

# Building Resilient Urban Communities

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# Institutional Case Studies

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## Upcoming Events

- **Symposium I - “Lessons learnt from European informality’** between 23rd and 24th of October 2019 in Krems, Austria
- **Symposium IV - “Defining new planning and design paradigm”** between 29th and 30th of November 2019 in Bhopal, India
- **Symposium III - ”Training needs for urban resilience in India”** between 3rd and 4th of December 2019 in Mumbai, India

Partner Institution	Nature of Collaboration		
	Institutional	Intra-Indian	International
<b>KRVIA, Mumbai</b>	Developing Resilience within Communities for Mitigating Impact Of Rampant Development and Conserving Heritage Within a Historic Indian Native Town.	Enhancing Urbanism to Community Resilience in Climate change related Water Stresses in Urban and Peri-urban areas.  Transformative resilience- Everyday Urbanism as a key to understand Marginalized Urban Communities.	Socio-Ecological Resilience in Peri-Urban Coastal Cities: Climate Change and its implications on highly contested urban peripheries of Mumbai
<b>SPA, Bhopal</b>	Learning Resilience from the Ziro Valley	Transformative resilience- Everyday Urbanism as a key to understand Marginalized Urban Communities	Enhancing Institutional and Community Resilience to Climate Change Impacts in the Jodhpur City Region  Enhancing Institutional and Community Resilience to Climate Change Impacts in the Jodhpur City Region
<b>NIT, Hamirpur</b>	Climate resilient planning and design for vulnerable urban hill settlements: A Case of Kullu and Manali region	Climate resilient adaptation of built-form in Hilly Region through Traditional Wisdom and best practices – A case of Himachal Pradesh	
<b>SPA, Vijayawada</b>	Urban Energy and Spatial Dynamics towards Climate Resilience: A Case of Bangalore	Climate resilient adaptation of built-form in Hilly Region through Traditional Wisdom and best practices – A case of Himachal Pradesh	Thermal Comfort study for mitigating heat stress through climate responsive planning: A case study of Vijayawada

# Case Study Briefs

## Kamla Raheja Vidyanidhi Institute for Architecture and Environmental Studies, Mumbai, India

### Developing Resilience within Communities for Mitigating Impact of Rampant Development and Conserving Heritage Within a Historic Indian Native Town– A case of Kalbadevi, Mumbai

#### Abstract:

The recent World Heritage tag for the Gothic Architecture and the Art Deco Ensemble in Mumbai prompts one to relook at the status of the communities, their livelihood and their housing within the Inner Fort Precincts (Bohra Bazaar) as well as the Native Town outside the fort precinct (Kalbadevi).

The once vibrant and boastful precinct now wears a decrepit look. The crumbling historic built stock juxtaposed with the slick high rises is reflective of a 'fait accompli' attitude of the city determined to change its skyline and further densify its built stock. Also responsible are the originally well intentioned policies which over period have failed and now are found to be difficult to revoke. Inadvertently, this has led to a gradual erasure of the architectural identity incrementally built by generations who were able to put Bombay on the global map earning it an epithet of The City of Gold. The new developments are also oblivious to the problems of gentrification and the imminent ecological impact on this coastal city in the context of the Climate Change.

In the last two decades, the urban growth coupled with the Infrastructure development and multiple attempts at redevelopment of historic core has led to a situation where the real estate market forces coupled with lack of political will to overhaul archaic and failed policies have created a notion of the inevitability of redevelopment and also have been able to manufacture consent amidst the popular imagination. Thus we have Bhandi Bazaar Redevelopment, the Eastern Waterfront Development, the Mill Land Development and the Coastal Road & Nhava Sheva Connectivity though being challenged and have been taken up in judicial deliberations, are still acceptable in the public imagination. The Infrastructure projects like the underground Metro if implemented with all care required including the last mile connectivity, can be a boon and an alternative to the private vehicle intensive mobility, and yet the manner of its implementation has forced many a citizen groups to knock on the judiciaries doorsteps.

While the 'development' lobby continues unabated in its zest, there exist discernible voices of caution amidst this clamour,

aware that what we will lose in the city's over enthusiasm is irrevocable. These voices coming from the affected communities, conservationists and historians, however, are being looked down as being regressive and stuck in the past.

#### Objectives:

- ⇒ Assessing the aspects of Risk and Resilience within the historic (native) towns under intense urban development pressures, while including the ecological, cultural & socio-economic sustainability.
- ⇒ To develop dynamic models of interaction, as Urban Designers and Conservationists, between various stakeholder groups based on their values, interests and aspirations. The studio will also seek to enrich the base data of the housing and livelihood conditions and make it available to the stakeholders in an easy to understand and use info graphic format.

#### Expected Outcomes:

- ⇒ Mapping the physical contemporary layer.
- ⇒ Building a timeline of the native town highlighting the demographic dynamics and the correlating urban growth
- ⇒ Interpretations of Interactions with the stakeholders, interviews.
- ⇒ Mapping the activities, demographics, economies
- ⇒ Comparisons with newer forms of goods market economies
- ⇒ Understanding and establishing the interrelationship of mixed use activities
- ⇒ Identifying community networks and potentials
- ⇒ Strategies to engage the community in drafting the idea of better quality of life.
- ⇒ Drafting frameworks to build community resilience and strengthen networks.

## Enhancing Urbanism to Community Resilience in Climate change related Water Stresses in Urban and Peri-urban areas: A case of Urban and Peri-Urban areas of Mumbai

### Abstract:

There is a need to identify the stresses arising out of climate change and other factors to ascertain as to how the communities can adapt to these detrimental influences. The climate change impacts that are affecting cities the most are the concerns over availability of water and of late the rising temperatures leading to heat stress.

Water as a vital human need is very critical and should be the prime consideration for all decisions related to spatial planning of cities. We need both continuous availability of water as well as protection from the devastating consequences of either scarcity or excess water as both scarcity and flooding have now become a common phenomenon in cities across India.

Water stress in the urban and peri urban areas through poor fresh and waste water management is getting aggravated with time and need to be looked from the perspective of enhancing community resilience through spatial planning and institutional participation. Communities in these places have been managing and coping up with the stress effectively through traditional knowledge systems. Of late these established systems are losing their utility due to pollution as well as to the external support system of piped water supply from far off places.

A comparative study of 'communities' along with a management of

fresh and waste water resources will be conducted to arrive at spatial planning strategies to enhance resilience. Institutional arrangements to cope up with the stresses at various levels will be studied to suggest suitable mechanism for enhancing institutional resilience for informed decision making.

### Objectives:

- ⇒ To assess the sensitivity, adaptive capacity and coping mechanism of communities to water stress in urban areas
- ⇒ To derive a mechanism for assessing Institutional and community arrangement for enhancing resilience to water stress
- ⇒ To propose a policy framework as well as spatial strategy for enhancing institutional and community resilience to water stress

### Expected Outcomes:

- ⇒ Macro and micro understanding of terrain, settlement patterns, water resources, their management as well as their stresses
- ⇒ Spatial strategies for enhancing community resilience to water stress
- ⇒ Adaptive framework for institutional resilience to water stress

## Transformative resilience- Everyday Urbanism as a key to understand Marginalized Urban Communities: A case of Gazdhar Bandh Slum, Mumbai

### Abstract:

As the world is facing the challenge of environmental change, low income countries, developing countries will be the most affected one. Especially, the level of poverty, the rapid pace of urbanization and a lack of education about climate change increase vulnerability and aggravate the effects of climate change in these countries. Innovative urban policies and practices have shown that adaptation to some of these effects is possible and can be built into development plans. These include community-based initiatives led by organizations formed by the urban poor, and local governments working in partnership with their low-income populations.

The case in context, Gazdhar Bandh is one such community which

is facing the immediate challenges of climate change, environmental risks, and the associated physical well-being. Being located near the seashore, the eminent issues are environmental pollution, rising water levels due to surrounding urban developments, access to civic services, overall spatial quality of the settlement and last but not least the socio-political representation in development debates of the Mumbai city.

Apart from conventional documentation and data gathering, the study will also employ various methods of data collection such as narratives, structured interviews, focused group discussions with the community and individual as participant.

**Objectives:**

To study the tacit and explicit risks posed by the climate change to marginalized communities and the adaptive transformation of its everyday urbanism

**Expected Outcomes:**

A systemic overview of everyday urbanism encompassing individual and community practices and its response to immediate and perceived risks posed by climate change.



**Gazdhar Bandh Slum, Mumbai**

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## Socio-Ecological Resilience in Peri-Urban Coastal Cities: Climate Change and its implications on highly contested urban peripheries of Mumbai: A case of peri-urban areas of Mumbai

**Abstract:**

“Thirteen of the world's 20 largest cities are located on the coast, and more than a third of the world's people live within 100 miles of a shoreline” (World Bank 2010). Coastal areas face multiple risks related to the climate change crisis and allied bio-geo-climatic variability thus affecting a large population. Vulnerability of coastal areas to climate change is an issue that has gained attention globally. Peri urban areas have peculiarities and challenges which are different from urban cores and these needs to be addressed while dealing with issues of ensuring resilience. They are often characterized by communities whose existence and livelihoods have been traditionally dependent on the environmental resources which are undergoing rapid change with time. The focus of the study centres on the threatened communities, their vulnerable habitats and their environment dependent livelihoods which may be affected adversely by the frequent and erratic climatic events.

Governmental bodies, professionals and organizations in the countries of the global south, often responsible for management and ensuring safety of its citizens, do not necessarily have the right tool kits/ indices for vulnerability assessment nor for ensuring resilience of such habitats.

**Objectives:**

To understand and illustrate systems and methods involved in ensuring Socio-ecological resilience of peri urban communities of the global south through the techniques of documenting and analyzing the effects of climate change related transformations on three peri-urban land-water edge settlements of Mumbai.

**Expected Outcomes:**

- ⇒ To put together a comprehensive Socio-ecological Resilience model for coastal peri urban habitats covering sea-edge, estuarine and riverine edge conditions.
- ⇒ To collate an appropriate tool kit to aid professionals/ government bodies etc to assess the vulnerability of existing and proposed developments in the rapidly urbanising peri-urban Coastal ecosystems.
- ⇒ To develop a series of educative opportunities like Open Online Coursework, GIS based Exploratory studio modules and Workshop modules for School Children in vulnerable zones.

*Saltpans and mangrove patches of Panju Island, the community's economic sustenance is heavily dependent on the natural processes of the bio-region and are highly vulnerable to climate change related effects.*

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## School of Planning and Architecture, Bhopal, Madhya Pradesh, India

### Learning Resilience from the Ziro Valley: A case study of Ziro Valley

#### Abstract:

With the discourse of sustainability as the predecessor and SDGs forming its backdrop, the Urban Resilience discourse has now entered into its third-generation, Socio-Ecological Resilience (UN Habitat, 2017). However, the role of culture still has the potential to be underscored through case studies. The above position aligns with the emerging inclination of 'resilience thinking' towards acknowledging the plurality and investigating interconnections and interdependencies within and beyond cities. (UN Habitat 2017, pp. 9). At present, as the state of the Resilience Literature is defined through formal structures, agencies and actors; there is an opportunity to put forward the indigenous knowledge systems in the body.

With the unique proposition of human and nature interaction, co-existence of formal political structures and traditional tacit anthropological systems, the Ziro Valley from Arunachal Pradesh offers opportunities to look into the cultural aspects through its integrated practices and continuums, to evolve towards a next paradigm in the Urban Resilience discourse. The local practices of urban agriculture, livelihood systems and worldview, natural resource consumption, water and forest conservation, cultural conflict resolution offers unique narratives in the part and whole for reimagining Urban Resilience systems.

The study employs qualitative methods, including the design ethnography and socio-cultural-technical system mapping with field visits and interviews to come up with a rooted and indigenous version of Urban Resilience.



*Marking places on the map\_ Ziro site visit*

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#### Objectives:

To explore and illustrate the resilience principles and system, grounded in the cultural continuum of Ziro Valley.

#### Expected Outcomes:

- ⇒ A Grounded Community Resilience Model: A model for similar traditional, indigenous and primitive communities around the region and world.
- ⇒ Pedagogical Cases: For the courses in Design, Planning and Architecture.

### Transformative Resilience:

#### Everyday Urbanism as a key to understand Marginalized Urban Communities

#### Abstract:

As the world is facing the challenge of environmental change, low income countries, developing countries will be the most affected one. Especially, the level of poverty, the rapid pace of urbanization and a lack of education about climate change increase vulnerability and aggravate the effects of climate change in these countries. Innovative urban policies and practices have shown that adaptation to some of these effects is possible and can be built into development plans. These include community-based initiatives led by organizations formed by the urban poor, and local governments working in partnership with their low-income populations.

The case in context, Gazdhar Bandh is one such community which is facing the immediate challenges of climate change, environmental risks, and the associated physical well-being. Being located near the seashore, the eminent issues are environmental pollution, rising water levels due to surrounding urban developments, access to civic services, overall spatial quality of the settlement and last but not least the socio-political representation in development debates of the Mumbai city.

At first, the study will take account of existing urban practices of community which include habitat construction, settlement growth, ecology-economy nexus, livelihood, resources of both

spatial and nonspatial nature and the institutional governance of formal and informal mechanism. In second part, the study will look at challenges posed by environmental change to these practices and possible scenarios of resilient future and participatory role of a community. Spanned from micro to macro level, the study will also look at individual and community as both influential actors within the complex network.

Apart from conventional documentation and data gathering, the study will also employ various methods of data collection such as narratives, structured interviews, focused group discussions with the community and individual as participant.

## Enhancing Institutional and Community Resilience to Climate Change Impacts in the Jodhpur City Region

### Abstract:

The increasing urbanization is posing a threat not only to natural resources but also exacerbating the risks arising out of climate change. While the population and character of cities has been continuously changing, external factors like climate change and natural disasters are causing their own impact. There is a need to identify the stresses arising out of climate change and other factors to ascertain as to how the communities can adapt to these detrimental influences. The climate change impacts that are affecting cities the most are the concerns over availability of water and of late the rising temperatures leading to heat stress.

Water as a vital human need is very critical and should be the prime consideration for all decisions related to spatial planning of cities. We need both continuous availability of water as well as protection from the devastating consequences of excess water. The scarcity and flooding have now become a common phenomenon in cities across India.

The spatial exposure to water risks is becoming well understood, but practices which increase the scope and strength of the hazard or the relative vulnerability of people and communities or the practices that strengthen the resistivity towards hazards are not yet influencing decision making and not being reckoned.

Water stress in the arid and semi-arid climatic zones of India is getting aggravated with time and need to be looked from the perspective of enhancing community resilience through spatial planning. Communities in these places have been managing and coping up with the stress effectively through traditional knowledge systems. Of late these established systems are losing their utility due to the external support system of piped water supply from far off places.

Towards development of a resilient city, with regard to the ability to manage water stress more effectively will be explored in a historic city Jodhpur. Jodhpur, located in semi-arid climatic zone, known for its traditional water harvesting systems is confronting water stress arising out of decaying traditional water systems in the city core and water scarcity in the peripheral wards. The city also offers a very interesting case of abundance of ground water in the city core leading to water logging whereas traditional water bodies are drying due to negligence.

### Objectives:

To study the tacit and explicit risks posed by the climate change to marginalized communities and the adaptive transformation of its everyday urbanism .

### Expected Outcomes:

A systemic overview of everyday urbanism encompassing individual and community practices and its response to immediate and perceived risks posed by climate change.

A comparative study of 'communities' managing stresses in core city wards with the peripheral wards will be conducted to arrive at spatial planning strategies to enhance resilience. Institutional arrangements to cope up with the stresses at various levels will be studied to suggest suitable mechanism for enhancing institutional resilience for informed decision making.



**People during intense heat sit under tree-shade**  
© 2019 SPA, BHOPAL

### Objectives:

- ⇒ To assess the sensitivity, adaptive capacity and coping mechanism of communities to water stress
- ⇒ To derive a mechanism for assessing Institutional arrangement for enhancing resilience to water stress
- ⇒ To propose a framework for enhancing institutional and community resilience to water stress

### Expected Outcomes:

- ⇒ Spatial strategies for enhancing community resilience to water stress
- ⇒ Adaptive framework for institutional resilience to water stress

## Enhancing Institutional and Community Resilience to Climate Change Impacts in the Jodhpur City Region

### Abstract:

Rising temperatures due to climate change is leading to heat stress and need remedial actions in designing and planning of built spaces at all scales of city planning to reduce the stress. The exposure to heat waves during summer months is aggravating the vulnerability of cities and more so the marginalized communities. The spatial exposure to heat risks due to design and planning of built spaces is becoming well understood, but practices which increase the resistivity towards the hazard or the relative vulnerability of communities are not yet influencing decision making and not being reckoned.

Heat stress in the arid and semi-arid climatic zones of India is getting aggravated with time and need to be looked from the perspective of enhancing community resilience through design and spatial planning. Communities in these places have been managing and coping up with the stress effectively through using traditional methods and materials in designing and planning of built spaces. Of late these established traditional methods of designing and planning built-up spaces to cope up with the heat are also dying due to use of modern material in construction having comparatively less resistivity towards heat.

Towards development of a resilient city, with regard to the ability to manage heat stress more effectively in the marginalized communities will be explored in a historic city Jodhpur. Jodhpur, located in semi-arid climatic zone, is confronting heat stress due to worsening built fabric to contest heat wave conditions. The proportion and layout of open spaces and built mass along with usage of material and construction technology shows variations in city core to peripheral wards.

A comparative study of 'marginalized communities' managing stresses in core city wards with the peripheral wards will be conducted to arrive at spatial planning strategies to enhance resilience. Institutional arrange-

ments to cope up with the stresses at various levels will be studied to suggest suitable mechanism for enhancing institutional resilience for informed decision making.

### Objectives:

- ⇒ To assess the sensitivity, adaptive capacity and coping mechanism of communities to water stress
- ⇒ To derive a mechanism for assessing Institutional arrangement for enhancing resilience to water stress
- ⇒ To propose a framework for enhancing institutional and community resilience to water stress



**Heritage Walk**  
© 2019 SPA,  
BHOPAL

### Expected Outcomes:

- ⇒ Spatial strategies for enhancing community resilience to water stress
- ⇒ Adaptive framework for institutional resilience to water stress

**National Institute of Technology, Hamirpur,  
Himachal Pradesh, India**

## Climate resilient planning and design for vulnerable urban hill settlements: A Case of Kullu and Manali region

### Abstract:

The case study is intended for disaster mitigation, preparedness, response & recovery. This work will guide in a planned way to minimize social, assets & environmental losses by creating resilient communities in hill regions. Recent Climatic disasters in hill areas due to uncontrolled and non-scientific growth have increased the need for making urban settlement resilient in nature. Demand for innovation and education for building a culture of safety and resilience in vulnerable urban hill settlements is major concern. Prevention of loss to life and property due to natural calamities and putting in place policy framework for disaster mitigation and management is an area where architects and planners input is vital.

Seismically, the study area lies in the great Alpine- Himalayan seismic belt. Region is prone to various natural hazards like earthquakes, landslides, flash floods, storms and dam failures. The hazard which however, poses biggest threat is the land slide and cloud burst. The project shall take up a detailed study of a few settlements in the hilly region of Kullu and Manali to demonstrate the level of current resilience. It should help in identifying the appropriate methods and actions to improve the present condition and reveal the appropriate traditional approaches used in past to survive the impacts of disasters.

The study shall explore the new settlement regions with relation to disaster readiness through climatic resilient planning and design strategies.

**Objectives:**

- ⇒ To map and document various effects and occurrence of previous climatic disasters in the region
- ⇒ Studying the old and new development pattern to identify the vulnerable regions
- ⇒ To identify various existing approaches and methods (Local and global) for mitigating the adverse impact of cloud burst, landslide and earthquake
- ⇒ To suggest context based planning and design strategy for mitigating the adverse impact of natural disasters in study area

**Expected Outcomes:**

- 1) Contextual adaptation strategy for mitigating the adverse impact of climatic disasters and development of design strategies.

- 2) Systematic data collection and analysis will help in framing policy decisions to reduce disaster risks and build resilience.
- 3) Comprehensive framework and methodology for carrying out future studies in hilly regions.



**Settlements in Manali**  
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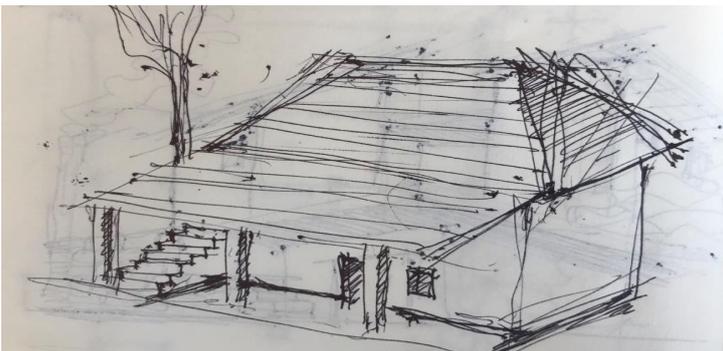
## Climate resilient adaptation of built-form in Hilly Region through Traditional Wisdom and best practices – A case of Himachal Pradesh

**Abstract:**

The urban form and settlement typology of any region determines the dynamic functions of an urban system. Settlements, which have evolved over centuries in the form of organic spatial pattern, has certain inherent factors that deal with externalities like disasters and natural calamities.

On the contrary, modern planned settlements, which are based on man-made scientific interventions also deal with resilience towards calamities and climate change. However, in hilly terrains, we often find that rampant, unregulated and accelerated modern urbanisation is leading to new urban fabric that is inorganic in nature and not tolerant to environmental requirements of a hilly region. This is leading to incidences of frequent landslides, flash floods and earthquakes and even though such incidences are linked to urbanisation patterns, it is not clearly established..

This calls for careful attention and study of the traditional wisdom and techniques used in design of buildings and settlements in hilly terrain.



**Traditional house in Khasgra**  
© 2019 NIT, HAMIRPUR

The project shall take up a detailed study of a few settlements in the hilly region of Dharamshala and shall aim to reveal the reasons why the traditional buildings and settlements have been able to survive the impacts of disasters in the long run that resulted in their heritage status. The study shall explore the new and old viewpoints of the cases of Dharamshala region with relation to design of traditional buildings and historic settlements that are sophisticated with traditional patterns, limited materials and technologies of past. A descriptive interpretative approach shall be employed to understand and document the traditional methods, tools and designs. Aiming at the natural hazards relevant to the region, a strong traditional knowledge base has to be gathered leading to the adaptation of modern architectural and planning design.

**Objectives:**

- ⇒ To explore traditional/vernacular best practices of built-form and its transformation for mitigating climate change impact in hilly region .
- ⇒ To assess the applicability of key design elements and concepts of traditional structures in contemporary planning and architecture .

**Expected Outcomes:**

The findings of the study would pave the way to explore the traditional wisdoms and best practices which can be applied in contemporary world with respect to adaptation to disasters and climate change.

## School of Planning and Architecture, Vijayawada

### Climatic resilient planning and design for vulnerable urban hill settlements: A Case of Kullu and Manali region

#### Abstract:

There exists a well established relationship between heatwaves (extremely high temperatures) and human mortality. Despite the prevention measures, heatwaves represent a real risk to vulnerable population and their impacts remain significant. As per literature, five types of heat-related risk factors are generally studied for understanding the impact of heatwaves on inhabitants, viz. i. Environmental factors (lack of vegetation, UHI, urban density, pollution level, humidity, heat-exposure, building physics etc); ii. Demography (population, age, gender, heat adaptation level etc); iii. Health factory (obesity, drug intake etc); iv. Social Factor (Poverty, social isolation etc); v. Behavioural factor (Clothing, activities, food habits etc). In addition to the outdoor thermal radiant environment (viz. UHI), the effect of heatwaves are worsened by increased retention of heat in buildings, percentage of openings, ventilation strategies, shading, vegetation, conditioned and non-conditioned spaces etc.

In this case study, the impact of heatwaves in identified case pockets of Vijayawada shall be carried-out, by studying the indoor and outdoor thermal conditions, and occupant behaviour. Meteorological weather data such as temperature, air flow velocity and humidity are obtained, building physics parameters such as building size, typology, aspect ratio, construction material, WWR, physical characteristics of the envelope are mapped, and occupant behavior through perception survey (clothing, activity, adaptive strategies etc) and field measurement (Test 480) are taken. Immediate thermal radiant environment of the case area is

simulated using ENVI-met software. Comfort indices such as PPD, PMV, UTCI and heat index chart are derived for demonstrating the relationship between thermal comfort and heat stress indices. Simple adaptation strategy for mitigating the adverse impact of heatwaves shall be discussed.

#### Objectives:

- ⇒ To document the local climate, morphological setting, and building physical characteristics of the case area.
- ⇒ To carryout perception survey of the occupants and record field measurement (temperature/humidity/air flow velocity)
- ⇒ To assess the existing heat stress condition for demonstrating the relationship between thermal comfort and heat stress indices (PPD, PMV, UTCI) and heat index chart are derived
- ⇒ To suggest adaptation strategy for mitigating the adverse impact of heatwaves

#### Expected Outcomes:

- 1) Understanding the role of local climate, morphological setting, building physics characteristics and occupant behavior in mitigating adverse effects of heatwave.
- 2) Simple adaptation strategy for mitigating the adverse impact of heatwaves in terms of morphology, building physics characteristics and adaptive thermal comfort strategies.
- 3) Comprehensive methodology for carrying out similar studies elsewhere.

### Urban Energy and Spatial Dynamics towards Climate Resilience: A Case of Bangalore

#### Abstract:

Emission of greenhouse gases is one of the main tenets behind adverse climate change, particularly in the aspect of global warming or temperature rise. Apart from the menace by industrial emissions, a substantial share of emissions in present times is from the rising energy consumption patterns in cities and its functions. As cities grow and spread, energy consumption rises and its patterns take varied trajectories, thereby eventually impacting the climate adversely. As per the IEA's Global Energy & CO<sub>2</sub> Status Report released in 2018, India is reported to have its primary energy demand increase to 4% in 2018, which is 11% of global demand growth. Comparably, global energy consumption grew by only 2.3% in 2018. In this backdrop, this project aims to take the

case of Bangalore city and delve into aspects of relating changing energy consumption patterns with transforming spatial patterns at the sub-city / zonal scale. The project shall take up three urban neighbourhoods, which represents different spatial characteristics in terms of location, morphology and density (one from old city centre area, one from mid city area which developed about 15 years back and one from city fringe area which is upcoming and developed in last 5-8 years). The neighbourhoods shall also purposively represent different income groups. Thereafter, energy consumption patterns shall be quantified through primary sample household surveys and from secondary energy supplier data. Consumption patterns shall be categorized as per type and use. Consumption of type of energy (solar, firewood, petrol, LPG, etc)

and the purpose for which it is consumed (cooking, lighting, luxury, transport, etc.) shall be aggregated. Emission factors shall be used to understand emission implications for the consumption. Direct use of energy shall be focused upon and not indirect or embodied energy (to adhere to the timeline of the project and limit its scope). Socio-economic attributes and basic physical attributes of the dwelling space shall also be documented. The analysis and understanding of the energy consumption patterns shall be done over time and space.

The project shall attempt to comprehend and establish relationships (or the lack of it) between the spatio-socio-economic attributes of the citizens from the three neighbourhoods and their energy consumption and emission patterns. Outcomes of the analysis can have bearing on the future planning of layouts and colonies for particular income groups or dwelling unit sizes in different parts of the city as it can help in estimating or simulating the associated energy consumption patterns.

### Objectives:

- ⇒ To explore various dimensions of urban energy consumption and its adverse impact on climate
- ⇒ To establish the causal linkages between changing urban morphology and energy consumption pattern

### Expected Outcomes:

The project shall have a direct pedagogical outcome of :

- 1) Having data and outcome which can sensitize and raise awareness of students about energy implications of sub-city planning
- 2) Make students learn of the tools used to estimate energy consumption and associated emission footprints

The project can also indirectly help in developing an analytical framework for estimating energy consumption index for a neighbourhood to compare and judge multiple neighbourhoods in terms of their energy consumption efficiency.



Water Pollution from City Sewerage © 2019 SPA, BHOPAL

## Climate resilient adaptation of built-form in Hilly Region through Traditional Wisdom and best practices: A case of Himachal Pradesh

### Abstract:

The urban form and settlement typology of any region determines the dynamic functions of an urban system. Settlements, which have evolved over centuries in the form of organic spatial pattern, has certain inherent factors that deal with externalities like disasters and natural calamities. In the contrary, modern planned settlements, which are based on man-made scientific interventions also deal with resilience towards calamities and climate change. However, in hilly terrains, we often find that rampant, unregulated and

accelerated modern urbanisation is leading to new urban fabric that is inorganic in nature and not tolerant to environmental requirements of a hilly region. This is leading to incidences of frequent landslides, flash floods and earthquakes and even though such incidences are linked to urbanisation patterns, it is not clearly established. This calls for careful attention and study of the traditional wisdom and techniques used in design of buildings and settlements in hilly terrain.

The project shall take up a detailed study of a few settlements in the hilly region of Dharamshala and shall aim to reveal the reasons

why the traditional buildings and settlements have been able to survive the impacts of disasters in the long run that resulted in their heritage status. The study shall explore the new and old viewpoints of the cases of Dharamshala region with relation to design of traditional buildings and historic settlements that are sophisticated with traditional patterns, limited materials and technologies of past. A descriptive interpretative approach shall be employed to understand and document the traditional methods, tools and designs. Aiming at the natural hazards relevant to the region, a strong traditional knowledge base has to be gathered leading to the adaptation of modern architectural and planning design.

## Thermal Comfort study for mitigating heat stress through climate responsive planning: A case study of Vijayawada

### Abstract:

There exists a well established relationship between heatwaves (extremely high temperatures) and human mortality. Despite the prevention measures, heatwaves represent a real risk to vulnerable population and their impacts remain significant. As per literature, five types of heat-related risk factors are generally studied for understanding the impact of heatwaves on inhabitants, viz,

- i. Environmental factors (lack of vegetation, UHI, urban density, pollution level, humidity, heat-exposure, building physics etc);
- ii. Demography (population, age, gender, heat adaptation level etc);
- iii. Health factory (obesity, drug intake etc);
- iv. Social Factor (Poverty, social isolation etc);
- v. Behavioral factor (Clothing, activities, food habits etc).

In addition to the outdoor thermal radiant environment (viz. UHI), the effect of heatwaves are worsened by increased retention of heat in buildings, percentage of openings, ventilation strategies, shading, vegetation, conditioned and non-conditioned spaces etc. In this case study, the impact of heatwaves in identified case pockets of Vijayawada shall be carried-out, by studying the indoor and outdoor thermal conditions, and occupant behavior. Meteorological weather data such as temperature, air flow velocity and humidity are obtained, building physics, parameters such as building size, typology, aspect ratio, construction material, WWR, physical characteristics of the envelope are mapped, and occupant behavior through perception survey (clothing, activity, adaptive strategies etc) and field measurement (Testo 480) are taken. Immediate thermal radiant environment of the case area is simulated using ENVI-met software. Comfort indices such as PPD,

### Objectives:

- ⇒ To explore traditional/vernacular best practices of built-form and its transformation for mitigating climate change impact in hilly region
- ⇒ To assess the applicability of key design elements and concepts of traditional structures in contemporary planning and architecture

### Expected Outcomes:

The findings of the study would pave the way to explore the traditional wisdoms and best practices which can be applied in contemporary world with respect to adaptation to disasters and climate change.

PMV, UTCI and heat index chart are derived for demonstrating the relationship between thermal comfort and heat stress indices. Simple adaptation strategy for mitigating the adverse impact of heatwaves shall be discussed.

### Objectives:

- ⇒ To document the local climate, morphological setting, and building physics characteristics of the case area.
- ⇒ To carryout perception survey of the occupants and record field measurements (temperature/humidity/air flow velocity)
- ⇒ To assess the existing heat stress condition for demonstrating the relationship between thermal comfort and heat stress indices (PPD, PMV, UTCI) and heat index chart are derived
- ⇒ To suggest adaptation strategy for mitigating the adverse impact of heatwaves

### Expected Outcomes:

- 1) Understanding the role of local climate, morphological setting, building physics characteristics and occupant behavior in mitigating adverse effects of heatwave.
- 2) Simple adaptation strategy for mitigating the adverse impact of heatwaves in terms of morphology, building physics characteristics and adaptive thermal comfort strategies.
- 3) Comprehensive methodology for carrying out similar studies elsewhere.

## Symposium 2

### Lessons Learnt from Climate Change Adaptation in Europe, - Krems, Austria

The five day symposium was divided into three parts: Project steering committee meeting to discuss management and organizations issues, along with presentations of case studies taken up by each institute and third was presentations from external experts on Climate Change and Resilience. There was also a site visit planned on the last day of the symposium. The agenda mainly was to talk about the progress made so far for each Work Package and share experiences on climate change & resilience from Europe. This symposium was attended by the following partner institutions – TWENTE (University of Twente) Netherlands, KRVI, Mumbai, SPA –Bhopal, SPA-Vijayawada, and NIT-Hamirpur. There were two NGO partners as well – CURE- Delhi and SPARC –Mumbai who attended the symposia. The teams were represented by their respective faculty. All partner institutions through this symposium made a presentation on selected case studies taken up by each focusing on climate change thus explaining the criteria for selection as well and looking at it from design and urban planning lens. There was also cross-learning and experience sharing during the individual presentations.

Four case studies by each Indian partner have been taken up at different levels viz. Institutional, Intra-Indian and International collaborative. These case studies will ponder on questions related to climate change and resilience at city and community level. These case studies can further be enhanced for better learning into Studios, Theory Courses, Summer & Winter Studios, and Online Courses or as Elective Courses, which will bring value from practice.



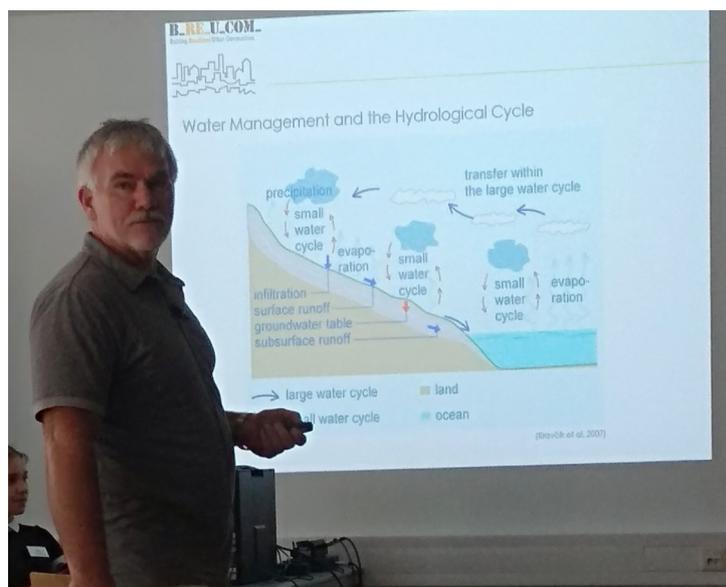
**Case Study update by KRVI**  
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There were discussions also on –

-Possibilities of publishing these case studies in the form of smaller articles in Environment and Urbanization, a platform that allows researchers, NGOs, professionals and activities to exchange research findings, to write about their work and share ideas, debate

on certain issues etc.

- Peer review of case studies by advisory committee or blind referring should be mandatory
- What should be the end objectives of these case studies (Policy change, design innovation, what is included and what is excluded etc.)
- eBooks, flyers, dissemination through NGOs in local language



**Image Caption**  
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On Thursday and Friday, there were presentation and lectures from experts on Climate Change, Migration, Green Infrastructure and so on.

Tim Cassidy talked about how to make recommendations for the councils to implement green infrastructure in planning for climate resilience and risk management. PPT can be accessed here—  
<https://www.breucom.eu/mod/folder/view.php?id=696>

Mathias Czaika made a presentation on Migration as an adaptive strategy, defining migration, reasons of migration, factors that influence people to migrate vs the ones who opt to stay back. PPT can be accessed here—  
<https://www.breucom.eu/mod/folder/view.php?id=696>

Herbert Formayer threw light on the Meteorological processes that are involved in the Urban Heat Island (UHI) and the impact of

climate change on that with some options of reducing UHI effect. PPT can be accessed here—<https://www.breucor.eu/mod/folder/view.php?id=696>

Willi Haas presentation focussed more on the connection between climate change and health and can already be seen as a threat to health in Austria. Heat is one of the major cause of health deterioration amongst the other factors. . PPT can be accessed here—<https://www.breucor.eu/mod/folder/view.php?id=696>

Ratheiser presented city-scale adaptation measures to a changing climate. He explained how the number of days with heat waves has increased since the 20<sup>th</sup> century. Providing and preserving the cold-air flowing into the city from the rural areas could be one of the adaptive measures as explained by Ratheriser. PPT can be accessed here—<https://www.breucor.eu/mod/folder/view.php?id=696>

Christine Rottenbacher a landscape architect has been working for the last 10 years on Green Infrastructure, its relation to climate change and how the evaluation of rural and urban green infrastructure can be possible. She emphasized through examples on considering existing ecosystems and at the same time developing GI with small scale implementations. PPT can be accessed here—<https://www.breucor.eu/mod/folder/view.php?id=696>

Franziska Schruth presentation was based on Transformation through Cooperation – meaning of participation, why is it considered important and who can participate. PPT can be accessed here—<https://www.breucor.eu/mod/folder/view.php?id=696>

Funda Atun-Girgin shared experiences from one of their project of Children, are we prepared against floods? PPT can be accessed here—<https://www.breucor.eu/mod/folder/view.php?id=696>

## Site Visit

A site visit to the fire department was arranged to understand the flood management system of Krems, situated along the Danube river. The teams cycled to the fire department and further continued cycling upstream approx. 1.5 miles (image 1). Along the way, mechanisms used during the floods to prevent river water from entering the city using aluminium plate walls were observed.



**Explanation on the mechanism developed to prevent flood water entering**

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During times of floods, when the water level increases beyond the embankment, it is the Fire Department's duty to respond to this situation. We learnt that unlike other rivers, Danube is used for

## Visit to Fire Department: 30 Aug 2019

navigation, and during flood situations, the water spills over the adjacent road due to the pressure of docked ships.

The fire department constructs 1.2 m high walls by combining multiple aluminium plates both horizontally and vertically. These walls can be mounted on stone wall, .5 m high, along the river. The process is simple and manual; no hi-tech machinery is required to construct these metal walls.

The columns and plates are brought in from the storage facility at the Fire Department which is approximately 1.5 miles from the river. Either hydraulic lifts are used to lift the plates or the plates are manually lifted and placed between the columns. This method is quick and effective, especially in the context of rapid response to natural disasters.



**Columns and plates used to construct walls**

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# Key Learnings: Symposium 2

## Green infrastructure - I. Green Infrastructure's Socio-Ecological Response to Climate Change

- In the presentation titled 'Green infrastructure's social ecological responses to climate change', natural systems have the potential for providing climate mitigation solutions and simultaneously providing climate resilient and adaptation planning, especially in urban areas were highlighted through case studies. Further, it was emphasized that technology-based solutions, cultural-based solutions, and behaviour based solutions should complement the work of nature-based solutions.
- The session on 'Green Infrastructure and Water Management' explained the potential of considering infrastructural networks as risk management strategies. The presentation also emphasised on ways of understanding aspects of environment through the lens of economics, (water budget/ carbon budget etc) and legislation (Water Framework Directive, Flood Directive etc). These are aspects which can be incorporated in the planning and management in the rapidly urbanising parts of India.

## 2. Green Infrastructure and Water Management

- Green infrastructure as an adaptable and multifunctional approach to storm water management and climate resiliency with many benefits for communities, such as improving water quality and conservation of water, strengthens the local economy and enhances community and infrastructure resiliency was presented. Successful solutions to inspire city managers, community leaders and engaged citizens looking to design their community space for better health, abundant water resources, and improved quality of life.

## Migration as adaptation strategy

- Climate change adaptation strategy on migration issues within and outside the regions were extensively discussed. Policy makers for finding practical adaptive capacity measures that can offset the challenges at the original homes of migrants were emphasized.

- The Migration as an adaptation strategy was interesting though it can be contested but got to know how migration can help people to adapt to environmental stress. Inclusion of Indian cases while highlighting the stress versus net migration helped in comprehending the phenomenon in much holistic way.

## Urban Heat Island and Micro-climate

- The need for passive design responds to local climate and site conditions in order to maximize the comfort and health of building users while minimizing energy use was stressed. The key to designing a passive building is to take best advantage of the local climate, such as local microclimate, prevailing wind conditions etc were highlighted.
- The session on Harnessing wind and Ventilation for cooling in Urban Settings' accentuated the importance of Urban Climate Analysis and the importance of establishing awareness through clear explanation and convincing evidence to all the stakeholders at the beginning of urban projects for strategic results. The presentation also emphasised on the importance of implementing and documenting pilot projects as crucial references. The discussions on Urban Climate Maps, Climate Function Maps and the use of technology to simulate future scenarios are all extremely relevant to the Indian context.
- Analysis methods and climatic maps shown during various sessions will help in building climate sensitive design and planning in disaster-prone areas of India.

## Community Engagement – I. Participatory Risk Management

- The session on 'Participatory Risk Management' showed how participatory methods of community engagement could lead to innovative solutions in complex and dynamic urban contexts. The presentation showed multiple examples wherein eschewing sectoral thinking and laying emphasis on holistic approaches led to inclusive, liveable and people oriented solutions. The potentials of 'transformation through cooperation' and its outcomes in the European context was interesting.

- Role and importance of community participation in designing and planning exercises shown through some case examples appeared to be one of the effective measures to build communities with a knowledge base about climate resilience.

## 2. Children awareness on flood related disaster risk

- showed how effective community participation of the most vulnerable and often neglected groups of the society- 'immigrant children' could be an effective strategy in developing persuasive content which could then be used for further generation of awareness regarding the notions of preparedness during climate related risks and vulnerabilities. This method could be adapted and used in the Indian context where a large number of the population especially children live in areas which are highly vulnerable. Generating pertinent awareness at the young age could be viewed as an effective strategy to ensure the goals of resilience building in communities are effectually tapped by the most vulnerable groups of the community.
- The methods used for conducting a case study in Milan on children awareness of disaster risk was interesting and can

be explored further to assess the awareness of children in disaster prone areas of India.

- The session on "Children are we prepared against floods" was very interesting, as we often think only about adults when it comes to teaching, informing or planning on climate change and resilience. We forget that there's another group that is also very much affected and can be trained much in advance to deal with such situations.

### Flood water protection

- The role that the fire department played on addressing flooding issues was surprising and appealing
- Flood control system and approach for preserving the character of world heritage site discussed during fire department session are appreciative and great learning.

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NEXT ISSUE:

Topics

- Report on Symposium 3 - "Lessons learnt from climate change adaptation in Europe"
- Report on Symposium 4 - "Defining New Planning and Design Paradigm"
- Report on case studies analysis