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# Climate resilient road assets the economic aspect

**Mark de Bel**
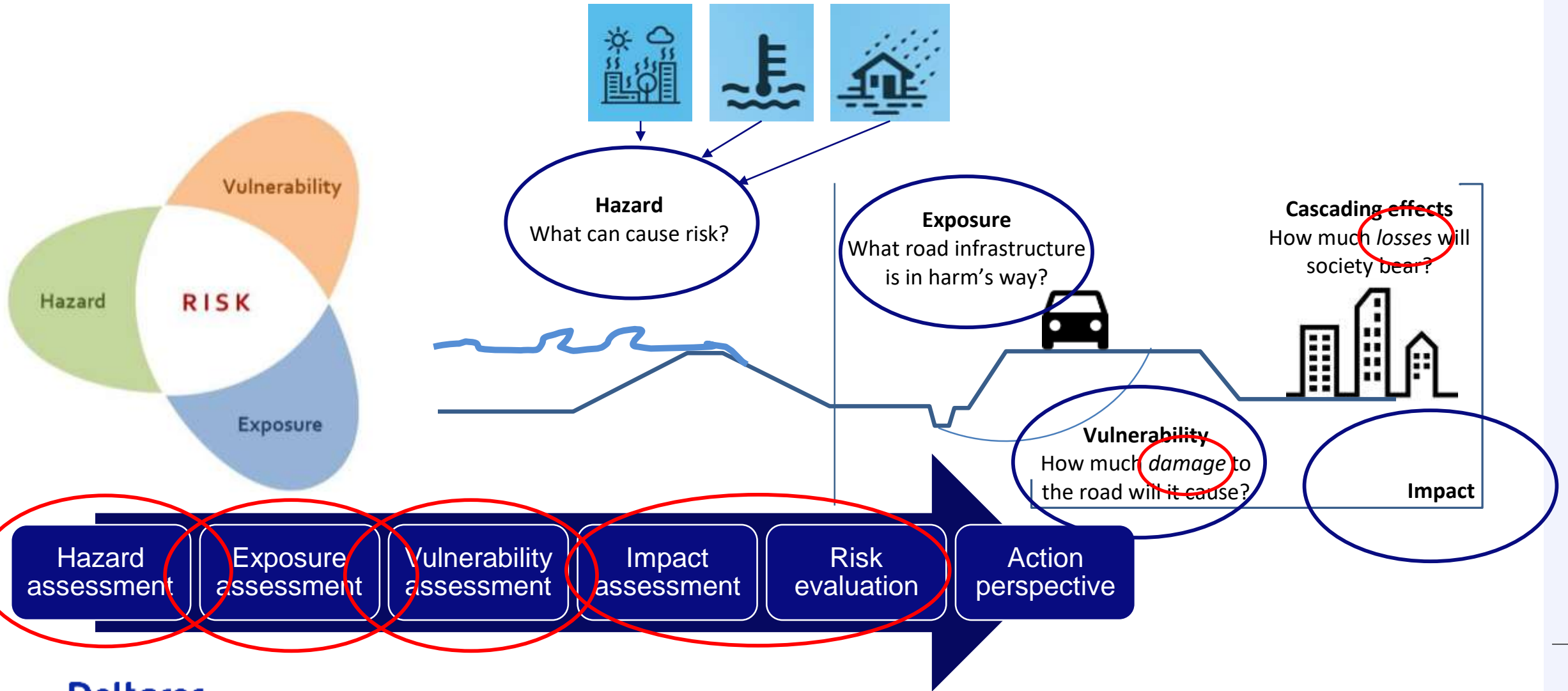
13 April 2022

# Table of contents

- **General Methodology**
  - Risk assessment
  - Damage and losses

- **Economic analysis of road assets in Albania**
  - Approach
  - Risk profile
  - Criticality
  - Cost Benefit Analysis

- **Lessons learned**

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# General Methodology

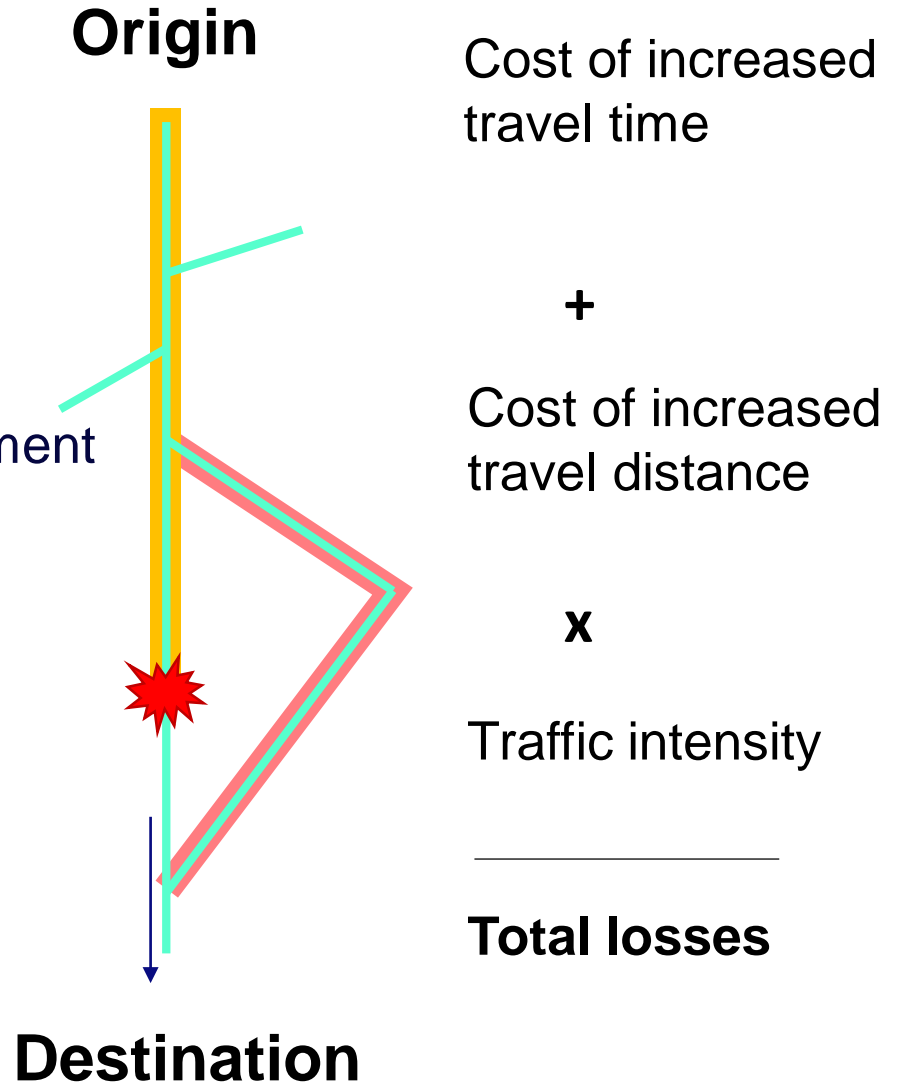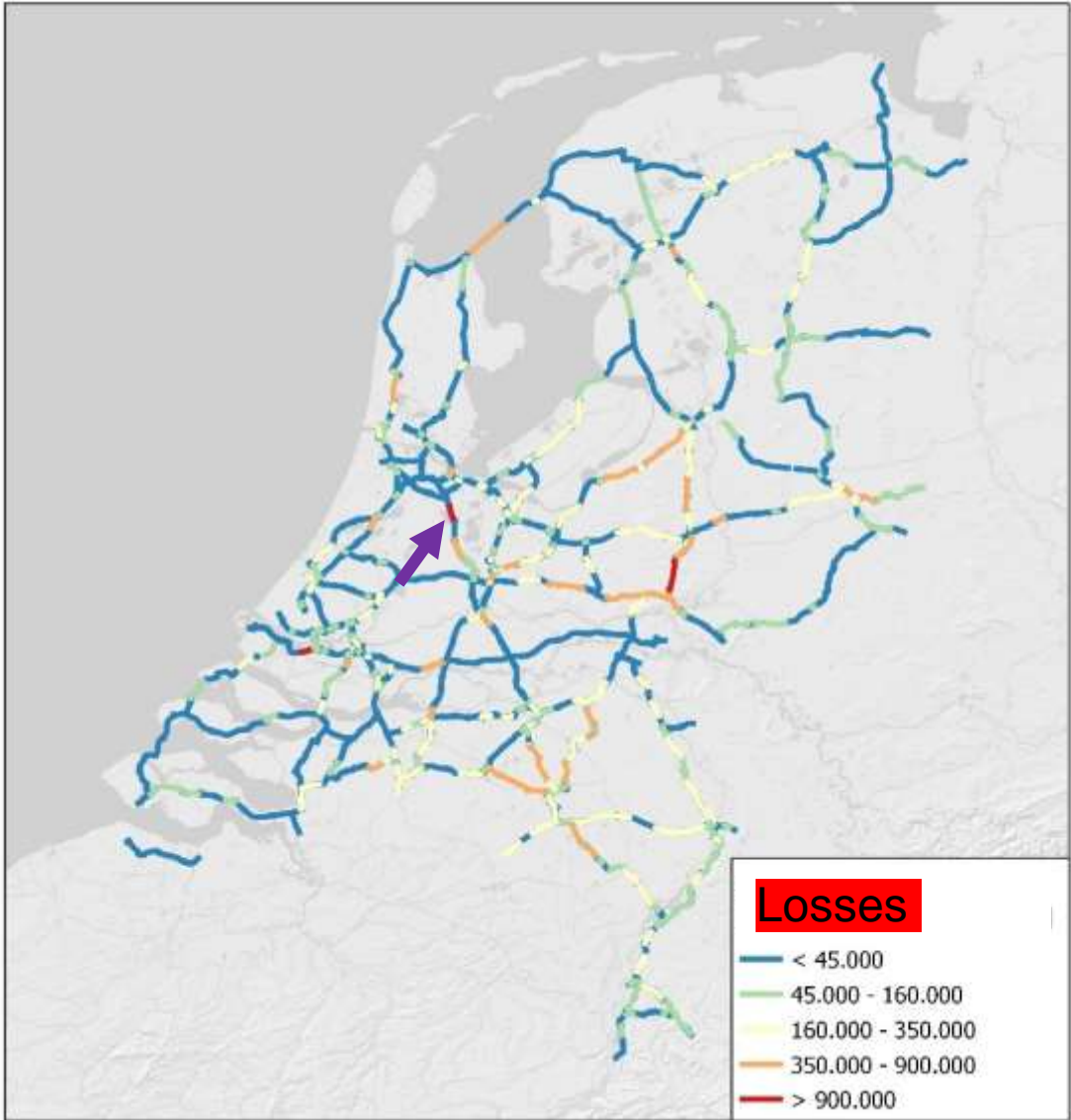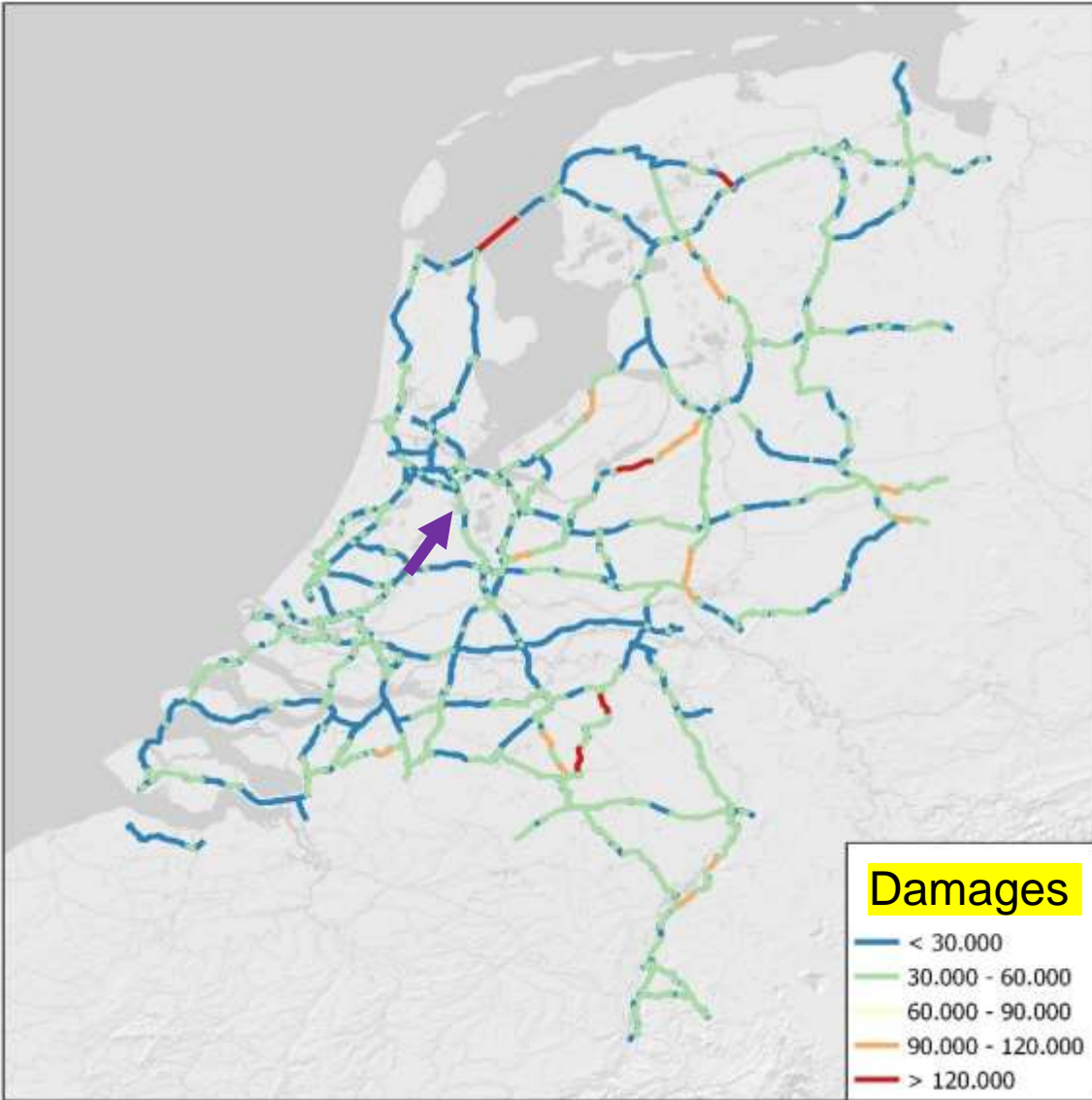From vulnerability assessment to action perspective



Hazard assessment → Exposure assessment → Vulnerability assessment → Impact assessment → Risk profile → Action perspective

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# Hazard and vulnerability

# Risk profile road network; Damage and Losses

**Origin**

Cost of increased travel time

+

Cost of increased travel distance

x

Traffic intensity

___

**Total losses**

- **Damage**
  - Damage to road assets (repair costs)
- **Losses**
  - Vehicle Loss Hours as a result of traffic jams on segment
  - Vehicles Loss Hours because of alternative routes

**Risk → AED = repair costs + economic losses**

| Hazard assessment | Exposure assessment | Vulnerability assessment | Impact assessment | Risk profile | Action perspective |

**Destination**

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# Example; The Netherlands (instability of embankments)

# Economic Analysis of risks on the Road Network in Albania

# Goal & scope of project

Inform the prioritisation of future climate and seismic resilient investments in primary road assets in Albania

**Hazards**

- Earthquakes
- Landslides
- Floods

# Approach – Risk analysis and action planning

**Risk analysis per hazard**

- Hazard mapping (example; floods)
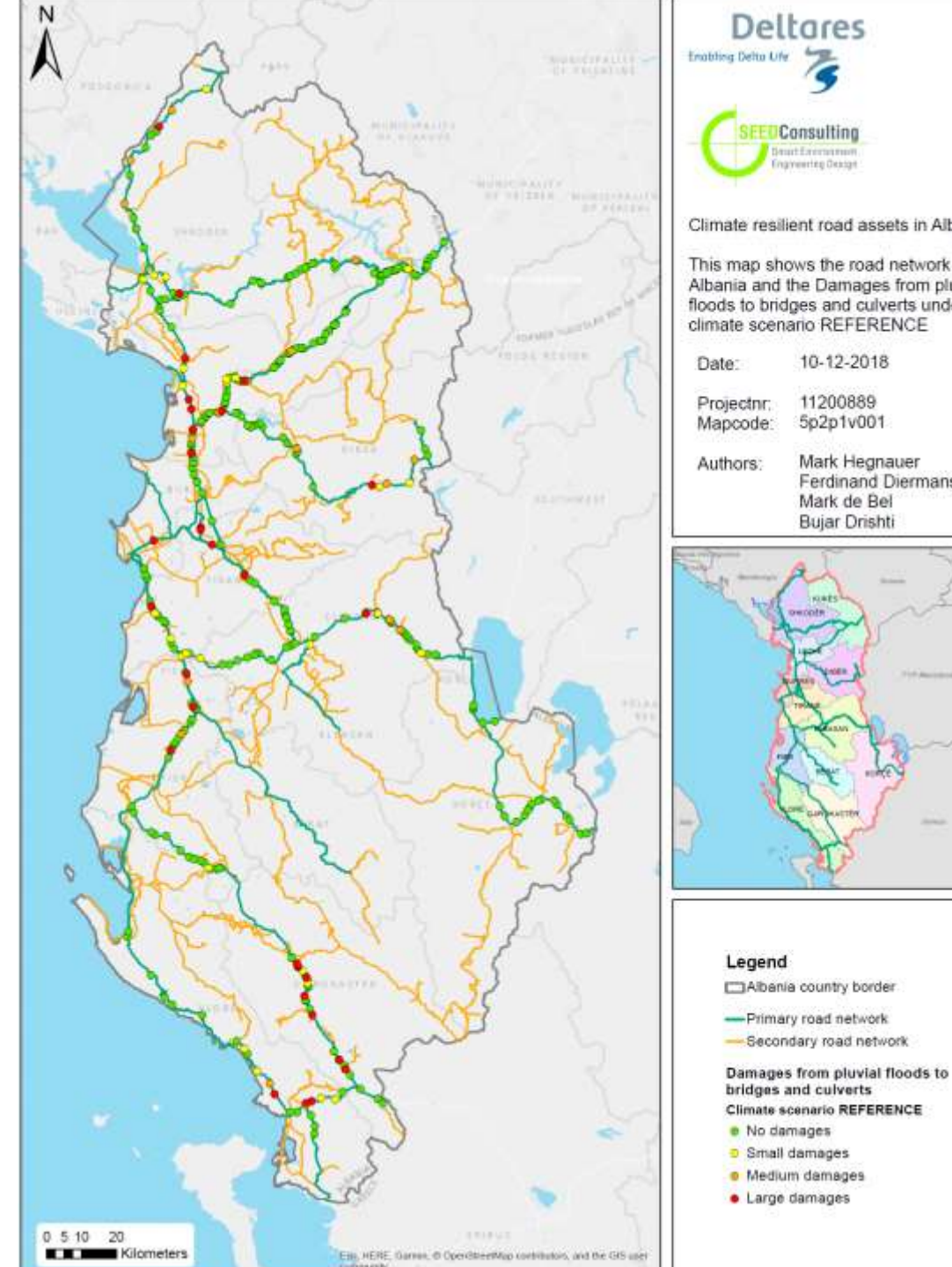- Risk analysis → Annual Expected Damages (AED)

**Action planning per hazard**

- Prioritization of locations
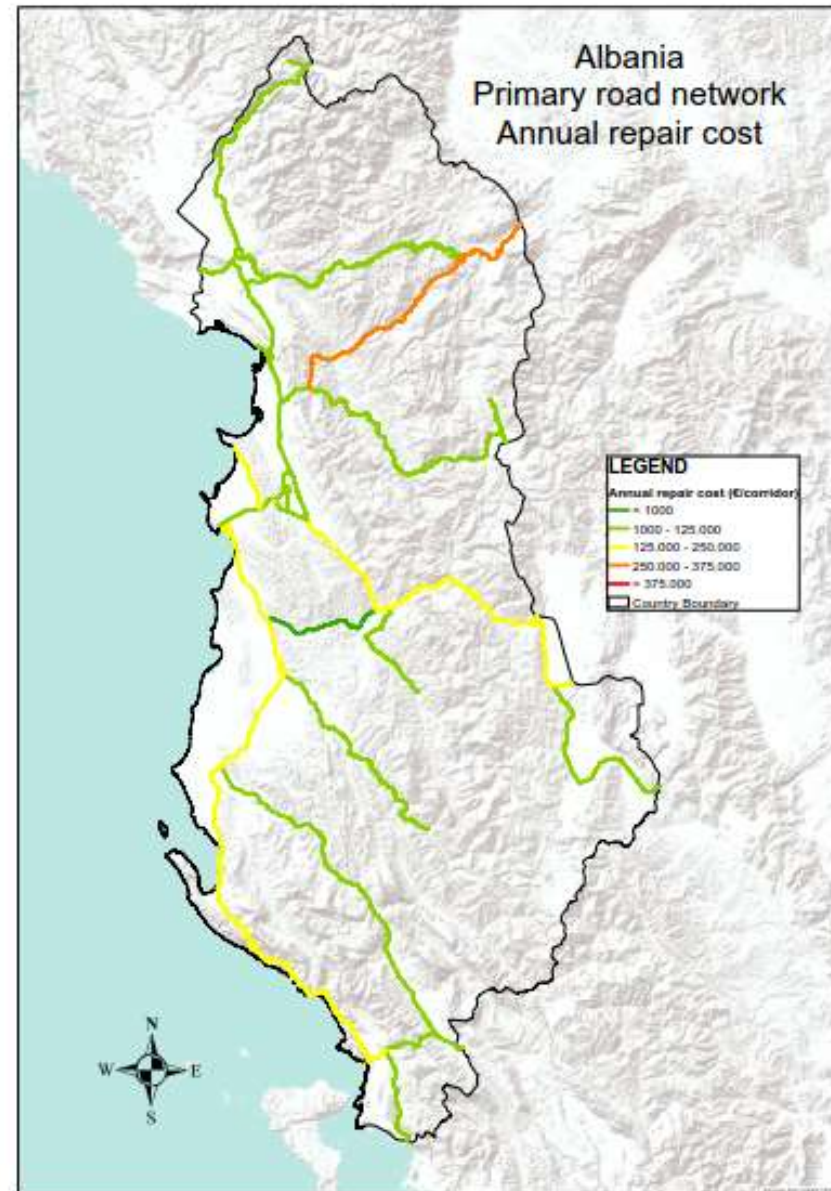- Criticality
- Cost effectiveness analysis
- B/C ratio

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# Risk map: Floods

•**Vulnerability**

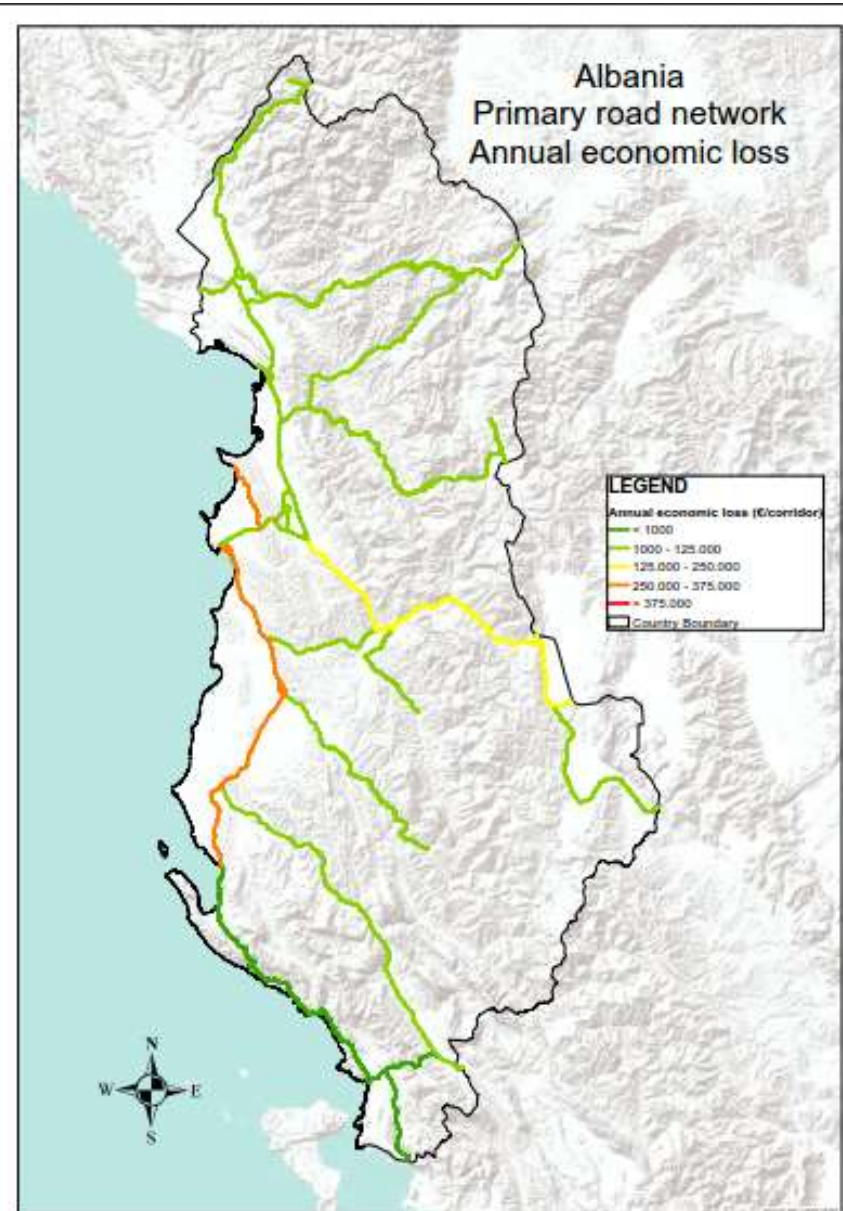•   Dots indicate culvert and bridge failures (<span style="color:red">High</span>, <span style="color:green">Low</span>)

•   Based on:
   •   Modelled discharges
   •   Design capacities

•   Interventions on <span style="color:red">red</span> locations ~ 20 % of assets

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Climate resilient road assets in Alb

This map shows the road network
Albania and the Damages from pl
floods to bridges and culverts und
climate scenario REFERENCE

| | |
|---|---|
| Date: | 10-12-2018 |
| Projectnr: | 11200889 |
| Mapcode: | 5p2p1v001 |
| Authors: | Mark Hegnauer |
| | Ferdinand Dierman |
| | Mark de Bel |
| | Bujar Drishti |

Legend
☐ Albania country border
— Primary road network
— Secondary road network

Damages from pluvial floods to
bridges and culverts
Climate scenario REFERENCE
• No damages
• Small damages
• Medium damages
• Large damages

0 5 10    20
Kilometers

# Annual repair costs



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# Annual economic losses



Albania
Primary road network
Annual economic loss

# AED = repair costs + economic losses



Albania
Primary road network
Total annual cost

LEGEND
Total annual cost (€/corridor)
— < 1000
— 1000 - 125.000
— 125.000 - 250.000
— 250.000 - 375.000
— > 375.000
☐ Country Boundary

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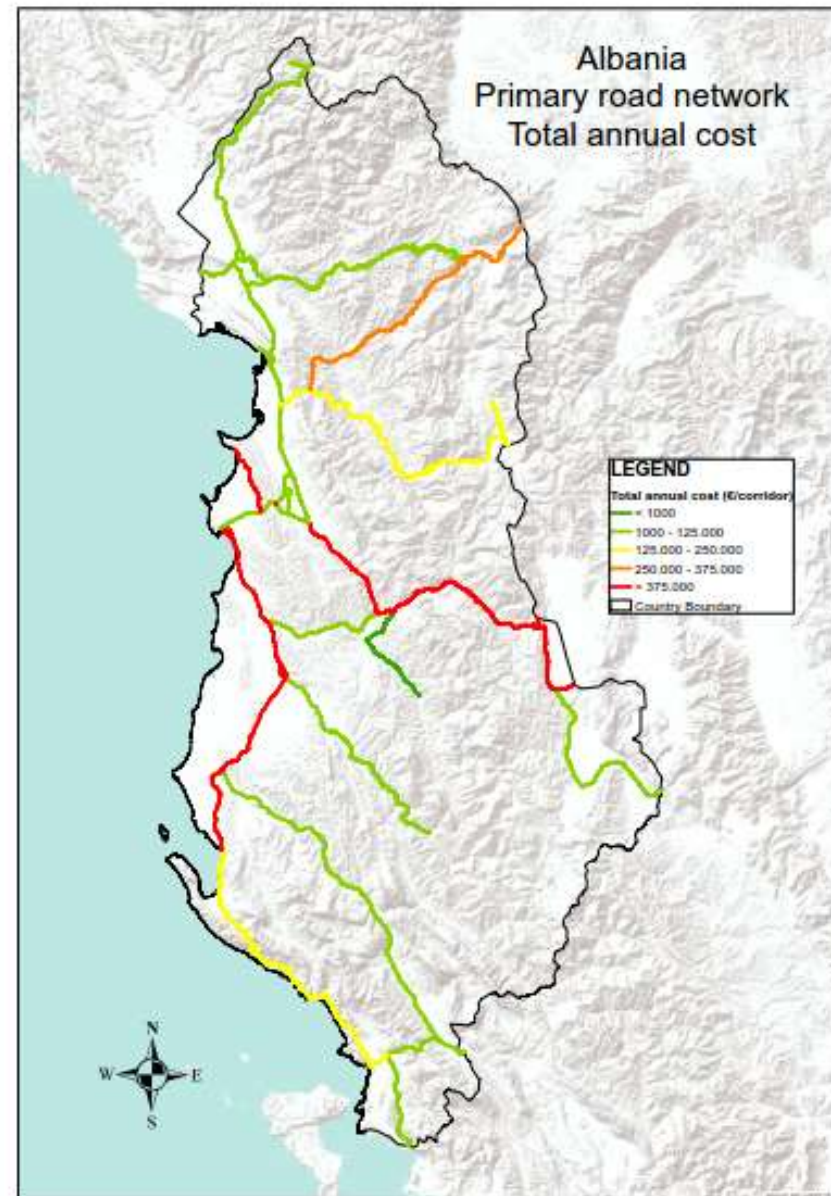
# Criticality

Criticality determined during workshop with local stakeholders.

Take into account, importance for:

- International connections
- Industry
- Harbour
- Tourism
- Evacuation

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# Action plan

| Corridor | Length (km) | AED (€/km) ('000) | Criticality | Floods | | Land slides | |
|---|---|---|---|---|---|---|---|
| | | | | Damage | Intervention | Damage | Intervention |
| 01 Milot - Morine New | 104 | 3,3 | 42 | | | ! | ✖ |
| 02 Shkoder - Puke - Kolsh | 126 | 1,0 | 24 | ! | ✓(orange) | ! | ✖ |
| 03 Milot - Shkoder - Muriqan | 127 | 12,8 | 37 | ! | | | |
| 04 Tirana - Durres | 32 | 59,1 | 53 | ! | ✓ | | |
| 05 Durres - Vlore | 152 | 69,0 | 52 | ! | ✓ | ! | ✓ |
| 06 Tirana - Elbasan - Pogradec | 139 | 24,9 | 42 | ! | ✓ | ! | ✓(orange) |
| 07 Fier - Gjirokaster - Kakavi | 128 | 10,6 | 37 | ! | ✓ | | |
| 08 Gjirokaster - Sarande - Ksamil | 58 | 1,4 | 39 | ! | | | |
| 09 Elbasan - Gramsh | 41 | 0,7 | 26 | | | | |
| 10 Lushnje - Berat - Çorovode | 86 | 4,1 | 24 | ! | ✓ | | |
| 11 Rrogozhine - Elbasan | 40 | 0,9 | 37 | | | | |
| 12 Shkoder - Hani i Hotit - Vermos | 125 | 2,3 | 40 | ! | ✓ | | |
| 13 Milot - Peshkopi | 136 | 5,3 | 30 | ! | ✓ | ! | ✖ |
| 14 Vlore - Sarande | 131 | 2,4 | 39 | ! | ✓ | ! | ✖ |
| 15 Pogradec - Korce - Kapshtice | 69 | 1,0 | 45 | | | | |

| | |
|---|---|
| ! | significant damages |
| ✓ | Positive B/C ratio |
| ✓ | Positive B/C ratio under certain conditions |
| ✖ | Negative B/C ratio |

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# Lessons learned 1

**Desktop studies** based on **global data** with coarse traffic data (corridor level) can produce useful and objective (strategic) results at a network level

- Results are a first scan at network level
- View input and results in this context
- Strategic assessment, not possible to downscale

**Field validation** is required for next steps (execution of action plan)

- Are identified locations indeed vulnerable?
- Does cost estimate of measure fit with location?
- Update CBA if needed

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# Lessons learned 2

Sometimes difficult to find **reliable input and data**

- Damage functions
- Historical data (for validation)
- Repair costs, downtimes, cost of measures per corridor
- difference between 'official input' and 'realistic input'

**National input** very important

- Local partners are vital (network, experience and validation)
- Interaction with local stakeholders (e.g. workshops)

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# Questions

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# Contact

🏠 www.deltares.nl 🐦 @deltares 💼 linkedin.com/company/deltares

✉ Mark.deBel@deltares.nl 📷 @deltares f facebook.com/deltaresNL

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