Climate change and disaster risk and vulnerability context of Province 5

Report

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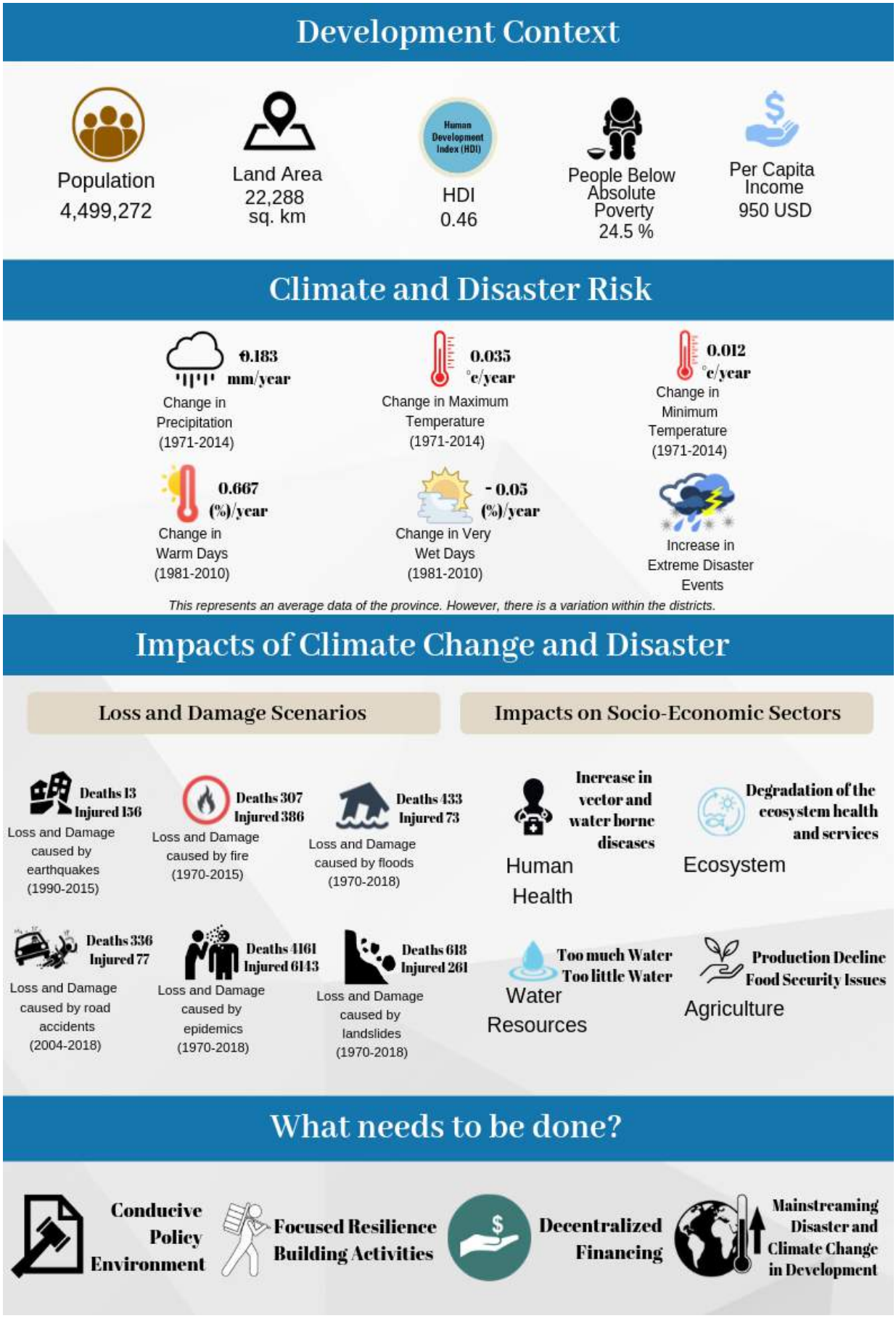

Development Context
Population
4,499,272
Land Area
22,288
sq. km
Human Development Index (HDI)
HDI
0.46
People Below Absolute Poverty
24.5 %
Per Capita Income
950 USD
Climate and Disaster Risk
0.183 mm/year
Change in Precipitation (1971-2014)
0.035 °c/year
Change in Maximum Temperature (1971-2014)
0.012 °c/year
Change in Minimum Temperature (1971-2014)
0.667 (%)/year
Change in Warm Days (1981-2010)
- 0.05 (%)/year
Change in Very Wet Days (1981-2010)
Increase in Extreme Disaster Events
This represents an average data of the province. However, there is a variation within the districts.
Impacts of Climate Change and Disaster
Loss and Damage Scenarios
Impacts on Socio-Economic Sectors
Deaths 13 Injured 136
Loss and Damage caused by earthquakes (1990-2015)
Deaths 307 Injured 386
Loss and Damage caused by fire (1970-2015)
Deaths 433 Injured 73
Loss and Damage caused by floods (1970-2018)
Increase in vector and water borne diseases
Human Health
Degradation of the ecosystem health and services
Ecosystem
Deaths 336 Injured 77
Loss and Damage caused by road accidents (2004-2018)
Deaths 4161 Injured 6143
Loss and Damage caused by epidemics (1970-2018)
Deaths 618 Injured 261
Loss and Damage caused by landslides (1970-2018)
Too much Water
Too little Water
Water Resources
Production Decline
Food Security Issues
Agriculture
What needs to be done?
Conducive Policy Environment
Focused Resilience Building Activities
Decentralized Financing
Mainstreaming Disaster and Climate Change in Development

Executive Summary

The Government of Province 5 is preparing its periodic development plan and has identified Disaster Risk Reduction (DRR) and Climate Change (CC) as an important environment and development agenda cutting across all the major socio-economic sectors. The Province Planning Commission (PPC) started a study, with the support from Policy and Institutions Facility (PIF) / Oxford Policy Management (OPM), to assess the situation of climate change and disaster risk in the province, and generate evidence to enable the integration of climate change and disaster risk reduction in the periodic plan.

A technical team, consisting of experts and subject matter specialists, worked closely with the Planning Commission. The team reviewed published literature and carried out consultations with the provincial and local governments between October 2018 and February 2019. The study team also reviewed disaster risk reduction plans and local plans on climate change adaptation and collected first-hand information at the Palika level.

The climate change trend analysis report (1971-2014), prepared by the Department of Hydrology and Meteorology (DHM) of Nepal, shows that almost all Province 5 districts experienced increased annual precipitation in winter, pre-monsoon and monsoon seasons with significant variations in monsoon precipitation among the districts. In all districts of Province 5, there is positive trend indicating a rise in minimum temperatures in all seasons. There is also a positive trend indicating an increase in maximum temperatures in all Province 5 districts. The trend in four Terai districts (Kapilvastu, Rupandehi, Banke and Bardiya) shows a decrease in maximum temperatures during winter.

Similarly the climate change scenario report (2014-2100), prepared by the DHM and International Centre for Integrated Mountain Development (ICIMOD), reveals that precipitation will increase in all Province 5 districts. As well as the positive change in precipitation levels in Province 5 districts are also expected to have an increase in temperature in the medium-term (2050) and the long-term (2100). The future Province 5 scenarios also reveal that extreme events, such as warm days, warm nights, warm spell duration, and wet days are going to increase rapidly. The increase in extreme events will have a direct impact on the health and livelihoods of people.

Findings further show that Province 5 is vulnerable to natural and human-induced disasters. Landslides, floods, fires, disease outbreaks, road accidents, drought, thunder and dry wind storm are among major hazard events. Disasters adversely affect natural resources, reduce people's livelihood opportunities and the amount of income they generate and exacerbate their suffering. Agriculture is one of the most impacted sectors in the province followed by water resources, ecosystems, and human health. The disasters not only take human lives and destroy/damage physical property but also slow the pace of development. It was also found that, among the vulnerable population,

children, older people and persons with disabilities (PwDs) are disproportionately affected by disaster and climate risks.

There are key challenges in terms of responding effectively to climate change and disaster risk and impact in the province. CC adaptation and disaster risk reduction and management (DRRM) activities are very limited and not effective. The evidence suggests that local and province governments do not have systematic legal, policy and programmatic response to climate change. There is therefore an urgency to devise policy and institutional mechanisms to mainstream climate change and disaster risk reduction in the development policies and plans of the provincial and local government.

In addition, the analysis demonstrates that local and provincial governments do not have systematized data storage and information generation in relation to climate change and disaster. Therefore, it is important for local governments to systematize their climate and disaster information collection and generation to support scientific planning and budgeting processes.

Mainstreaming climate change and disaster risk reduction (DRR) in legal measures, policies, and programs is instrumental in order to ensure climate and disaster resilient development. The provincial government should provide adequate support to local governments to draft policies and other necessary legal instruments to mainstream climate change and DRRM in development policies and plans. Institutional and financial arrangements should be strengthened at both levels of governance - local and provincial.

Table of contents

List of tables, figures and boxes

List of abbreviations

CC	Climate Change
CCA	Climate Change Adaptation
CCD	Consecutive Dry Days
DADO	District Agriculture Development Office
DDRMP	District Disaster Risk Management Plan
DEOC	District Emergency Operation Centre
DFID	Department for International Development
DHM	Department of Hydrology and Meteorology
DIMS	Disaster Information Management System
DMC	Disaster Management Committee
DPRP	Disaster Preparedness and Response Plan
DRR	Disaster Risk Reduction
DRRM	Disaster Risk Reduction and Management
EWS	Early Warning System
FGD	Focus Group Discussion
FY	Financial Year
GDP	Gross Domestic Product
GLOF	Glacier Lake Outburst Flood
GoN	Government of Nepal
HDI	Human Development Index
ICIMOD	International Centre for Integrated Mountain Development
IPCC	Intergovernmental Panel on Climate Change
LAPA	Local Adaptation Plans of Action
LDRMP	Local Disaster Risk Management Plan
LGOA	Local Governance Operation Act
MoFE	Ministry of Foresets and Environment
MoHA	Ministry of Home Affairs
NAPA	National Adaptation Programme of Action

NARC	National Agriculture Research Council
NNBC	Nepal National Building Code
NSSP	Nepal Safer School Project
OPM	Oxford Policy Management
PDMC	Province Disaster Management Committee
PDNA	Post Disaster Need Assessment
PIF	Policy and Institutions Facility
PPC	Province Planning Commission
PwD	Persons with Disabilities
RCP	Representative Concentration Pathway
SDG	Sustainable Development Goals
UNDP	United Nations Development Programme
VDC	Village Development Committee
WASH	Water, Sanitation and Hygiene

1. Introduction

1.1 Introduction

Nepal is a mountainous, land-locked country that sits in a seismically active zone, harbours different climate zones and experiences frequent extreme weather events. As such, the country is exposed to a broad range of natural hazards. Due to climate change, the frequency and intensity of natural hazards in Nepal is rising. The Observed Climate Trend Analysis Report (2017) prepared by the Department of Hydrology and Meteorology (DHM), Nepal based on temperature and precipitation data from the year 1971 to 2014 finds out that the average annual temperature increase rate of Nepal is 0.056°C.

Nepal is already witnessing the impacts of climate change and disasters in different socio-economic sectors and systems. The disasters negatively impact livelihoods and the built environment, increasing the vulnerability of the local population. The negative impact of natural and human-induced disasters both contribute to and intensify other factors such as urbanization, deforestation, encroachment of flood plains, and poor planning and building practices.

Nepal is one of the least developed countries in the world, with 25% of the population living below the poverty line.[1] Around 80% of Nepal's population is at risk from natural and climate-induced hazards.[2] The social and economic impact of disasters in Nepal is high and disproportionate to physiographic regions, gender and people with different livelihood strategies. A recent study suggests that from 1980-2017, disasters in Nepal have caused in 21,000 deaths and impacted the livelihoods of up to 13 million people, resulting in roughly USD 5.9 billion in physical losses[3]. Government estimates indicate that disasters cost the Government of Nepal about 6% of its annual development expenditures[4].

The economic impact of climate change is massive. Current climate variability and extreme events lead to major economic costs in Nepal. Extreme events are dominated by floods, but also include rainfall variability on agriculture (rain-fed agriculture, soil erosion, droughts) and low-season river flows reducing hydroelectricity generation. The estimated direct cost of these events is equivalent to 1.5–2% of current GDP/year (approximately US$ 270–360 million/year in 2013 prices), and is much higher in

[1] Central Bureau of Statistics (2018). Statistical Yearbook of Nepal: 2017, 16th edition. National Planning Commission, Kathmandu, Nepal
[2] Ministry of Home Affairs. (2018). Nepal Disaster Report, 2017: The Road to Sendai, Kathmandu: Government of Nepal.
[3] D. Guha-Sapir, R. Below, Ph. Hoyois – EM-DAT: The CRED/OFDA International Disaster Database – www.emdat.be – Universite' Catholique de Louvain – Brussels – Belgium, cited in ADB 2018.
[4] Ministry of Home Affairs (2017), National Position Paper on Disaster Risk Reduction and Management Nepal, Government of Nepal.

extreme years, rising to 5% or more. This is high by international standards. Consideration of the additional indirect and macro-economic costs could increase current estimates by 25–100%[5].

Province 5 is prone to disaster and climate change risk. In this context, the province is preparing its periodic plan and has identified disaster risk reduction and climate change as an underlying issue and a cross-cutting theme in its development plan. The Policy and Institutions Facility (PIF) is working closely with the Province Planning Commission (PPC) to generate the evidence base for integrating climate change and disaster risk reduction in the periodic plan.

1.2 Province background

Province 5 covers an area of 22,288 sq. km or 15.1% of Nepal. It consists of 12 districts with 109 local governments. Out of the 109 local governments, there are 4 sub-metropolitan cities, 32 urban municipalities, and 73 rural municipalities. The population is 4,499,272 and population density is 252 persons per sq. km. Rupandehi represents 19.6% of Province 5 population, followed by Kapilvastu-12.8%, Dang-12.3%, and Banke-10.9%. Of the total population, 52% are women and 48% are male. In terms of languages, 51.6% people speak Nepali, followed by Tharu (12.26%) and Awadhi (10.18%). Over one-quarter (25.96%), population speak other languages. Some other key features are depicted in table 1.

Table 1: Status of key features in Province 5

Target area	Present Status
Human Development Index	0.46
People below absolute poverty (%)	24.5
Per capita income (USD$)	950
Multidimensional Poverty Rate (%)	29.9
Human Poverty Index	31.9%
Overall literacy rate	66.6%
Male literacy rate	75.5%
Female literacy rate	58.3%
Government hospital	18 (no.)
Primary Health Centers (number)	31
Health Posts (number)	570
Households with access to drinking water (%)	86.2
Households with access to electricity facility (%)	66
Irrigated area (%)	50

[5] IDS-Nepal, PAC and GCAP (2014). Economic Impact Assessment of Climate Change In Key Sectors in Nepal. IDS-Nepal, Kathmandu, Nepal.

Paved roads (%) and (km)	7% and 800 km
Households with access to internet (%)	51.1

Source: Province Planning Commission (2018)

The human development index of Province 5 is 0.461 which is lower than the national average of 0.490. The per capita income of the province is US$ 950 which is lower than the national average of US$ 1160. The population under the poverty line is 25.9% which is slightly higher than national average of 25.2%. In addition, the population with multidimensional poverty is 29.9% which is higher than the national average of 28.6% (PPC's Approach Paper, 2018). The literacy rate is 66.43%, slightly higher than the national average of 65.9%. The major sector contributor in GDP for Province 5 is agriculture. This shows that the socio-economic development of Province 5 is moderate (Source: Situation paper, 2018).

Province 5 has experienced the negative impact of climate change and disasters and is at high risk of multiple disasters. Floods, landslides, earthquakes, epidemics, fires, lightning strikes, and wind and hail-storms are all becoming more frequent undermining the development gains. Of these hazards, floods and landslides are the most frequent and have the greatest impact on people's lives and livelihoods. Province 5 also lies in a seismically active zone and has a high probability of earthquake risk.

1.3 Province development priorities

Province 5 has initiated its first periodic planning process. A draft approach paper for the periodic plan was prepared by the Planning Commission. As mentioned in the approach paper, the overall development vision of the Province is “Prosperous Province, Happy People” (Draft approach paper of Province 5, 2018).

The approach paper has aligned its objectives, indicators and targets with the Sustainable Development Goals (SDGs), the global goals adopted by the Government of Nepal and the national development goals. They aim to ensure an ecologically sustainable and socially-just development by reconciling the economic, social and environmental dimensions of sustainable development. Province 5 wants to alleviate poverty and generate inclusive development through ensuring: food security; health; education; gender equality; clean drinking water and sanitation; access to clean energy; employment; inclusive and sustainable industrialization; safe human settlement; sustainable production and consumption system; climate change and disaster risk reduction; ecology and biodiversity protection; among others, to achieve sustainable development goals.

Province 5 has identified the different sectors in which to pursue its objective of a ‘Prosperous Province, Happy People’. Table 2 depicts each sector and the cross-cutting areas identified by the province to address climate change and disaster risk reduction. These sectors are categorized into economic, social, infrastructure, governance and monitoring and cross cutting areas. The sectors are the major pillars for achieving the goal and objectives of the province.

Table 2: Climate and DRRM relevant sectors of Province 5

Integrated Economic Policy	Economic Sectors	Social Sector	Infrastructure Sector	Cross-cutting Area	Governance and Monitoring
	• Mines and minerals • Tourism • Medicinal herbs • Agriculture • Livestock • Fisheries • Land management	• Health • Resource protection	• Irrigation • Hydro-electricity and energy • Road and transport infrastructure • Disaster risk reduction • Urban development • Drinking water and sanitation • Settlement development	• Human resource development • Women and children • Labour and employment • Science and technology • Poverty alleviation • Forest and environment • Disaster risk reduction and management	• Governance • Monitoring and evaluation of implementation

Source: PPC Approach Paper, 2018.

Province 5 has identified socio-economic targets to achieve during its first five-year plan period (FY 2075/76 - 2080/81 VS). The province wants to reduce the rate of people below absolute poverty from 24.5% to 10% including a reduction in the multidimensional poverty rate from 29.9% to 15% by 2080/81. Similarly, the province aims to increase households' access to drinking water and access to electricity facility to 100% within 5 years.

1.4 Study objectives

The main objectives of this study are:

(i) to assess the status of hazards, vulnerabilities and risks of climate change and disasters in Province 5 to support decision making about relevant policies, strategies, programmes and plans in the province;

(ii) to analyse potential legal and policy instruments, institutional structures for climate change and DRRM, and integration pathways for CC and DRRM into development plans; and

(iii) to analyse CC and DRRM among the most vulnerable population in the province and offer strategies to address its vulnerabilities and risks from the perspective of gender equality and social inclusion.

1.5 Study methods and approach

The study team used both qualitative and quantitative data. Qualitative data was collected through a literature review and empirical field work. The team carried out a thorough analysis of the 2017 Department of Hydrology and Meteorology (DHM) climate change trend report and the Ministry of Forests and Environment (MoFE), DHM

and International Centre for Integrated Mountain Development (ICIMOD) climate change scenario report (unpublished). We also reviewed the following documents:

- The draft approach paper of Province 5;
- National development plans; the constitution; laws and policies relevant to climate change and DRRM;
- Local Adaptation Plan for Action (LAPAs); Disaster Preparedness and Response Plans (DPRPs); Local and District Disaster Risk Management Plans (LDRMPs and DDRMPs respectively);
- Reports on climate trends and scenarios prior to the field mission helped the team understand the overall policy, disaster and climate context in the province.

Primary information was collected using participatory tools like focus group discussions (FGDs), key informant interviews (KIIs), competency analysis, site visits and observation of hazard-prone areas. The team met with relevant authorities in province and local governments, representatives of civil society, and community stakeholders.

We conducted a survey involving 109 local governments of the province on climate change, hazards, loss and damage from disaster. FGDs were conducted in Arghakhanchi, Kapilvastu, Nawalparasi and Banke districts with farmers' groups and disaster management committees. Strengths, weaknesses, opportunities and threats exercises were also carried out during the FGDs. Key Informants Interviews were held with elected representatives and local governments' office bearers.

The study team participated in feedback workshops organized by the Province Planning Commission (PPC) in all 12 districts, where the team closely listened to the issues and concerns of stakeholders, interacted with officials to understand the disaster and climate context as well as risks and vulnerabilities, and gathered feedback.

1.6 Limitations

There are some limitations related to this study. The limitations are:

- There is no systematic secondary data at either local or provincial levels of government which made the analysis more challenging in terms of drawing conclusions on the real impact of climate change and disasters.
- Due to time constraints and the need to provide a timely report to the Planning Commission, the team could not cross-check the information received from the survey on disaster and climate change via further qualitative interviews with local government officials.

2. State of Climate Change and Disaster Risk

2.1 Overview of Climate in the Province

The climatic conditions of Province 5 are very diverse ranging from sub-tropical to alpine. Province 5 extends to all five physiographic zones in Nepal: 3.1% of its area is covered by high mountains, 9.1% by high hills, 32.2% by mid-hills, 27.9% by Siwalik and 27.6% by Terai (Approach paper, 2018). The altitude of the province ranges from 500 to 5,000 meters above sea level. The majority of the land area (63.3%) is within an altitude of 1,000 meters. Province 5 is rich in vegetation and river systems. Almost half of the land is covered by forest. It also has two national parks, Banke and Bardiya and one conservation area (part of Dhorpatan Hunting Reserve). Province 5 has 32 major watersheds consisting of 42 major rivers and tributaries. West Rapti is the longest river in the province, at 207.7 km.

2.1.1 Climate change trend of Province 5

The climate change trend analysis presented in this section is based on Observed Climate Trend Analysis Report (2017) of the Government of Nepal which analysed district-wise climate data (temperature and precipitation) between 1971 and 2014.

Precipitation

Almost all the districts of Province 5 experienced increased annual precipitation in winter, pre-monsoon and monsoon seasons with significant variations in monsoon precipitation among the districts

During the 1971-2014 period, except in Rukum, all other 11 districts experienced increased annual precipitation during winter. Similarly, the northern districts of Rukum and Rolpa were the only districts to experience decreased pre-monsoon precipitation. The change in monsoon precipitation varied significantly among districts with decreased precipitation at the rate of -3.92 mm/year in Rukum to increased precipitation at the rate of 6.56 mm/year in Bardiya. The district-wise precipitation trend is presented in Table 3 below.

Table 3: District-wise precipitation trend of Province 5

District	Change in precipitation, mm/year (1971-2014)				
	Winter	Pre-monsoon	Monsoon	Post-monsoon	Annual trend
Rukum	-0.12	-0.70	-2.50	-0.37	-3.80
Rolpa	0.03	-0.48	-3.92	-0.40	-5.19
Pyuthan	0.08	0.21	-1.88	-0.68	-3.69
Gulmi	0.15	0.91	5.40	-0.73	5.11
Arghakhanchi	0.14	1.07	-1.53	-0.56	-3.04

Palpa	0.005	1.04	0.77	-0.51	0.81
Dang	0.14	0.67	-1.28	-0.62	-2.27
Kapilvastu	0.19	0.67	-1.86	-0.59	-2.17
Rupandehi	0.17	0.89	-2.70	-0.42	-3.28
Nawalparasi	0.08	1.58	2.64	-0.30	3.72
Banke	0.23	0.81	3.94	-0.11	3.75
Bardiya	0.41	0.67	6.56	-0.18	7.86

Source: DHM (2017)

The increasing trend of precipitation is likely to facilitate the occurrence of hazards like flood, landslide, and erosion. Bardiya district is experiencing floods almost every monsoon season as the precipitation level is increasing. The consultations carried out for this report also identify floods as one of the top hazards. The consultations with locals highlight the concern that more floods are likely to occur in the coming years if proper flood hazard mitigation measures are not implemented. On the other hand, a decreasing trend of precipitation is likely to increase the occurrence of drought and fire, because the dry spell will increase.

Temperature (minimum)

In all Province 5 districts there is a positive trend in the rise of annual minimum temperatures in all seasons.

The temperature trend shows that, except in the northern district of Rukum, the minimum temperature during winter and pre-monsoon season increased in all districts during the 1971-2014 period. Likewise, minimum temperatures increased in all districts during monsoon and post-monsoon seasons. Among all districts across all seasons, the rise in minimum temperature was highest in Rukum (0.038°C/year during monsoon) followed by Rolpa (0.033°C/year during winter). Rukum experienced the most dramatic change in minimum temperature with the largest decrease during winter and the highest increase in monsoon. The increase in minimum temperature was relatively consistently high in Rolpa across all seasons. The district-wise trend in minimum temperature change is presented in the table 4 below.

Table 4: District-wise minimum temperature trend of Province 5

District	Change in minimum temperature, °C/year (1971-2014)				
	Winter	Pre-monsoon	Monsoon	Post-monsoon	Annual trend
Rukum	-0.019	-0.007	0.038	0.002	0.008
Rolpa	0.033	0.028	0.026	0.019	0.025
Pyuthan	0.003	0.007	0.019	0.003	0.009
Gulmi	0.002	0.005	0.013	0.003	0.007
Arghakhanchi	0.009	0.011	0.018	0.004	0.013
Palpa	0.004	0.005	0.002	0.001	0.004
Dang	0.005	0.006	0.014	0.001	0.008
Kapilvastu	0.009	0.014	0.018	0.004	0.016

Rupandehi	0.021	0.014	0.013	0.007	0.017
Nawalparasi	0.017	0.015	0.009	0.010	0.015
Banke	0.015	0.005	0.010	0.009	0.009
Bardiya	0.012	0.009	0.017	0.013	0.012

Source: DHM, 2017

Temperature (maximum)

There is a positive trend in the increase in maximum temperatures in all Province 5 districts. In the four districts of Kapilvastu, Rupandehi, Banke and Bardiya there is a decrease in maximum temperatures during winter.

Table 5: District-wise maximum temperature trend of Province 5

District	Change in maximum temperature, °C/year (1971-2014)				
	Winter	Pre-monsoon	Monsoon	Post-monsoon	Annual trend
Rukum	0.056	0.042	0.068	0.060	0.064
Rolpa	0.047	0.039	0.051	0.048	0.048
Pyuthan	0.028	0.031	0.045	0.038	0.040
Gulmi	0.034	0.046	0.051	0.043	0.045
Arghakhanchi	0.019	0.029	0.043	0.034	0.034
Palpa	0.020	0.045	0.056	0.039	0.043
Dang	0.017	0.032	0.037	0.032	0.031
Kapilvastu	-0.003	0.020	0.035	0.022	0.021
Rupandehi	-0.012	0.025	0.043	0.022	0.021
Nawalparasi	0.009	0.033	0.049	0.018	0.026
Banke	-0.005	0.024	0.034	0.025	0.020
Bardiya	-0.003	0.020	0.036	0.032	0.024

Source: DHM, 2017

Except in four districts during winter (Kapivastu, Rupandehi, Banke, and Bardiya though insignificant), maximum temperatures increased in all other seasons in the province (Table 5). Rukum recorded a relatively higher increase in maximum temperatures across all seasons from 0.042°C/year during pre-monsoon to 0.068°C/year during monsoon. Rukum is also the only district to have experienced a fall in minimum temperatures during winter and pre-monsoon seasons and a rise in maximum temperatures during the same seasons.

In contrast, Kapilvastu, Rupandehi, Banke, and Bardiya experienced a rise in minimum temperatures during winter and a fall in maximum temperatures (although nominal) during the same season. This suggests that the diurnal temperature range is decreasing suggesting the days are getting colder whereas the winter are getting warmer. This will have implications on the daily life of the people as well as in the production of the agriculture sector.

The results from the survey carried out in this study also show that cold waves are ranked amongst the top hazards in all districts. For example, respondents in Banke and Nawalparasi perceived cold waves as the second worst hazard, and respondents in Kapilvastu ranked cold waves as the third worst hazard.

2.1.2 Future projected climate change scenario of Province 5

Precipitation

All Province 5 districts are expected to have an increase in precipitation in both Representative Concentration Pathways (RCPs) [RCP 4.5 and RCP 8.5] scenarios.[6]

The scenario report suggested that under the RCP 4.5, Kapilvastu district will experience the least change in percentage of precipitation (0.05) from the reference period of 1981-2010 whereas Gulmi district will experience more change in percentage of the precipitation (2.85) for the year 2016 to 2045. The precipitation is likely to increase more in the RCP 8.5 scenario ranging from 6.7 % change to 14.78% for the year 2016-2015 and 2036-2065 respectively. With the increasing precipitation, more floods are likely to occur in the plain areas whereas landslides and flash floods are likely to occur in the hills. The changes in precipitation will also trigger health related issues such as the spread of water-borne diseases.

Table 6: District-wise precipitation scenario of Province 5

S.N.	District Name	RCP4.5		RCP8.5	
		2016-2045	2036-2065	2016-2045	2036-2065
1	Arghakhanchi	1.9	8.73	7.03	11.65
2	Banke	1.66	8.64	6.42	12.69
3	Bardiya	1.15	9.33	7.33	14.53
4	Dang	1.1	7.62	6.7	12.36
5	Gulmi	2.85	9.36	7.74	12.05
6	Kapilvastu	0.05	7.55	6.19	10.03
7	Nawalparasi	0.54	7.44	5.43	8.47
8	Palpa	1.58	8.34	6.34	9.8
9	Pyuthan	2.62	9.3	8.37	13.78
10	Rolpa	2.1	8.91	8.3	14.53
11	Rukum	1.69	9.15	8.55	15.38
12	Rupandehi	0.23	7.48	5.56	8.85

Source: MoFE, 2019

[6] DHM, 2017. "Climate change scenarios of Nepal for National Adaptation Plan Formulation Process in Nepal." Department of Hydrology and Meteorology, Ministry of Population and Environment, Kathmandu Supported by International Centre for Integrated Mountain Development. Representative Concentration Pathways (RCPs) are greenhouse gas concentration trajectories that are used for climate modelling in order to project and describe climate futures in different conditions emissions.

The trend and scenarios findings also matches the perception data. The Focus Group Discussion (FGD) conducted at Sitganga Municipality of Arghakhanchi, Mayadevi Municiplaity of Kapilvastu, Rajapur Municipality of Bardiya, Rapti-Sonari Rural Municipality of Banke confirmed the perception of an increasingly erratic rainfall pattern.

Temperature

As in the positive change in the precipitation, all the districts of Province 5 are also expected to have an increase in temperature in both the Representative Concentration Pathways (RCPs) [RCP 4.5 and RCP 8.5] scenarios.

All Province 5 districts are expected to have an increase in temperature by 1^0C in average by 2045 and 1.5 ^{0}C by 2065 in RCP 4.5. Kapilvastu, Nawalparasi, Rupandehi will experience the least change in temperature (0.96, 0.9 and 0.92) compared to other Province 5 districts. The scenario report suggests there will be a more than 1.5^0C temperature increase. An increased temperature is likely to trigger several problems in Province 5. There is a likelihood that with the increase in temperature, will come severe drought, water shortages, fire outbreaks, health relat issues and the spread of vector borne diseases. It will impact women, disabled, children and people with low income. The below table shows the change in temperature in different timeframes under the RCP 4.5 and RCP 8.5 scenarios.

Table 7: District-wise temperature scenario of Province 5

S.N.	District	RCP4.5		RCP8.5	
		2016-2045	2036-2065	2016-2045	2036-2065
1	Arghakhanchi	1.02	1.37	1.87	1.14
2	Banke	1.09	1.47	1.9	1.21
3	Bardiya	1.07	1.51	1.91	1.2
4	Dang	1.03	1.37	1.81	1.16
5	Gulmi	0.97	1.35	1.85	1.09
6	Kapilvastu	0.96	1.26	1.75	1.11
7	Nawalparasi	0.9	1.2	1.68	1.07
8	Palpa	0.96	1.3	1.81	1.1
9	Pyuthan	1.01	1.39	1.84	1.13
10	Rolpa	0.98	1.38	1.76	1.11
11	Rukum	0.93	1.34	1.7	1.07
12	Rupandehi	0.92	1.23	1.72	1.1

Source: MoFE, 2019

2.1.3 Projected scenario of extreme events trend of Province 5

2.1.3.1 Warm Days, Nights and Spell duration

In case of warm days (% of days when maximum temperature is greater than 90th percentile), all the districts of Province 5 demonstrate an increasing trend. Among the districts, Arghakhanchi, Nawalparasi, Pyuthan, Gulmi, Palpa, Rolpa, Rukum demonstrate a positive trend with 99% or higher significance level. Warm days increased by more than 5% from the reference period of 1981 to 2010 for the year 2016 to 2045. Similarly, the change in warm days (%) for the year 2036 to 2064 are found to have more than 9% increase.

In case of warm nights (% of days when minimum temperature exceeds 90th percentile), there is a positive trend in almost all districts of Province 5. Among the districts, Arghakhanchi, Bardiya, Dang, Gulmi, Kapilvastu, Pyuthan, Rolpa and Rukum demonstrate the positive trend with 95% or higher confidence level. The nights are expected to be warmer than today, with a 10% increase in warm nights in the period 2016 to 2045.

Under various scenarios, there is a positive trend in warm spell duration throughout all districts of Province 5, among which Gulmi, Rukum and Palpa show the highest positive annual trend of 0.3%. Similarly, the scenario projections of warm spell duration are positive in all Province 5 districts. With the increase in warm spell duration, the likelihood of heat waves, forests fire, pest and diseases increases as well, affecting the entire ecosystem. The districts in the low-lying regions of Province 5 have already suffered from heat waves which are likely to increase more.

2.1.3.2 Cool Days, Nights and Spell duration

The climate change trend demonstrates a decreasing trend of annual cool days (% of days when maximum temperature <10th percentile) in most of Province 5 districts except Nawalparasi. In the context of the districts with decreasing trend in percentage of annual cool days, Arghakhanchi, Dang, Gulmi, Palpa, Pyuthan, Rolpa, Rukum demonstrate a decreasing trend with 95% or higher confidence level. The cool days are expected to decrease.

The climate change trend shows a mixed trend of cool nights (% of days when minimum temperature <10th percentile) where Rolpa and Rupandehi districts show a negative trend with 95% or higher confidence level. Under the climate change scenario, the cold nights will decrease by almost 5 % to 7%. The change in cool nights will mostly affect the horticulture sector and will have implications for human health.

In case of cold spell duration, there is a positive trend in all districts of Province 5 except Rolpa. However, the scenario projections demonstrate a negative scenario of cold spell durations.

2.1.3.3 Consecutive dry days, rainy days, wet days, very wet days, extremely wet days

In case of consecutive dry days (maximum number of consecutive days with daily rainfall with <1mm), the analysis shows an insignificantly negative trend in all the districts of Province 5. The number of annual rainy days (rainfall greater than 1 mm in a day) demonstrates a positive trend in all the districts of Province 5. However, Rukum shows a significant positive trend with 99% confidence level. This means the number of rainy days are expected to decrease but the amount of rainfall may not decrease which implies there will be a more erratic rainfall pattern.

The higher number of wet days is likely trigger flash floods and landslides thus affecting the entire human and natural ecosystem. In case of consecutive wet days (max number of consecutive days with daily rainfall >1mm), it demonstrates the increasing trend in all districts of Province 5 with the highest trend in Rukum with 0.7 percent with 99% confidence level followed by Gulmi with 0.5 percent. Banke and Dang suggest a negative trend both with -0.1 percent.

The data for very wet days (days with annual daily rainfall >95th percentile) demonstrates a decreasing trend in most of Province 5 districts with the highest trend in Rukum with -0.4 percent with 99.9% confidence level. Districts like Nawalparasi, Banke, Bardiya demonstrate a positive trend. Some of the districts (Arghakhanchi, Bardiya, Dang, Kapilvastu, Palpa and Pyuthan) are found to have an increase in very wet days whereas other districts are likely to experience a decrease in very wet days.

In case of extremely wet days (days with daily rainfall >99 percentile) there is a negative trend with Pyuthan, Rolpa and Rukum all with -0.1 % with 95% or more confidence level. However, the scenario report suggested that the change in extreme wet days are likely to increase by more than 25% in 2016 to 2045 time-period and more than that in the following year. These extremely wet days' events are of concern as they might affect the human mobility by triggering hazards such as flash floods and landslides.

2.2 Hazards

Province 5 is exposed to multiple geo-physical and hydro-meteorological extreme events and climatic and non-climatic hazards, each with the potential to intensify into a disaster. Climate-induced extreme events are broadly categorized as (i) hydro-meteorological events such as floods, landslides, hailstorms, thunderstorms, lightning strikes, fog, glacier lake outburst floods (GLOFs), avalanches, severe storms/windstorms and (ii) climatological events like extreme temperatures, droughts, wildfires, and heat and cold waves. Non-climatic hazards are primarily geo-physical events like earthquakes and dry-mass movements, including rock slides. Other disasters are biological events and may be either related to the climate or not. They include epidemics, infection, invasive species, insect infestations and animal stampedes. Moreover, human-induced disasters such as road and fire accidents are

increasing and improper land use and development interventions are aggravating natural hazards.

Climate change is expected to make hazards and disasters more frequent and severe in the future. Province 5 topography, characterized by steep and mountainous terrain in the north, the fragile Churia hills in the centre, and the geology of the Terai is prone to risks. The district-wise top five hazard ranking of the province is presented below in Table 8.

Table 8: District-wise top five hazards of Province 5

SN	Districts	Top 5 hazards based on the questionnaire
1	Rolpa	1. Landslide 2. Flood 3. Fire 4. Drought 5. Crop and livestock diseases
2	Glulmi	1. Landslide 2. Flood 3. Fire 4. Drought 5. Crop and livestock diseases
3	Nawalparasi	1. Flood 2. Cold waves 3. Crop and livestock disease 4. Fire 5. Windstorm
4	Banke	1. Flood 2. Cold waves 3. Crop and livestock disease and outbreaks 4. Fire 5. Windstorm
5	Pyuthan	1. Landslide 2. Flood 3. Fire 4. Drought 5. Crop and livestock diseases
6	Bardiya	1. Flood 2. Fire 3. Crop and livestock disease and outbreaks 4. Cold waves 5. Hailstone
7	Dang	1. Flood 2. Fire 3. Drought 4. Crop and livestock diseases 5. Landslide
8	Rukum	1. Landslide 2. Flood 3. Drought 4. Crop and livestock disease 5. Fire
9	Arghakhanchi	1. Landslide 2. Fire 3. Drought 4. Crop and livestock disease 5. Flood
10	Kapilvastu	1. Fire 2. Flood 3. Cold waves 4. Drought 5. Heatwaves
11	Rupandehi	1. Flood 2. Cold waves 3. Drought 4. Fire 5. Crop and livestock diseases
12	Palpa	1. Landslide 2. Flood 3. Drought 4. Fire 5. Crop and livestock diseases

Source: Field study and questionnaire survey in local governments (2018)

3. Impact, Vulnerability and Risk

3.1 Risk and vulnerability of climatic and non-climatic hazards

3.1.1 Climate change impacts, disaster vulnerability and risk

The impacts of climate change occur due to the interaction of climate change, climate variability or extreme climatic events combined with the vulnerability of the exposed systems. Climate change impacts social, economic and ecological systems and sectors. The vulnerability to the impacts of climate change is defined as the degree to which a system is incapable of dealing with adverse impacts of climate change which also includes climate variability and extreme events (IPCC, 2016).

The escalating impacts of natural hazards are caused mostly by increasing exposure of populations and assets. Whereas risk is defined as the combination of the likelihood of an event and its consequences. Impact assessments have widely examined the consequences of climate change but have been less able to attach likelihoods to those outcomes. We aim to look into trends and scenarios data to determine the probability of risk and its implications.

The current disaster and climate change trend and future scenarios are likely to have impact on different economic sectors of the province. Impacts on some sectors are likely to be more pronounced than others. Based on the context of the province, the climate sensitive sectors are agriculture, forestry, water, tourism, health, and infrastructure. The impacts fall more disproportionately on women, poor and marginalized people and communities.

This section identifies and presents the impact, vulnerabilities, risks posed by both climatic and non-climatic hazards in different local governments and districts of the province. The identification of hazards is important to identify the potential risk so that respective adaptation measures can be adopted accordingly.

3.1.2 Disaster vulnerability and risk

Province 5 is exposed to multiple hazards: floods, epidemics, landslides, fires, and hailstorms are a major risk and have caused much loss and damage (Annex I and II). Disaster data demonstrates that the frequency and intensity of the multiple disasters that Province 5 faces are increasing. These disasters adversely affect natural resources, reduce livelihood opportunities and the amount of income they generate, and exacerbate people's suffering. Disasters not only take many human lives and physical property but also slow down the pace of development. Stakeholder consultations revealed that assets are being lost at a greater rate because people are ill-prepared and fatalistic.

The hazard responsible for taking the most lives in Province 5 (based on the data available till 2018) is epidemics - diseases outbreaks which killed 4,161, followed by

landslides (618), floods (433), and fires (307). Many families were affected by different hazards: floods (334,837 affected families), epidemics (110,974), landslides (66,512), fire (60,176), heavy rainfall (52,202), hailstorms (4,371), and forest fires (324). Floods and landslides cause the most people to go missing, 258 and 46 respectively. Injuries were mainly attributable to epidemics (6,143), fires (386), landslides (261), and floods (73), (Annex I and II). Table 9 provide information about the loss and damage caused by hazards and disasters in Province 5 in different time periods.

Table 9: Number of families affected by hazards/disasters

District	Hazards related to high precipitation		Hazards related to low temperature	Hazards related to high temperature		
	Flood (1970-2013)	Landslide (1970-2013)	Cold waves (1990-2013)	Heatwaves (affected families)	Epidemics (affected family)	Fire (affected family)
Arghakhanchi	4202	10564	0		15692	1733
Banke	28146	293	0	0	22768	18496
Bardiya	65673	0	12	0	946	5427
Dang	67188	441			3000	7627
Gulmi	1363	19712	0		1461	705
Kapilvastu	26386	297		0	6212	13675
Nawalparasi	82139	3034	7	0	28605	2413
Palpa	25814	3948	0		25352	1849
Pyuthan	192	1288			1011	1320
Rolpa	410	2875			884	1646
Rukum	4840	4112	0		1752	2214
Rupandehi	28484	19948		0	3291	3071

Source: Field study and questionnaire survey in local governments (2018)

The data shows that the trend of deaths by landslide are decreasing in Arghakhanchi, where the annual decrease is -0.02 (yearly death toll decreased by -0.02 number of people). Deaths by landslide in Palpa, in contrast, are increasing the most, by 0.09 annually. Deaths by floods are decreasing most in Gulmi (-0.01 annually) and increased most in Dang (0.07). In terms of deaths by fire, Kapilvastu and Rukum recorded the highest increase, 0.04. Deaths by epidemics have decreased most in Gulmi (-0.03) and increased the most in Bardiya, Palpa, Pyuthan and Kapilvastu (0.06 each) and in Dang (0.42), refer to Annex IV.

In terms of the number of families affected by landslides, Gulmi recorded the highest increase (24.1), followed by Rupandehi (4.33), and deaths are decreasing in Nawalparasi by -3.38. Floods have affected more families in Nawalparasi, where the annual increase was 95.31, followed by Bardiya (84.62) and Dang (82.26), but deaths in Palpa and Rupandehi have decreased by -32.75 and Rupandehi (-8.76). Fires affected more families in Kapilvastu and Banke, where the rates went up by 10.76 and 7.75 respectively but decreased in Dang by -6.18. The trend of epidemics affecting

families increased in Banke (9.52), Nawalparasi (3.81) but decreased in Kapilvastu (-0.14), refer to Annex IV.

Avalanches seems to have caused the most loss and damage in Rukum, while in Nawalparasi and Bardiya cold waves prevailed, and epidemics found to be most devastating in Banke, Rupandehi, Palpa, and Nawalparasi. Loss and damage by fire was observed more in Kapilvastu, Banke, and Dang while the impacts of the flood were felt the most in districts of the Terai like Nawalparasi, Dang, Bardiya, Banke, Kapilvastu, and Rupandehi, (Annex I and II). Forest fire seems to have been the dominant hazard in Arghakhanchi, Rukum, and Dang while the impact of hailstorms was observed to most in Banke, Bardiya, Nawalparasi, Rupandehi and Rukum.

Likewise, heatwaves have affected lowland districts: Kapilvastu, Rupandehi, and Banke while the impact of heavy rainfall was observed the most in Banke, Bardiya, Nawalparasi, Kapilvastu, Rolpa and Pyuthan. Rukum and Rolpa were most vulnerable to the impact of snowstorms while rainstorms had major impacts in Rupandehi. Windstorm-prone districts include Dang, Banke and Bardiya (Annex I and II).

The data on loss and damage is also consistent with peoples' perception about the trend and severity of disaster impacts. Participants of FDG in Mayadevi Municipality claimed that both rapid and slow-onset disasters affect their lives and wellbeing. The floods of 1993, 2014, and 2017 are some notable examples of floods (DesInventar and MoHA, 1970-2018) which had profoundly negative impacts. Overall, flood events are increasing in frequency and in the scale of their impact.

Earthquakes are also a major potential hazard in Province 5 because it lies in a zone of high seismic risk (Durham University, 2015). The rates of urbanization in Nepal, especially in cities like Butwal, Bhairahawa, Ghorahi and Nepalgunj, have risen sharply in the last decade. Poor implementation and enforcement of building codes during construction and the consequent paucity of earthquake-resistant structures in new buildings exacerbate the earthquake risk.

The impact of disasters is further triggered by other factors such as population, population density, location of settlements, and vulnerability. Past occurrences of floods and landslides, and the resultant loss and damage may suggest some correlation with changes in precipitation that have occurred over the years (Table 7). For instance, the number of families affected by floods during the 1970-2018 period was high in Nawalparasi, a district that saw a sharp increase in pre-monsoon precipitation (1.58 mm/year) and in monsoon precipitation (2.64 mm/year).

The increase in monsoon precipitation was highest (6.56 mm/year) in Bardiya, a district where the number of families affected by floods during the 1970-2018 period was also high. Other districts with large number of families that are at risk in the face of floods are Palpa, Dang, Kapilvastu, Rupandehi, and Banke. All of these districts showed increases in winter and pre-monsoon precipitation. There are also districts, like Gulmi, where the monsoon precipitation increased by 5.40 mm/year but where the number of families affected by flooding is relatively low, which needs further investigation.

The future scenarios data shows that Province 5 is at high risk from disaster and climate change impacts. The temperature will continue to increase. Shifting and widely fluctuating patterns of rainfall marked by fewer days of rain of higher than average intensity will increase the magnitude and frequency of water-induced disasters like landslides and floods. The data suggests that both the number of heavy rainfall events and the average length of droughts will increase. While the total amount of monsoon rainfall is expected to change little, the number of days of rain is expected to decrease, and the number of days of extreme rainfall events is likely to increase. These projections are likely to reinforce the current trend of increasingly more climate-induced disasters in Province 5.

The risk and vulnerability of climatic and non-climatic hazard in Province 5 are discussed below.

3.1.2.1 Flood

Flooding is an almost annual phenomenon in the Mid-Hill and Terai districts of Province 5. The frequency, duration, and intensity of floods has been increasing every year because of heavy rainfall and river overflow (NAPA, 2010). The floods of 1993, 1998, 2006, 2014, and 2017 stand out for the scale of loss and damage they brought (DesInventar and MoHA, 1970-2018). Inundation is also a problem as a result of debris deposition in the river bed, poor drainage and waterlogging in semi-urban and urban areas. Figure 1 depicts the major rivers in Province 5.

Box 1: Major flood-prone areas in Province 5

- **Bardiya:** Flooding of the Babai and Karnali rivers has impacted Rajapur and Southern Guleriya, the district headquarters. Ward no. 7 and 4 of Thakurdwara Village Development Committee (VDC) (which now falls under Thakurbaba Municipality) are at higher risk of flood and other climate change impacts (LAPA, 2015). Similarly, Manau VDC (which now falls under Geruwa Rural Muncipality) is worst affected by flood, where more than 48% of climate change affected households are affected by flood and inundation (LAPA, 2013). Ward no. 1, 8 and 9 are the worst affected wards in Manuwa VDC (LAPA, 2013). Similarly, Khairichandan VDC (which now falls under Rajapur Municpality) has identified flood and inundation as the worst hazard of the VDC. Similarly, Suryapatuwa VDC (which now falls under Madhuban Municipality) also identified flood as its worst hazard (LAPA, 2014) of which Ward no. 1 falls under ‘extremely higher’ vulnerability ranking followed by ward no. 4,5,6,7,9. The Questionnaire Survey carried out in all local governments of the province also substantiate the fact that the worst hazard for the whole District is flood. Rajapur and Thakurbaba Municipalities and Geruwa Rural Municipality also identifies flood as the second worst hazard (Questionnaire survey in local governments, 2018).

- **Banke:** The villages of Binauna, Phattepur, Gangapur and Matehiya on the east of Rapti River and the villages of Bankatti, Bankatawa, Betahani, Holiya, Kamdi, Kachanapur, and Udharapur on the west, along with some parts of the municipalities of Kolalpur and Nepalgunj are at high risk. Binauna VDC (which now falls under Rapti Sonari Rural Municipality) identifies flood, inundation and river bank erosion as the worst hazard of which ward no. 9 and 3 (LAPA, 2017). Out of 1438 households, 348 households are

extremely vulnerable from flood and river bank erosion followed by 739 households. The recurrent nature flood, although, remains for few days but the intensity of loss and damage is high. (LAPA, 2017). The Questionnaire Survey carried out in all local governments of the province also substantiate the fact that the most severe hazard of the whole District is flood and also that of Rapti Sonari Rural Municipality (Questionnaire survey in local governments, 2018).

- **Dang:** Flooding of the Rapti River has affected the villages of Lalmatiya, Sishaniya, Satbariya, Gobardiha, Gangaparaspur, Gadhawa, Bela and Rajpur and eroded a large area of productive land. In addition, Gadhawa, Gangaparaspur and Gobardiha villages are at risk from snake bites following inundation. In Bela VDC (which now falls under Rajpur Rural Municipality), flood account for the severe hazard to which almost all the wards are vulnerable and at risk to the impacts of flood. Among the population, 40% of the impacted communities belong to aadhibasi janajatis, 24% madheshis and 16% dalit communities (LAPA, 2013). The Survey, 2018 also identifies flood as the first ranked hazard of Rajpur RM. In Satbariya VDC (which now falls under Lamahi Municipality) flood is ranked as severe hazard from which ward no. 3 is extremely vulnerable and ward 1 and 2 are highly vulnerable (LAPA, 2014). In Phulbari VDC (which now falls under Tulsipur Sub-Metropolitan) flood is second worst ranked hazard in the VDC (LAPA, 2014). The Questionnaire Survey carried out in all local governments of the province identifies flood as the worst hazard of Dang District. (Questionnaire survey in local governments, 2018).
- **Kapilvastu:** Southern Kapilvastu which is adjacent to the Indian border is prone to flooding. In 2004 BS, a total of 120 people died when a boat capsized in Sauraha, Kapilvastu.
- **West Nawalparasi:** The villages of Bhujahawa, Kudiya, Prasauni, Rampur Khadauna, Rampurawa, and Tribeni Susta are at risk from flood.
- **Rupandehi:** The Tinau, Danab, and Khanchan rivers have increased inundation and severe impacted the villages of Ama, Bhagwanpur and Sipawa (DPRP reports, 2011-2015)

The human losses from floods is an increasing trend. Flood events also render many people homeless and cause huge loss and damage to public and private property. During the last 48 years (1970-2018), a total of 477 people died, 273 went missing, more than 75 people were injured, and 343,228 families were affected. The highest and lowest cumulative death tolls were recorded in Rupandehi (90) and Pyuthan (20) respectively. In terms of the number of affected families, Nawalparasi (83,131) experienced the worst and Pyuthan (192) the least (Annex I and II).

Figure 1: Major rivers in Province 5

Flash floods and recurrent inundations erode river banks and deposit sand on agricultural land. This can render the land unusable for farming. Floods also destroy seedlings, standing crops, and stored grain. Crops, livestock, poultry, and fisheries are damaged by floods and, as a result, food security is reduced. Suryapatuwa VDC of Bardiya District (which now falls under Madhuban Municipality) identified flood as its worst hazard and identified its impacts highest in agriculture sector through river bank erosion, inundation, destruction of standing crops (LAPA document of the VDC, 2014). Similarly, the agricultural lands in Jukena VDC of Arghakhanchi District (which now falls under Sitganga Municipality) was affected from flood and inundation (LAPA, 2015).

Irrigation and drinking water systems are damaged by floods. In an inundated area, ensuring safe sanitation and water security is always a challenge. Communicable diseases are spread through contaminated water and food. Water-borne pathogens can be introduced in drinking water, especially when it is drawn from traditional wells like in the Terai. It is estimated that more than 25% of hand pumps and 35% of temporary toilets are defunct for a week after every instance of flooding and inundation in southern Terai (Gautam *et al*., 2007). In Rolpa, the villages of Jaimakasala, Uwa, Iribang, Talabang, Rankot, Rangsi, Pachabang, Pakhapani, Jinabang and Ghartigoan are at risk of a diarrhoea epidemic every year due to contaminated water (DPRP report, 2072).

Damage to natural vegetation, physical infrastructures and human settlements is common during flooding and inundation. In Bela VDC (which now falls under Rajpur Rural Municipality) of Dang District about 50 hectares of forest area were eroded by flood in the past 30 years (LAPA, 2013). Floods damage earthen roads, irrigation channels, and shelters.

The sensitivity of flood-exposed system adversely affects people irrespective of gender, economic condition and location through heavy losses, through casualties, injuries or damage to property and other assets. Flood-affected people, mostly women, including new mothers and their new-born babies have to live in temporary shelters, facing extreme safety risks, including those of disease-carrying mosquitoes and contaminated water. Women, particularly pregnant women, lactating mothers, elderly women, the disabled and menstruating women are more vulnerable during flooding and inundation.

There has been some efforts to respond to the impact of disasters. Stakeholders in different districts claimed that in order to reduce the impacts of floods, a few communities have adopted adaptive measures. In flood-prone areas in in Rampur Khadauna, East Nawalparasi, for example, people have started to build two-story houses and houses on raised plinths and in Niglihawa, Kapilvastu, as well as the villages of Gangaparaspur, Gadhawa, Bela and Rajpur in Dang, people constructed embankments and spurs using stone masonry and bioengineering technologies (DPRP reports). In other Terai districts, river training works have been implemented and earthen dikes constructed to improve river channels and increase flood diversion.

Some flood-affected local communities in Dang, Banke and Bardiya have developed evacuation plans and stockpiled relief items like food and non-food items, communication equipment, and wooden boats. In West Rapti flood early warning system (EWS) have been implemented to forecast and subsequently communicate weather and flood-related information. District emergency operation centres (DEOCs), especially those in Dang, Banke and Bardiya, have been strengthened to implement an effective EWS. People have started to plant flood- and drought-resilient varieties in coordination with district agriculture development office (DADO) in Kopuwa, Kapilvastu, and Thada, Arghakhanchi. These adaptive and response measures, however, are limited to very small areas.

The government has initiated some risk reduction measures such as an embankment improvement programme. The Peoples' Embankment Programme is one of the flagship programme in DRR implemented in some rivers - Karnali, Babai, West Rapti in Province. In parallel, local governments implement small scale soil conservation initiatives such as check dams, plantation and restoration of flood affected areas.

3.1.2.2 Landslide

Most landslides are caused by multiple factors that act together to destabilize the slope. Excessive water is one of the most common triggers for landslides. Recent rainfall trends illustrate that though there are fewer annual days of rain than there used to be, the average intensity of rainfall events has increased and, as a result, the total amount of annual precipitation has not decreased. These trends have increased the frequency, duration, and intensity of landslides.

Box 2: Landslide prone areas in different districts of Province 5

- **Gulmi:** The Kali Gandaki, Ridi, Badhigad, Chaldi, Panaha and Nisti rivers have eroded the land adjacent to rivers and thereby caused landslides. Aapchaur VDC (which falls under Musikot Municipality) has identified landslide as the worst ranked hazard affecting ward no 1, 2, 4 and 5 (LAPA, 2015).
- **Arghakhanchi:** Banganga and Mathura Beshi rivers are the two of many destructive rivers that erode productive land by triggering landslides, particularly in Southern Arghakhanchi. In Jukena VDC (which now falls under Sitganga Municipality) landslide is the worst hazard followed by fire.
- **Dang:** The Babai and the Rapti are the main rivers carrying soil, boulders and stones from upstream and depositing grit on productive land in downstream areas. The main landslide-prone villages are Loharpani and Kavre.
- **Rolpa:** The villages of Gairigoan, Jugar, Budhagaon, Libang, Kotgoan, Bhabang, Sakhi, Dubring, Jaimakasala, Uwa, Mirul, Harjang, Ghartigoan are at risk from landslides.
- **Pyuthan:** The villages of Syaulibang, Phopli, Chunja, Arkha, Damri, Bijuwar, Okharkot, Tushara, Gothibang, Libang, Khaira, Sari, Punja, Rajwara, Kochibang, Dharampani, Tiram are landslide-prone villages (Survey, 2018).
- **Palpa:** The upstream areas of the Tinau and Nishdi rivers, Arungkhola, Dobhankhola, Kushumkhola are landslide-prone areas. In Palpa district, s landslides are ranked as a severe problem in Baganskali, Purbakhola, Rainadevichhara, Ramba, Tinau Rural Municipalities. Mathagadhi, Nisdi Rural Municipalities and Tansen Municipality have identified earthquake as the top-ranking hazard.

Source: DPRP Reports, 2011-2016, LAPAs, Survey, 2018

The impact of landslides is multi-faceted. Over the last 48 years (1970-2018), 639 people were killed and 45 people went missing. Among Mid-Hill and High Hill districts, Gulmi reported the greatest number of human causalities (142) followed by Pyuthan (132), Palpa (102) and Arghakhanchi (75). In terms of greatest number of families affected by landslides, Gulmi district has the highest number of deaths which is 19,713, followed by Arghakhanchi (10,564), Rukum (4,123), Palpa (3,948), and Rolpa (3,046). The data showed that even though the death toll by landslides in Rupandehi was very low (only 14), the number of affected families is very because what happens in upstream areas has a huge impact on downstream areas (Annex I and II).

Landslides affect agriculture, water, forest, land, health, tourism and physical infrastructures sections in various ways. The contamination of rivers is likely through the spread of debris like trees and dead animals. For example, due to frequent landslides in the villages of Markawang, Tiram, Baraula, Pakala, Khawang, Bangemaroth, and Bangesal drinking water became contaminated and increased the risk of diarrhoea (DPRP, 2011). Injury, disability and loss of life due to landslides results in mental health problems like shock and trauma.

"In our experience, compared to 20 years ago, the frequency and the intensity of landslides are both increasing. We don't know the technical reasons, but in our view, it

is the result of deforestation, heavy soil erosion, haphazard slash-and-burn and shifting cultivation, and free and haphazard grazing practices. Landslides not only damage our crops and farmland but also disrupt our agricultural calendar because they damage irrigation canals, filling them with so much debris and silt that they are rendered defunct. This year, we were not able to get water from the Kondre River and had to rely on rainwater alone. Landslides also destroyed drinking water pipelines, forcing us to fetch water from afar." - **Experience of local farmers, Sitganga Municipality, Arghakhanchi (FGD, 2018).**

The sensitivity of a landslide-exposed system affects people irrespective of gender, economic condition, and location through heavy losses (casualties and injuries) and damage to properties and assets. Mostly poor, marginalized and deprived families are affected by landslides because they have little capacity to cope. It was found that people living in the Churia hills are very prone to landslides because their geology is young and fragile.

In recent years, government and non-government agencies have collaborated and coordinated to reduce the impact of landslides. Along with providing capacity-building measures like training, workshops, and study tours, agencies have supported landslide-prone communities through (i) afforestation, especially the plantation of deep-rooted grasses and shrubs like broom grass, hay, and bamboo in Rikot, Arghakhanchi); (ii) introducing the use of cover and root crops in the villages of Simalpani and Thada in Arghakhanchi), (iii) setting and enforcing conservation rules regarding rotation grazing and advocating for the stall-feeding of animals in the villages of Pawora and Bikramsota in Arghakhanchi, and (iii) imparting disaster education to reduce the impacts of landslides.

In addition, adaptation and disaster response measures such as roadside slope stabilization, integrating bio-engineering measures with conventional structural options in Niglihawa, Kapilvastu, using HDP pipes for cross drainage and water conveyance along landslide-prone zones, and selecting geologically stable sites for local bridges and river crossings designed to reduce the impact of landslides.

3.1.2.3 Domestic Fire

The districts of Province 5 suffer from fire outbreaks[7] in the dry, stormy season between April and June. Although humans have a big part to play in domestic fires, they are also associated with high temperatures (higher risk when exceed 35°C), dry winds and the availability of burning materials such as wood and thatch to ignite fires. Seasonal fires catch mostly in houses with wooden structures and thatched roofs.

In the winter, the major cause of fires is the short circuiting of electrical appliances, particularly heaters. In the inner city areas of fast-growing urban centres, houses are

[7] On average, fires are responsible for property losses worth 350 million rupees and the deaths of 43 people annually (MoHA, 2009).

old, made with wooden joists, and placed in close proximity. These are vulnerable, as fires easily leap from one house to the next.

Among the Terai districts, the impact of domestic fire is more severe in Dang District and the villages of Rajpur, Bela, Gadhawa, Gangaparaspur and Gobardiha (DPRP report, 2015). The frequency, duration and intensity of fire hazards are on the increase due to congested settlements.

Data from DesInventar and MoHA indicate that 296 people died in fires between 1970 and 2013. In terms of loss of life, Dang, with 43 dead, had the highest death toll. It was followed by Banke and Kapilvastu, each of which had 32 and Rukum, which had 29. In terms of the number of fire-affected, however, families Banke District had the most — 18,494 — followed by Kapilvastu, with 13,674 fire-affected families. Dang had only 7624 fire-affected families (Annex I and II). Madhesi communities in Terai districts are particularly prone to fires because of the nature of their settlement patterns.

In Rapti Sonai Rural Muncipality of Banke District (earlier Binauna VDC), domestic fire due to excessive heat is the fourth hazardous event that accounts for loss of life and property (LAPA, 2017). In Bela VDC (which falls under Rajpur Rural Municipality) fire is ranked as the third worst hazard. The 2018 Survey ranks fire as the second worst hazard faced by the rural municipality.

Domestic fires impact food security, health and infrastructures. They often damage stored grain and seeds. The immediate health impact of domestic fires include deaths and injuries, especially burns. Fires also damage assets and possessions and disrupts lifeline systems.

Women are more vulnerable to domestic fires because of their presence at home and their clothing style. They are more likely than men to attempt to rescue children and save assets like cash, jewellery, grain and clothes, ignoring the scale and extent of danger. Poor and marginal communities are more at risk from fires than affluent communities because they live close together and have thatched roofs that easily catch on fire. Southern parts of Terai districts are more prone to domestic fires than northern parts because of the nature of their settlements and certain socio-cultural factors.

There are some attempts to reduce the impact of fire. Community-managed fire lines and trench lines have been dug. They separate villages from forests and stop and control the spread of fire. Trench lines help to provide multiple services; they can act as firebreaks and water reservoir, as they do in the municipality of Sitganga in Arghakhanchi. Fire management planning is in place in the Patana forest area of Kapilvastu, where a fire control team and local youth groups engage in fire preparedness efforts.

Basic information about the importance of fire detectors and fire extinguishers is disseminated through FM radio and television channels and training was provided to municipal staff, municipal police, and disaster focal persons in the municipality of Butwal on subjects such as emergency fire management, risk assessment, search and rescue, first aid, fire-fighting, and evacuation.

3.1.2.4 Drought

Drought is a slow-onset disaster. It originates from a deficit in water availability as a result of prolonged dry periods or lack of rain. It impacts on drinking water and domestic water use, agriculture and the overall ecosystem. Province 5 experienced drought cases in 1972, 1977, 1982, 1992, 2002, and from 2004 to 2006—both in dry and wet monsoon (Nepal Disaster Report, 2015). Weather variability and climate change are mostly responsible for drought. Late onsets of monsoon, poor distribution of rainfall, and reduction in intensity of rainfall are other causes of drought. Droughts are likely to become more frequent, last longer and intensify in the future due to prolonged dry seasonal spells even if total annual precipitation remains the same.

It is perceived that the drought has adversely affected forest and biodiversity in Thakurdwara VDC (which now falls under Thakurbaba Municipality) (LAPA, 2015). Drought pose medium risk in the VDC, Ward no. 1 and 9 of Manuwa VDC (which now falls under Geruwa Rural Municipality) (LAPA, 2013). Similarly, in Rapti Sonari Rural Municipality (earlier Binauna VDC), although almost all the wards are vulnerable and at risk to flood, ward no. 4 is highly vulnerable and at risk to the impact of drought (LAPA, 2017). Phulbari VDC (which now falls under Tulsipur Sub-Metropolitan) of Dang District, drought is ranked as the worst hazard in the VDC (LAPA, 2014). The Questionnaire Survey carried out in all local governments of the province identifies drought as the third worst hazard of the whole District. (Survey, 2018).

Droughts have triggered migration. After facing acute shortage of water supply for years and decreased irrigated land size, the population of a few villages of East Rukum migrated further downstream.

Drought causes severe water stress to both grain crops and fruit trees. Farmers during the focus group discussion cited that the lack of sufficient water, crop-specific diseases, low production, inadequate benefits, and unfavourable climate, are all discouraging farmers from on-farm based activities. Shrinking glaciers, changes in the hydrological regime, poor water storage capacity, lowering groundwater levels result in the scarcity of water, both for drinking and farming. In Bela VDC (which falls under Rajpur Rural Municipality) of Dang District, drought has caused the drying up of water sources (LAPA, 2013).

Acute water crises also induce malnutrition and other health related issues. As malnutrition increases, human immune function is weaker and morbidity and mortality rates due to infectious and other diseases increase. While identifying sectoral impacts of climate change in Thakurdwara VDC (which now falls under Thakurbaba Municipality), the water sector is mostly hit by flood and secondly by drought (LAPA, 2015). Its impact takes the form of a decrease in water level, and a degradation in the quality of water. Among the three most impacted sectors, water resource was ranked third in the VDC.

Drought creates chronic poverty further contributing to the vulnerability of the poor and marginalized. Within the farming community, marginal and poor farmers, and women with limited access to resources and livelihood options are most affected by droughts.

When the yield is not enough to meet the food demands of the family, they are compelled to sell their lands, household goods, and livestock at deflated prices. The people living in water-poor areas like Churia, and high hills without alternative water sources will be more affected in the future as water resources become even more depleted if appropriate measures are not taken to finds alternative water sources.

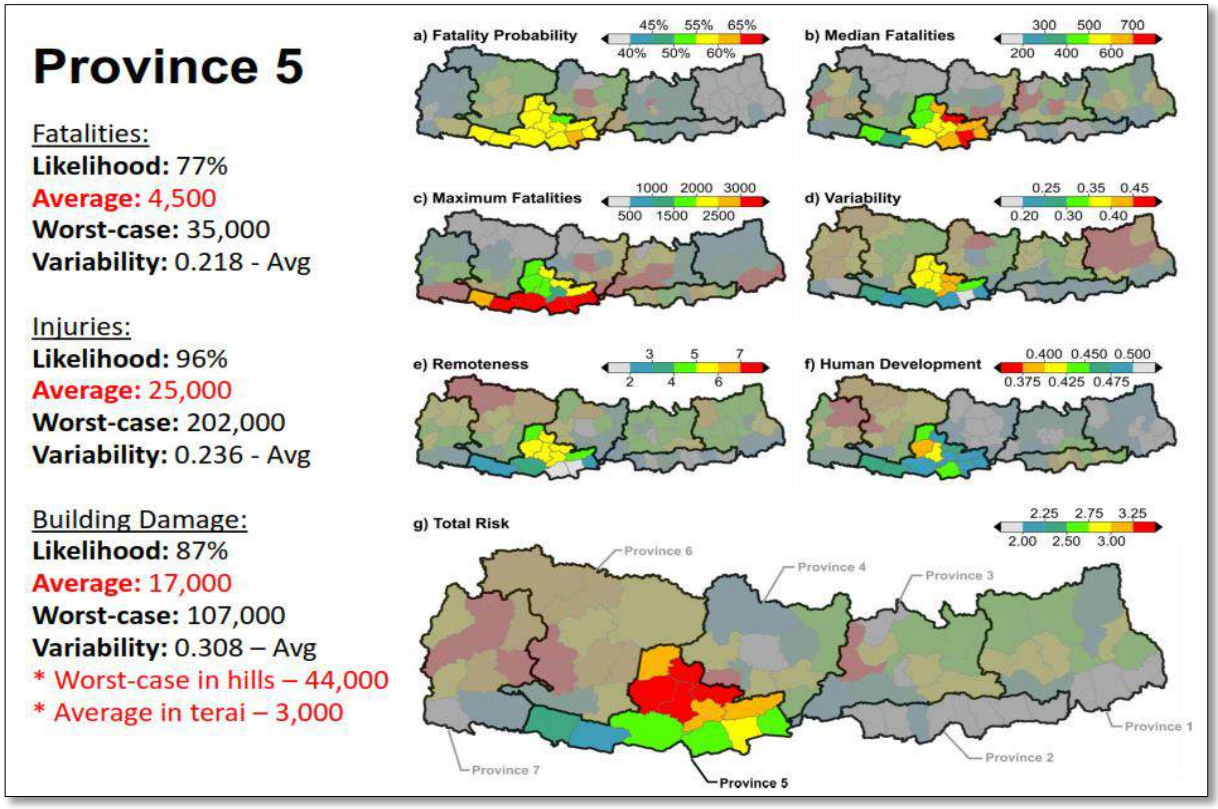
The response to droughts is limited in the province. Some communities in coordination with the government, NGOs and INGOs, have tried to mitigate the effects of droughts by rain water harvesting (Daungha of Gulmi) and conservation ponds for ground water storage (Dohote of Arghakhanchi). Conservation ponds help to recharge the ground water and solve the acute water crisis. Soil and water management practices are being adopted through tillage and weed control, efficient use of ground water irrigation, moisture conservation, etc. (Jasrame of Arghakhanchi). Instead of lifting the ground water for irrigation, now emphasis is given to surface water irrigation (Niglihawa of Kapilvastu). Farmers have switched from high water requiring crops, like paddy, to low water requiring crops, such as maize. System of rice/wheat intensification methods (Rajapur of Bardiya) have been introduced to crop paddy and wheat with minimal water requirement.

Farmers have begun growing more drought-resistant varieties of wheat and water-intensive cash crops such as citrus and bananas instead of other cereal crops. They have started to promote crops such as ginger, turmeric, and peanut that are less sensitive to uncertain rainfall (Dohote Arghakhanchi). Crop shifting, tunnel vegetable farming, keeping *sukkah dhan* (dry paddy) and *dhulebyad* (dry paddy seed bed) are some of the practices to cope with water crises. Mulching and traditional harrowing practices (for potato cultivation) are used to protect from evaporation. In some areas, field crops are being replaced with tree crops like timber, fuel wood and fruit trees. Integrated approaches to watershed management are important measures to restore the hydrological cycle and keeping soil moisture. Area specific studies are necessary in the province to take evidence-based action.

3.1.2.5 Earthquake

Province 5 is prone to earthquakes (Figure 2). In Province 5, during the 25 years from 1990-2015, a total of 13 people died in earthquakes. The highest loss was in Nawalparasi, where five died, followed by Gulmi, where three died. A total of 156 people were injured in earthquakes and 2,407 people went missing (Annex I and II). The 2015 earthquake was more damaging. In Gulmi, for example, a total of 3,192 houses were destroyed (DPRP report, 2016).

Figure 2: Scenario Results of Earthquake likelihood in Province 5



Source: Robinson et al, 2018

Earthquakes do not discriminate: they hit the young, the old, the rich and the poor alike. However, their impact is felt differently by different social groups. Women, older people, person with disabilities, and children are hardest hit. *Dalits* and other ethnic minorities are disproportionally affected as they have few livelihood options and limited coping capacities. Women and vulnerable groups are disproportionately impacted by earthquakes. Data on earthquakes reveals that, in the past, more women and girls died than men and boys, partly because of differences in gender roles.

In recent years, especially after the 1988 earthquake, initiatives have been undertaken to increase the adaptive capacity of people and communities and to lessen the impact of earthquakes. These initiatives include designing and constructing earthquake-resilient infrastructures, implementing building codes, and improving legal and institutional arrangements through awareness building, advocacy, training, review and reflection.

Agencies have allocated additional resources to knowledge-building; increased preparedness, response, relief and logistics systems; and invested in the principle of "build back better". The capacity of information and communication systems to promote relief, response and recovery efforts has been strengthened. Efforts are also in place to enhance multi-hazard risk monitoring and vulnerability assessment, disseminate risk information, and promote awareness. Mainstreaming DRR into the developmental

sector, particularly the housing, private and public infrastructure, social (health and education) sectors, and livelihood sectors, is now a focus.

3.1.2.6 Road accidents

The data of the Nepal Police revealed that 8,982 people have lost their lives from road accidents in the past five years (2013-2018), meaning the average is nearly 2,000 people annually. These accidents cost 0.8% of the gross national product (GNP). More than half of the population of Nepal has no access to all-weather roads.

Between 2004 and 2018, a total of 336 people were killed, 57 went missing and 77 were injured from the road accidents in Province 5. Rukum saw the most deaths, 49, and Rolpa, the fewest, just 8. The number of families affected by road accidents was 2013, with Banke recording the most (1,500), followed by Palpa (286) and Gulmi (210), Annex I and II.

These figures show Province 5 has fewer road accidents than the national average. Despite government efforts, challenges to road safety remain, including inadequate resources for road safety and accident prevention, poor coordination among relevant stakeholders, inadequate skills and technical know-how among transport workers, the leniency with which the National Road Safety Policy and Action Plan is enforced, and the poor management of the accident database.

Almost half of the people who die in road accidents are pedestrians, cyclists or people on motor scooters or motorbikes. Public vehicles account for a lot of fatalities. Poor and marginalized people are disproportionately affected as they have no other option than to use public transport. Because of Nepal's topography and poor road conditions, the chance of passengers surviving an accident is also low. Few initiatives have been undertaken to improve road safety. Measures to minimize the number of road accidents include promoting awareness about road safety, designing and engineering good roads, enforcing traffic rules and regulations, periodically evaluating road safety, conducting anti drink-and-drive campaigns, and regulating the distribution of licenses.

3.1.2.7 Windstorms

Windstorms have become a major hazard in recent decades, as measured in terms of the scale of damage they cause. Their death toll may be lower than those of other hazards, but the economic loss and damage they cause is very high. Windstorms have the potential to harm lives and physical property. Nawalparasi and Banke districts have identified windstorm as one of their top 5 hazard. Bardaghat, Sunawal Municipality of Nawalparasi have identified windstorms as third and fourth worst hazard respectively. Baijanath, Duduwa, Janaki, Khajura and Rapti Sonari rural municipalities have identified windstorms as third, fourth, third, fourth, and second worst hazard respectively (Survey, 2018).

In Province 5, between 1970 and 2018, two people died and 30 people were injured from windstorms, 138 families were affected (Disadvantar & MoHA, 1970-2018). Windstorms damaged 0.2 percent of the total number of houses damaged by the

earthquake of 2015 (Nepal Disaster Report, 2017). Windstorms have swept cross the Terai, one more symptom of the unusual weather that the region has been witnessing for the last few years. Standing crops, trees, cash crops and forests have also suffered damage and, as a result, lead to heavy economic loss.

The people most affected by windstorms are poor and marginal families, especially those with houses with either CGI sheet/thatched roofs or wooden houses and whose settlements are on ridge tops.

Despite windstorms' capacity for severe economic loss, awareness about and preparedness for windstorms is very low. Low educational achievement, inadequate technical know-how and poor implementation of building codes have exacerbated losses. Proper design and construction of windstorm-resilient houses and strict implementation of building codes could reduce losses. Adopting wind-resilient crop varieties could also lessen the impact of windstorms on farming.

3.1.2.8 Snakebite

The number of snakebites increases during the rainy season and floods. A study from Lumbini Zonal Hospital in Butwal found that of the total bites, kraits were responsible for 29%, Cobras 10% and vipers 1% and 59% are from other species (Shrestha, 2011). Many people from rural areas lose their lives because proper health facilities equipped with anti-venom and qualified staff are lacking. People turn to traditional faith healers, with poor outcomes.

Among the groups most bitten are farmers, daily wage labourers, Tharu community people when they hunt rats by digging ridges, herders, and fishermen. Some rural communities in the Terai are still not connected to a road network and find it hard to access public transport, including ambulances. Their members often die before they reach health centers. Limited training, awareness and knowledge increase the likelihood of snakebites having bad outcomes.

Inadequate infrastructure, poor transportation facilities, and insufficient health facilities and trained health workers are the main reasons snakebite victims die before reaching hospital. Their first impulse, to seek the treatment from traditional healers, also delays treatment. In fact, it is estimated that more than 80% of snakebite cases are treated by traditional healers. Since most trained health workers are found in urban areas, where snakebite is rare, faith healers play a major role in the treatment of snakebite. Limited public awareness and education and widespread myths and superstitions regarding snakebites also limit the number of patients who seek proper treatment at health centres.

The Nepal Army treats poisonous snakebites in its service delivery outlets but such services are not accessible to those in remote areas. Snakebite management needs to be strengthened.

3.1.2.9 Hailstones

Hailstorms can cause serious damage to crops, livestock, and forests. Wheat, maize, soybeans, and other cash crops are the most sensitive to hail damage. A total of five people died between 1970 and 2018 from hailstorms. Rupandehi saw the most deaths, with four, and Gulmi had one death. A total of 4,371 families were affected by hailstorms. Most (1551) were in Rukum but Nawalparasi, with 1,465, was not far behind (Disadvantar & MoHA, 1970-2018). Hailstorms occur mostly at the beginning and the end of the monsoon season. They damage property and crops and increase vulnerability to food insecurity. Hailstorms cause heavy losses to agricultural crops.

Hailstorms can damage ready-to-harvest vegetable in a few minutes. For example, in 2018 in the Tansen Municipality of Palpa District, hailstorms damaged 199 hectares of farmland, harming 80% of the cucumbers, bitter gourds, bottle gourds, beans, eggplants, tomatoes, chilies, capsicums, radishes, coriander, cabbage, cauliflower, onions, garlic and spinach that were growing. Preliminary estimates approximated that 1,600 tonnes of vegetables worth NPR 48 million were damaged (Source: e-Kantipur).

Farmers whose livelihoods rely on cereals, cash crops, vegetables, and livestock are badly affected by hailstorms. Hailstorms also damage grass and fodder, making food for livestock scarce and reducing the benefits of animal husbandry. Every year, loss and damage by hailstorms is high because people know little about hailstorm-resilient crops and allied technologies. Government and non-government agencies try to promote pilot projects of plastic tunnel-based vegetable farming, the planting of hailstorms-resilient crop varieties, and changes in the crop calendar to reduce the impacts of hailstorms. Tunnel-based vegetable farming is very popular and is widely replicated.

3.1.2.10 Thunderstorms

All thunderstorms are dangerous because they produce lightning. Most occur in the pre-monsoon months between March and June due to the natural electrical discharge within the atmosphere and the imbalance between positive and negative charges. Both human fatalities and loss and damage to assets have increased with the recent increase in the frequency and intensity of the storms. Between 1970 and 2013, 160 people died in Province 5 due to thunderstorms. Dang had the most deaths, 39, followed by Rolpa and Nawalparasi, with 19 and 17 deaths respectively. A total of 349 people were injured and 993 families were affected by thunderstorms, which kill not just humans but also livestock (Annex I and II).

Thunderstorms can form and develop in any geographic location. Poor and marginalized people who work daily on their farms to earn a living and have a limited awareness level about thunderstorms are affected the most. Few people, regardless of their social group, are aware of precautionary safety measures they can take to reduce the risk of thunderstorms.

3.1.2.11 Heat Waves

The climate trend and scenarios analysis, as discussed in previous chapter, show that extreme events such as hot days and warm nights are increasing and projected to increase in the future. There is a positive trend in warm spell duration throughout all districts of Province 5, among which Gulmi, Rukum and Palpa show the highest positive annual trend of 0.3%. With the increase in warm spell duration, the likelihood of heat waves.

An increasing temperature trend, an increasing trend in the number of warm days and warm spell durations have a positive relation in determining the incidences of heat waves. Heat waves endanger the health and life of the population to a great extent. Research demonstrate that the impact falls disproportionately on senior citizens, children, pregnant women and poor and marginalized people.

Box 3: Major Heatwave prone areas in Province 5

- **Kapilvastu:** Between 1980-2013, there were 9 deaths documented in Kapilvastu District (MoHA, Des Inventar). In overall district hazard ranking, only Kapilvastu district identifies heatwaves as top 5 hazard. Both Bijayanagar and Mayadevi rural municipalities, rank heatwave as fifth worst hazard and Kapilvastu, Krishnanagar and Shivraj Municipalities identify heatwave as fifth fourth, and fourth worst hazard respectively (Survey, 2018).
- **Rupandehi:** Between 1980-2013, there were 4 deaths documented in Rupandehi District (MoHA, Des Inventar). Although heatwave does not appear in the top district hazard ranking, Omsatiya, Suddhodhan rural municipalities identified heatwave as fifth and fourth worst hazard respectively (Survey, 2018).
- **Banke:** Between 1980-2013, there were 2 deaths documented in Banke District (MoHA, Des Inventar). Though heatwaves do not rank in the top district hazard ranking, Narainapur rural municipality and Nepalgunj Sub-Metropolitan City rank heatwaves as fifth in the ranking of hazards (Survey, 2018).
- **Bardiya:** Between 1980-2013, there were 2 deaths documented in Bardiya District (MoHA, Des Inventar). Barbardiya municipality and Geruwa rural municipality identify heatwave in ninth ranking (Survey, 2018).
- **Nawalparasi**: Between 1980-2013, there was 1 death documented in Nawalparasi District (MoHA, Des Inventar).

3.1.2.12 Cold Waves

The climate change trend from 1971-2014 demonstrates the increasing number of cold days in Nawalparasi district which can be indicative of an increasing number of cold waves events in the districts. Under the climate change scenario, the cold nights will decrease by almost 5 % to 7%. The change in cool nights will mostly affect the horticulture sector and will have implications for human health.

Box 4: Major Cold Wave prone areas in Province 5

- **Arghakhanchi:** Between 1990-2013, there were 12 deaths documented in Arghakhanchi District (MoHA, Des Inventar)
- **Banke:** Between 1990-2013, there were 12 deaths documented in Banke District (MoHA, Des Inventar). Questionnaire survey carried out in the district identifies cold waves as second most hazard affecting the district. Rapti Sonari Rural Muncipality, cold wave is third most hazardous event with high vulnerability ranking (LAPA, 2016)
- **Bardiya:** Between 1990-2013, there were 5 deaths documented in Bardiya District (MoHA, Des Inventar). Thakurdwara VDC (which now falls under Thakurbaba Municipality) has identified erratic cold wave as the second worst hazard after flood (LAPA, 2015).
- **Gulmi:** Between 1990-2013, there were 19 deaths documented in Gulmi District (MoHA, Des Inventar)
- **Nawalparasi:** Between 1990-2013, there were 22 deaths and 80 injured individuals documented in Nawalparasi District (MoHA, Des Inventar); Questionnaire survey carried out in the district identifies cold waves as second worst hazard affecting the district.
- **Palpa:** Between 1990-2013, there is 1 death documented in Palpa District (MoHA, Des Inventar)
- **Rukum:** Between 1990-2013, there were 9 deaths documented in Rukum District (MoHA, Des Inventar)

4. Climate Change and DRRM Governance Structure and Mechanisms

4.1 Policy - Provincial and local level policies and other legislations on CC and DRR

4.1.1 Provincial and local policies and legislation on DRRM

The GoN has developed several sectoral plans and policies (Table 10) designed to reduce disaster risk. These plans and policies have provisions related to DRR issues.

In 2015, the GoN promulgated the Constitution of Nepal. Along with this, the GoN also promulgated the Disaster Risk Reduction and Management Act (DRRM, 2017), Local Governance Operation Act (LGOA, 2017) and National DRR Strategy and Action Plan (2018-2030). All these plans and policies advocate and build resilience and mainstream DRR into development planning.

Table 10: Chronology of sectoral policies

Year	Name of the Policy
1982	Soil and Watershed Conversation Act
1982	Natural Calamity Relief Act
1994	Building Code
1996	Shelter Policy
1996	Environmental Protection Act
2002	Forestry Sector Policy
2002	Water Resources Strategy
2004	National Agricultural Policy
2005	National Water Plan
2006	Water-Induced Disaster Management Policy
2006	Integrated Energy Strategy
2007	Nepal Building Act
2007	National Urban Policy
2009	Water Conservation Act
2010	Climate Change Policy
2012	National Land-Use Policy
2015	Constitution - provisions on DRRM
2017	DRRM Act
2017	Local Government Operation Act
2018	DRRM Policy
2018	DRRM Strategy and Action Plan

Box 5: Disaster management authority of provincial government as provisioned by Nepal's Constitution

- Article 51(G) of the Constitution concerns "policies relating to the protection, promotion and use of natural resources" and states that provinces should formulate policies regarding the development of sustainable and reliable irrigation by controlling water-induced disasters and expediting river management and that they should pursue policies the protection, promotion and use of natural resources.
- Article 273 (2) states that if there arises a grave emergency in a province because of a natural calamity or epidemic, the concerned provincial government may request the GoN to declare a state of emergency in the whole of the province or of any specified part thereof.
- The provisions made in the Schedule 5 (competence of federal government) that provides 'environment adaptation' and 'carbon services' are proximate to interpretation as climate change adaptation and mitigation.

Nepal's Constitution states that the responsibility for natural and human-induced disaster preparedness, rescue, relief and rehabilitation falls under the jurisdiction of federal, provincial and local governments. Disaster management is one of the 22 tasks that are assigned to local-level governments in Schedule 8 of the Constitution. Schedule 9 identifies DRRM as one of the concurrent powers of the federal, provincial and local levels. The DRRM is a responsibility shared by every level of governance, but is largely the responsibility of the local government, or *Palika*.

The LGOA outlines the roles and responsibilities of *Palika*, district council/district coordination committees, and provincial coordination councils. The Act specifies local government functions and powers and provides a basic structure for the working of municipal assemblies.

To follow through on its endorsement of the Sendai Framework, the GoN enacted the National DRR Policy and the Strategic Action Plan for DRR (2018–2030) in order to make Nepal a safer and more resilient nation by 2030. All the above policies and plans lay a strong foundation for developing federal, provincial and local government plans and policies on DRRM.

4.1.2 Provincial and local policies and legislation on climate change

However, climate change as a concept did not receive a mention in the Constitution of Nepal 2015. Respondents who were interviewed and consulted took the view that environmental adaptation[8] and carbon services[9] provisions in the Constitution respectively address the need for climate change adaptation and mitigation.

[8] Constitution of Nepal 2015, Schedule 5 #29
[9] Constitution of Nepal 2015, Schedule 5 #27

Furthermore, the right to a clean environment[10], policies relating to the protection, promotion and use of natural resources[11], and several provisions in different jurisdictions of all tiers of governments[12] have an indirect relevance to climate change, as also agreed by most of the respondents. Importantly, disaster management received a mention in the Directive Principles chapter in the Constitution[13], and under the jurisdiction of all tiers of government[14], for the first time in the constitutional history of Nepal.

Ministries at Province 5 have started formulating sectoral policies and plans. In its Provincial Periodic Plan, it prioritizes DRRM and CC. Responsibilities related to CC have been assigned to the Ministry of Industry, Tourism, Forest and Environment whereas those related to DRRM to the Ministry of Internal Affairs and Law. The Ministry of Industry, Tourism, Forest and Environment has recently formulated Riverine Material Management Procedure (2075) with the following key provisions:

- It has mandated to commission Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) before establishing any industry. Before extracting and selling riverine materials, industries should follow the land use policy of the local government. Prior to giving permission for collection of riverine materials, local government should formulate action plans for riverine materials extraction, collection, storage and selling.
- The amount collected from selling riverine materials should be allocated for the welfare of communities affected and for the conservation of the river-banks.

In the context of legal frameworks for local governments to combat climate change, the Local Government Operation Act (2017) serves as an entry point. The federal act defines the rights, power and functions of local governments originating from the Constitution. Though there are provisions relevant to climate change in the Act, the explicit mention of climate change adaptation is only made in the Transport Permit section of the Act which does not give any legal definition.

4.2 Institutional structure and governance of Climate Change and DRRM in Province 5

The DRRM Act envisions the institutional structure (i.e. disaster management committee) from province to local government level. The role[15] of the province disaster

[10] Constitution of Nepal 2015, Article 30
[11] Constitution of Nepal 2015, Article 51(g)
[12] Constitution of Nepal 2015, Schedule 5 to 9
[13] Constitution of Nepal 2015, Article 51(g) (4) & (9)
[14] Constitution of Nepal 2015, Schedule 7 (List of Concurrent Powers of Federation and State) #17, Schedule 8 (List of Local Level Power) #20
[15] The role of the province disaster management committee (PDMC), as defined in the DRRM Act, is to (i) implement disaster-related short- and medium-term policies, plans, and programs that accord with the approved national policies and plans, (ii) contribute in facilitating and coordinating the preparedness

management committee (PDMC) is well defined in the DRRM Act. However, the exact terms of this provision need to be specified in by-laws and provincial acts. The DRRM Act says nothing about the structure of the executive committee of a PDMC or of an expert committee(s), but it does have provision for a secretariat for a PDMC and does prescribe its roles, responsibilities and authority.

The DRRM Act does not specify the roles of provincial and local government security forces in DRR or the roles of public and private organizations and does not explicitly acknowledge the coordinated work carried out at the federal, provincial and local levels. According to DRRM Act, a province can ask the federal government to declare a disaster emergency within that province. The province needs to specify the roles and responsibilities of emergency operations and actions including procurements and coordination with the national DRRM authority. The DRRM Act specifies nothing about inter- provincial coordination or collaboration for DRRM, and the roles of provinces are limited to monitoring, facilitation and coordination.

The DRRM Act also lays out connections among federal, provincial and local entities. However strategies, policies and plans that translate policy to implementation have yet to be formulated at province and local level. The questionnaire survey results show the implementation status of institutions, structure, plans and policies at the local government level (Table 11).

Table 11: Status of institutions, structure, plans and policies at local government level

SN	Key parameter	Yes (%)	No (%)	Not Available (%)
1	*Palikas* have formed LDMCs	89.1	10.9	0.0
2	*Palikas* have local climate change management committees	10.9	89.1	0.0
3	*Palikas* have disaster focal desks	64.5	33.6	1.9
4	*Palikas* have CC focal desks	21.1	77.1	1.8
5	*Palikas* have LDMPs	55.6	42.6	1.9
6	*Palikas* have LAPAs	21.8	72.7	5.5
7	*Palikas* have local DM policies, rules, or acts	45.4	53.7	0.9
8	*Palikas* have local CC policies, rules, or acts	10.0	84.5	5.5
9	*Palikas* have established disaster management funds	91.6	6.5	1.9
10	*Palikas* have guideline for disaster management funds	42.2	25.7	32.1

activities of local disaster management committees to ensure their effectiveness, (iii) coordinate with the national, other provincial, and local levels to ensure the effective provision of search-and-rescue materials, (iv) prepare standards for the management of rescue items, (v) manage food and non-food items in disaster-affected areas, and (vi) facilitate the installation of early warning system. The DRRM Act also calls for the PDMC to be chaired by the chief minister of the province but the exact terms of this provision need to be specified in by-laws and provincial acts.

11	*Palikas* have established climate change funds	8.3	88.0	3.7
12	*Palikas* have guideline for CC funds	11.0	0.9	88.1
13	*Palikas* have DRRM-related projects	28.4	39.4	32.1
14	*Palikas* have CCA-related projects	14.7	44.0	41.3

Source: Questionnaire survey with Palikas in Province 5 (2018)

The Province Assembly provides for the provision of the Agriculture, Forest and Environment Committee (Province Assembly 5, 2075). It has provided 13 members in the committee to look after the implementation of agriculture, forest and environment relevant functions of the province government. It has an oversight function to guide the province government to observe its mandates in these areas.

The interaction its members reveal that the committee is responsible for providing comments and suggestions on the laws, guidelines, and rules prepared by the relevant ministries in these matters; monitor and provide direction on policy, programs and resource allocation; oversight and guidance to the provincial government to make sure it is observing its legal obligation and implementing plans and policies.

In terms of local level institutional structure and governances in Province 5, it seems the concerns of climate change have not yet reached the local governance structure.

4.4 Programme and projects

The Government of Nepal, UNDP and the UK's Department for International Development (DFID) in Nepal have designed climate-resilient development initiatives to support climate-vulnerable Palikas in Province 5. DFID has launched Nepal Safer School Project (NSSP) in Province 5 to help retrofit and reconstruct the schools vulnerable to earthquakes. The NSSP is aligned with the Government of Nepal's School Sector Development Plan (2016-2023) which includes a focus on School Safety and Disaster Risk Reduction, by upgrading physical infrastructure to be more resilient and ensuring the curriculum and teacher training integrates disaster resilience. Rural Water Supply and Sanitation Project Phase II (RWSSP-WN II) is also implemented in Province 5. It is a bilateral development cooperation project funded by the Governments of Nepal and Finland which focuses in disaster and climate resilient WASH program.

In the context of climate change, Nepal Climate Change Support Program (NCCSP), Hariyo Baan, and BRACED anukulan have implemented Local Adaptation Plan for Actions (LAPAs) in Banke, Bardiya, Dang, Rukum and Rolpa.

Province 5 is also implementing riverbank protection work (Janatako Tatabandha) in major rivers of the Terai, integrated watershed management projects in the Churia and flood-based early warning system to manage the impacts of flood. Moreover, it has also run resettlement programmes for flood (2014 and 2017) affected families in Banke and Bardiya districts. The institutional capacity of fire brigades has been upgraded to systematize the fire emergency response. The province government is managing

warehouses and deploying needed materials and equipment alongside training of staff to use those materials.

4.5 Financial arrangements for CC and DRRM

Financial management on climate change and disaster at province level is still unclear. The questionnaire survey carried out among the local governments of Province 5 shows that about 42% of local governments have prepared directives to use the allocated fund. Whereas less than 1% of the local governments that have devised fund for climate change have prepared directives to use the fund. This demonstrates that local level financial arrangements in allocating and utilizing funds are not well systematized in both disaster management and climate change, and more so in climate change.

In addition to giving *Palika*s judiciary responsibilities, the Local Governance Operation Act also entrusts them with the responsibility of formulating their own laws, by-laws and regulations, levying taxes, and raising funds. The fiscal management fund procedure (2075) of Province 5 has set the following provisions as part of its financial arrangement:

- The province government can collect tax from various sectors and deposit it in its consolidated fund for best use.
- The province government can receive 60% of the total fund collected in the consolidated fund and local governments can obtain 40% of the amount.
- The province government can allocate fiscal equalization of the grant based on the expenditure need of local governments and revenue capacity as recommended by the fiscal commission.
- The province government can provide matching funds to local governments for the implementation of infrastructure development programs. It can also provide a 'special grant' for special projects designed to serve a large population of the poor and deprived communities by local governments.
- Local governments can fix the rate of tax for riverine materials and collect the tax for the welfare of affected communities.
- Local government have earmarked budget for disaster emergency funds and have allocated funds to reduce the risks of various disasters, but the amount of money allocated is inadequate and officials are not certain how and where to use these funds. Disaster Management fund is solely provisioned to manage disaster emergencies while the resources available for DRR is only 20-25% of the total fund.

5. Ways Forward

5.1 Ways to address CC and DRR in Periodic plan and other policies

There are still gaps in terms of mainstreaming DRR into development and formulating and implementing policies. While both local and provincial governments are preparing disaster policies and plans, they need to coordinate with each other and with federal policies where necessary.

Periodic plans can be entry points in ensuring climate change and disaster issues are well integrated across sectors and appropriate measures are taken. Provincial policies and plan need to prioritize implementing adaptation and risk mitigation activities including adopting low carbon development pathways.

Extreme disastrous events could be better dealt by setting up a reliable database and profile of hazards, vulnerabilities and risks in the province through multi-hazard risk assessments. Particular focus and caution are necessary to generate reliable, verifiable and easy to understand information that can be utilized in decision making.

It is also important to analyse the capacity of provincial and local governments to address gaps, problems and issues and find what areas require federal support.

Consideration of differentiated vulnerability and capacity is important including the issues of poor and more vulnerable communities in disaster-prone areas. Peoples' vulnerability and adaptive capacity are influenced by their gender, age, location, and ethnic practices. These are further affected by geography, local climate, culture and overall governance as well as other demographic and socio-economic characteristics. The use of such data will help to mainstream these issues in the development plans and policies which will ultimately benefit the poor, women and marginalized communities.

Drought, flood and landslide induced-risk pose a challenge to key sectors such as agriculture, forestry, livestock, and water. There are several gaps in creating resilience to disaster/climate risks in these sector. Issues of climate and disaster risk in agriculture and food security could be mitigated by (i) using drought- and flood-resilient seeds varieties, (ii) encouraging inter- and multi-cropping practices, (iii) promoting agro-biodiversity practices such as saving local seeds, (iv) using water efficient technologies and practices (v) using tunnel farming, (vi) facilitating the implementation of crop, livestock, and infrastructure insurance schemes and other risk-sharing financial mechanisms. It is important all interventions including the projects and programmes in the periodic plan consider DRRM and climate change an integral part of the project design, construction and operationalisation.

Province 5 need to enhance the recharge of watersheds and conservation of ground water storage. It is particularly important and urgent to conserve water catchments in

Churia. Regulatory measures are important. However, because of the way the settlement is developing, regulation alone is not enough. In Province 5, it is worth designing and implementing Churia-centered assisted water reservoirs to recharge the Churia and Bhawar range.

It is equally important to implement integrated watershed management programmes in mid-hills and mountains. In Terai, we would recommend the continuation of embankment programmes and ground water recharge initiatives to reduce river bank erosion and flooding risks. This globally proven approach shows that the ecosystem health can be improved by adopting integrated watershed management systems and adapt to a changing climate.

In the short-term, issues of water security and access could be increased by (i) cautiously managing the use of water, (ii) adopting drip irrigation, rain water harvesting and making conservation ponds, and (iii) practicing furrow methods for irrigation.

Development infrastructures must be designed to withstand natural hazard stresses and climate change. In order to conform to sustainable development standards, they should consider external and internal risk factors, their root causes and driving factors in their planning, design, construction and operation.

Infrastructure and settlements particularly houses could be made more robust by reinforcing the national building code (NBC), and building the capacity of provincial and local governments to implement the NBC by (i) training engineers and masons in seismic-resistant construction, (ii) training municipal authorities to carry out hazard, risk and vulnerability assessments, (iii) increase the awareness of local people through social media, and (iv) strengthen the process of issuing building permits by making earthquake-resistant measures mandatory.

DRRM as standalone theme, access to climate and disaster information and knowledge is weak in the province. Climate information services could be improved through (i) preparing detailed risk maps and establishing early warning systems, (ii) installing hydrological-meteorological stations in appropriate locations in coordination with the DHM and strengthen the capacity of weather-monitoring agencies and DRRM actors; (iii) having a robust hazard monitoring and management mechanism; and (iv) strengthening the capacities of DEOCs and local EOCs through technical backstopping and the regular allocation of financial resources.

5.2. Policy, institutional and financing mechanism

As Nepal has transitioned to a federal structure that provides provincial and local government with new authority, there are opportunities for the Province 5 government to become both reactive and proactive in addressing locally assessed needs and aspirations in an innovative way. One of the opportunities is to mainstream climate and disaster issues with local government policies, plans and budgeting process. Relevant sectorial and cross-sector policies, regulatory measures and mechanisms need to take into account disaster prevention and operational safety.

It is suggested that the provincial government should take the lead in providing adequate support to local governments in ensuring climate and disaster issues are addressed by policy and legislative mechanisms.

In order to translate the policies and plans into action, there is a need for a robust institutional mechanism through (i) interconnectivity among the Disaster Management Committees (DMCs) and climate change related committees or mechanisms at different level, (ii) building the capacity of these DMCs and relevant institutions, (iii) improving data management systems, and (iv) institutionalizing the DMCs and related institutions.

Financing climate change adaptation and DRRM interventions require significant financial resources. Considering the level of revenue provincial and local government is currently raising, this is projected to be insufficient to meet the need for infrastructure investment.

There is a need to create new avenues and ventures for resource mobilization for DRRM and CCA interventions. This requires an enabling environment to access global funds, and new laws dealing with international cooperation, private participation and capital market access. It is essential that local governments receive advice about legal provisions and the subnational-level regulatory framework for the mobilization of private capital.

6. Conclusion

Province 5 has faced multiple disaster events. It is exposed to various geo-physical and hydro-meteorological extreme events and hazards. This study is designed to assess the status of hazards, vulnerabilities and risks of climate change and disasters with the objective of feeding this evidence in the approach paper, periodic plan and provincial sectoral policies and strategies.

The study identified that almost all the districts of Province 5 have experienced increased annual precipitation in winter, pre-monsoon and monsoon seasons with significant variations in monsoon precipitation among the districts. In all districts, the annual minimum temperature is increasing in all seasons. Additionally, the maximum temperature is also increasing. In the future, all Province 5 districts are expected to have an increased temperature and precipitation levels.

Between 1970 and 2018 epidemics killed 4,161 people; followed by landslides (618), floods (433), and fires (307). Many families were affected by floods (334,837), epidemics (110,974), landslides (66,512), fire (60,176), heavy rainfall (52,202), hailstorms (4371), and fires (324) at different times. Many people went missing. Injuries were mainly attributable to epidemics (6,143), fires (386), landslides (261), and floods (73), as presented in the tables in annexed this report. It is noteworthy that many small-scale disasters often go unreported.

Disaster event data demonstrates that the frequency and intensity of multiple disasters is increasing. These disasters claim lives and assets, adversely affect development outcomes, set back the development pace, destroy natural resources, reduce livelihood opportunities and exacerbate people's suffering.

It is globally agreed that children, older persons and persons with disabilities are disproportionately affected by disaster and climate change induced risks. Specific and targeted programme designs and implementation are necessary to ensure that no one is left behind in development and prosperity building in the province.

There is a need to mainstream DRRM and CCA in development plans and programs particularly for some sectors such as physical infrastructure, services, agriculture, forestry, livestock, water and watersheds and hazard monitoring, weather forecasting and risk information services.

There is yet to establish a robust mechanism and procedure for multi-hazard risk assessment. This mechanism must be able to identify the scale and the magnitude of the hazard risk, the level of vulnerability and the current adaptive capacity of the local communities. It will provide decision support information in development planning and implementation.

Mainstreaming climate change and disaster needs investment in knowledge generation, technology transfer, vulnerability assessment and adequate financing for implementation. There is a gap in understanding on the impact of climate change and

disaster risk due to the lack of a proper database and reliable information. The province and the local governments need to work together, with other province governments and federal government to deal with climate and disaster risk in the province.

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Annex I: Loss and damage caused by various disasters

AVALANCHES

Table 12: Loss and damage caused by Avalanches in Province 5, 1991-2013

District	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi				NA	
Banke				NA	
Bardiya				NA	
Dang				NA	
Gulmi				NA	
Kapilvastu				NA	
Nawalparasi				NA	
Palpa				NA	
Pyuthan				NA	
Rolpa				NA	
Rukum	1	0	0	NA	0
Total	**1**	**0**	**0**	**0**	**0**

Source: MoHA, DesInventar

COLD WAVES

Table 13: Loss and damage caused by cold-wave in Province 5, 1990-2013

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	12	0	0	NA	0
Banke	12	0	0	NA	0
Bardiya	5	0	12	NA	0
Dang				NA	
Gulmi	19	0	0	NA	1
Kapilvastu				NA	
Nawalparasi	22	0	7	NA	80
Palpa	1	0	0	NA	0
Pyuthan				NA	
Rolpa				NA	
Rukum	9	0	0	NA	0
Rupandehi				NA	
Total	**80**	**0**	**19**	**0**	**81**

Source: MoHA, DesInventar

EPIDEMICS

Table 14: Loss and damage caused by Epidemics in Province 5, 1970-2018

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	44	0	15692	NA	249
Banke	1970	0	22768	NA	1170
Bardiya	151	0	946	NA	455
Dang	393	0	3000	NA	458
Gulmi	105	0	1461	NA	32
Kapilvastu	208	0	6212	NA	298
Nawalparasi	141	0	28605	NA	699
Palpa	164	0	25352	NA	902
Pyuthan	139	0	1011	NA	560
Rolpa	147	0	884	NA	154
Rukum	345	0	1752	NA	104
Rupandehi	354	0	3291	NA	1062
Total	**4161**	**0**	**110974**		**6143**

Source: MoHA, DesInventar

EARTHQUAKE

Table 15: Loss and damage caused by Earthquake in Province 5, 1990-2015

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi				NA	
Banke	0	0	0	NA	1
Bardiya	0	0	0	NA	2
Dang	0	0	2	NA	10
Gulmi	3	0	0	NA	14
Kapilvastu	0	0	0	NA	6
Nawalparasi	5	0	3	NA	46
Palpa	1	0	0	NA	17
Pyuthan	0	0	0	NA	9
Rolpa	2	0	0	NA	4
Rukum	2	0	2402	NA	8
Rupandehi	0	0	0	NA	39
Total	**13**	**2407**	**0**		**156**

Source: MoHA, DesInventar

FIRE

Table 16: Loss and damage caused by Fire in Province 5, 1970-2015

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	11	0	1733	103659000	11
Banke	32	0	18496	169444000	134
Bardiya	25	0	5427	42315600	36
Dang	45	0	7627	232750480	29
Gulmi	28	0	705	169653000	16
Kapilvastu	32	0	13675	181352500	36
Nawalparasi	25	0	2413	40448050	9
Palpa	26	0	1849	38681600	16
Pyuthan	20	0	1320	30178000	21
Rolpa	20	0	1646	73272900	36
Rukum	26	0	2214	NA	6
Rupandehi	17	0	3071	310591500	36
Total	**307**	**0**	**60176**	**1392346630**	**386**

Source: MoHA, DesInventar

FLOOD

Table 17: Loss and damage caused by Flood in Province 5, 1970-2018

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	15	11	4202	NA	1
Banke	35	13	28146	480000000	5
Bardiya	54	25	65673	3775550700	6
Dang	75	17	67188	511839420	27
Gulmi	25	10	1363	NA	3
Kapilvastu	13	2	26386	NA	0
Nawalparasi	34	19	82139	NA	8
Palpa	19	52	25814	NA	6
Pyuthan	20	5	192	NA	0
Rolpa	21	1	410	NA	2
Rukum	31	9	4840	NA	5
Rupandehi	91	94	28484	NA	10
Total	**433**	**258**	**334837**	**4767390120**	**73**

Source: MoHA, DesInventar

FOREST FIRE

Table 18: Loss and damage caused by Forest Fire in Province 5, 1979-2013

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	0	0	162	NA	1
Banke				NA	
Bardiya				NA	
Dang	2	0	22	NA	3
Gulmi	1	0	0	NA	3
Kapilvastu				NA	
Nawalparasi	1	0	0	NA	5
Palpa	2	0	0	NA	2
Pyuthan				NA	
Rolpa				NA	
Rukum	0	0	140	NA	3
Rupandehi				NA	
Total	**6**	**0**	**324**	**0**	**17**

Source: MoHA, DesInventar

HEATWAVES

Table 19: Loss and damage caused by Heatwaves in Province 5, 1980-2013

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi				NA	
Banke	2	0	0	NA	12
Bardiya	2	0	0	1	0
Dang				NA	
Gulmi				NA	
Kapilvastu	9	0	0	NA	0
Nawalparasi	1	0	0	NA	0
Palpa				NA	
Pyuthan				NA	
Rolpa				NA	
Rukum				NA	
Rupandehi	4	0	0	3	0
Total	**18**	**0**	**0**	**4**	**12**

Source: MoHA, DesInventar

HEAVY RAINFALL

Table 20: Loss and damage caused by Heavy rainfall in Province 5, 1990-2018

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	0	0	5	2405000	0
Banke	3	0	50006	352000	2
Bardiya	3	0	22	150000	7
Dang	1	0	13	1142000	1
Gulmi	0	0	2	100000	1
Kapilvastu	0	0	1811	1220000	2
Nawalparasi	2	0	205	160000	10
Palpa	0	0	8	781000	3
Pyuthan	3	0	35	NA	1
Rolpa	3	0	3	NA	0
Rukum	1	0	12	5024000	0
Rupandehi	1	0	80	NA	2
Total	**17**	**0**	**52202**	**11334000**	**29**

Source: MoHA, DesInventar

LANDSLIDE

Table 21: Loss and damage caused by Landslides in Province 5, 1970-2018

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	75	0	10564	2700000	51
Banke	5	0	293	NA	5
Bardiya	2	0	0	NA	0
Dang	9	1	441	NA	13
Gulmi	143	11	19712	943000	39
Kapilvastu	0	0	297	NA	0
Nawalparasi	19	6	3034	NA	14
Palpa	102	1	3948	NA	39
Pyuthan	132	9	1288	747667979	36
Rolpa	58	16	2875	NA	39
Rukum	59	0	4112	2374000	18
Rupandehi	14	2	19948	NA	7
Total	**618**	**46**	**66512**	**753684979**	**261**

Source: MoHA, DesInventar

SNOW STORM

Table 22: Loss and damage caused by snow storm in Province 5, 2000-2013

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi				NA	
Banke				NA	
Bardiya				NA	
Dang				NA	
Gulmi				NA	
Kapilvastu				NA	
Nawalparasi				NA	
Palpa				NA	
Pyuthan				NA	
Rolpa	4	0	0	NA	0
Rukum	1	0	0	1	30
Rupandehi				NA	
Total	**5**	**0**	**0**	**1**	**30**

Source: MoHA, DesInventar

STORM

Table 23: Loss and damage caused by Storm in Province 5, 1970-2013

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	0	0	6	NA	0
Banke	3	0	0	NA	1
Bardiya				NA	
Dang				NA	
Gulmi				NA	
Kapilvastu				NA	
Nawalparasi				NA	
Palpa				NA	
Pyuthan				NA	
Rolpa				NA	
Rukum				NA	
Rupandehi	0	0	1620	NA	3
Total	**3**	**0**	**1626**	**0**	**4**

Source: MoHA, DesInventar

THUNDERBOLT

Table 24: Loss and damage caused by Thunderbolt in Province 5, 1990-2013

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	0	0	6	NA	0
Banke	7	0	0	NA	4
Bardiya	10	0	6	NA	6
Dang	39	0	50	NA	50
Gulmi	16	0	33	NA	79
Kapilvastu	10	0	5	NA	10
Nawalparasi	17	0	0	NA	54
Palpa	14	0	16	NA	13
Pyuthan	13	0	10	NA	64
Rolpa	19	0	806	NA	19
Rukum	4	0	33	NA	26
Rupandehi	11	0	28	NA	24
Total	**160**	**0**	**993**	**0**	**349**

Source: MoHA, DesInventar

HAILSTORM

Table 25: Loss and damage caused by Hailstorm in Province 5, 1970-2018

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	0	0	0	NA	0
Banke	0	0	681	165000	0
Bardiya	0	0	664	NA	0
Dang	0	0	0	NA	0
Gulmi	1	0	0	NA	0
Kapilvastu	0	0	0	NA	0
Nawalparasi	0	0	1465	NA	3
Palpa	0	0	0	NA	0
Pyuthan	0	0	0	NA	0
Rolpa	0	0	0	NA	0
Rukum	0	0	1551	292000	0
Rupandehi	4	0	10	NA	0
Total	**5**	**0**	**4371**	**457000**	**3**

Source: MoHA, DesInventar

WINDSTORM

Table 26: Loss and damage caused by windstorm in Province 5, 2013-2018

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	0	0	2	NA	2
Banke	1	0	8	1262000	4
Bardiya	0	0	60	4089282	10
Dang	0	0	42	5091000	12
Gulmi				NA	
Kapilvastu	0	0	6	1178500	2
Nawalparasi	1	0	3	NA	0
Palpa	0	0	12	NA	0
Pyuthan				NA	
Rolpa				NA	
Rukum				NA	
Rupandehi	0	0	5	550000	0
Total	**2**	**0**	**138**	**12170782**	**30**

Source: MoHA, DesInventar

ACCIDENT

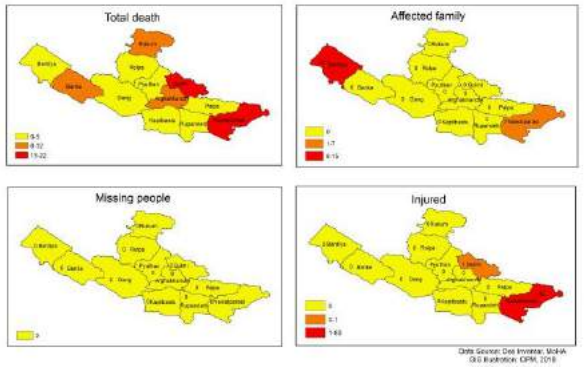
Table 27: Loss and damage caused by Accident in Province 5, 2004-2013

DISTRICT	Total Death	Missing People	Affected Family	Estimated Loss	Injured
Arghakhanchi	9	0	0	NA	4
Banke	41	3	1500	NA	12
Bardiya	27	9	12	NA	1
Dang	48	1	0	NA	3
Gulmi	24	7	210	NA	17
Kapilvastu	34	0	5	NA	4
Nawalparasi	40	13	0	NA	11
Palpa	16	4	286	NA	4
Pyuthan	14	1	0	NA	5
Rolpa	8	1	0	NA	1
Rukum	49	13	0	NA	12
Rupandehi	26	5	0	NA	3
Total	**336**	**57**	**2013**	**0**	**77**

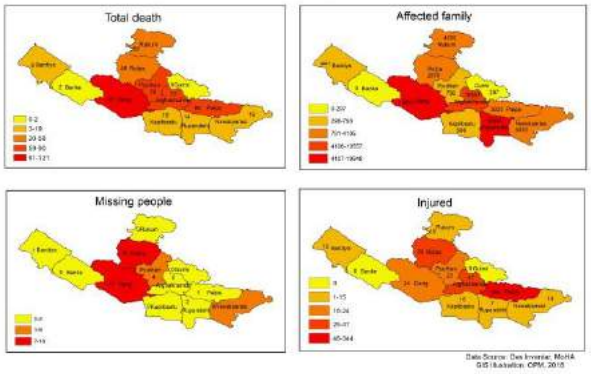
Source: MoHA, DesInventar

Annex II: Loss and damage by different hazards

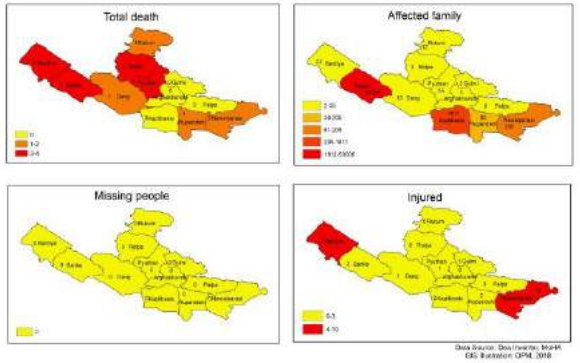
Loss and damage caused by Coldwaves (1970-2013)



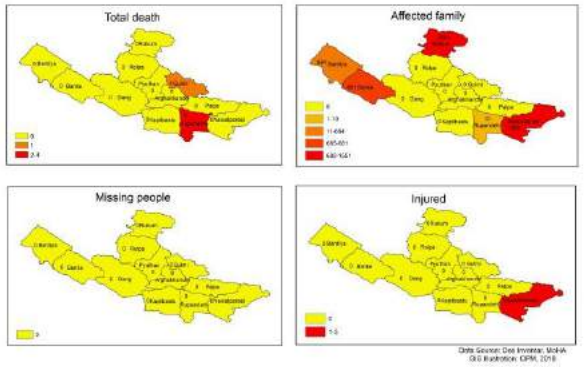
Loss and damage caused by Landslide (1970-2018)



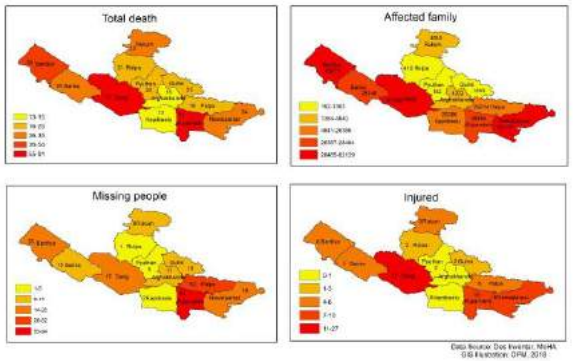
Loss and damage caused by Heavyrain (1990-2018)



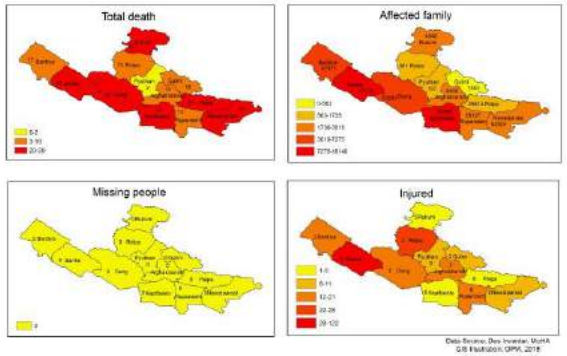
Loss and damage caused by Hailstone (1970-2018)



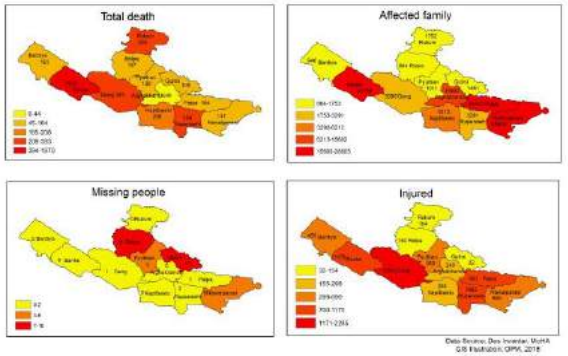
Loss and damage caused by Flood (1970-2018)



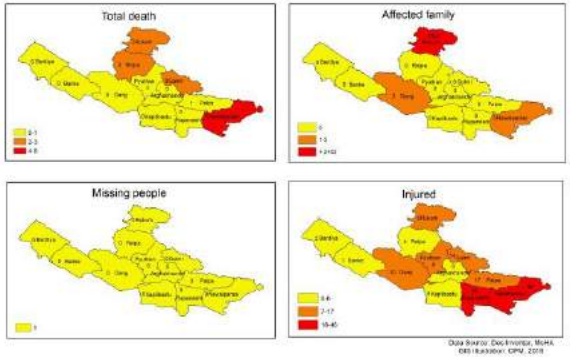
Loss and damage caused by Fire (1970-2015)



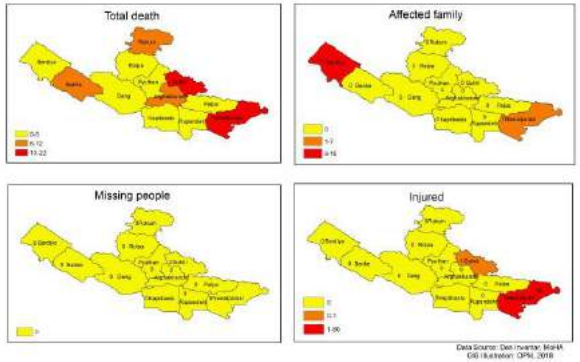
Loss and damage caused by Epidemics (1970-2018)



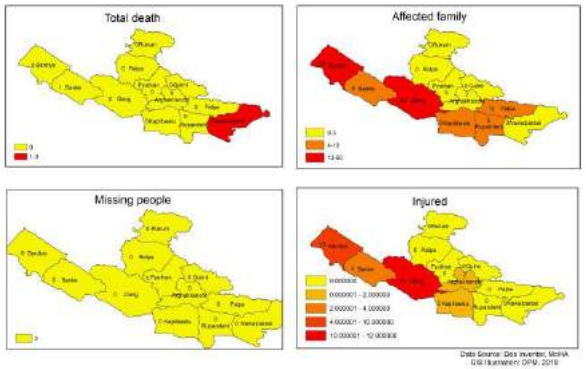
Loss and damage caused by Earthquake (1990-2015)



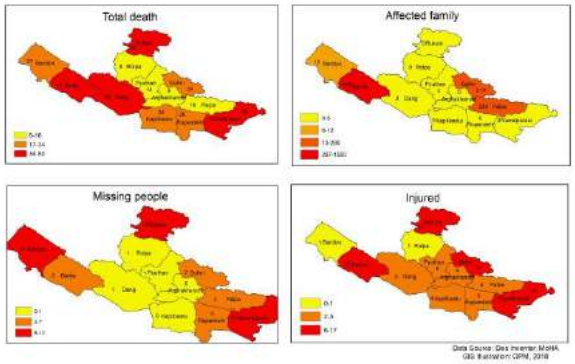
Loss and damage caused by Coldwaves (1990-2013)



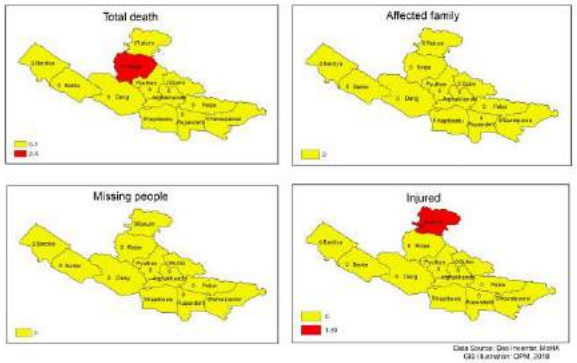
Loss and damage caused by Windstorms (2013-2018)



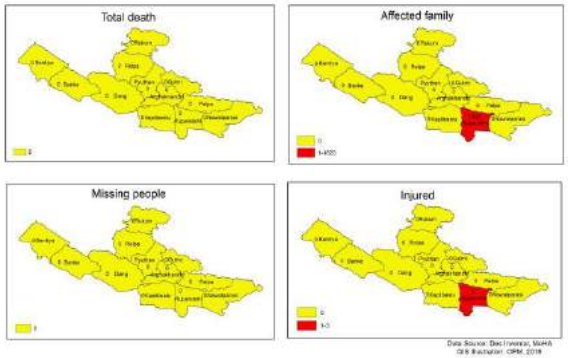
Loss and damage caused by Accident (2004-2013)



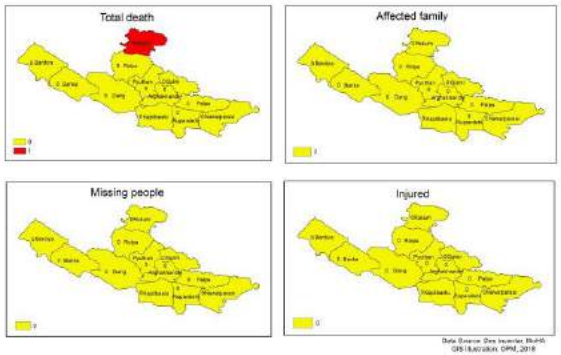
Loss and damage caused by Snow storm (2000-2013)



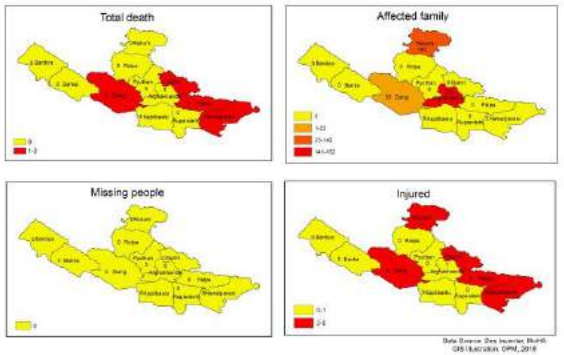
Loss and damage caused by Storm (1970-2013)



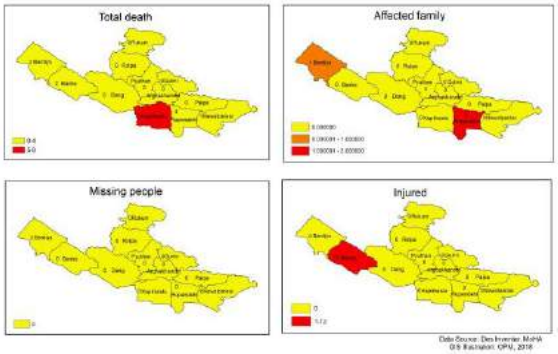
Loss and damage caused by Avalances (1991-2013)



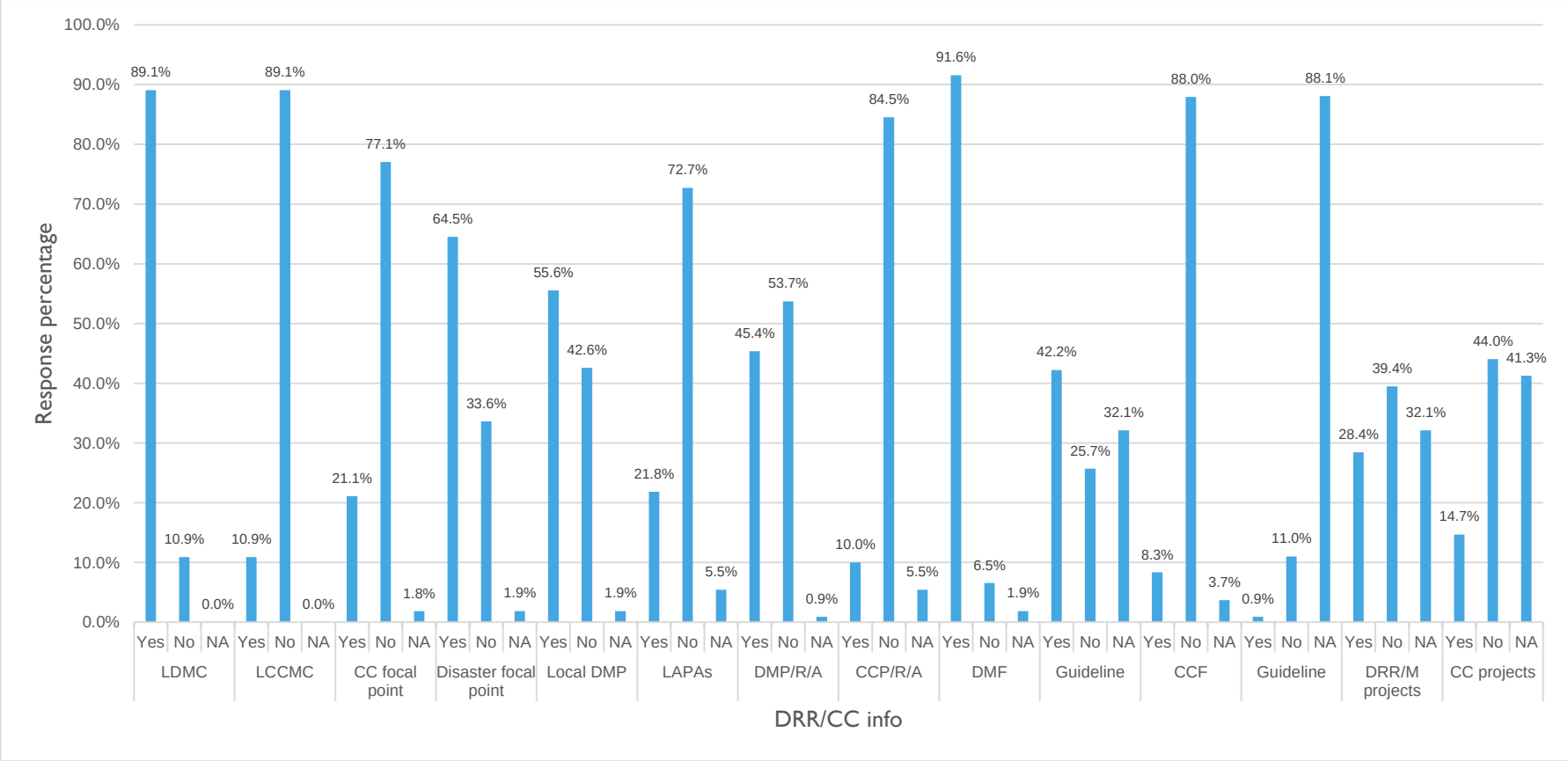
Loss and damage caused by Forest fire (1979-2013)



Loss and damage caused by Heatwaves (1980-2013)



Annex III: Status of DRRM and CC related activities by districts and Palikas



Districts	Municipalities	LDMC	CCC	CC Focal point	DRR Focal point	Local DMPs	LAPAs	DMP/R/A	CCP/R/A	DM fund	DMF Guideline	CC fund	CCF guidelines	DRR/M projects	CC projects
Rolpa	Lungri Gaunpalika	1	0	1	1	1	0	1	0	1	0	0	NA	1	1
	Madi Gaunpalika	1	0	1	0	1	1	0	0	1	1	0	NA	0	NA
	Rolpa Municipality	1	1	1	1	1	1	0	0	1	0	0	NA	NA	NA
	Runtigadhi Gaunpalika	1	0	0	1	0	0	0	0	1	1	0	NA	1	0
	Sukidaha Gaunpalika	1	0	0	0	1	0	1	0	1	0	0	NA	NA	NA
	Sunchhahari Gaunpalika	1	0	0	1	1	1	1	0	1	1	0	0	1	1
	Thawang Gaunpalika	1	0	0	1	1	1	1	0	1	1	0	NA	1	1
	Tribeni Gaunpalika	0	0	1	1	1	1	1	0	1	1	0	0	1	1
	Pariwarthan/Duikholi GauPalika	1	0	0	0	0	1	1	0	1	1	0	NA	1	1
	Sunilsmriti/Subarnabati GauPalika	1	0	0	1	0	1	0	0	1	NA	0	NA	0	0
	Yes	9	1	4	7	7	7	6	0	10	6	0	0	6	5
	No	1	9	6	3	3	3	4	10	0	3	9	2	2	2
	NA	0	0	0	0	0	0	0	0	0	1	0	8	2	3

Gulmi	Chandrakot Gaunpalika	1	0	0	1	1	0	0	0	1	1	0	NA	0	0
	Chhatrakot Gaunpalika	1	0	1	1	0	1	0	0	1	1	0	NA	0	0
	Dhurkot Gaunpalika	1	0	0	1	1	0	1	0	1	1	0	NA	0	0
	Gulmi Durbar Gaunpaika	1	0	0	1	1	0	1	0	1	1	0	NA	NA	NA
	Isma Gaunpalika	1	0	0	1	1	0	1	0	1	1	0	0	0	0
	Kali Gandaki Gaunpalika	0	0	0	0	0	0	0	0	1	NA	0	NA	0	0
	Madane Gaunpalika	1	0	0	1	1	0	0	0	1	1	0	NA	NA	NA
	Malika Gaunpalika	1	0	0	1	1	0	1	0	1	1	1	1	NA	NA
	Musikot Municipality	1	0	0	1	1	0	1	0	1	1	0	NA	0	0
	Resunga Municipality	0	0	1	1	0	0	0	0	NA	NA	0	NA	0	0
	Ruru Gaunpalika	1	0	0	0	0	0	1	0	1	NA	0	NA	0	0
	Satyawoti Gaunpalika	1	0	0	1	1	0	0	0	1	NA	1	NA	NA	NA
	Yes	10	0	2	9	7	1	6	0	10	8	1	1	0	0
	No	2	12	10	2	4	11	6	12	0	0	10	1	8	8
	NA	0	0	0	0	0	0	0	0	1	4	0	10	4	4
Nawal parasi	Bardaghat Municipality	1	0	0	0	1	0	1	0	1	1	0	NA	1	NA

	Palhinandan Gaunpalika	1	0	0	0	1	NA	1	0	1	1	0	NA	1	NA
	Pratapapur Gaunpalika	1	0	0	0	1	0	1	0	0	NA	0	NA	1	NA
	Ramgram Municipality	1	1	1	1	1	1	1	1	1	1	0	NA	NA	NA
	Sarawal Gaunpalika	1	0	0	1	1	0	1	0	1	0	0	NA	1	NA
	Sunawal Municipality	1	1	1	1	0	0	1	NA	NA	NA	NA	NA	1	1
	Susta Gaunpalika	1	0	0	1	0	NA	1	0	1	1	0	NA	1	1
	Yes	7	2	2	3	5	1	6	1	4	3	0	0	5	1
	No	0	5	5	3	2	4	0	5	1	1	6	0	0	0
	NA	0	0	0	0	0	2	0	1	1	2	1	7	1	5
Banke	Baijanath Gaunpalika	1	0	0	0	1	0	1	0	1	0	0	NA	1	0
	Duduwa Gaunpalika	1	0	0	1	NA	NA	NA	NA	1	1	0	NA	NA	NA
	Janaki Gaunpalika	0	0	0	1	0	0	0	0	1	0	0	NA	NA	NA
	Khajura Gaunpalika	1	0	0	0	NA	0	0	0	1	1	0	NA	1	0
	Kohalpur Municipality	1	0	0	1	1	0	1	1	1	1	0	NA	1	NA
	Narainapur Gaunpalika	1	0	0	1	1	0	0	0	1	1	0	NA	NA	NA
	Nepalganj Sub-Metropolitian City	1	1	1	1	1	1	1	1	1	0	1	0	NA	1

	Rapti Sonari Gaunpalika	1	0	0	0	1	1	1	1	1	0	0	NA	1	1
	Janaki Gaunpalika	1	0	1	1	1	0	1	1	1	NA	NA	NA	1	NA
	Yes	8	1	2	6	6	2	5	4	9	4	1	0	5	2
	No	1	8	7	3	1	6	3	4	0	4	7	1	0	2
	NA	0	0	0	0	2	1	1	1	0	1	1	8	4	5
Pyuthan	Aairawati Gaunpalika	1	0	0	1	1	0	0	0	1	NA	0	NA	NA	NA
	Gaumukhi Gaunpalika	1	0	0	0	0	0	0	0	1	1	0	NA	0	0
	Jhimaruk Gaunpalika	1	0	0	0	1	0	0	1	1	1	0	NA	1	0
	Mallarani Gaunpalika	1	0	1	0	0	0	0	0	1	NA	0	NA	NA	NA
	Mandavi Gaunpalika	1	0	0	0	1	0	1	0	1	0	0	NA	0	0
	Naubahini Gaunpalika	1	1	0	0	1	1	1	1	1	1	0	NA	1	1
	Pyuthan Municipality	1	0	0	1	1	0	1	0	1	NA	0	NA	NA	NA
	Sarumarani Gaunpalika	1	0	0	1	1	NA	0	0	1	0	NA	NA	0	0
	Sworgadwari Municipality	1	0	1	1	1	1	0	0	1	1	0	NA	1	1
	Yes	9	1	2	4	7	2	3	2	9	4	0	0	3	2
	No	0	8	7	5	2	6	6	7	0	2	8	0	3	4
	NA	0	0	0	0	0	1	0	0	0	3	1	9	3	3

Bardiya	Badhaiyatal Gaunpalika	1	1	1	1	1	1	0	0	1	1	0	NA	1	1
	Bansgadhi Municipality	1	1	1	1	1	1	0	0	1	0	1	0	0	0
	Barbardiya Municipality	1	0	0	1	1	1	1	0	1	1	1	0	NA	NA
	Geruwa Gaunpalika	1	0	0	1	0	0	0	0	1	1	0	NA	NA	NA
	Gulariya Municipality	1	1	1	1	1	0	1	NA	1	1	0	NA	1	0
	Madhuwan Municipality	1	0	NA	0	0	NA	0	0	0	0	0	NA	NA	NA
	Rajapur Municipality	1	0	0	1	1	0	1	0	0	0	0	NA	NA	NA
	Thakurbaba Municipality	1	0	0	1	1	0	0	1	1	1	0	NA	1	NA
	Yes	8	3	3	7	6	3	3	1	6	5	2	0	3	1
	No	0	5	4	1	2	4	5	6	2	3	6	2	1	2
	NA	0	0	1	0	0	1	0	1	0	0	0	6	4	5
Dang	Babai Gaunpalika	0	0	0	1	0	0	0	0	1	NA	1	NA	1	1
	Bangalachuli Gaunpalika	1	0	0	1	1	0	0	0	1	NA	0	NA	0	0
	Dangisharan Gaunpalika	0	0	0	1	0	0	0	0	0	0	0	0	0	NA
	Gadhawa Gaunpalika	1	1	1	1	1	1	0	0	1	NA	1	NA	NA	NA
	Ghorahi Sub-Metropolitian City	1	0	0	1	0	1	1	1	1	0	0	NA	1	1

	Lamahi Municipality	0	0	0	1	0	0	0	0	1	0	0	NA	0	0
	Rajpur Gaunpalika	1	0	0	1	0	0	0	0	1	0	0	NA	0	0
	Rapti Gaunpalika	1	0	0	1	0	0	0	0	1	NA	0	NA	0	0
	Shantinagar Gaunpalika	1	0	0	0	0	0	0	0	0	NA	0	NA	0	0
	Tulsipur Sub-Metropolitian City	1	0	1	1	1	0	1	0	1	NA	0	NA	0	0
	Yes	7	1	1	8	2	2	1	1	7	0	2	0	2	2
	No	3	9	8	1	7	8	8	9	2	4	8	1	7	6
	NA	0	0	0	0	0	0	0	0	0	6	0	9	1	2
Rukum	Bhoome Gaunpalika	1	0	0	0	0	1	1	0	1	1	NA	NA	0	1
	Putha Uttanganga Gaunpalika	1	0	0	1	0	0	0	0	1	NA	0	NA	NA	NA
	Sisne Gaunpalika	1	0	0	0	0	1	0	0	1	0	0	NA	0	0
	Yes	3	0	0	1	0	2	1	0	3	1	0	0	0	1
	No	0	3	3	2	3	1	2	3	0	1	2	0	2	1
	NA	0	0	0	0	0	0	0	0	0	1	1	3	1	1
Arghakhanchi	Bhumikasthan Municipality	1	0	0	1	1	0	1	0	1	1	0	NA	NA	0
	Chhatradev Gaunpalika	1	0	1	1	1	0	1	0	1	1	0	NA	NA	0
	Malarani Gaunpalika	1	0	0	0	1	0	0	0	1	NA	1	NA	NA	NA

	Panini Gaunpalika	1	0	0	1	1	0	1	0	1	1	0	NA	NA	NA
	Sandhikharka Municipality	1	0	0	1	1	0	1	0	1	1	0	NA	NA	NA
	Shitaganga Municipality	1	0	0	1	0	0	1	0	1	1	0	0	0	0
	Yes	6	0	1	5	5	0	5	0	6	5	1	0	0	0
	No	0	6	5	1	1	6	1	6	0	0	5	1	1	3
	NA	0	0	0	0	0	0	0	0	0	1	0	5	5	3
Kapilvastu	Banganga Municipality	1	0	1	1	0	0	0	0	1	0	1	0	NA	NA
	Bijayanagar Gaunpalika	1	0	0	1	0	0	0	0	1	0	0	0	0	0
	Buddhabhumi Municipality	1	0	0	1	1	0	0	1	1	1	0	NA	1	0
	Kapilvastu Municipality	0	0	0	0	0	0	0	0	1	0	0	NA	0	0
	Krishnanagar Municipality	0	0	0	0	1	0	0	0	0	NA	0	NA	0	0
	Maharajganj Municipality	1	0	0	1	0	0	0	0	1	1	0	NA	0	0
	Mayadevi Gaunpalika	1	1	0	1	1	1	1	1	1	1	0	0	0	1
	Shivaraj Municipality	1	0	0	0	0	0	1	0	1	NA	0	NA	0	0
	Shuddhodhan Gaunpalika	1	0	0	0	1	0	1	0	1	1	0	NA	0	0
	Yasodhara Gaunpalika	0	0	0	0	0	0	0	0	0	NA	0	NA	0	0
	Yes	7	1	1	5	4	1	3	2	8	4	1	0	1	1

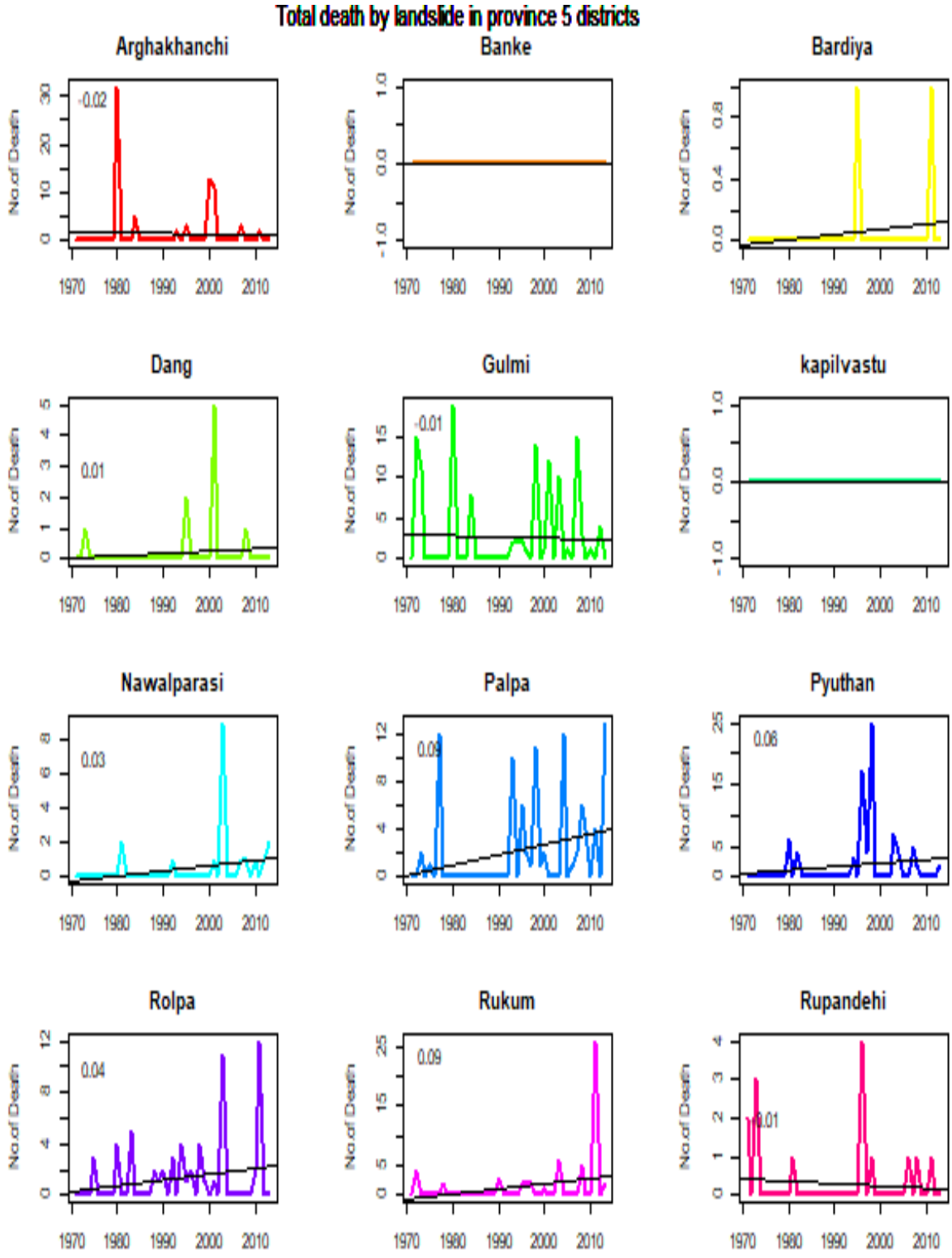
	No	3	9	9	5	6	9	7	8	2	3	9	3	8	8
	NA	0	0	0	0	0	0	0	0	0	3	0	7	1	1
Rupandehi	Butwal Sub-Metropolitian City	1	0	1	1	1	0	1	0	1	1	0	0	1	1
	Devdaha Municipality	1	0	0	0	1	0	0	0	1	0	0		1	0
	Gaidahawa Gaunpalika	1	0	NA	NA	0	0	0	0	1	0	0	NA	0	0
	Kanchan Gaunpalika	1	0	0	1	0	0	1	0	1	1	0	NA	NA	NA
	Kotahimai Gaunpalika	1	0	0	1	1	0	0	0	1	NA	0	NA	1	0
	Lumbini Sanskritik Municipality	1	0	0	1	0	0	0	0	1	0	0	NA	0	0
	Marchawari Gaunpalika	1	0	0	1	1	0	1	0	1	0	0	NA	0	0
	Mayadevi Gaunpalika	1	0	0	0	0	0	0	NA	1	1	0	NA	NA	NA
	Om Satiya Gaunpalika	1	0	0	1	0	0	1	0	1	NA	0	NA	NA	NA
	Rohini Gaunpalika	1	0	1	1	0	0	0	0	1	NA	0	NA	0	0
	Sainamaina Municipality	1	0	0	1	0	0	0	0	1	1	0	NA	1	NA
	Sammarimai Gaunpalika	1	0	0	1	0	1	0	0	1	NA	0	NA	NA	NA
	Siddharthanagar Municipality	1	0	0	0	1	0	1	0	1	NA	0	NA	0	0

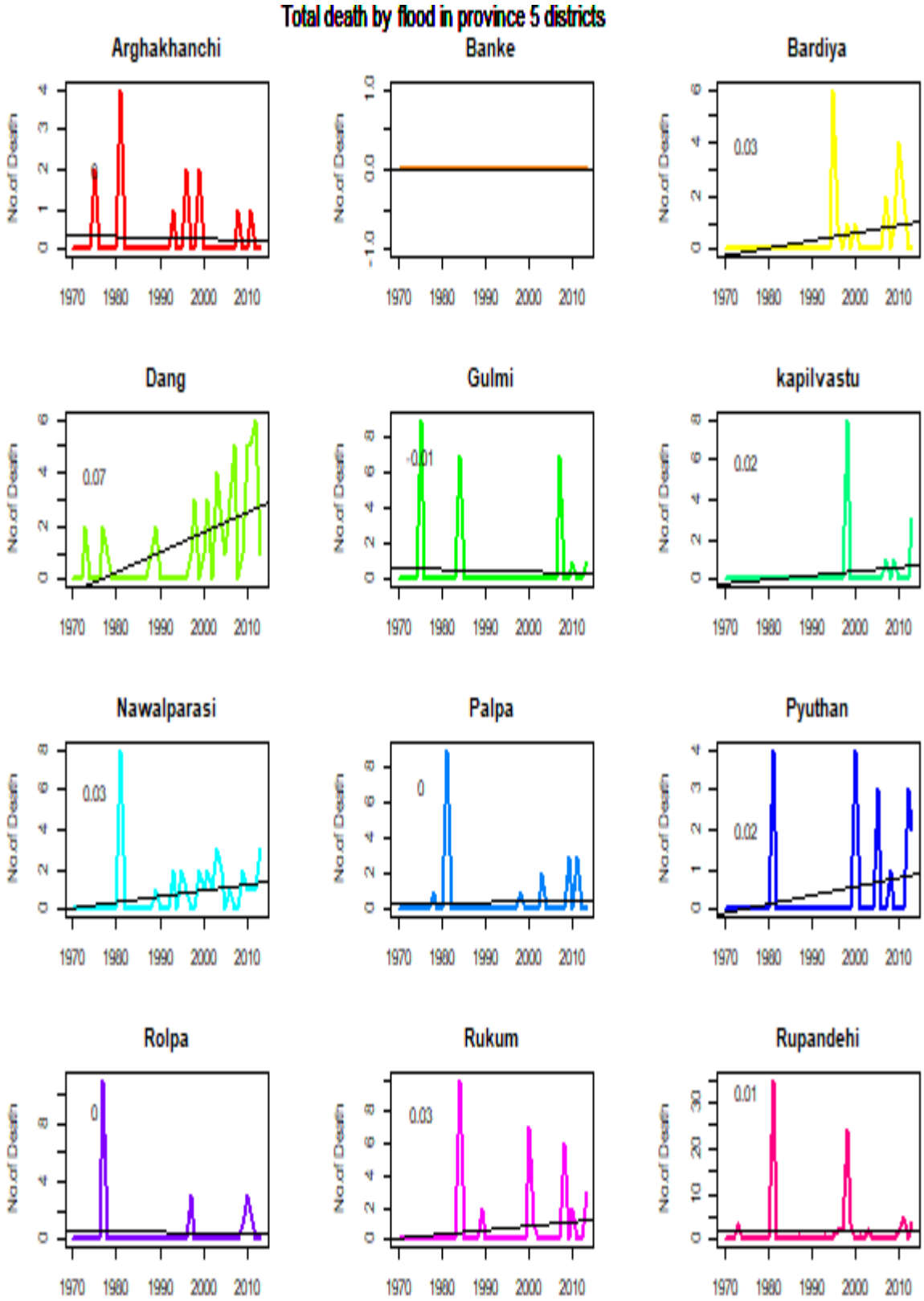
	Siyari Gaunpalika	1	0	0	1	1	0	1	NA	1	NA	0	NA	1	0
	Suddhodhan Gaunpalika	1	1	1	1	0	0	1	0	1	NA	0	NA	NA	NA
	Tilottama Municipality	1	0	0	1	1	0	1	0	1	NA	0	NA	0	NA
	Yes	16	1	3	12	7	1	8	0	16	4	0	0	5	1
	No	0	15	12	3	9	15	8	14	0	4	16	1	6	8
	NA	0	0	1	1	0	0	0	2	0	8	0	14	5	7
Palpa	Baganaskali Gaunpalika	0	0	1	0	0	0	0	0	1	0	0	NA	NA	NA
	Mathagadhi Gaunpalika	1	0	0	0	1	0	0	0	1	1	0	NA	1	0
	Nisdi Gaunpalika	1	0	0	0	0	0	0	0	1	NA	0	NA	0	NA
	Purbakhola Gaunpalika	1	0	0	0	1	1	0	0	1	0	0	NA	NA	NA
	Rainadevi Chhahara Gaunpalika	1	0	0	1	0	1	0	0	1	NA	0	NA	NA	NA
	Rambha Gaunpalika	1	0	0	1	1	0	1	0	1	1	0	NA	0	0
	Rampur Municipality	1	1	1	NA	1	0	0	NA	1	NA	1	NA	NA	NA
	Ribdikot Gaunpalika	1	0	0	0	0	0	1	0	1	NA	0	NA	0	NA
	Tansen Municipality	0	0	0	0	0	0	0	0	1	0	0	NA	0	0
	Tinau Gaunpalika	1	0	0	0	0	NA	0	0	1	NA	0	NA	0	0

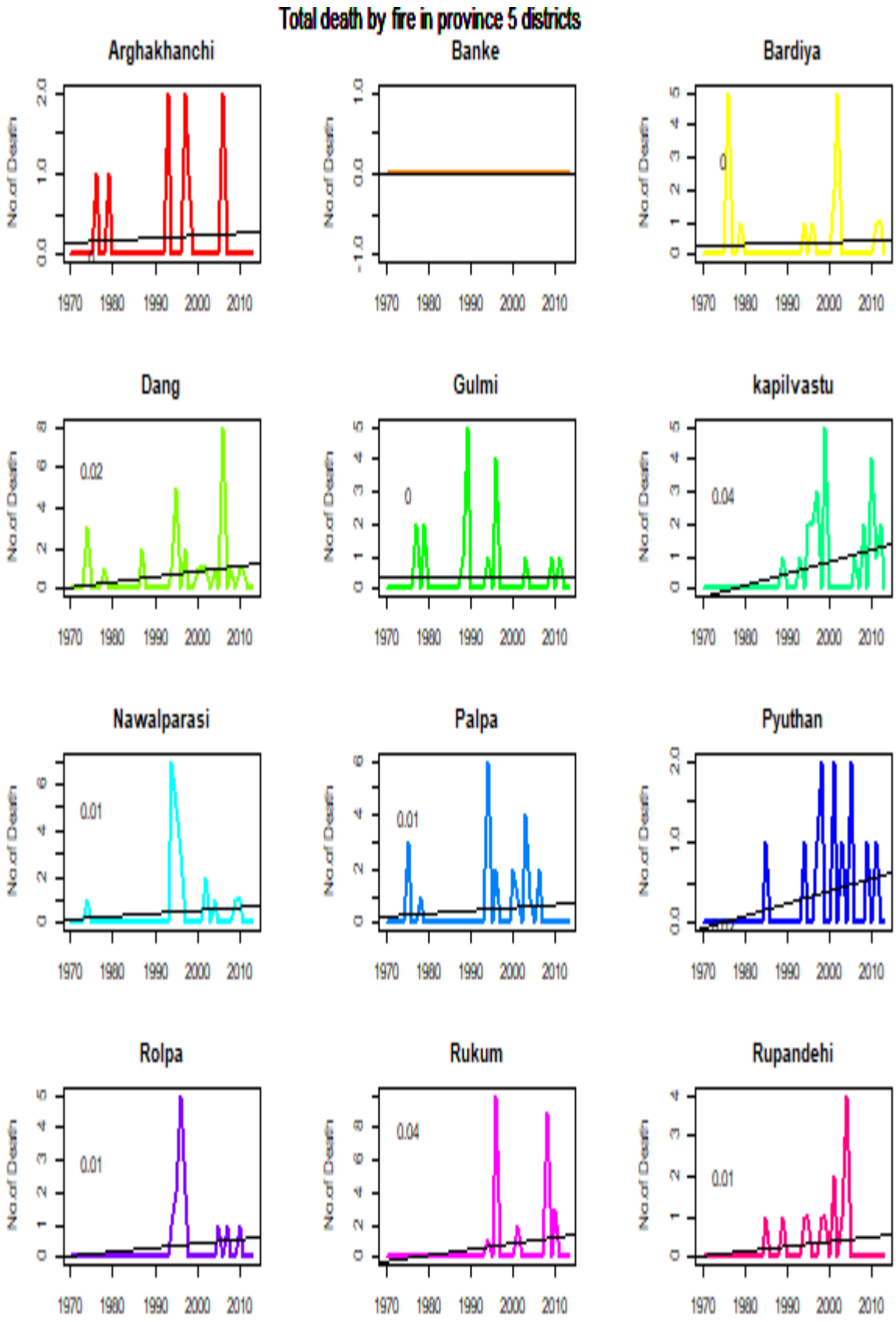
	Yes	8	1	2	2	4	2	2	0	10	2	1	0	1	0

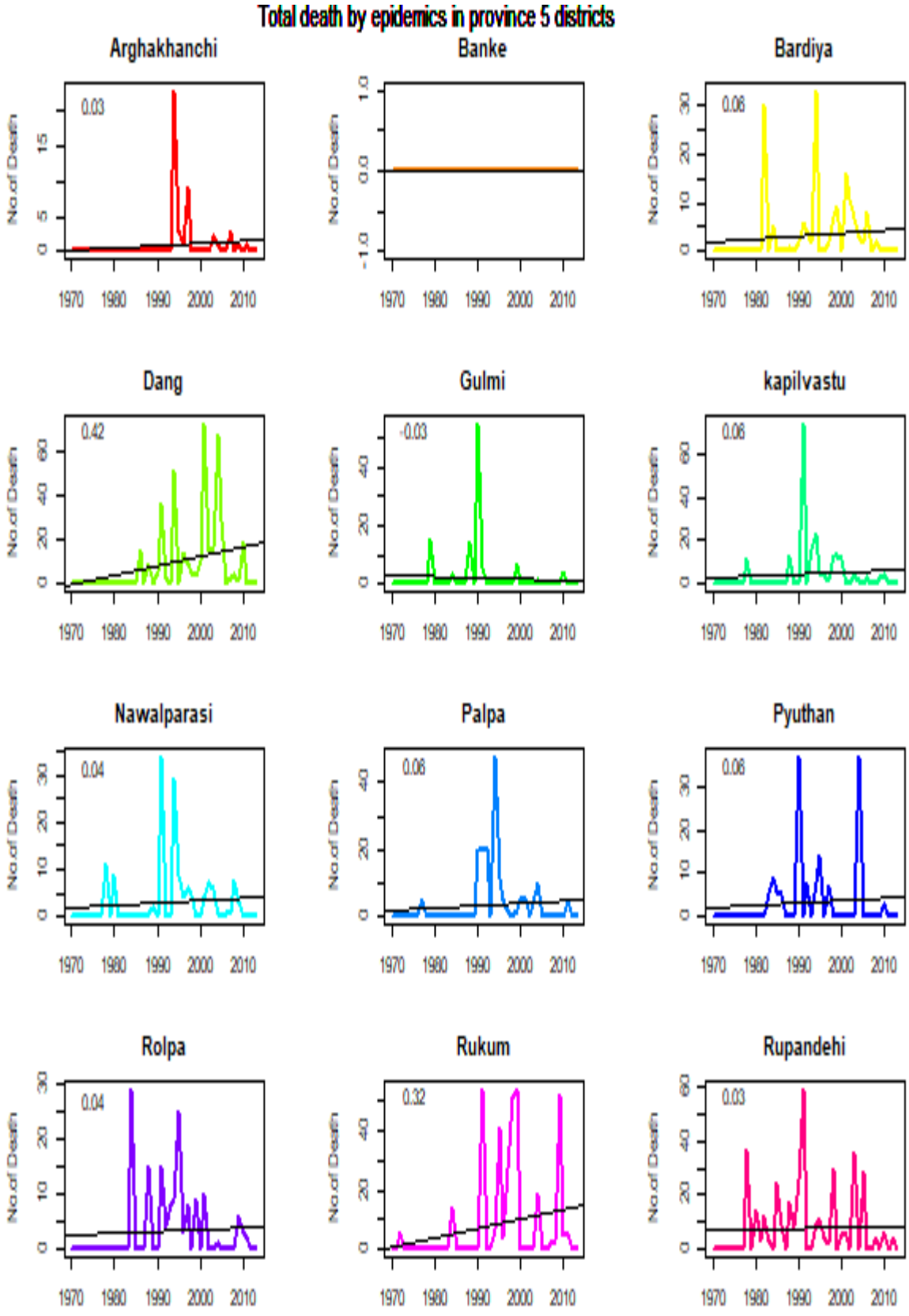
*LDMC= Local Disaster Management Committee, CCC= Climate change committee, CC Focal Pont= Climate change focal point, DRR focal point= Disaster Risk Reduction Focal point, DMPs= Disaster Management Plans, DMP/R/A= Disaster Management Plans/Rules/Act, CCP/R/A= Climate change Plans/Rules/Act, DM fund= Disaster management fund, DMF guideline= Disaster management fund guideline, CCF guideline= Climate change fund guideline

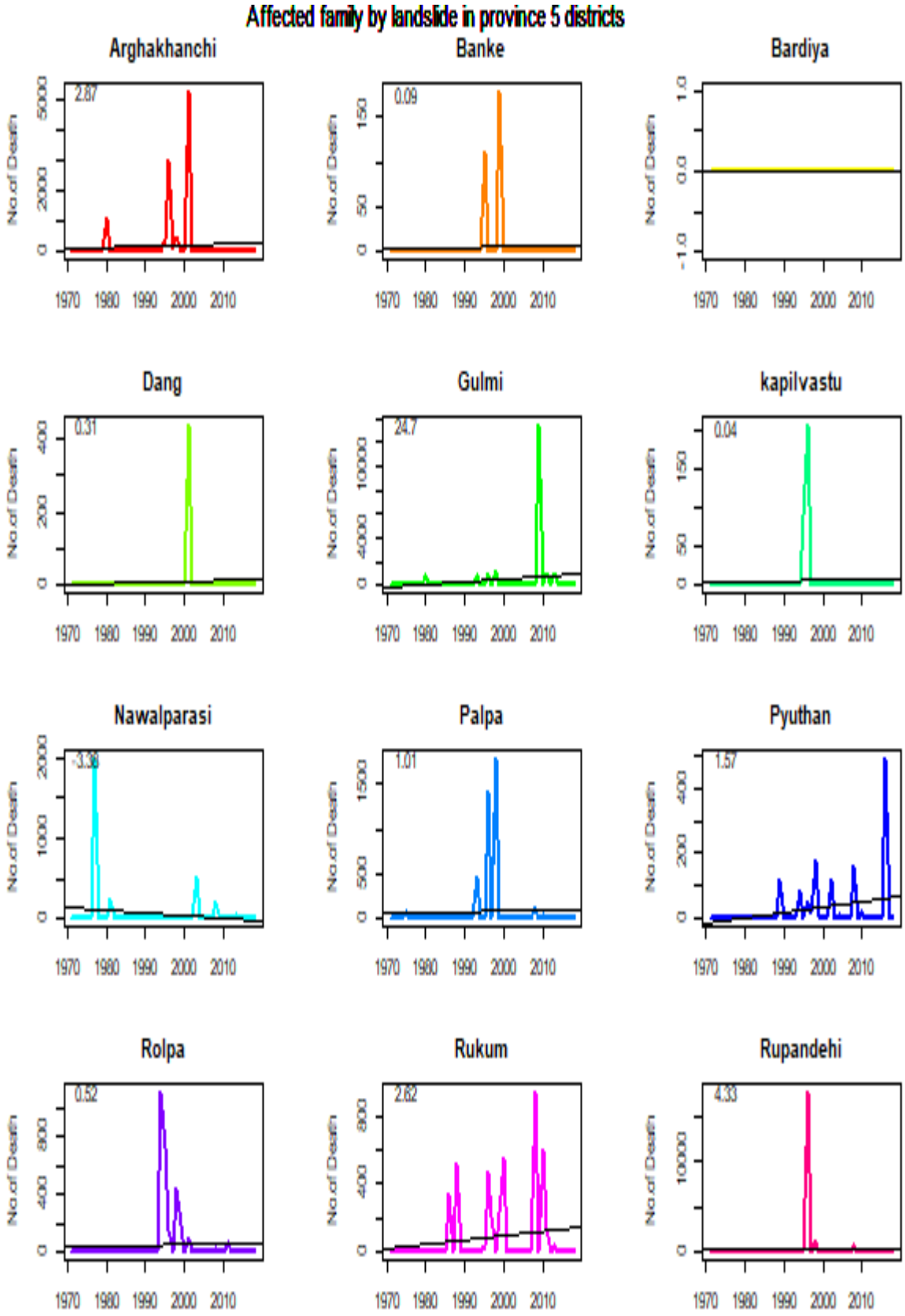
Annex IV: Trend of Disaster by District

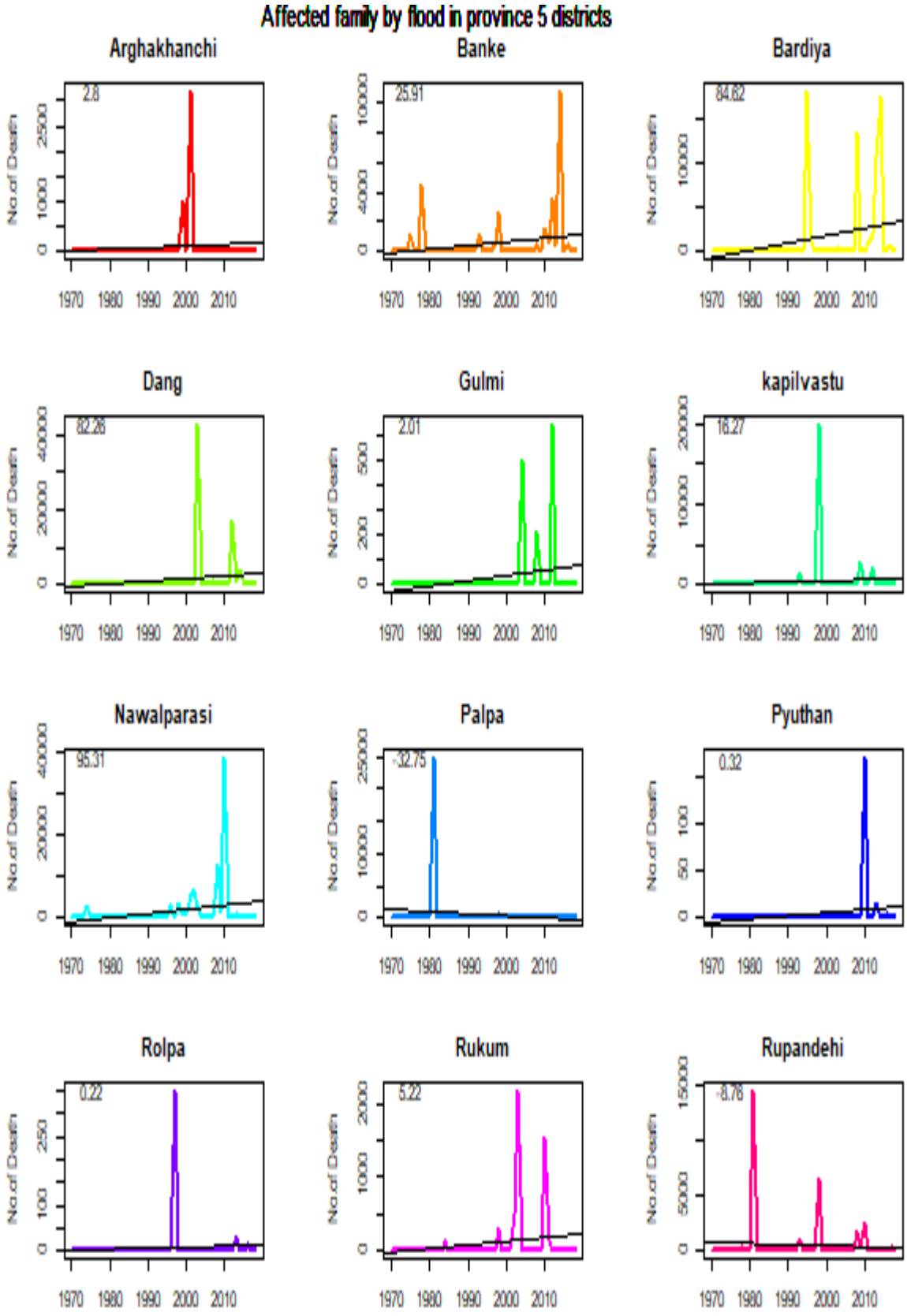


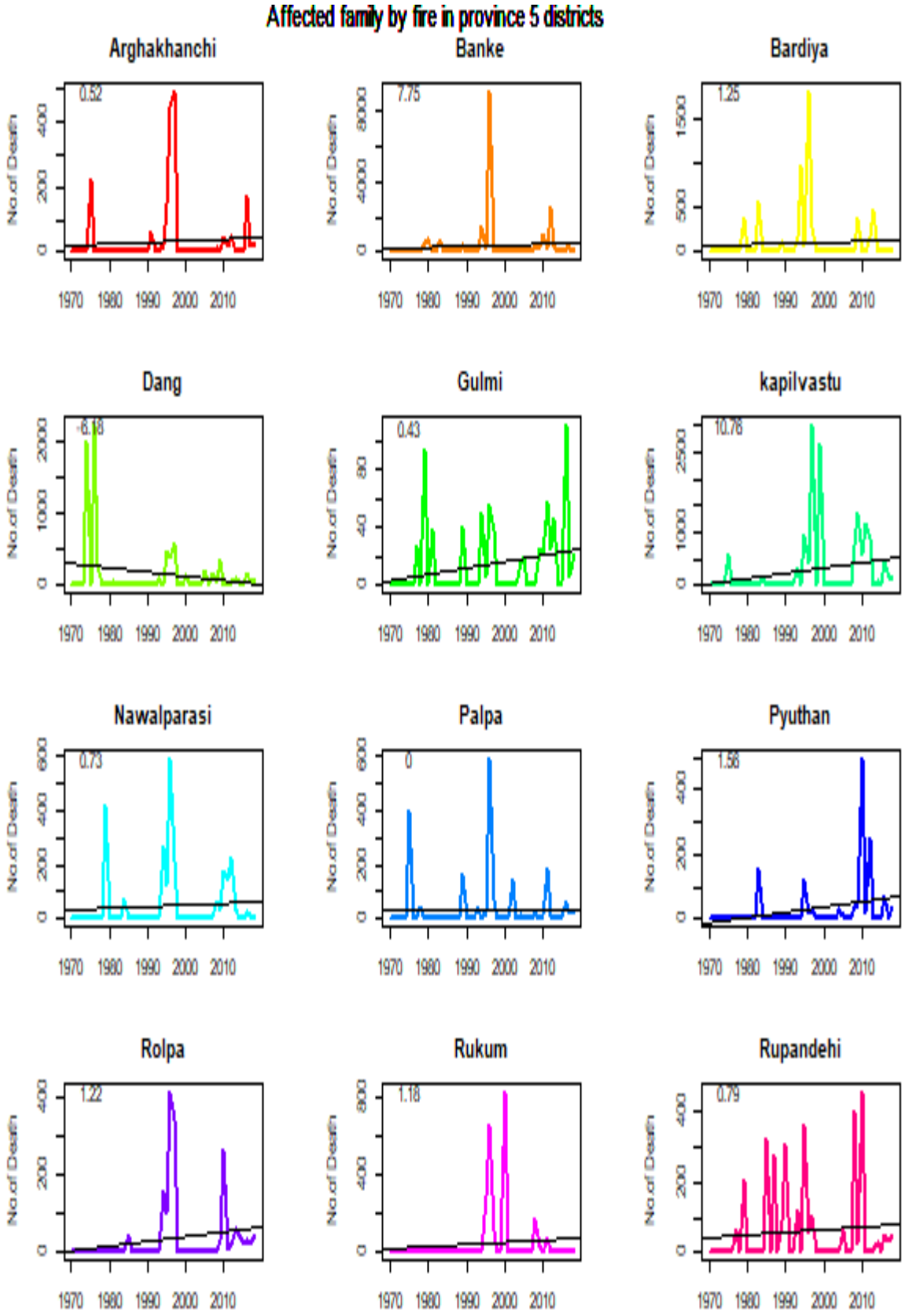

Total death by flood in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1970
1980
1990
2000
2010

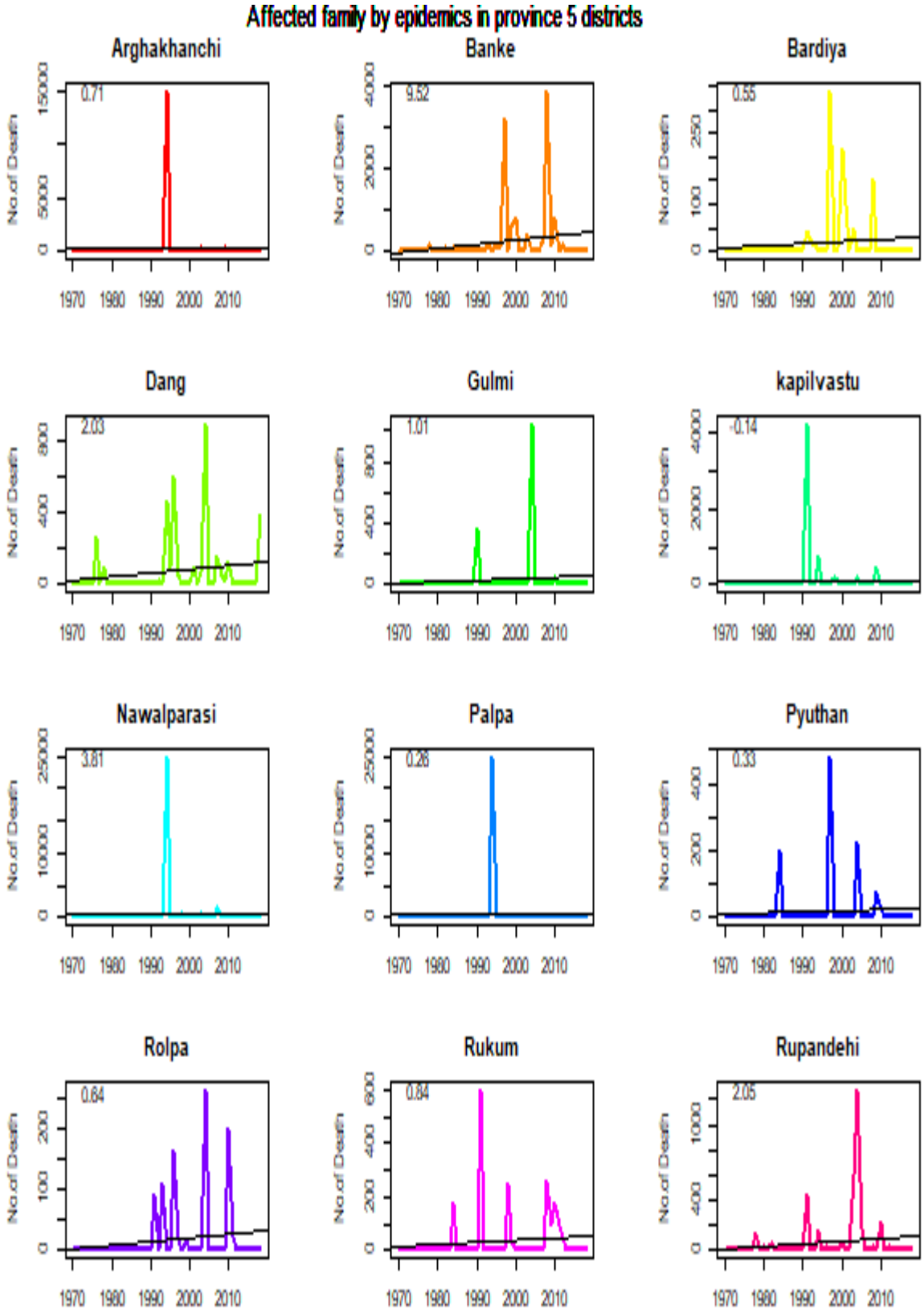

Total death by fire in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1970
1980
1990
2000
2010

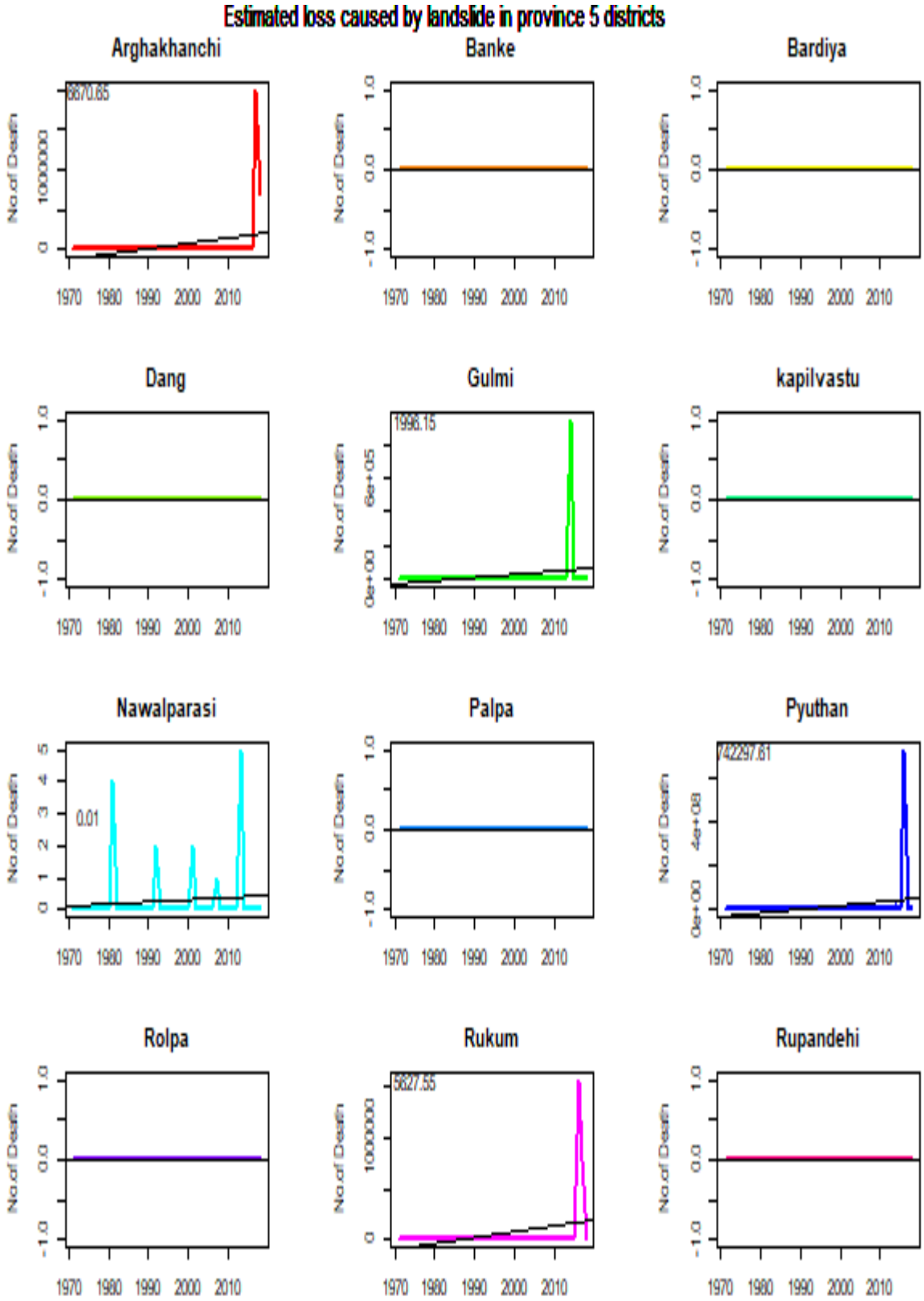

Total death by epidemics in province 5 districts
Arghakhanchi
0.03
Banke
Bardiya
0.06
Dang
0.42
Gulmi
-0.03
kapilvastu
0.08
Nawalparasi
0.04
Palpa
0.08
Pyuthan
0.08
Rolpa
0.04
Rukum
0.32
Rupandehi
0.03
No.of Death
1970
1980
1990
2000
2010

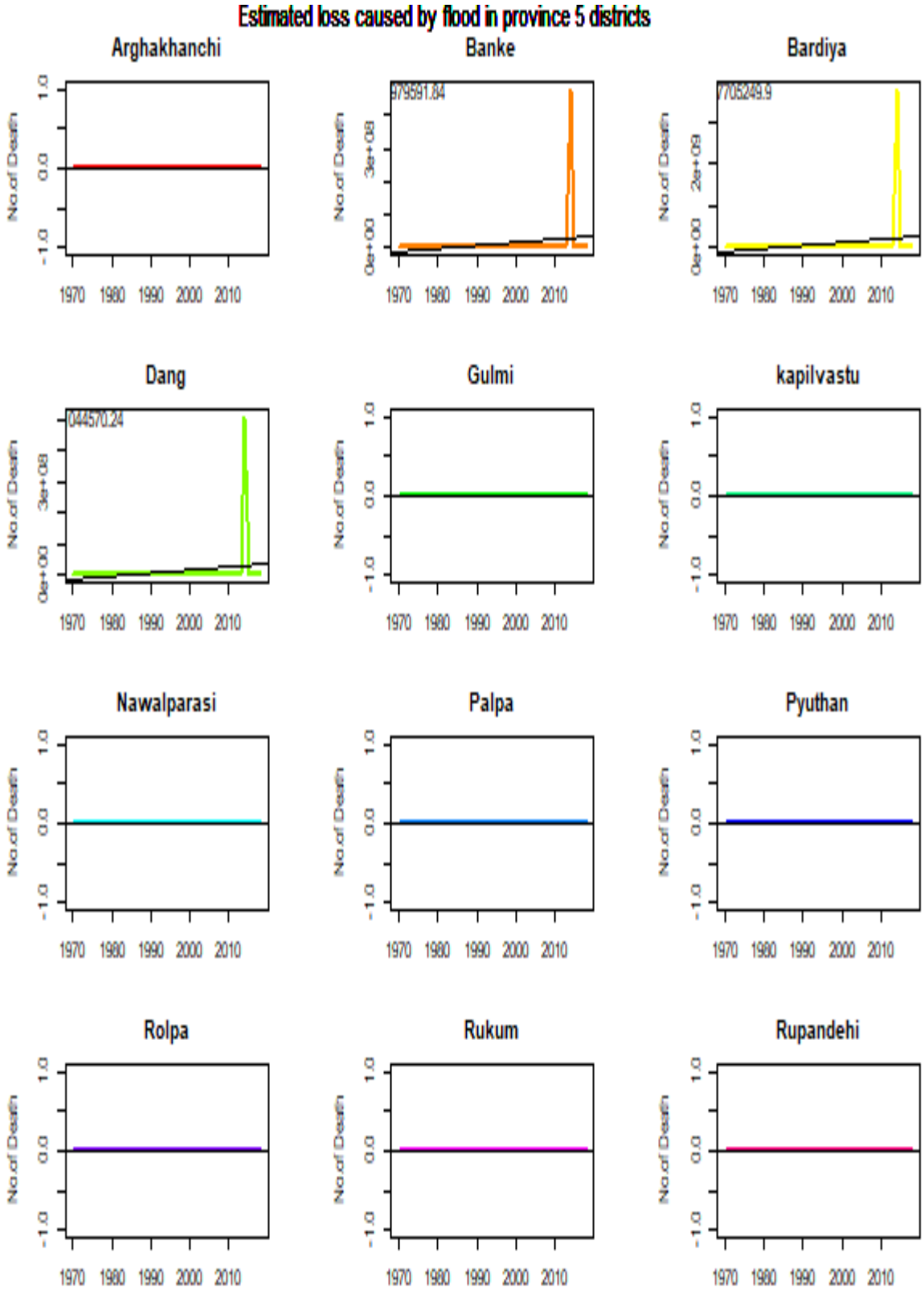

Affected family by landslide in province 5 districts
Arghakhanchi
2.87
Banke
0.09
Bardiya
Dang
0.31
Gulmi
24.7
kapilvastu
0.04
Nawalparasi
-3.36
Palpa
1.01
Pyuthan
1.57
Rolpa
0.52
Rukum
2.62
Rupandehi
4.33
No.of Death
1970
1980
1990
2000
2010

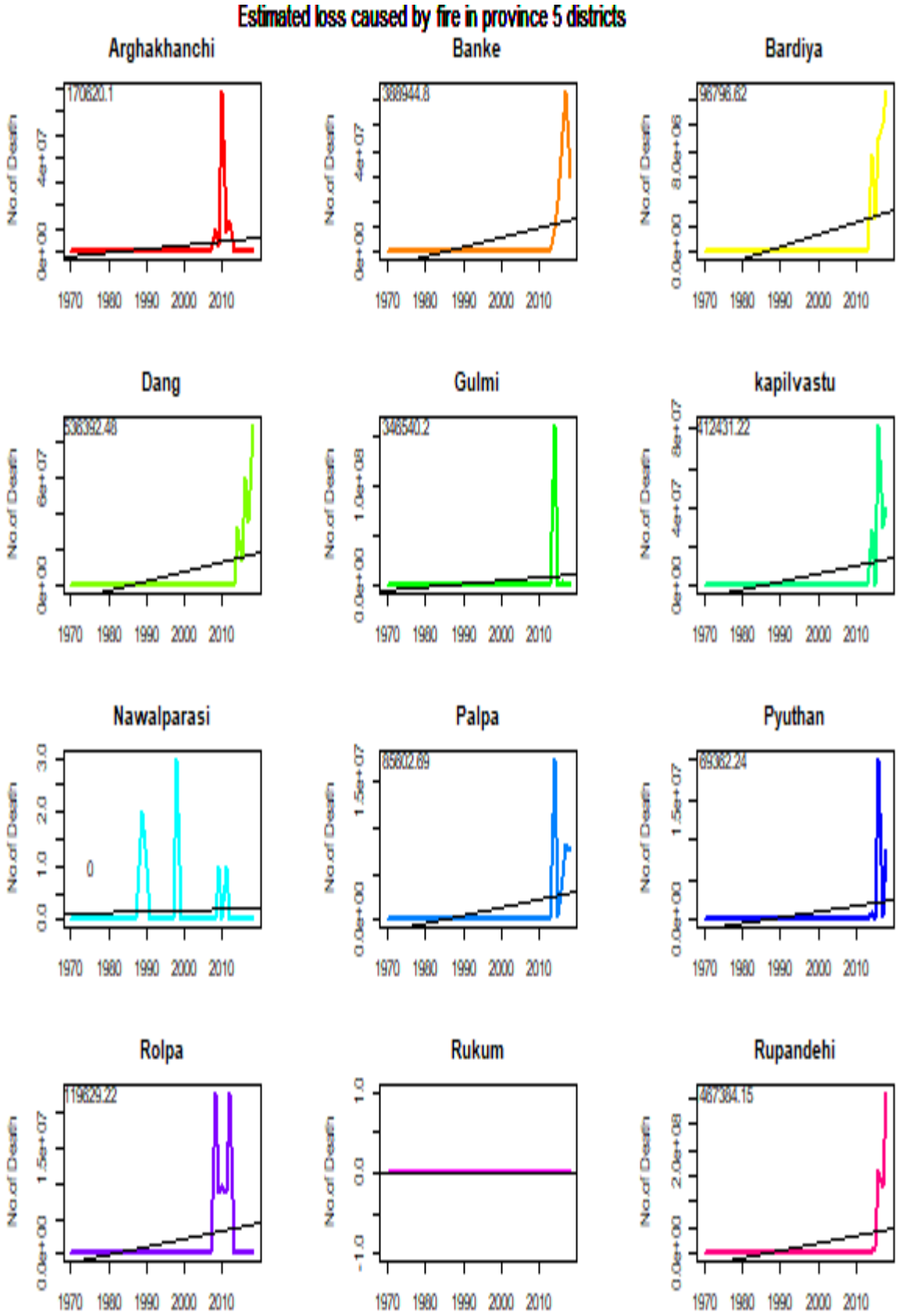

Affected family by flood in province 5 districts
Arghakhanchi
2.8
Banke
25.91
Bardiya
84.62
Dang
82.28
Gulmi
2.01
kapilvastu
16.27
Nawalparasi
95.31
Palpa
32.75
Pyuthan
0.32
Rolpa
0.22
Rukum
5.22
Rupandehi
8.78
No.of Death
1970
1980
1990
2000
2010

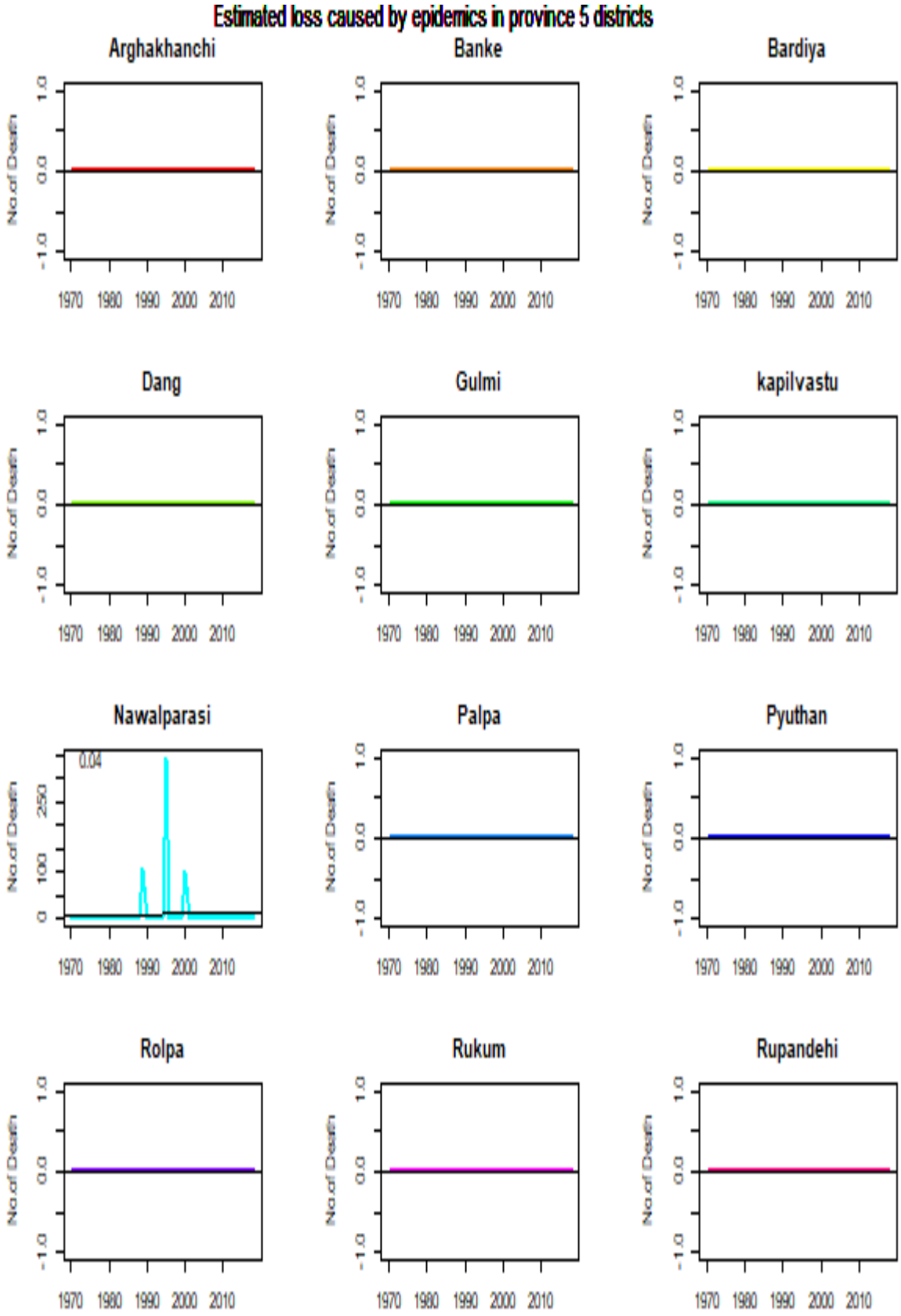

Affected family by fire in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1970
1980
1990
2000
2010

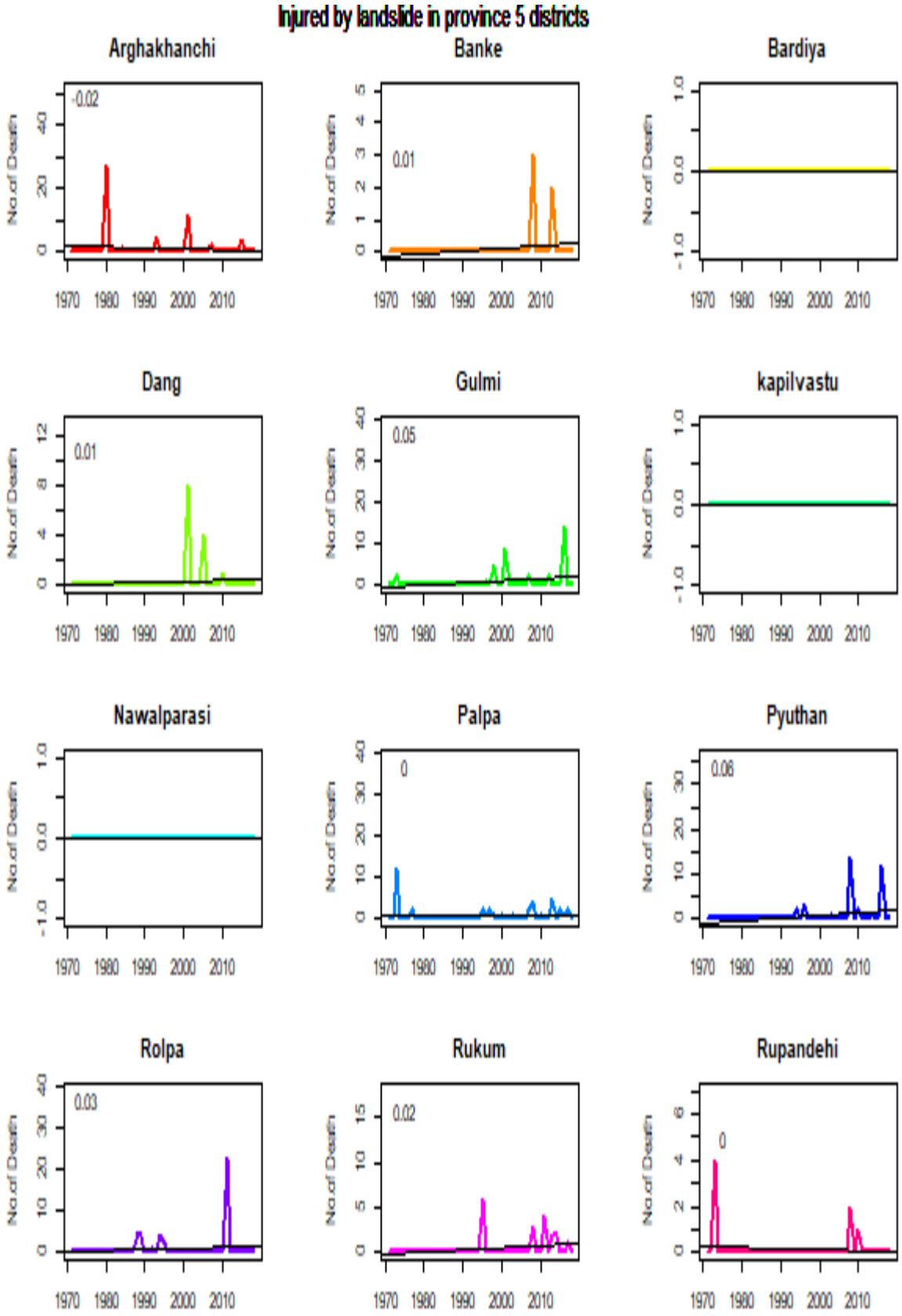

Affected family by epidemics in province 5 districts
Arghakhanchi
0.71
Banke
9.52
Bardiya
0.55
Dang
2.03
Gulmi
1.01
kapilvastu
-0.14
Nawalparasi
3.81
Palpa
0.26
Pyuthan
0.33
Rolpa
0.64
Rukum
0.84
Rupandehi
2.05
No.of Death
1970
1980
1990
2000
2010

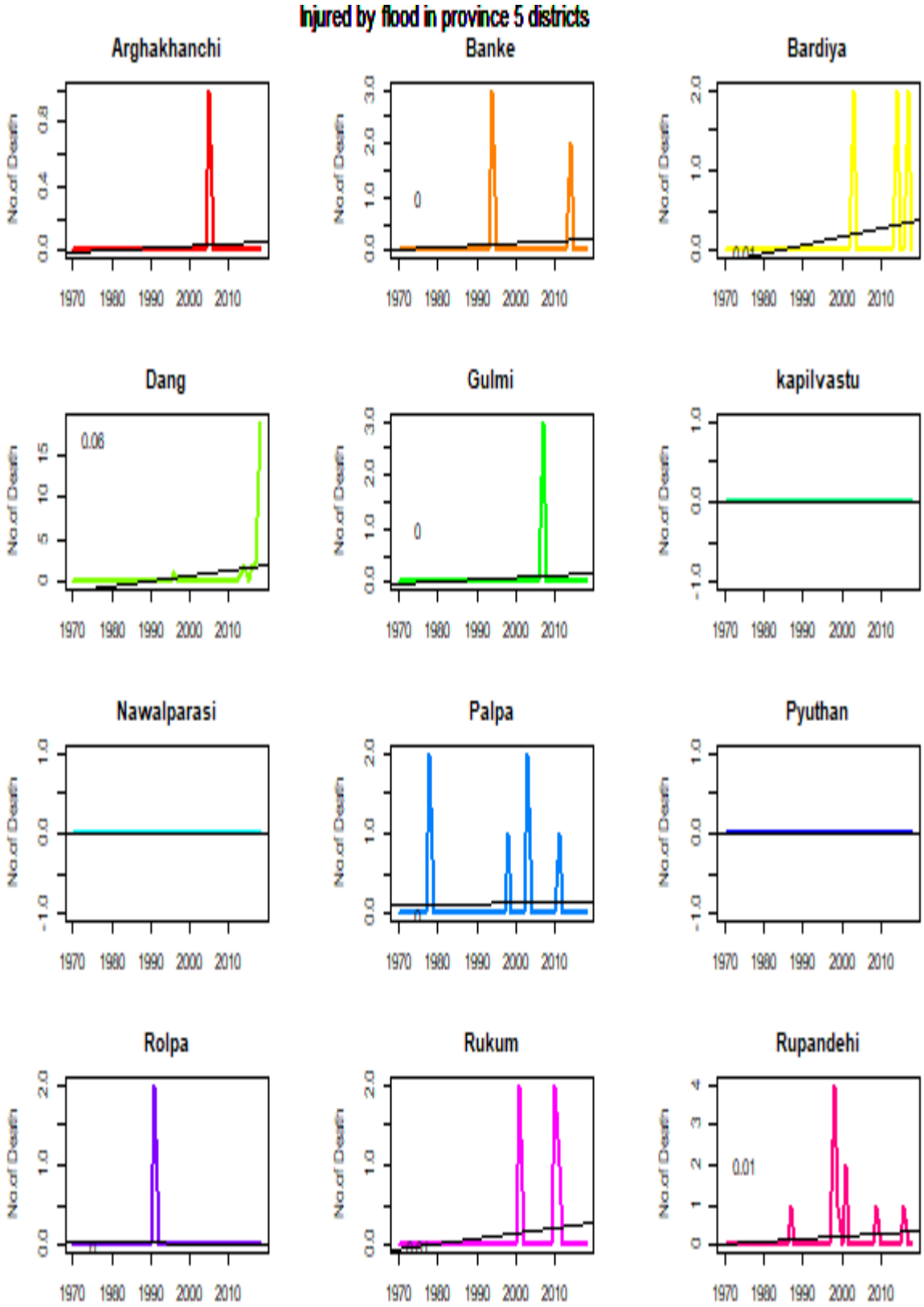

Estimated loss caused by landslide in province 5 districts
Arghakhanchi
8670.65
Banke
Bardiya
Dang
Gulmi
1998.15
kapilvastu
Nawalparasi
0.01
Palpa
Pyuthan
742297.61
Rolpa
Rukum
5827.55
Rupandehi
No.of Death
1970
1980
1990
2000
2010

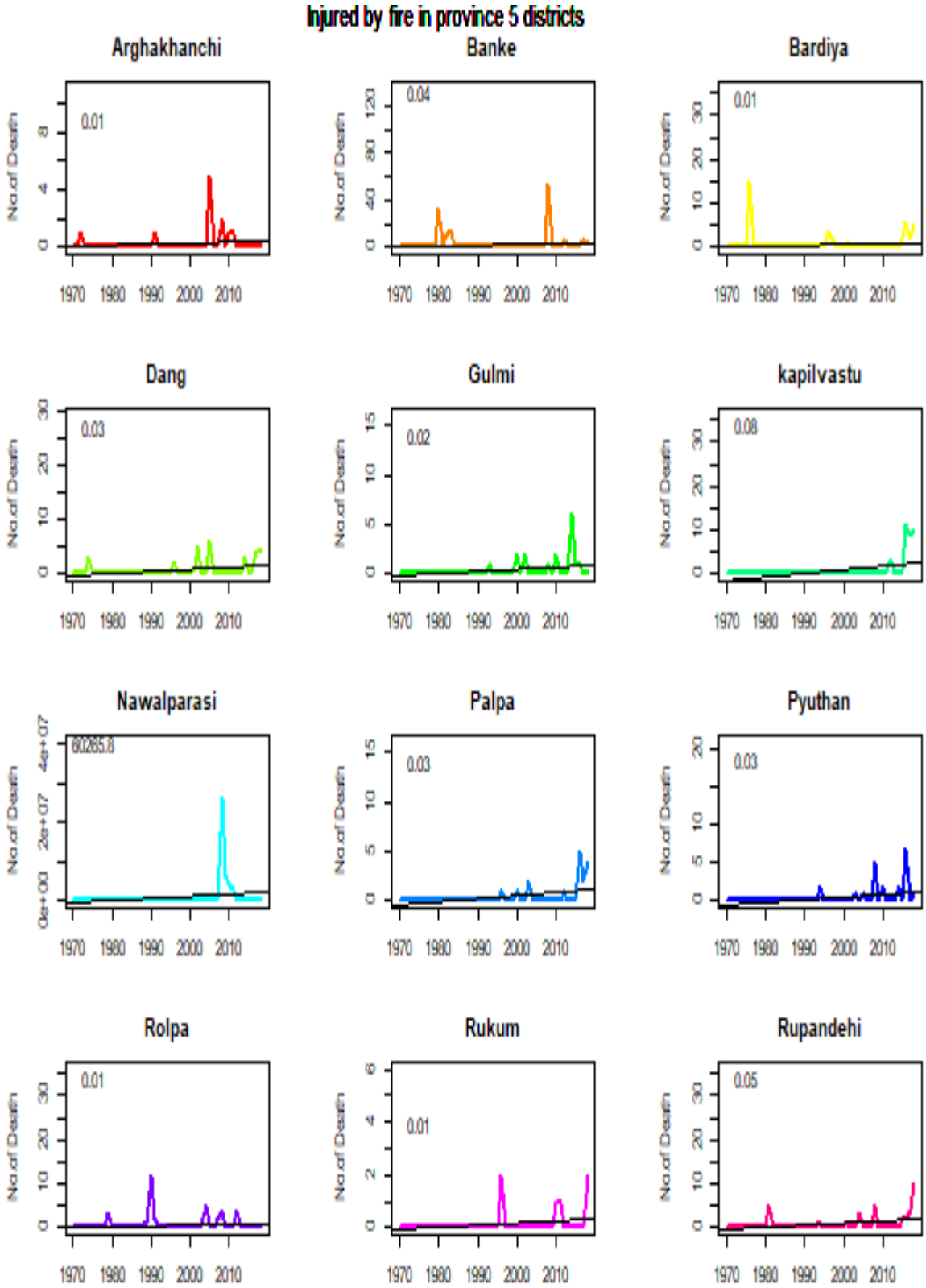

Estimated loss caused by flood in province 5 districts
Arghakhanchi
Banke
879591.84
Bardiya
7705249.9
Dang
044570.24
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Deaths
1970
1980
1990
2000
2010

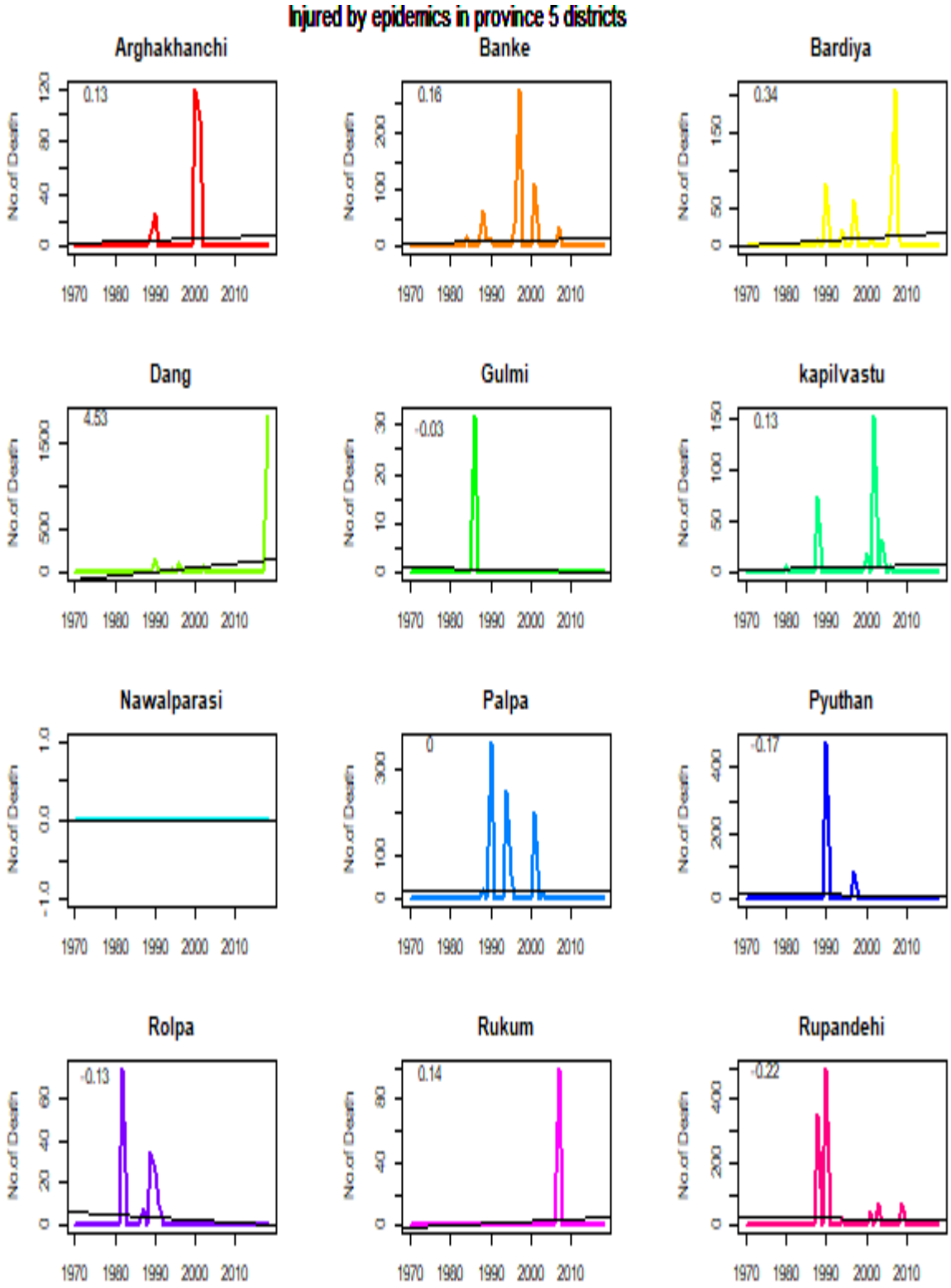

Estimated loss caused by fire in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Deaths
1970
1980
1990
2000
2010

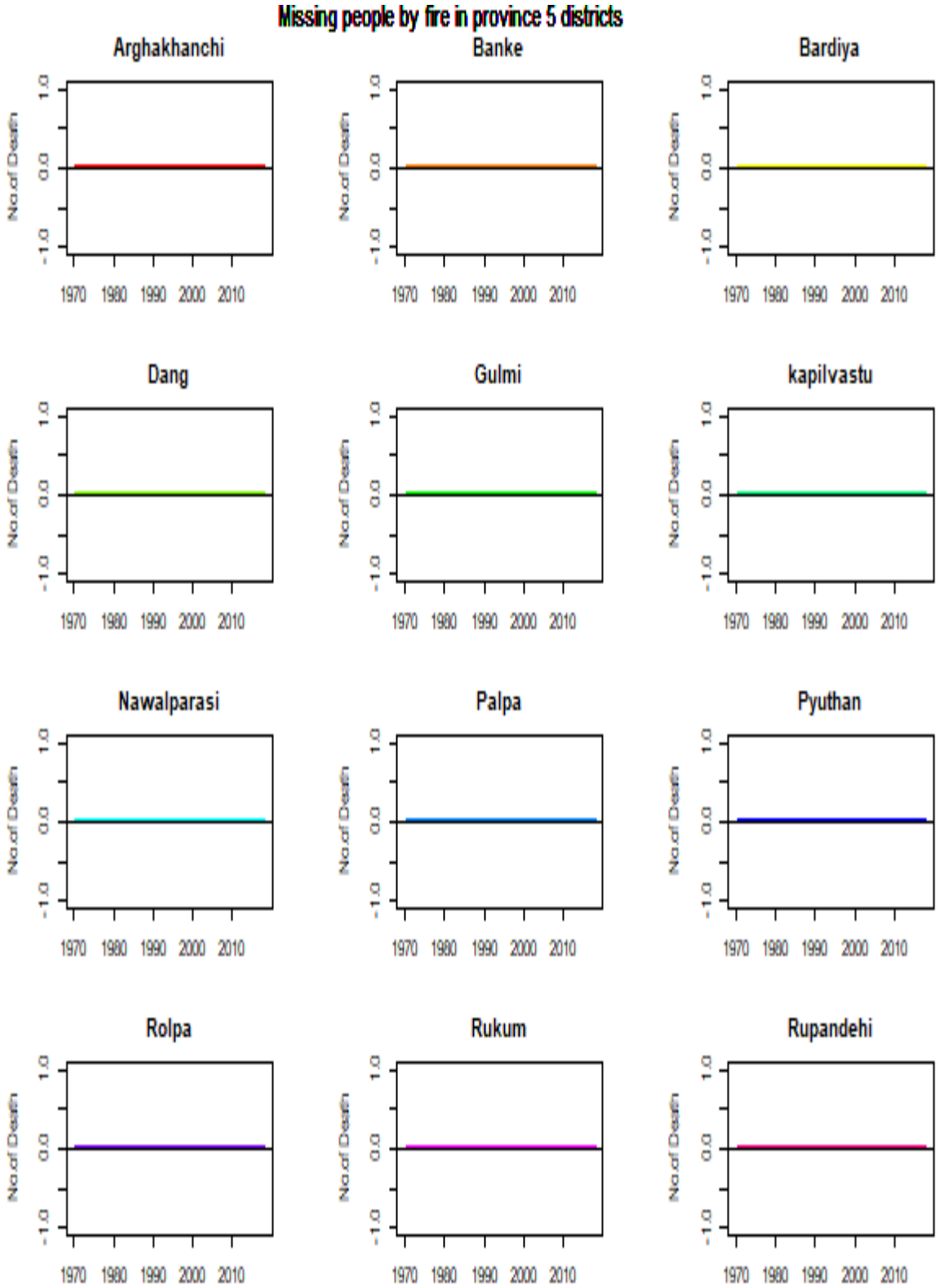

Estimated loss caused by epidemics in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1970
1980
1990
2000
2010
0.04

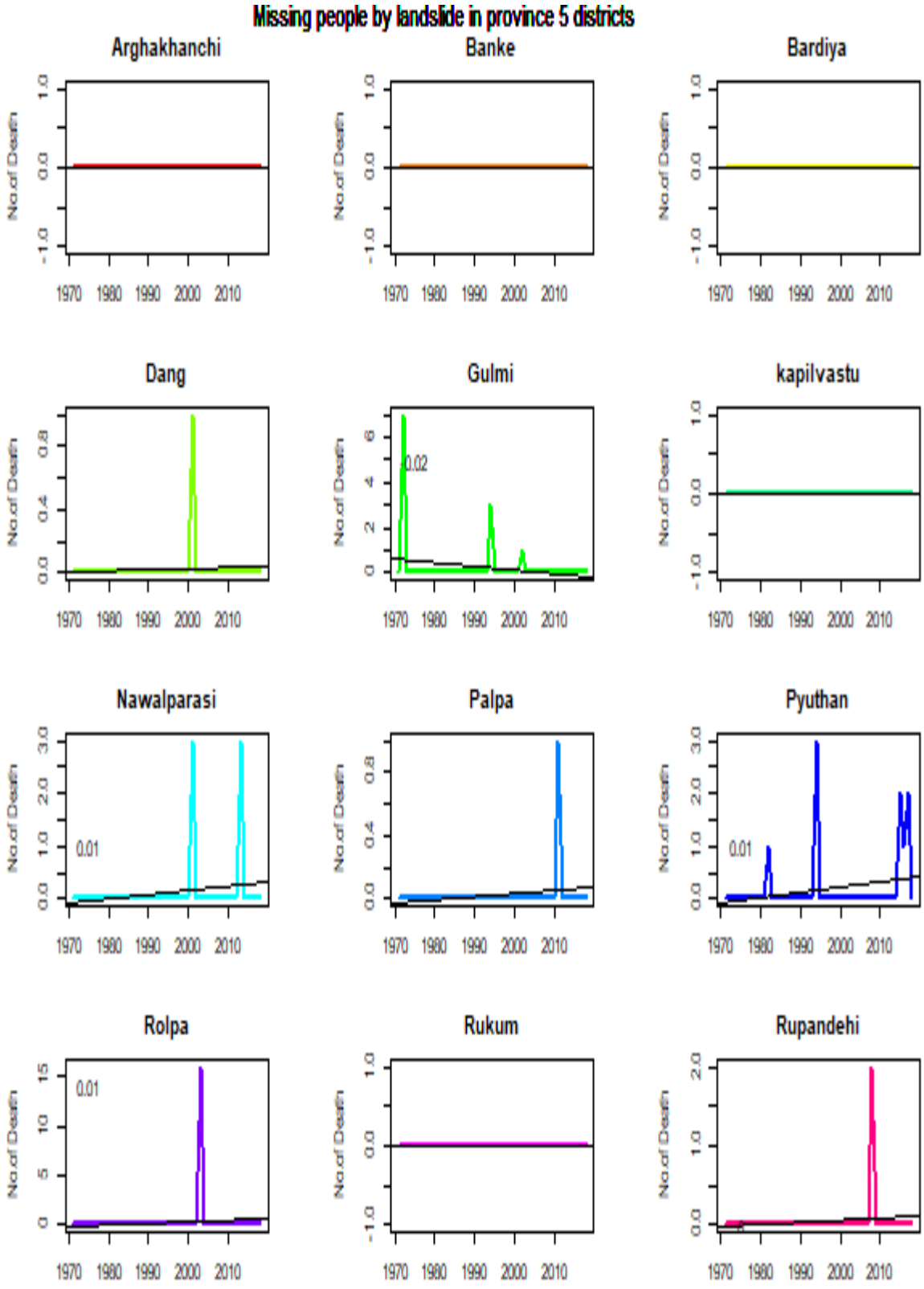

Injured by landslide in province 5 districts
Arghakhanchi
-0.02
Banke
0.01
Bardiya
Dang
0.01
Gulmi
0.05
kapilvastu
Nawalparasi
Palpa
0
Pyuthan
0.06
Rolpa
0.03
Rukum
0.02
Rupandehi
0
No.of Death
1970
1980
1990
2000
2010

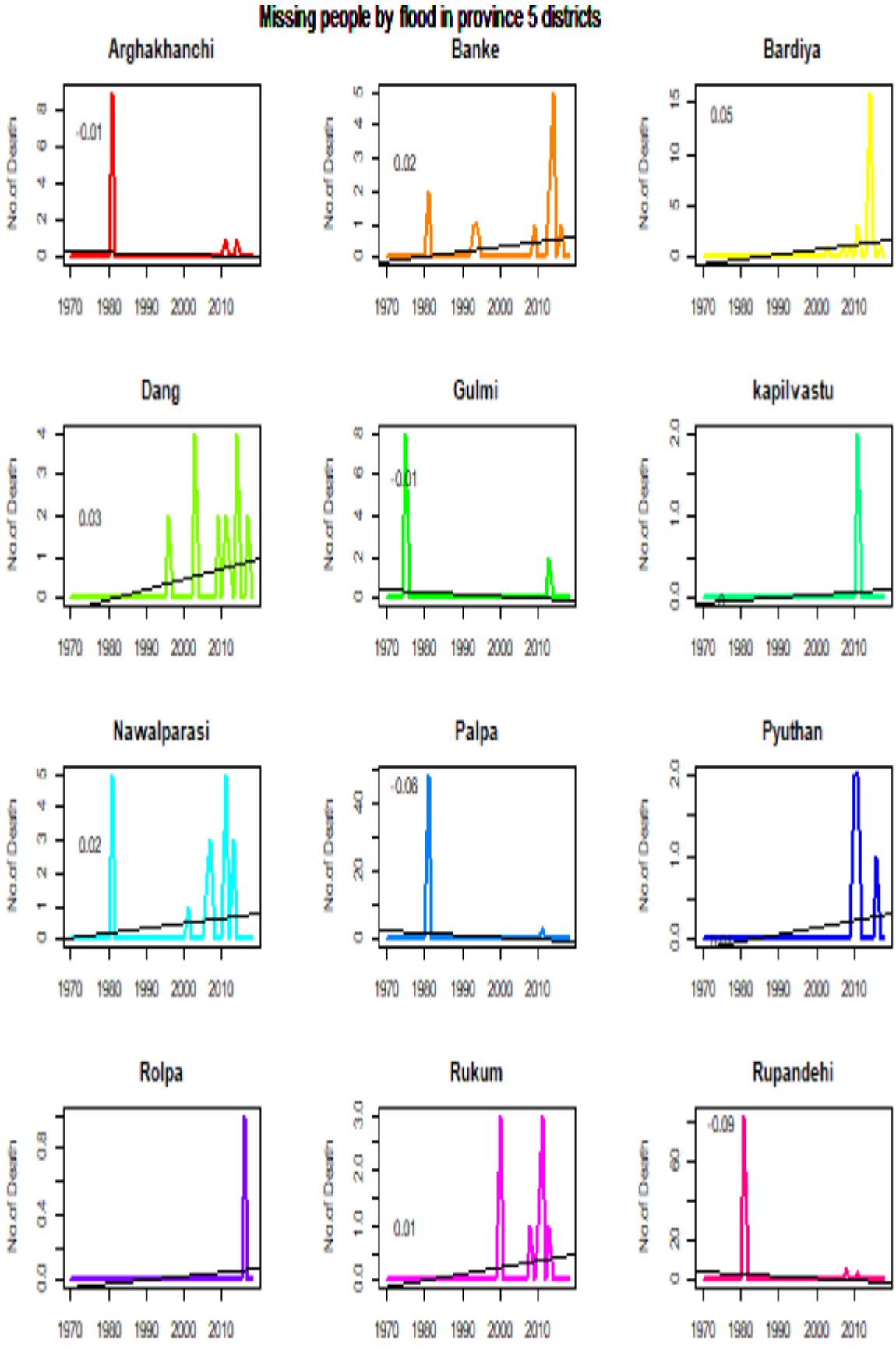

Injured by flood in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1970
1980
1990
2000
2010

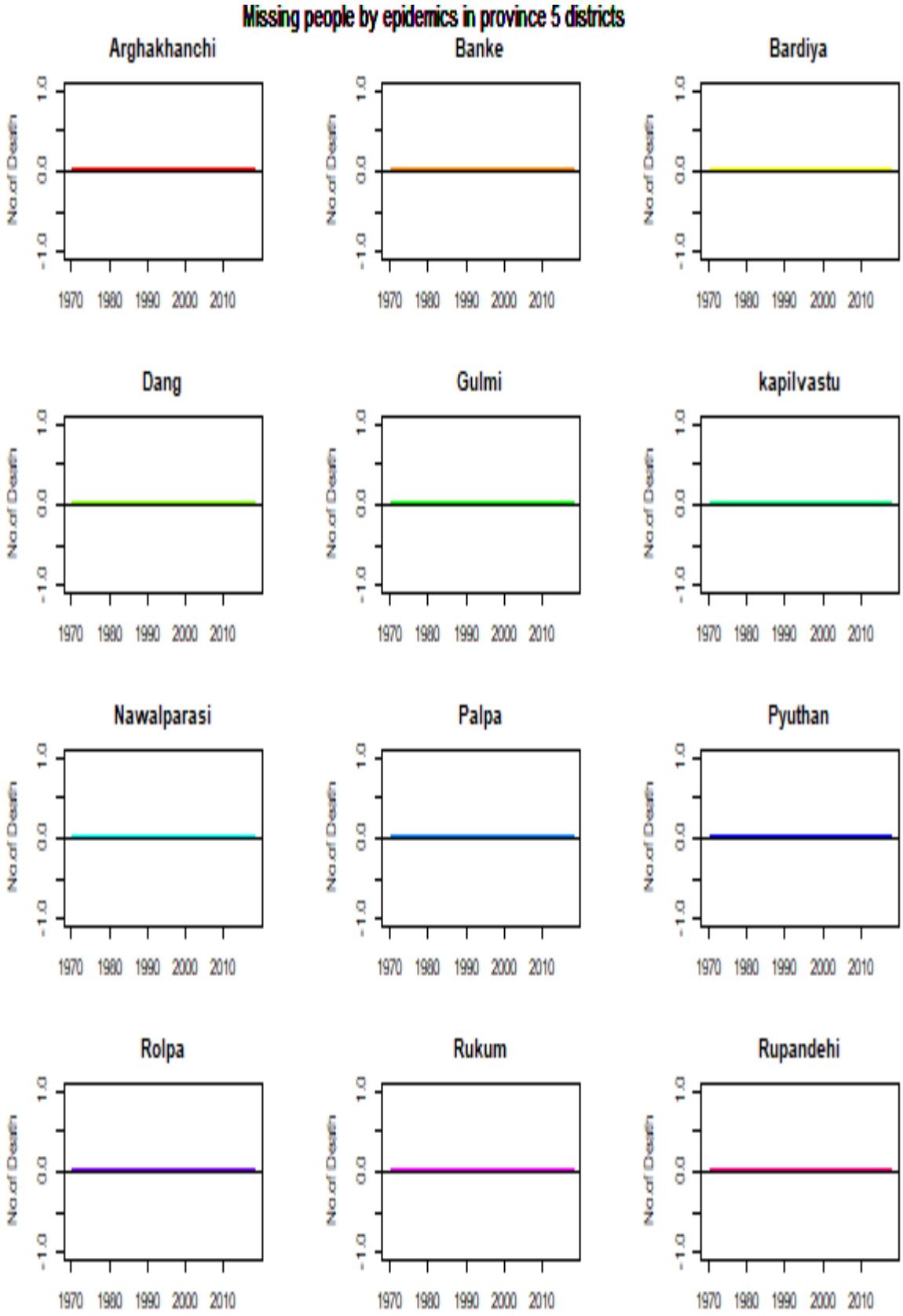

Injured by fire in province 5 districts
Arghakhanchi
0.01
Banke
0.04
Bardiya
0.01
Dang
0.03
Gulmi
0.02
kapilvastu
0.08
Nawalparasi
60285.8
Palpa
0.03
Pyuthan
0.03
Rolpa
0.01
Rukum
0.01
Rupandehi
0.05
No.of Death
1970
1980
1990
2000
2010


Injured by epidemics in province 5 districts
Arghakhanchi
0.13
Banke
0.16
Bardiya
0.34
Dang
4.53
Gulmi
0.03
kapilvastu
0.13
Nawalparasi
Palpa
0
Pyuthan
0.17
Rolpa
0.13
Rukum
0.14
Rupandehi
0.22
No.of Death
1970
1980
1990
2000
2010


Missing people by fire in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1.0
0.0
-1.0
1970
1980
1990
2000
2010


Missing people by landslide in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1970
1980
1990
2000
2010
0.02
0.01
0.01


Missing people by flood in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1970
1980
1990
2000
2010


Missing people by epidemics in province 5 districts
Arghakhanchi
Banke
Bardiya
Dang
Gulmi
kapilvastu
Nawalparasi
Palpa
Pyuthan
Rolpa
Rukum
Rupandehi
No.of Death
1.0
0.0
-1.0
1970
1980
1990
2000
2010

Annex V: CC Scenario and Trend

Table 28: Change in Precipitation (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	1.9	8.73	7.03	11.65	-3.05
2	Banke	1.66	8.64	6.42	12.69	3.75
3	Bardiya	1.15	9.33	7.33	14.53	7.86
4	Dang	1.1	7.62	6.7	12.36	-2.27
5	Gulmi	2.85	9.36	7.74	12.05	5.12
6	Kapilvastu	0.05	7.55	6.19	10.03	-2.18
7	Nawalparasi	0.54	7.44	5.43	8.47	3.72
8	Palpa	1.58	8.34	6.34	9.8	0.81
9	Pyuthan	2.62	9.3	8.37	13.78	-3.69
10	Rolpa	2.1	8.91	8.3	14.53	-5.19
11	Rukum	1.69	9.15	8.55	15.38	-3.80
12	Rupandehi	0.23	7.48	5.56	8.85	-3.28

Table 29: Change in Temperature (0C) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend	
SN	District Name	RCP4.5		RCP8.5		Annual	
		2016-2045	2036-2065	2016-2045	2036-2065	Max temp	Min temp
1	Arghakhanchi	1.02	1.37	1.87	1.14	*** 0.034	** 0.013
2	Banke	1.09	1.47	1.9	1.21	** 0.025	* 0.009
3	Bardiya	1.07	1.51	1.91	1.2	*** 0.032	*** 0.012
4	Dang	1.03	1.37	1.81	1.16	*** 0.032	* 0.008
5	Gulmi	0.97	1.35	1.85	1.09	*** 0.043	0.007
6	Kapilvastu	0.96	1.26	1.75	1.11	** 0.022	** 0.016
7	Nawalparasi	0.9	1.2	1.68	1.07	0.018	** 0.015
8	Palpa	0.96	1.3	1.81	1.1	*** 0.039	00.004
9	Pyuthan	1.01	1.39	1.84	1.13	*** 0.038	* 0.009
10	Rolpa	0.98	1.38	1.76	1.11	*** 0.048	0.025
11	Rukum	0.93	1.34	1.7	1.07	*** 0.060	0.008
12	Rupandehi	0.92	1.23	1.72	1.1	** 0.022	** 0.017

Table 30: Change in Very Wet Days (P95) (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	0.94	13.7	17.43	22.57	-0.1
2	Banke	-2.07	10.6	10.44	14.59	0.1
3	Bardiya	1.28	13.6	16.88	22.21	*0.2
4	Dang	3.07	15.1	15.34	21.24	0
5	Gulmi	-1.73	9.64	9.91	13.72	0
6	Kapilvastu	3.74	16.6	13.7	19.78	-0.1
7	Nawalparasi	-1.88	10.1	11.64	15.98	0.1
8	Palpa	1.9	14.1	13.21	19.14	0
9	Pyuthan	0.81	13.9	10.29	14.75	-0.1
10	Rolpa	-0.84	12.3	7.42	11.58	*-0.2
11	Rukum	-0.89	11.7	8.9	14.53	***-0.4
12	Rupandehi	-1.08	12.6	8.19	12.31	-0.1

Table 31: Change in Extreme Wet Days (P99) (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	26.06	49.47	41.39	68.46	0.0
2	Banke	25.82	55.04	31.28	64.23	0.0
3	Bardiya	20.11	45.52	27.68	57.05	0.0
4	Dang	22.08	50.28	34.92	65.51	0.0
5	Gulmi	27.96	49.58	37.8	69.09	0.0
6	Kapilvastu	19.72	41.28	40.58	56.92	0.0
7	Nawalparasi	21.36	38.1	30.22	50.37	0.0
8	Palpa	26.49	46.31	35.3	59.65	0.0
9	Pyuthan	26.43	49.05	39.49	70.28	** -0.1
10	Rolpa	24.04	48.11	34.31	65.8	** -0.1
11	Rukum	21.65	44.82	33.71	63.3	*** -0.1
12	Rupandehi	18.94	33.88	30.78	47.67	0.0

Table 32: Change in No. of Rainy Days (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	-2	-1.25	-0.75	0.22	* 0.3
2	Banke	-2.05	-0.97	-0.22	0.75	0.1
3	Bardiya	-1.7	-1.05	-0.76	0.07	0.1
4	Dang	-2.04	-1.12	-0.45	-0.25	-0.1
5	Gulmi	-2.01	-1.1	-0.4	0.15	0.3
6	Kapilvastu	-1.9	-1.07	-0.34	-0.17	0.2
7	Nawalparasi	-2.07	-1.23	-0.33	-0.29	0.2
8	Palpa	-2.45	-1.48	0.12	-0.13	0.2
9	Pyuthan	-2.01	-1.16	-0.14	-0.21	0.2
10	Rolpa	-2.25	-1.13	-0.42	-0.58	0.4
11	Rukum	-2.91	-1.36	-0.45	-0.5	** 0.5
12	Rupandehi	-1.97	-0.84	-1.23	-1.19	0 0.3

Table 33: Change in Consecutive Dry Days (CDD) (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	7.69	1.71	-3.7	-4.55	-0.2
2	Banke	5.94	3.93	-1.1	-0.54	-0.1
3	Bardiya	8.75	3.8	-1.69	-3.45	-0.2
4	Dang	11.16	6.01	0.36	-1.93	0.1
5	Gulmi	7.46	3.7	-0.53	-0.05	-0.2
6	Kapilvastu	10.24	6.68	1.5	-2.14	0
7	Nawalparasi	11.3	6.1	-0.43	-0.49	-0.1
8	Palpa	11.35	6.89	1.09	1.68	-0.2
9	Pyuthan	10.33	5.84	-1.82	-1.54	-0.2
10	Rolpa	9.43	4.72	-2.23	0.26	-0.4
11	Rukum	12.66	8.27	0.34	3.69	-0.4
12	Rupandehi	8.47	3.69	-0.9	1.16	-0.2

Table 34: Change in Consecutive Wet Days (CWD) (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	0.27	2.13	2.12	6.05	* 0.3
2	Banke	-4.41	-0.28	17.51	16.16	-0.1
3	Bardiya	-1.29	-0.19	4.98	8.36	00.1
4	Dang	-2.52	-0.41	8	7.44	-0.1
5	Gulmi	-3.27	-0.26	12.65	12.35	** 0.5
6	Kapilvastu	-2.04	0.19	6.68	5.93	0.3
7	Nawalparasi	-2.36	-0.51	11.92	10.77	0.2
8	Palpa	-5.5	-1.05	10.01	6.51	0.0
9	Pyuthan	-2.79	0.58	8.07	6.04	* 0.4
10	Rolpa	-10.61	-5.24	5.84	4.1	0.3
11	Rukum	-13.03	-5.94	6.94	6.55	** 0.7
12	Rupandehi	-13.48	-7.6	5.43	5.83	0.2

Table 35: Change in Warm Days (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	6.77	8.87	6.39	10.89	**0.7
2	Banke	5.37	7.65	5.82	9.42	0.3
3	Bardiya	5.54	8.06	5.69	9.14	0.2
4	Dang	5.85	7.99	6.19	9.96	0.4
5	Gulmi	7.13	9.5	6.21	11.14	***1
6	Kapilvastu	6.78	8.45	7.01	11.56	0.4
7	Nawalparasi	7.31	9.21	6.9	11.84	**0.7
8	Palpa	7.29	9.77	6.08	11.15	***1
9	Pyuthan	6.76	9.35	6.06	10.48	**0.7
10	Rolpa	6.68	9.56	5.78	9.88	***0.8
11	Rukum	6.47	8.86	5.42	9.18	***1.3
12	Rupandehi	6.29	7.82	6.67	10.9	*0.5

Table 36: Change in Warm Nights (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	6.96	10.03	8.52	12.04	***0.8
2	Banke	7.93	11.45	11.3	15.6	0.2
3	Bardiya	8.01	11.24	9.9	14.1	*0.5
4	Dang	9.74	13.19	11.03	16	*0.5
5	Gulmi	9.76	13.46	12.19	17.62	**0.6
6	Kapilvastu	9.56	13.16	10.33	15.47	**0.6
7	Nawalparasi	10.35	13.99	12.35	18.02	0.4
8	Palpa	10.87	14.73	12.24	17.81	0
9	Pyuthan	10.44	14.61	11.18	16.85	***0.9
10	Rolpa	10.66	14.92	11.51	17.24	**0.6
11	Rukum	11.13	15.2	13.1	18.97	***1.1
12	Rupandehi	10.89	15.23	12.27	18.05	0.4

Table 37: Change in Cold Days (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	-4.21	-5.19	-5.35	-7.08	**-0.4
2	Banke	-4.65	-5.66	-5.08	-6.78	-0.1
3	Bardiya	-4.74	-6.02	-5.48	-7.14	-0.1
4	Dang	-4.42	-5.41	-5.09	-6.83	**-0.4
5	Gulmi	-4.32	-5.4	-5.51	-7.26	***-0.7
6	Kapilvastu	-3.76	-4.45	-4.9	-6.52	-0.1
7	Nawalparasi	-3.66	-4.28	-5.03	-6.58	0
8	Palpa	-4.02	-4.83	-5.26	-6.92	*-0.4
9	Pyuthan	-4.38	-5.62	-5.55	-7.29	***-0.6
10	Rolpa	-4.55	-5.94	-5.69	-7.42	***-0.9
11	Rukum	-4.55	-5.9	-5.29	-6.98	***-0.8
12	Rupandehi	-3.57	-4.14	-4.95	-6.47	0

Table 38: Change in Cold nights (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	-4.64	-5.85	-5.22	-6.99	0.0
2	Banke	-4.67	-5.94	-5.33	-7.15	-0.1
3	Bardiya	-4.67	-5.96	-5.42	-7.16	-0.1
4	Dang	-4.68	-5.88	-5.04	-6.76	0.0
5	Gulmi	-4.72	-5.93	-5.57	-7.29	0.1
6	Kapilvastu	-4.07	-5.25	-4.01	-5.68	-0.3
7	Nawalparasi	-4.61	-5.84	-5.46	-7.13	-0.3
8	Palpa	-4.38	-5.65	-4.58	-6.19	0.0
9	Pyuthan	-3.98	-5.42	-4.06	-5.62	0.1
10	Rolpa	-3.68	-5.37	-4.17	-5.72	** -0.5
11	Rukum	-3.88	-5.34	-4.44	-6.04	0.2
12	Rupandehi	-3.57	-5.29	-4.09	-5.62	* -0.3

Table 39: Change in Warm Spell Duration Index (WSDI) (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	104.03	139.49	147.26	211.94	0.2
2	Banke	75.24	110.89	92.38	149.88	0.2
3	Bardiya	73.86	107.61	92.91	150.01	0.2
4	Dang	85.43	122.38	103.04	160.82	0.2
5	Gulmi	115.28	154.97	165.78	250.38	** 0.3
6	Kapilvastu	92.12	122.19	136.94	190.37	0.1
7	Nawalparasi	116.31	146.88	267.83	340.29	0.2
8	Palpa	117.87	147.61	227.52	303.92	** 0.3
9	Pyuthan	100.21	141.95	121.21	195.59	0.2
10	Rolpa	102.89	148.92	104.66	178.2	* 0.3
11	Rukum	101.93	140.24	113.7	178.73	*** 0.3
12	Rupandehi	105.5	132.94	193.91	257.38	0.2

Table 40: Change in Cold Spell Duration Index (CSDI) (%) for districts of Nepal from the reference period (1981-2010)

Scenarios						Trend
SN	District Name	RCP4.5		RCP8.5		Annual
		2016-2045	2036-2065	2016-2045	2036-2065	
1	Arghakhanchi	-55.81	-65.9	-61.34	-80.08	0.2
2	Banke	-62.71	-69.58	-72.44	-89.71	0.0
3	Bardiya	-56.34	-67.51	-66.17	-84.27	0.1
4	Dang	-56.36	-66.23	-66.75	-84.6	0.2
5	Gulmi	-63.29	-69.15	-76.82	-91.33	0.2
6	Kapilvastu	-49.32	-62.21	-53.66	-73.24	0.0
7	Nawalparasi	-59.18	-67.45	-75.19	-90.2	0.0
8	Palpa	-52.57	-63.46	-63.93	-81.69	0.2
9	Pyuthan	-47.46	-62.57	-54.77	-73.49	0.1
10	Rolpa	-47.16	-63.7	-61.89	-80.44	-0.2
11	Rukum	-49.95	-63.44	-63.38	-82.23	0.2
12	Rupandehi	-47.1	-63.82	-61.43	-80.19	0.0

Annex VI: Climate Change Trend

Figure 3: Precipitation trend

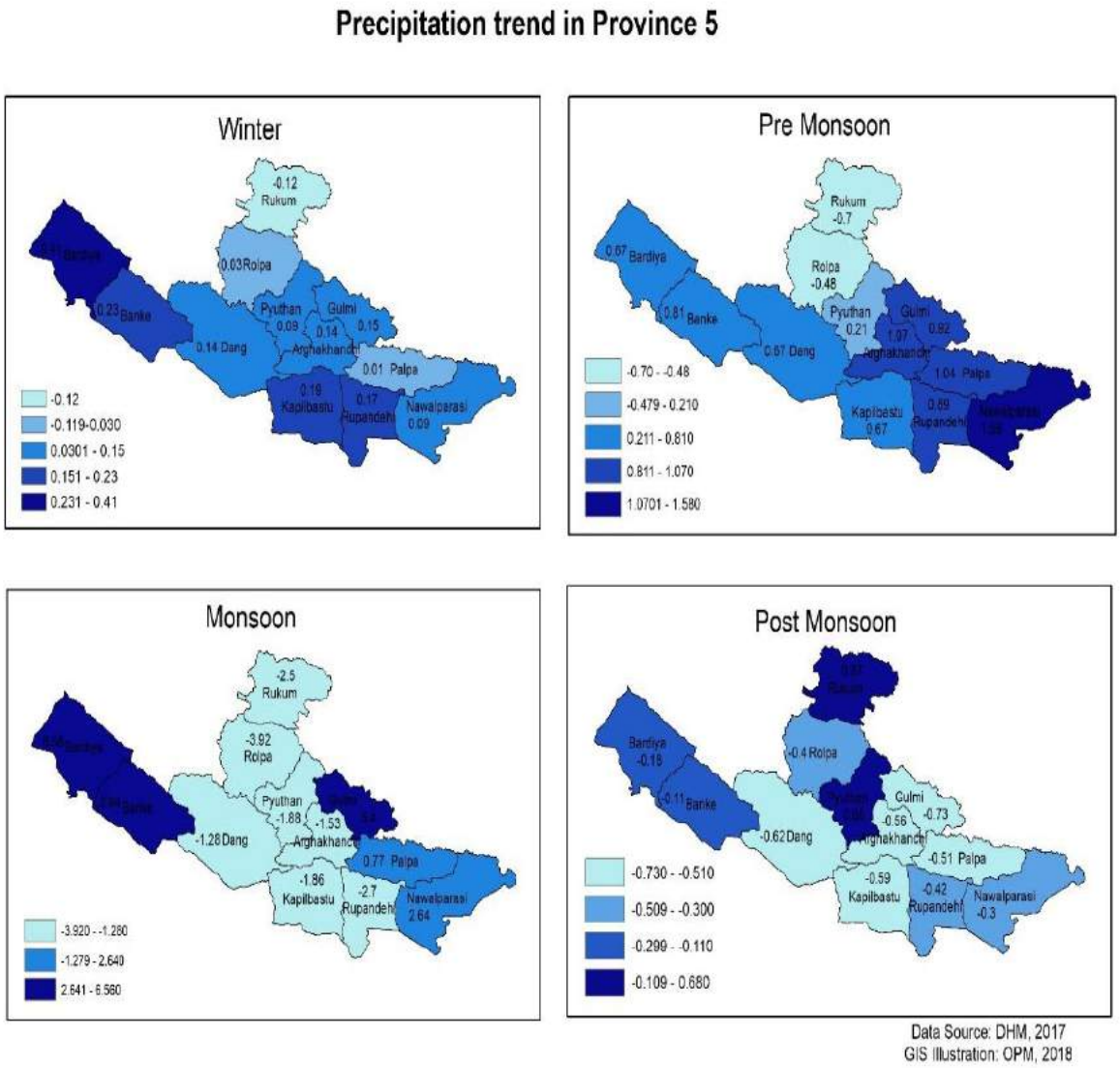


Figure 4: Minimum temperature trend

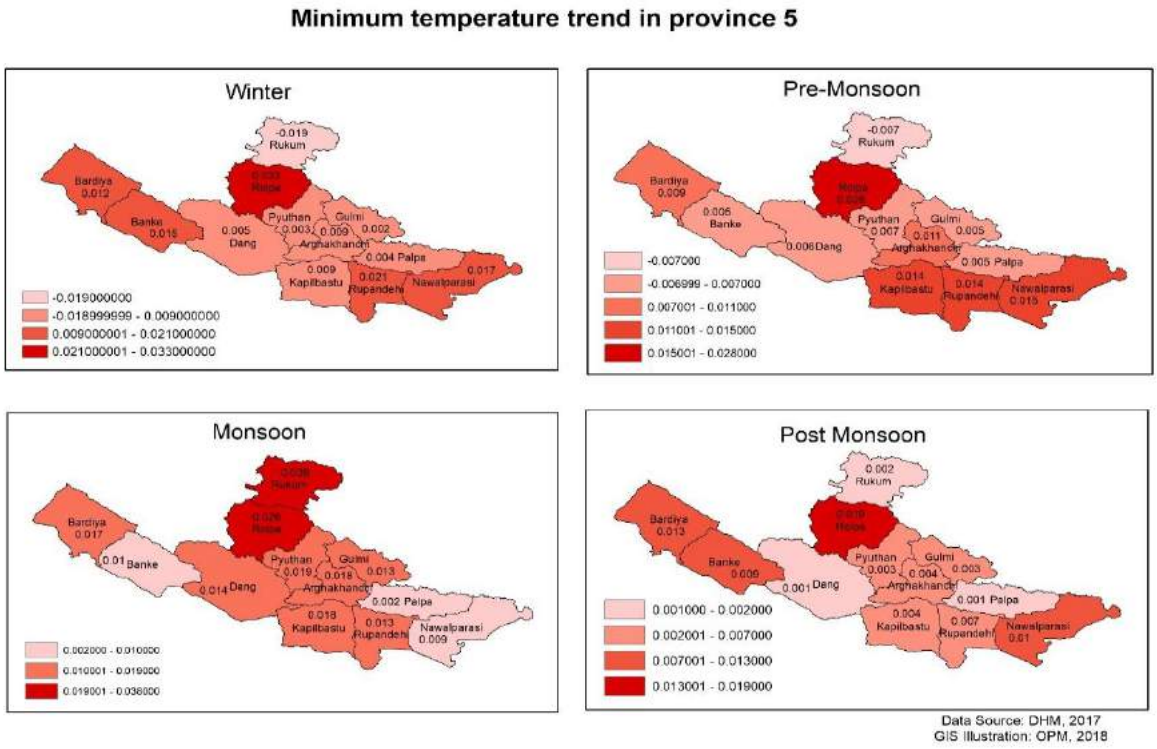
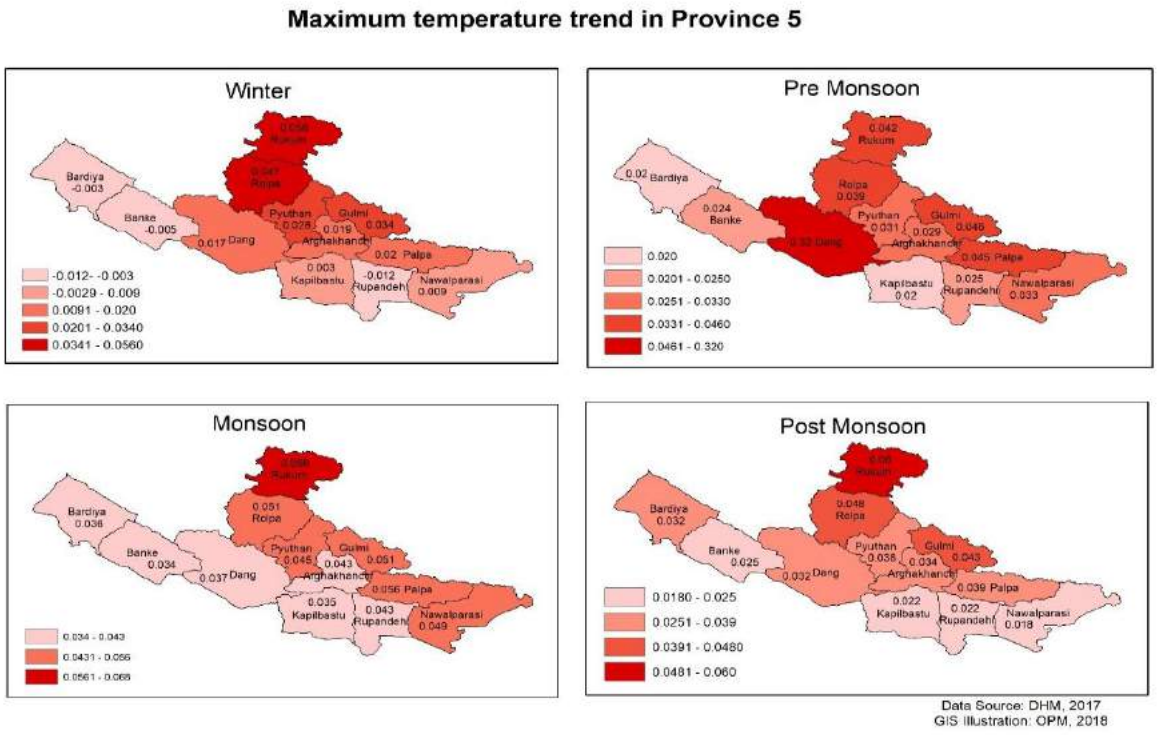


Figure 5: Maximum temperature trend



Scenarios of climate change under different RCP values

Figure 6: Scenarios of change in very warm days

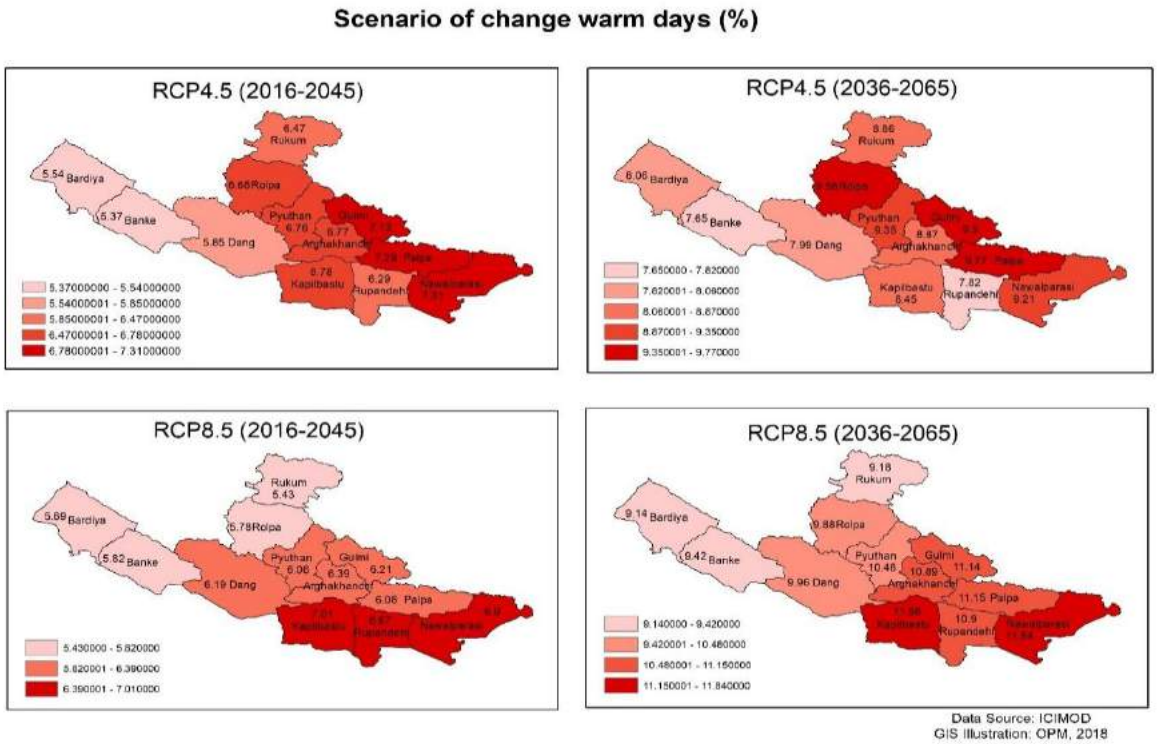


Figure 7: Scenarios for change in very wet days

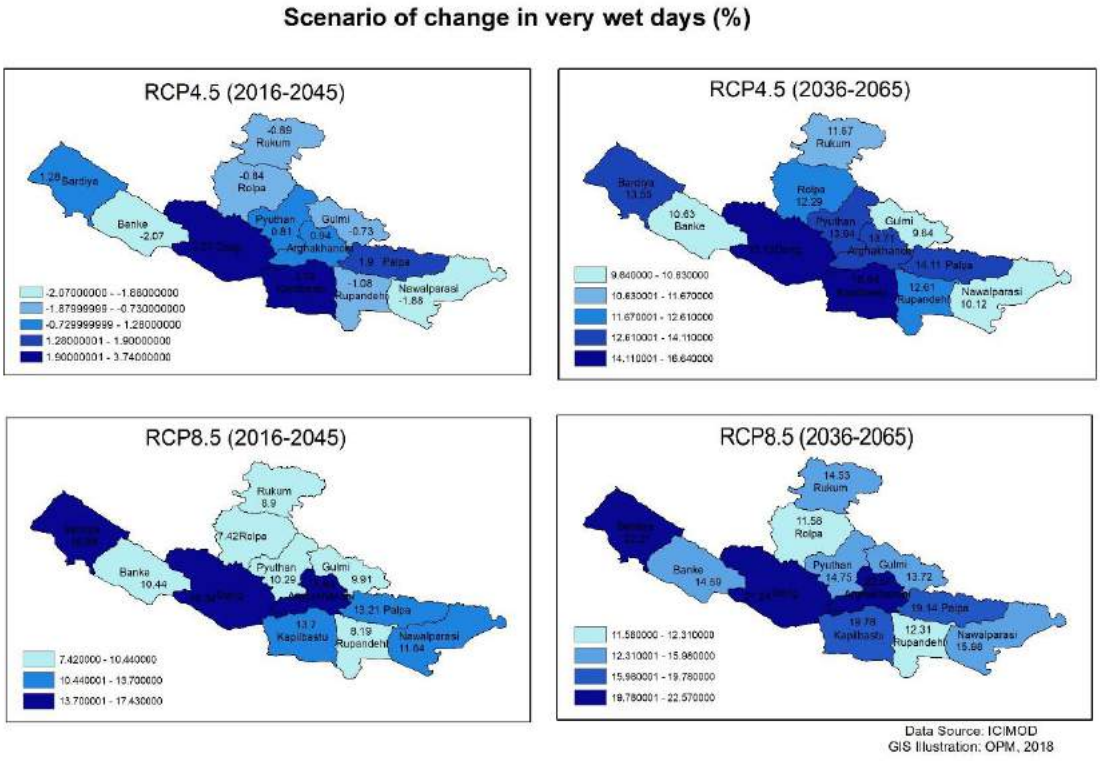


Figure 8: Scenario of change in temperature

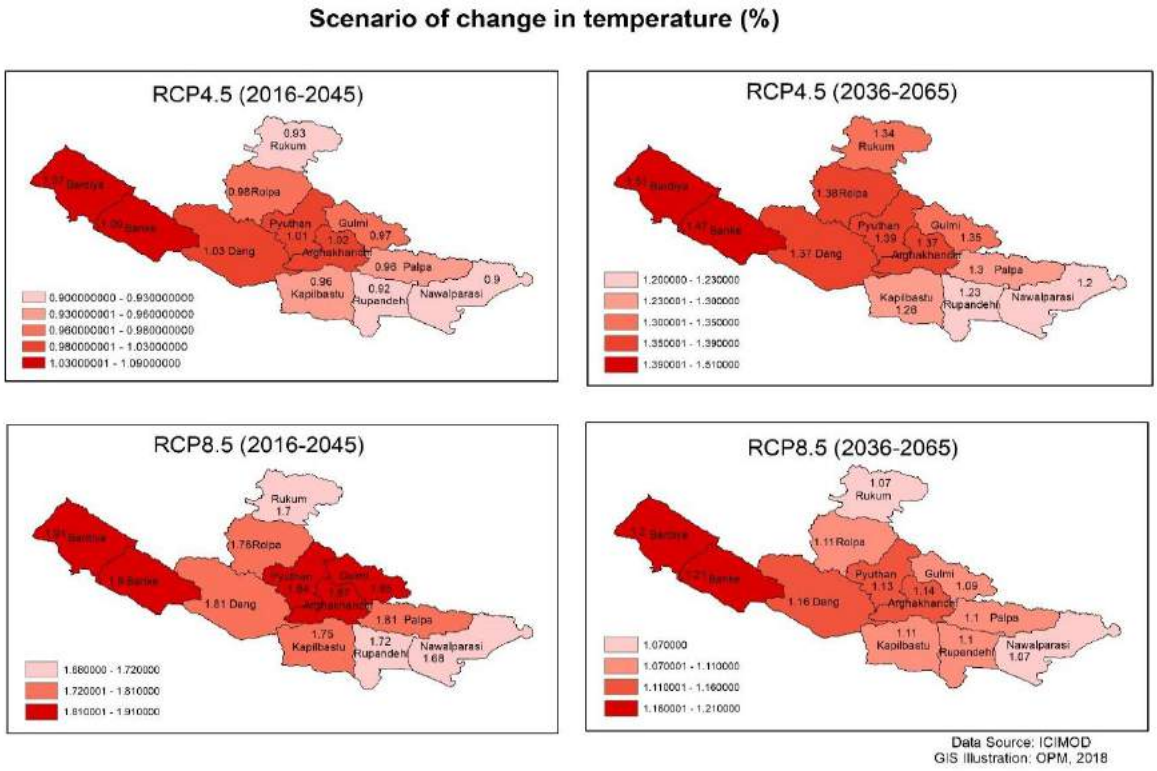


Figure 9: Scenario of change in precipitation

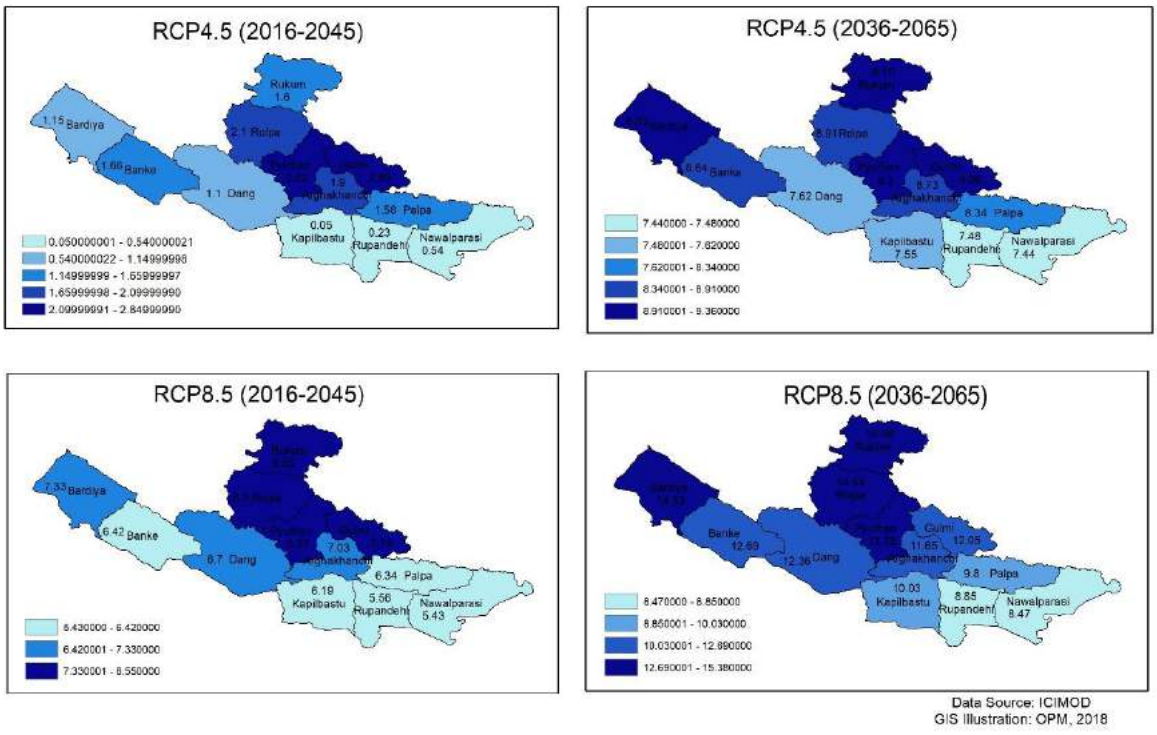


Figure 10: Scenario of change in number of rainy days

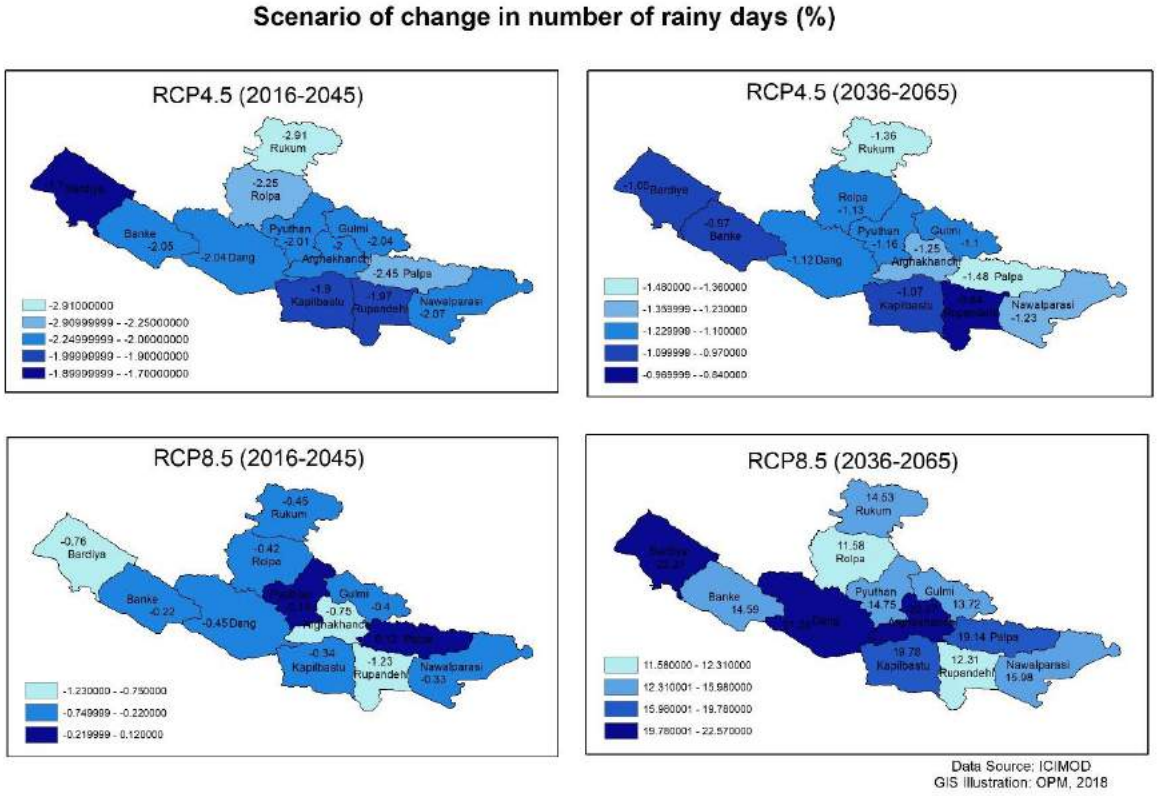


Figure 11: Scenario of change in extreme wet days

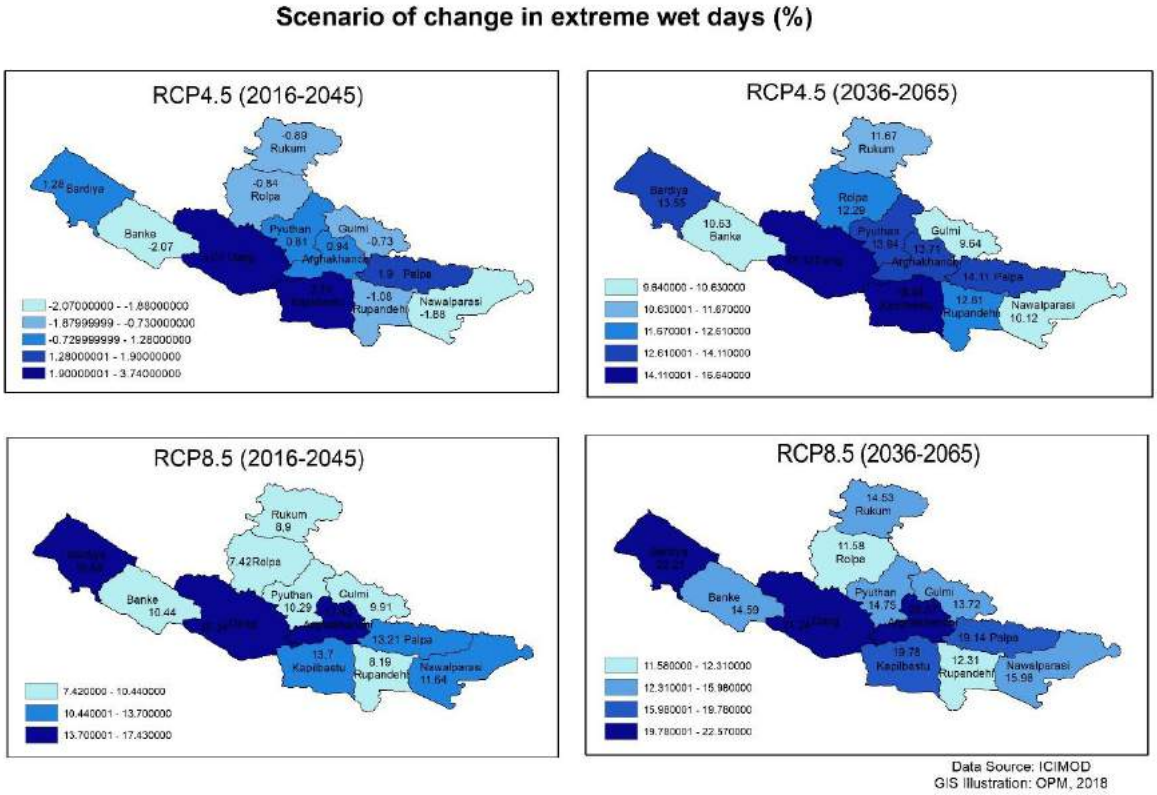


Figure 12: Scenario of change in wet days

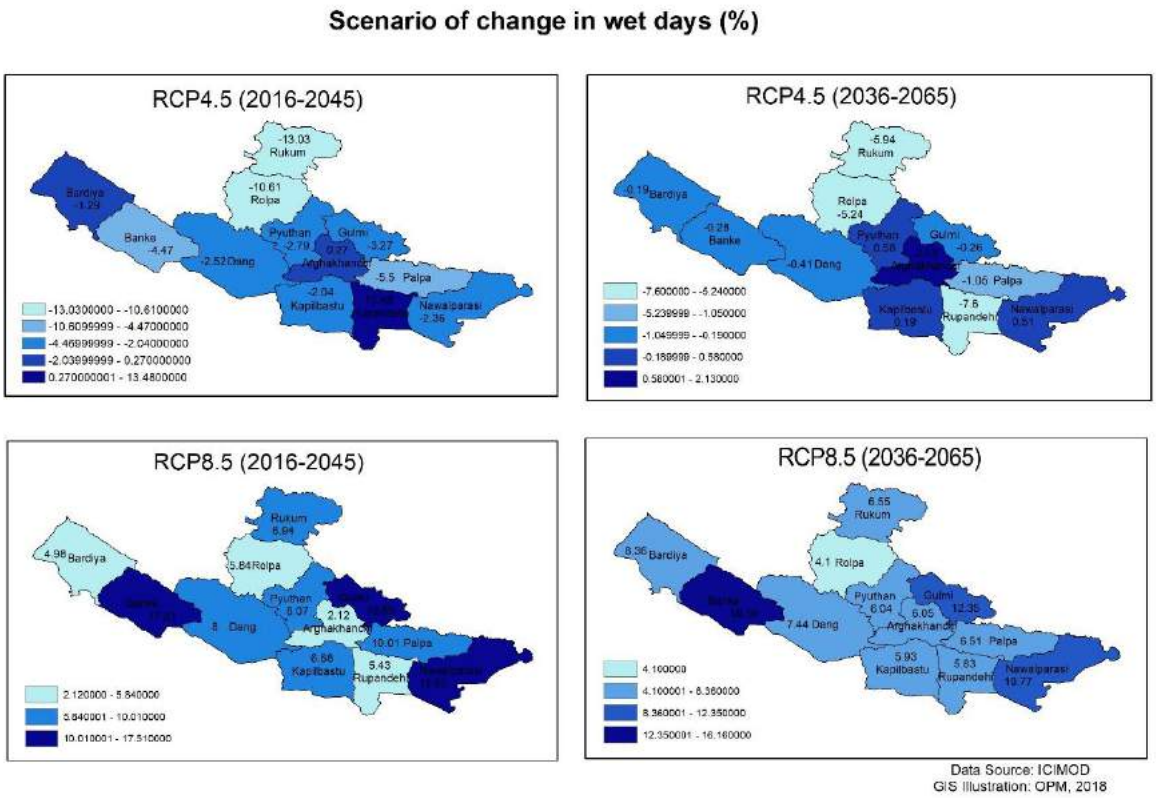


Figure 13: Scenario of change in consecutive dry days

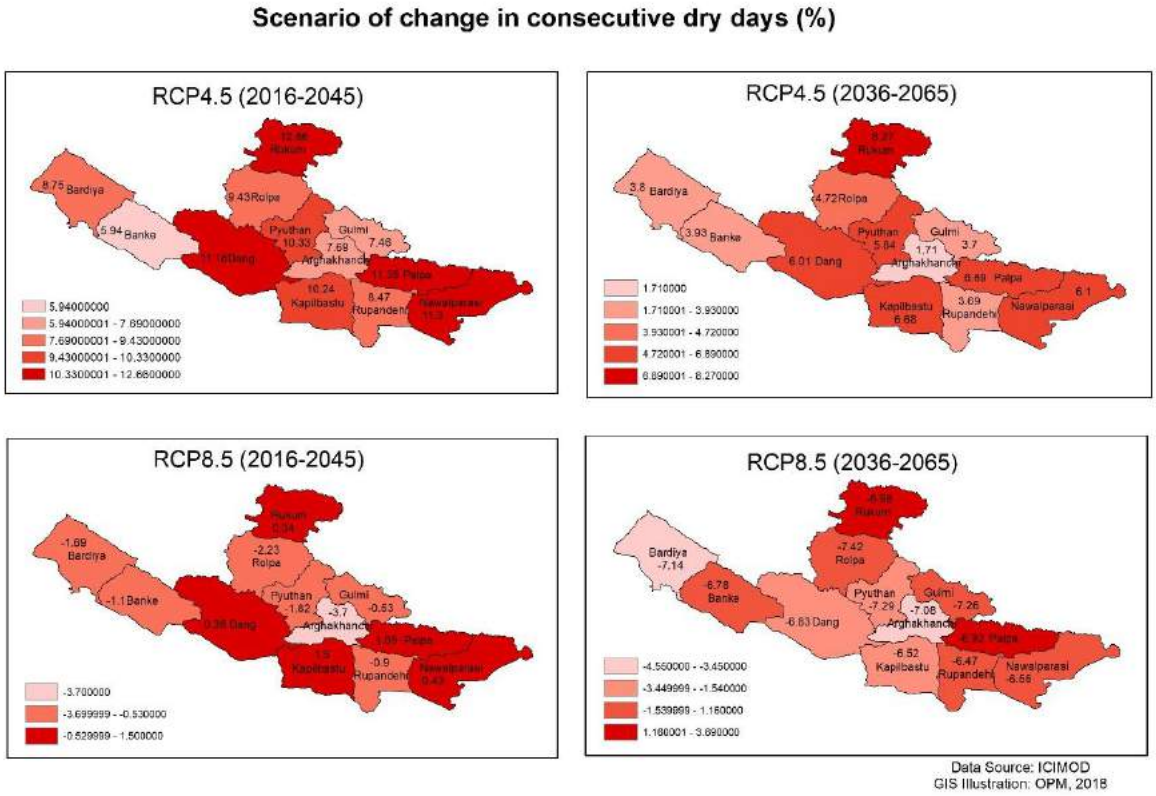


Figure 14: Scenario of change in cold nights

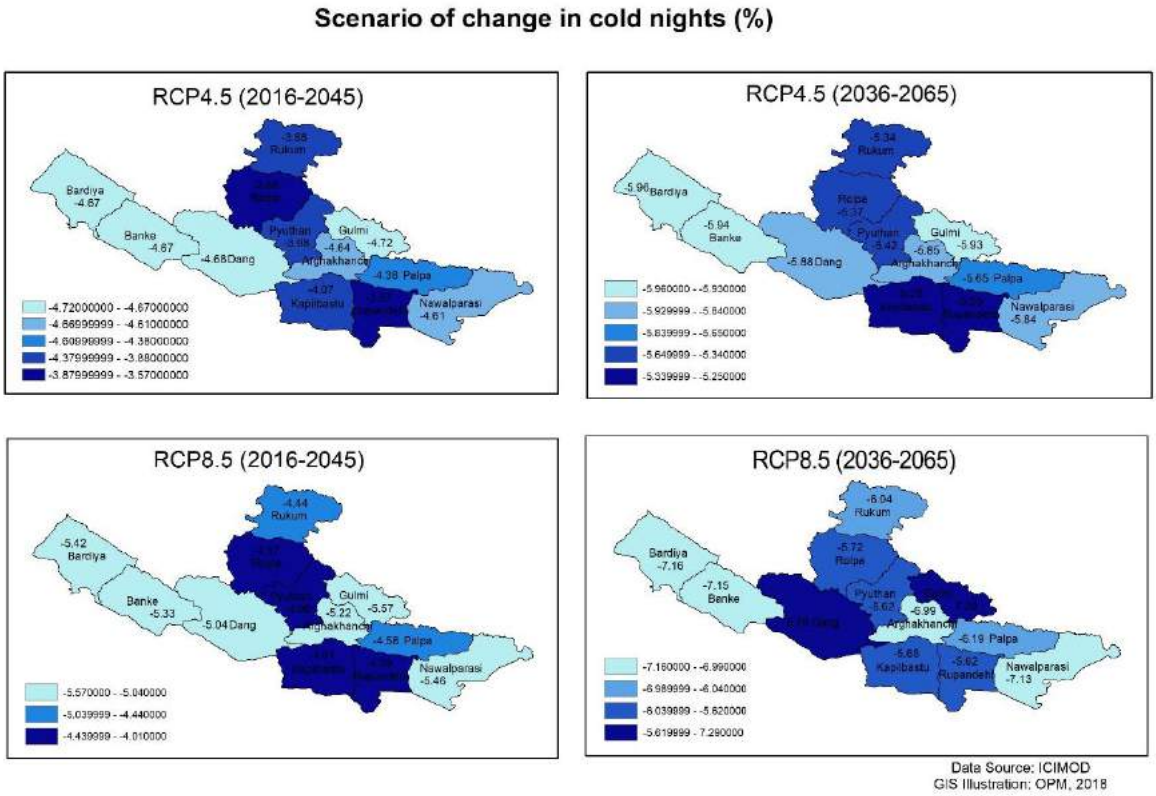


Figure 15: Scenario of change in cold days

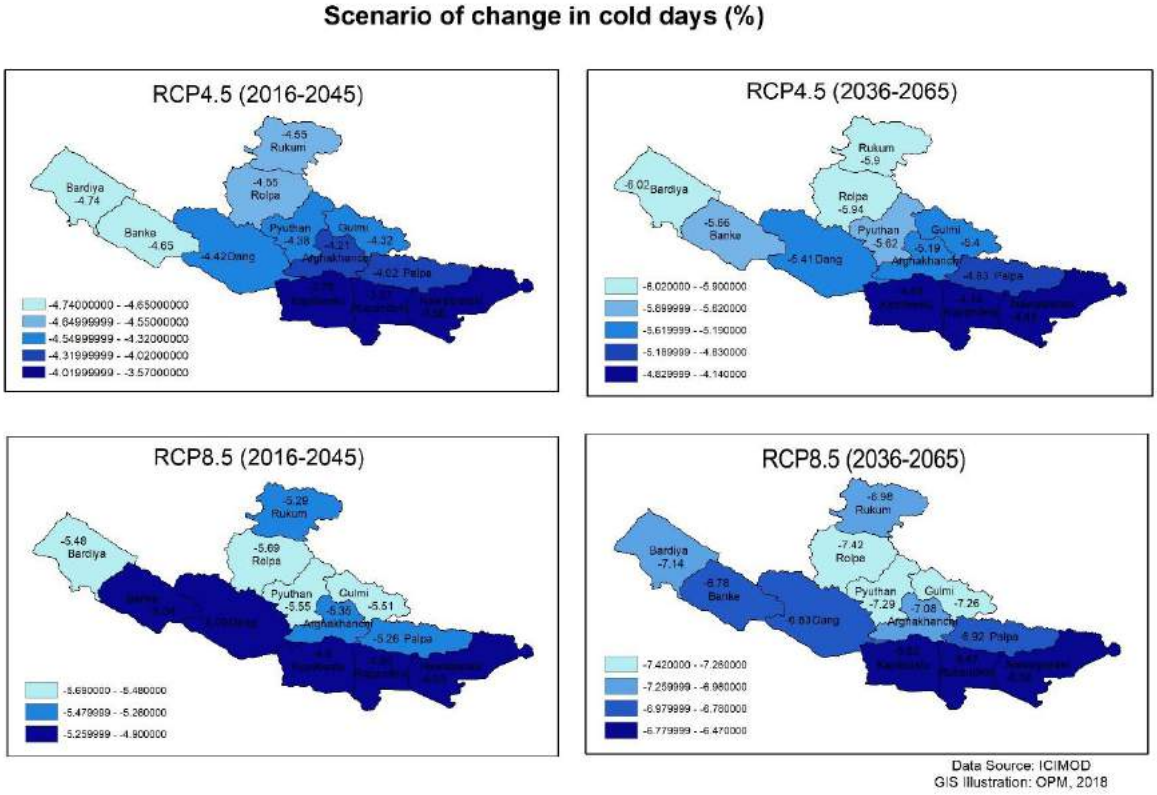
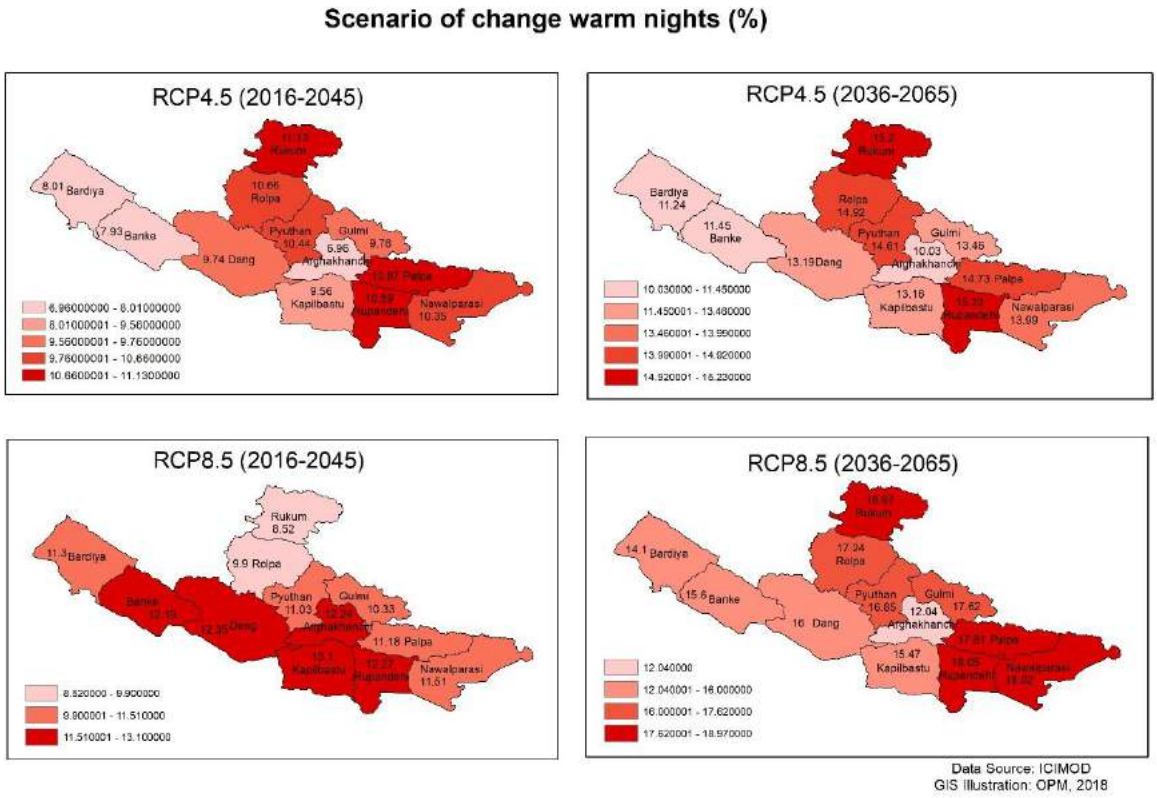


Figure 16: Scenario of change in warm nights



Annex VII: Top Three Hazards by District and Palikas

Table 41: Top 5 hazard ranking of Province 5

SN	Districts	Top 5 hazards based on the questionnaire
1	Rolpa	1. Landslide 2. Flood 3. Fire 4. Drought 5. Crop and livestock diseases
2	Glulmi	1. Landslide 2. Flood 3. Fire 4. Drought 5. Crop and livestock diseases
3	Nawalparasi	1. Flood 2. Cold waves 3. Crop and livestock disease 4. Fire 5. Windstorm
4	Banke	1. Flood 2. Cold waves 3. Crop and livestock disease and outbreaks 4. Fire 5. Windstorm
5	Pyuthan	1. Landslide 2. Flood 3. Fire 4. Drought 5. Crop and livestock diseases
6	Bardiya	1. Flood 2. Fire 3. Crop and livestock disease and outbreaks 4. Cold waves 5. Hailstone
7	Dang	1. Flood 2. Fire 3. Drought 4. Crop and livestock diseases 5. Landslide
8	Rukum	1. Landslide 2. Flood 3. Drought 4. Crop and livestock disease 5. Fire
9	Arghakhanchi	1. Landslide 2. Fire 3. Drought 4. Crop and livestock disease 5. Flood
10	Kapilvastu	1. Fire 2. Flood 3. Cold waves 4. Drought 5. Heatwaves
11	Rupandehi	1. Flood 2. Cold waves 3. Drought 4. Fire 5. Crop and livestock diseases
12	Palpa	1. Landslide 2. Flood 3. Drought 4. Fire 5. Crop and livestock diseases

Note: based on the response of the Palika's representatives

Table 42: Overall hazard rank of each Palika of Province 5

District	Municipality	Top hazard of last 10 years
Rolpa	Lungri Gaunpalika	1. Landslide 2. Fire 3. Drought 4. Flood 5. Windstorm 6. Crop and livestock diseases 7. Epidemics 8. Hailstone
	Madi Gaunpalika	1. Landslide 2. Drought 3. Fire 4. Crop and livestock diseases 5. Windstorm 6. Epidemics 7. Hailstone 8. Flood 9. Earthquake 10. Cold waves 11. Heatwaves
	Rolpa Municipality	1. Landslide 2. Hailstone 3. Fire 4. Flood 5. Epidemic 6. Crop and livestock diseases 7. Drought 8. Earthquake 9. Cold waves 10. Heatwaves 11. Avalanche
	Runtigadhi Gaunpalika	1. Fire 2. Landslide 3. Drought 4. Windstorm 5. Hailstone 6. crop and livestock disease
	Sukidaha Gaunpalika	1. Landslide 2. Flood 3. Crop and livestock disease 4. Fire 5. Drought 6. lightening
	Sunchhahari Gaunpalika	1. Landslide 2. Flood 3. Windstorm 4. Lightening 5. Crop and livestock disease 6. Hailstone 7. fire
	Thawang Gaunpalika	1. Landslide 2. Flood 3. Crop and livestock disease 4. Drought 5. lightening
	Tribeni Gaunpalika	1. Flood 2. Drought 3. Fire 4. Landslide 5. Drought 6. Wind storm
	Pariwarthan/Duikholi GauPalika	1. Landslide 2. Flood 3. Fire 4. Hailstone 5. Drought 6. Wind storm 7. Crop and livestock disease 8. Epidemics 9. Avalanche
	Sunilsmriti/Subarnabati GauPalika	1. Landslide 2. Hailstone 3. Fire 4. Epidemics 5. Flood 6. Drought 7. Windstorm 8. Earthquake 9. Cold waves 10. Heatwaves
Gulmi	Chandrakot Gaunpalika	1. Landslide 2. Flood 3. Crop and livestock disease 4. Drought 5. Fire 6. Hailstone 7. Earthquake 8. Cold waves 9. Heatwaves 10. Wind storm 11. Avalanche
	Chhatrakot Gaunpalika	1. Landslide 2. Earthquake 3. Drought 4. Fire 5. Crop and livestock diseases 6. Hailstone 7. Windstorm 8. Flood 9. Epidemics 10. Cold waves 11. Heatwaves 12. Avalanche
	Dhurkot Gaunpalika	1. Landslide 2. Drought 3. Fire 4. Crop and livestock diseases 5. Flood 6. hailstone
	Gulmi Durbar Gaunpaika	1. Landslide 2. Flood 3. Fire 4. Crop and livestock disease 5. Drought 6. Hailstone 7. Wind storm 8. Earthquake 9. Cold waves 10. Heatwaves 11. Epidemics 12. Avalanche
	Isma Gaunpalika	1. Crop and livestock diseases 2. Flood 3. Landslide 4. Fire 5. Windstorm 6. Drought 7. Hailstorm
	Kali Gandaki Gaunpalika	1. Earthquake 2. Landslide 3. Flood 4. Fire 5. Windstorm 6. Hailstone 7. Drought 8. Crop and livestock diseases 9. Epidemics 10. Heatwaves
	Madane Gaunpalika	1. Landslide 2. Fire 3. Flood 4. Crop and livestock diseases 5. Epidemics
	Malika Gaunpalika	1. Flood 2. Landslide 3. Fire 4. Windstorm 5. Crop and livestock disease 6. Drought
	Musikot Municipality	1. Flood 2. Landslide 3. Fire 4. Crop and livestock disease 5. Drought 6. Hailstone 7. Wind storm 8. Earthquake 9. Cold waves 10. Heatwaves 11. Epidemics 12. Avalanche

	Resunga Municipality	1. Landslide 2. Drought 3. Fire 4. Crop and livestock diseases 5. Earthquake 6. Storm 7. Hailstone 8. Cold waves 9. Epidemic 10. Heatwaves 11. Avalanche
	Ruru Gaunpalika	Landslide 2. Flood 3. Drought 4. Fire 5. Earthquake 6. Hailstone 7. Wind storm 8. crop and livestock diseases
	Satyawoti Gaunpalika	1. Earthquake 2. Landslide 3. Flood 4. Fire 5. Windstorm 6. Crop and livestock disease 7. Hailstone 8. Drought 9. Epidemics 10. Cold waves 11. Heatwaves 12. Avalanche
Nawalparasi	Bardaghat Municipality	1. Flood 2. Wind storm 3. Landslide 4. Crop and livestock disease 5. Hailstone 6. Fire.
	Palhinandan Gaunpalika	1. Flood 2. Drought 3. Hail storm 4. Fire 5. Cold waves 6. Crop and livestock disease 7. Wind storm 8. Heatwaves
	Pratapapur Gaunpalika	1. Flood 2. Crop and livestock disease 3. Wind storm 4. Fire 5. cold waves
	Ramgram Municipality	1.Flood 2. Heatwaves 3. Cold waves 4. Fire 5. Drought 6. Windstorm 7. Crop and livestock diseases 8. Hailstone 9. Earthquake 10. Avalanche 11. Landslide
	Sarawal Gaunpalika	1. Flood 2. Cold waves 3. Fire 4. Hailstone 5. Crop and livestock disease 6. Wind storm 7. drought
	Sunawal Municipality	1. Flood 2. Fire 3. Cold waves 4. Windstorm 5. Diseases 6. Avalanches
	Susta Gaunpalika	1. Flood 2. Cold waves 3. Landslide 4. Crop and livestock disease 5. Wind storm 6. fire
Banke	Baijanath Gaunpalika	1. Cold waves 2. Flood 3. Windstorm 4. Hailstone 5. crop and livestock diseases
	Duduwa Gaunpalika	1. Flood 2. Fire 3. Cold waves 4. Windstorm 5. Diseases
	Janaki Gaunpalika	1. Fire 2. Cold waves 3 Windstorm
	Khajura Gaunpalika	1. Flood 2. Cold waves 3. Crop and livestock disease 4. Wind storm 5. fire
	Kohalpur Municipality	1. Flood 2. Fire 3. Cold waves 4. Epidemics 5. crop and livestock diseases
	Narainapur Gaunpalika	1. Flood 2. Fire 3. Cold waves 4. Crop and livestock diseases 5. Heatwaves 6. Windstorm
	Nepalganj Sub-Metropolitian City	1. Flood 2. Drought 3. Cold waves 4. Fire 5. Heatwaves 6. Windstorm 7. Epidemic 8 Diseases 9. Earthquake 10. Hailstone
	Rapti Sonari Gaunpalika	1. Flood 2. Wind storm 3. Cold waves 4. Fire 5. Hailstone 6. Drought
	Janaki Gaunpalika	1.Flood 2. Earthquake 3. Cold waves 4.Windstorm 5.Crop and livestock disease 6.heatwaves 7.Epidemics 8.Drought 9.Avalanche 10.Flood 11.Hailstone
Pyuthan	Aairawati Gaunpalika	1. Landslide 2. Flood 3. Drought 4. Crop and livestock disease 5. Hailstone 6. Wind storm 7. Epidemics 8. Fire 9. Heatwaves 10. Cold waves 11. Earthquake 12. Avalanche
	Gaumukhi Gaunpalika	1. Landslide 2. Flood 3. Drought 4. Hailstone 5. Crop and livestock disease 6. Wind storm 7. Epidemics 8. Fire 9. Earthquake 10. Cold waves 11. Heatwaves 12. Avalanche

	Jhimaruk Gaunpalika	1. Flood 2. Lightening 3. Fire 4. Wind storm 5. Crop and livestock disease 6. Drought 7. landslide
	Mallarani Gaunpalika	1.Fire 2.Wind storm 3.drought 4.landslide 5.Flood 6.Hailstone 7.Earthquake 8.Epidemics
	Mandavi Gaunpalika	1. Fire 2. Flood 3. Landslide 4. Earthquake 5. Drought 6. Crop and livestock diseases 7. Epidemics 8. Storm 9. Heatwaves 10. Earthquake 11. Avalanche
	Naubahini Gaunpalika	1. Landslide 2. Flood 3. Lightening 4. Wind storm 5. Fire 6. Hailstone 7. crop and livestock diseases
	Pyuthan Municipality	1. Flood 2. Landslide 3. Fire 4. Storm 5. Crop and livestock disease 6. Hailstone 7. Drought
	Sarumarani Gaunpalika	1. Fire 2. Flood 3. Landslide 4. Windstorm 5. Crop and livestock disease 6. Hailstone 7. Drought 8. Epidemics 9. Heatwaves 10. Cold waves 11. Avalanche
	Sworgadwari Municipality	1. Drought 2. Crop and livestock disease 3. Fire 4. Landslide 5. Cold waves 6. Windstorm 7. Epidemics 8. Hailstone 9. Flood 10. Earthquake
Bardiya	Badhaiyatal Gaunpalika	1. Flood 2. Drought 3. Hailstone 4. Fire 5. Cold waves 6. Windstorm 7. Crop and livestock diseases
	Bansgadhi Municipality	1. Flood/inundation 2. Wildlife conflict 3. Crop and livestock disease 4. Cold waves 5. Windstorm 6. Drought 7. Fire 8 Epidemics 9. Hailstone 10. Earthquake
	Barbardiya Municipality	1. Flood 2. Cold waves 3. Diseases 4. Hailstone 5. Windstorm 6. Fire 7. Drought 8. Epidemics 9 Heatwaves 10. Earthquake 11. Landslide 12. Avalanches
	Geruwa Gaunpalika	1. Wildlife attacks 2. Flood 2. Cold waves 4. Fire 5. Crop and livestock diseases 6. Drought 7. Heatwaves
	Gulariya Municipality	1. Flood 2. Fire 3. Cold waves 4. Hailstone 5. Windstorm 6. Crop and livestock disease 7. Epidemics 8. Earthquake 9. Drought 10. Landslide
	Madhuwan Municipality	1. Flood 2. Fire 3. Cold waves 4. Hailstone 5. Windstorm 6. Crop and livestock disease 7. Epidemics 8. Earthquake 9. Drought
	Rajapur Municipality	1. Flood 2. Inundation/embankment 3. Fire 4. Windstorm 5. Cold waves 6. Crop and livestock disease
	Thakurbaba Municipality	1. Flood 2. Hailstone
Dang	Babai Gaunpalika	1. Flood 2. Drought 3. Crop and livestock disease 4. Landslide 5. Hailstone 6. Earthquake 7. Fire 8. Wind storm 9. Epidemics 10. Damage by wild animals
	Bangalachuli Gaunpalika	1. Drought 2. Fire 3. Flood 4. Wind storm 5. Crop and livestock damage 6. Flood 7. Epidemics 8. Hailstone 9. Cold waves 10. Earthquake 11. Avalanche 12. Heatwaves
	Dangisharan Gaunpalika	1. Flood 2. Fire 3. Landslide 4. Windstorm 5. Drought 6. Epidemics 7. Crop and livestock disease 8. Hailstone 9. Cold waves 10. Earthquake 11. Heatwaves 12. Avalanche
	Gadhawa Gaunpalika	1. Drought 2. Crop and livestock disease 3. Flood 4. Hailstone 5. Fire 6. Earthquake 7. Heatwaves 8. Epidemics 9. Landslide 10. Avalanche

	Ghorahi Sub-Metropolitian City	1. Flood 2. Fire 3. Cold waves 4. Wind storm 5. Crop and livestock disease 6. Drought 7. Landslide 8. Hailstone 9. 10. Epidemics 11. Earthquake
	Lamahi Municipality	1. Flood 2. Fire 3. Drought 4. Cold waves 5. Wind storm 6. Epidemics 7. Crop and livestock disease 8. Heatwaves 9. Hailstone 10. Earthquake 11. Landslide 12. Avalanche
	Rajpur Gaunpalika	1. Flood 2. Fire 3. Landslide 4. Crop and livestock disease 5. Cold waves 6. 7. Wind storm 8. Epidemics 9. Drought 10. Hailstone 11. Earthquake 12. Heatwaves 13. Avalanche
	Rapti Gaunpalika	1. Flood 2. Fire 3. Landslide 4. Drought 5. Cold waves 6. Epidemics 7. Wind storm 8. Heatwaves 9. Crop and livestock disease 10. Earthquake
	Shantinagar Gaunpalika	1. Landslide 2. Flood 3. Hailstone 4. Fire 5. Windstorm 6. Crop and livestock disease 8. Drought 9. Earthquake
	Tulsipur Sub-Metropolitian City	1. Flood 2. Fire 3. Crop and livestock disease 4. Wind storm 5. Hailstone 6. Earthquake 7. Cold waves 8. Drought 9. Epidemics 10. Landslide 11. Heatwaves 12. Avalanche
Rukum	Bhoome Gaunpalika	1. Landslide 2. Wind storm 3. Fire 4. Flood 5. Hailstone 6. Drought 7. Epidemics 8. Crop and Livestock Disease 9. Earthquake 10. Heatwaves 11. Cold wave
	Putha Uttanganga Gaunpalika	1. Landslide 2. Flood 3. Epidemics 4. Crop and livestock disease 5. Drought 6. Earthquake 7. Fire 8. Wind storm 9. Cold waves 10. Heatwaves 11. Avalanche
	Sisne Gaunpalika	1. Landslide 2. Drought 3. Hailstone 4. Crop and livestock disease 5. Wind storm 6. Epidemics 7. Flood 8. Fire 9. Lightening 10. Earthquake 11. Cold waves 12. Heatwaves
Arghakhanchi	Bhumikasthan Municipality	1.Fire 2. Flood 3. Drought 4. Cold waves 5. Heatwaves 6. Crop and livestock disease 7. Epidemics 8. Wind storm 9. Hailstorm 10. Earthquake
	Chhatradev Gaunpalika	Drought 2. Landslide 3. Crop and livestock disease 4. Flood 5. Hailstone 6. Windstorm 7. Earthquake 8. Fire 9. Epidemics 10. heatwaves
	Malarani Gaunpalika	1. Landslide 2. Fire 3. Crop and livestock disease 4. Drought 5. Windstorm 6. Wind storm 7. Epidemics 8. Flood 9. Earthquake 10. Cold waves 11. Heatwaves 12. Avalanche
	Panini Gaunpalika	1. Crop and livestock disease 2. Drought 3. Wind storm 4. Fire 5. Epidemics 6. Flood 7. Landslide 8. Hailstone 9. Earthquake 10. Cold waves 11. Heatwaves 12. Avalanche
	Sandhikharka Municipality	1. Landslide 2. Flood 3. Fire 4. Drought 5. Hailstone 6. Wind storm 7. Crop and livestock disease 8. Epidemics 9. Cold waves 10. heatwaves
	Shitaganga Municipality	1. Landslide 2. Fire 3. Drought 4. Flood 5. Cold waves 6. Heatwaves 7. Wind storm 8. Crop and livestock disease 9. Epidemics 10. Earthquake
Kapilvastu	Banganga Municipality	1. Flood 2. Fire 3. Cold waves 4. Drought 5. Crop and livestock diseases 6. Heatwaves 7. Landslide
	Bijayanagar Gaunpalika	1.Fire 2. Flood 3. Drought 4. Cold waves 5. Heatwaves 6. Crop and livestock disease 7. Epidemics 8. Wind storm 9. Hailstone 10. Earthquake

	Buddhabhumi Municipality	1. Flood 2. Fire 3. Cold waves 4. Crop and livestock disease 5. Epidemics 6. Wind storm 7. Drought 8. Heatwaves 9. Hailstone 10. Earthquake
	Kapilvastu Municipality	1. Drought 2. Fire 3. Flood 4. Cold waves 5. Heatwaves 6. Wind storm 7. Crop and livestock disease 8. Epidemics 9. Hailstone 10. Avalanche 11. Earthquake 12. Flood
	Krishnanagar Municipality	1. Flood 2. Fire 3. Cold waves 4. Heat waves 5. Storm 6. Drought 7. Epidemic 8. Crop and livestock disease 9. Hailstone 10. Landslide 11. Avalanche
	Maharajganj Municipality	1. Flood 2. Fire 3. Windstorm 4. Epidemics 5. Crop and livestock diseases 6. Cold waves 7. Drought 8. Heatwaves 9. Earthquake 10. Landslide 11. Avalanche
	Mayadevi Gaunpalika	1. Fire 2. Flood 3. Drought 4. Cold waves 5. Heatwaves 6. Wind storm 7. Crop and livestock disease 8. Epidemics 9. Hailstone 10. Earthquake
	Shivaraj Municipality	1. Fire 2. Flood 3. Cold waves 4. Heatwaves 5. Windstorm 6. Drought 7. Epidemics 8. Crop and livestock disease 9. Hailstone 10. Earthquake
	Shuddhodhan Gaunpalika	1. Fire 2. Flood 3. Cold waves 4. Wind storm 5. Crop and livestock disease 6. Drought 7. Hailstone 8. Heatwaves 9. Epidemics
	Yasodhara Gaunpalika	1. Fire 2. Cold waves 3. Drought 4. Hailstone 5. Flood 6. Heatwaves 7. Epidemics 8. Crop and livestock disease
Rupandehi	Butwal Sub-Metropolitian City	1. Flood 2. Fire 3. Cold waves 4. Crop and livestock diseases 5. Landslide 6. Windstorm 7. Drought 8. Hailstone 9. Earthquake 10. Heatwaves
	Devdaha Municipality	1. Flood 2. Cold waves 3. Fire 4. Drought 5. Windstorm 6. Heatwaves 7. Earthquake 8. Hailstone 9. Crop and livestock diseases
	Gaidahawa Gaunpalika	1. Flood 2. Fire 3. Cold waves 4. Crop and livestock diseases 5. Epidemics 6. Windstorm 7. Drought 8. Hailstone 9. Earthquake 10. Heatwaves 11. Landslide
	Kanchan Gaunpalika	1. Flood 2. Drought 3. Hailstone 4. Fire 5. Cold waves 6. Heatwaves 7. Storm 8. Crop and livestock diseases 9. Epidemics
	Kotahimai Gaunpalika	1. Cold waves 2. Flood 3. Crop and livestock diseases 4. Drought 5. Fire 6. Windstorm 7. Epidemic 8. Heatwaves 9. Hailstone 10. Earthquake 11. Landslide 12. Avalanches
	Lumbini Sanskritik Municipality	1. Flood 2. Drought 3. Fire 4. Cold waves 5. Hail 6. Heatwaves 7. Windstorm 8. Epidemics 9. Crop and livestock diseases 10. Earthquake 11. Avalanches
	Marchawari Gaunpalika	1. Flood 2. Hailstone 3. Cold waves 4. Drought 5. Crop and livestock Disease 6. Windstorm 7. Fire 8. Epidemic 9. Heatwaves 10. Landslide 11. Earthquake 12. Avalanche
	Mayadevi Gaunpalika	1.Flood 2. Fire 3. Windstorm 4. Cold waves 5. Hailstone 6. Crop and livestock disease 7. Drought 8.Earthquake 9.Epidemics
	Om Satiya Gaunpalika	1. Earthquake 2. Fire 3. Cold waves 4. Flood 5. Heatwaves 6. Windstorm 7. Hailstone 8. Drought 9. Landslide 10. Crop and livestock diseases 11. Epidemics 12. Avalanche

	Rohini Gaunpalika	1. Flood 2. Cold waves 3. Drought 4. Hailstone 5. Fire 6. Windstorm 7. heatwaves
	Sainamaina Municipality	1. Earthquake 2. Flood 3. Landslide 4. Fire 5. Cold waves 6. Hailstone 7. Drought 8. Heatwaves 9. Crop and livestock diseases 10. Windstorm 11. Epidemic 12. avalanche
	Sammarimai Gaunpalika	1. Flood 2. Fire 3. Cold waves 4. Drought 5. Windstorm 6. Crop and livestock diseases 7. Epidemics 8. Snakebites 9. Hailstone 10. Heatwaves 11. Earthquake
	Siddharthanagar Municipality	1. Flood 2. Earthquake 3. Fire 4. Cold waves 5. Windstorm
	Siyari Gaunpalika	1. Flood 2. Hailstone 3. Drought 4. Cold waves 5. Crop and livestock diseases 6. Earthquake 7. Fire 8. Heatwaves 9. Windstorm 10. Epidemics 11.Avalanches
	Suddhodhan Gaunpalika	1. Flood 2. Fire 3. Drought 4. Heatwaves 5. Windstorm 6. Crop and livestock diseases 7. Epidemic 8. Cold waves 9. Hailstone 10. Landslide 11. Earthquake
	Tilottama Municipality	1. Flood 2. Fire 3. Cold waves 4. Heatwaves 5. Windstorm 6. Crop and livestock diseases 7. Hailstone 8. Drought 9. Earthquake 10. Landslide 11. Avalanche
Palpa	Baganaskali Gaunpalika	1. Landslide 2. Windstorm 3. Crop and livestock Diseases 4. Hailstone 5. Fire 6. Drought 7. Epidemics 8. Cold waves 9. Earthquake 10.Heatwaves 11. Avalanches
	Mathagadhi Gaunpalika	1. Earthquake 2. Landslide 3. Flood 4. Road accident 5. Fire 6. Windstorm 7. Thunderstorm 8. Wildlife conflict 9. Epidemics 10. Drought 11. Coldwaves 12. Heatwaves 13. Avalanche
	Nisdi Gaunpalika	1. Earthquake 2. Landslide 3. Flood 4. Drought 5. Hailstone 6. Fire 7. Windstorm 8. Crop and livestock diseases 9. Epidemics 10. Cold waves 11. Avalanche
	Purbakhola Gaunpalika	1. Landslide 2. Drought 3. Crop and livestock diseases 4. Windstorm 5. Hailstone 6. Earthquake 7. Cold waves 8. Fire 9. Flood 10. Epidemics
	Rainadevi Chhahara Gaunpalika	1. Landslide 2. Flood 3. Windstorm 4. Drought 5. Fire 6. Hail
	Rambha Gaunpalika	1. Landslide 2. Hailstone 3. Flood 4. Drought 5. 6.Windstorm 7.Epidemics 8.Windstorm 9.Crop and livestock diseases 10.Earthquake
	Rampur Municipality	1.Flood 2. Landslide 3. Fire 4. Hailstone 5. Crop and livestock diseases 6. Windstorm 7. Epidemics 8. Earthquake 9. 10.Drought 11.Coldwaves 12.heatwaves
	Ribdikot Gaunpalika	1. 2. Drought 3. Flood 4. Fire 5. Windstorm 6. Crop and livestock diseases 7. Flood 8. Hailstone 9. Earthquake 10. Epidemics
	Tansen Municipality	1.Earthquake 2. Landslide 3. Flood 4. Fire 5. Crop and livestock diseases 6. Hail
	Tinau Gaunpalika	1. Landslide 2. Flood 3. Fire 4. Earthquake

Source: Questionnaire survey, 2018