

Mainstreaming Climate Change considerations into **Spatial Planning**

—
**Recommendations for Country level plans (National Spatial Plan)
and Region level plans (Regional Plans)**





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Why mainstream Climate Change considerations into Spatial Planning?

- **Temperature Increase (average, minimum and maximum)**
- **Increase of hot extremes**
- **Decrease of cold extremes**
- **Annual Decrease in precipitation (for RCP8.5 scenario)**
- **Redistribution in annual precipitation cycle**
- **Less summer precipitation (risk of drought)**
- **Increase in number and intensity of extremes (risk of floods)**

Report on "CLIMATE EXTREMES PROJECTIONS FOR MACEDONIA UP TO 2100"
by Dr. Vladimir Djurdjevic for UNDP, MoEPP of Republic of North Macedonia

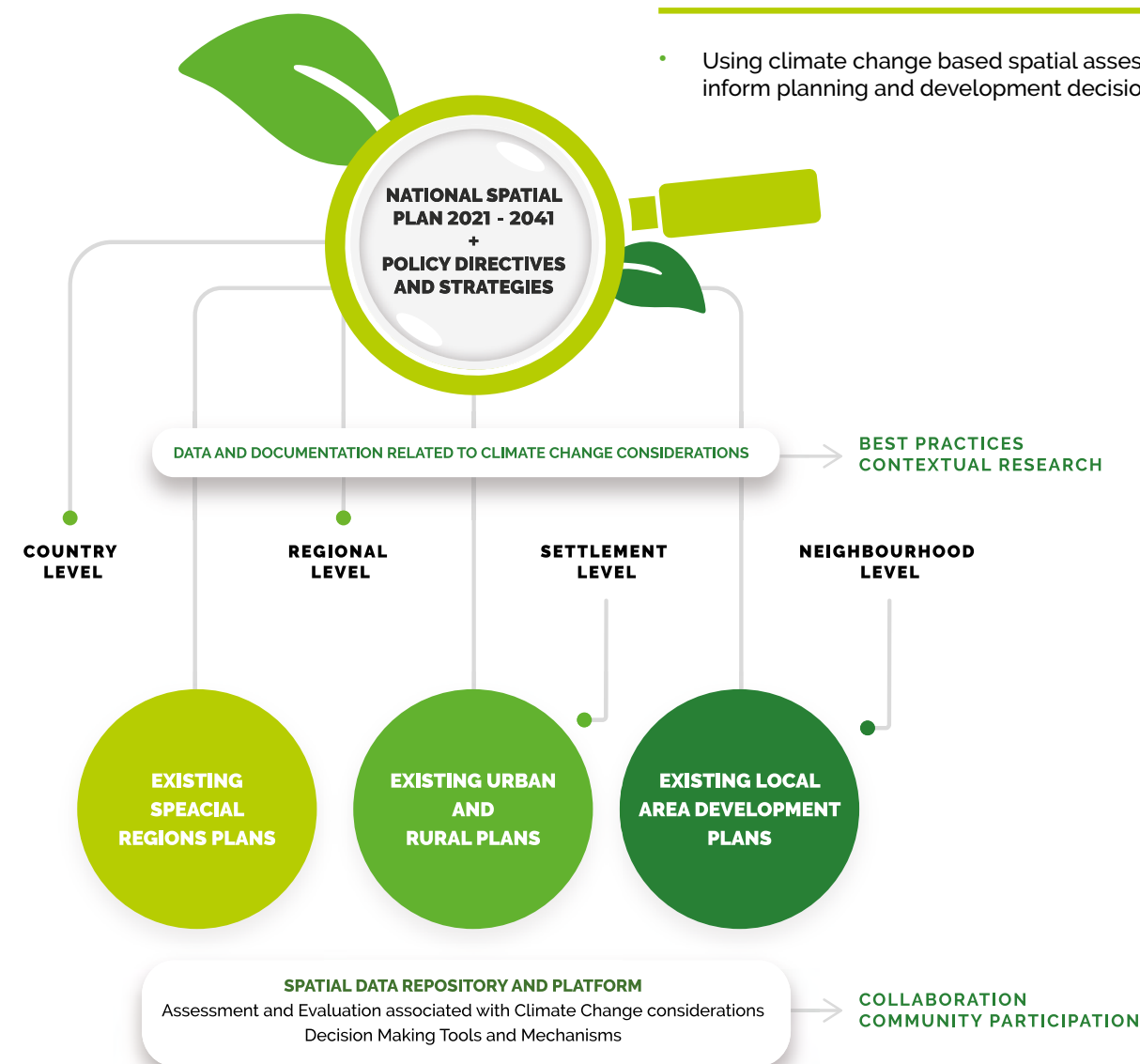
Climate Change is a result of interplay of multiple causes and consequences. The primary cause being an imbalance in the green house gases emitted into the atmosphere which triggers a systemic and cyclic shift in normal atmospherical processes resulting in changes in Global weather patterns. Such rapid changes in weather patterns affect both regional and local landscapes/ecosystems/biodiversity.

This is because local systems struggle to adapt and evolve given the margins of unpredictability of climate change triggered extreme events. Hence any approach in spatial planning should seek to understand and address concerns such as;

- 1 Which factors of Global Climatic variables are going to affect the country and its regions?
How are these going to affect the country at large?
- 2 How will different geographic regions, different types of ecosystems, local landscapes be affected by the Global Climate Change Variables?
- 3 Which other location specific anthropogenic factors or entities could exasperate local impacts?
- 4 Which are the most vulnerable landscapes and regions?
- 5 How well-equipped are such vulnerable regions, in addressing such risks?
- 6 What are the spatial implications of predicted climate change trends? How does these implications affect any given region or locality?
- 7 What preventive or mitigative measures can be taken to reduce the degree of impact?
- 8 What proactive measures can help regions and localities strengthen its resilience to such extreme and unforeseen risks?
- 9 How can communities and governments be prepared for extreme events?
- 10 How can new development choices be more climate change resilient?
- 11 How can existing landscapes and human habitats adapt and be more resilient?
- 12 How can the ecosystem services provided by natural systems be utilised to strengthen resilience of settlements and landscapes?

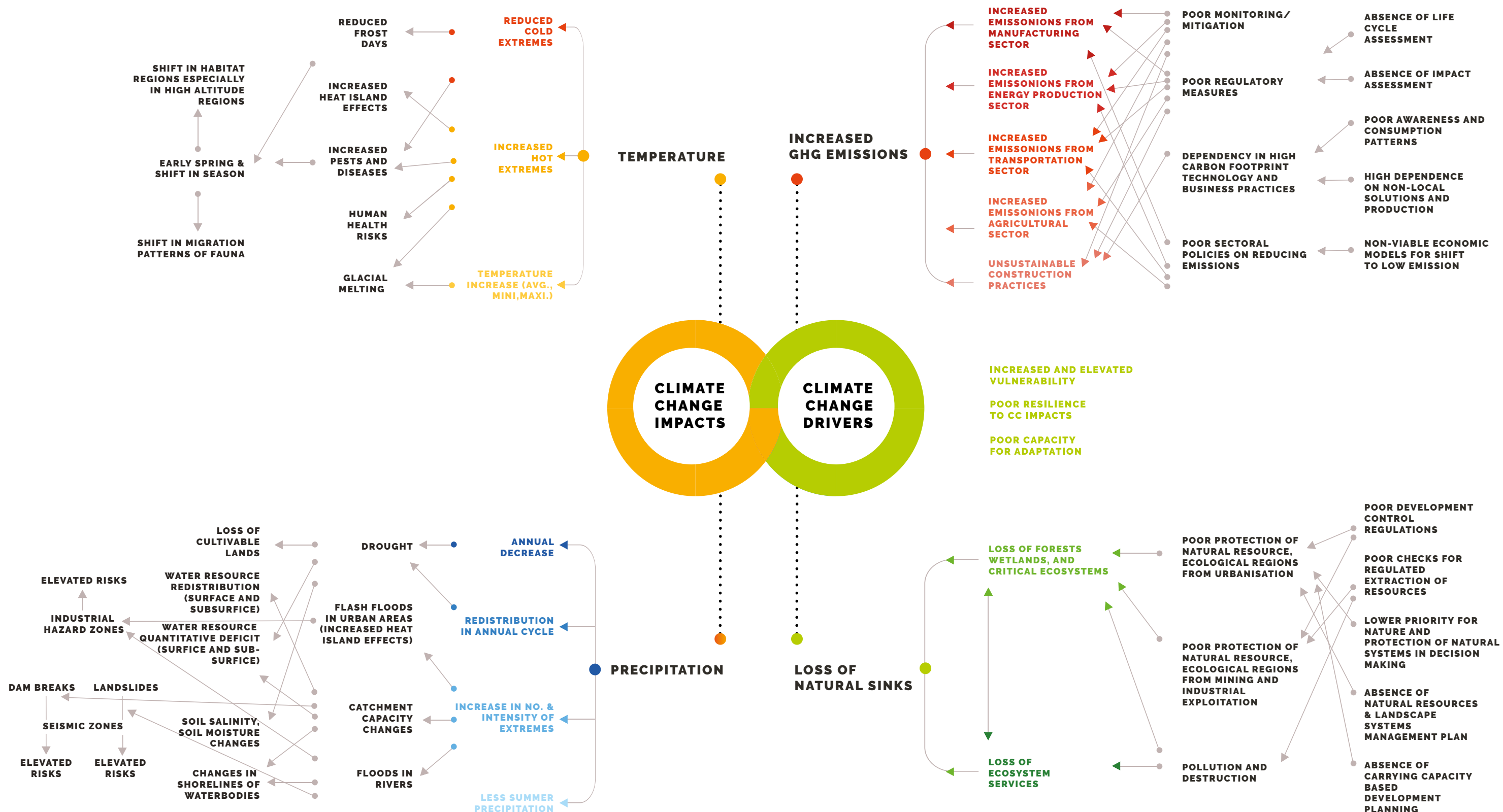
Spatial Planning and Climate Change Management Framework: Purpose and Objective

- Climate actions and strategies in all levels of spatial plans (National Spatial Plans, Special Plans, Urban Plans, Land use Plans, Neighbourhood Plans).
- Connect between higher level plans and lower level plans in terms informing each other for policy making.
- Collaboration with communities, citizens and other relevant organisations in the process of spatial plan preparation at various levels (in higher level and lower level plans).
- Demographic data: In case of climate change studies and impacts, demographic data allows to estimate; carbon footprint, carrying capacity, resource need etc. These assessments could inform strategic actions with respect to; a) need and availability of resources, b) estimation of per capita ecological footprint and carbon footprint which can inform prioritised measures at various levels (from individuals to communities within any territorial limits), c) accounting of emissions.
- Incorporation of Climate Change considerations into the decision making process to determine allocation of land/area for various development projects especially with respect to addressing conflicts with land use plans or spatial plans.
- Using climate change based spatial assessments to inform planning and development decisions.



Climate Change implications in North Macedonia

Climate Change Nexus: Impacts and Drivers



What are the contextual spatial (land and landscape) parameters that can increase Climate Change risks and impacts?



NATURAL TERRAIN AND TOPOGRAPHY

Valleys surrounded by mountains and hills can have regional climatic changes and consequences. Alpine regions will have different implications and risks, floodplains and water bodies along with the catchment areas will have different local impacts and will be driven by various location specific parameters. Continental plains may have different and localised implications and consequences especially w.r.t drought and agricultural landscapes.



DEGREE OF SLOPE

The steeper slopes in regions where rainfall increases are predicted will be more vulnerable.



SOIL STABILITY

Soils which are inherently less stable because of its structural properties on slopes which are subject to intense rainfall especially with new changes in rainfall distribution would make previously less vulnerable regions more vulnerable.



SOIL TYPE

Whether with low drainage capacity etc. which can cause increased water retention that may further destabilise the land.



LAND COVER W.R.T WHETHER PERMEABLE OR NON-PERMEABLE

Non-permeable areas will cause increased rate of run-off and reduce the time of concentration of water in reaching the sink. Catchments with non- permeable surfaces are at more risk to flooding or flash floods. Permeable lands allow percolation and reduce the run-off rate and increasing the time of concentration. of water in the sink, thus reducing risk of flash floods.



LAND COVER W.R.T WHETHER VEGETATED/PLANTED OR NOT

Planted and vegetated surfaces allow water retention and percolation reducing run-off rates and thus flash floods in catchment areas.



VALLEY AREAS IN PROXIMITY TO LANDSLIDE PRONE HILLS/SLOPES

These low lying areas will also be affected by landslides and soil deposition.

FLOOD PLAINS

Flood plains are highly dynamic areas which are subjected to inundation with varying water in the river and lake. With changes in precipitation extremes and seasonal changes, the run-off from catchment will change due to increase in incident rainfall, thereby changing inundation patterns and floodplain extents.



DRY VEGETATION AND AREAS WITH FOREST FIRE RISKS

Those landscapes with dry vegetation and in dry climatic regions will be more prone to increased forest fires if these areas are found to have more increased temperatures and hot days.



ALTERED NATURAL TERRAIN RESULTING FROM CONSTRUCTION ACTIVITIES

Altered terrain affects surface water flow dynamics. This can cause flooding in new areas. Such local and regional interventions can further the impact of extreme precipitation events.



FRAGMENTATION OF SURFACE DRAINS OR NATURAL STREAMS BY ARTIFICIAL/MAN-MADE OBSTRUCTIONS

By blocking natural drains the upstream areas will be at risk of back flow of accumulated water, it can cause saturation of soil causing it to wash off and destabilise the land. When streams are obstructed the downstream water needs and soil moisture is affected adding to the drought like situation and depending on the type of stream it can also deplete the sub-surface water dynamics.



STORAGE CAPACITY OF DAMS IN CASES WHERE CATCHMENT MAY RECEIVE INCREASED RAINFALL

The altered run-off quantity generated in catchments of dams where changes in precipitation extremes are predicted is important to estimate. (Eg: some areas are predicted to see upto 60% increase in number of days with rainfall above 40mm/day and with 20% increase in daily maximum precipitation accumulation.)



DESIGN AND CAPACITY OF STORM WATER DRAINS

Often storm water drains, storm water canals and channels are designed for average. But with changes in the average and extreme rainfall events the design capacity of storm water channels/drain/canals will have to be compensated by either enhancing the design capacity or by taking passive design measures to reduce the load on the drains. Some such passive and landscape infrastructure measures includes increasing permeable surfaces in the catchment, installation of green infrastructure such as rain gardens, bio-sales etc.



Principles of Climate Change Management in **Spatial Planning**

VULNERABILITY AND
RISK ASSESSMENT

MITIGATION MEASURES
TO REDUCE RISKS

ADAPTATION MEASURES
TO ENHANCE RESILIENCE

ADAPTATION MEASURES
TO LOWER EMISSIONS

EMBEDDING INTO THE PLANNING
PROCESS (ACROSS PLAN PREPARATION,
EVALUATION AND IMPLEMENTATION)

ACROSS SCALES
OF PLANS

INTEGRATING
MULTIPLE SECTORS

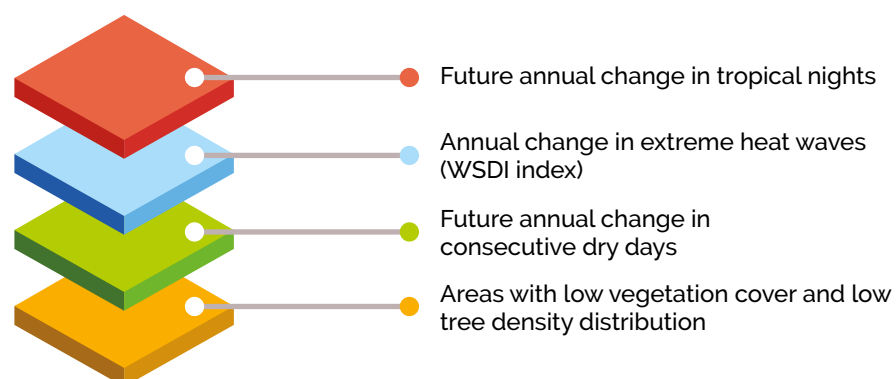
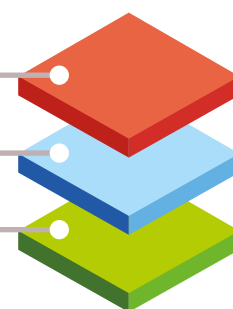


A. Identification of spatial implications and elevated risks associated with Climate Change

Cumulative multi-layer spatial assessment

CCI.1 Areas with elevated drought risks triggered by CC

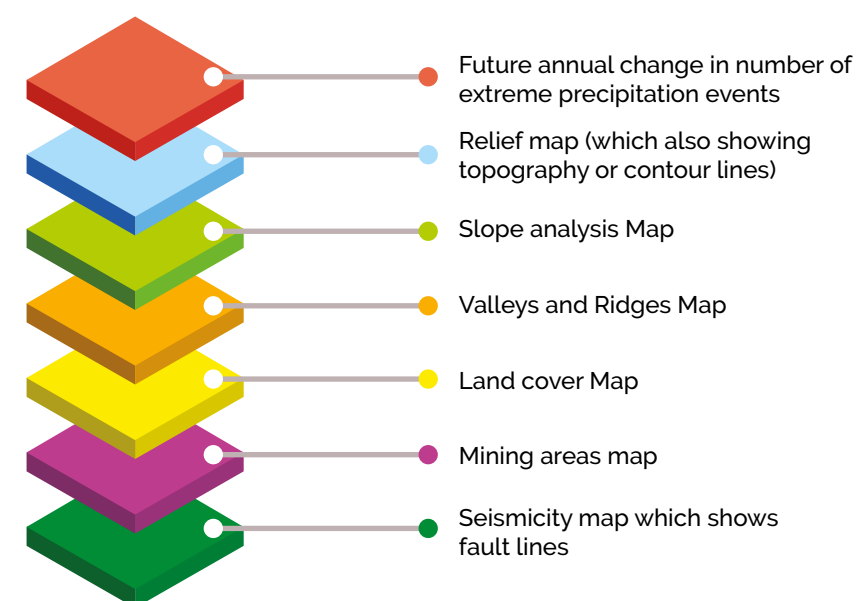
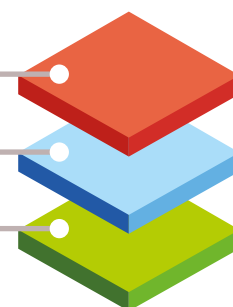
- Temperature variability prediction map for country (for three scenarios)
- Aridity index map for the country
- Sub-surface water (aquifer) condition map (areas with degraded or and depleting aquifer/ground water)



Areas with higher Heat wave risks triggered by CC predictions CCI.2

CCI.3 Areas with additional Flood risks triggered by CC

- Future annual change in number of extreme precipitation events
- Flood prone areas w.r.t rivers (Floodplains and drainage areas with catchments/basins boundaries)
- Valleys and Ridges Map

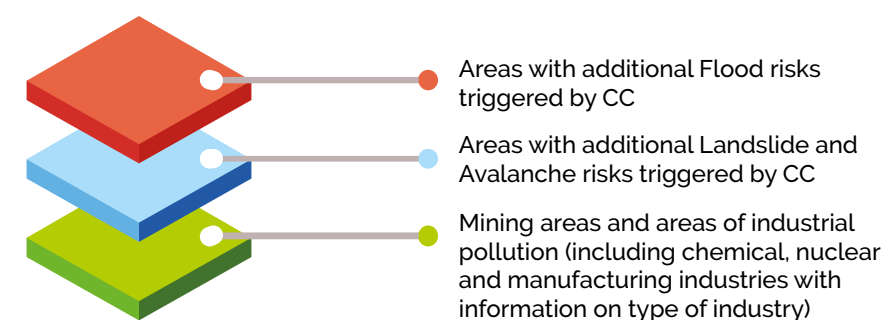


Areas with additional Landslide and Avalanche risks triggered by CC

CCI.4

CCI.5 Habitat vulnerability triggered by CC

- Temperature variability prediction map for country (for three scenarios)
- Wildlife habitat map (water and land habitats and ecosystems)
- Areas with additional Landslide and Avalanche risks triggered by CC
- Relief/Terrain map with contours and elevation data

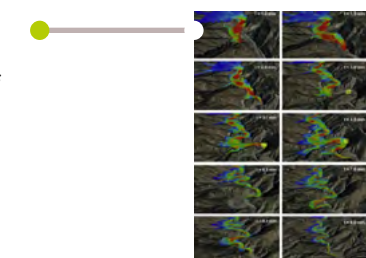


Areas of industrial disaster risks elevated by CC implications

CCI.6

CCI.7 Habitat vulnerability triggered by CC

- Dams location-catchment and downstream drainage area mapping w.r.t various models of incident rainfall in the catchment



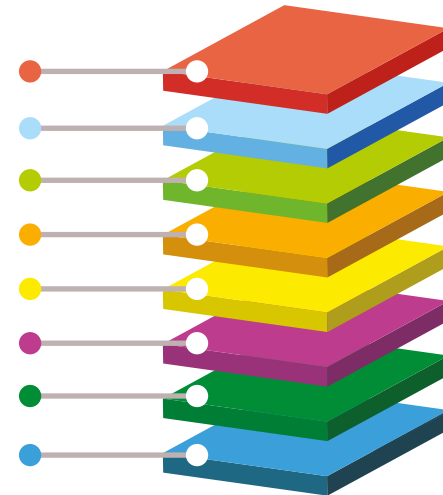
B. Decision Making Spatial Tools and Strategies at country (Nc) and region (Rc) scale Cumulative, multilayer spatial assessment - Outputs

Nc.1 National Special

These map will be a useful reference for management and decision making for national authorities and has to be supported by detailed legends and qualitative/quantitative spatial and non-spatial information.

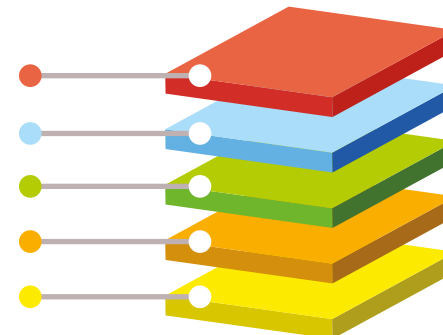
National Comprehensive Hazard Zonation Map

Natural disaster events and extreme events of past
Seismicity map which shows fault lines
Soil erodibility map
Relief Map (Terrain Map)
Mining areas and areas of industrial pollution
Dam spills and associated flooding risk map
Map showing all existing human settlements (Land cover Map)
Map showing all future developments



National Resource Management Regions Map

Productive Landscapes suitable for Agriculture and Cultivation
Ecosystems Map
Water Resources Map
Mineral Resource regions map
Map showing rivers and stream networks

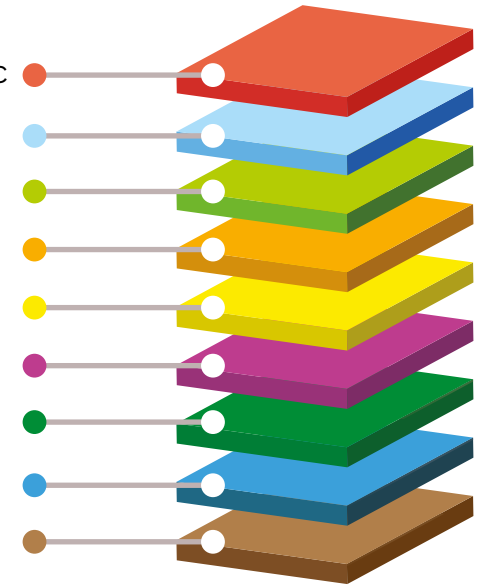


National Adaptation Regions Map

These are those regions which has been identified to be affected by climate change extremes.

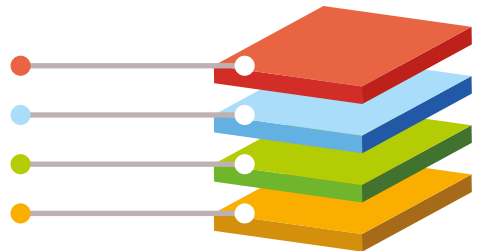
The priority regions for adaptation would be those regions which has been identified to be affected by climate change extremes.

Areas with elevated drought risks triggered by CC
Areas with higher Heat wave risks triggered by CC predictions
Areas with additional Flood risks triggered by CC
Areas with additional Landslide and Avalanche risks triggered by CC
Habitat vulnerability triggered by CC
Areas of industrial disaster risks elevated by CC implications
Catchments with elevated risks for Dam breach triggered by CC risks of increased precipitation
Map showing all existing human settlements (Land cover Map)
Map showing all future developments



Nc.2 Development Suitability and Suitability based Strategies for sectoral development

Areas of no or low vulnerability to disasters and extreme events
Areas of no or low agri suitability
Areas of no or low environmental resource value
Areas of existing development



Deduce areas falling under Hazard zones, Resource regions and Adaptation regions from the country map

The areas would be most preferred for any future development and expansion. Lower level spatial plans could use this reference to avoid areas of risk and vulnerability while planning.

Sectoral policies and sectoral plans could refer to this spatial information to inform there respective policy making. (This is especially relevant for those sectors which do not have specific spatial assessments related to risks and vulnerabilities associated with climate change.

Strategies

Nc.3

Spatial strategies and protocols/guidelines for National Reserves/Parks/Sanctuaries Management

Include strategies for conservation and protection of these areas, identification of responsible authorities, institutions in charge as well as management strategies for individual National Parks/Reserves/Sanctuaries.

Provide information on various protocols/guidelines for any activity having any spatial implications associated with tourism sector, forest management, habitat and species management/monitoring etc. (if such protocols doesn't exist, these will have to be prepared and approved by concerned authorities).

These strategies and protocols to be evolved through a joint exercise in collaboration with Ministry of Environment and Physical Planning, Agency of Spatial Planning and Management authorities in-charge of national reserves/park/sanctuaries.

Derived through collaborative efforts involving disaster management authorities. The spatial output map, **"National Comprehensive Hazard Zonation Map" under Nc1** is the supporting reference map for developing appropriate strategies and guidelines of management of these regions.

Consider regional differences and hence along with the overarching protocols, specific protocols for unique and regional differences could also be integral in these protocols.

National spatial strategies and protocols/guidelines for Hazard Zone Management

Nc.4

Nc.5

National spatial strategies and protocols/guidelines for Climate Change related Risk Management and Adaptation

Derived through collaborative efforts with experts and concerned authorities. To be evolved with reference to best practices from across the world and will have to be articulated to suit to the social, environmental, and administrative strengths unique to the country.

The spatial output map "National Adaptation Regions Map" under Nc1 is the supporting reference map for developing appropriate strategies and guidelines of management of these regions.

Prioritise interventions in these critical areas for climate change impact management, followed by areas outside these which are affected by climate change.

Nc.6

National spatial strategies and protocols/guidelines for Resource Regions Management

Food Security and Management

Strategies and mechanisms to protect highly productive lands which are most suited for agriculture and cultivation. Ensure that these landscapes are protected Strategies for sustainable agriculture Prescribe preferred agricultural practices for various soil types and terrains.

For Water Security and Management

Strategies and mechanisms to protect water resource regions, areas with high risk to pollute critical water resources Adaptation needs to revive those water resource regions which are degraded.

For Mineral Resource Management

Strategies and mechanisms to regulate regions which are mineral rich. Delineate mineral resource regions, information on mineral resource availability in various reserves, Prescribe phasing of mineral exploration, extraction, limits to extractions of minerals, allowable methods for extraction based on risks to other natural resources, landscape, land etc.

Nc.7

Recommendations to inform sectoral strategies to address climate change related risks

To be evolved with reference to identification of specific climate change implications that are spatial in nature for any given sector.

For sectors especially, agriculture, water, forestry, industries etc. such recommendations would enable, better informed sectoral management decisions.

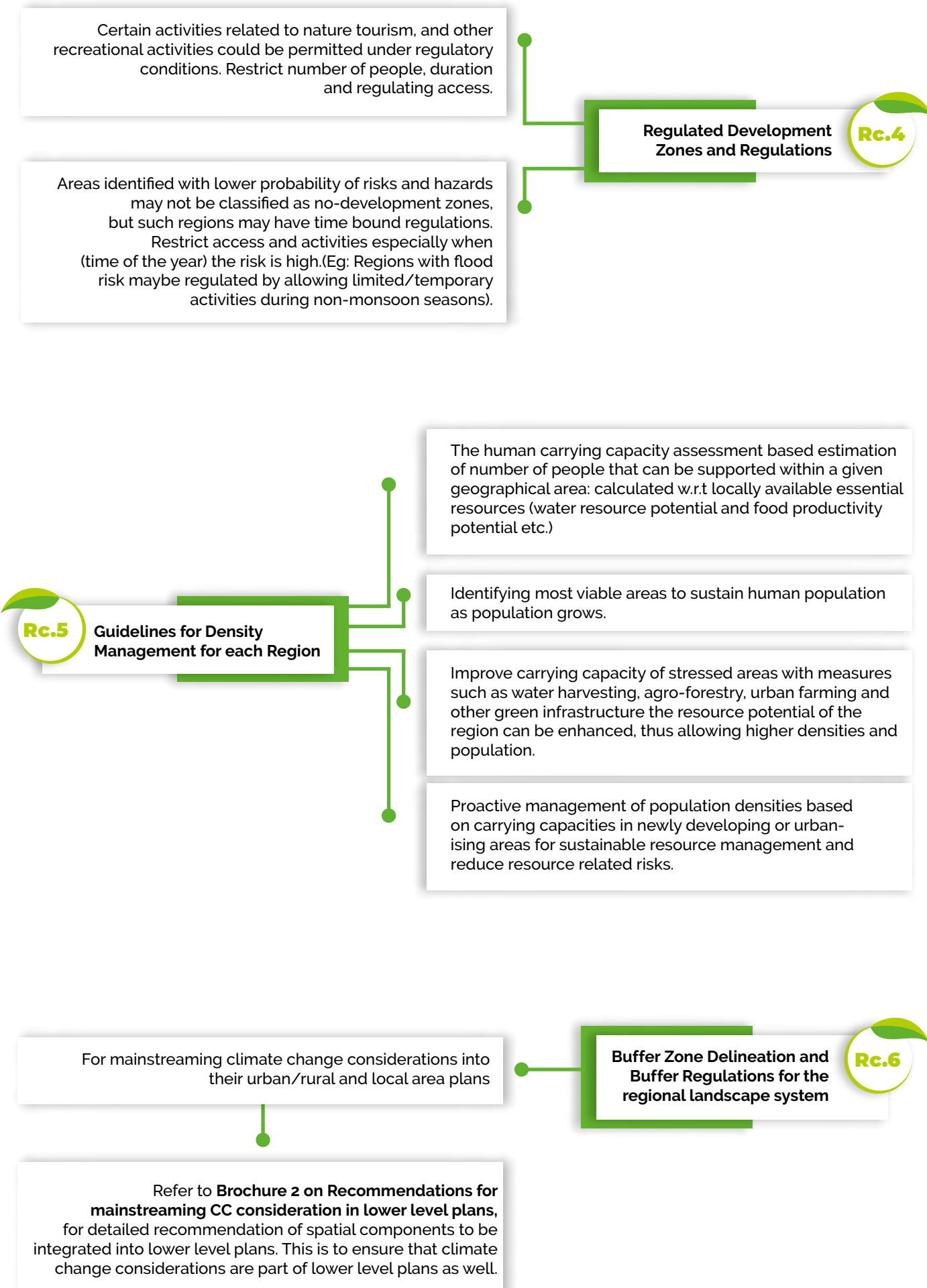
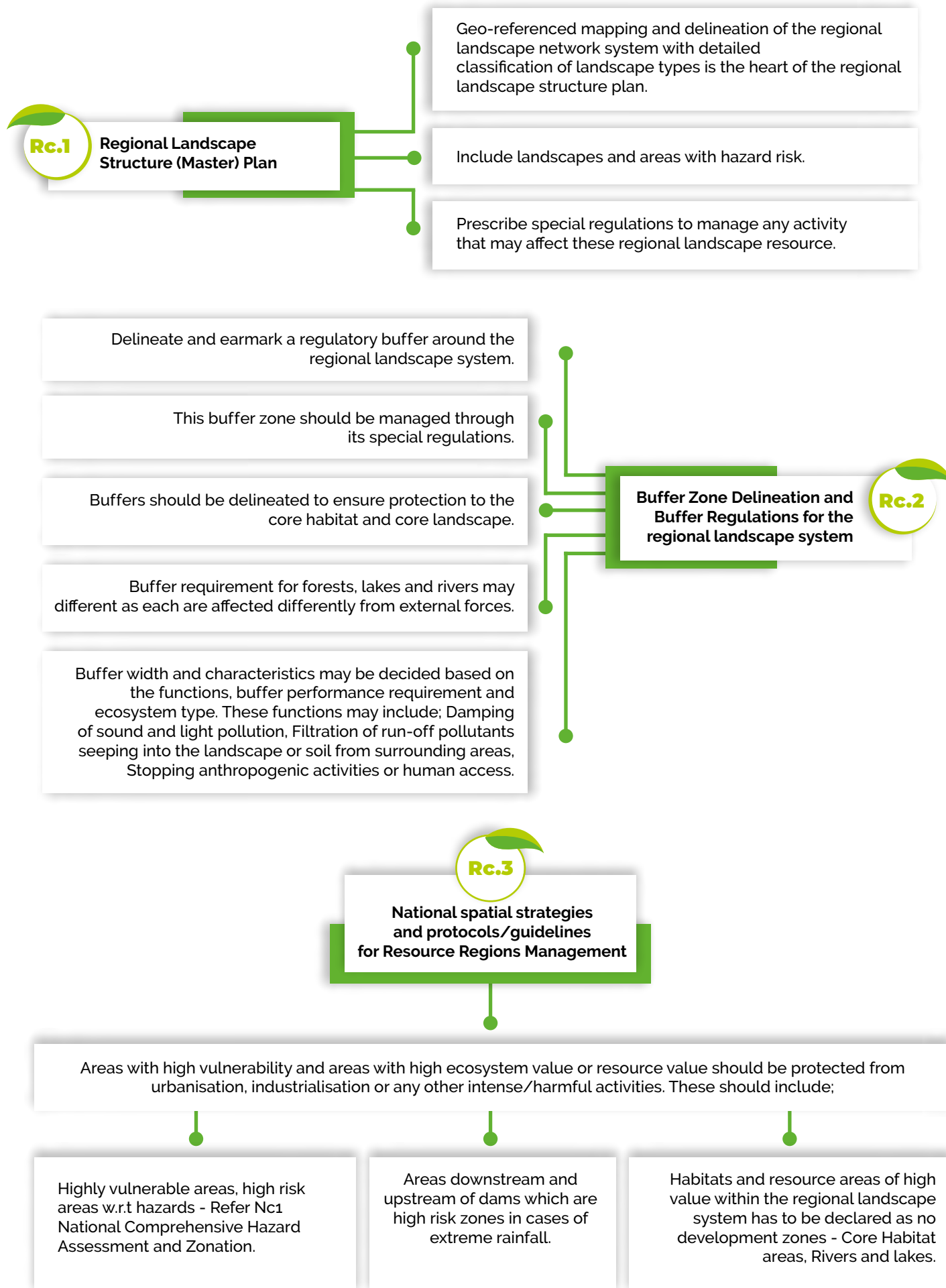
Enable the mobilisation of different sector including industries and skilled workers for emergency production and services in case of any extreme events (eg: the recent CoVID-19 pandemic has shown the need to establish protocols for such extreme events).

Enable every sector to be capable of handling emergency protocols, enough preparedness training and regular drills are critical.

The spatial planning components related to extreme events and climate change consideration across scales can provide spatial information for emergency management.

Recommendations to inform Disaster Management Authorities and emergency Protocols/guidelines for different sectors

Nc.8



Integrating Climate Change considerations into Spatial Planning

01

INCORPORATE CLIMATE CHANGE CONSIDERATIONS INTO THE LARGER METHODOLOGY OF SPATIAL PLANNING

02

INCLUDE SPATIAL DATA ON CLIMATE CHANGE IMPLICATIONS INTO THE SPATIAL DATA INFRASTRUCTURE (SDI) AND INSPIRE PLATFORM

03

PARAMETERS FOR EVALUATION OF SPATIAL PLAN FOR CLIMATE CHANGE INTEGRATION

04

PERFORM SPATIAL ANALYSIS AND COMPREHENSIVE ASSESSMENTS OF CLIMATE CHANGE PARAMETERS AND IMPLICATIONS USING TOOLS LIKE GIS, DPSIR AND SWOT

05

INCLUDE SPATIAL STRATEGIES FOR CLIMATE CHANGE MANAGEMENT (MITIGATION, ADAPTATION AND RESILIENCE BUILDING)

06

INTEGRATE CC CONSIDERATIONS INTO DECISION MAKING RELATED TO SPATIAL PLAN (PRIORITISATION, TRADE-OFFS ETC.)

07

EVALUATE FINAL SPATIAL PLAN TO EXAMINE INTEGRATION OF CLIMATE CHANGE CONSIDERATIONS/ASSESSMENTS

08

USE RECOMMENDATIONS TO INFORM LAND MANAGEMENT AND LAND REGULATIONS AND POLICIES AT NATIONAL, AS WELL AS LOCAL LEVEL



03

STRATEGIES FOR SPATIAL PLANNING AND MANAGEMENT OF CC IMPLICATIONS

04

EVALUATION OF THE PROPOSED PLAN INCLUDING THE CONTENT OF SPATIAL PLAN FOR CC ASPECTS

FINAL SPATIAL PLAN
INTEGRATING CLIMATE
CHANGE

CC BASED SPATIAL ANALYSIS
AND COMPREHENSIVE
ASSESSMENTS USING TOOLS
LIKE GIS, DPSIR, SWOT

02

CC RELATED SPATIAL DATA AND
DOCUMENTATION,
EVALUATION PARAMETERS AND
GUIDELINES

01



Supporting and Facilitating instruments for integration of Climate Change Aspects

01

ADVANCED TOOLS FOR SPATIAL DOCUMENTATION AND ANALYSIS INCLUDING MANAGEMENT OF DATA PLATFORM

02

INSTITUTIONAL CAPACITY BUILDING (TRAINING AND WORKSHOPS FOR NEW TOOLS)

03

COLLABORATION (BETWEEN SECTORAL EXPERTS AND INSTITUTIONS BOTH NATIONAL AND INTERNATIONAL)

04

AWARENESS AND COMMUNITY PARTICIPATION (ESPECIALLY VIABLE FOR LOWER LEVEL PLANS)

05

HAND-HOLD OTHER DEPARTMENT AND SECTORS TO INFORM ABOUT SPATIAL IMPLICATIONS WITH REFERENCES TO PROPOSED SPATIAL PLAN AND STRATEGIES FOR CLIMATE CHANGE MANAGEMENT