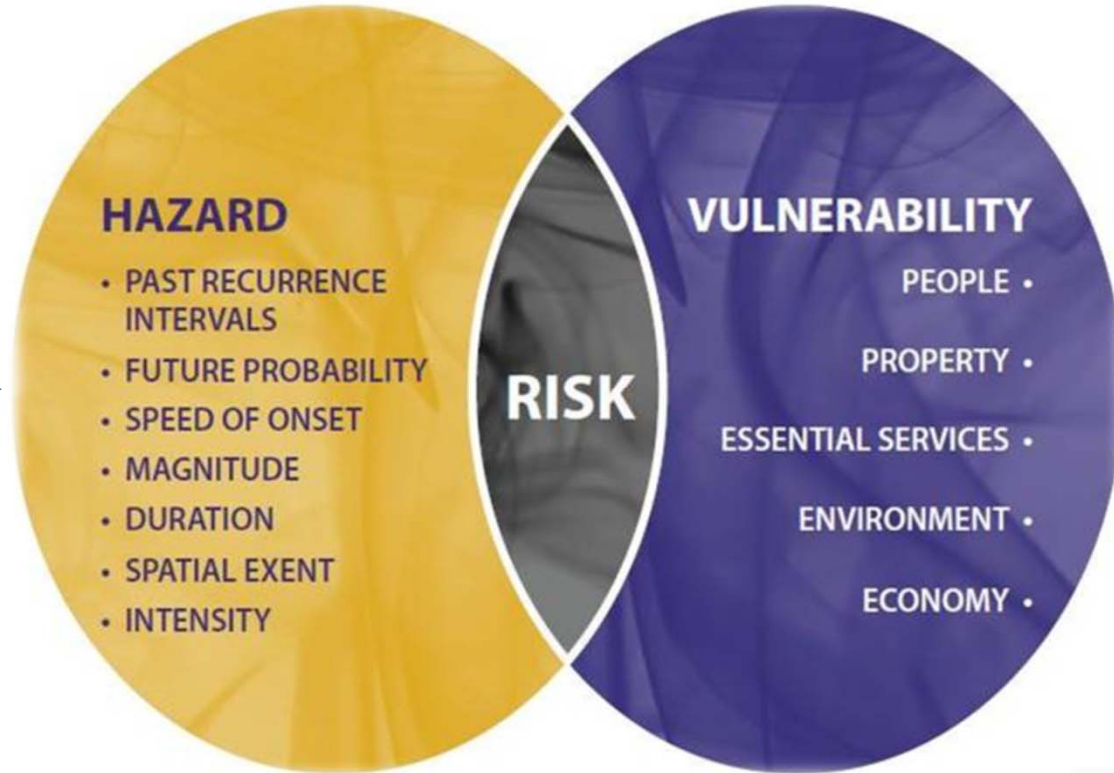
Reduce flood related risks

***Improve the
citizens' well-
being***

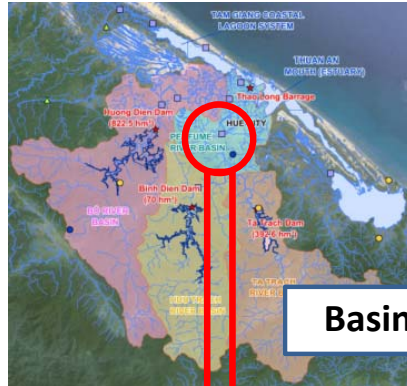


Key Concepts (1)

FLOOD RISK



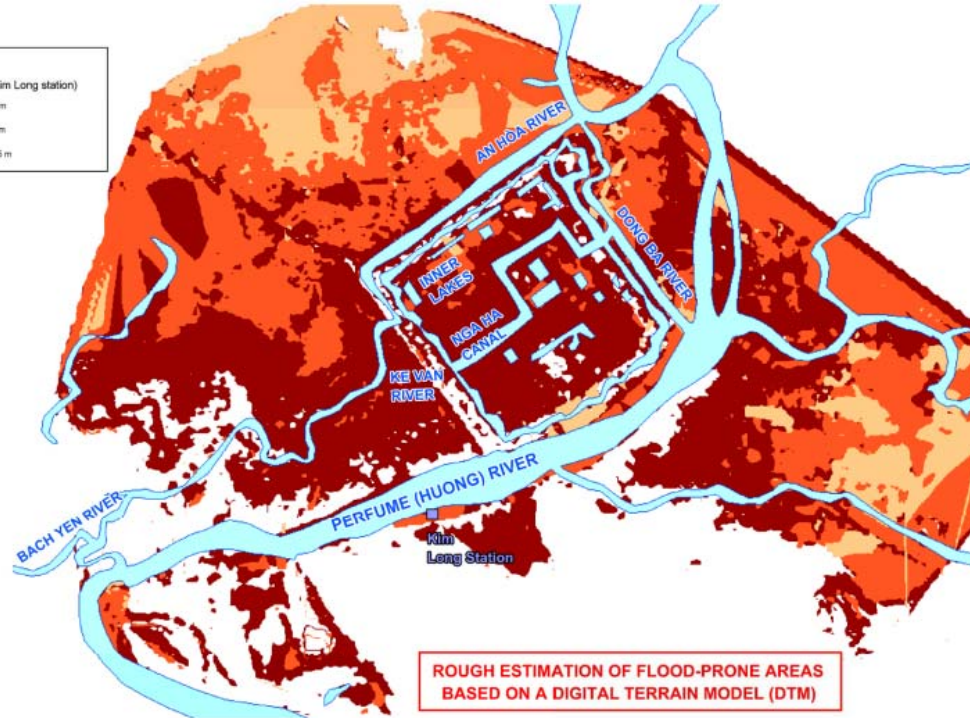
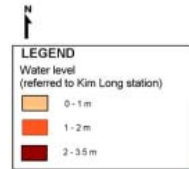
Key Concepts (2)



Basin scale



Urban scale



ROUGH ESTIMATION OF FLOOD-PRONE AREAS BASED ON A DIGITAL TERRAIN MODEL (DTM)

Hue City (Central Viet Nam) – UNESCO World Heritage Centre



Flood Hazard (1)

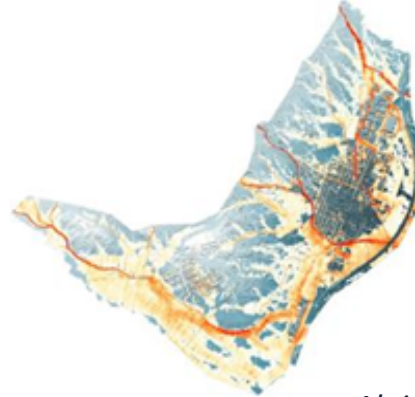
HAZARD



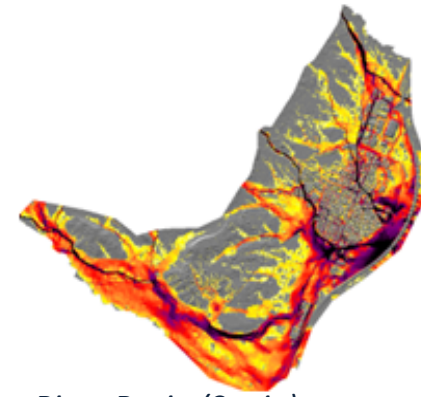
Water depth grid



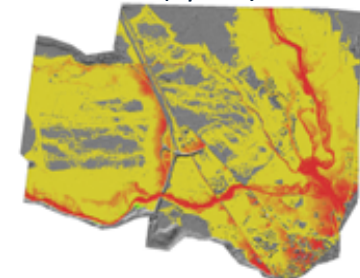
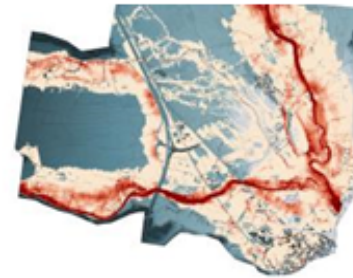
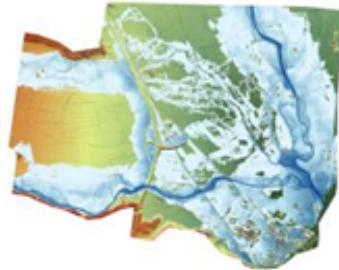
Water velocity grid



Hazard grid



Alginet River Basin (Spain)

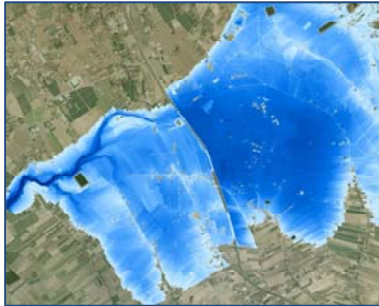


Duerna River Basin (Spain)



Flood Hazard (2)

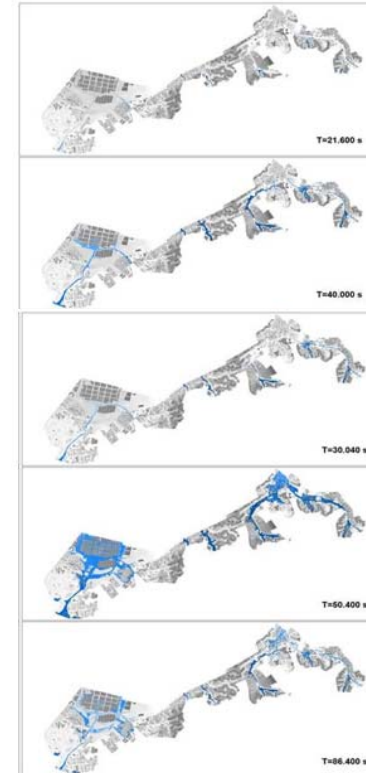
CALIBRATED HYDRAULIC
MODEL



REAL FLOOD EVENT



SIMULATION OF THE
EVOLUTION OF A
FLOOD EVENT

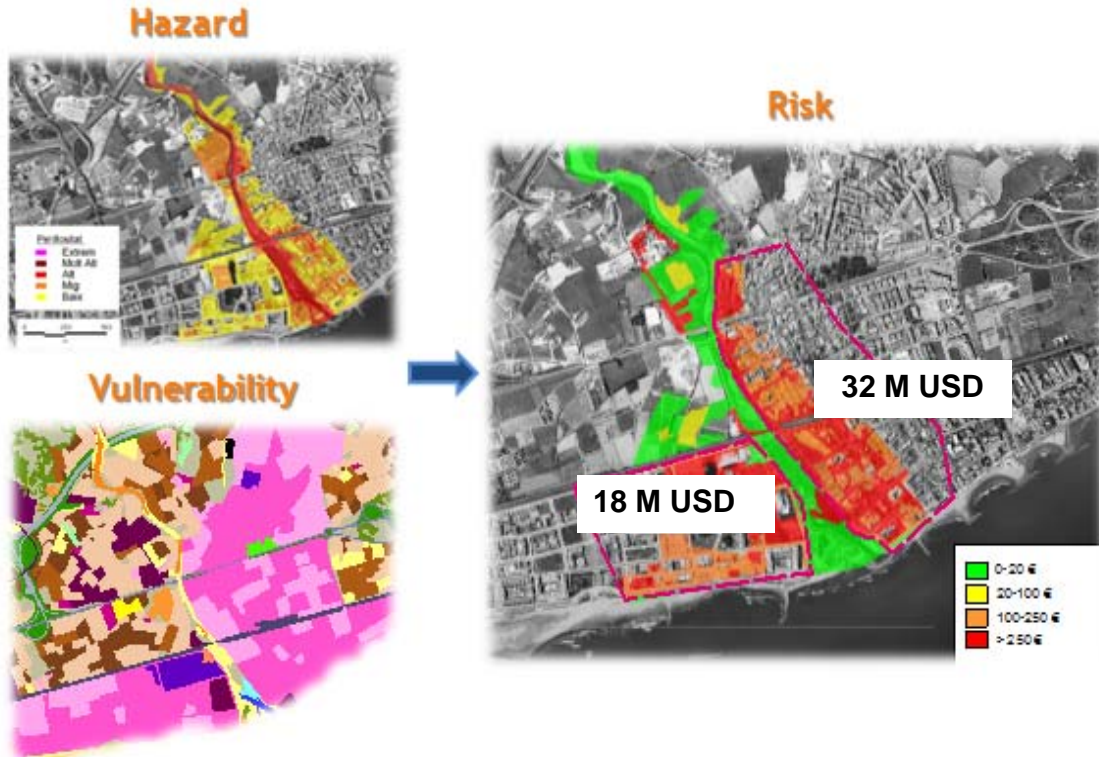


*Urban Drainage Master Plan
of Colon District (Panama)*



How do we Assess Flood Risk?

$$\text{HAZARD} * \text{VULNERABILITY} = \text{RISK}$$



To Assess **Risk**



To Propose Measures
Cost/Benefit analysis



Flood Risk
Management Plan
(FRMP)



Cost-Benefit Analysis (CBA)

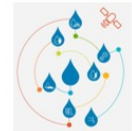
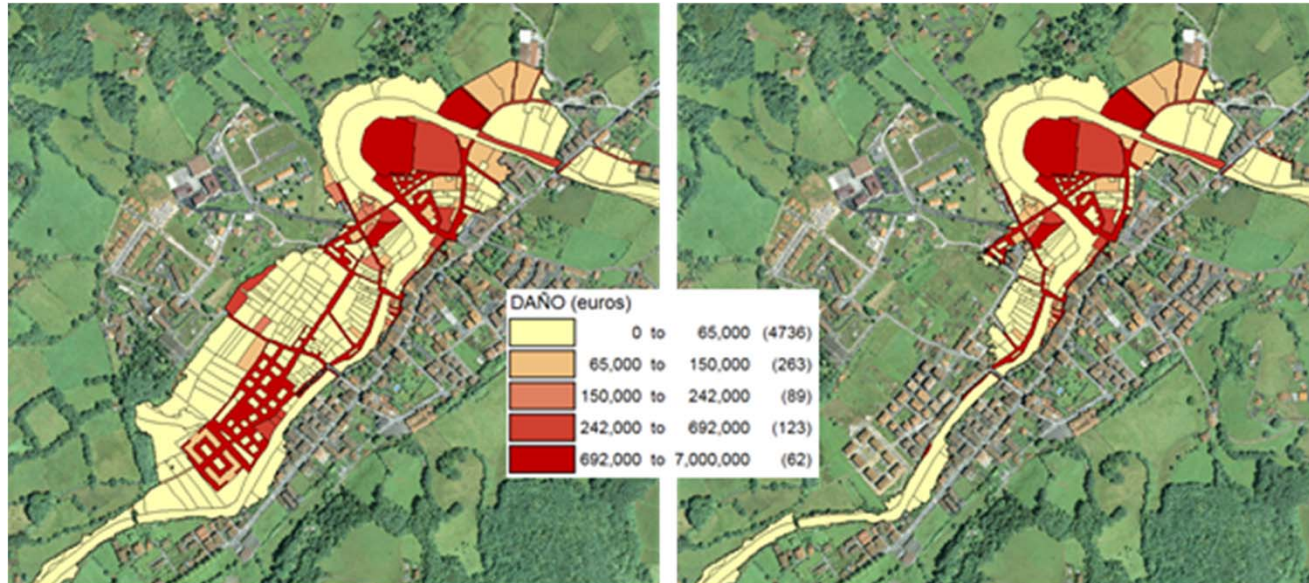
Measures Cost-benefit analysis



Comparative analysis of the cost-benefit helps to make decisions, to choose the best solution

BENEFITS: Damage quantification before and after the measures were implemented.

Average year Cost:

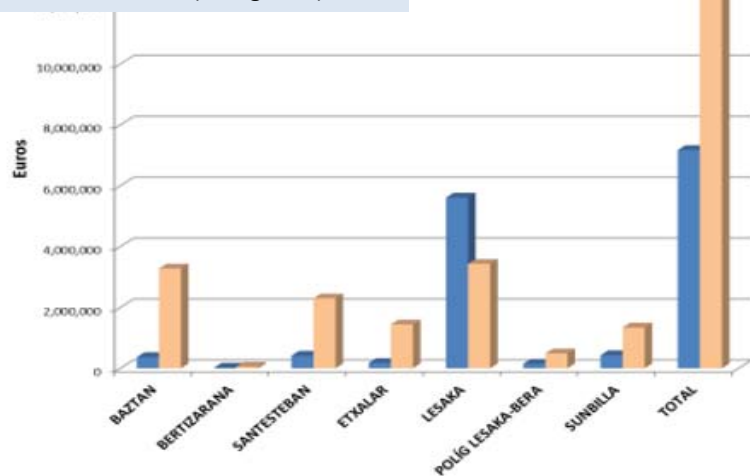


Mitigation Measures

Economic Profitability Analysis

COSTS: Measure Implementation and maintenance and repairs works cost during the lifetime are considered.

Average Annual Improvement (blue bar)
Total measures cost (orange bar)



Priority Level. Multi-Criteria



Measures priority (by program)

PROGRAM 1: River restoration Measures
PROGRAM 2: Infrastructures drainage improvement Measures
PROGRAM 3: Flood prediction Measures
PROGRAM 4: Civil Protection Measures
PROGRAM 5: Urban and Territorial Planning and Development
PROGRAM 6: Knowledge Improvement
PROGRAM 7: Erosion and sedimentation Control
PROGRAM 8: Resilience Improvement
PROGRAM 9: Training and communication
PROGRAM 10: Plan Management and Coordination with other authorities
PROGRAM 11: Structural Measures

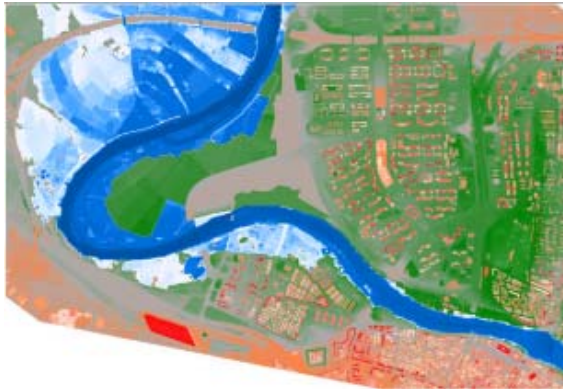
Support to Decision-Making

Feasibility studies of structural and non-structural measures

Ranillas Meander (Spain)



Measures



Flood Hazard



Impact of flood mitigation measures



Real Simulation example



Flood simulation example

**Iloilo City, Panay Island,
Philippines**

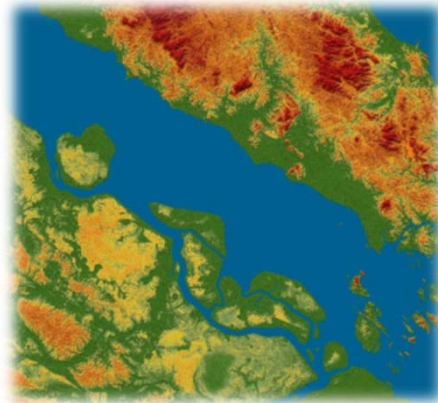


Other examples of Real Current Problems

ESTERO DE PACO (PHILIPPINES)



MELAKA (MALAYSIA)



VINH YEN (VIET NAM)



High vulnerability

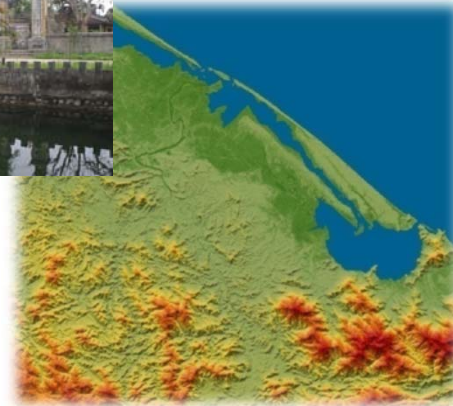
MANDALAY (MYANMAR)



Historical protection infrastructures



HUE (VIET NAM)



Historical heritage threatened by floods



Key Conclusions

| FINANCIAL | DEVELOPMENT MANAGEMENT | SOCIAL |
|-------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Increased security over investments | Multicriteria (environment, people, property, etc.) | Improve citizens's well being |
| Mitigates potential risks | More efficient decision making | Reduced vulnerability |
| More accurate cost-benefit analysis | Key aspect of the development strategies and compliant with national & international regulations | Improves security of the communities through more efficient evacuation and urban/land development plans |

