

Climate Change

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Climate Change

Climate change: Abnormal Variation in Climate. Effect parts of Earth(ice caps) over decades to millions of years.



Climate
change is
happening

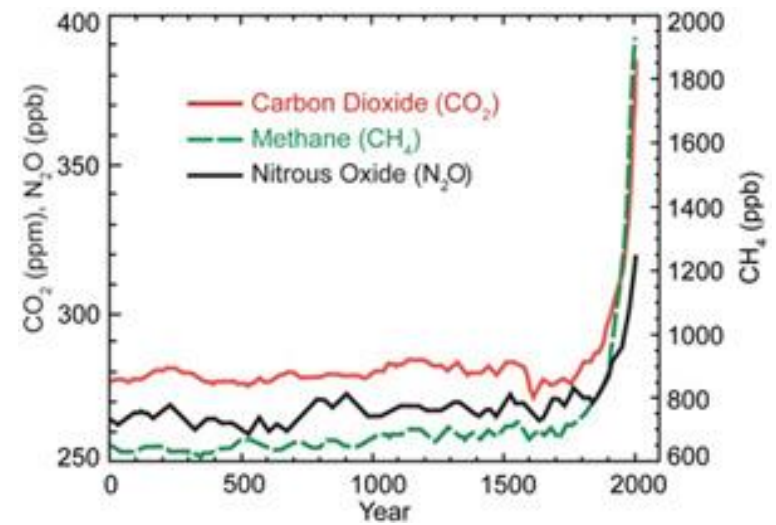
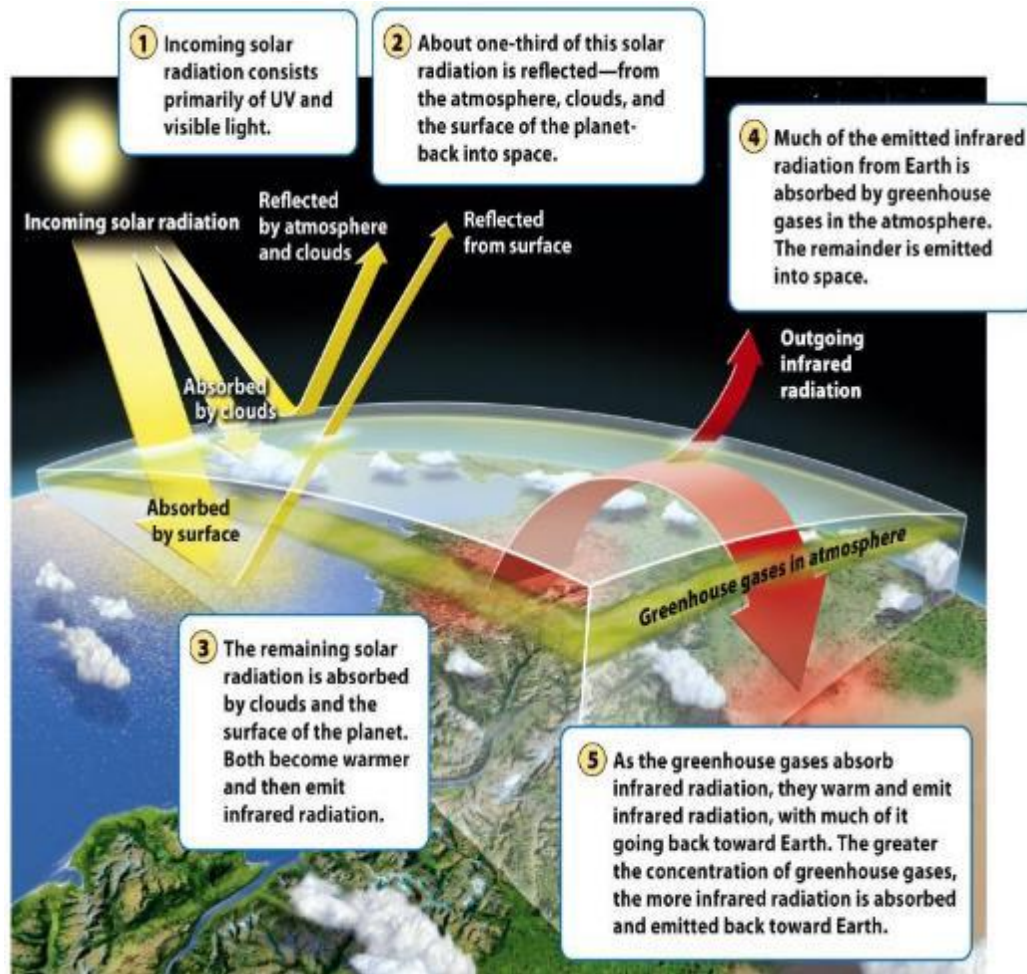
Our Earth is warming. 1880 to 2012, average global temperature up by 0.85°C . By 2100, this increase will exceed 1.5°C compared to 1850 to 1900.

Small changes in average temperature of Earth lead to large and potentially dangerous shifts in climate and weather

The evidence is clear. Rising global temperatures + Changes in weather and climate. Many places have seen:

Changes in rainfall, resulting in more floods, droughts, or intense rain, as well as more frequent and severe heat waves.

Science of climate change

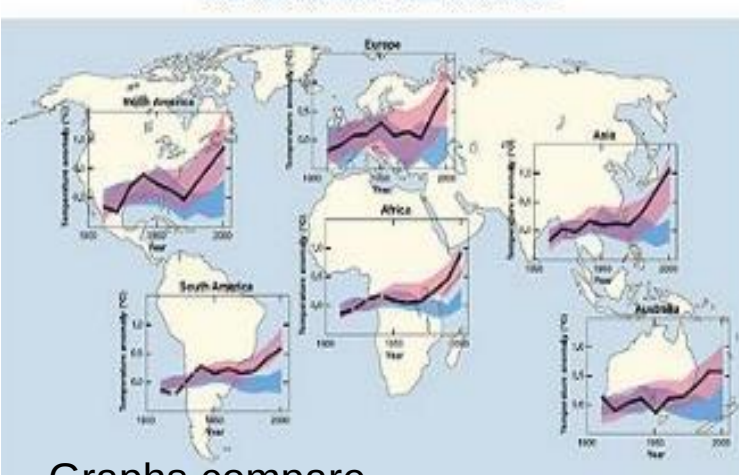


Increase in GHG concentrations in the atmosphere over the last 2,000 years

The Green house effect

Assessment of global change in temperature by IPCC

GLOBAL AND CONTINENTAL TEMPERATURE CHANGE



Graphs compare observed changes in temperature (black lines) with model results that include only natural climate forcings like volcanic eruptions and changes in solar energy (blue) and model results that use both natural and human caused climate forcings (pink).

Snow cover

- Annual average Arctic sea ice has shrunk, with larger decreases observed each decade. Mountain glaciers and snow cover have declined.

Rain and drought

- There have been significant changes in precipitation patterns globally. The area affected by drought is likely to have increased since the 1970s.

A hotter world

- Over the past 50 years, cold days & nights, frosts have become less frequent and hot days and hot nights, more frequent.

Extreme weather

- An increase in intense tropical cyclone activity in the North Atlantic has been observed. Warm air is fuel for cyclones and hurricanes.

Seasons

- Spring events come earlier and plants and animals are moving upwards and pole wards because of recent warming trends.

Nature

- Scientists have observed climate-induced changes in at least 420 physical processes and biological species or communities.

Climate change impacts for India

Expected climate change impacts for India



Changes in weather patterns



Cyclonic disturbances



Sea-level rise



Changes in agriculture yields



Changes in fresh water supply



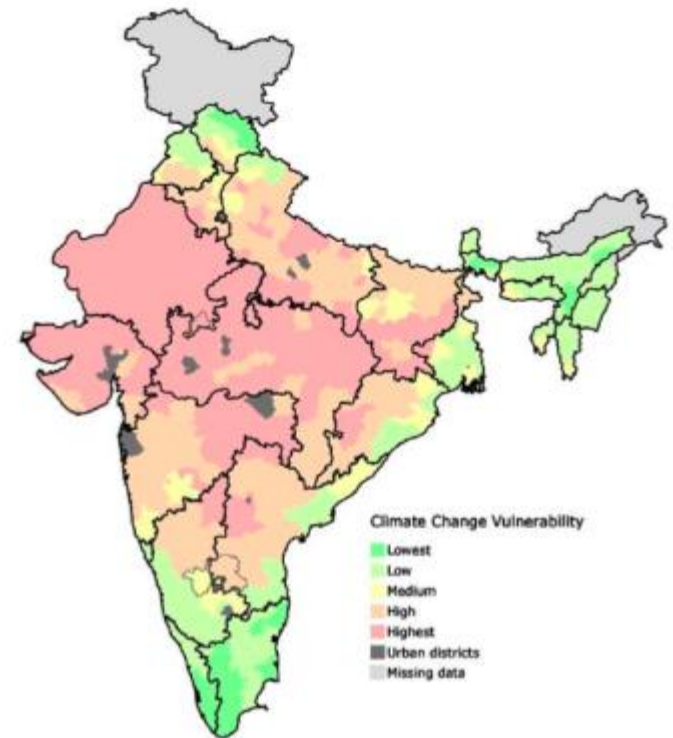
Impacts on forests and natural ecosystems



Impacts on human health

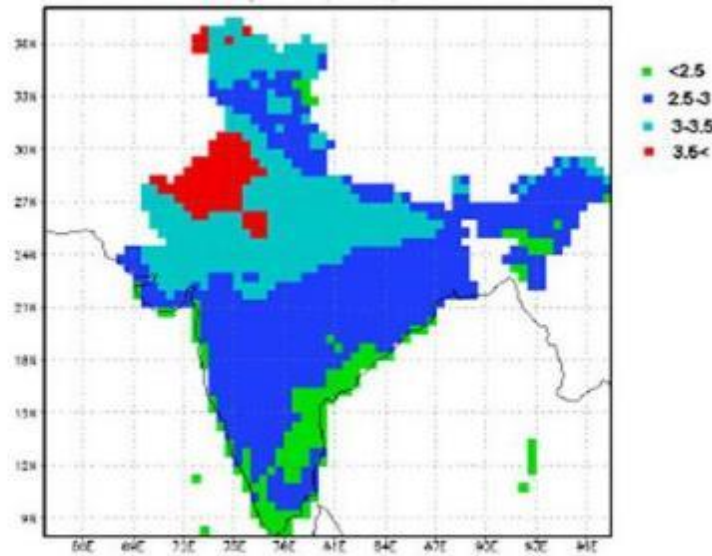
Source :Expected effects (of expected climate change) for India: examples (INCCA 2010)

Mapping vulnerability : climate change in India



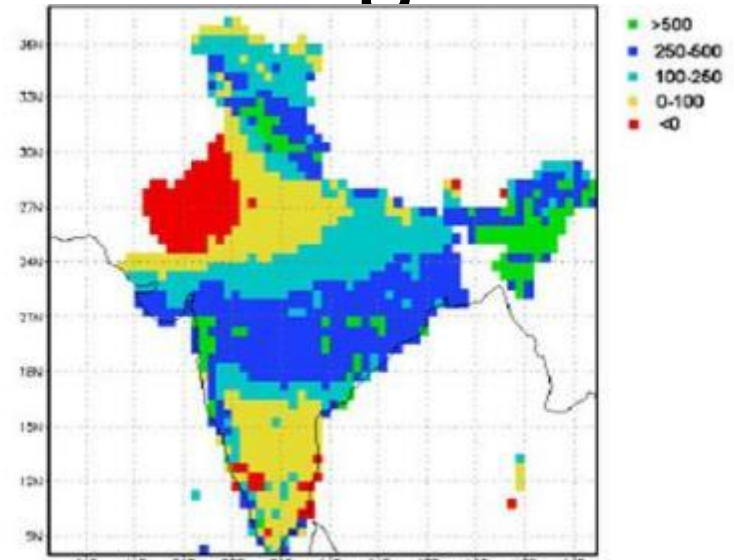
Source: Mapping vulnerability to multiple stressors: climate change and globalization in India

India and climate change



Q4252: O3.A/1025

Predicted change in Temperature (Degrees) by 2085



2004-10-
Q4252: O3.A/1025

Predicted change in Rainfall (mm) by 2085

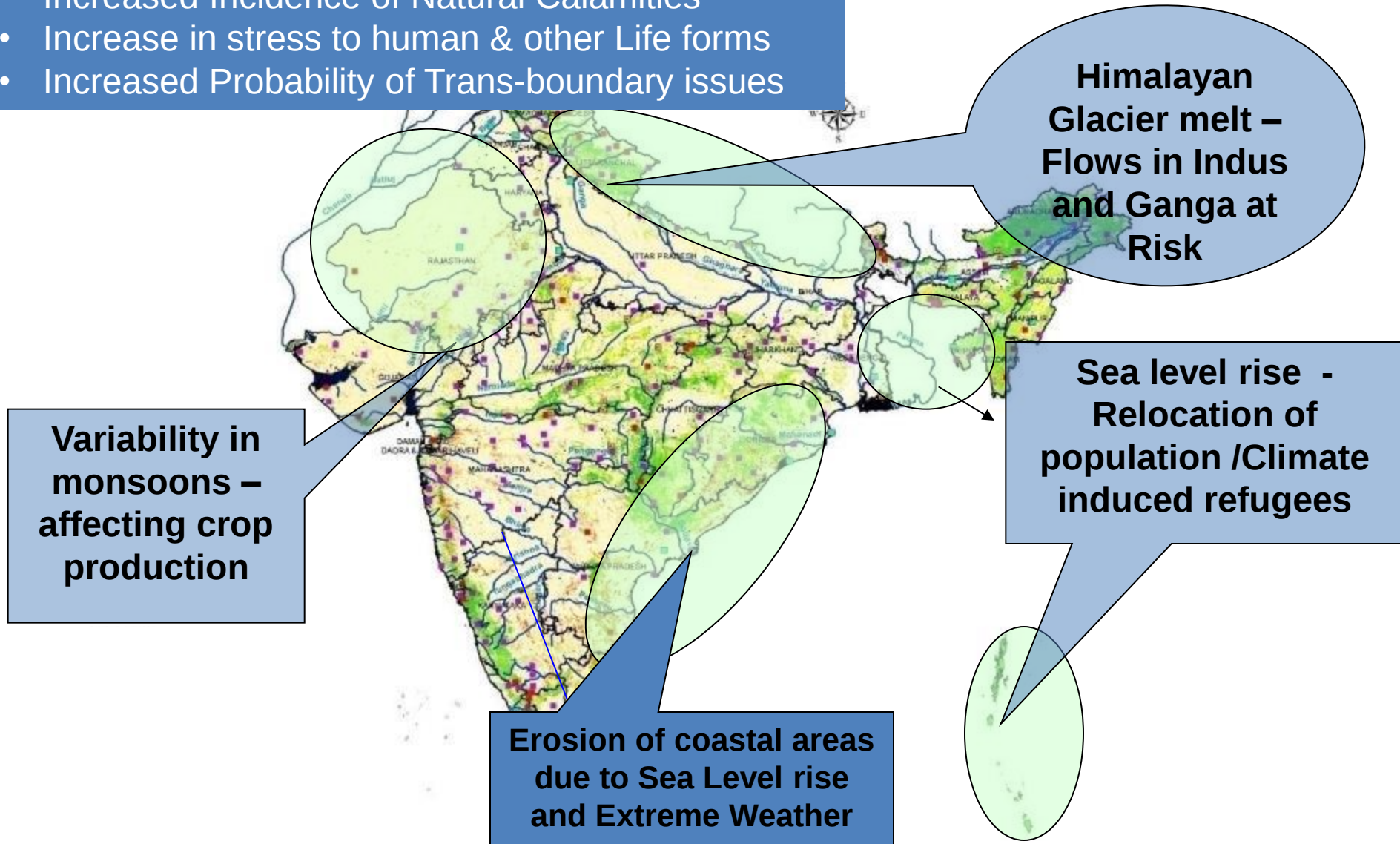
2004-10-10-1025

Source: Indian Network for Climate Change Assessment (INCCA)

- Simulations indicate an all-round warming, associated with increasing greenhouse gas concentrations, over the Indian subcontinent. The rise in annual mean surface air temperature by the 2030s ranges from 1.7°C to 2.0°C.
- There is considerable geographical variation in the magnitude of changes for both temperature as well as rainfall
- Northwestern India is likely to become drier, while northeastern India is likely to become much wetter, The temperature increase in northwestern India is also much more than that in the northeast.

Risks to Ecosystems & People in India

- Increased Incidence of Natural Calamities
- Increase in stress to human & other Life forms
- Increased Probability of Trans-boundary issues



Climate change impacts in India

What the INCCA Report has found

Warmer seasons

- Avg. temp rise: 2.0 deg C predicted
- 1.0-4.0 deg C at extreme ranges

Increased annual precipitation

- lower frequency of rainy days; increased intensity

Cyclonic disturbances

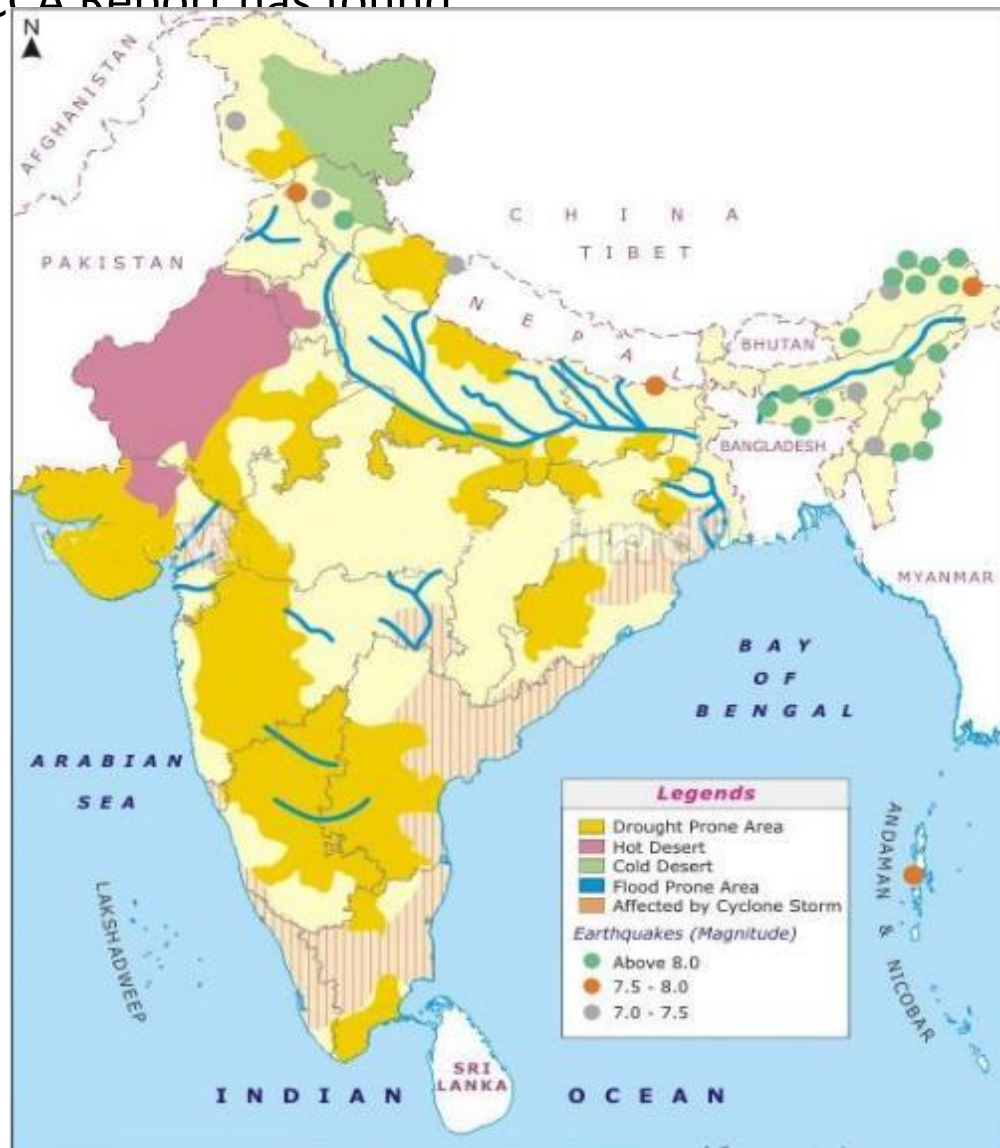
- lower frequency; increased intensity
- increased risk of storm surges

Sea-level rise

- 1.3 mm/year on average

Fresh water supply

- High variability predicted in water yields (from 50% increase to 40-50% reduction)
- 10-30% increased risk of floods; increased risks of droughts



Climate change impacts in India

What the INCCA Report has found

Forests and natural ecosystems

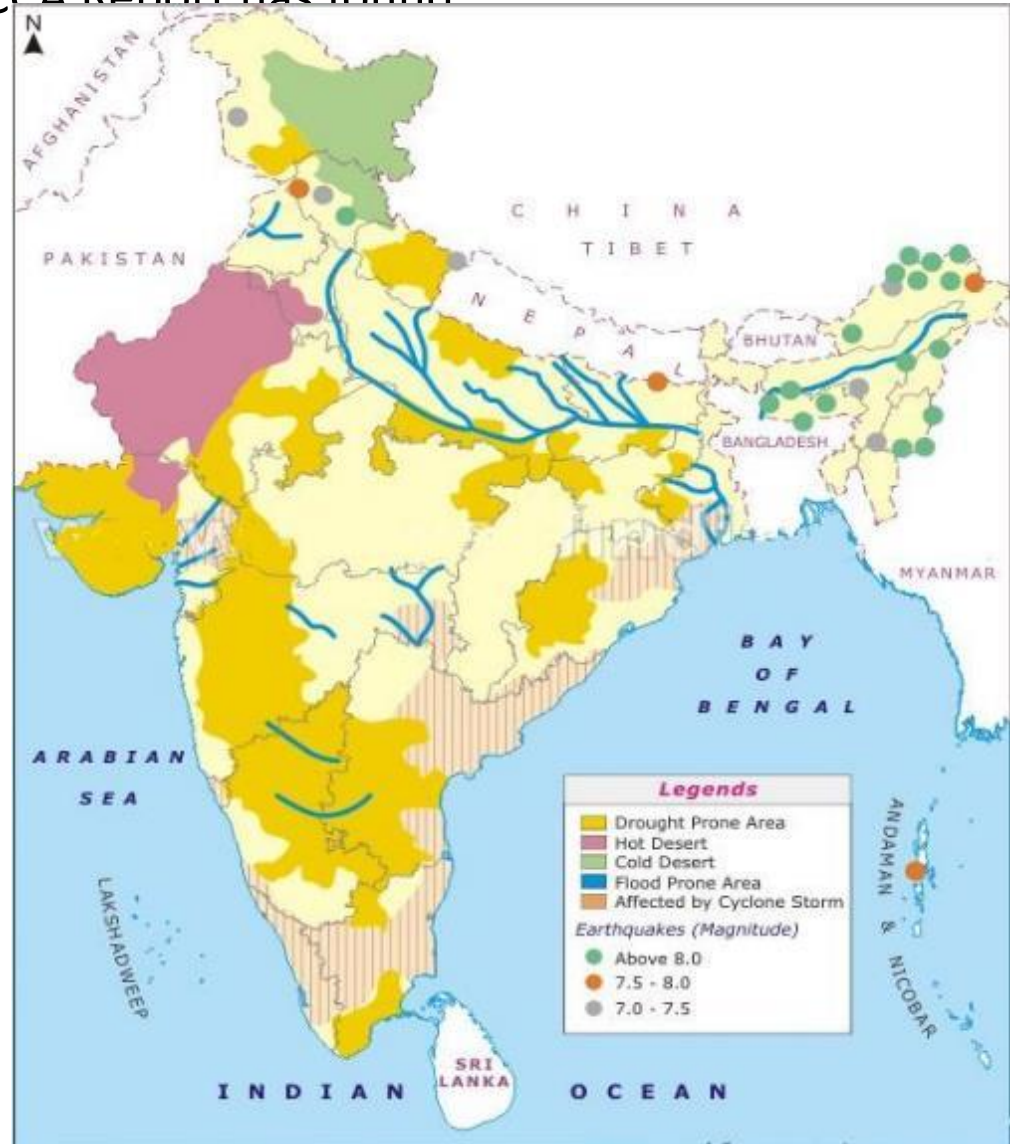
- Increased net primary productivity
- Shifting forest borders; species mix; negative impact on livelihoods and biodiversity

Human health

- Higher morbidity and mortality from heat stress and vector/water-borne diseases
- Expanded transmission window for malaria

Reduced agricultural productivity

- Sharp fall in land productivity of 17% farmers
- General decrease in productivity of crops; however, cash crops like coconut may increase
- Crops earlier grown in lower or mid-Himalayan regions are now grown at higher altitudes
- Marine fisheries are likely to be impacted as the area of spawning shifts to higher latitudes



Climate Change impacts in India

Extreme Heat

What we know

- India is already experiencing a warming climate.

What could happen

- Unusual and unprecedented spells of hot weather are expected to occur far more frequently and cover much larger areas.

What can be done

- With built-up urban areas rapidly becoming “heat-islands”, urban planners will need to adopt measures to counteract this effect.

Changing Rainfall Patterns

What we know

- A decline in monsoon rainfall since the 1950s has already been observed. The frequency of heavy rainfall events has also increased.

What could happen

- A 2°C rise in the world’s average temperatures will make India’s summer monsoon highly unpredictable

What can be done

- Improvements in hydro-meteorological systems for weather forecasting
- Installation of flood warning systems can help people move out of harm’s way before a weather-related disaster strikes.

Climate Change impacts in India

Droughts

What we know

- Droughts have major consequences. In 1987 and 2002-2003, droughts affected more than half of India's crop area and led to a huge fall in crop production.

What could happen

- Droughts are expected to be more frequent in some areas, especially in north-western India, Jharkhand, Orissa and Chhattisgarh.
- Crop yields are expected to fall significantly because of extreme heat by the 2040s.

What can be done

- Investments in R&D for the development of drought-resistant crops can help reduce some of the negative impacts.

Groundwater

What we know

- More than 60% of India's agriculture is rain-fed, making the country highly dependent on groundwater.

What could happen

- Falling water tables can be expected to reduce further on account of increasing demand for water from a growing population, more affluent life styles, as well as from the services sector and industry.

What can be done

- The efficient use of ground water resources will need to be incentivized.

Climate Change impacts in India

Glacier Melt

What we know

- Himalayan glaciers - where a substantial part of the moisture is supplied by the summer monsoon - have been retreating over the past century.

What could happen

- At 2.5°C warming, melting glaciers and the loss of snow cover over the Himalayas are expected to threaten the stability and reliability of northern India's primarily glacier-fed rivers, particularly the Indus and the Brahmaputra.

What can be done

- Major investments in water storage capacity would be needed to benefit from increased river flows in spring and compensate for lower flows later on

Sea level rise

What we know

- Mumbai has the world's largest population exposed to coastal flooding, with large parts of the city built on reclaimed land, below the high-tide mark. Rapid and unplanned urbanization further increases the risks.

What could happen

- Sea-level rise and storm surges would lead to saltwater intrusion in the coastal areas, impacting agriculture, degrading groundwater quality, contaminating drinking water

What can be done

- Building codes will need to be strictly enforced and urban planning will need to prepare for climate-related disasters.

Climate Change impacts in India

Agriculture and food security

What we know

- Rising temperatures with lower rainfall at the end of the growing season have caused a significant loss in India's rice production. Without climate change, average rice yields could have been almost 6% higher (75 million tons in absolute terms).

What could happen

- Seasonal water scarcity, rising temperatures, and intrusion of sea water would threaten crop yields, jeopardizing the country's food.

What can be done

- Crop diversification, and improved soil management practices, together with the development of drought-resistant crops.

Energy Security

What we know

- Climate-related impacts on water resources can undermine the two dominant forms of power generation in India - hydropower and thermal power generation - both of which depend on adequate water supplies to function

What could happen

- The increasing variability and long-term decreases in river flows can pose a major challenge to hydropower plants.

What can be done

- Projects will need to be planned taking into account climatic risks.

Climate Change impacts in India

Water Security

What we know

- Many parts of India are already experiencing water stress.

What could happen

- An increase in variability of monsoon rainfall is expected to increase water shortages in areas.

What can be done

- Improvements in irrigation systems, water harvesting techniques, and more-efficient agricultural water management can offset some of these risks.

Health

What we know

- Climate change is expected to have major health impacts in India- with the poor likely to be affected most severely. Malaria and other vector-borne diseases, along with diarrheal infections, are likely to spread into areas where colder temperatures had previously limited

What could happen

- Health systems will need to be strengthened in identified hotspots.

What can be done

- Improvements in hydro-meteorological systems for weather forecasting and the installation of flood warning systems can help people move out of harm's way before a weather-related disaster strikes.

Climate Change impacts in India

Migration and conflict

What we know

- South Asia is a hotspot for the migration of people from disaster-affected or degraded areas to other national and international regions.
- The Indus and the Ganges-Brahmaputra-Meghna Basins are major trans boundary rivers, and increasing demand for water is already leading to tensions among countries over water sharing.

What could happen

- Climate change impacts on agriculture and livelihoods can increase the number of climate refugees.

What can be done

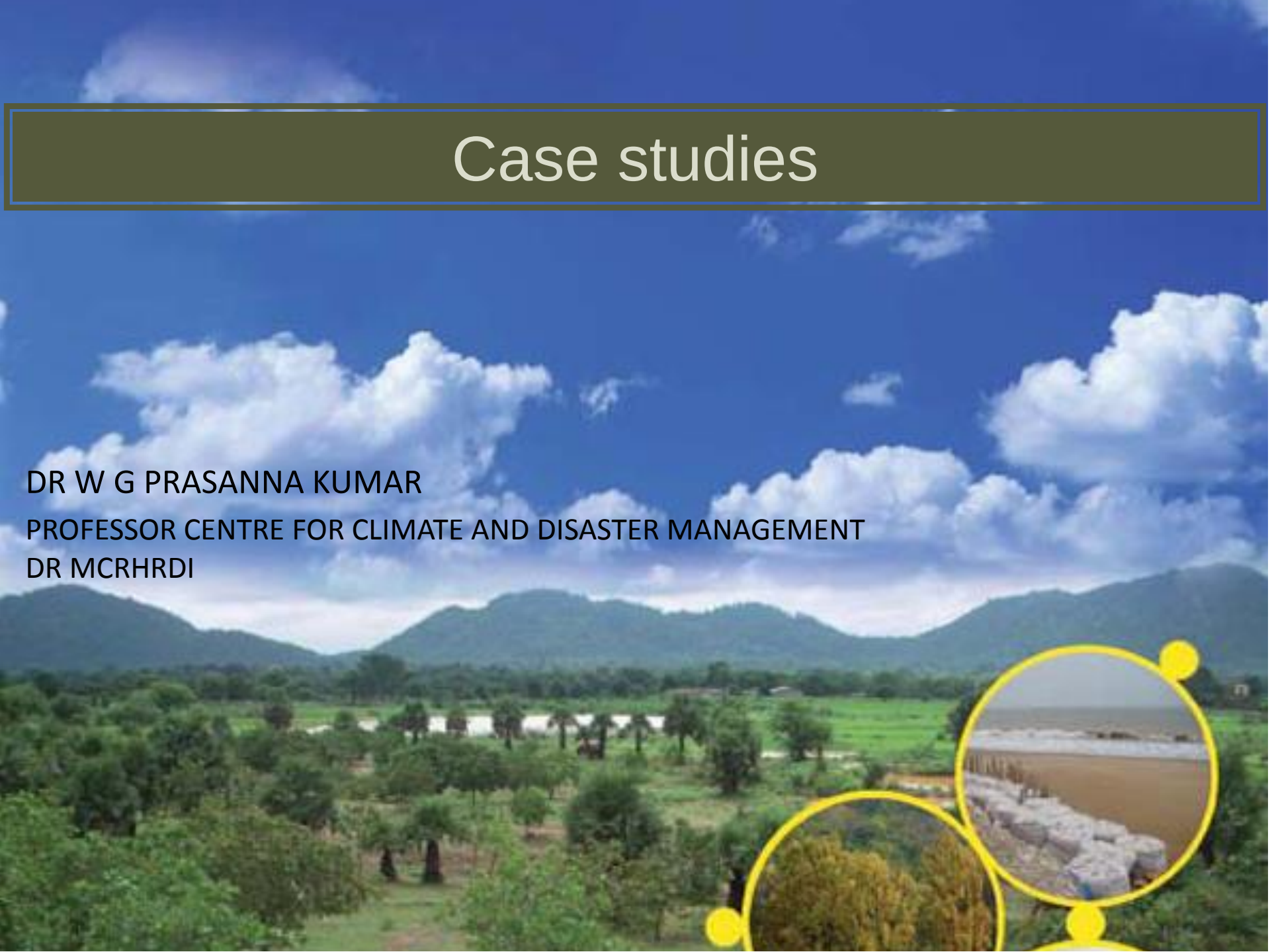
- Regional cooperation on water issues will be needed.

Case studies

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Projected Climate Trends

Bhubaneswar

Climate trends from INCCA 4x4 Assessment Report for 2030s



- Increase in Average Annual Rainfall
- Max increase March - May



- Increase in Average Annual Temp.
- Max increase in temp March - May



- Probable decrease in frequency of cyclonic disturbances but increase in intensity (June – Sept)

Risk Assessment

Bhubaneswar

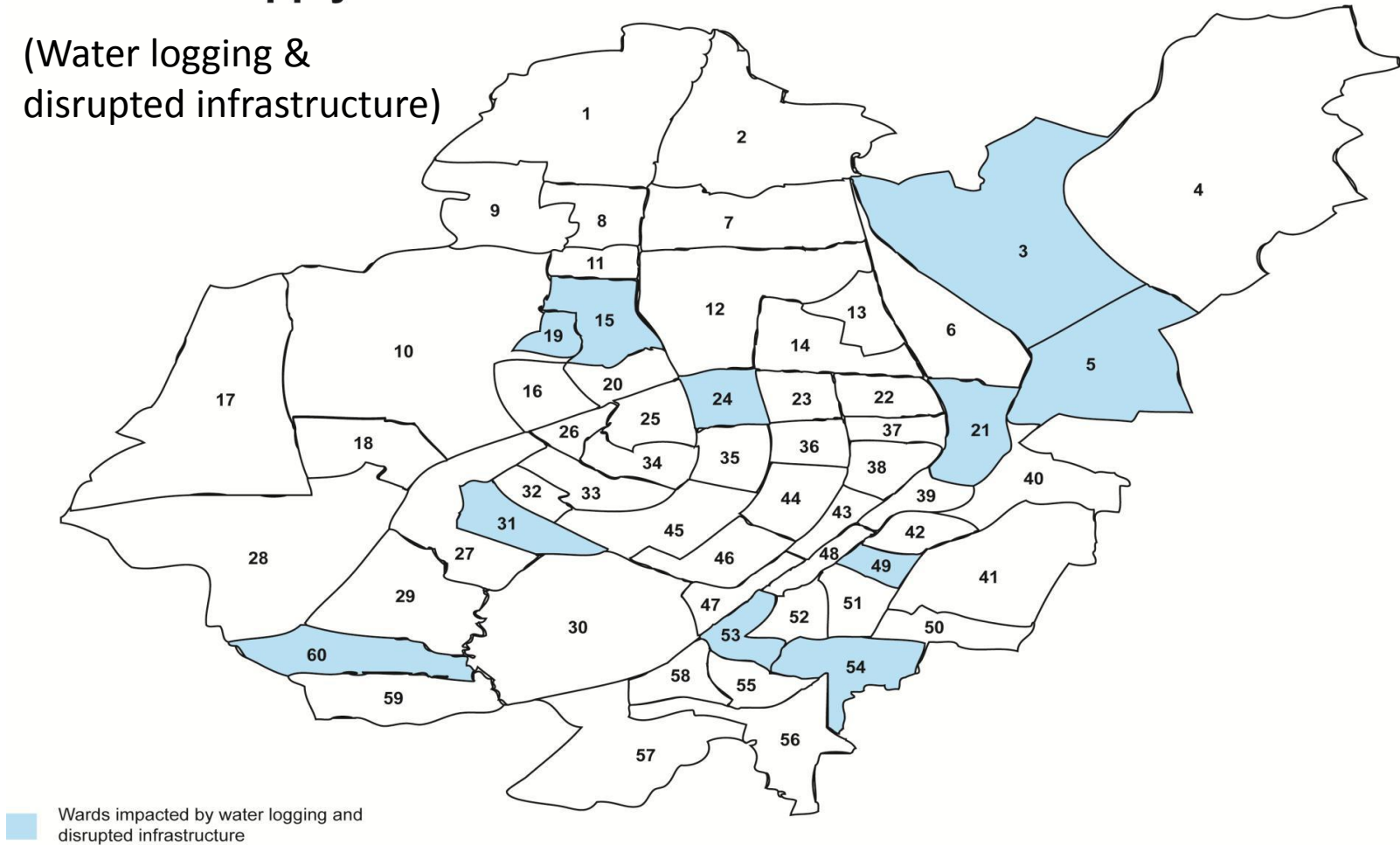
Urban system	Impacts of climate change	Likelihood	Consequence	Risk score	Risk status
Water supply	Increased precipitation disrupts/ damages water supply infrastructure	3	3	9	Medium
	Increased precipitation causes increased incidences of urban flooding / water logging	4	3	12	High
	Increased temperatures will lead to increased demand for water thereby posing additional stress on the supply system	5	3	15	High
Housing	Increased precipitation causes greater health risks	4	3	12	High
	Increased temperature causes greater fire risks	4	2	8	Medium
Energy	Increased precipitation disrupts / damages power supply infrastructure	4	2	8	Medium
	Increased temperature leads to increased energy demand will increase, causing a shortage	4	3	12	High
Ecosystem	There will be additional stress on the ecosystems e.g. the water bodies may dry up	4	2	8	Medium

Increased precipitation impact

Bhubaneswar

Water supply

(Water logging &
disrupted infrastructure)

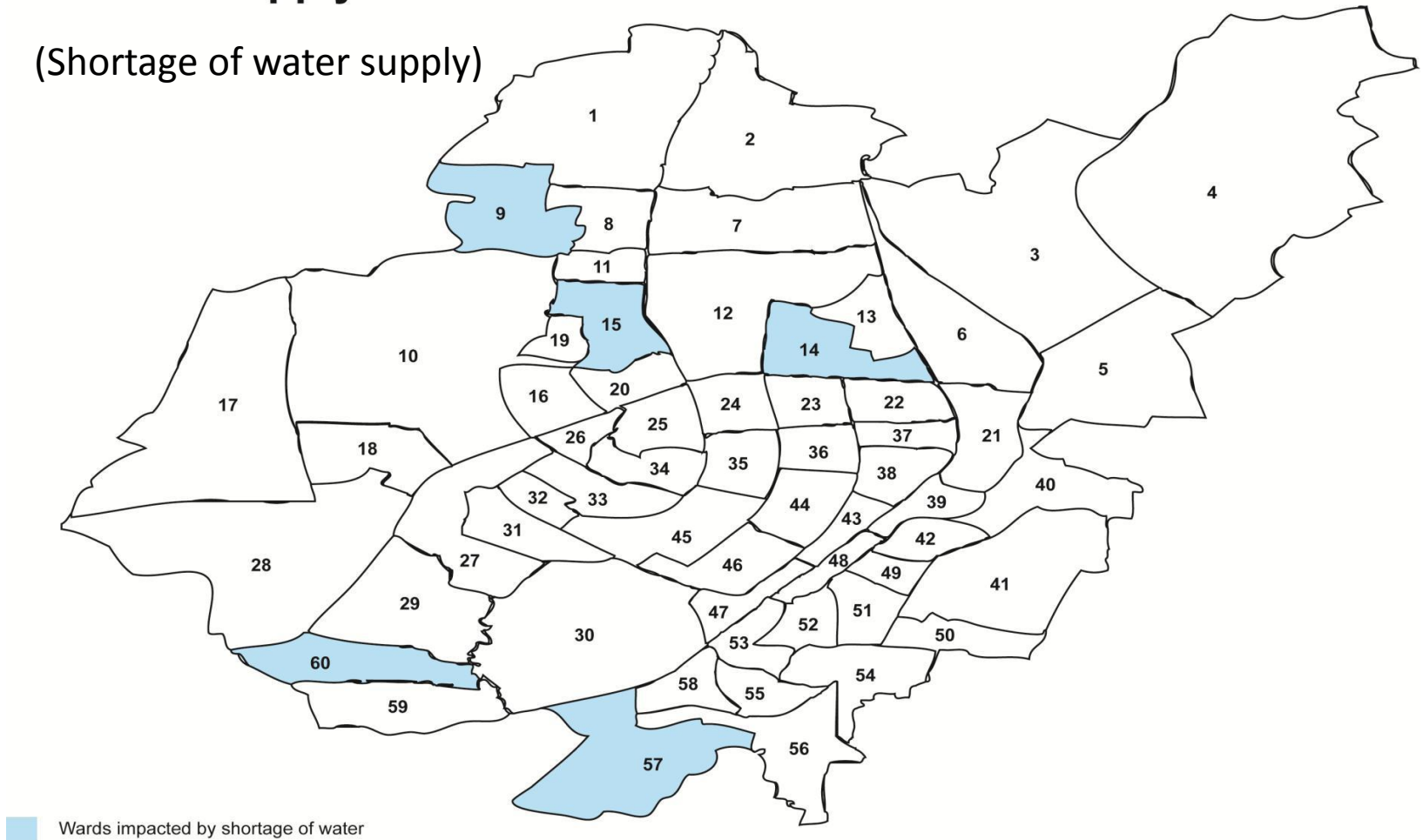


Increased temperature impact

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Water supply

(Shortage of water supply)

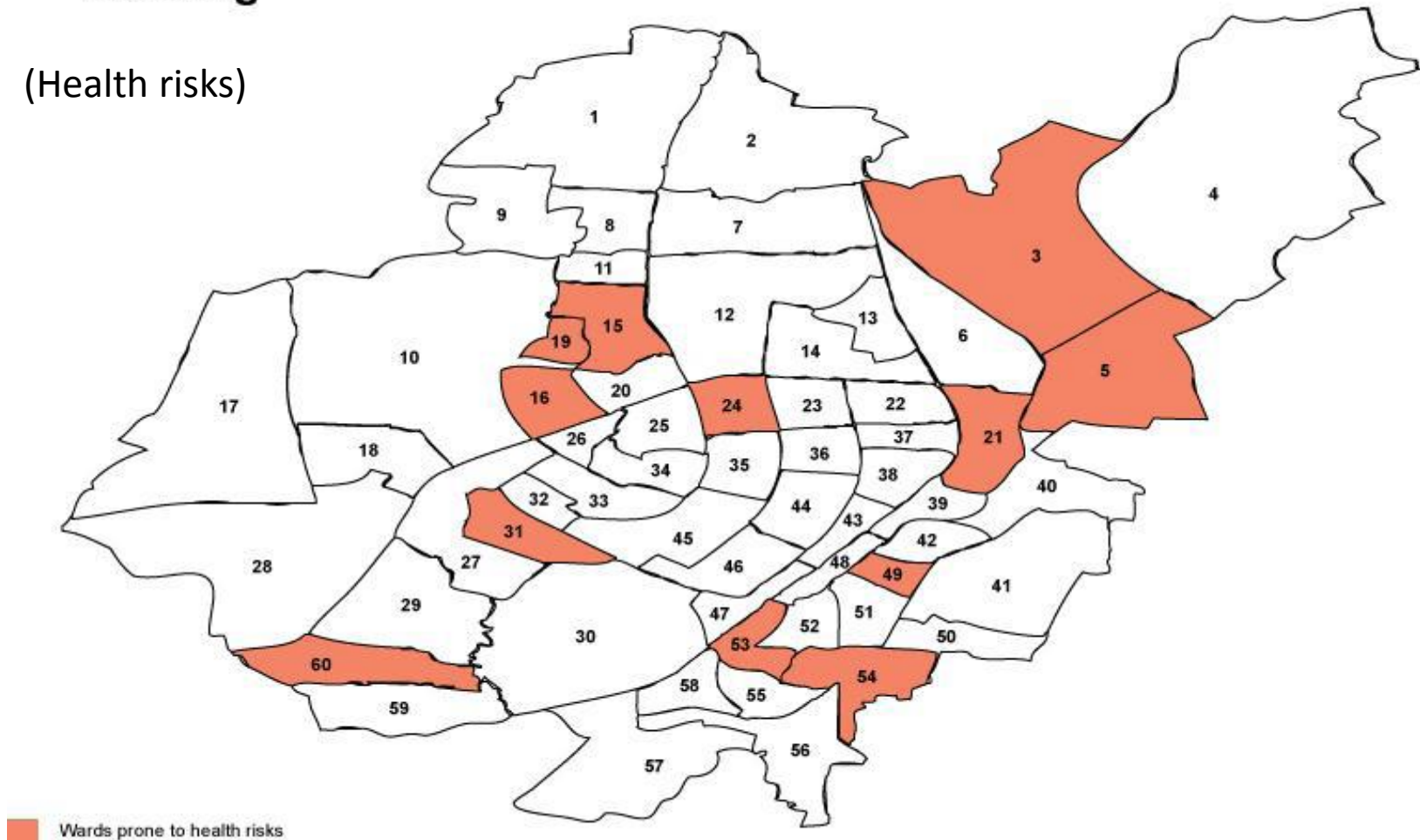


Increased precipitation impact

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Housing

(Health risks)

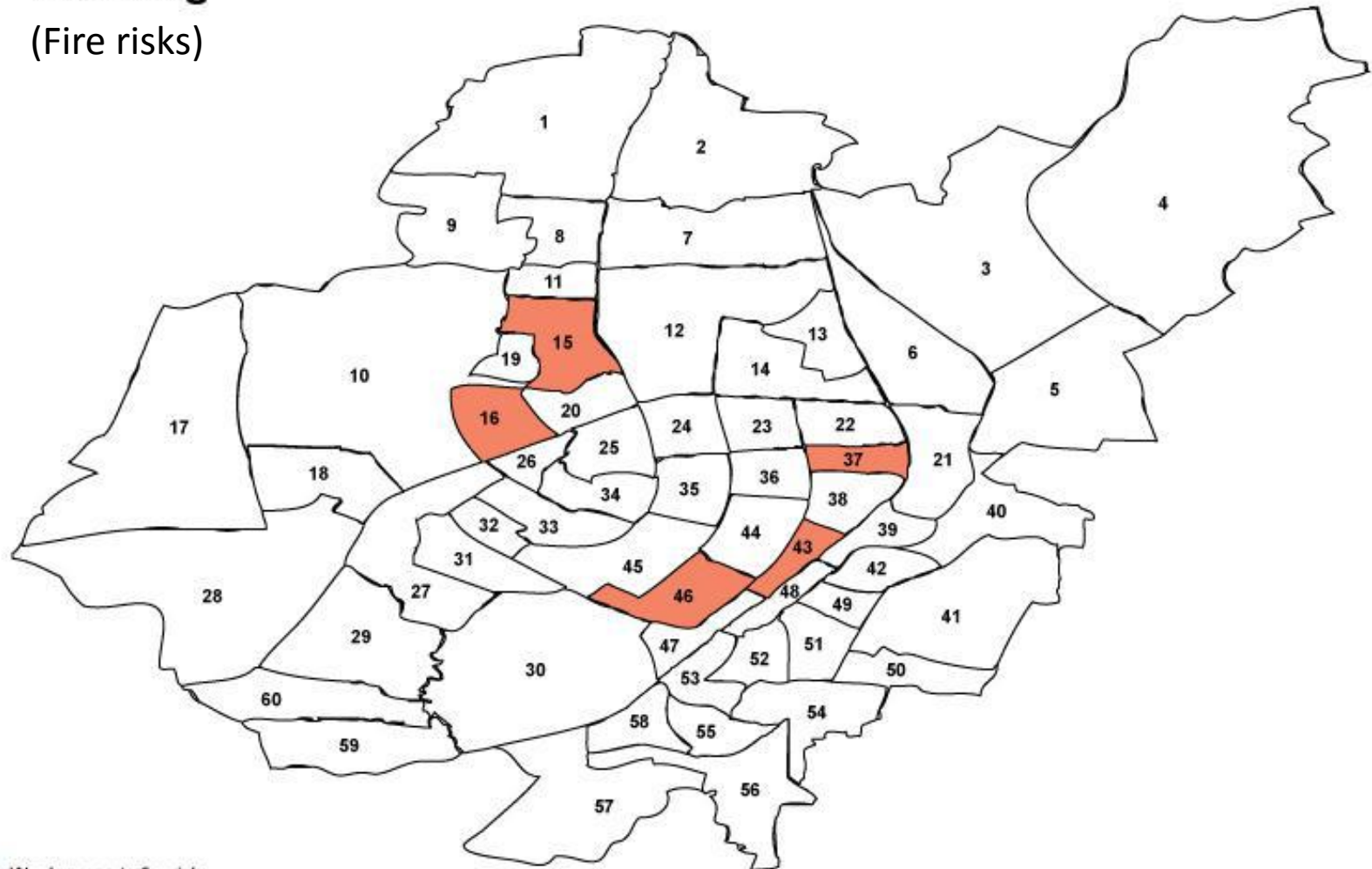


Increased temperature impact

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Housing

(Fire risks)



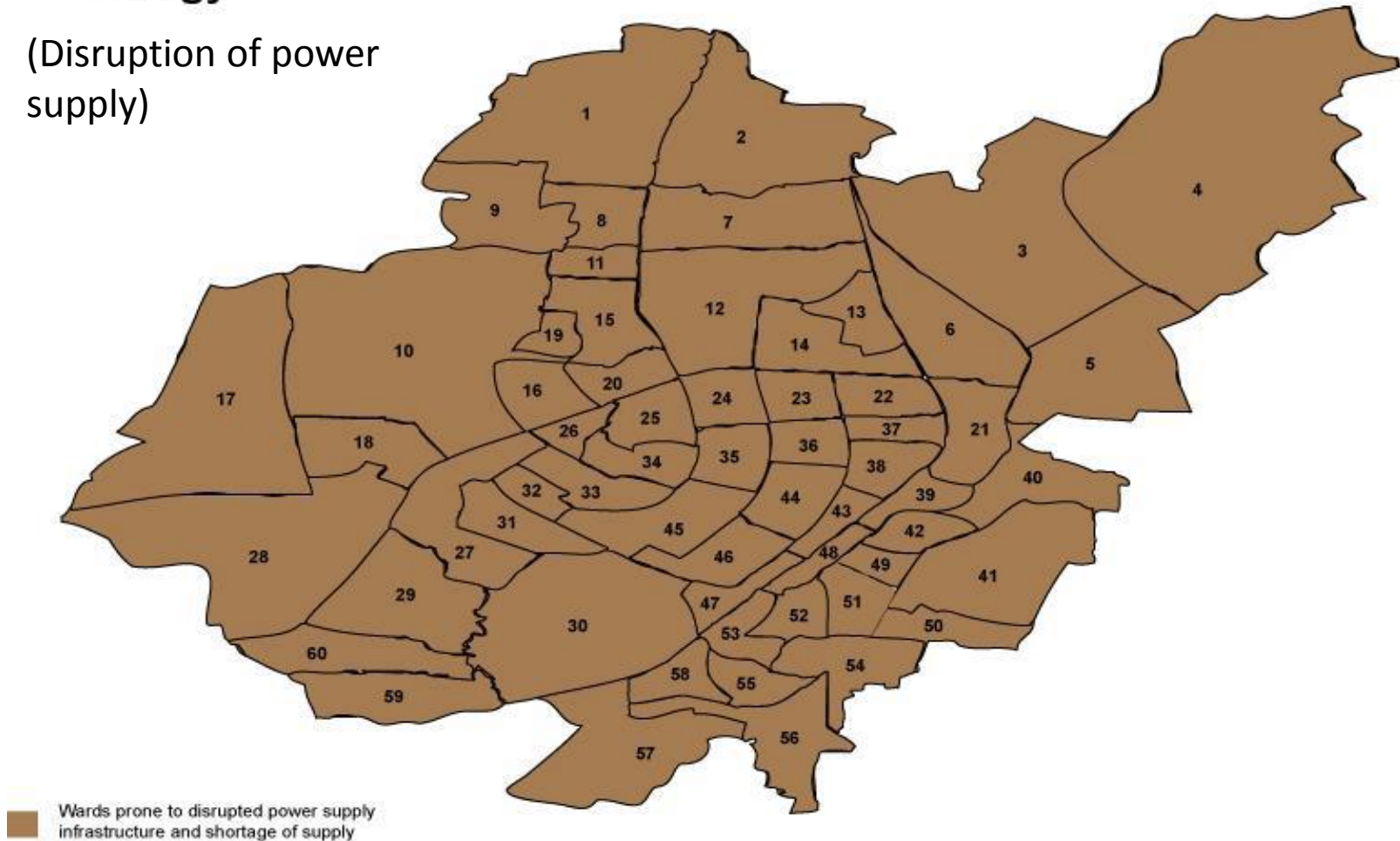
Wards prone to fire risks

Increased temperature impact

Bhubaneswar

Energy

(Disruption of power supply)

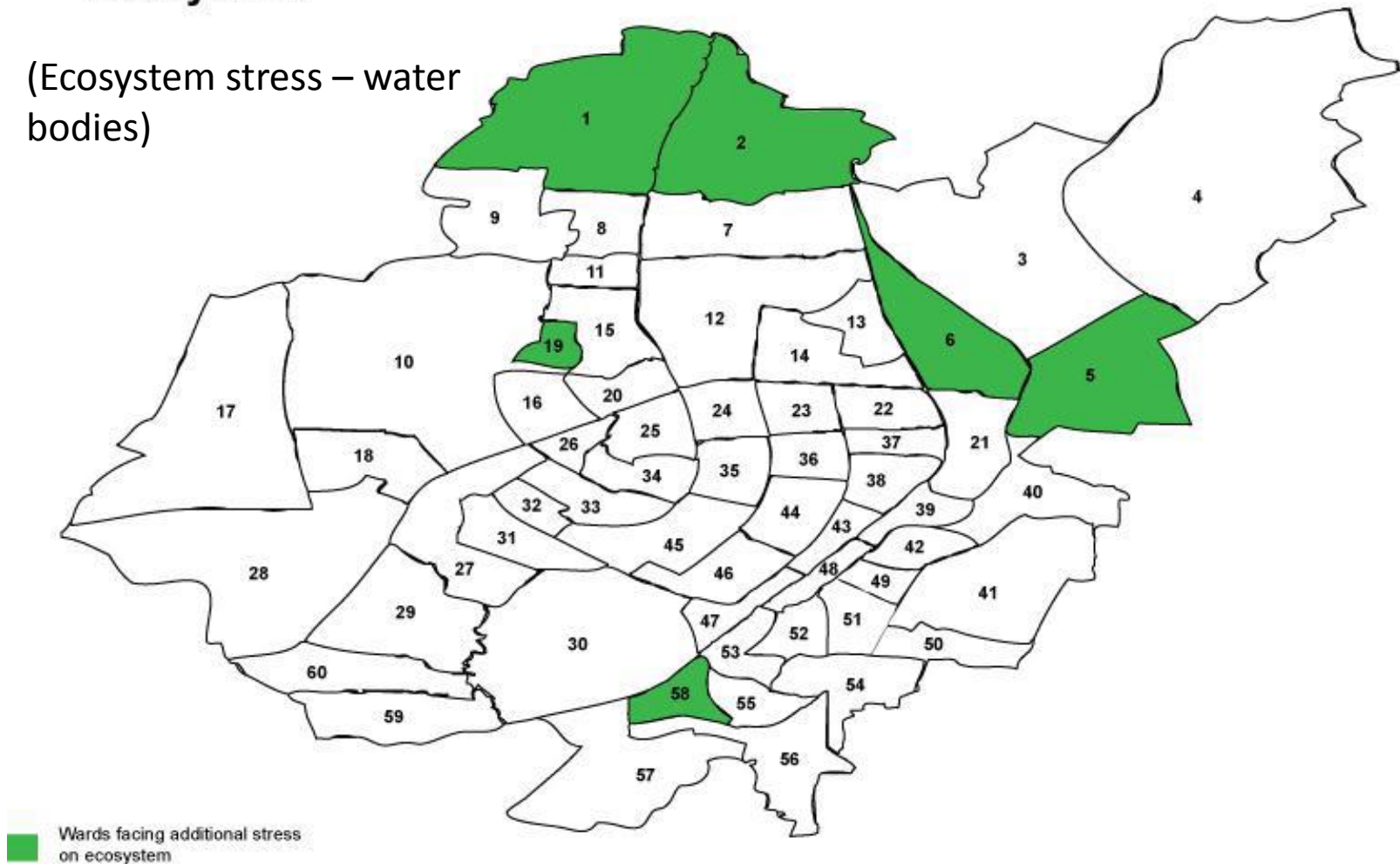


Increased temperature impact

Bhubaneswar

Ecosystem

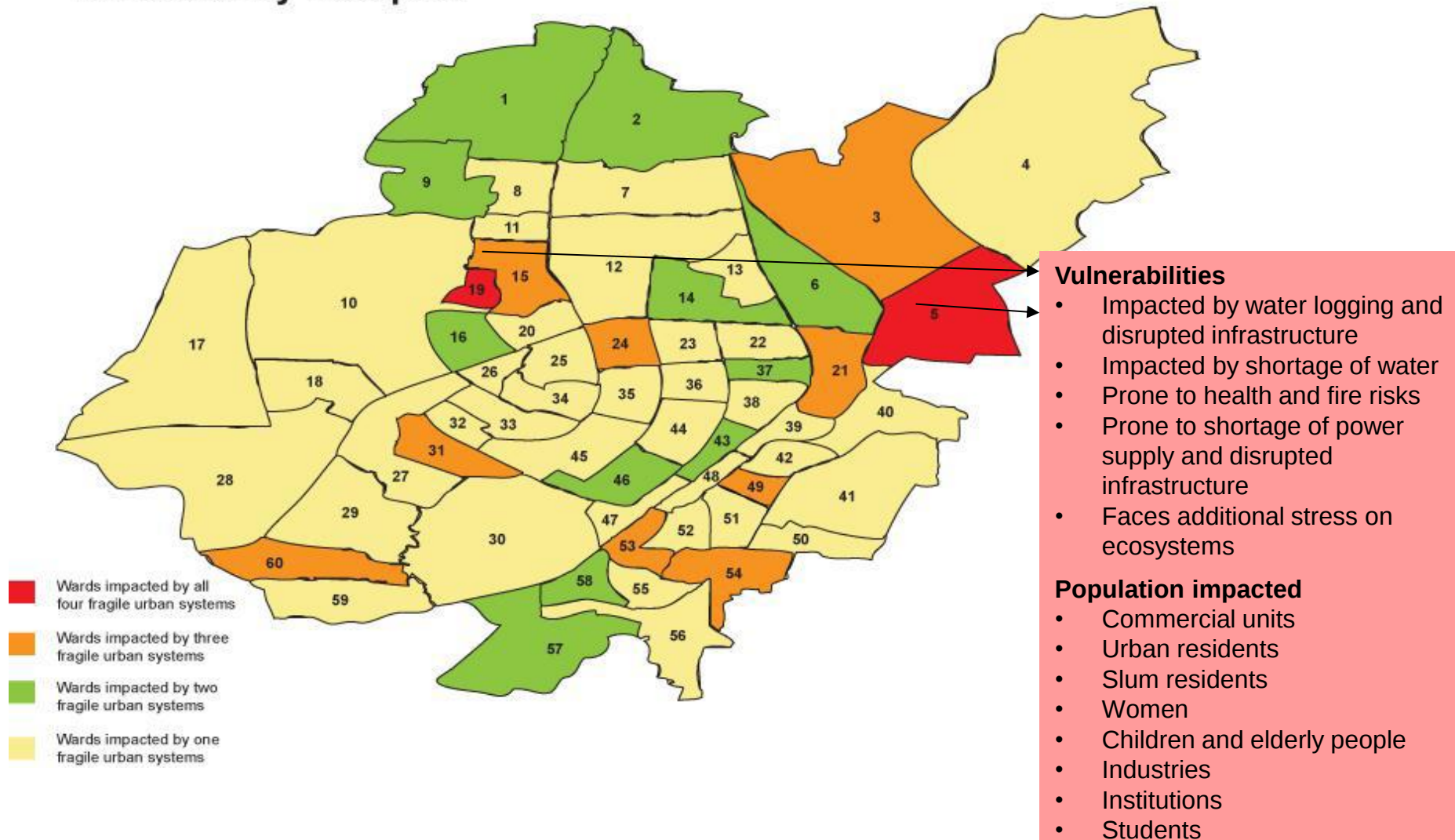
(Ecosystem stress – water bodies)



Vulnerability Hotspots

Bhubaneswar

Vulnerability Hotspots



Proposed resilience actions

Bhubaneswar

- Bye laws should include climate change aspects
- Encouraged use of energy efficient lighting
- Provision of green belt in the city plan
- Drainage system should be provided for residential areas
- Training and capacity building on fire fighting and fire prevention should be provided

Energy efficiency in steel re-rolling mills

Energy efficiency in steel re-rolling mills

- Duration: 2004-2012
- Implementing Partners: UNDP and Ministry of Steel
- Budget: Total: US\$ 14.03 million
 - Global Environment Facility: US\$ 6.75 million
 - Steel Development Fund, GoI: US\$ 7.28 million



Results

- Identification and popularization of 10 technology packages for intervention in the re-heating furnace and 19 eco-tech options to enable greater energy efficiency in rolling mill processes
- Significant savings through implementation of energy-efficient technologies in 29 SRRM units resulting in savings of 87,819,968 MJ of energy and reduction of 131,738 tCO₂.
- Post commissioning measurements have been conducted in 16 of them. This has resulted in:
 - Saving of 10,077 kilo litres furnace oil
 - 6,345 tons of coal
 - 13,706,205 KWh (units) of electricity
- Greater awareness generated through training and capacity building programmes to internalize energy efficiency and conservation measures

Wind power for captive use

Company	State Bank of India
Location of intervention	Maharashtra, Tamil Nadu and Gujarat
Type of intervention	Wind energy

- SBI had initiated “Green Banking” activities in the year 2007 by way of putting in place a comprehensive board approved policy
- Under this intervention 10 wind mills were commissioned in the states of Maharashtra (6), Tamil Nadu (3) and Gujarat (1) - Total 15 MW
- Total investment incurred: INR 100 crores in March, 2010
- Total generation in FY 2012-13: 51 million units (kWh)
- Estimated pay back period: 10 years

Resource energy efficiency optimization through awareness

Company	KPIT
Location of intervention	Pune, Maharashtra
Type of intervention	Reduction in fresh water consumption through technological innovations

- Revamp of sprinkler system by eliminating the use of fresh water for gardening purposes
- Detailed survey carried out for identifying and arresting water leakages in the premises
- Water pressure adjusted at different outlets for minimizing wastage of water
- Concept of dry toilets for reduction in consumption of water
- Employee engagement and education through posters, screen savers etc.

Savings of water consumption by 22% i.e. 14,500 cum. per annum.

Waste to Energy

Company	Hindustan Unilever Limited (HUL)
Location of intervention	Nasik, Maharashtra
Type of intervention	Waste to energy from gas produced through ETP's sludge digestion

- Sludge Digester was installed in the ETP. This facilitates anaerobic digestion, thereby converting a part of the organic waste into Methane gas. Methane gas is then fed into the engine for generating electricity and used to power street lights.
- Biogas plant capacity is around 2500 kg/day
- Gas produced is approximately 175 m³ per day which is equivalent to 78 kg of LPG or 315 kWh per day of electricity
- Total investment incurred: INR 56 lakh in March, 2013
- Estimated savings through project lifetime: INR 100 lakhs

Rooftop Solar PV

Company	Mahindra Lifespaces
Location of intervention	Chennai, Tamil Nadu
Type of intervention	Solar Photovoltaic (SPV) based power generation

- Realizing the uncertainty in electricity supply and to lessen dependency on power utilities, Mahindra Lifespaces installed a 75 kW Solar PV plant at their site
- Diesel generators were used earlier but frequent diesel price hikes were increasing cost of generation. They also caused air and noise pollution
- Estimated annual generation: 116,000 kWh
- Estimated saving in electricity bills: 8%

Indira Paryavaran Bhawan

- The Indira Paryavaran Bhawan is a project of MoEF&CC for Construction of New office Building at Aliganj, Jor Bagh Road, New Delhi
- The basic design concept is to make a “net zero energy” green building
- The building is targeted to achieve LEED India Platinum Rating and GRIHA 5 star rating
- Many energy conservation measures are adopted to optimize the overall design load:
 - High Efficiency Solar Panels are planned to achieve Net Zero criteria
 - Energy efficient T-5 and LED fixtures innovative chilled beam system for cooling
 - Pre-cooling of fresh air from toilet exhaust using heat recovery wheel in order to reduce load on chiller plant

Indira Paryavaran Bhawan

- Water cooled chillers
- Double skin air handling units with variable frequency drives
- Geo thermal heat exchange technology for heat rejection from Air-conditioning system
- Innovative energy saving regenerative lifts
- Water conservation measures like:
 - Low discharge water fixtures
 - Dual flushing cistern
 - Low demand plants in landscaping
 - Drip irrigation system for green areas
 - Make up water tank for chiller plant, irrigation
 - Rain water harvesting system

THANK YOU