

Societal Impacts and Risk Perception of Landslides in Sino- Nepal Road Corridor

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Introduction

It is a part of ongoing PhD research

“Landslide risk of Sino-Nepal Transportation Corridor: A Case of Kathmandu-Kyirong Highway”

- ❑ Every monsoon triggers many landslides - 46 DF (2003-2004) (Burtin et al 2009) in 35 km section of it
- ❑ Sometimes occur in other seasons especially rock falls
- ❑ Gorkha earthquake (2015) - 89 co-seismic landslides (Xu et al 2017)
- ❑ Landsliding has massive impact on road condition and socioeconomy
- ❑ Risk anticipation of whole highway route has not made yet, so as societal impacts and how people perceive the risk

Objectives

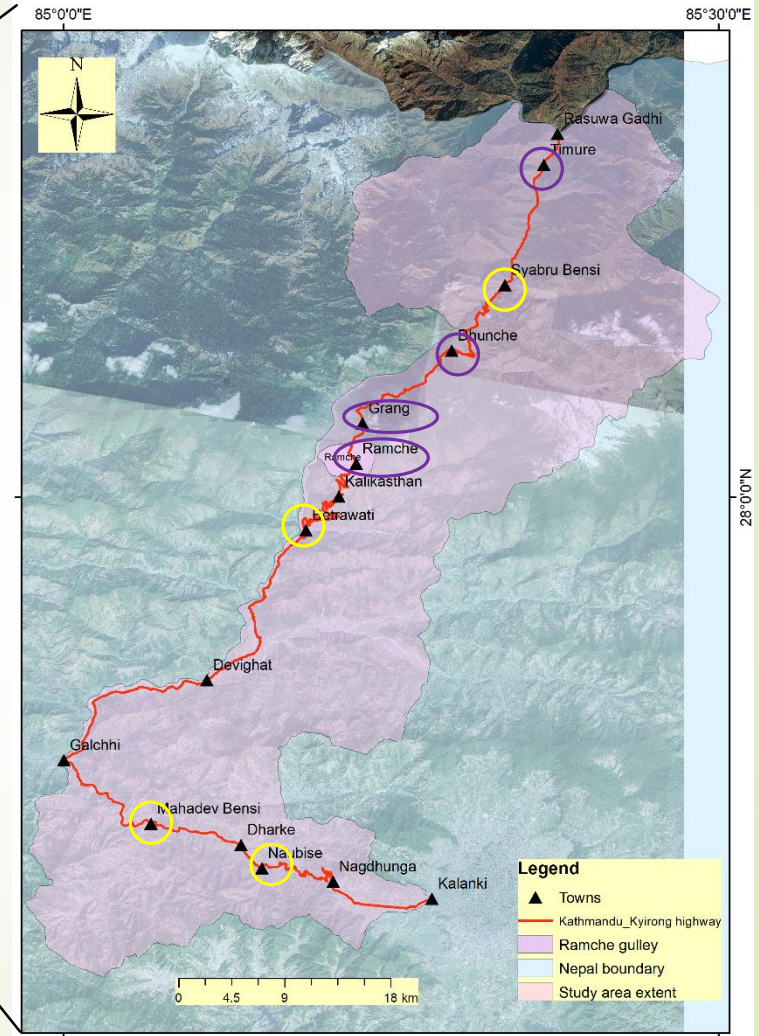
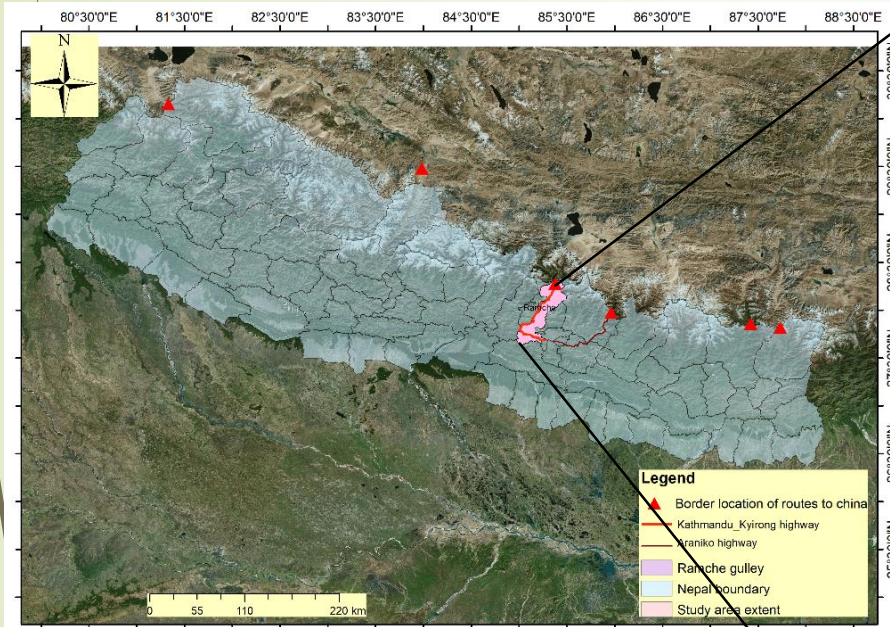


Within the main aim of landslide risk estimation of Kathmandu-Kyirong highway corridor of doctoral research, following objectives are set for this part.

1. To analyze the impacts of mass failure to the roadside communities
2. To assess how locals perceive the risk associated with landsliding in their neighborhood

Study area

Out of eight towns taken, four towns (purple) included in this presentation



Lat : $27^{\circ}37'59.54'' - 28^{\circ}18'45.98''$

Long: $84^{\circ}58'11.97'' - 85^{\circ}30'4.34''$

KKH- 155 km

The corridor – 1375.4 km²

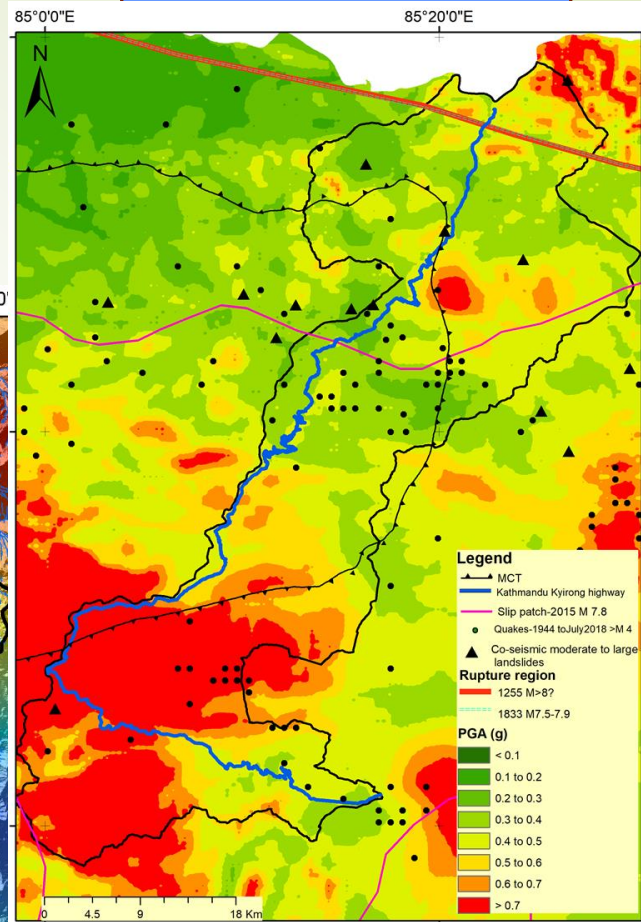
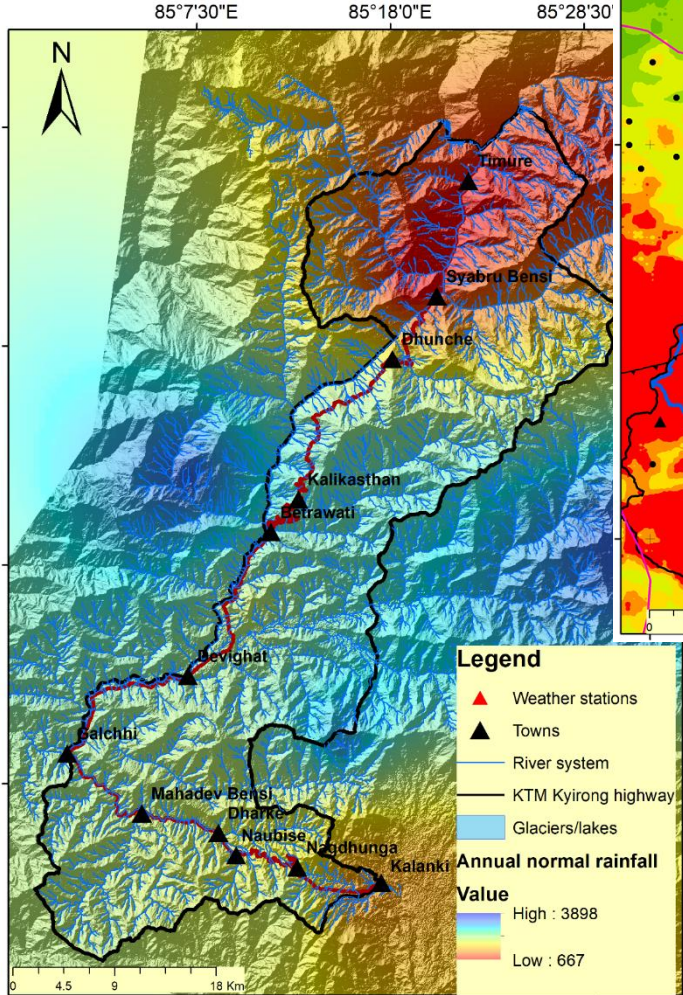
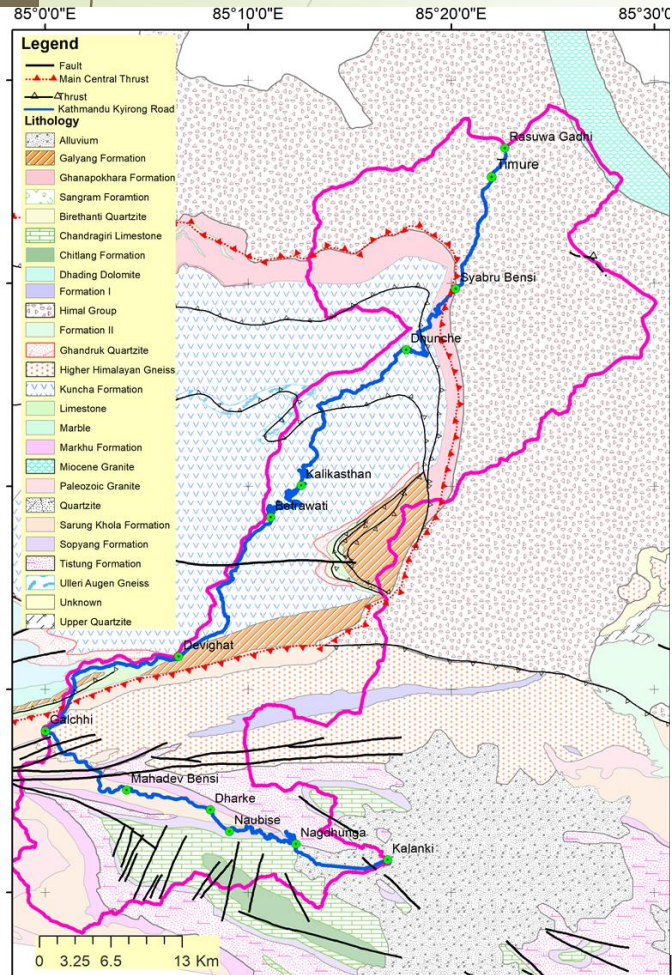
Study area

High tectonism

Favorable conditions for mass failure

Young and weak geology

Extreme seasonal climatic situation



And also high relative relief

Events of mass failure

Mass failure is a frequent hazard



9
fatalities
2018

Few hours
/days to
clean
2018



45
fatalities
2003

5 weeks
road
obstructed
2018



Methods



Towns at least one damaging event experienced in the past were selected.

Total population in the towns are **not known** (data is available for bigger administrative units).

- ❑ Social survey applying **FGD, KII and household survey** (impacts: 21 questions; perception: 10 questions) was made

Methods

- ❑ For HHS, households within the 150 m (Euclidian distance) from the highway were considered
- ❑ Survey continues from one end to the another taking into account:
 - Respondent should be **local resident** if not should be stayed **more than 20 years** in the town
 - If the town is parental land of respondent's, age should be **more than 25 years**

Methods

Societal impacts

HH information: Name, age, sex, family size (T, M, F), elders, children and disable persons, education, annual earning

Landslides and highway: facility comes with highway, past landslide events, impacted sectors when road blocked, direct victims, and loss and damage information, impact to respondent's family, extent and coping capacity, road blockade impact on livelihood and coping strength

Methods

Risk Perception

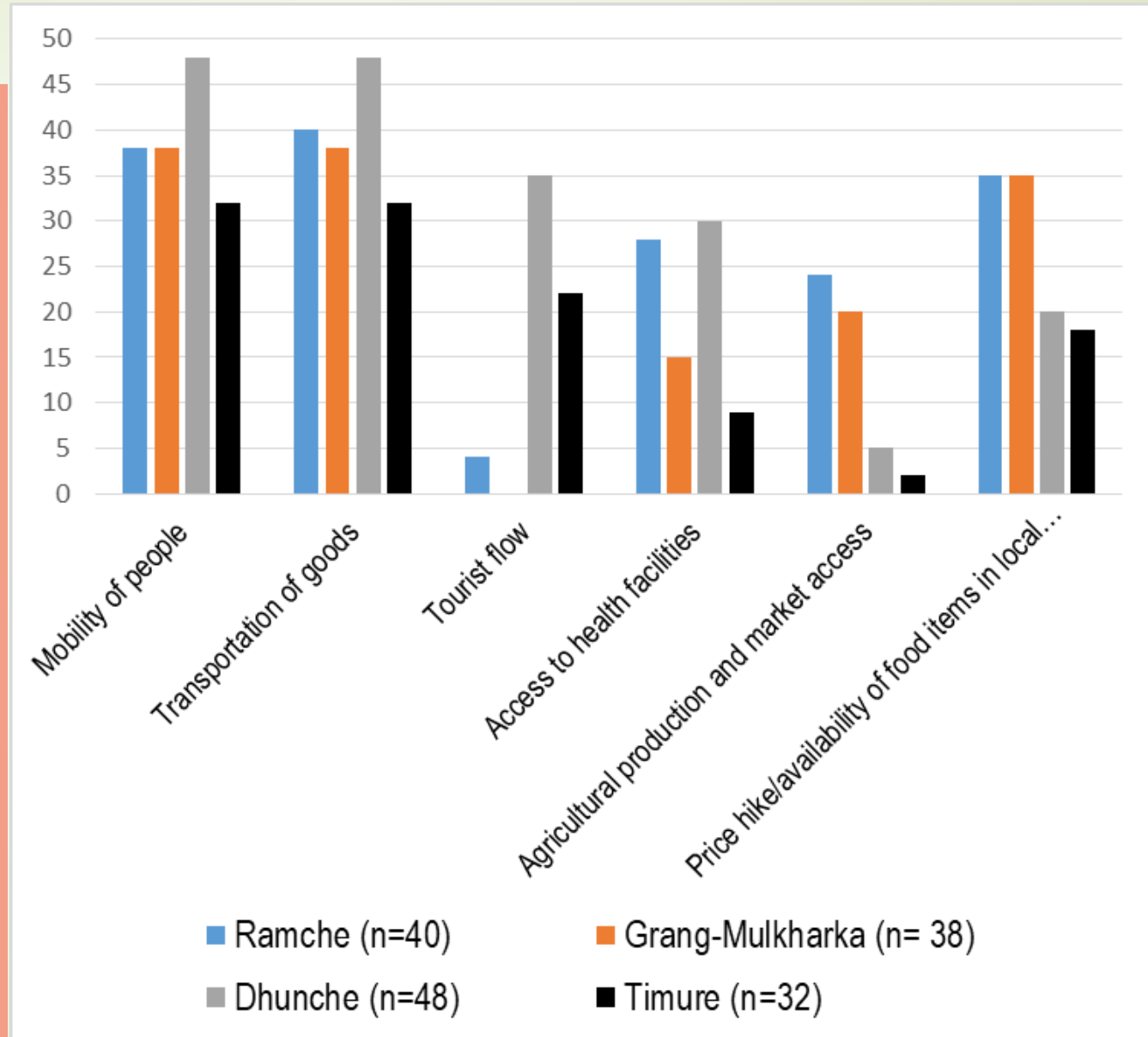
Understanding level, how they know (formal education/trainings or life time learning), past devastation, how they responded, organizations' activities

Adapted from California Hospital Association (2017)

		SEVERITY = (MAGNITUDE - MITIGATION)						
EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPAREDNESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	RISK
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Community, Govt entities, NGOs and supplies</i>	<i>Relative threat*</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 - 100%
Landslide	2	3	3	3	3	2	2	59%

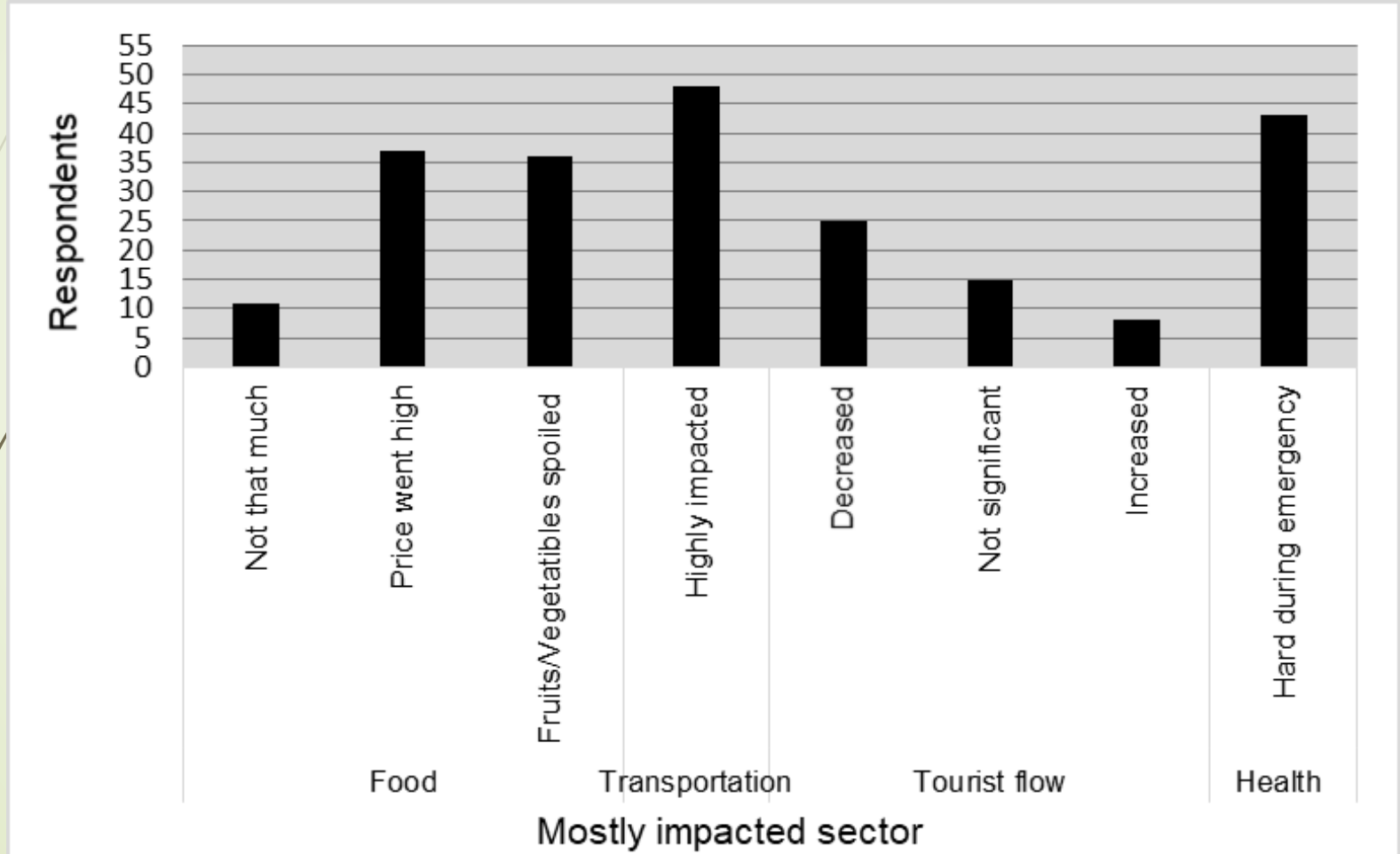
Results: Societal impacts

With the consideration of Landslides, 2018 Co-seismic landslides, 2015 Past (Ramche, Mulkharka) landslides



Societal impacts

Dhunche: Impact of 5 weeks road obstruction, 2018



Societal impacts

Dhunchu

Number of tourism entrepreneurs: **30**

Tourists in the town/year: 14,000 – 20,000

Average stay: **1-2 days**

Money spent/tourist: NPR 1,000-2,500

Annual transaction: NPR **10 to 30** million

Impact of 2015 co-seismic and post-seismic landslides on tourist flow: **50-100%**

Tourist flow still **5-20%** less compare to normal year

Coping

In descending order

1. One way transportation and walk in damaged area
2. Carry goods by foot from nearby market
3. Walk to reach the nearby destinations
4. Keep stock of goods
5. Use savings to buy expensive stuffs in local market
6. Helicopter lifting during emergency

Risk perception

Ramche: Creeping large landslide with multiple debris gullies, took 45 lives in 2003 including 20 army personnel.

Perceived risk

FGD amongst victims

83%

HHs Survey

n=40

Min: 37%

Max: 83 %

Median: 58.5%



Urpa Titung, 61, showing the area where army barrack was swept away by debris flow, 2003

Risk perception

Grang-Mulkharka

Perceived risk

FGD

28%

HHs Survey

n=38

Min: 26%

Max: 78%

Median: 46%



Creeping large landslide that took 5 lives in 1995 and obstructed road during monsoon for many years.

Risk perception

Dhunche: Mass failure both in the north and the south

Perceived risk

HHs Survey

n= 48

Min: 13%

Max: 78%

Median: 56%



Khopang cliff (rock fall), and debris slide, North of Dhunche, 2018.

Risk perception

Timure: town near to the Sino-Nepal border

Perceived risk

FGD amongst
victims

30%

HHs Survey

n= 32

Min: 22%

Max: 59%

Median: 52%



Debris flow that took 9 lives, 2018
Tenjung Dolma (inset)

Summary

- ❑ Mass failure is **common hazard** along the Kathmandu Kyirong highway
- ❑ It has remarkable impact not only on **road condition** but also on **livelihood** of roadside residents
- ❑ Locals are **aware** of the **devastation** that comes with landsliding but acceptable risk is high
- ❑ People are **resilient** though they have very limited resources
- ❑ Risk perception is basically **lifetime observation** of events in their surrounding



Thank you