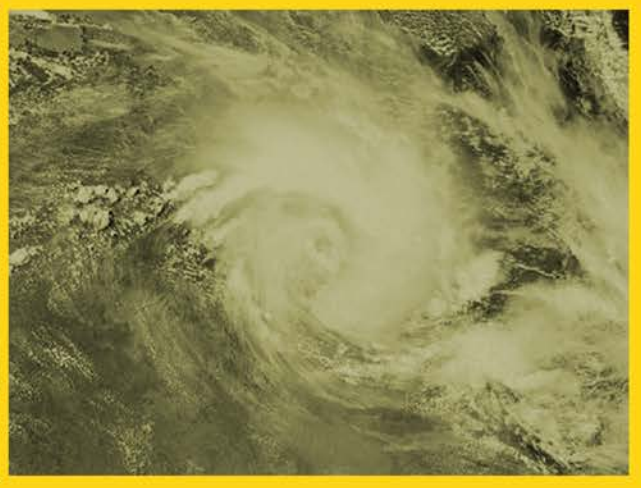
bushfire&natural HAZARDSCRC



NATURAL HAZARD DECISION SUPPORT SYSTEM

Holger R. Maier, Hedwig van Delden, Aaron Zecchin, Jeff P. Newman, Graeme C. Dandy, Ariella Helfgott, Graeme Riddell, Charles P. Newland, Michael O'Flaherty

School of Civil, Environmental and Mining Engineering, The University of Adelaide, SA

An Australian Government Initiative

CRC AUSTRALIA

THE UNIVERSITY of ADELAIDE

RISK ASSESSMENT

*"Natural disaster risk management is **complex**, and decision makers need to deal with **uncertainty, long time frames, unquantifiable costs and benefits**, and **stakeholder values and expectations**"*

(Source: Productivity Commission Draft Report)

A Decision Support System for assessing Policy & Planning Investment Options For Optimal Natural Hazard Mitigation

A Decision Support System for the Assessment of Policy & Planning Investment Options For Optimal Natural Hazard Mitigation

How the system assesses risk

How you can use the system,

what it can do for you

Work ahead and end-user engagement

A Decision Support System for the Assessment of Policy & Planning Investment Options For Optimal Natural Hazard Mitigation

How the system assesses risk

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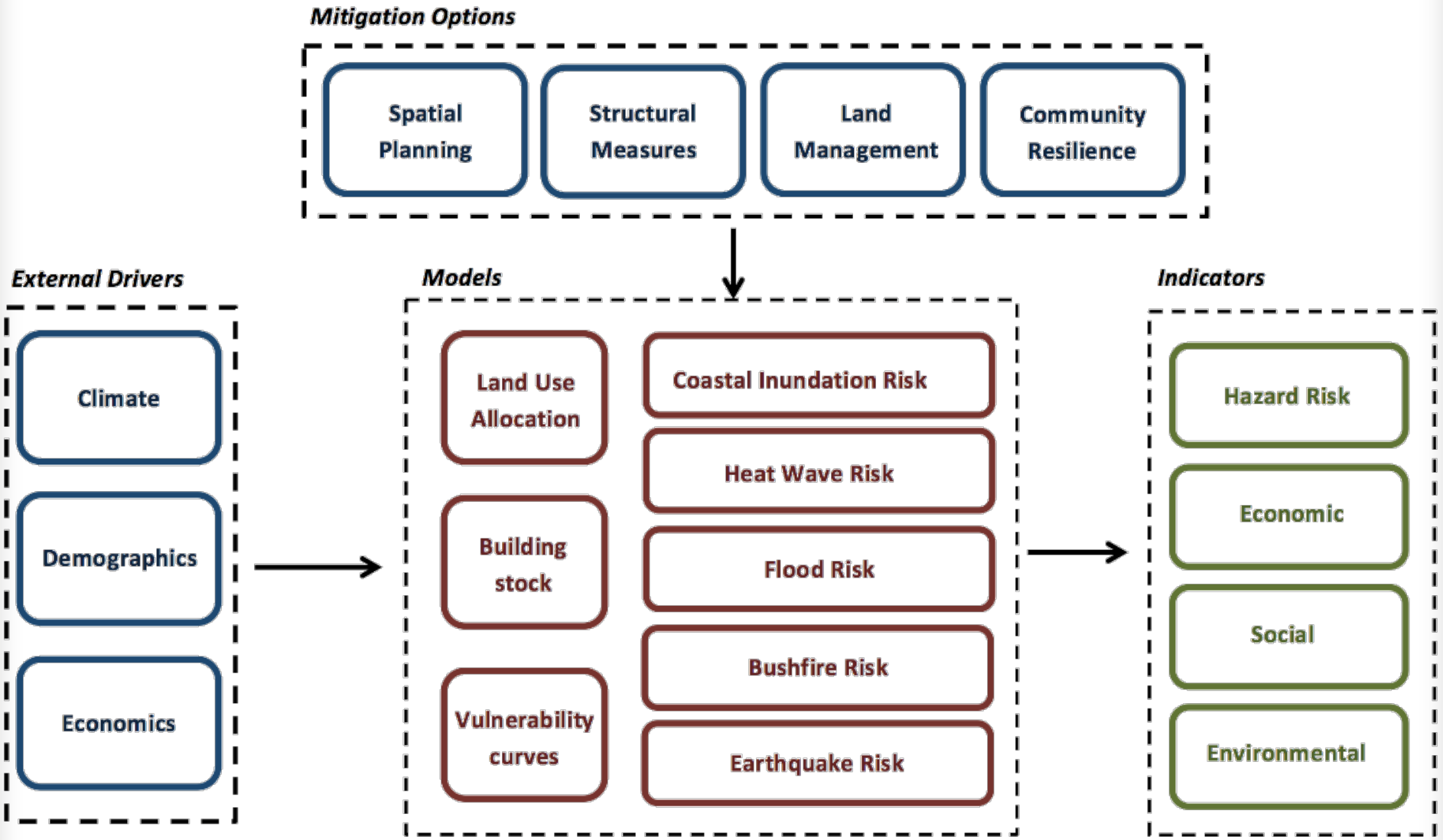
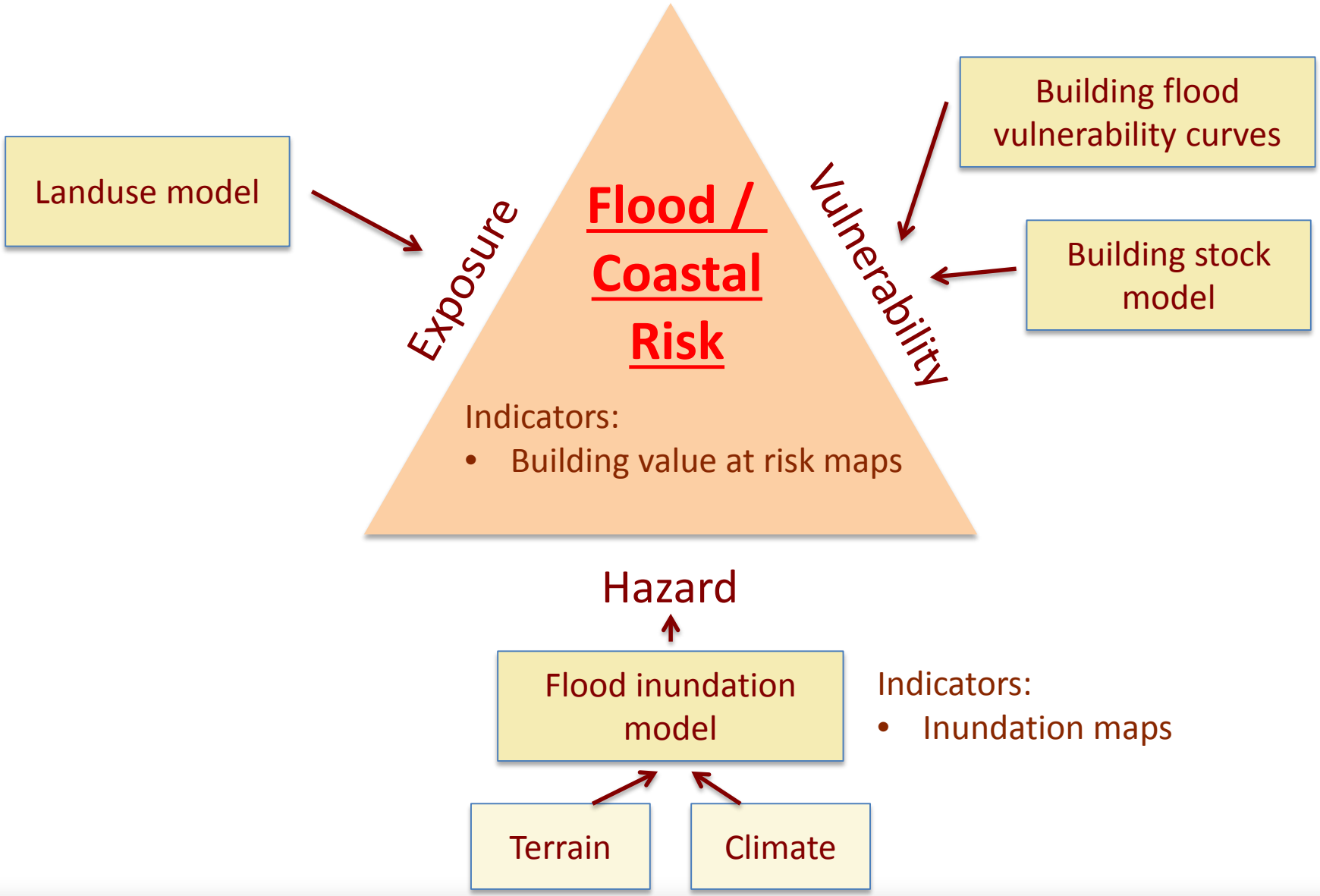
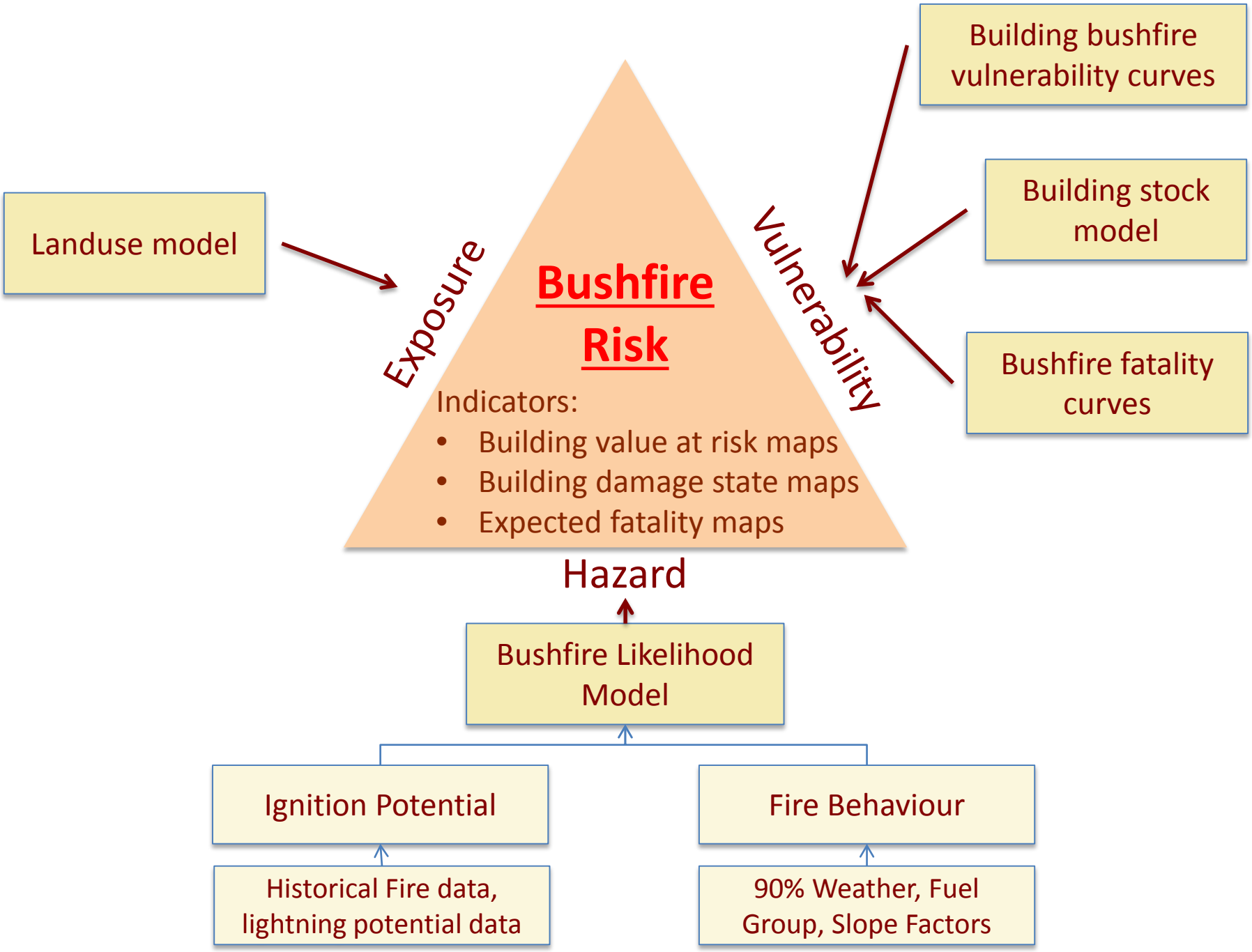
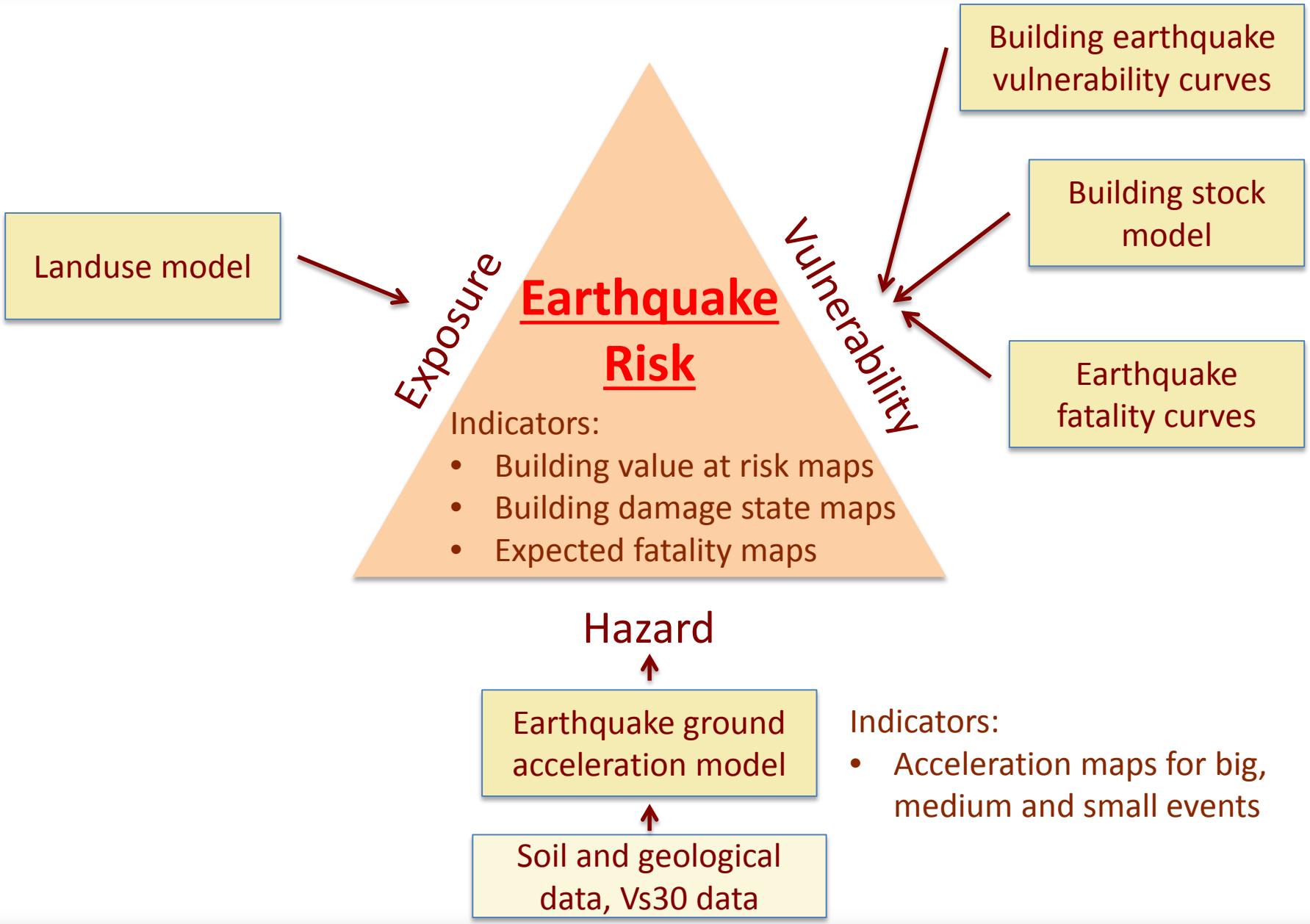
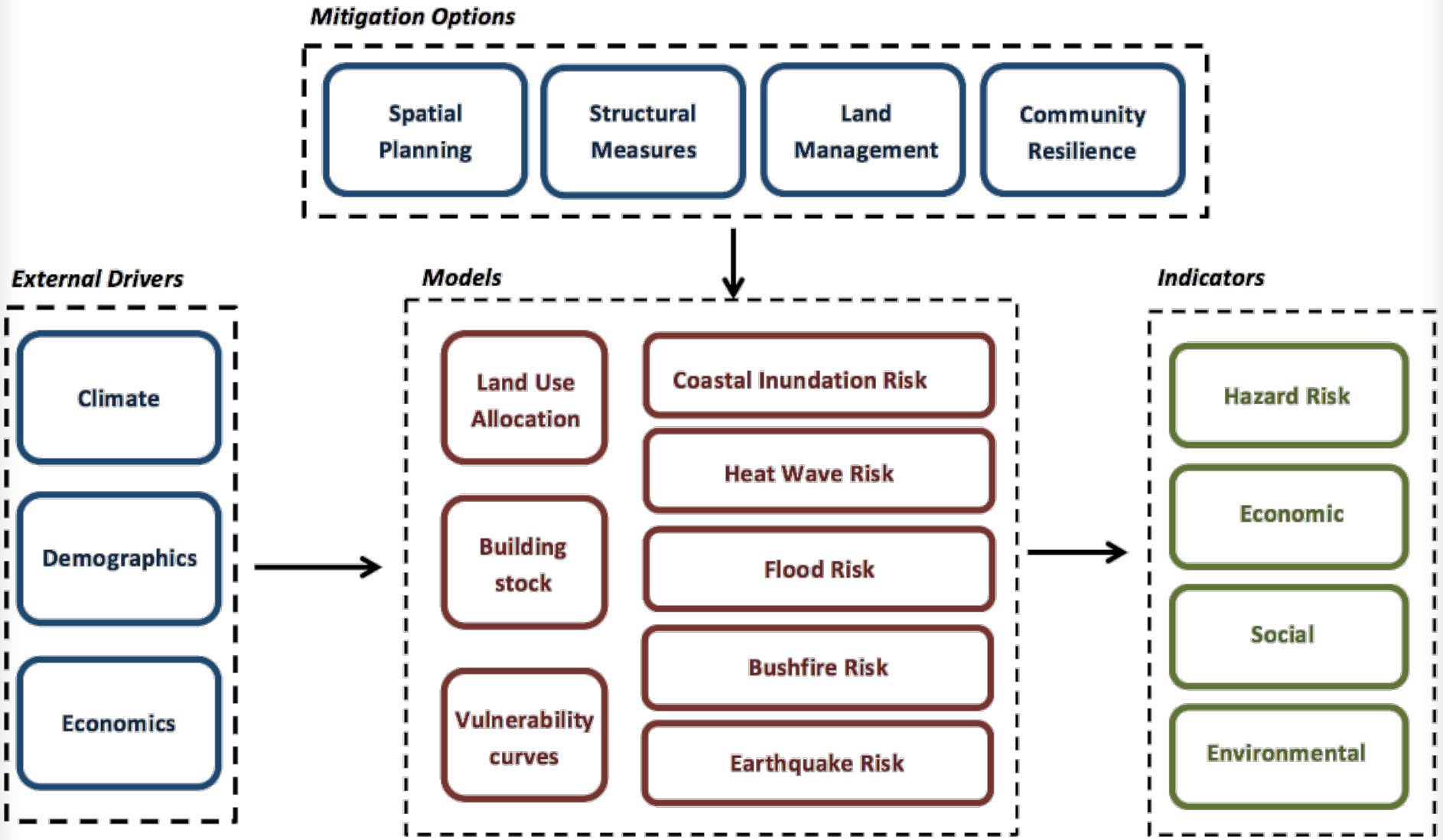

Mitigation Options
Spatial Planning
Structural Measures
Land Management
Community Resilience
External Drivers
Climate
Demographics
Economics
Models
Land Use Allocation
Building stock
Vulnerability curves
Coastal Inundation Risk
Heat Wave Risk
Flood Risk
Bushfire Risk
Earthquake Risk
Indicators
Hazard Risk
Economic
Social
Environmental


Landuse model
Exposure
Flood / Coastal Risk
Indicators:
• Building value at risk maps
Vulnerability
Building flood vulnerability curves
Building stock model
Hazard
Flood inundation model
Indicators:
• Inundation maps
Terrain
Climate


Building bushfire vulnerability curves
Building stock model
Bushfire fatality curves
Landuse model
Exposure
Vulnerability
Bushfire Risk
Indicators:
• Building value at risk maps
• Building damage state maps
• Expected fatality maps
Hazard
Bushfire Likelihood Model
Ignition Potential
Fire Behaviour
Historical Fire data, lightning potential data
90% Weather, Fuel Group, Slope Factors


Building earthquake vulnerability curves
Building stock model
Earthquake fatality curves
Landuse model
Exposure
Vulnerability
Earthquake Risk
Indicators:
• Building value at risk maps
• Building damage state maps
• Expected fatality maps
Hazard
Earthquake ground acceleration model
Soil and geological data, Vs30 data
Indicators:
• Acceleration maps for big, medium and small events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Hazard Risk
Economic
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Environmental

HAZARD RISK IS INCREASING

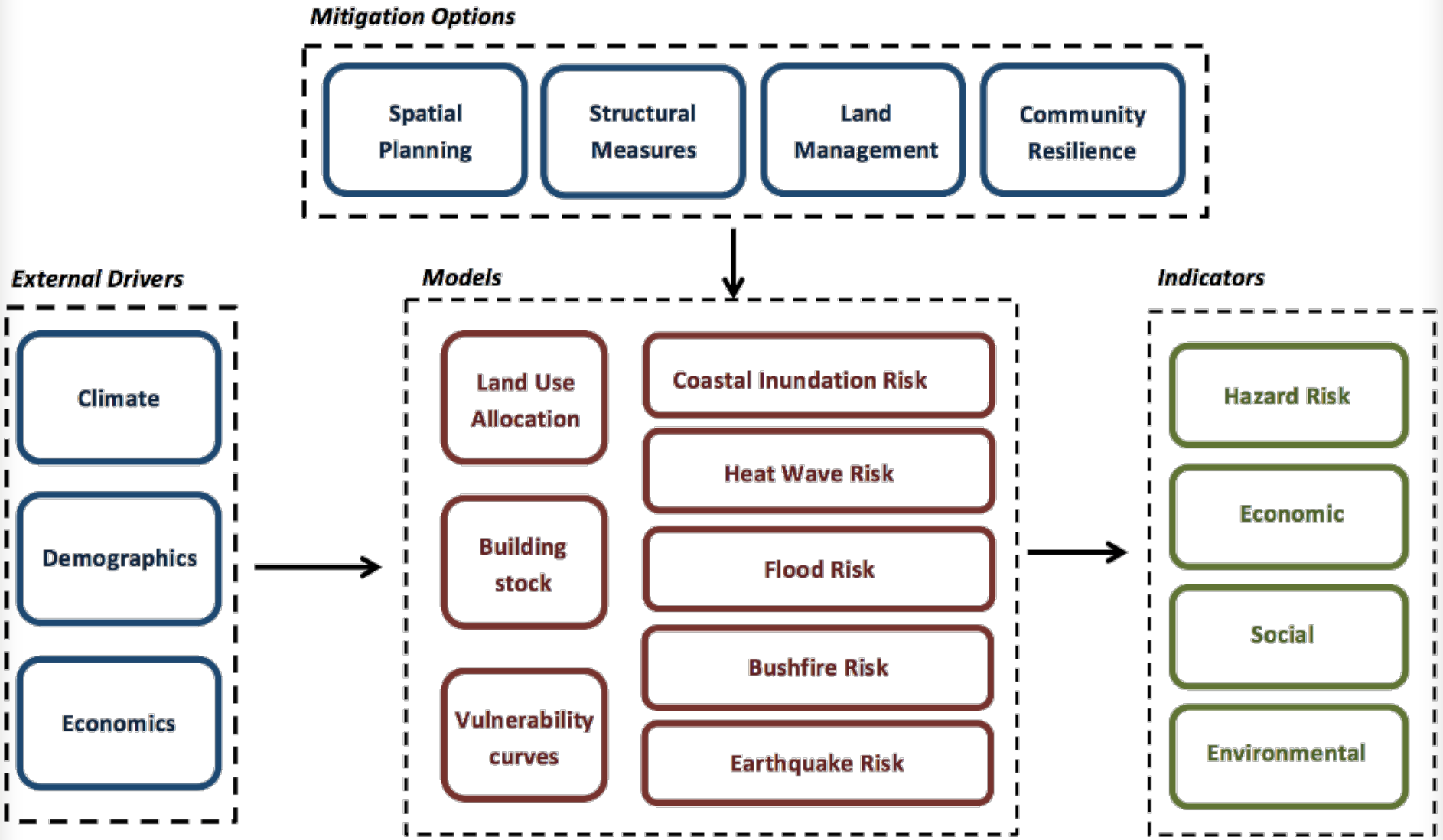
Increased population and assets

Increased value of assets

Climate change

Increased population in high risk areas

Ageing population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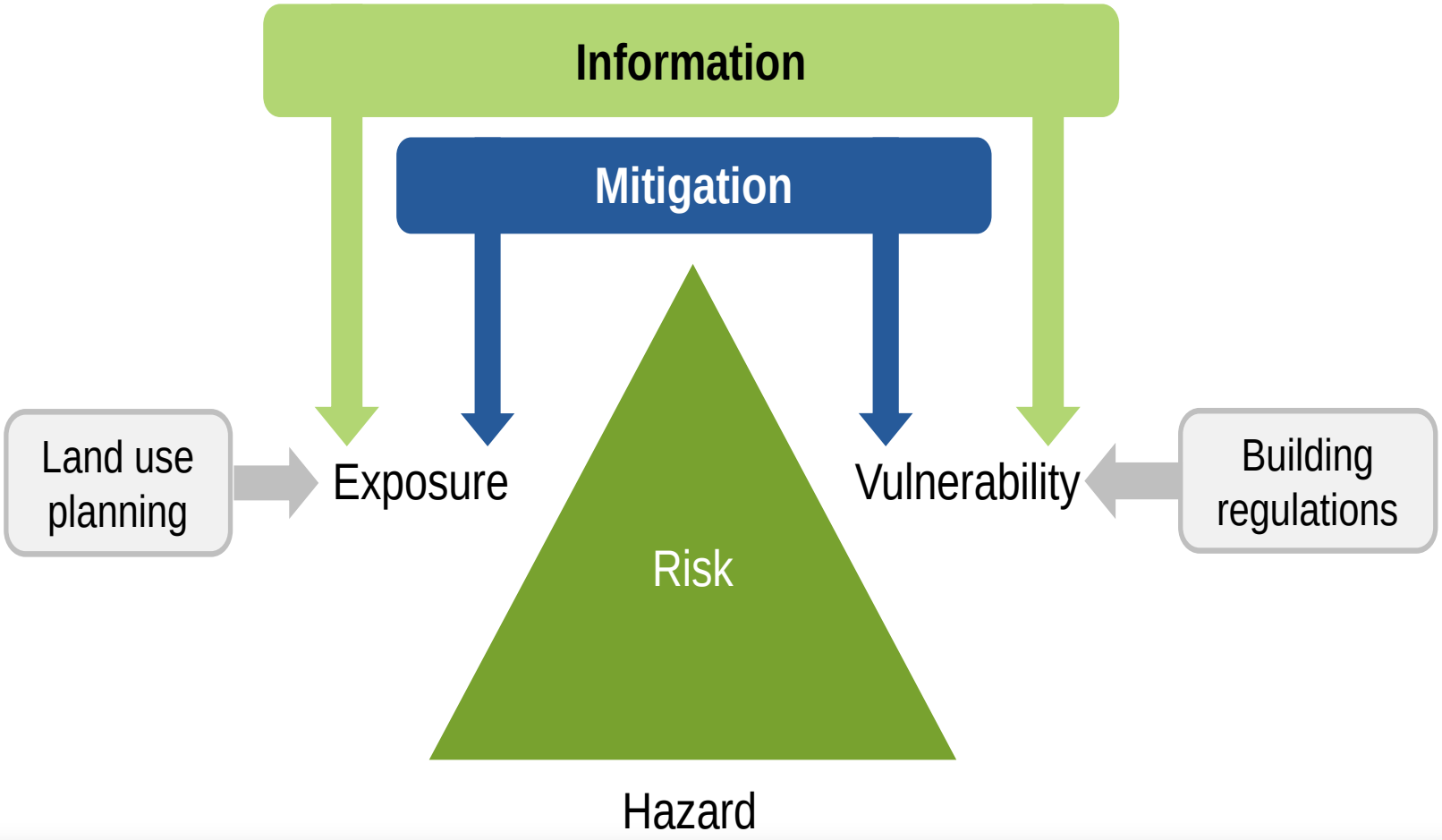
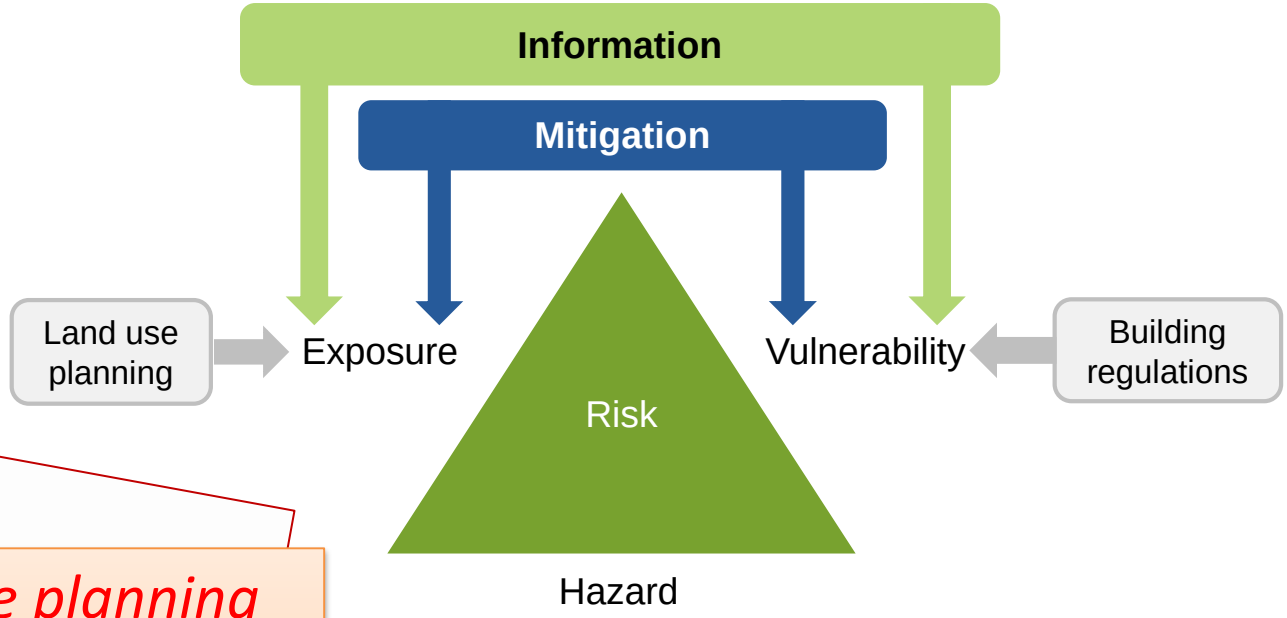
Economic
Social
Environmental

DISASTER RISK CAN BE MITIGATED BY REDUCING EXPOSURE, VULNERABILITY (AND SOMETIMES HAZARD)



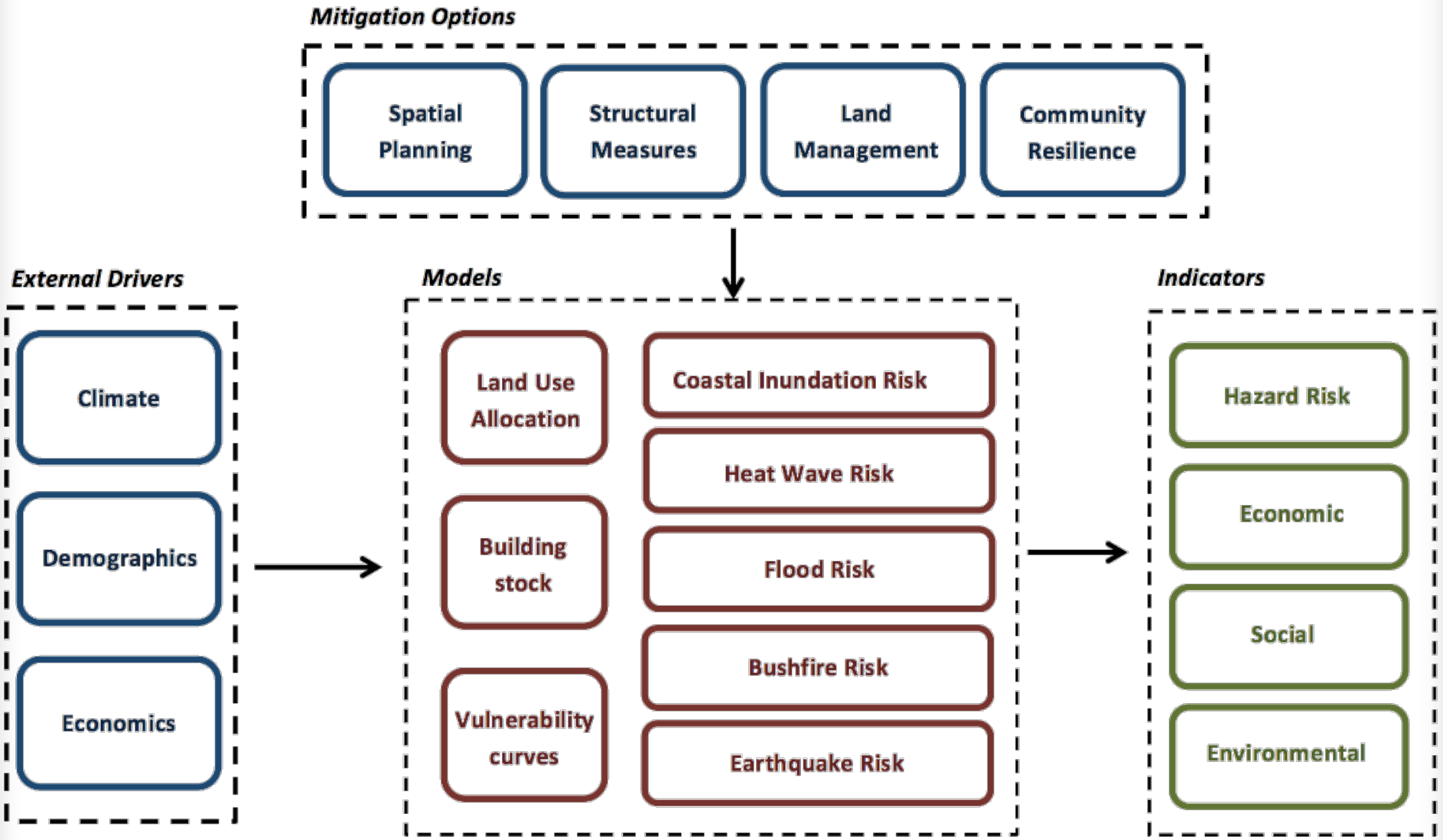
(Source: Productivity Commission Draft Report)

LAND USE PLANNING IS VITALLY IMPORTANT



*"Land use planning is perhaps **the most potent policy lever** for influencing the level of future natural disaster risk"*

mission Draft Report)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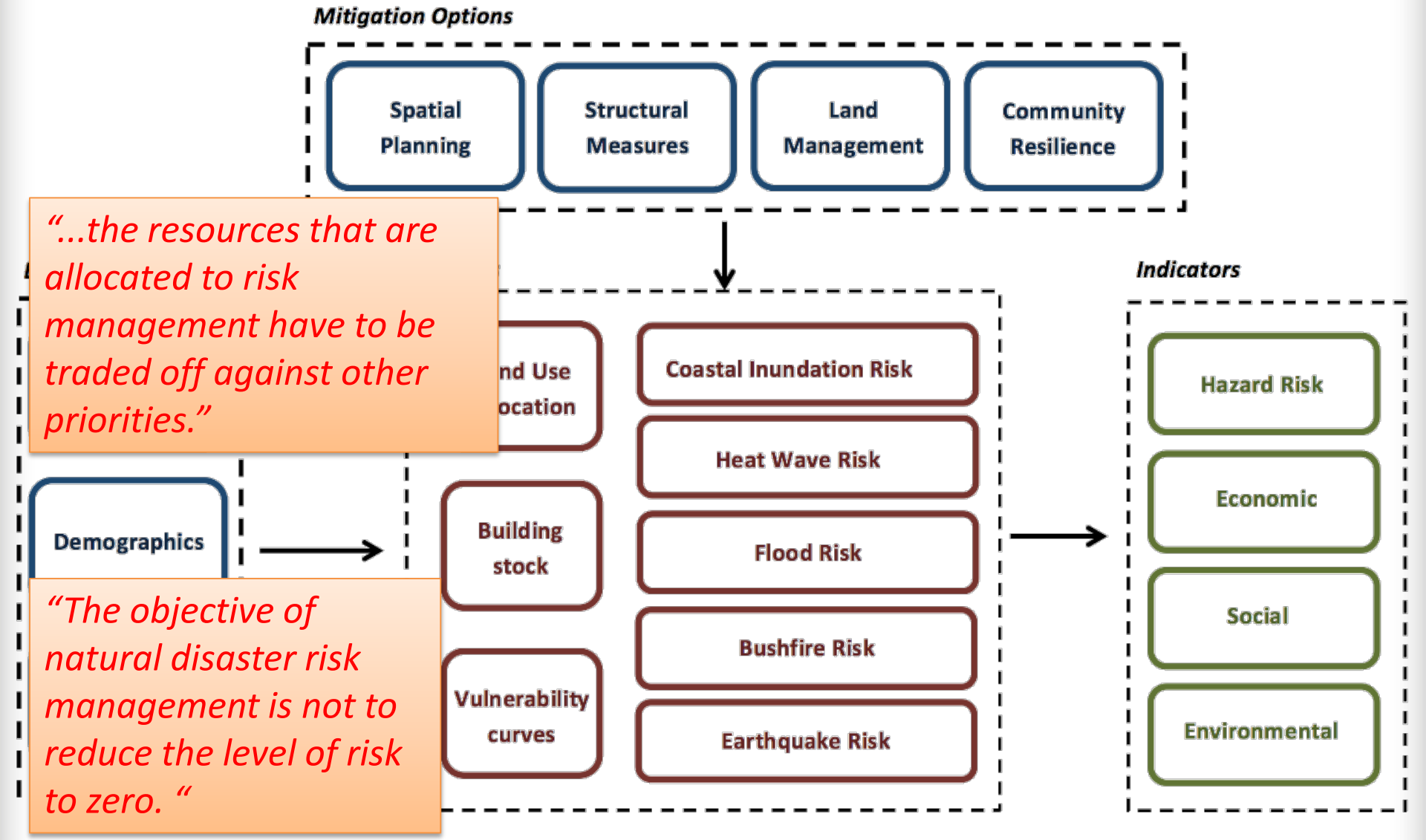

Mitigation Options
Spatial Planning
Structural Measures
Land Management
Community Resilience
"...the resources that are allocated to risk management have to be traded off against other priorities."
Indicators
Demographics
nd Use
ocation
Building stock
Vulnerability curves
Coastal Inundation Risk
Heat Wave Risk
Flood Risk
Bushfire Risk
Earthquake Risk
Hazard Risk
Economic
Social
Environmental
"The objective of natural disaster risk management is not to reduce the level of risk to zero. "

A Decision Support System for the Assessment of Policy & Planning Investment Options For Optimal Natural Hazard Mitigation

How the system assesses risk

How you can use the system, what it can do for you

Work ahead and end-user engagement

USING THE SYSTEM

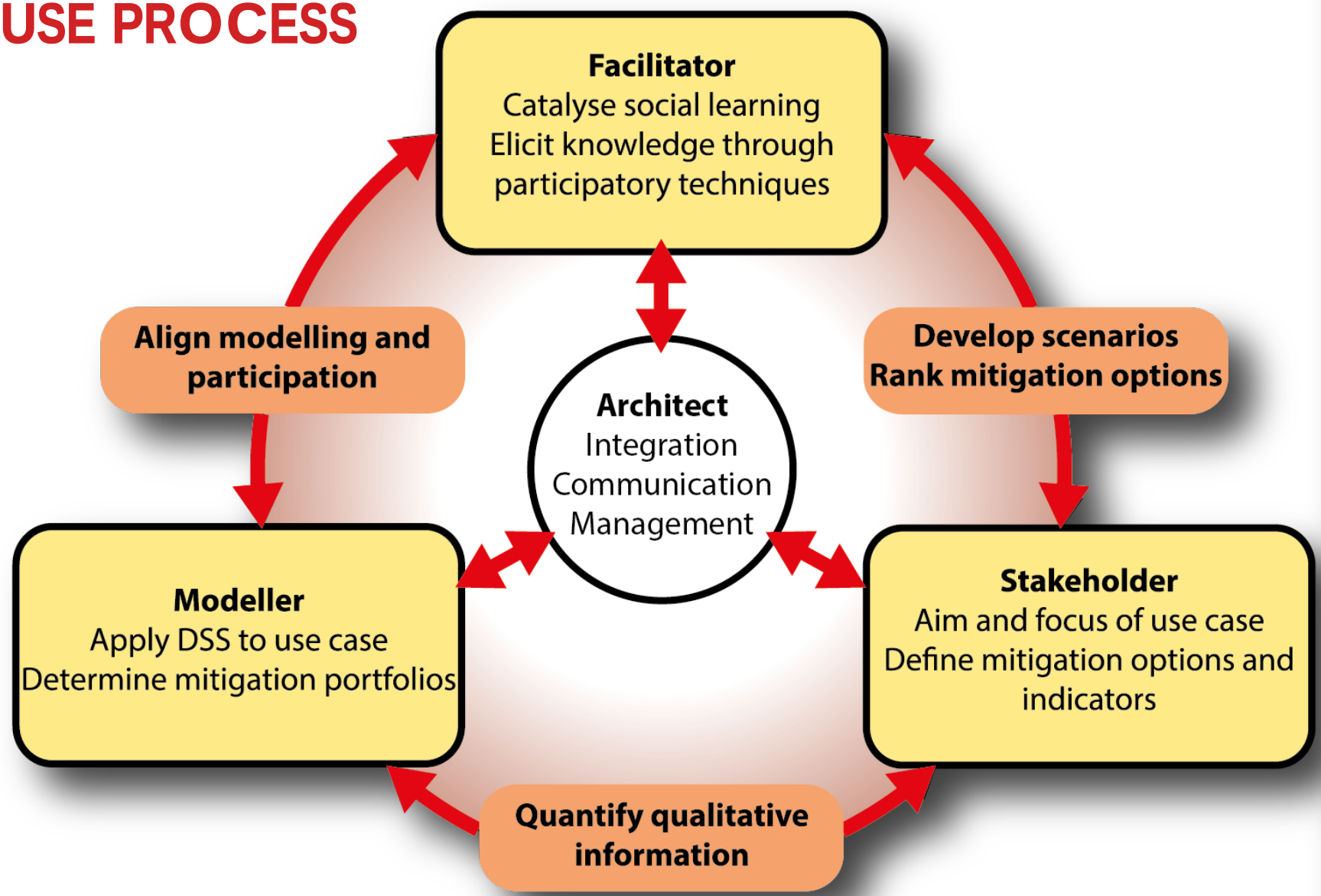
1) Where should the system be?
2) How do I use the system?
3) What can I do with the system?
4) What does the software look like?

WHERE SHOULD THE SYSTEM BE?

HOW DO I USE THE SYSTEM?

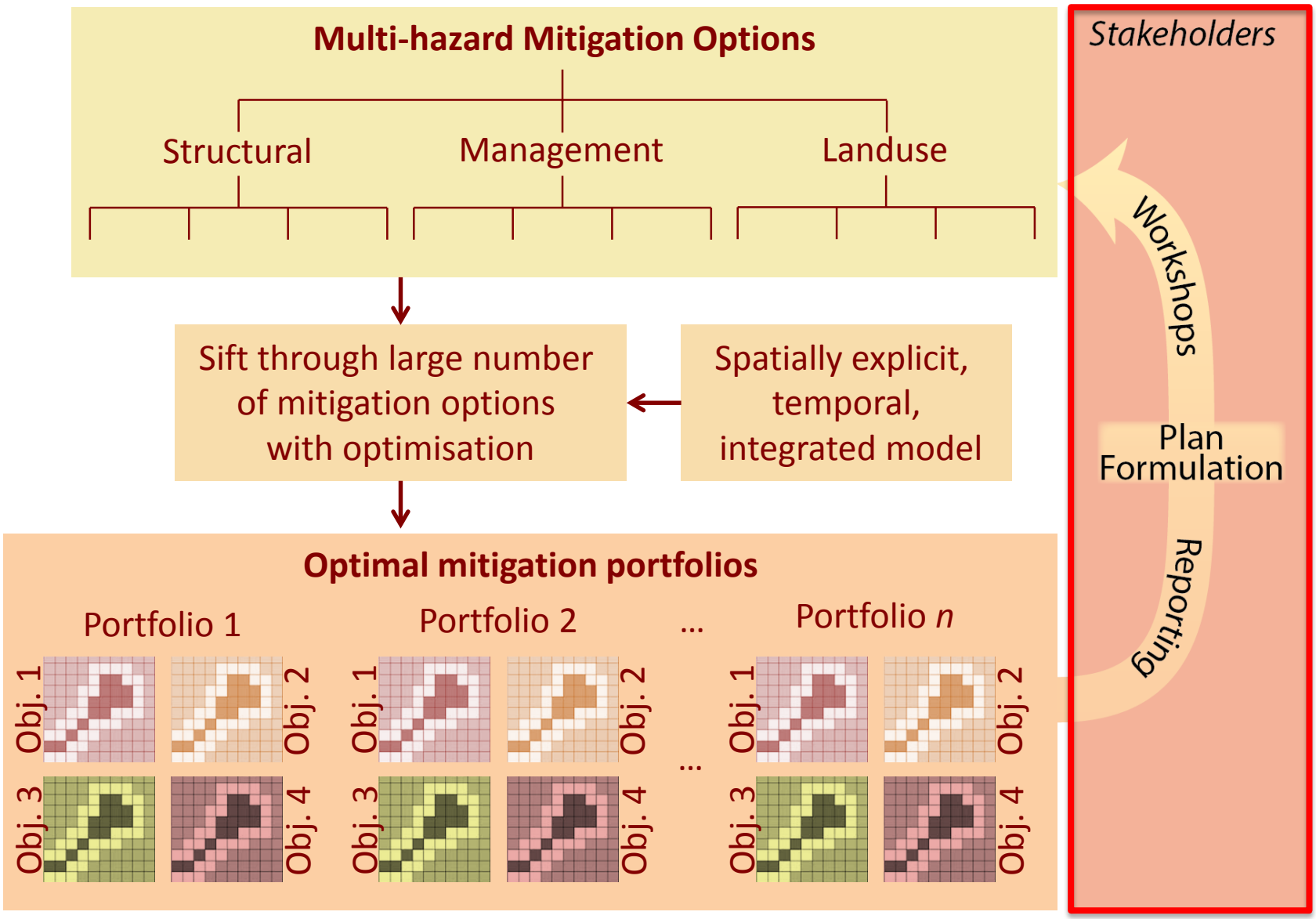
Social learning occurs when stakeholders, modellers and facilitators explore and evaluate policy options through group interaction with the DSS — adding value over the common approach where reports are delivered using software.

USE PROCESS


Facilitator
Catalyse social learning
Elicit knowledge through participatory techniques
Align modelling and participation
Develop scenarios
Rank mitigation options
Architect
Integration
Communication
Management
Modeller
Apply DSS to use case
Determine mitigation portfolios
Stakeholder
Aim and focus of use case
Define mitigation options and indicators
Quantify qualitative information

WHAT CAN THE SYSTEM DO?

1) Identify areas of risk, now and into the future
2) Understand the implications of this risk, through indicators
3) Test different mitigation options
4) Identify/suggest mitigation portfolios, through sifting through a large number of mitigation options with optimisation.


Multi-hazard Mitigation Options
Structural
Management
Landuse
Sift through large number of mitigation options with optimisation
Spatially explicit, temporal, integrated model
Optimal mitigation portfolios
Portfolio 1
Portfolio 2
...
Portfolio n
Obj. 1
Obj. 2
Obj. 3
Obj. 4
Stakeholders
Workshops
Plan Formulation
Reporting

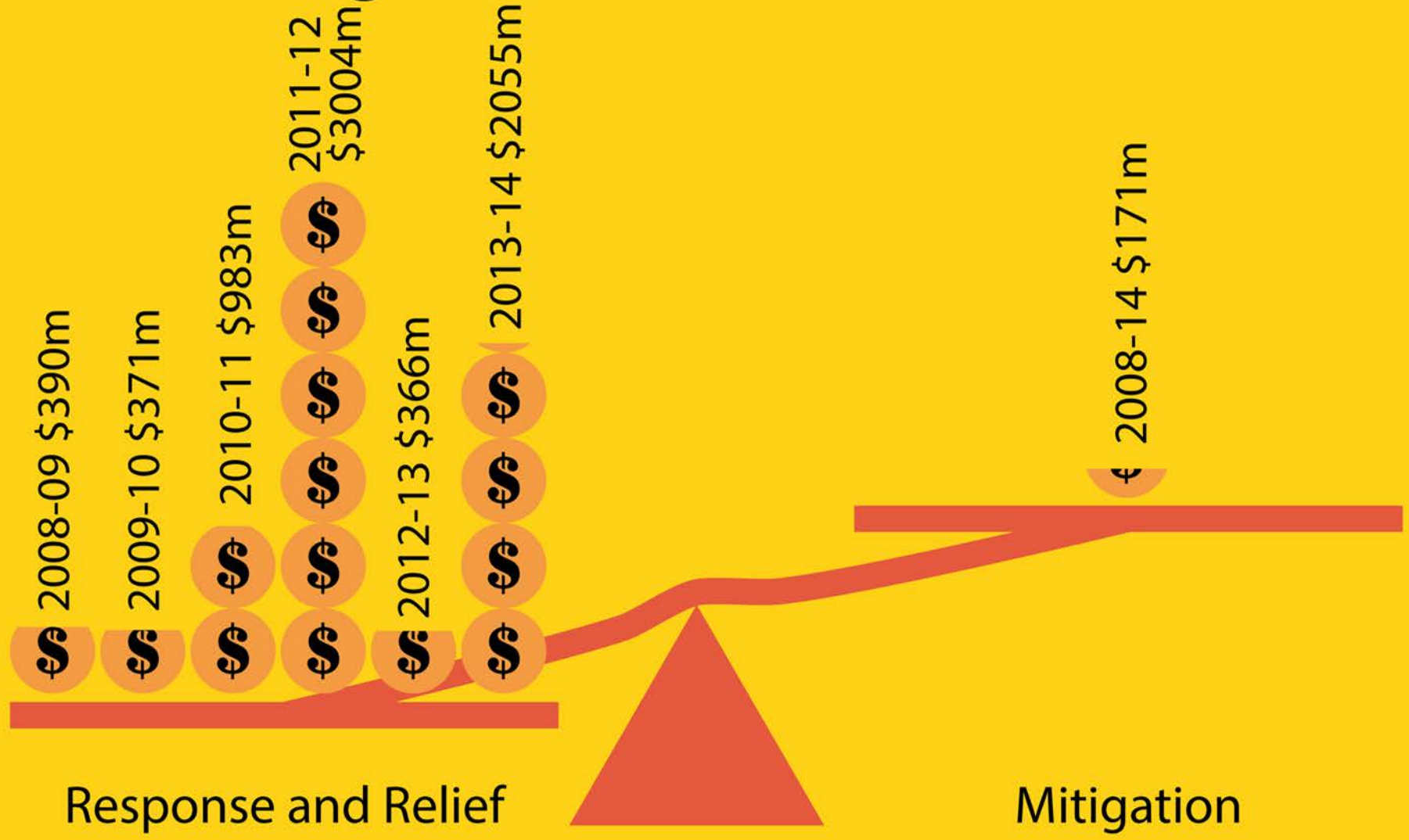
Mitigation Investment Ratio

1:4 ratio

Predisaster
Mitigation spend

Reduces present value
of postdisaster recovery spend
by factor of about 4

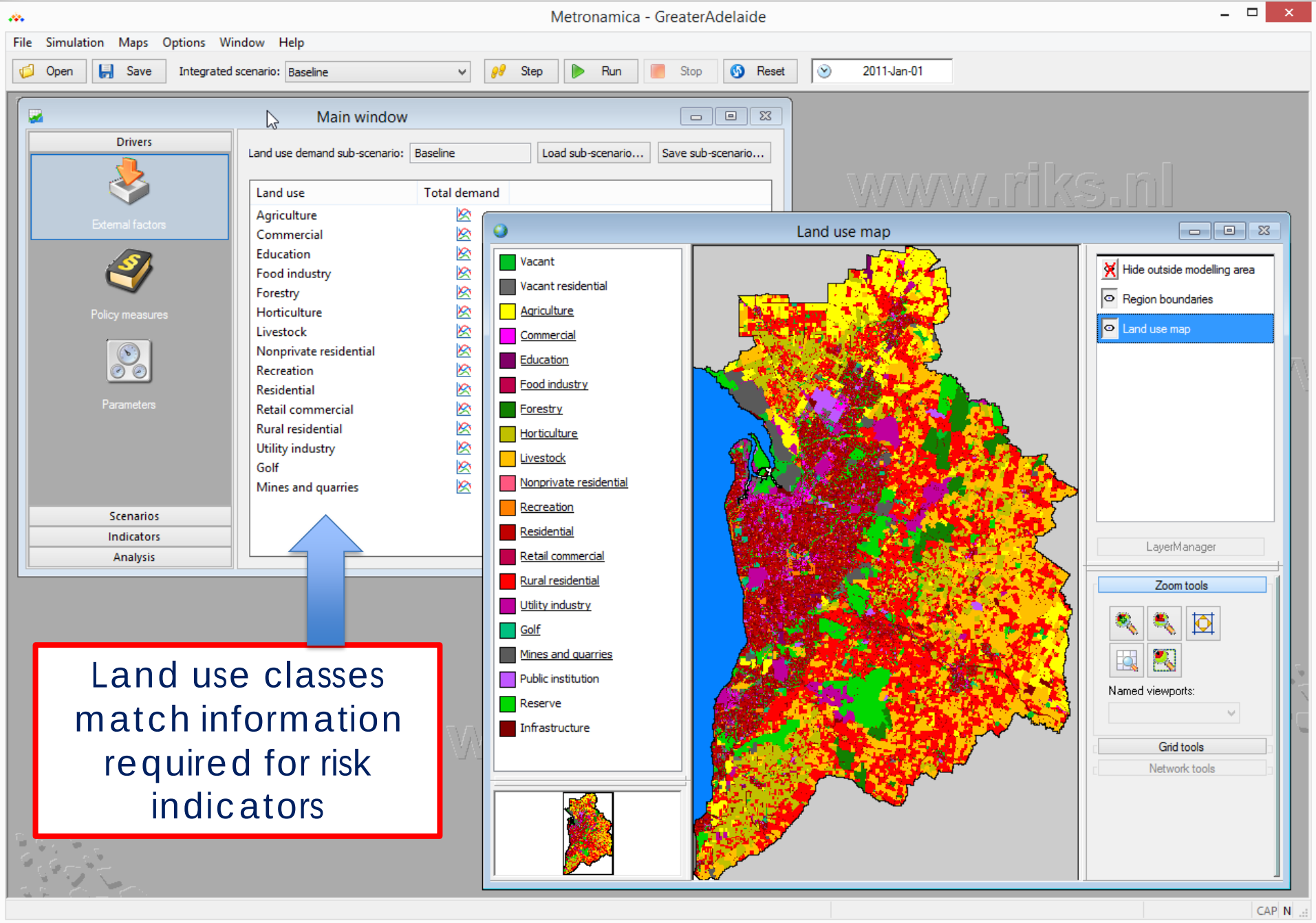
Mitigation Investment Ratio

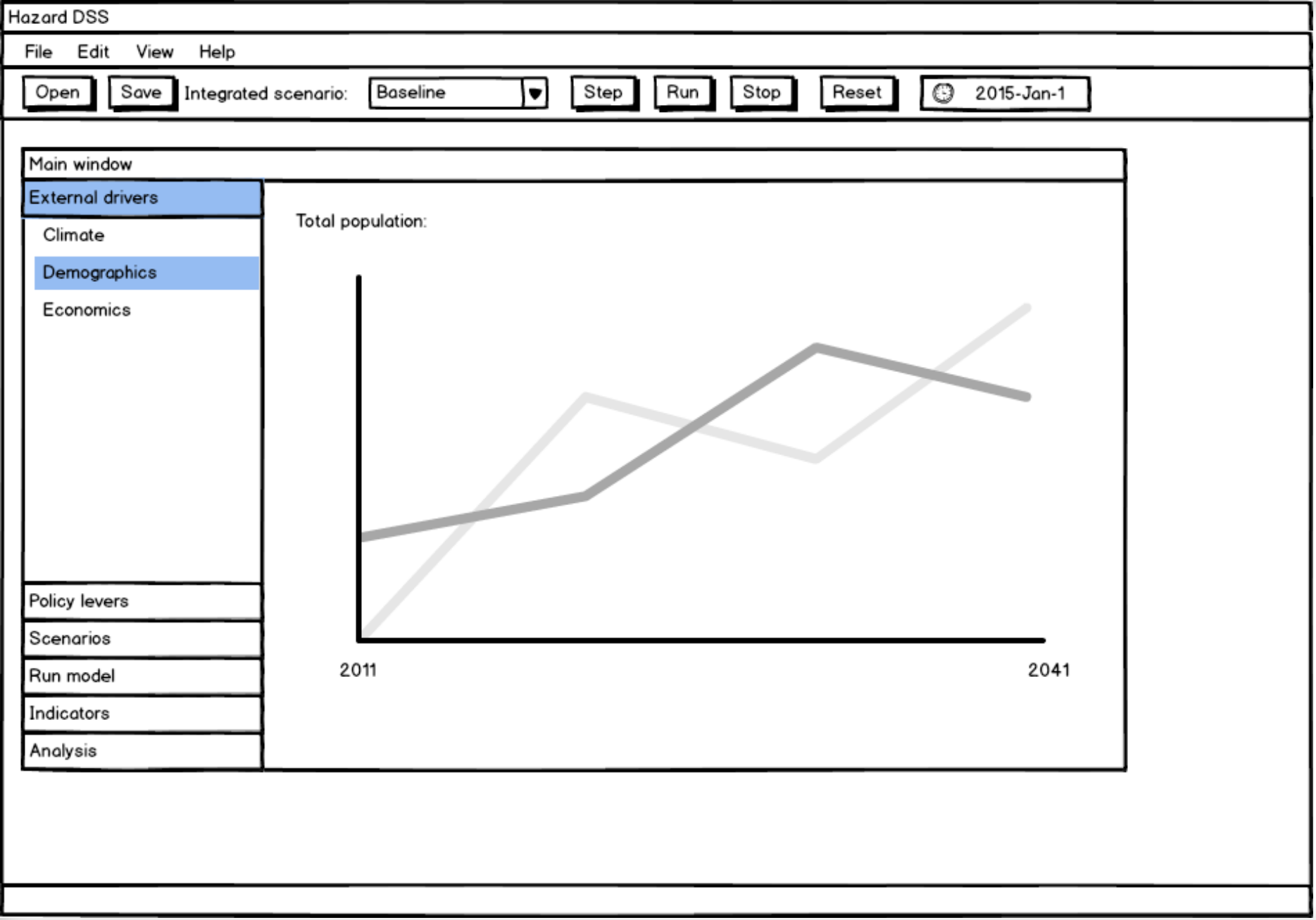


*"On balance, total **mitigation expenditure** across all levels of government is more likely to be **below the optimal level** than above it, given the biased incentives towards recovery under current budget treatments and funding arrangements."*

The Australian Government *"...should **increase annual mitigation expenditure gradually to $200 million**, distributed to the states and territories on a per capita basis."*

WHAT DOES THE SYSTEM LOOK LIKE?


Metronamica - GreaterAdelaide
File Simulation Maps Options Window Help
Open Save Integrated scenario: Baseline Step Run Stop Reset 2011-Jan-01
Main window
Drivers
External factors
Policy measures
Parameters
Scenarios
Indicators
Analysis
Land use demand sub-scenario: Baseline Load sub-scenario... Save sub-scenario...
Land use Total demand
Agriculture
Commercial
Education
Food industry
Forestry
Horticulture
Livestock
Nonprivate residential
Recreation
Residential
Retail commercial
Rural residential
Utility industry
Golf
Mines and quarries
Land use map
Vacant
Vacant residential
Agriculture
Commercial
Education
Food industry
Forestry
Horticulture
Livestock
Nonprivate residential
Recreation
Residential
Retail commercial
Rural residential
Utility industry
Golf
Mines and quarries
Public institution
Reserve
Infrastructure
Hide outside modelling area
Region boundaries
Land use map
LayerManager
Zoom tools
Named viewports:
Grid tools
Network tools
Land use classes match information required for risk indicators
www.riks.nl
CAP N
bnhcrc.com.au


Hazard DSS
File
Edit
View
Help
Open
Save
Integrated scenario:
Baseline
Step
Run
Stop
Reset
2015-Jan-1
Main window
External drivers
Climate
Demographics
Economics
Policy levers
Scenarios
Run model
Indicators
Analysis
Total population:
2011
2041

Hazard DSS

File Edit View Help

Open | Save | Integrated scenario: Baseline | Step | Run | Stop | Reset | 2015-Jan-1

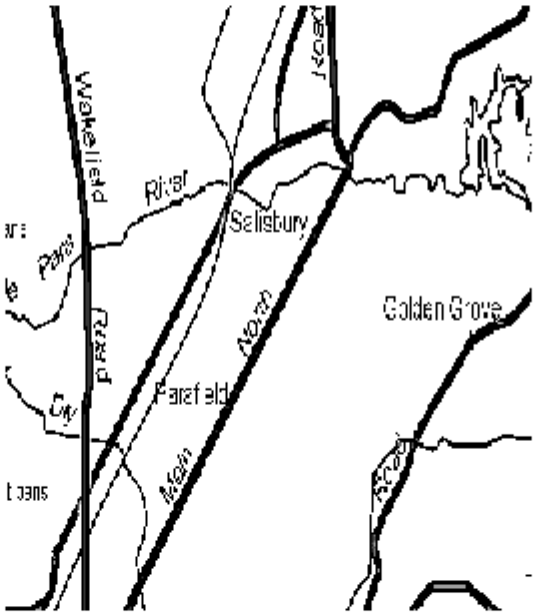
Main window

- External drivers
- Policy levers
  - Spatial planning
  - Land management
  - Structural measures
  - Community resilience
- Scenarios
- Run model
- Indicators
- Analysis

Land management sub-scenario: Baseline | Load... | Save...

Draw land managment interventions:

- (•) Planned burning
- ( ) Vegetation clearance
- ( ) Change in vegetation type

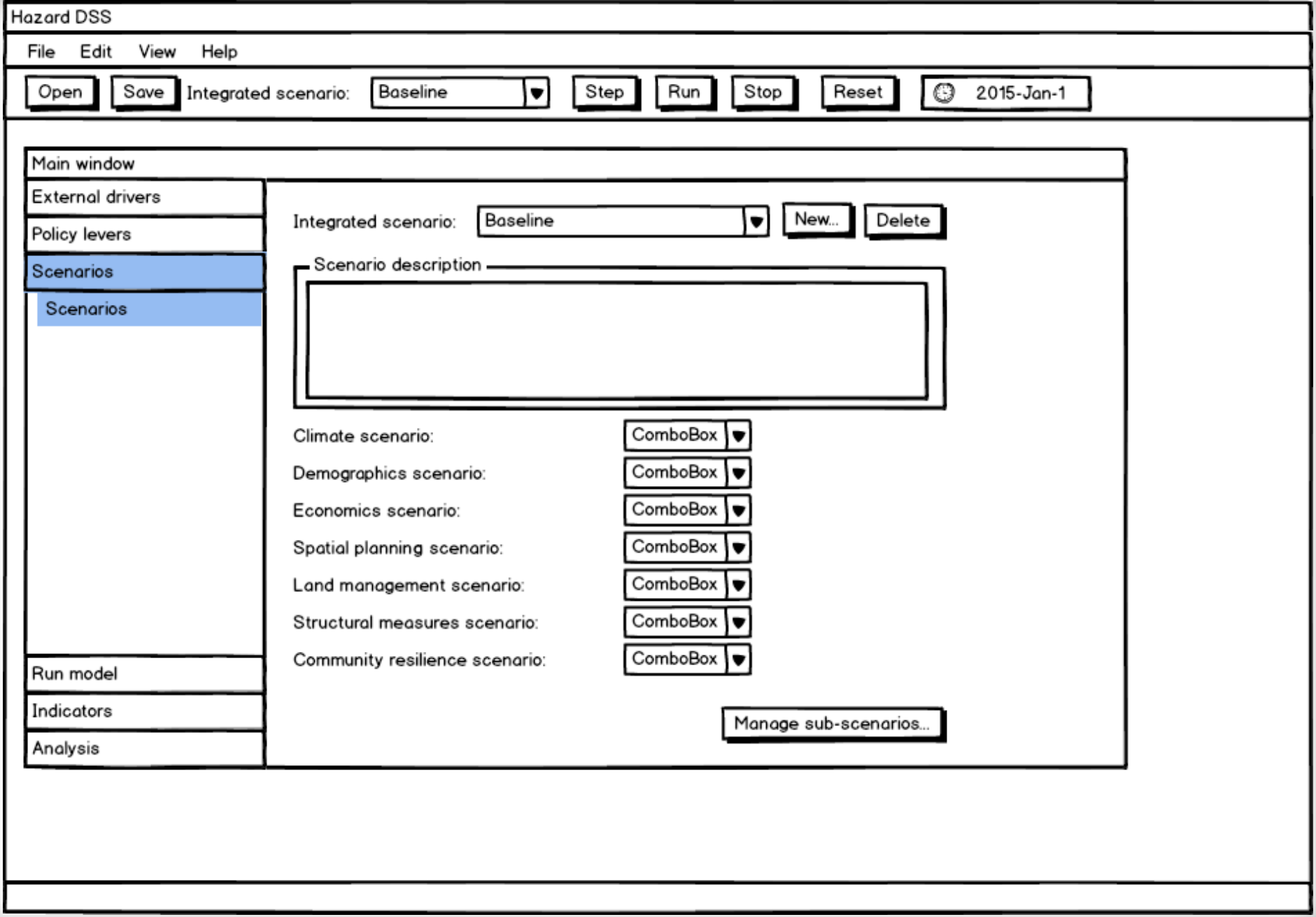


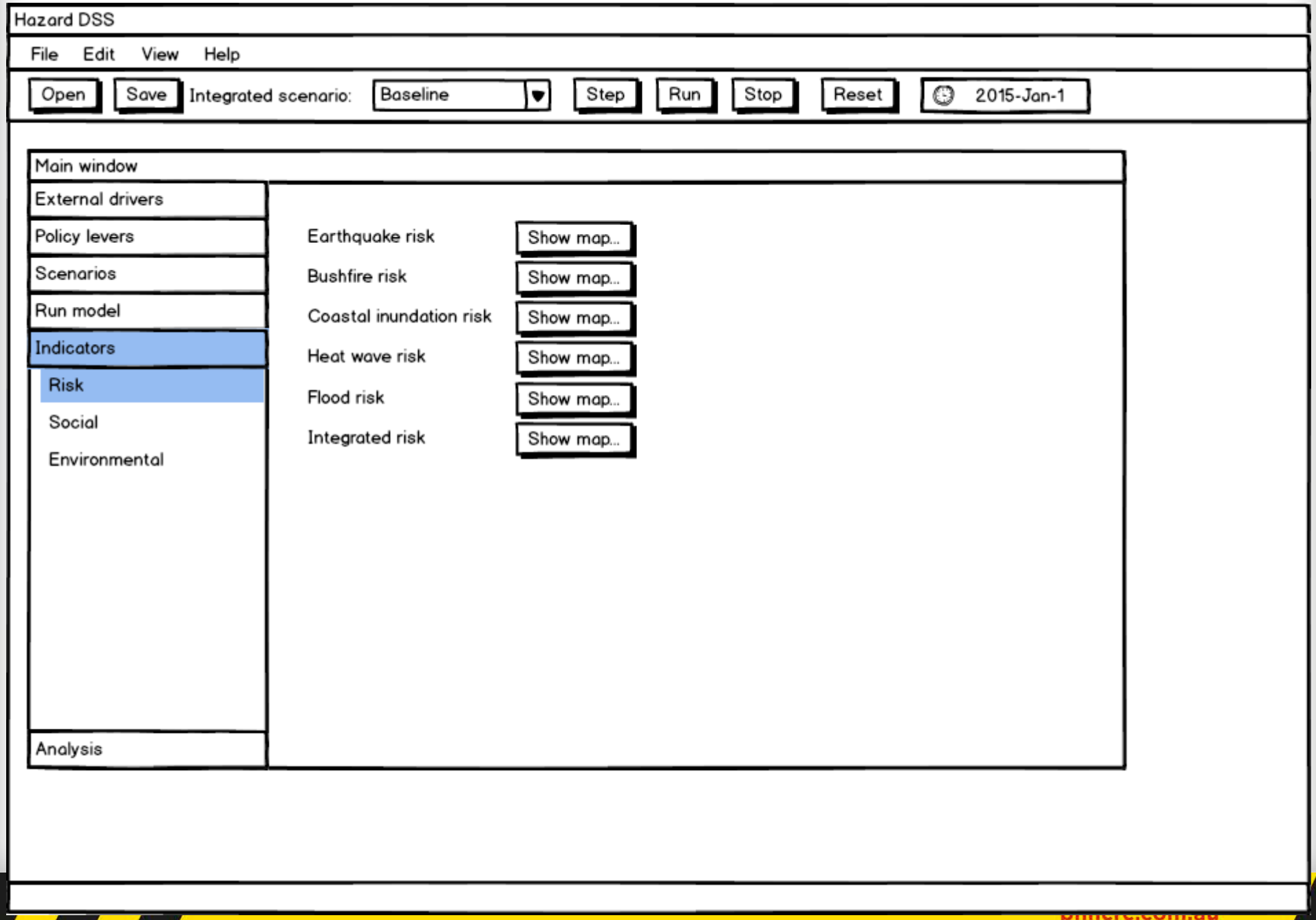
Map layers

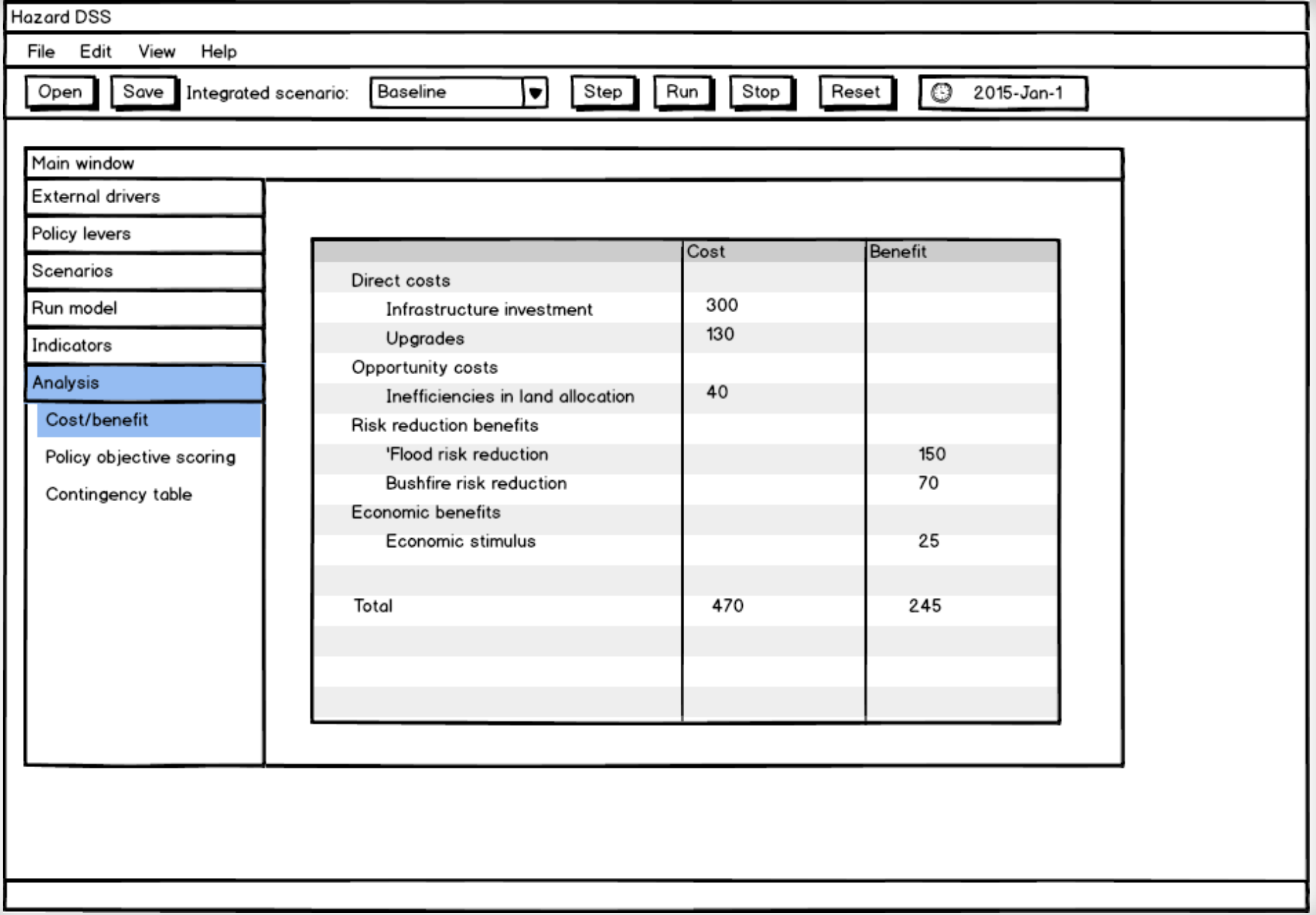
- Land use
- Vegetation
- Management

Grid tools

- Pen
- Flood fill
- Copy


Hazard DSS
File
Edit
View
Help
Open
Save
Integrated scenario:
Baseline
Step
Run
Stop
Reset
2015-Jan-1
Main window
External drivers
Policy levers
Scenarios
Scenarios
Run model
Indicators
Analysis
Integrated scenario:
Baseline
New...
Delete
Scenario description
Climate scenario:
Demographics scenario:
Economics scenario:
Spatial planning scenario:
Land management scenario:
Structural measures scenario:
Community resilience scenario:
ComboBox
Manage sub-scenarios...


Hazard DSS
File
Edit
View
Help
Open
Save
Integrated scenario:
Baseline
Step
Run
Stop
Reset
2015-Jan-1
Main window
External drivers
Policy levers
Scenarios
Run model
Indicators
Risk
Social
Environmental
Analysis
Earthquake risk
Show map...
Bushfire risk
Show map...
Coastal inundation risk
Show map...
Heat wave risk
Show map...
Flood risk
Show map...
Integrated risk
Show map...


Hazard DSS
File Edit View Help
Open Save Integrated scenario: Baseline Step Run Stop Reset 2015-Jan-1
Main window
External drivers
Policy levers
Scenarios
Run model
Indicators
Analysis
Cost/benefit
Policy objective scoring
Contingency table
Cost
Benefit
Direct costs
Infrastructure investment 300
Upgrades 130
Opportunity costs
Inefficiencies in land allocation 40
Risk reduction benefits
'Flood risk reduction 150
Bushfire risk reduction 70
Economic benefits
Economic stimulus 25
Total 470 245

A Decision Support System for the Assessment of Policy & Planning Investment Options For Optimal Natural Hazard Mitigation

How the system assesses risk

How you can use the system,

what it can do for you

Work ahead and end-user engagement

NEXT STEPS

- Workshops for DSS development to Victoria and Tasmania cast studies (Oct/Nov 2015)
- Developing Scenarios and mitigation portfolios for Adelaide through Workshops (Oct/Nov 2015)

MAJOR OUTCOMES (1)

1) Utilisation of a **systematic** and **transparent** approach to evaluating disaster and natural hazard mitigation options (e.g. infrastructure, land use, policy).

2) The ability to make **more strategic** and **less responsive** decisions in relation to mitigating the impact of disasters and natural hazards as a result of the availability of better information.

MAJOR OUTCOMES (2)

3) The availability of **prototype decision support software tools** for **three** end-user defined **case studies** to enable recommended options to be identified by sifting through and evaluating and ranking a large number of options).

4) A better understanding of the **trade-offs between economic and risk objectives** for different mitigation options for three end-user defined case studies.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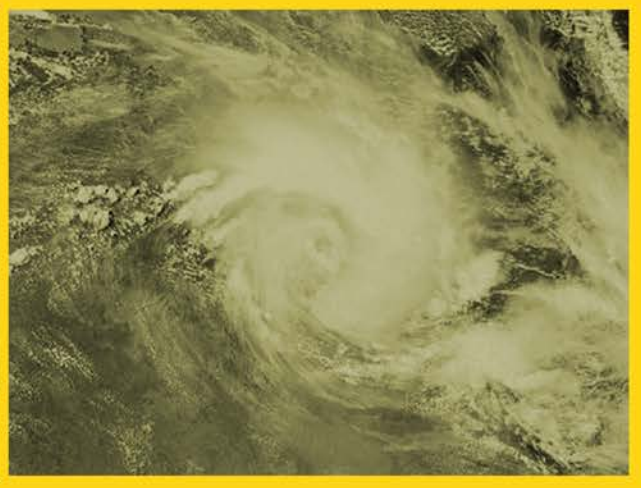
PROJECT TEAM - RESEARCHERS

1) Prof Holger Maier (U of A – Project Leader)
2) A/Prof Hedwig van Delden (U of A / RIKS)
3) Dr Aaron Zecchin (U of A)
4) Prof Graeme Dandy (U of A)
5) Dr Ariella Helfgott (U of A)
6) Jeff Newman (U of A)

7) Graeme Riddell (U of A – PhD Student)
8) Charles Newland (U of A – PhD Student)
9) Michael O'Flaherty (U of A – PhD Student)

bushfire&natural HAZARDSCRC



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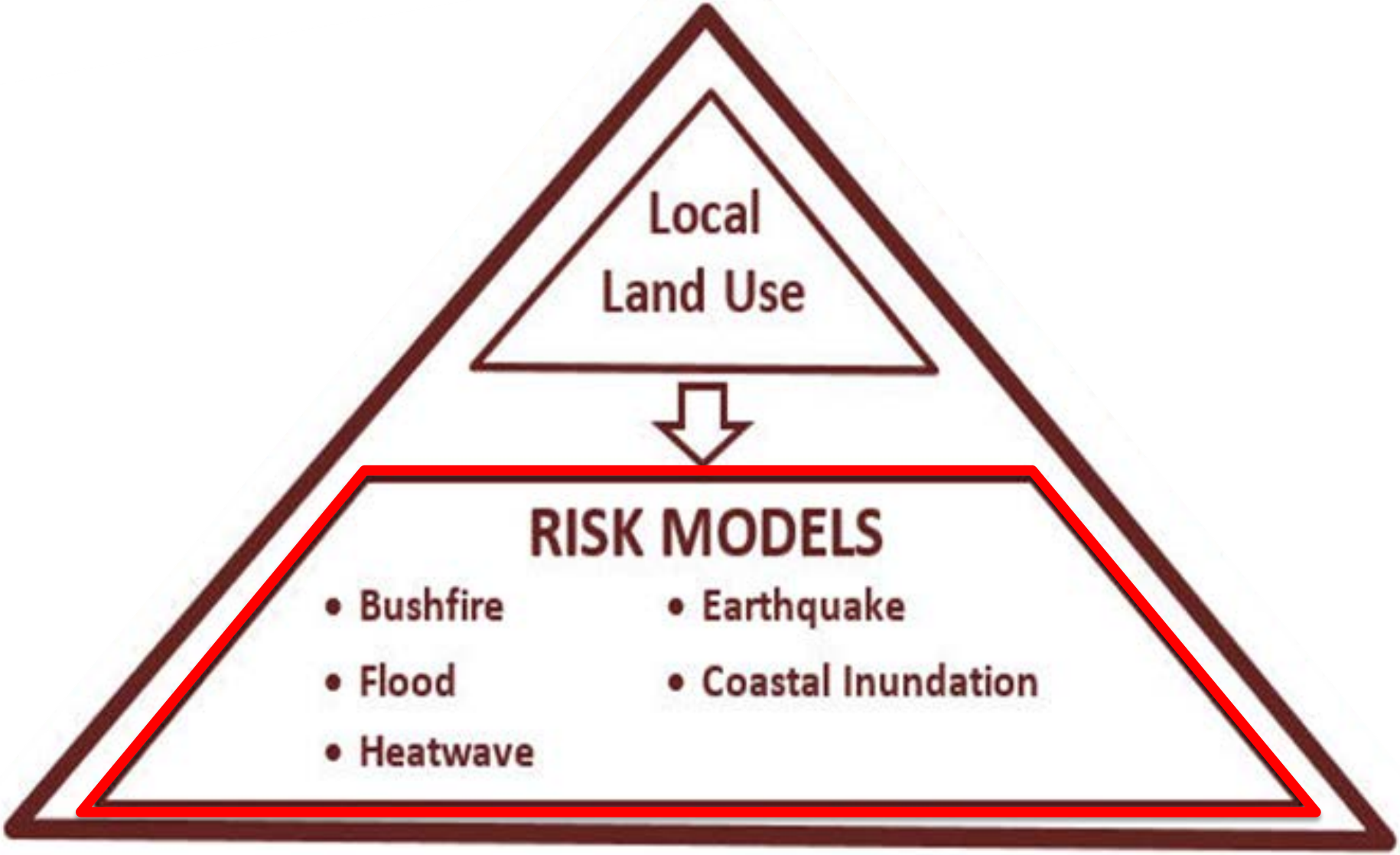
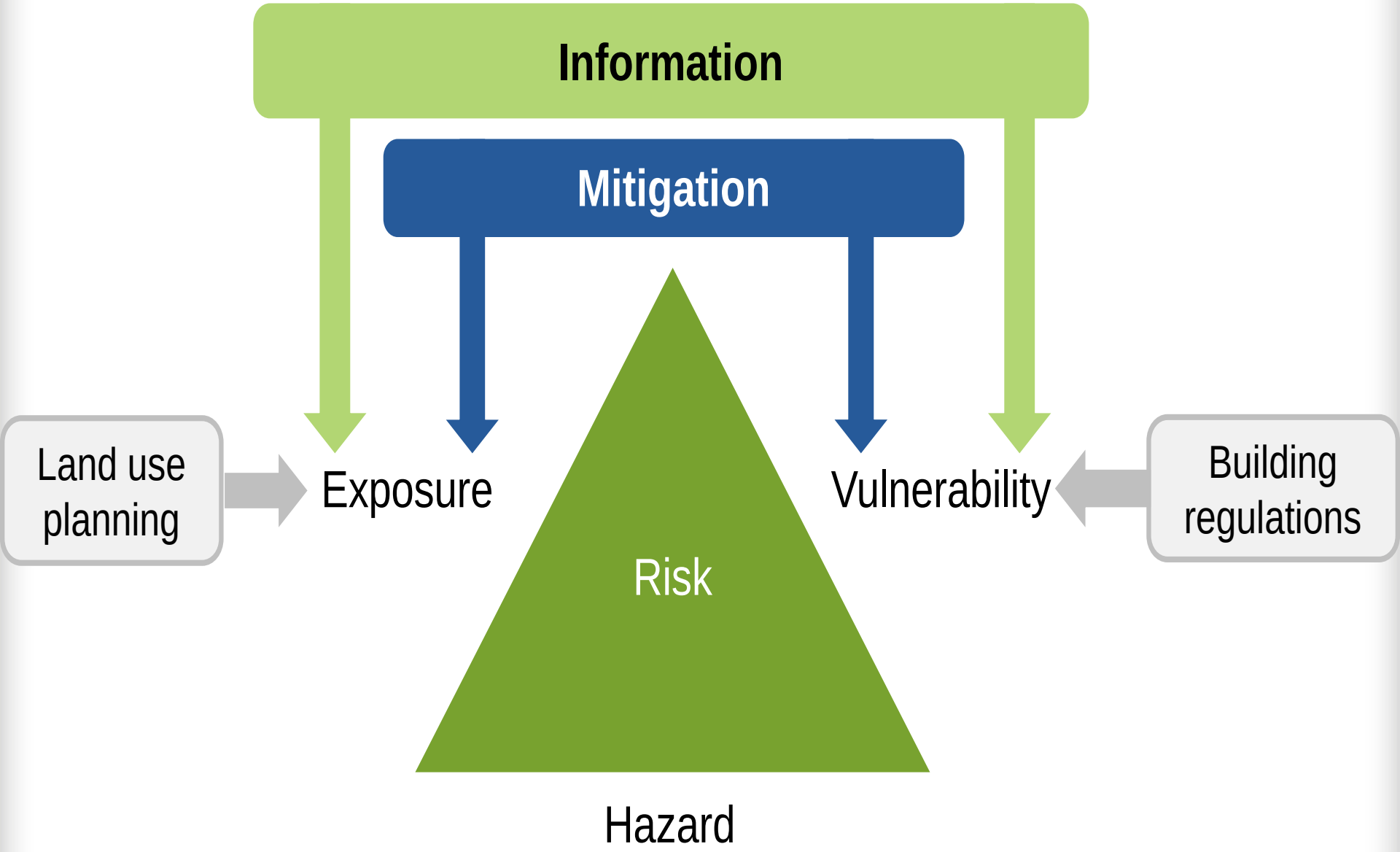
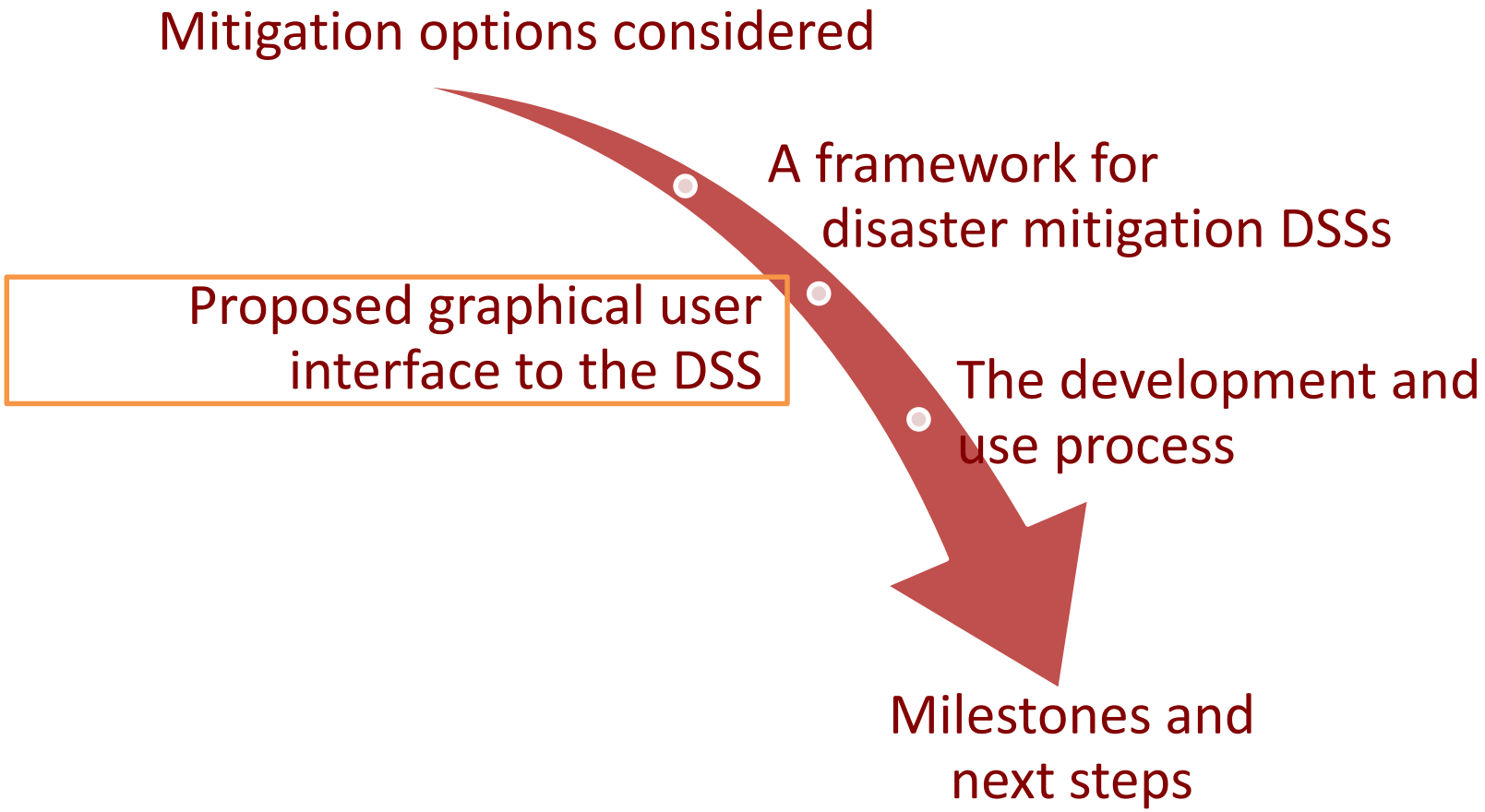

Local
Land Use
RISK MODELS
• Bushfire
• Flood
• Heatwave
• Earthquake
• Coastal Inundation



(Source: Productivity Commission Draft Report)

TODAY'S PRESENTATION



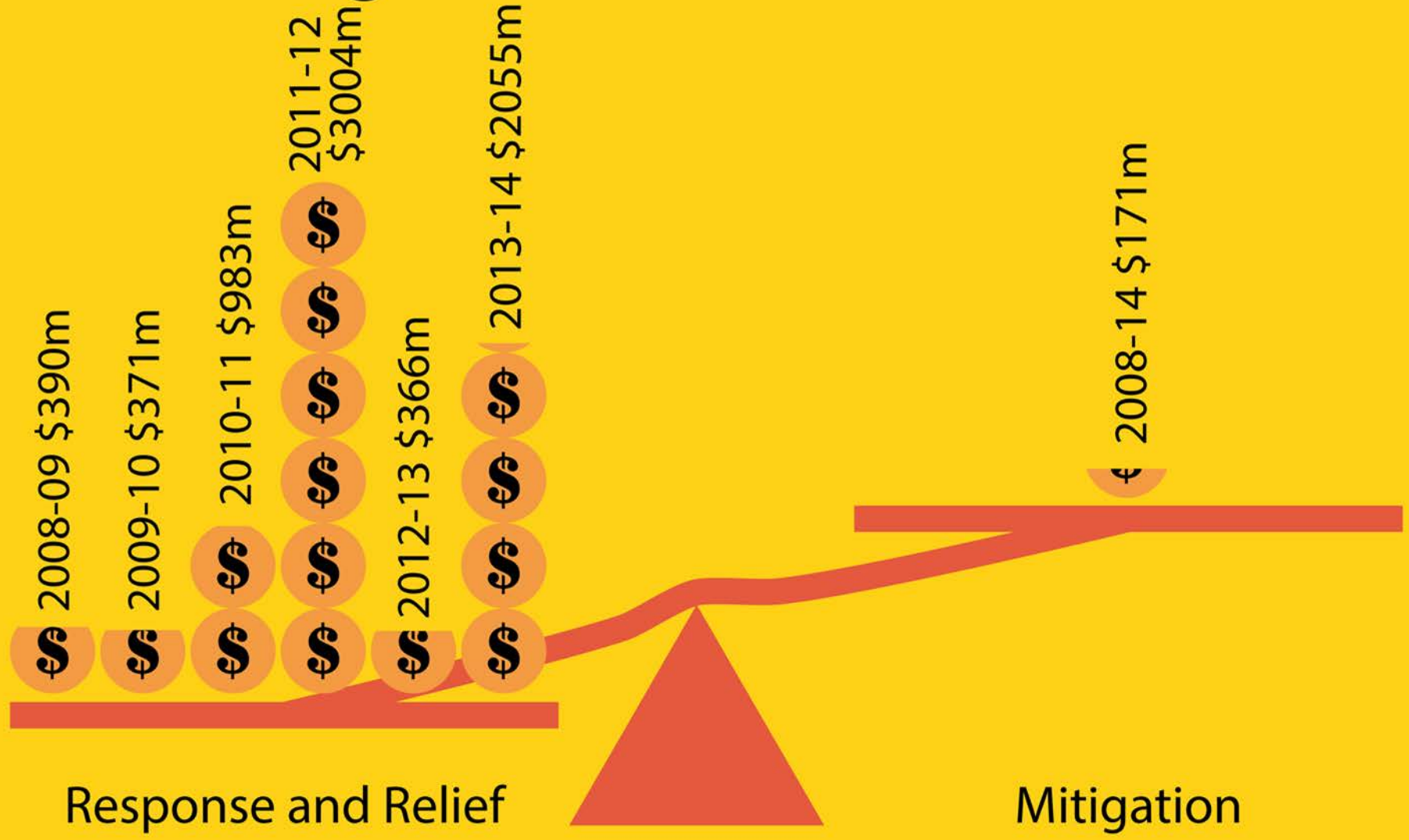
Mitigation Investment Ratio

1:4 ratio

Predisaster
Mitigation spend

Reduces present value
of postdisaster recovery spend
by factor of about 4

Mitigation Investment Ratio



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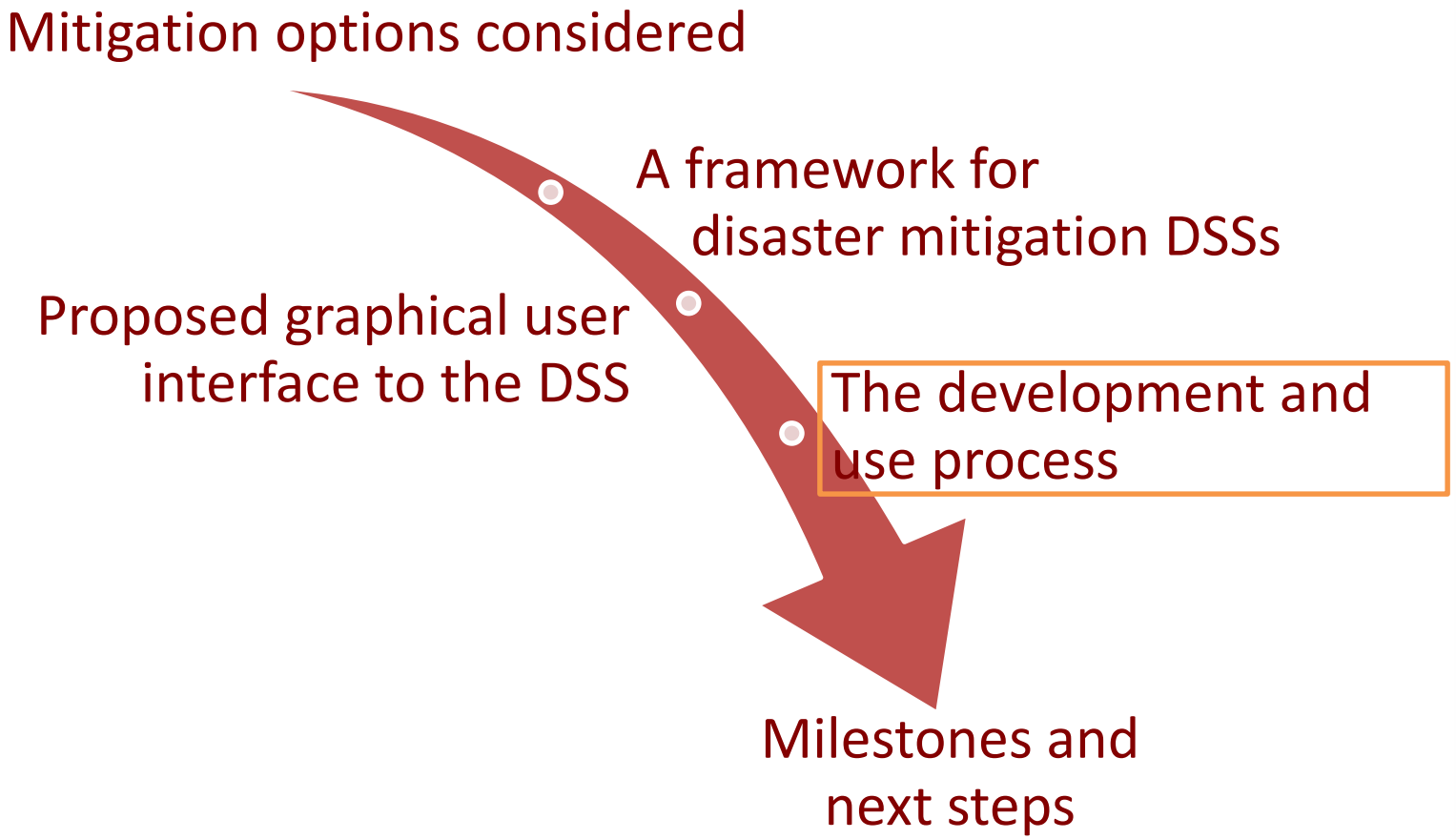
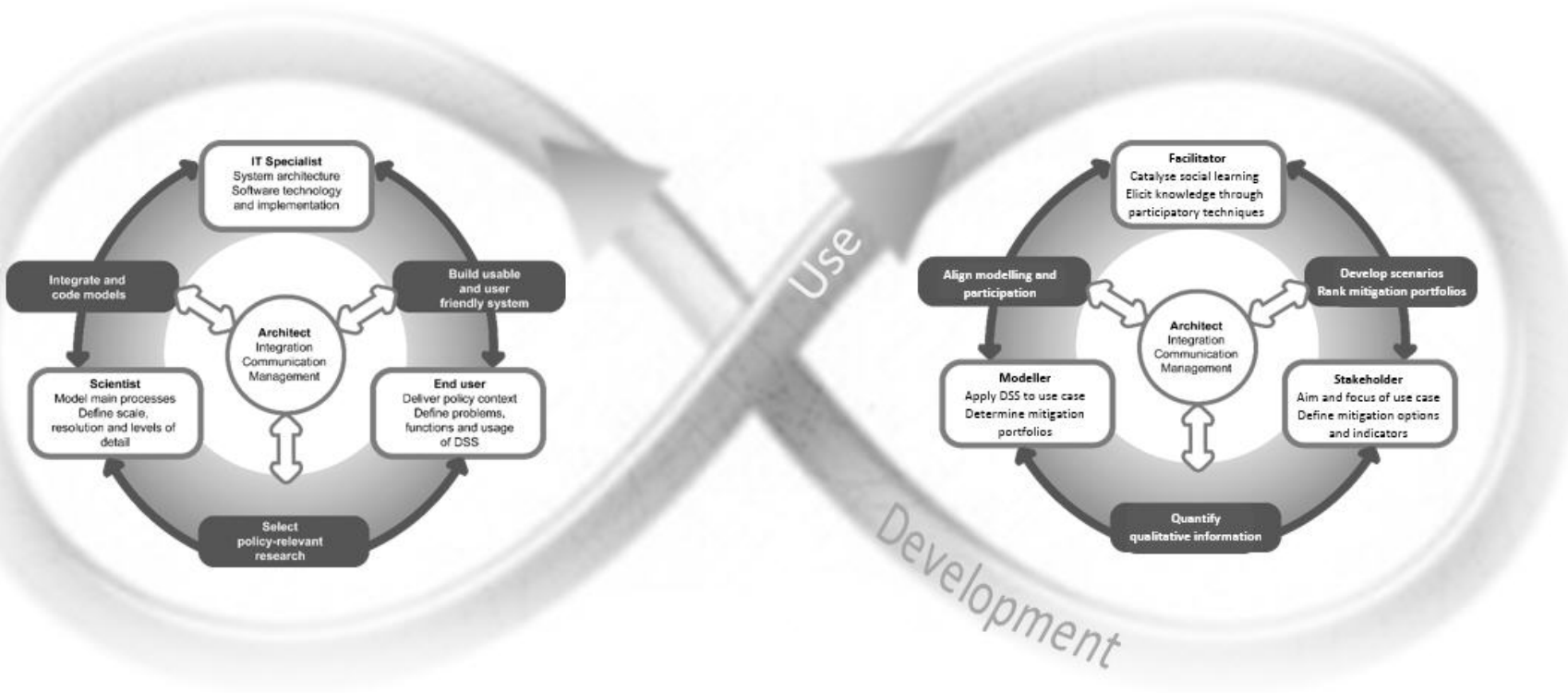
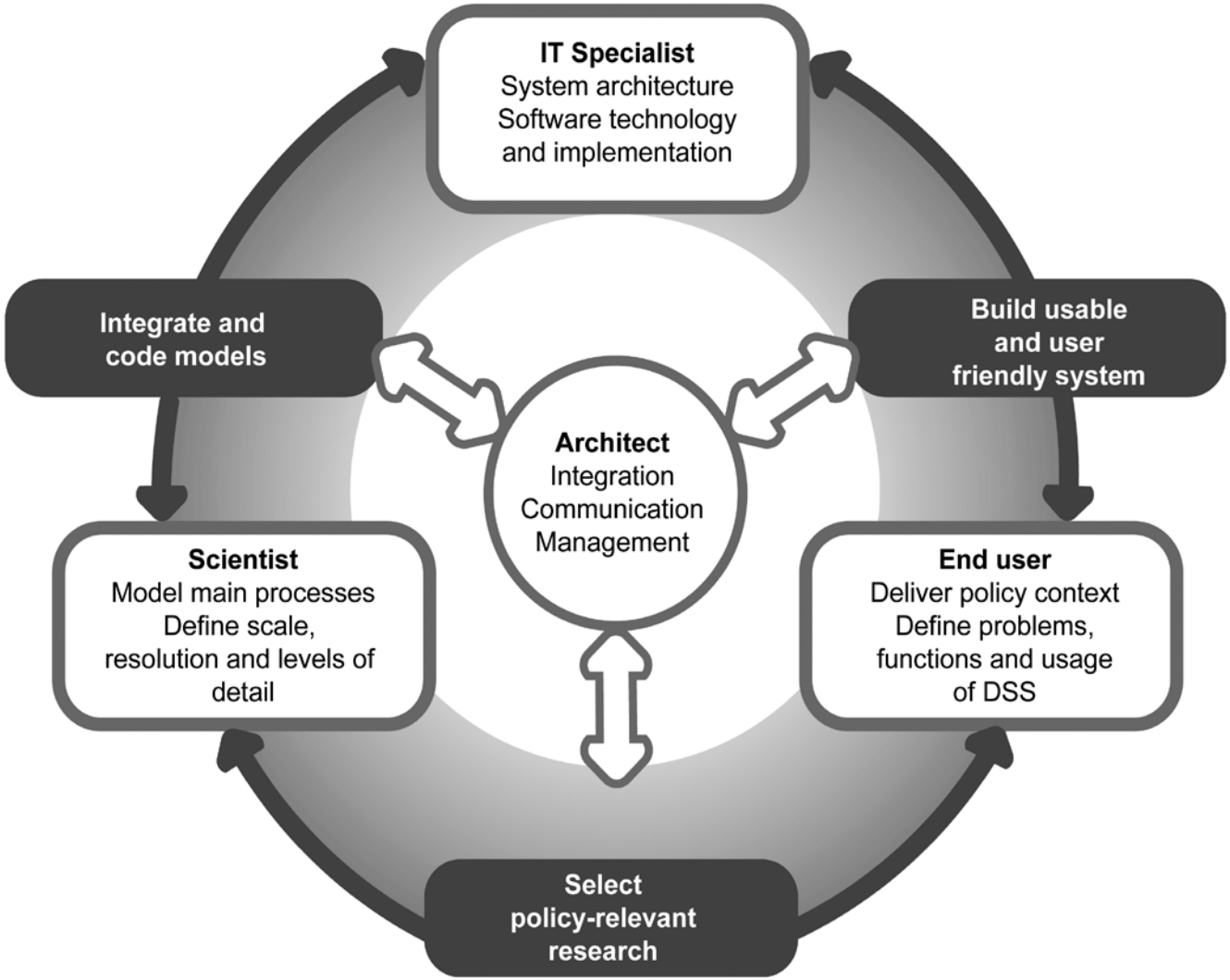



IT Specialist
System architecture
Software technology
and implementation
Integrate and
code models
Build usable
and user
friendly system
Architect
Integration
Communication
Management
Scientist
Model main processes
Define scale,
resolution and levels of
detail
End user
Deliver policy context
Define problems,
functions and usage
of DSS
Select
policy-relevant
research
Use
Development
Facilitator
Catalyse social learning
Elicit knowledge through
participatory techniques
Align modelling and
participation
Develop scenarios
Rank mitigation portfolios
Architect
Integration
Communication
Management
Modeller
Apply DSS to use case
Determine mitigation
portfolios
Stakeholder
Aim and focus of use case
Define mitigation options
and indicators
Quantify
qualitative information

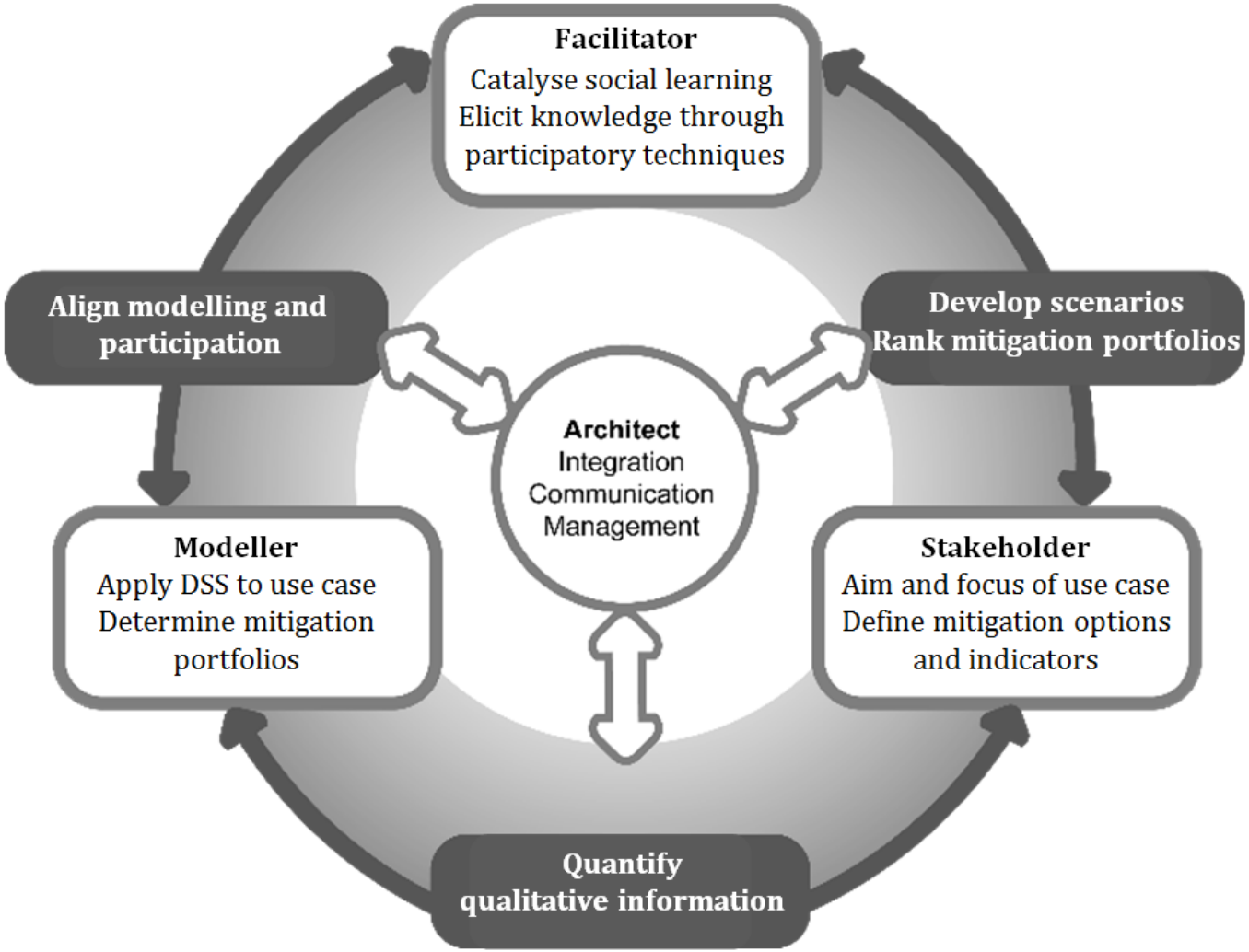
DEVELOPMENT PROCESS



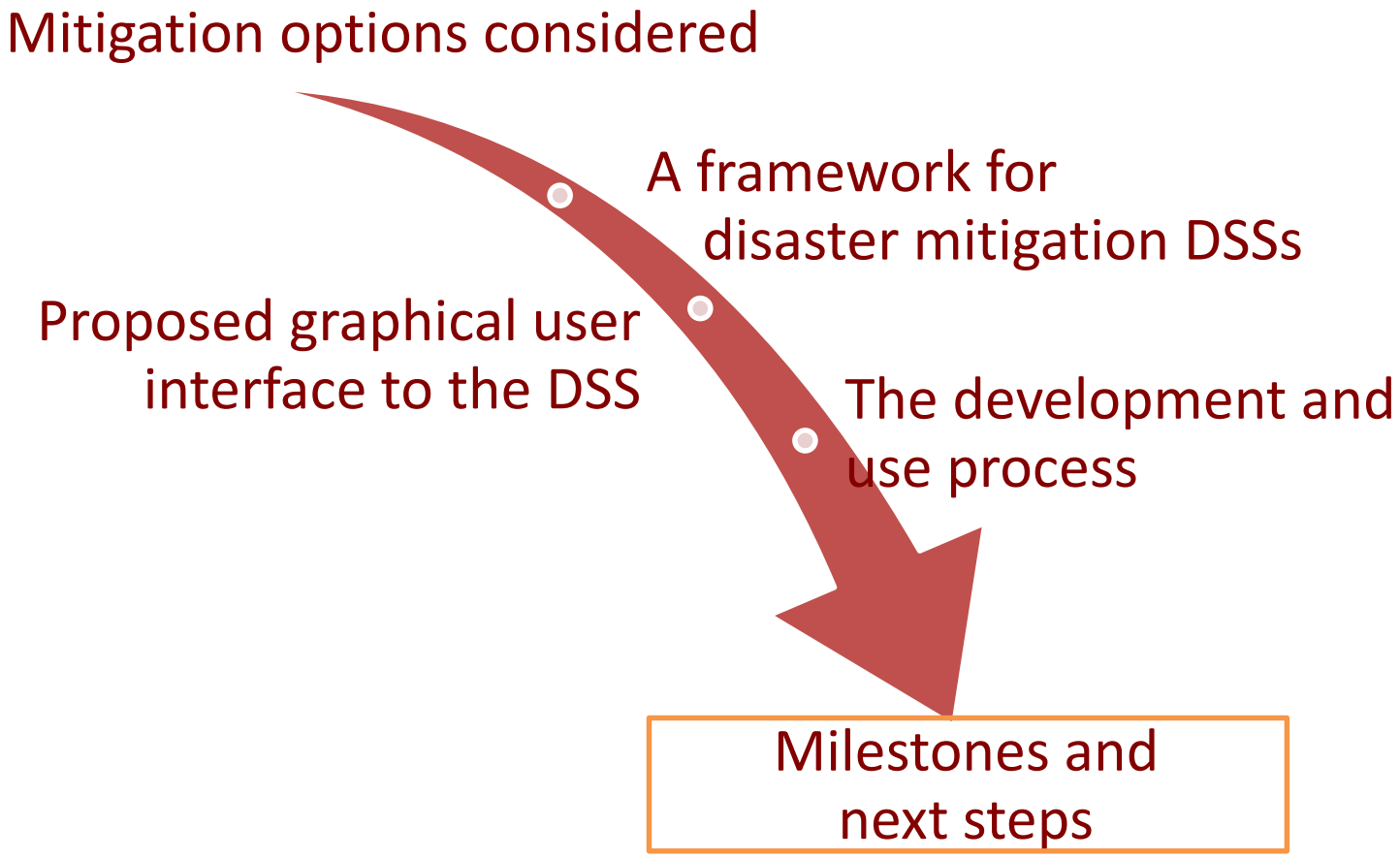

LAND USE PLANNING
ADAPTIVE GOVERNANCE
STRUCTURAL


HAZARD
MEASURE
Multi-Hazard
* refer to Hazard Plans.
Community Education
Fire Prevention
How community changes after a crisis
Existing
Activities per agency.
Changes to budgets according to risk
Multi-capacity development.
Fire; rainfall, flood
Extreme Heat, fire, flood, etc...
ICT
Infrastructure
Business + Government

USE PROCESS


Facilitator
Catalyse social learning
Elicit knowledge through participatory techniques
Develop scenarios
Rank mitigation portfolios
Stakeholder
Aim and focus of use case
Define mitigation options and indicators
Quantify qualitative information
Modeller
Apply DSS to use case
Determine mitigation portfolios
Align modelling and participation
Architect
Integration
Communication
Management

TODAY'S PRESENTATION



OUTPUTS

1) Literature review (Delivered)

2) Framework report (Delivered)

3) Workshop report for Adelaide (Delivered)

4) Strategy report for Adelaide (in progress)

NEXT STEPS

- Scoping of other two case studies
  - Victoria
  - Tasmania
- Workshops 2 and 3 for Adelaide case study (Oct/Nov 2015)
- Workshop 1 for other two case studies (Oct/Nov 2015)

MAJOR OUTCOMES (1)

1) Utilisation of a **systematic** and **transparent** approach to evaluating disaster and natural hazard mitigation options (e.g. infrastructure, land use, policy).

2) The ability to make **more strategic** and **less responsive** decisions in relation to mitigating the impact of disasters and natural hazards as a result of the availability of better information.

MAJOR OUTCOMES (2)

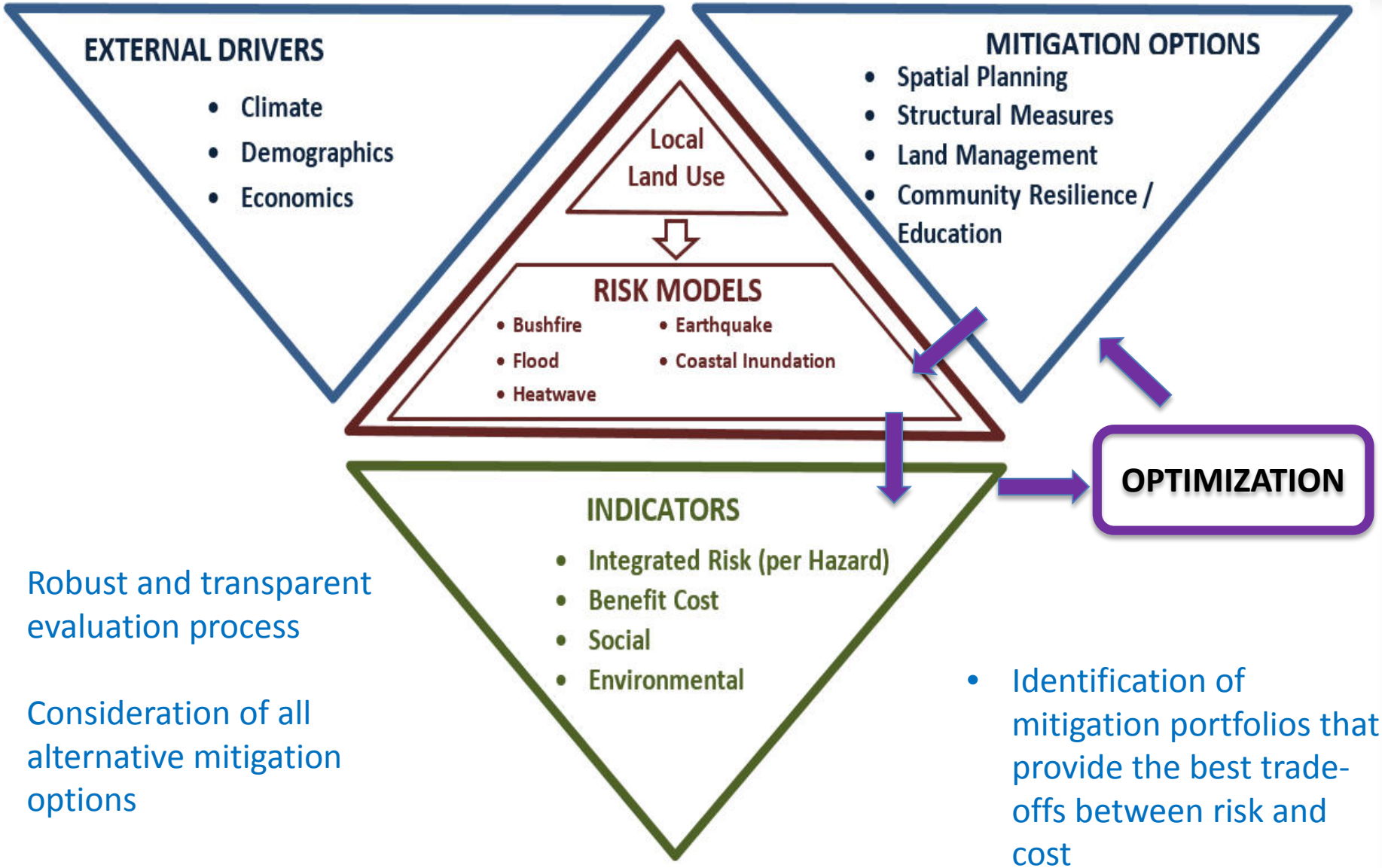
3) The availability of **prototype decision support software tools** for **three** end-user defined **case studies** to enable recommended options to be identified by sifting through and evaluating and ranking a large number of options).

4) A better understanding of the **trade-offs between economic and risk objectives** for different mitigation options for three end-user defined case studies.

PROJECT TEAM - RESEARCHERS

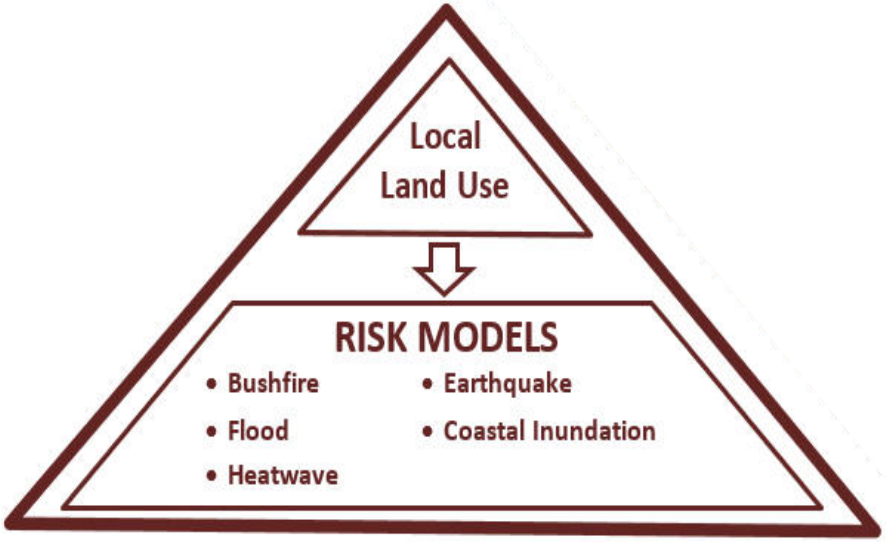
1) Prof Holger Maier (U of A – Project Leader)
2) A/Prof Hedwig van Delden (U of A / RIKS)
3) Dr Aaron Zecchin (U of A)
4) Prof Graeme Dandy (U of A)
5) Dr Ariella Helfgott (U of A)
6) Jeff Newman (U of A)

7) Graeme Riddell (U of A – PhD Student)
8) Charles Newland (U of A – PhD Student)
9) Michael O'Flaherty (U of A – PhD Student)



- Robust and transparent evaluation process
- Consideration of all alternative mitigation options
- Consideration of multiple hazards

- Identification of mitigation portfolios that provide the best trade-offs between risk and cost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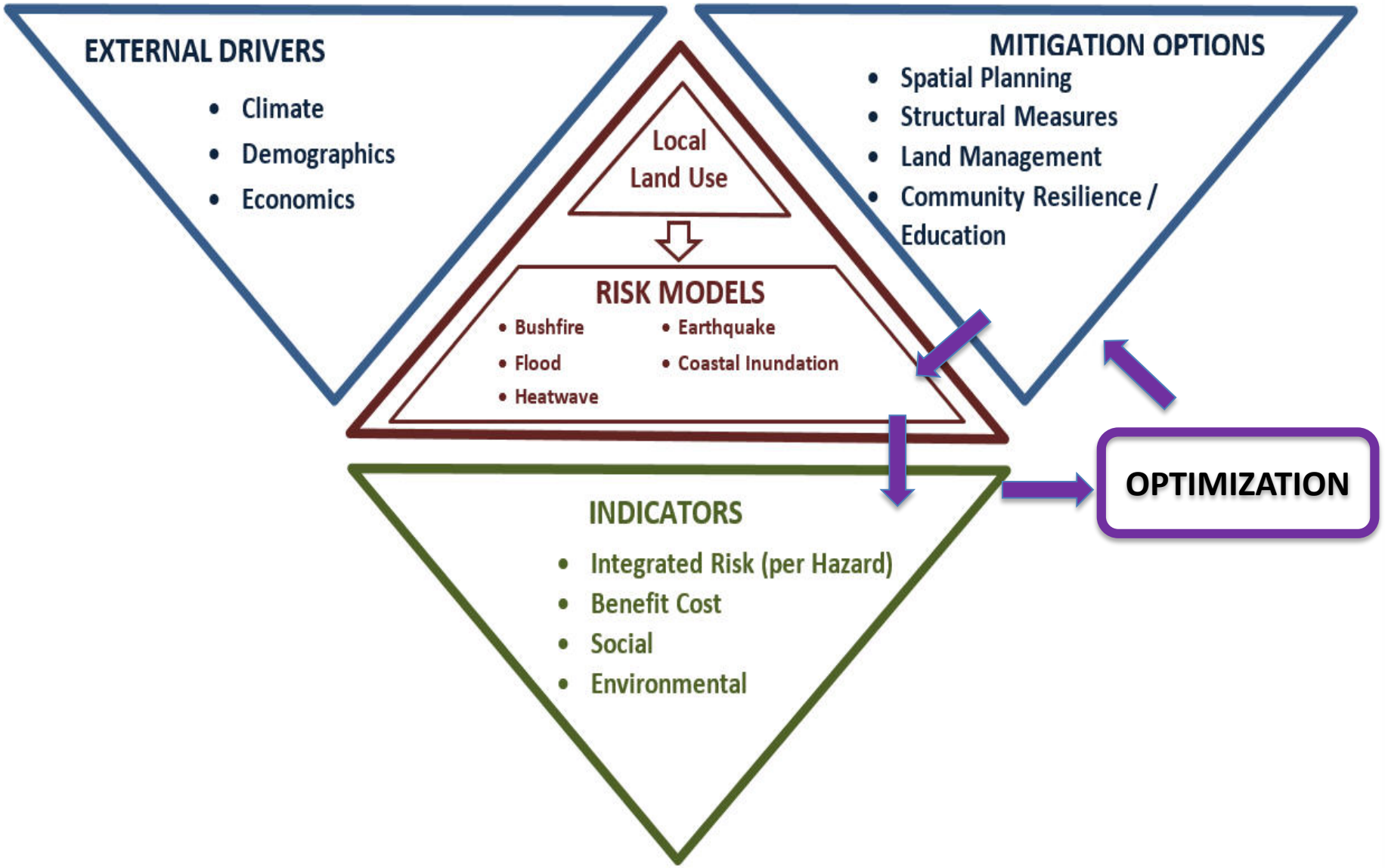
EXTERNAL DRIVERS
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• Structural Measures
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• Community Resilience / Education
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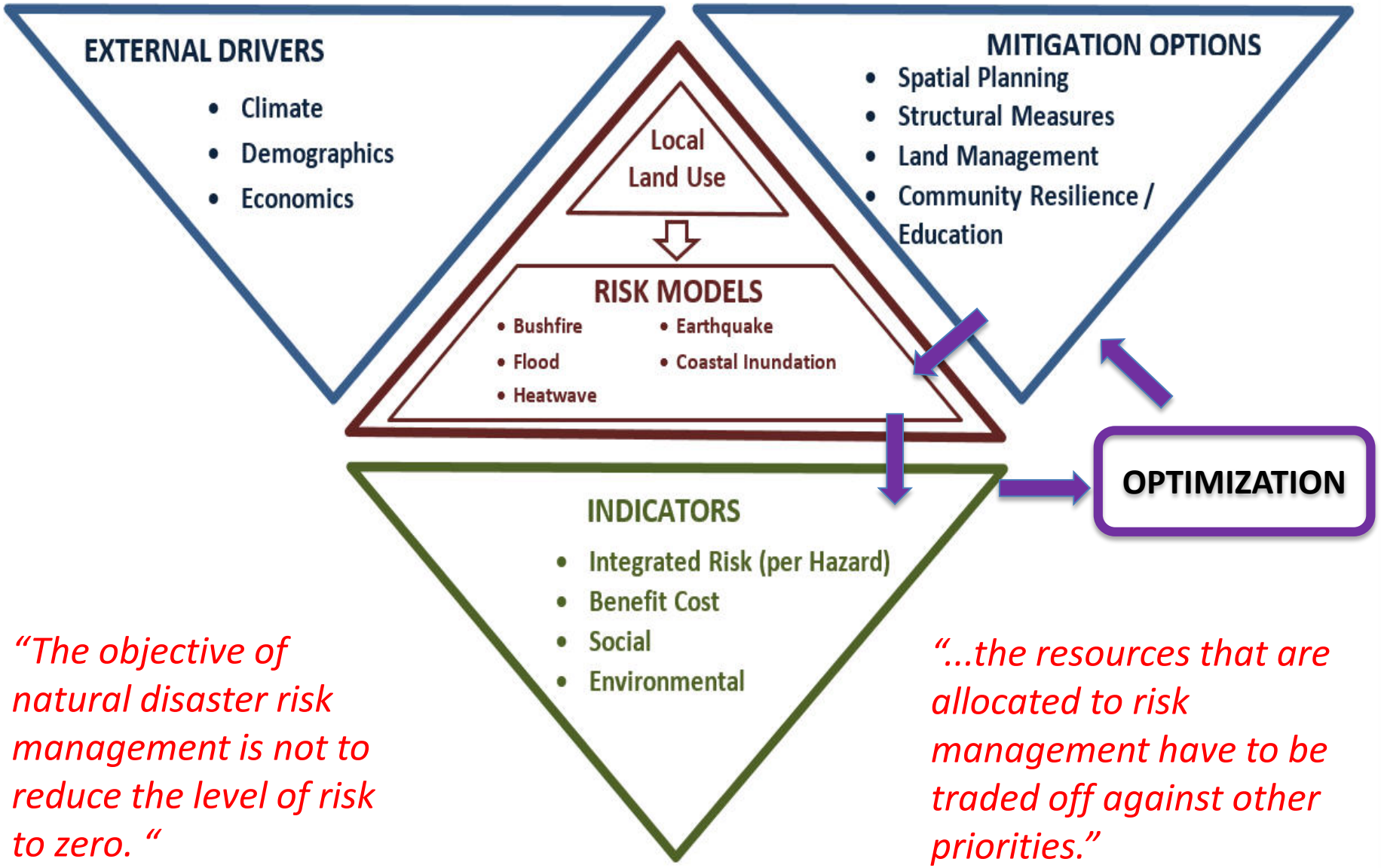
• Integrated Risk (per Hazard)
• Benefit Cost
• Social
• Environmental
OPTIMIZATION



"The objective of natural disaster risk management is not to reduce the level of risk to zero. "

"...the resources that are allocated to risk management have to be traded off against other priorities."

(Source: Productivity Commission Draft Report)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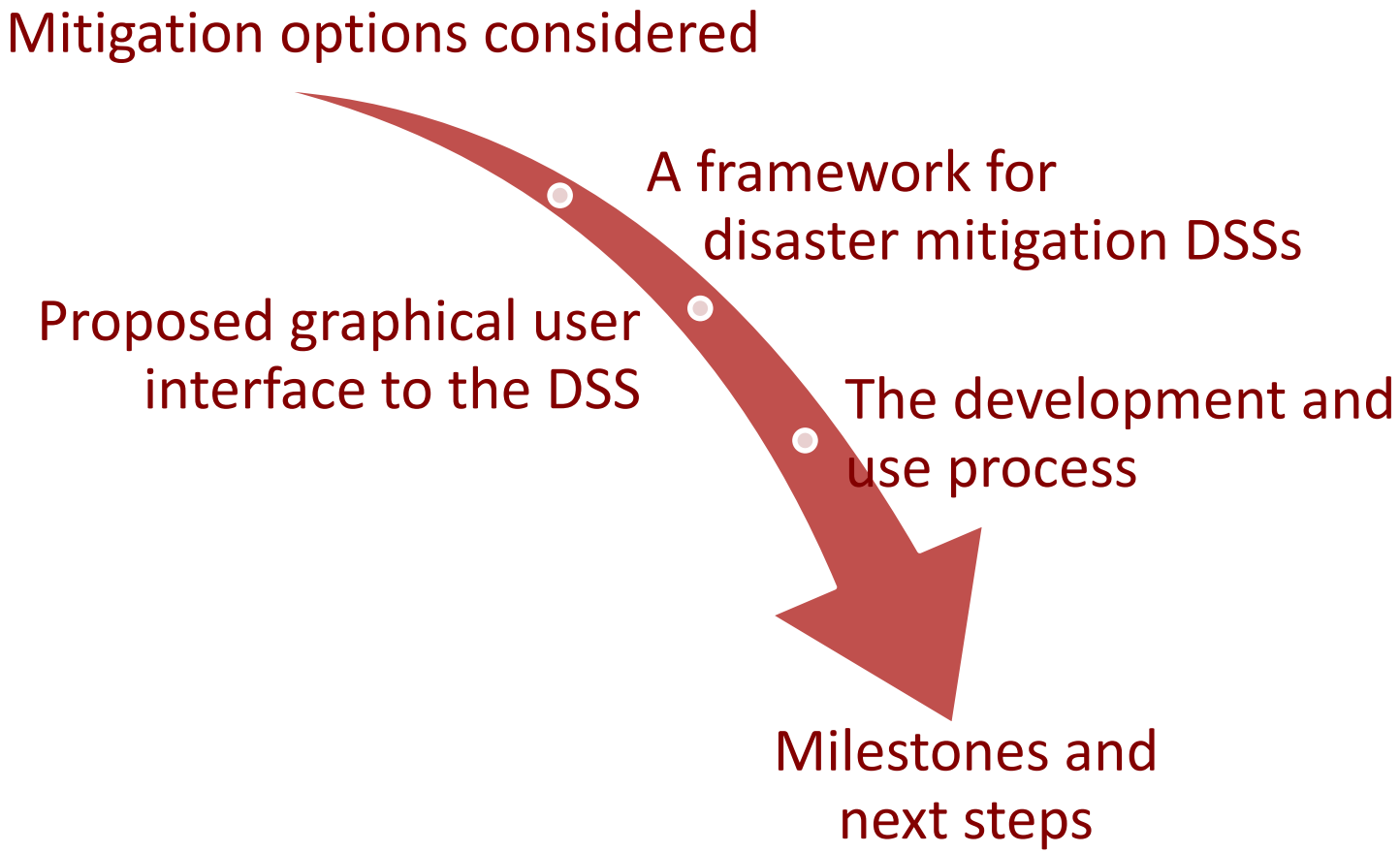
TODAY'S PRESENTATION



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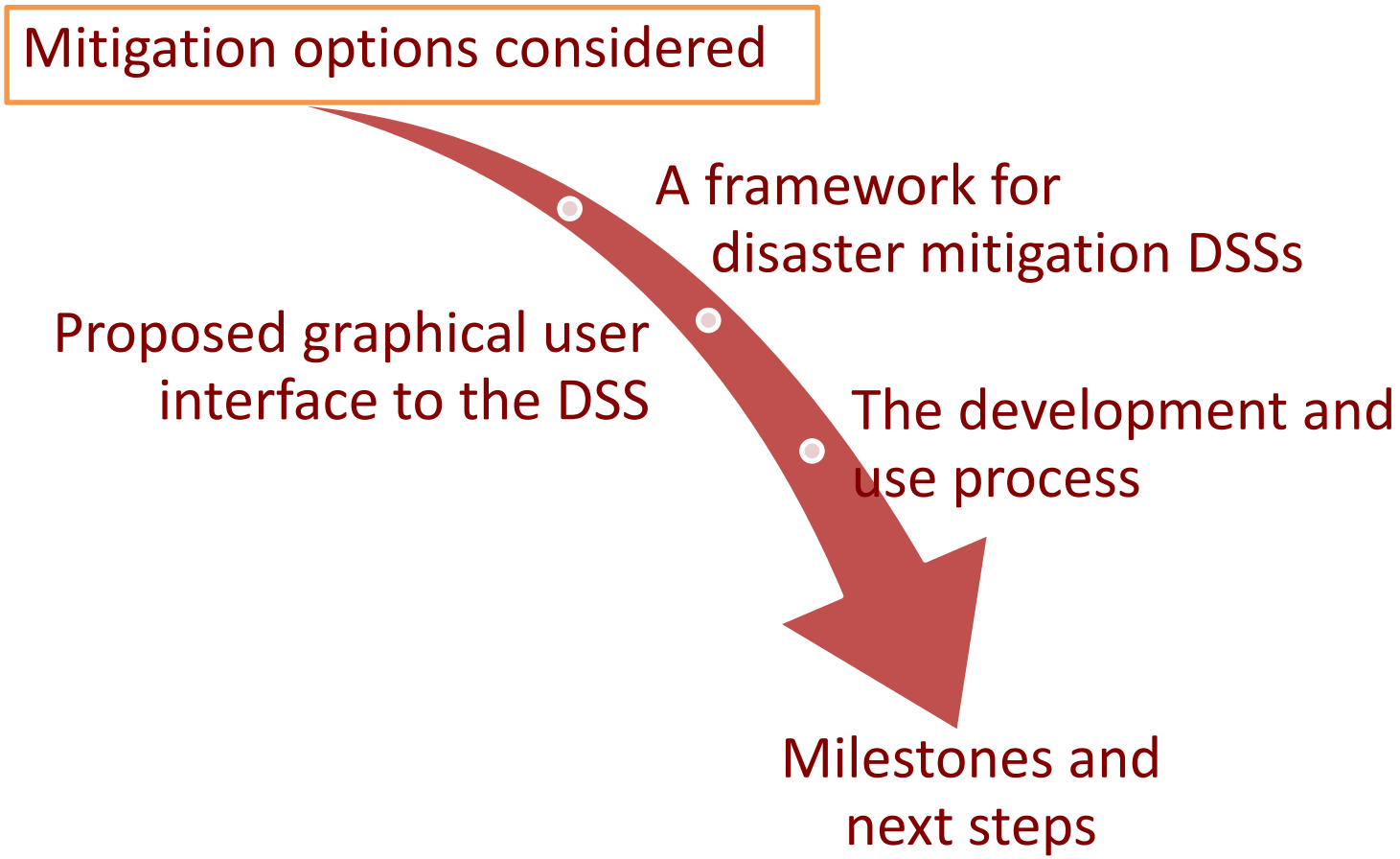

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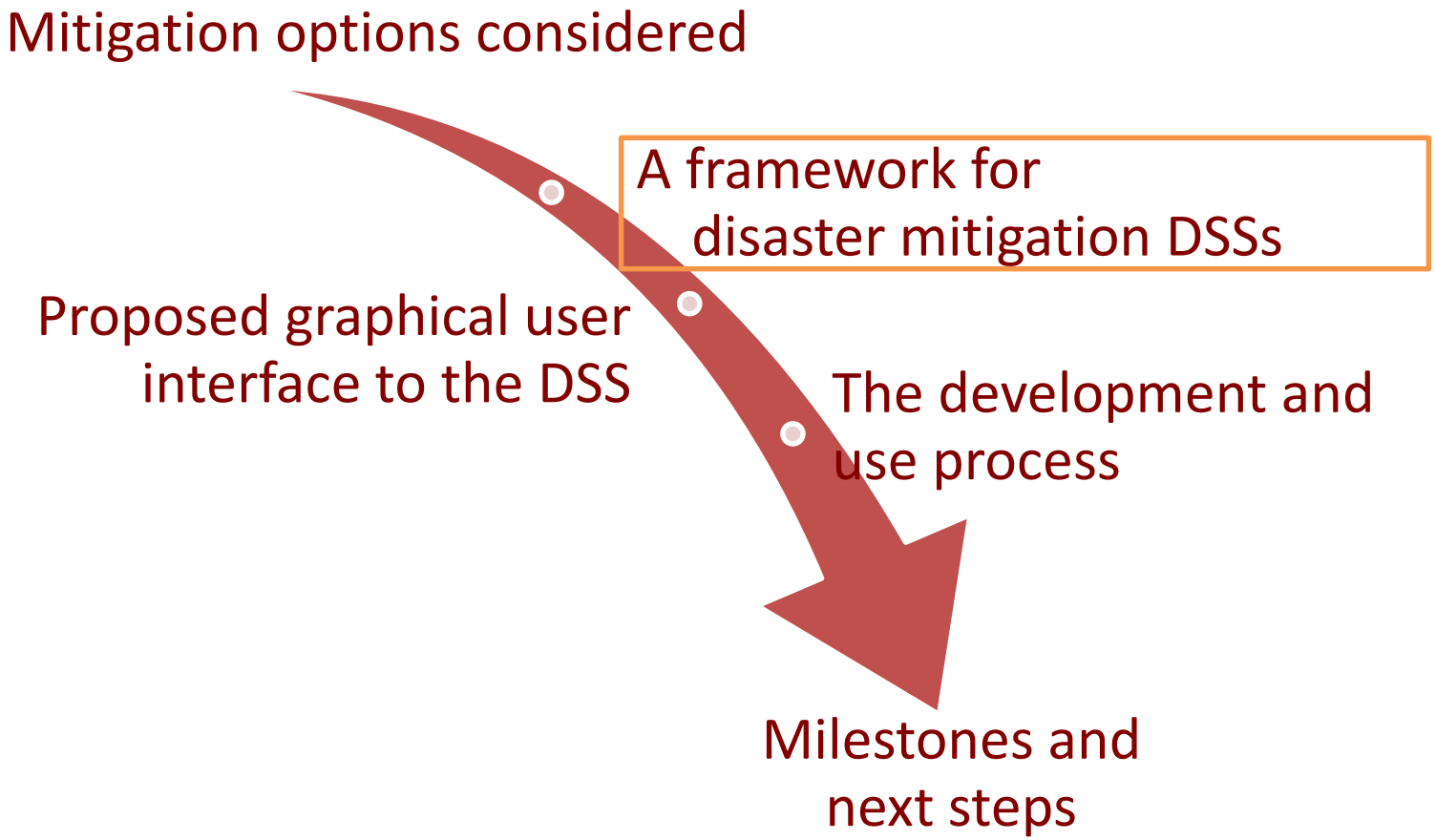

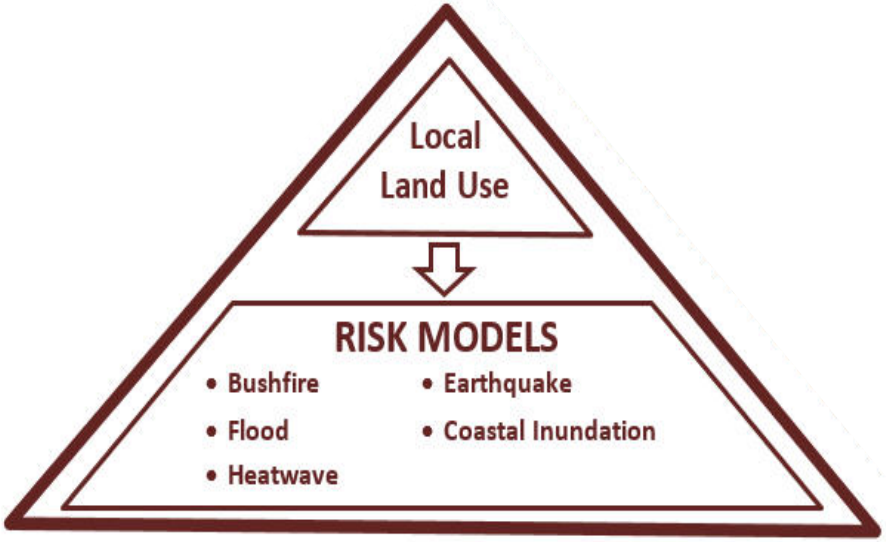
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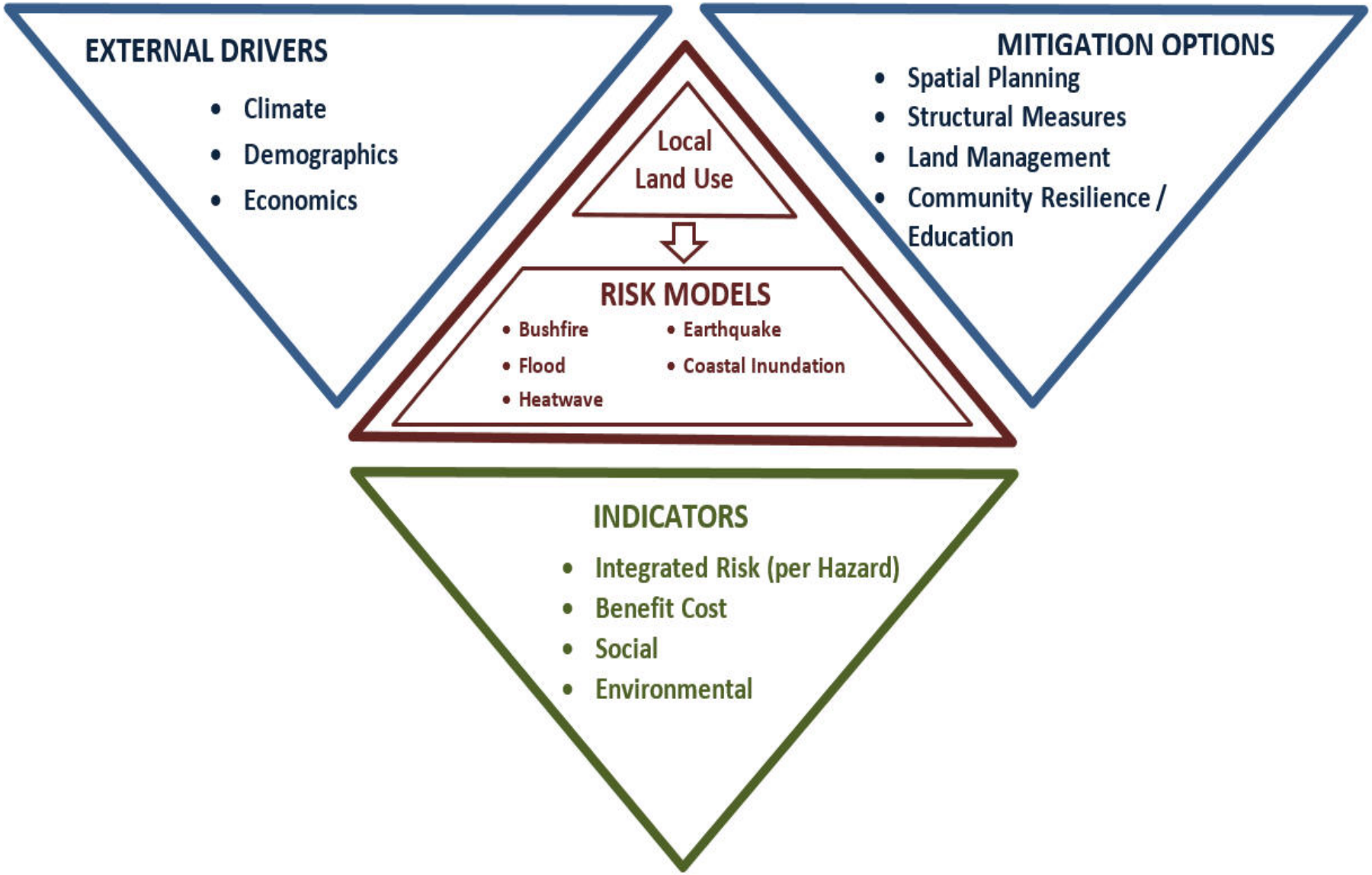
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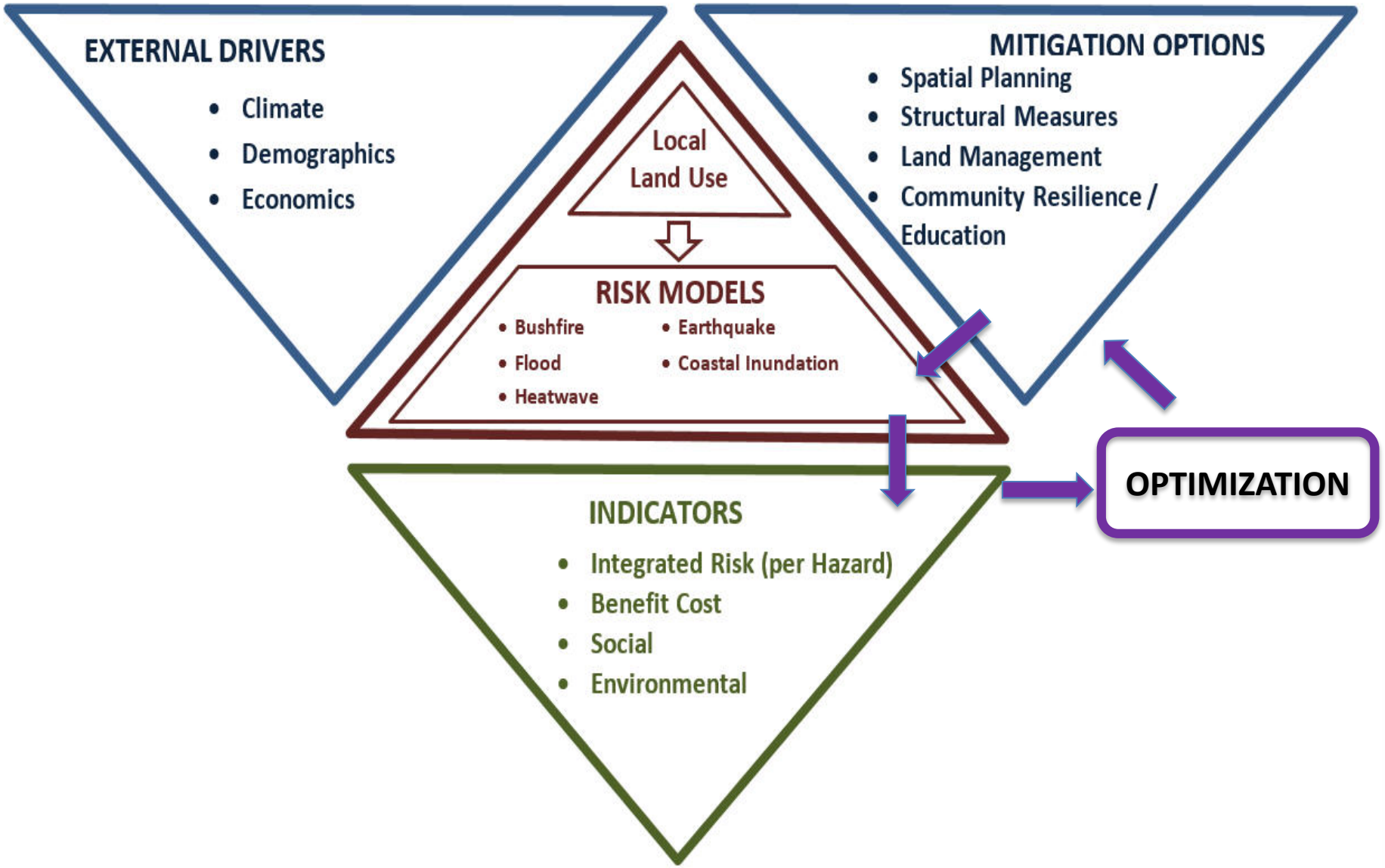
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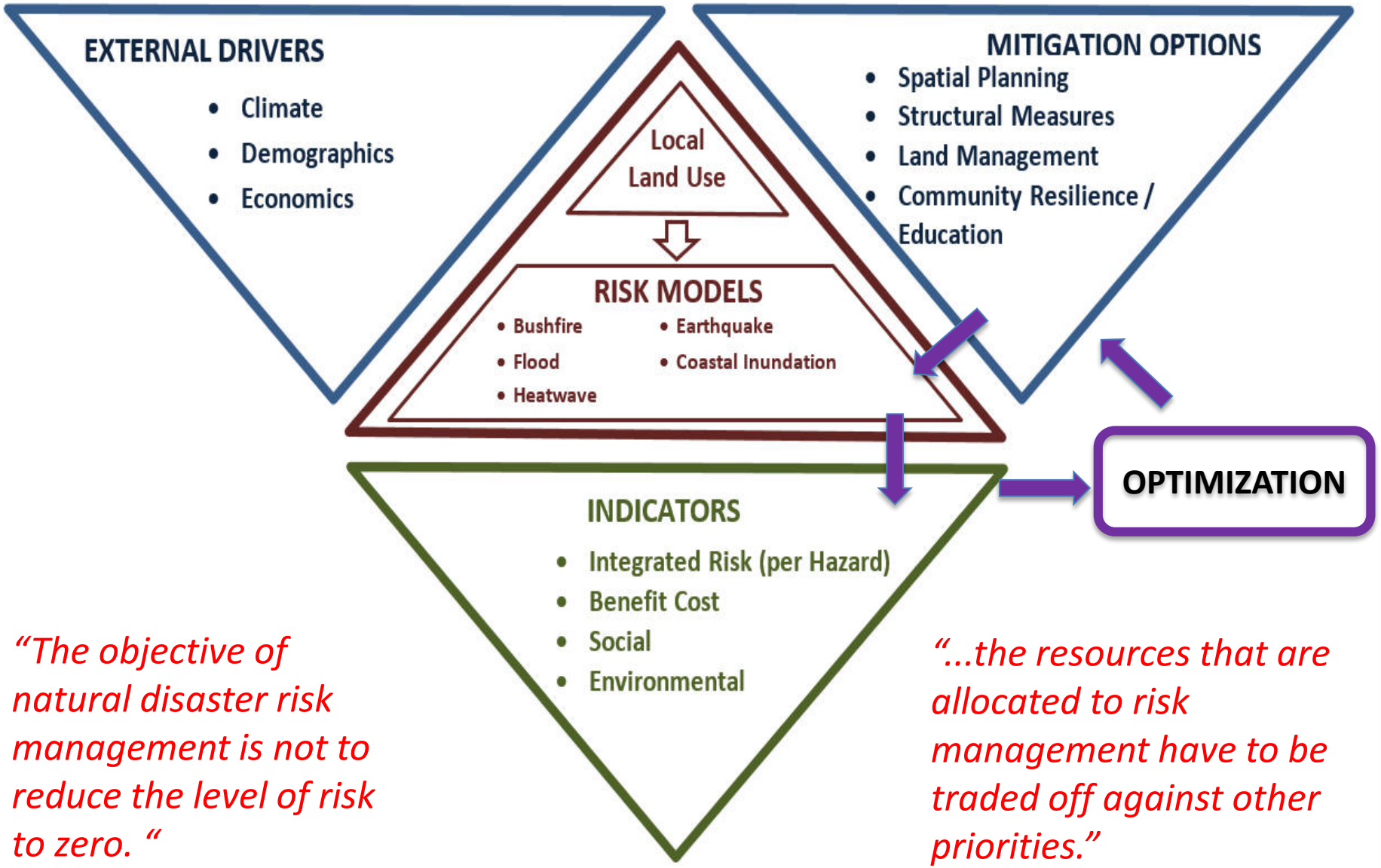

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