Sustainable Urban Planning Strategies for Cities in Karnataka

9 January 2019

Scope

Sustainable Urban Planning Strategies for Cities in Karnataka

Part 1

Developing a Proof of Concept Urban Observatory for Karnataka

Part 2

Pre- Feasibility Assessment of Sanitation Options for Cities

Part-I

Urban Observatory for Karnataka

Why an Urban Observatory

Urban Observatories help address urban challenges by:

- Providing better insights into a problem or phenomenon
- Identifying it's intensity, pattern, cause-effect loop to design appropriate response strategies

Objective of an UO: Geo-spatial data analyses and visualisation to enable data-driven decision-making

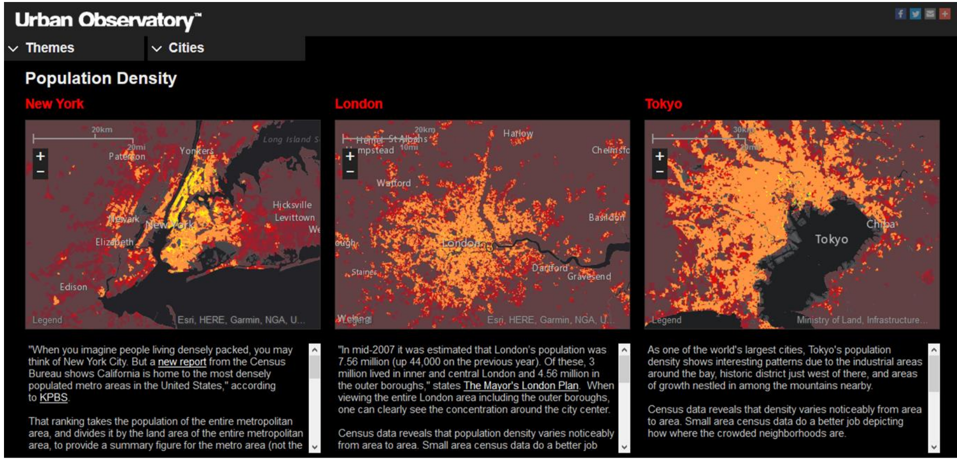
Global Initiatives

Urban Observatory Project by ESRI
Compare and contrast maps of cities around the world

Dublin Dashboard by Dublin City Council
Evidence informed analysis for decision making

City Dashboard for cities in UK
Aggregates simple spatial data for cities in UK

Urban Observatory at Newcastle
Aggregates data on air quality, traffic, from sensors


Urban Observatory™
Themes
Cities
Population Density
New York
London
Tokyo
Paterson
Yonkers
Long Island S
Newark
New York
Elizabeth
Hicksville
Levittown
Edison
Legend
Esri, HERE, Garmin, NGA, U...
Hemel Hempstead
St Albans
Harlow
Chelmsfo
Watford
Basildon
London
Dartford
Gravesend
Staines
Woking
Chiba
Tokyo
Ministry of Land, Infrastructure...

"When you imagine people living densely packed, you may think of New York City. But a new report from the Census Bureau shows California is home to the most densely populated metro areas in the United States," according to KPBS.

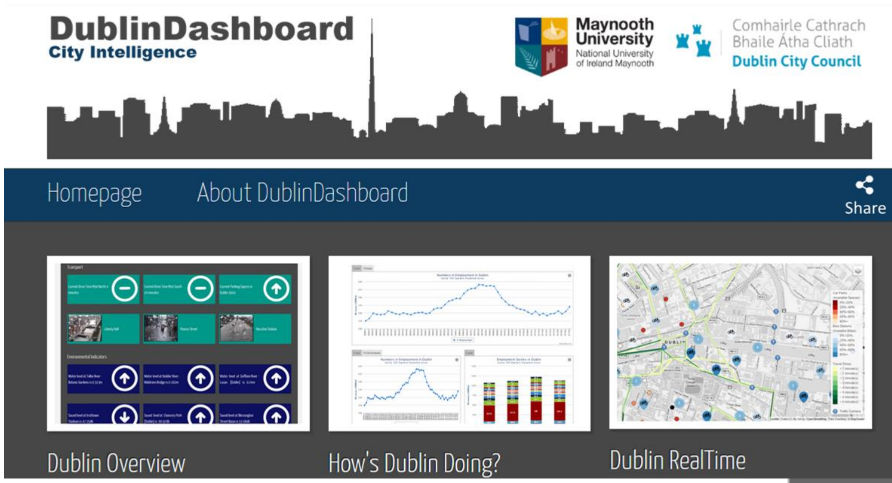
That ranking takes the population of the entire metropolitan area, and divides it by the land area of the entire metropolitan area, to provide a summary figure for the metro area (not the

"In mid-2007 it was estimated that London's population was 7.56 million (up 44,000 on the previous year). Of these, 3 million lived in inner and central London and 4.56 million in the outer boroughs," states The Mayor's London Plan. When viewing the entire London area including the outer boroughs, one can clearly see the concentration around the city center.

Census data reveals that population density varies noticeably from area to area. Small area census data do a better job

As one of the world's largest cities, Tokyo's population density shows interesting patterns due to the industrial areas around the bay, historic district just west of there, and areas of growth nestled in among the mountains nearby.

Census data reveals that density varies noticeably from area to area. Small area census data do a better job depicting how where the crowded neighborhoods are.


DublinDashboard
City Intelligence
Maynooth University
National University of Ireland Maynooth
Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council
Homepage
About DublinDashboard
Share
Dublin Overview
How's Dublin Doing?
Dublin RealTime

Indian Initiatives

Integrated Command Control Centre, Vizag

[redacted]

Smart City Centre/ Integrated Command Control Centre, Madhya Pradesh

The UO platform developed by CSTEP makes Karnataka one of the first States in India to have a functioning observatory platform at a state level

MoHUA initiatives

- Indian Urban Data Exchange (IUDX), 2018
- DataSmart Cities Initiative (under preparation)
- National Urban Observatory

Features and Functionalities

- **Collates data**

  Ability to access and collate reliable data through **crowdsourcing and from third party database and portals**

- **Analyses data for informed decision making**

  Ability to generate **spatial and temporal analysis** and visualise data for informed decision making

Noise pollution monitoring

Air/ water pollution mapping

Pothole monitoring

Mapping direction of city's built growth

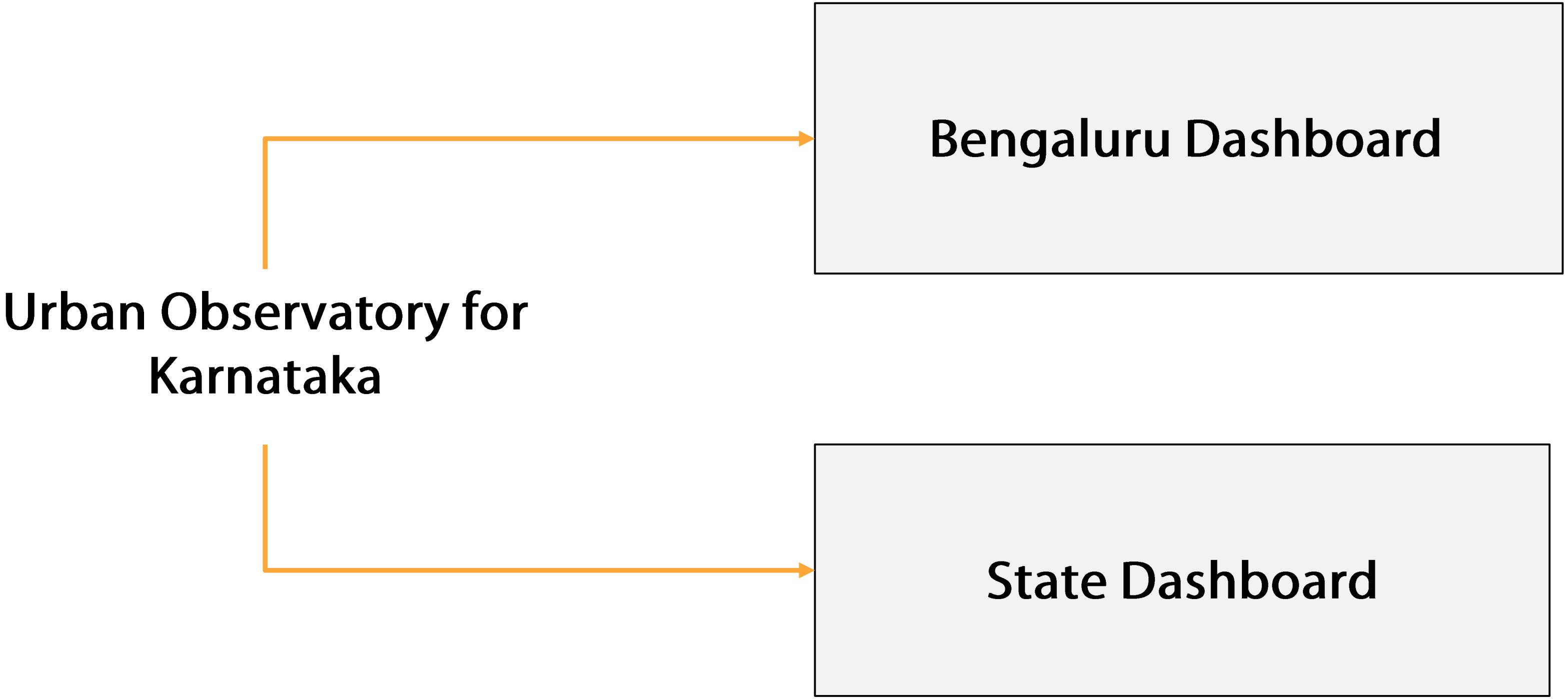
Assessing future infrastructure/ service delivery needs for a city

Assessing impact of new development /investments

Tracking compliance with city master plans

Aid in value- capture financing in a city

Urban Observatory for Karnataka: Components



Urban Observatory for Karnataka

Bengaluru Dashboard

State Dashboard

Bengaluru Dashboard

Bengaluru Dashboard

Map noise pollution levels in different parts in Bengaluru in different times

Noise levels collected through ***Shabda*** app developed by CSTEP

Collation with noise levels reported by KSPCB monitoring stations

Analyses to show:

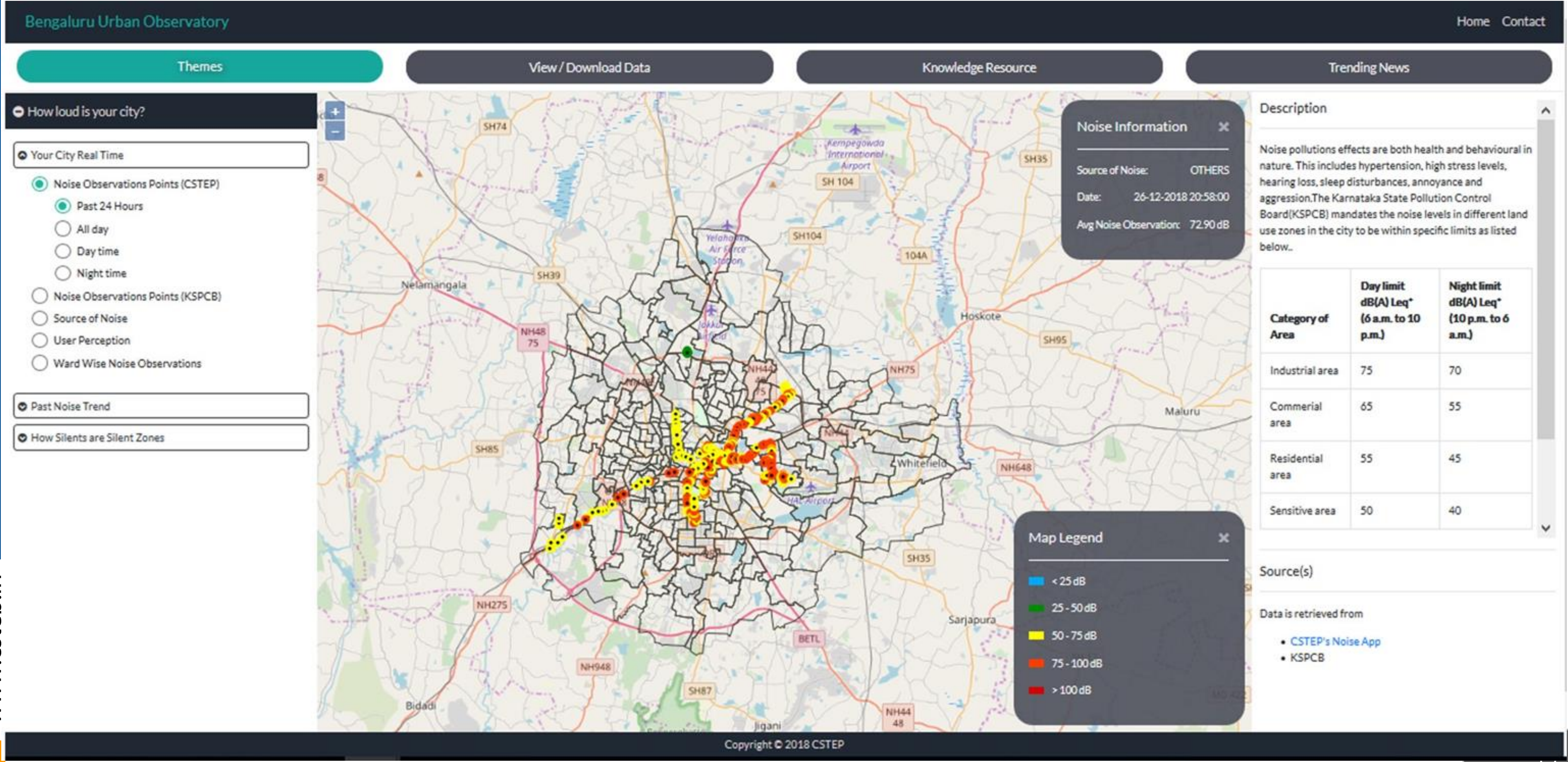
- Point wise noise pollution levels on a map
- Temporal variation of ward-wise noise levels
- Spatial analyses for noise levels in silent zones

Bengaluru Dashboard- Demo

Bengaluru Dashboard

Shabda application

Bengaluru Dashboard- Screenshots


Bengaluru Urban Observatory
Home
Contact
Themes
View / Download Data
Knowledge Resource
Trending News
+
−
SH74
Kempegowda International Airport
SH 104
SH35
Yelahanka Air Force Station
SH104
104A
SH39
Nelamangala
Hoskote
NH48 75
SH95
NH75
Maluru
SH85
Whitefield
NH648
HAL Airport
NH275
SH35
Sarjapura
BETL
NH948
SH87
Bidadi
Jigani
NH44 48

How loud is your city?

Your City Real Time

- ● Noise Observations Points (CSTEP)
  - ● Past 24 Hours
  - ○ All day
  - ○ Day time
  - ○ Night time
- ○ Noise Observations Points (KSPCB)
- ○ Source of Noise
- ○ User Perception
- ○ Ward Wise Noise Observations

Past Noise Trend

How Silents are Silent Zones

Noise Information

Source of Noise:	OTHERS
Date:	26-12-2018 20:58:00
Avg Noise Observation:	72.90 dB

Map Legend

- 🟦 < 25 dB
- 🟩 25 - 50 dB
- 🟨 50 - 75 dB
- 🟧 75 - 100 dB
- 🟥 > 100 dB

Description

Noise pollutions effects are both health and behavioural in nature. This includes hypertension, high stress levels, hearing loss, sleep disturbances, annoyance and aggression.The Karnataka State Pollution Control Board(KSPCB) mandates the noise levels in different land use zones in the city to be within specific limits as listed below..

Category of Area	Day limit dB(A) Leq* (6 a.m. to 10 p.m.)	Night limit dB(A) Leq* (10 p.m. to 6 a.m.)
Industrial area	75	70
Commerial area	65	55
Residential area	55	45
Sensitive area	50	40

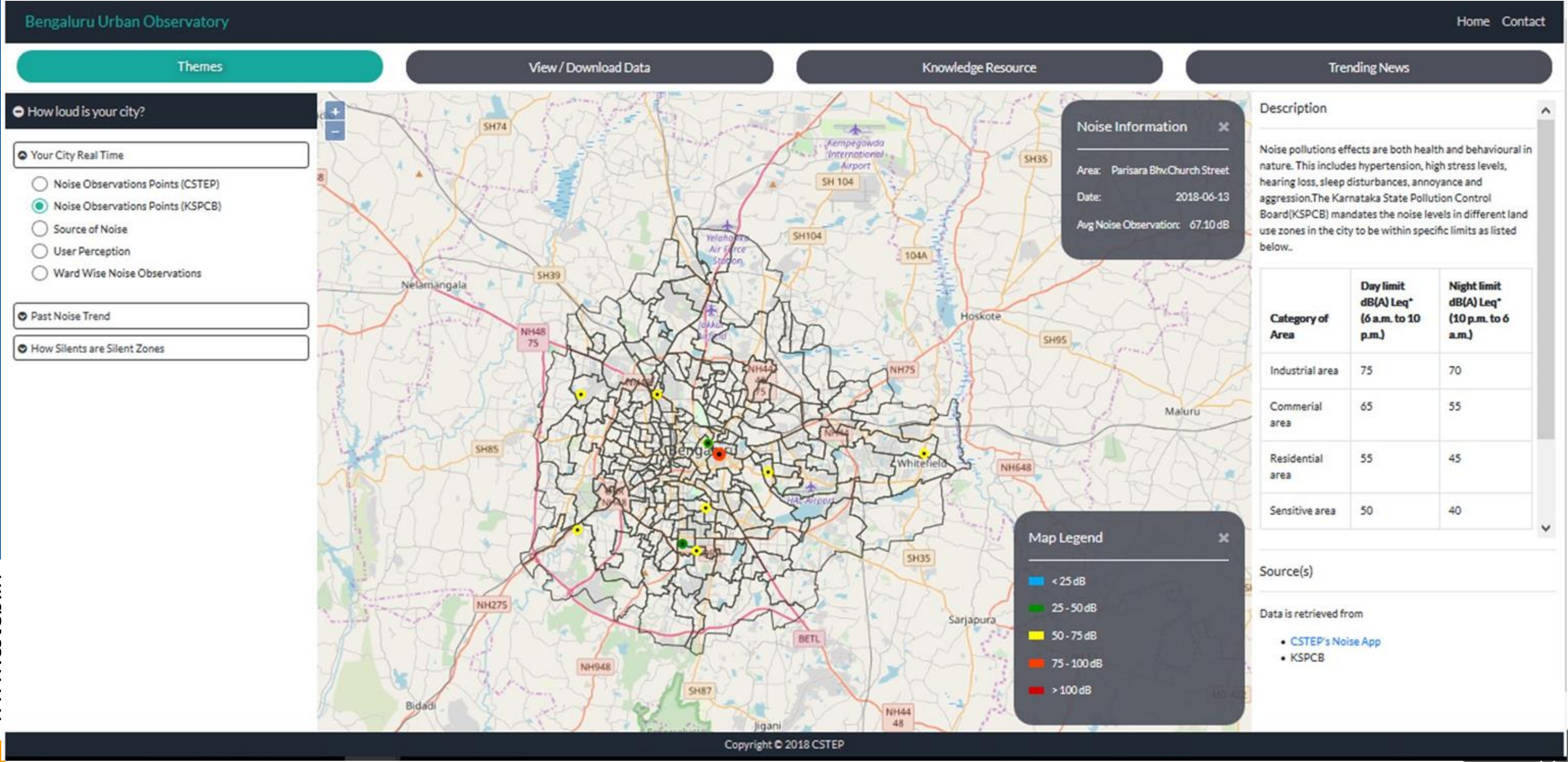
Source(s)

Data is retrieved from

- CSTEP's Noise App
- KSPCB

Copyright © 2018 CSTEP

Bengaluru Dashboard- Screenshots


Bengaluru Urban Observatory
Home
Contact
Themes
View / Download Data
Knowledge Resource
Trending News
SH74
Kempegowda International Airport
SH35
SH 104
SH104
104A
Yelahanka Air Force Station
SH39
Nelamangala
Hoskote
NH48 75
SH95
NH75
Maluru
SH85
Whitefield
NH648
HAL Airport
SH35
NH275
BETL
Sarjapura
NH948
SH87
Bidadi
NH44 48
Jigani

How loud is your city?

Your City Real Time

○ Noise Observations Points (CSTEP)
● Noise Observations Points (KSPCB)
○ Source of Noise
○ User Perception
○ Ward Wise Noise Observations

Past Noise Trend

How Silents are Silent Zones

Noise Information

Area: Parisara Bhv.Church Street
Date: 2018-06-13
Avg Noise Observation: 67.10 dB

Map Legend

- 🟦 < 25 dB
- 🟩 25 - 50 dB
- 🟨 50 - 75 dB
- 🟧 75 - 100 dB
- 🟥 > 100 dB

Description

Noise pollutions effects are both health and behavioural in nature. This includes hypertension, high stress levels, hearing loss, sleep disturbances, annoyance and aggression.The Karnataka State Pollution Control Board(KSPCB) mandates the noise levels in different land use zones in the city to be within specific limits as listed below..

Category of Area	Day limit dB(A) Leq* (6 a.m. to 10 p.m.)	Night limit dB(A) Leq* (10 p.m. to 6 a.m.)
Industrial area	75	70
Commerial area	65	55
Residential area	55	45
Sensitive area	50	40

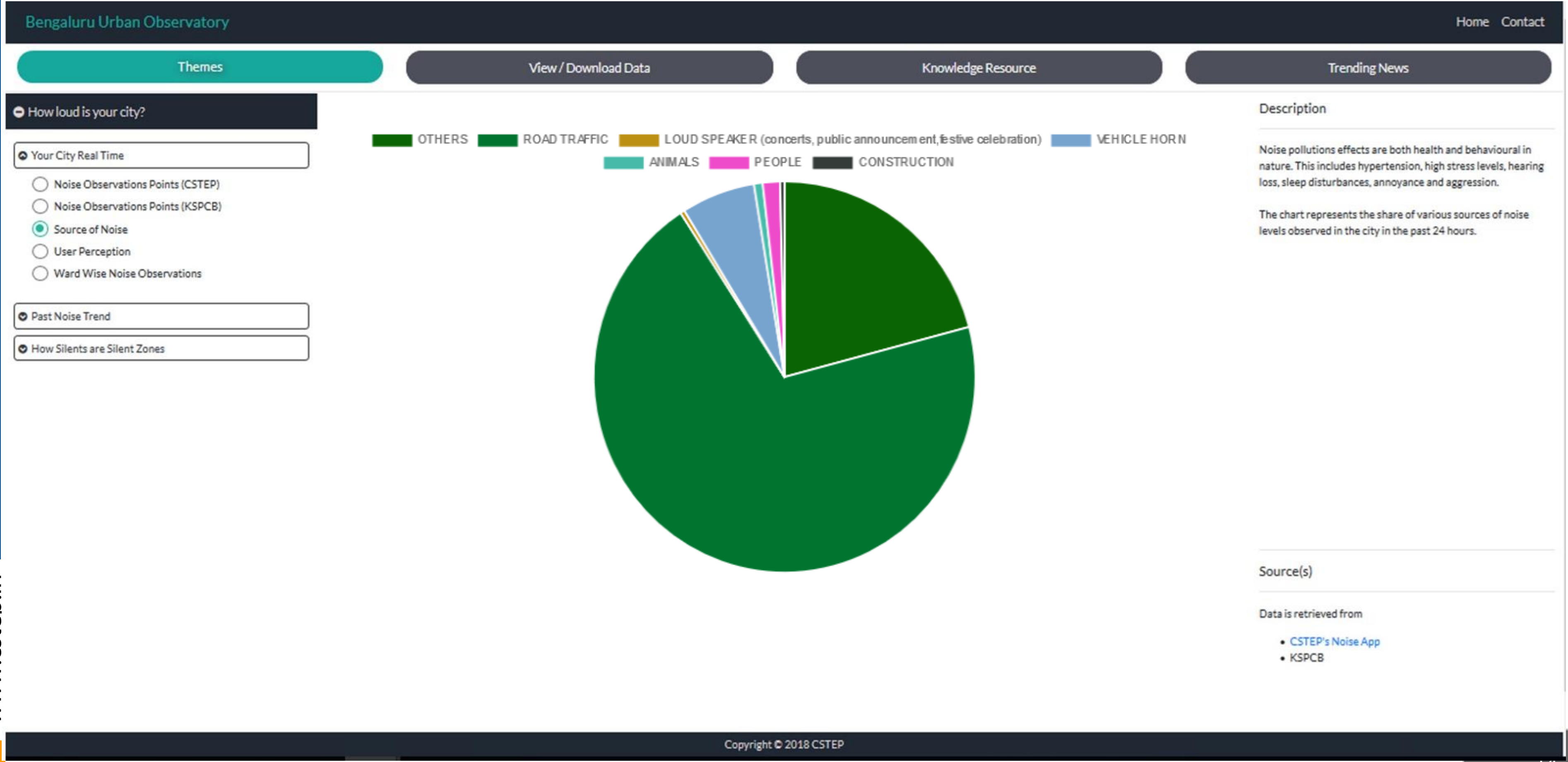
Source(s)

Data is retrieved from

- CSTEP's Noise App
- KSPCB

Copyright © 2018 CSTEP

Bengaluru Dashboard- Screenshots


Bengaluru Urban Observatory
Home
Contact
Themes
View / Download Data
Knowledge Resource
Trending News
OTHERS
ROAD TRAFFIC
LOUD SPEAKER (concerts, public announcement, festive celebration)
VEHICLE HORN
ANIMALS
PEOPLE
CONSTRUCTION

How loud is your city?

Your City Real Time

○ Noise Observations Points (CSTEP)
○ Noise Observations Points (KSPCB)
● Source of Noise
○ User Perception
○ Ward Wise Noise Observations

Past Noise Trend

How Silents are Silent Zones

Description

Noise pollutions effects are both health and behavioural in nature. This includes hypertension, high stress levels, hearing loss, sleep disturbances, annoyance and aggression.

The chart represents the share of various sources of noise levels observed in the city in the past 24 hours.

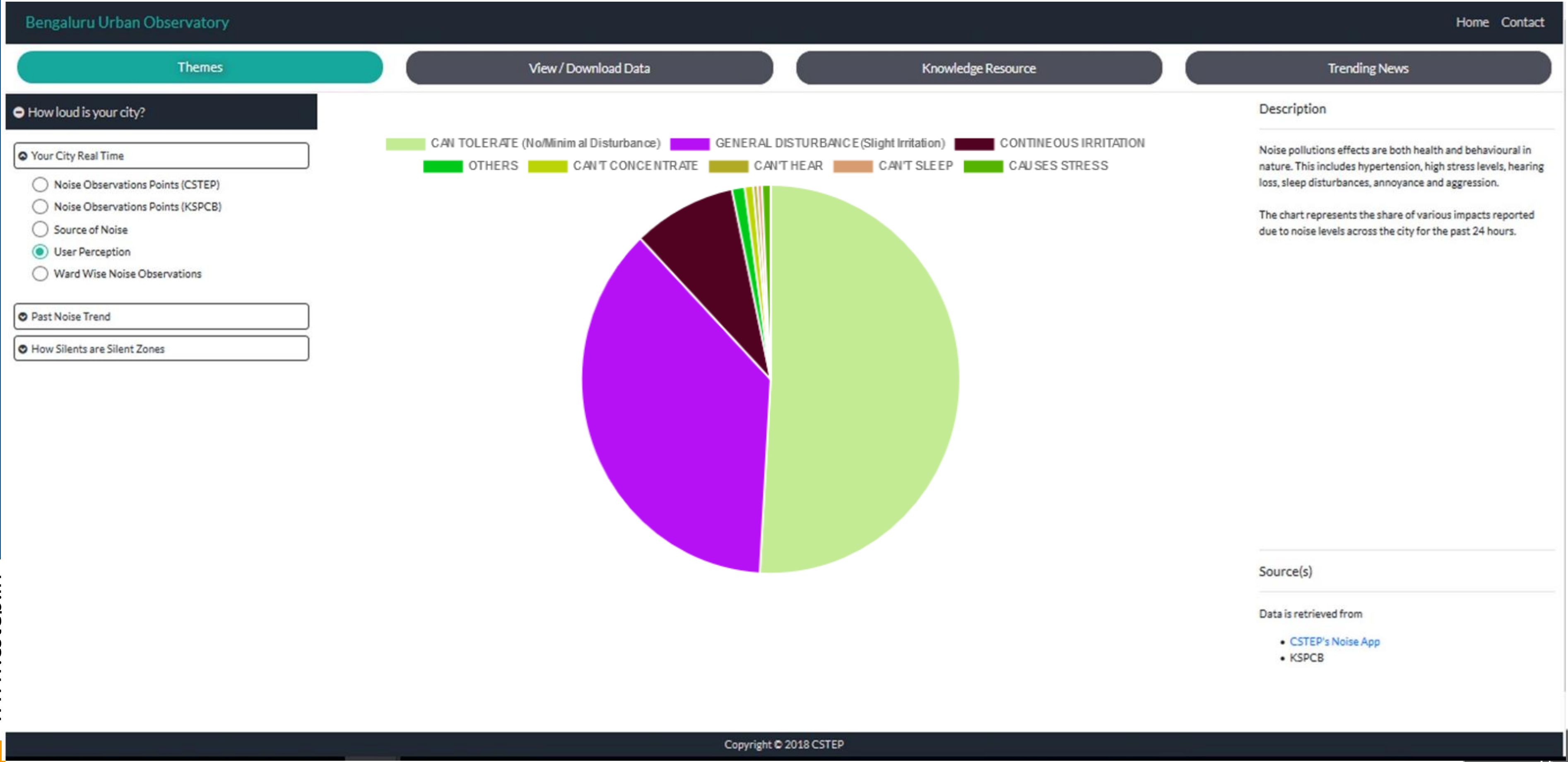
Source(s)

Data is retrieved from

- CSTEP's Noise App
- KSPCB

Copyright © 2018 CSTEP

Bengaluru Dashboard- Screenshots


Bengaluru Urban Observatory
Home
Contact
Themes
View / Download Data
Knowledge Resource
Trending News
CAN TOLERATE (No/Minimal Disturbance)
GENERAL DISTURBANCE (Slight Irritation)
CONTINEOUS IRRITATION
OTHERS
CAN'T CONCENTRATE
CAN'T HEAR
CAN'T SLEEP
CAUSES STRESS

How loud is your city?

Your City Real Time

- ○ Noise Observations Points (CSTEP)
- ○ Noise Observations Points (KSPCB)
- ○ Source of Noise
- ● User Perception
- ○ Ward Wise Noise Observations

Past Noise Trend

How Silents are Silent Zones

Description

Noise pollutions effects are both health and behavioural in nature. This includes hypertension, high stress levels, hearing loss, sleep disturbances, annoyance and aggression.

The chart represents the share of various impacts reported due to noise levels across the city for the past 24 hours.

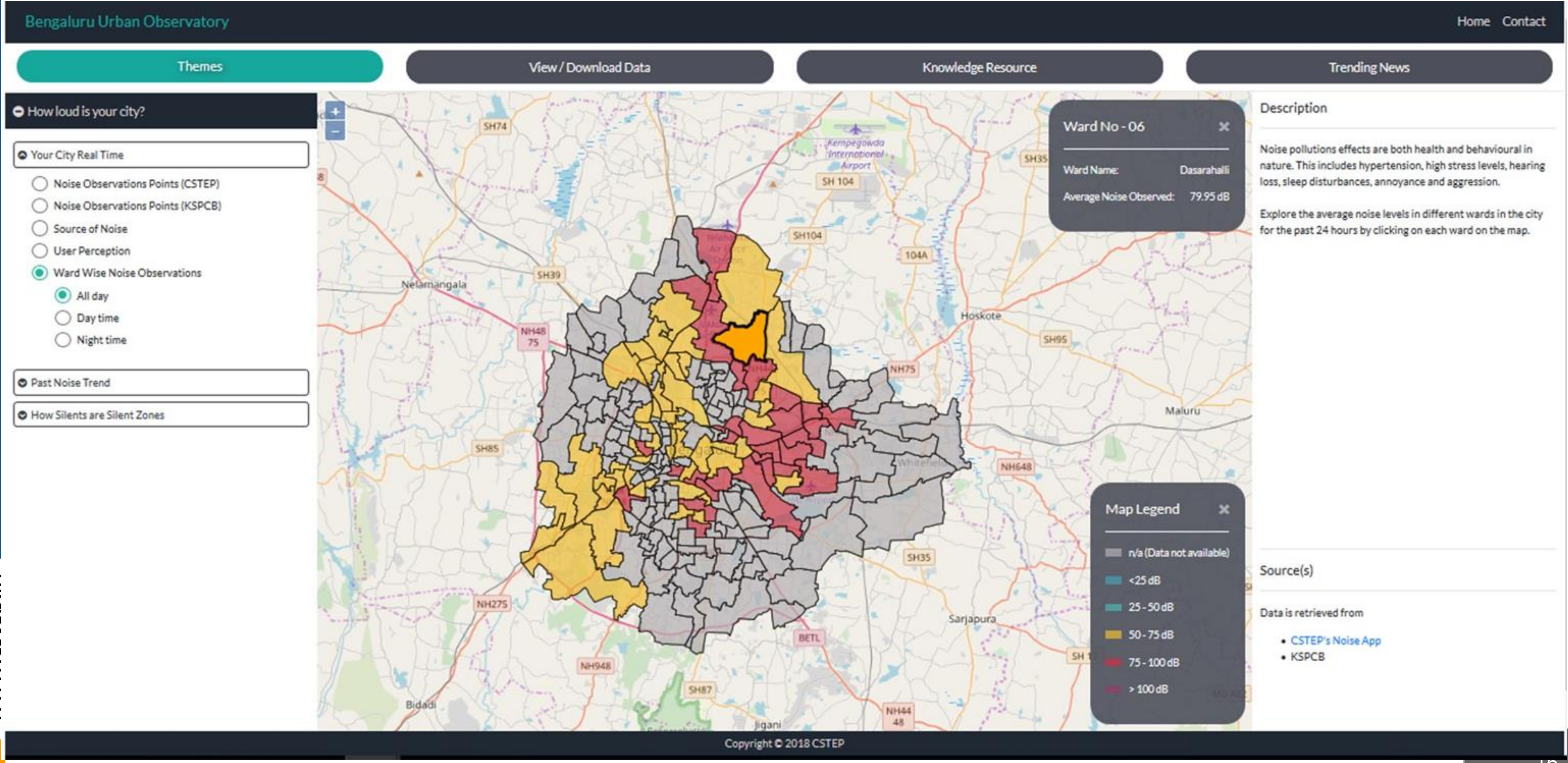
Source(s)

Data is retrieved from

- CSTEP's Noise App
- KSPCB

Copyright © 2018 CSTEP

Bengaluru Dashboard- Screenshots


Bengaluru Urban Observatory
Home
Contact
Themes
View / Download Data
Knowledge Resource
Trending News
SH74
Kempegowda International Airport
SH 104
SH35
SH104
104A
SH39
Nelamangala
NH48 75
Hoskote
SH95
NH75
Maluru
SH85
Whitefield
NH648
SH35
NH275
Sarjapura
BETL
NH948
SH87
Bidadi
NH44 48
Jigani

How loud is your city?

Your City Real Time

- ○ Noise Observations Points (CSTEP)
- ○ Noise Observations Points (KSPCB)
- ○ Source of Noise
- ○ User Perception
- ● Ward Wise Noise Observations
  - ● All day
  - ○ Day time
  - ○ Night time

Past Noise Trend

How Silents are Silent Zones

Ward No - 06

Ward Name: Dasarahalli

Average Noise Observed: 79.95 dB

Map Legend

▬	n/a (Data not available)
▬	<25 dB
▬	25 - 50 dB
▬	50 - 75 dB
▬	75 - 100 dB
▬	> 100 dB

Description

Noise pollutions effects are both health and behavioural in nature. This includes hypertension, high stress levels, hearing loss, sleep disturbances, annoyance and aggression.

Explore the average noise levels in different wards in the city for the past 24 hours by clicking on each ward on the map.

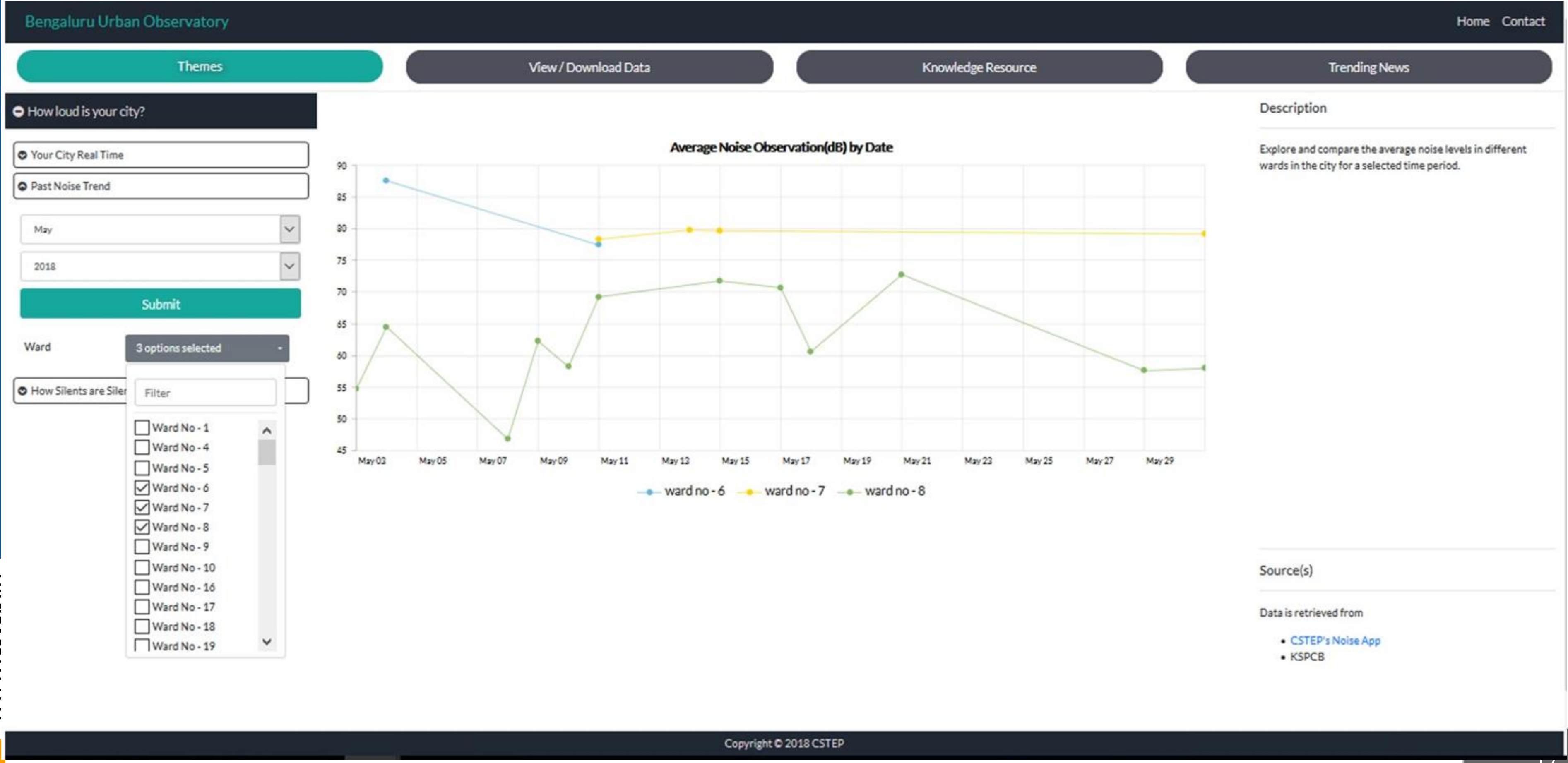
Source(s)

Data is retrieved from

- CSTEP's Noise App
- KSPCB

Copyright © 2018 CSTEP

Bengaluru Dashboard- Screenshots



Bengaluru Urban Observatory
Home
Contact
Themes
View / Download Data
Knowledge Resource
Trending News
How loud is your city?
Your City Real Time
Past Noise Trend
Submit
How Silents are Siler
Filter
Average Noise Observation(dB) by Date
90
85
80
75
70
65
60
55
50
45
May 03
May 05
May 07
May 09
May 11
May 13
May 15
May 17
May 19
May 21
May 23
May 25
May 27
May 29
ward no - 6
ward no - 7
ward no - 8

May

2018

Ward: 3 options selected

- ☐ Ward No - 1
- ☐ Ward No - 4
- ☐ Ward No - 5
- ☑ Ward No - 6
- ☑ Ward No - 7
- ☑ Ward No - 8
- ☐ Ward No - 9
- ☐ Ward No - 10
- ☐ Ward No - 16
- ☐ Ward No - 17
- ☐ Ward No - 18
- ☐ Ward No - 19

Description

Explore and compare the average noise levels in different wards in the city for a selected time period.

Source(s)

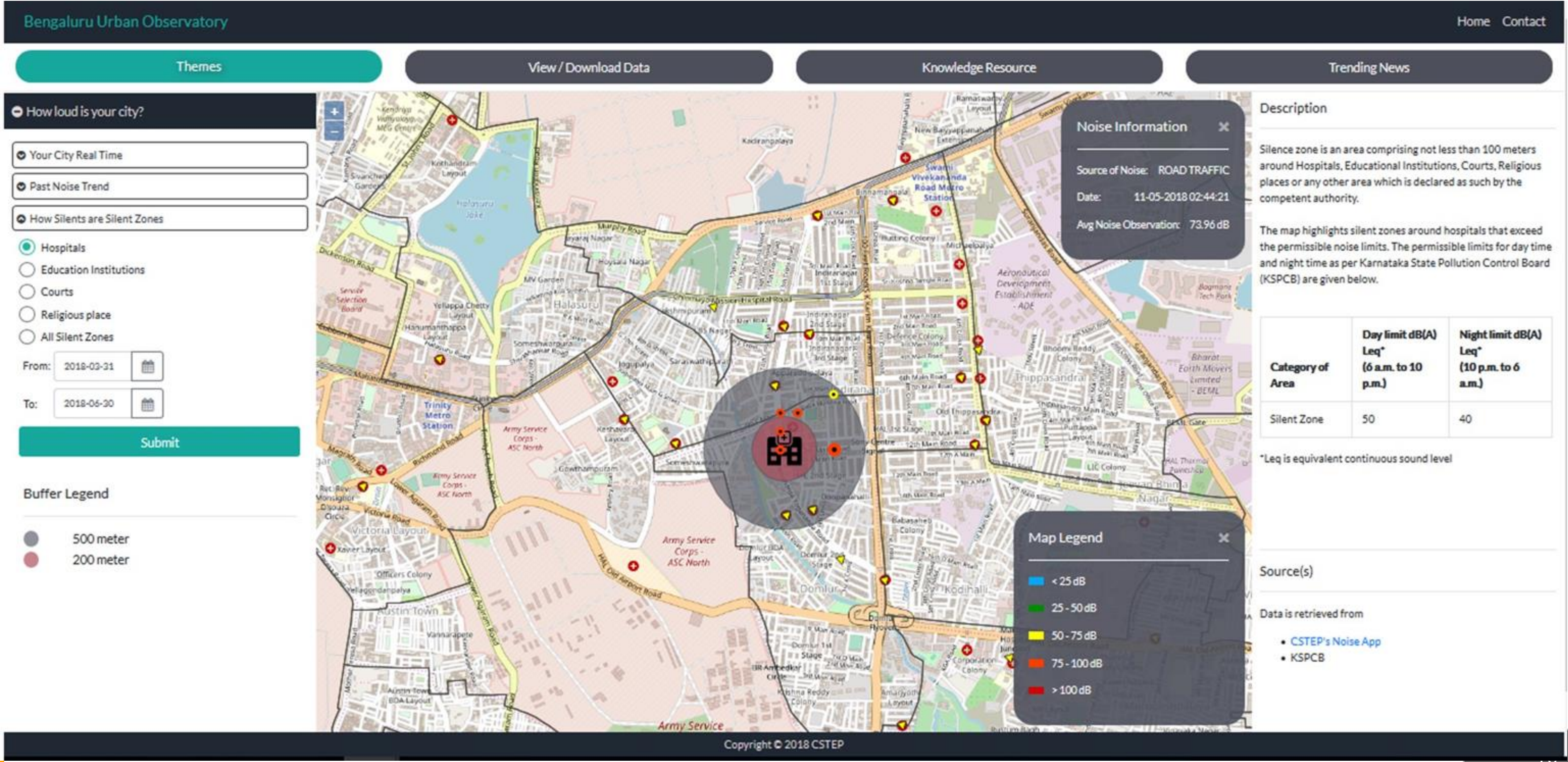
Data is retrieved from

- CSTEP's Noise App
- KSPCB

Copyright © 2018 CSTEP

www.cstep.in

Bengaluru Dashboard- Screenshots


Bengaluru Urban Observatory
Home
Contact
Themes
View / Download Data
Knowledge Resource
Trending News
How loud is your city?
Your City Real Time
Past Noise Trend
How Silents are Silent Zones
Submit
+
−

● Hospitals
○ Education Institutions
○ Courts
○ Religious place
○ All Silent Zones

From: 2018-03-31

To: 2018-06-30

Buffer Legend

● 500 meter
● 200 meter

Noise Information

Source of Noise: ROAD TRAFFIC

Date: 11-05-2018 02:44:21

Avg Noise Observation: 73.96 dB

Map Legend

🟦 < 25 dB
🟩 25 - 50 dB
🟨 50 - 75 dB
🟧 75 - 100 dB
🟥 > 100 dB

Description

Silence zone is an area comprising not less than 100 meters around Hospitals, Educational Institutions, Courts, Religious places or any other area which is declared as such by the competent authority.

The map highlights silent zones around hospitals that exceed the permissible noise limits. The permissible limits for day time and night time as per Karnataka State Pollution Control Board (KSPCB) are given below.

Category of Area	Day limit dB(A) Leq* (6 a.m. to 10 p.m.)	Night limit dB(A) Leq* (10 p.m. to 6 a.m.)
Silent Zone	50	40

*Leq is equivalent continuous sound level

Source(s)

Data is retrieved from

- CSTEP's Noise App
- KSPCB

Copyright © 2018 CSTEP

www.cstep.in

State Dashboard

State Dashboard

Spatial analyses and visualization to indicate direction of built growth

Building permission issuance data from the KMDS application- Nirmana

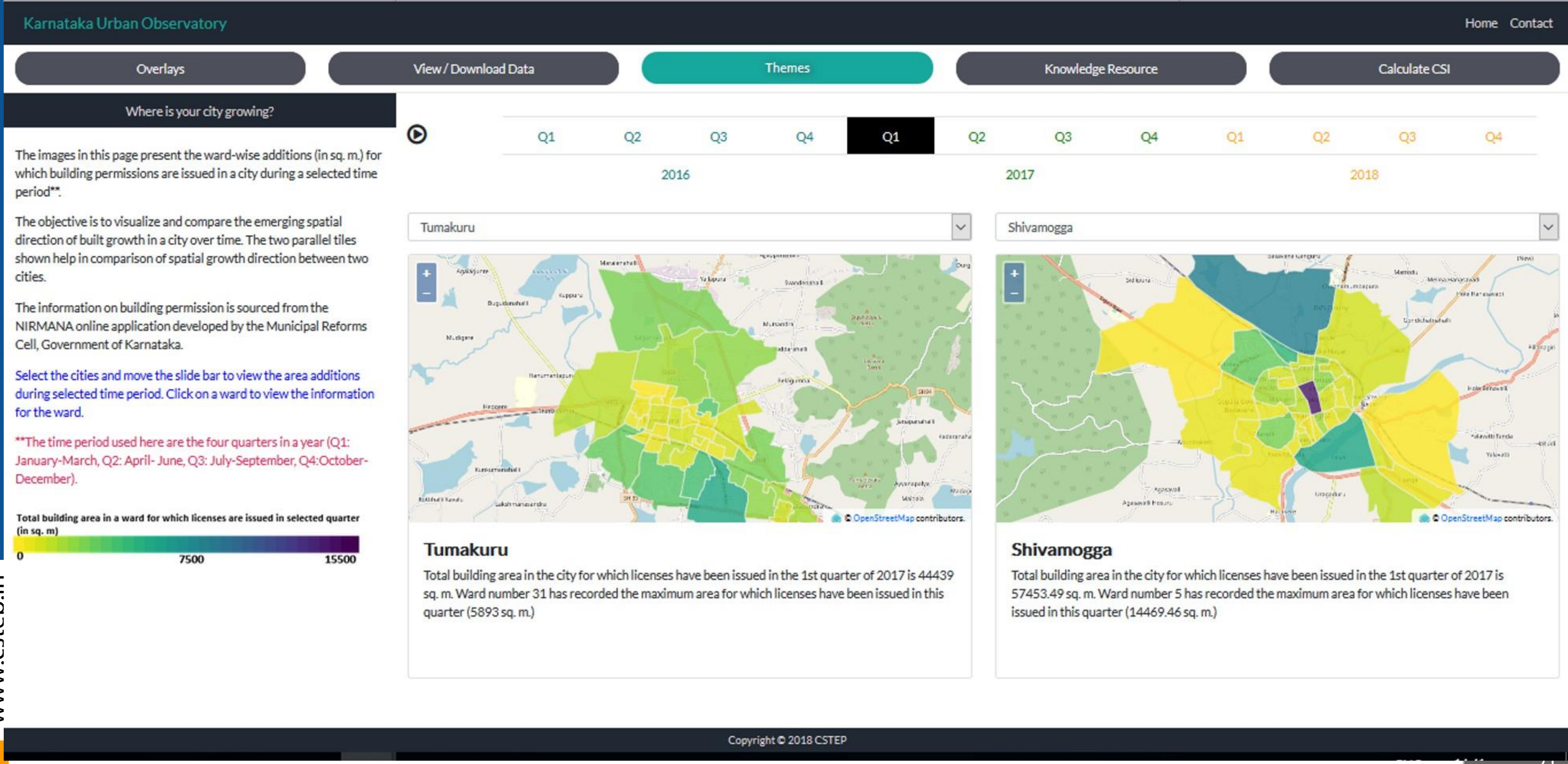
Aggregation at ward level (quarterly in sq. m)

Spatial mapping to show intensity of built growth in each ward

State Dashboard- Demo

State Dashboard

State Dashboard- Screenshots


Karnataka Urban Observatory
Home
Contact
Overlays
View / Download Data
Themes
Knowledge Resource
Calculate CSI
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
2016
2017
2018
Tumakuru
Shivamogga
© OpenStreetMap contributors.
© OpenStreetMap contributors.
Total building area in a ward for which licenses are issued in selected quarter (in sq. m)
0
7500
15500
Copyright © 2018 CSTEP

Where is your city growing?

The images in this page present the ward-wise additions (in sq. m.) for which building permissions are issued in a city during a selected time period**.

The objective is to visualize and compare the emerging spatial direction of built growth in a city over time. The two parallel tiles shown help in comparison of spatial growth direction between two cities.

The information on building permission is sourced from the NIRMANA online application developed by the Municipal Reforms Cell, Government of Karnataka.

Select the cities and move the slide bar to view the area additions during selected time period. Click on a ward to view the information for the ward.

**The time period used here are the four quarters in a year (Q1: January-March, Q2: April- June, Q3: July-September, Q4:October-December).

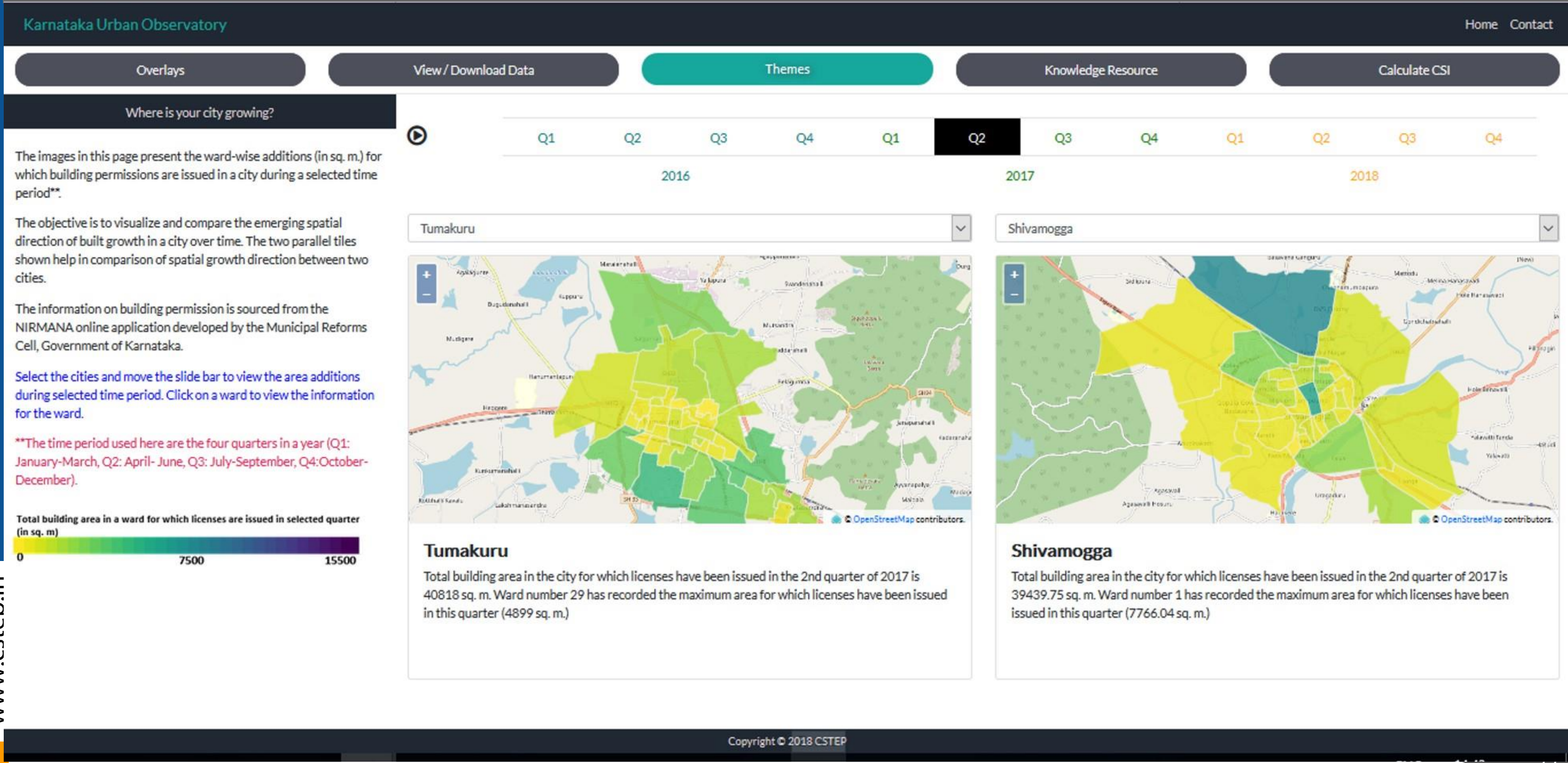
Tumakuru

Total building area in the city for which licenses have been issued in the 1st quarter of 2017 is 44439 sq. m. Ward number 31 has recorded the maximum area for which licenses have been issued in this quarter (5893 sq. m.)

Shivamogga

Total building area in the city for which licenses have been issued in the 1st quarter of 2017 is 57453.49 sq. m. Ward number 5 has recorded the maximum area for which licenses have been issued in this quarter (14469.46 sq. m.)

State Dashboard- Screenshots


Karnataka Urban Observatory
Home
Contact
Overlays
View / Download Data
Themes
Knowledge Resource
Calculate CSI
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
2016
2017
2018
Tumakuru
Shivamogga
+
−
© OpenStreetMap contributors.
0
7500
15500
Copyright © 2018 CSTEP

Where is your city growing?

The images in this page present the ward-wise additions (in sq. m.) for which building permissions are issued in a city during a selected time period**.

The objective is to visualize and compare the emerging spatial direction of built growth in a city over time. The two parallel tiles shown help in comparison of spatial growth direction between two cities.

The information on building permission is sourced from the NIRMANA online application developed by the Municipal Reforms Cell, Government of Karnataka.

Select the cities and move the slide bar to view the area additions during selected time period. Click on a ward to view the information for the ward.

**The time period used here are the four quarters in a year (Q1: January-March, Q2: April- June, Q3: July-September, Q4:October-December).

Total building area in a ward for which licenses are issued in selected quarter (in sq. m)

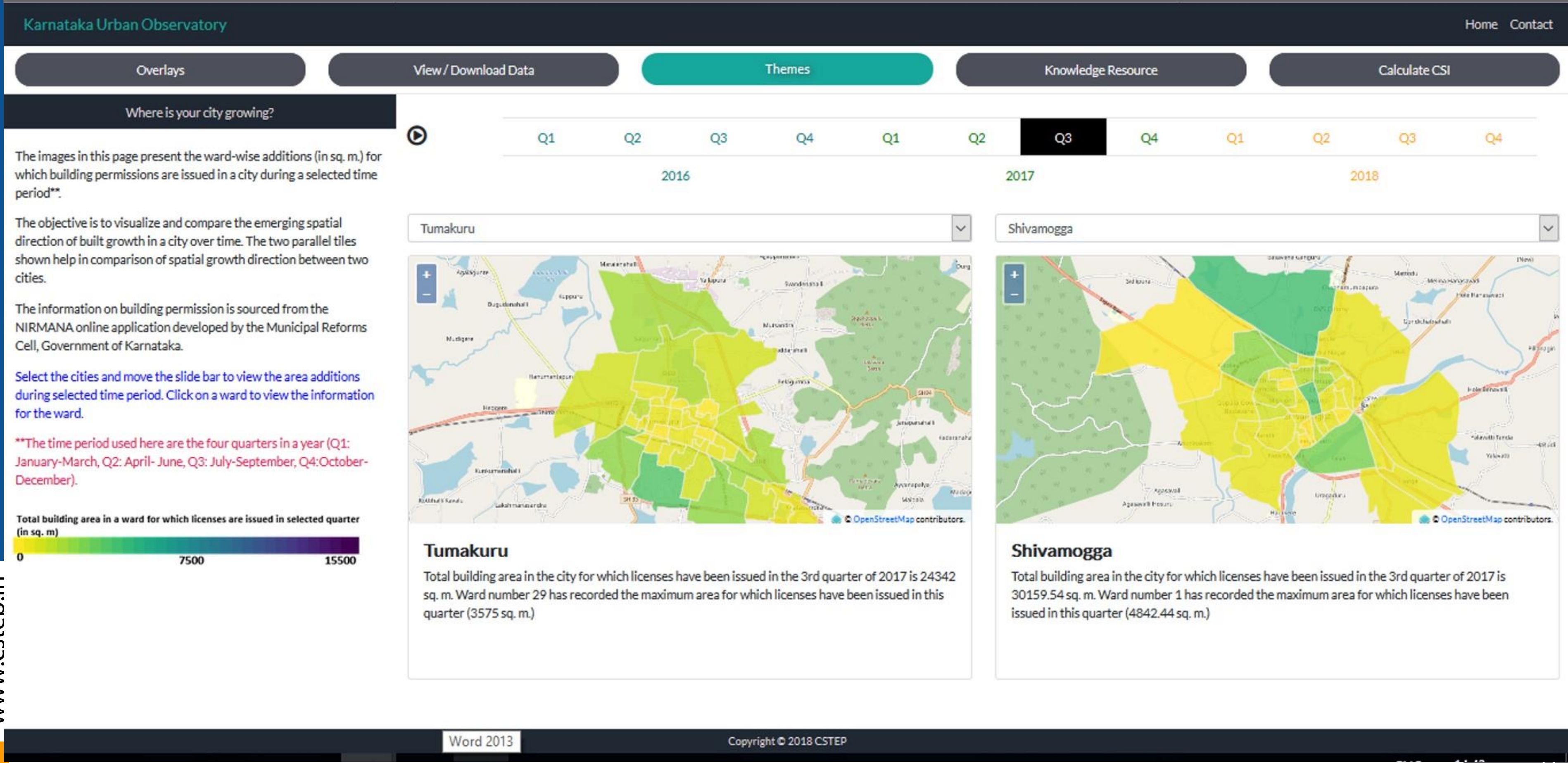
Tumakuru

Total building area in the city for which licenses have been issued in the 2nd quarter of 2017 is 40818 sq. m. Ward number 29 has recorded the maximum area for which licenses have been issued in this quarter (4899 sq. m.)

Shivamogga

Total building area in the city for which licenses have been issued in the 2nd quarter of 2017 is 39439.75 sq. m. Ward number 1 has recorded the maximum area for which licenses have been issued in this quarter (7766.04 sq. m.)

State Dashboard- Screenshots


Karnataka Urban Observatory
Home
Contact
Overlays
View / Download Data
Themes
Knowledge Resource
Calculate CSI
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
2016
2017
2018
Tumakuru
Shivamogga
© OpenStreetMap contributors.
© OpenStreetMap contributors.
Word 2013

Where is your city growing?

The images in this page present the ward-wise additions (in sq. m.) for which building permissions are issued in a city during a selected time period**.

The objective is to visualize and compare the emerging spatial direction of built growth in a city over time. The two parallel tiles shown help in comparison of spatial growth direction between two cities.

The information on building permission is sourced from the NIRMANA online application developed by the Municipal Reforms Cell, Government of Karnataka.

Select the cities and move the slide bar to view the area additions during selected time period. Click on a ward to view the information for the ward.

**The time period used here are the four quarters in a year (Q1: January-March, Q2: April- June, Q3: July-September, Q4:October-December).

Total building area in a ward for which licenses are issued in selected quarter (in sq. m)

0 **7500** **15500**

Tumakuru

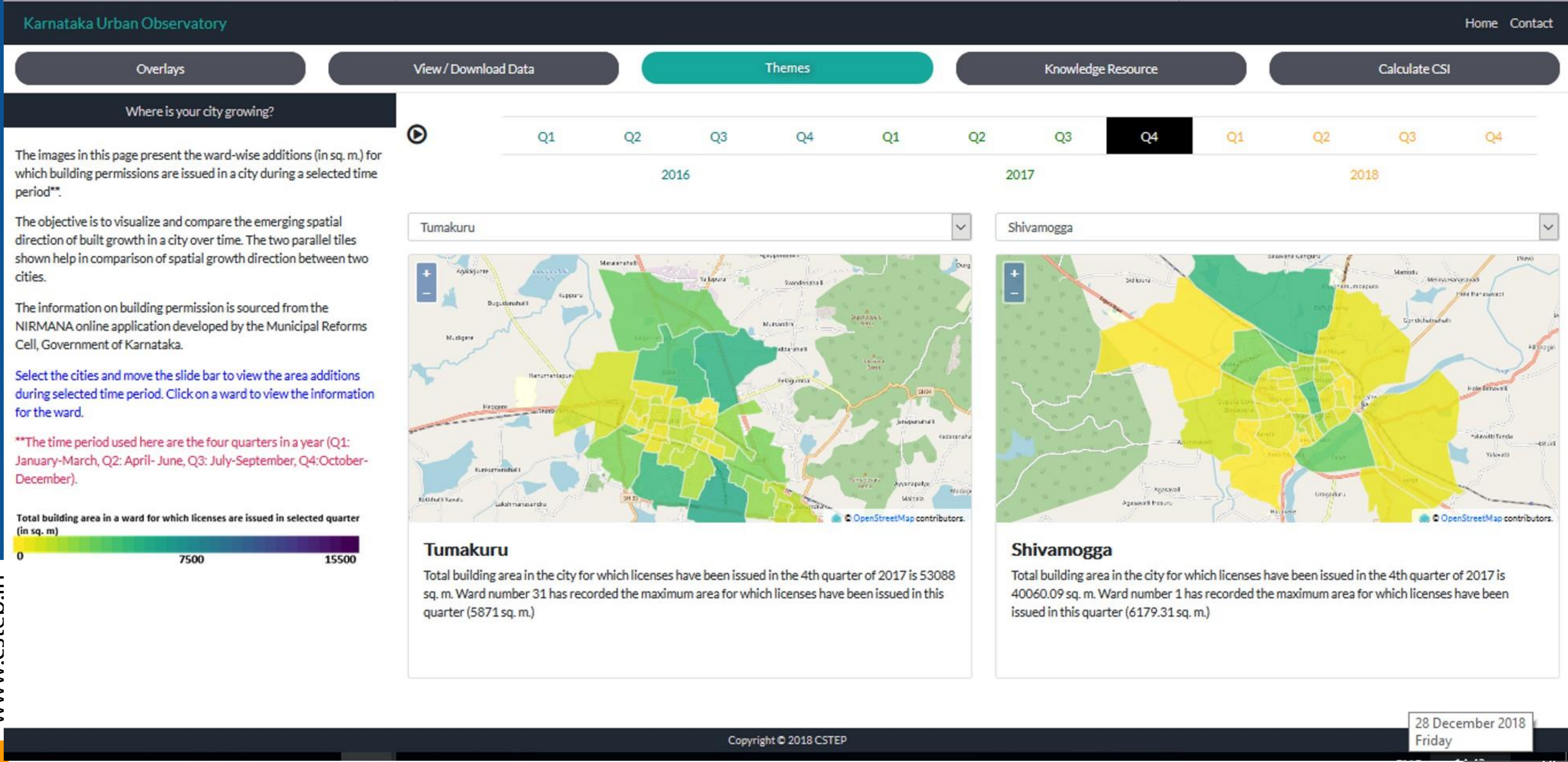
Total building area in the city for which licenses have been issued in the 3rd quarter of 2017 is 24342 sq. m. Ward number 29 has recorded the maximum area for which licenses have been issued in this quarter (3575 sq. m.)

Shivamogga

Total building area in the city for which licenses have been issued in the 3rd quarter of 2017 is 30159.54 sq. m. Ward number 1 has recorded the maximum area for which licenses have been issued in this quarter (4842.44 sq. m.)

Copyright © 2018 CSTEP

State Dashboard- Screenshots


Karnataka Urban Observatory
Home
Contact
Overlays
View / Download Data
Themes
Knowledge Resource
Calculate CSI
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
2016
2017
2018
Tumakuru
Shivamogga
+
−
© OpenStreetMap contributors.
28 December 2018
Friday

Where is your city growing?

The images in this page present the ward-wise additions (in sq. m.) for which building permissions are issued in a city during a selected time period**.

The objective is to visualize and compare the emerging spatial direction of built growth in a city over time. The two parallel tiles shown help in comparison of spatial growth direction between two cities.

The information on building permission is sourced from the NIRMANA online application developed by the Municipal Reforms Cell, Government of Karnataka.

Select the cities and move the slide bar to view the area additions during selected time period. Click on a ward to view the information for the ward.

**The time period used here are the four quarters in a year (Q1: January-March, Q2: April- June, Q3: July-September, Q4:October-December).

Total building area in a ward for which licenses are issued in selected quarter (in sq. m)

0 7500 15500

Tumakuru

Total building area in the city for which licenses have been issued in the 4th quarter of 2017 is 53088 sq. m. Ward number 31 has recorded the maximum area for which licenses have been issued in this quarter (5871 sq. m.)

Shivamogga

Total building area in the city for which licenses have been issued in the 4th quarter of 2017 is 40060.09 sq. m. Ward number 1 has recorded the maximum area for which licenses have been issued in this quarter (6179.31 sq. m.)

Copyright © 2018 CSTEP

Conclusion

- The Proof-of-Concept Urban Observatory platform demonstrates features of data collation, analysis and visualisation through two selected themes/ functionalities.

- These features can be extended to other themes for all cities in Karnataka.

Part-II

Pre- Feasibility Assessment of Sanitation Options for Cities

Background

- GoK policies for Sanitation
    - Urban Waste Water Reuse Policy: Preparation of IUWM plans for 10 cities
    - Faecal Sludge and Septage Management Policy: Phase-wise implementation of FSSM in combination with networked systems, with first phase focussing on AMRUT cities
    - State Sanitation Strategy: 100% sanitation coverage in all cities

Objectives

To facilitate implementation of UWWR Policy, FSSM Policy and the State Sanitation Strategy in an integrated manner

1. Identify cities and regions which would require priority attention due to high water-stress and growth pressure by 2020

2. Demonstrate a pre-feasibility assessment methodology for choice of sanitation systems for select cities which can help achieve objectives of stated policies

Methodology

Identifying regions facing varying levels of

1. Water Stress
2. Demographic & Economic Growth

(Overlay Analysis in GIS)

Identification of Priority Regions and cities across Karnataka

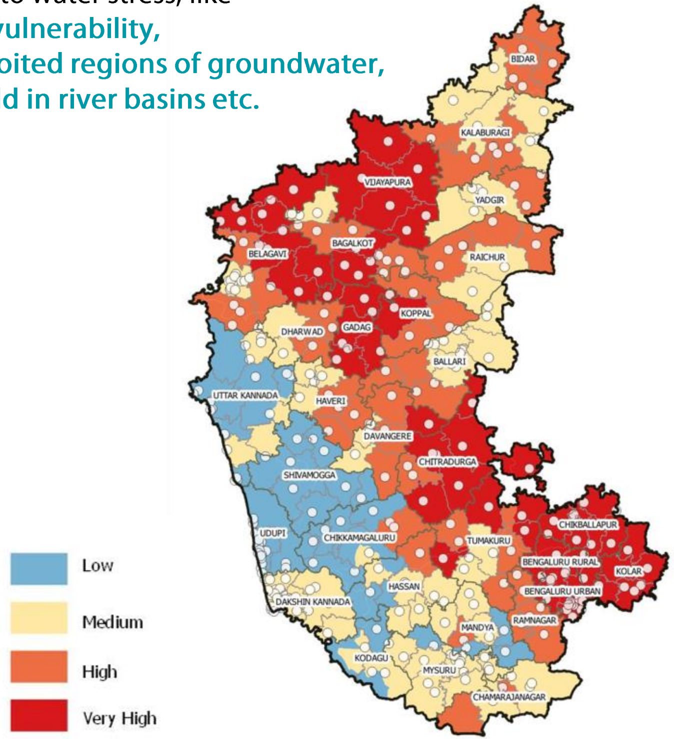
Development and comparison of scenarios for sanitation system choices in select 4 cities

Methodology

Regions facing varying levels of water stress

Weighted overlay analysis of possible criteria contributing to water stress, like

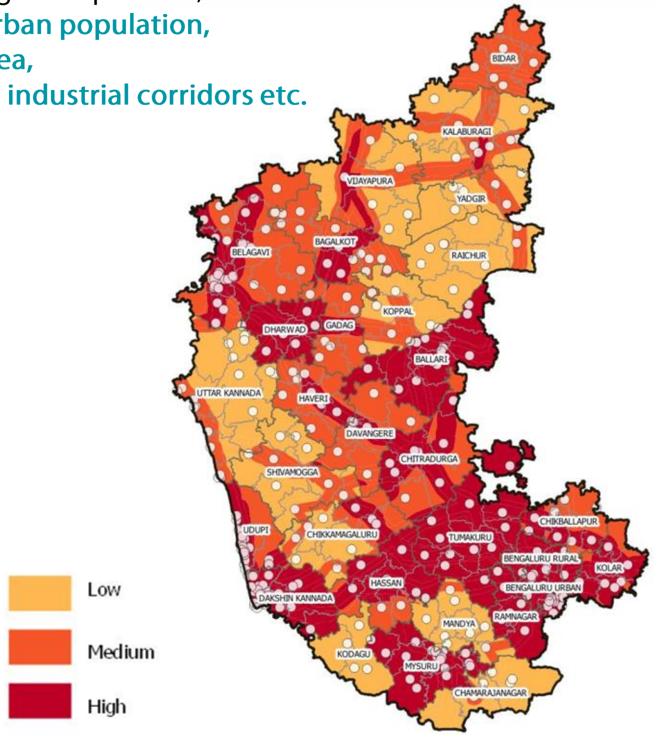
- drought vulnerability,
- over exploited regions of groundwater,
- water yield in river basins etc.


BIDAR
KALABURAGI
VIJAYAPURA
YADGIR
BAGALKOT
BELAGAVI
RAICHUR
KOPPAL
DHARWAD
GADAG
BALLARI
UTTAR KANNADA
HAVERI
DAVANGERE
CHITRADURGA
SHIVAMOGGA
UDUPI
CHIKKAMAGALURU
TUMAKURU
CHIKBALLAPUR
BENGALURU RURAL
KOLAR
BENGALURU URBAN
HASSAN
DAKSHIN KANNADA
RAMNAGAR
MANDYA
KODAGU
MYSURU
CHAMARAJANAGAR
Low
Medium
High
Very High

Regions facing varying levels of growth pressure

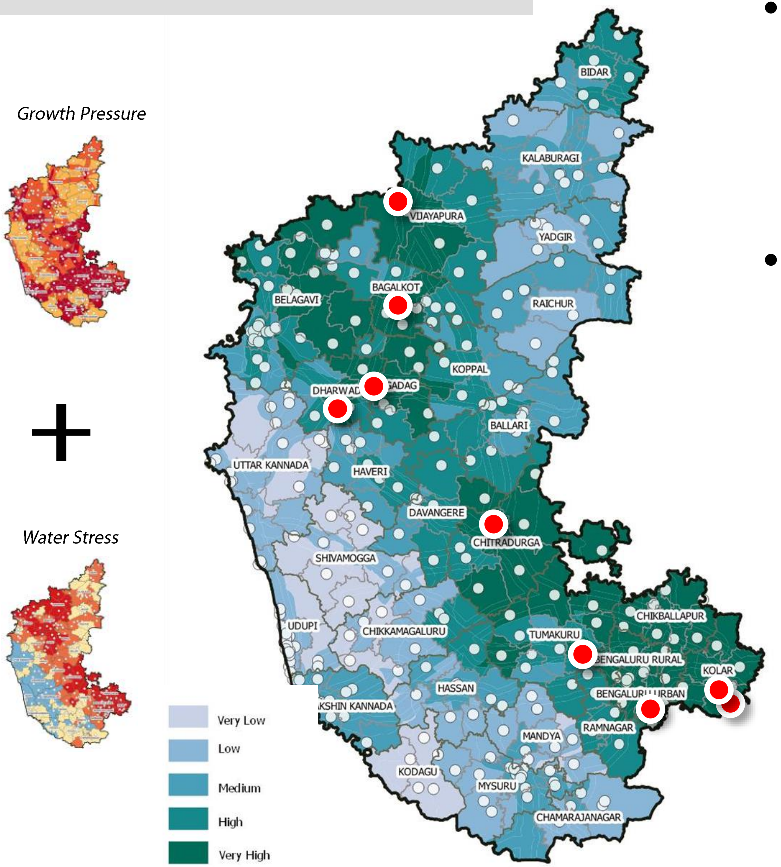
Weighted overlay analysis of possible socio-economic criteria contributing to growth pressure, like

- growth of urban population,
- industrial area,
- proximity to industrial corridors etc.


BIDAR
KALABURAGI
VIJAYAPURA
YADGIR
BAGALKOT
BELAGAVI
RAICHUR
KOPPAL
DHARWAD
GADAG
BALLARI
UTTAR KANNADA
HAVERI
DAVANGERE
CHITRADURGA
SHIVAMOGGA
UDUPI
CHIKKAMAGALURU
TUMAKURU
CHIKBALLAPUR
BENGALURU RURAL
KOLAR
BENGALURU URBAN
HASSAN
DAKSHIN KANNADA
RAMNAGAR
MANDYA
KODAGU
MYSURU
CHAMARAJANAGAR
Low
Medium
High

Results: Priority regions and cities

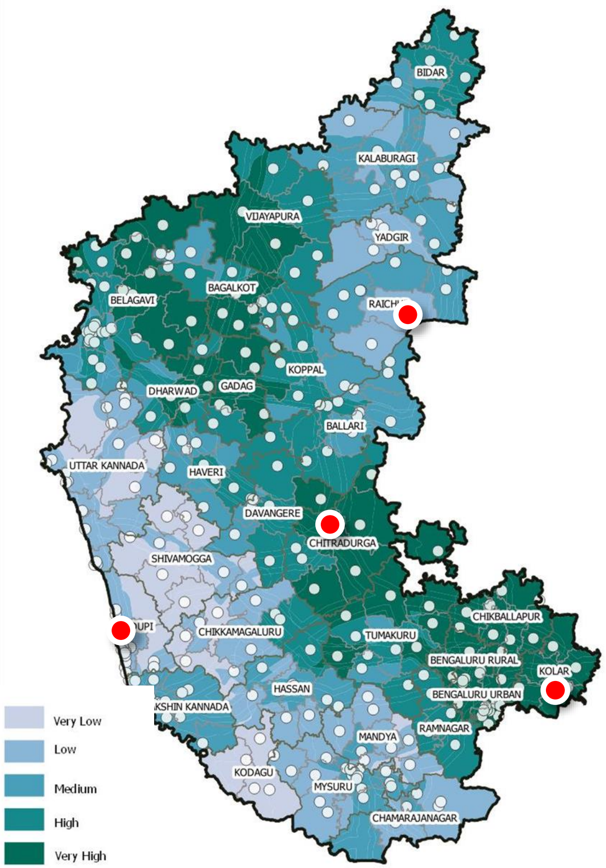
Priority Regions


Growth Pressure
+
Water Stress
BIDAR
KALABURAGI
VIJAYAPURA
YADGIR
BAGALKOT
BELAGAVI
RAICHUR
KOPPAL
DHARWAD
GADAG
BALLARI
UTTAR KANNADA
HAVERI
DAVANGERE
CHITRADURGA
SHIVAMOGGA
CHIKBALLAPUR
UDUPI
CHIKKAMAGALURU
TUMAKURU
BENGALURU RURAL
KOLAR
HASSAN
BENGALURU URBAN
AKSHIN KANNADA
RAMNAGAR
MANDYA
KODAGU
MYSURU
CHAMARAJANAGAR
Very Low
Low
Medium
High
Very High

- High priority regions lie mostly along **the Bengaluru-Mumbai Economic corridor**
- 8 class-I and 12 class-II are located in high-priority regions

Class 1 cities	Class 2 cities
Bengaluru, Hubballi-Dharwad Vijaypura, Tumakuru Gadag, Robertsonpet Chitradurga, Kolar, Bagalkot	Doddaballapur, Gokak, Chintamani, Chikkaballapura Nipani, Tiptur, Sira, Mulbagal Hosakote, Hiriyur, Challakere, Sidlaghatta

Sanitation pre-feasibility assessment


BIDAR
KALABURAGI
VIJAYAPURA
YADGIR
BAGALKOT
BELAGAVI
RAICH
KOPPAL
DHARWAD
GADAG
BALLARI
UTTAR KANNADA
HAVERI
DAVANGERE
CHITRADURGA
SHIVAMOGGA
CHIKBALLAPUR
UPI
CHIKKAMAGALURU
TUMAKURU
BENGALURU RURAL
KOLAR
BENGALURU URBAN
HASSAN
KSHIN KANNADA
RAMNAGAR
MANDYA
KODAGU
MYSURU
CHAMARAJANAGAR
Very Low
Low
Medium
High
Very High

Selection of cities

2 cities in very high water stressed region

- Kolar
- Chitradurga

2 cities in different geographic regions

- Udupi (Coastal city),
- Raichur (Northern Karnataka region)

Sanitation pre-feasibility assessment: Scenarios

- Three scenarios were designed for each city:
    - **Scenario 1:** Decentralised FSSM system using natural treatment technologies
    - **Scenario 2:** Decentralised FSSM system using mechanised treatment
    - **Scenario 3:** Centralised networked systems
- Techno-economic analysis done for each scenario

Sanitation pre-feasibility assessment

Baseline parameters

Baseline parameters	Kolar	Raichur	Chitradurga	Udupi
Estimated present population (2018)	1,69,207	2,84,221	1,67,975	1,93,196
No. of households	36,632	55,996	36,235	42,402
% of homes with toilets and storage	22%	20%	33%	82%
% of homes with toilets (but no storage/collection)	3%	5%	3%	0%
% of homes with sewerage system	68%	34%	51%	15%
% of homes with decentralised system	0%	0%	0%	0%
% of homes with no toilets	7%	41%	13%	3%

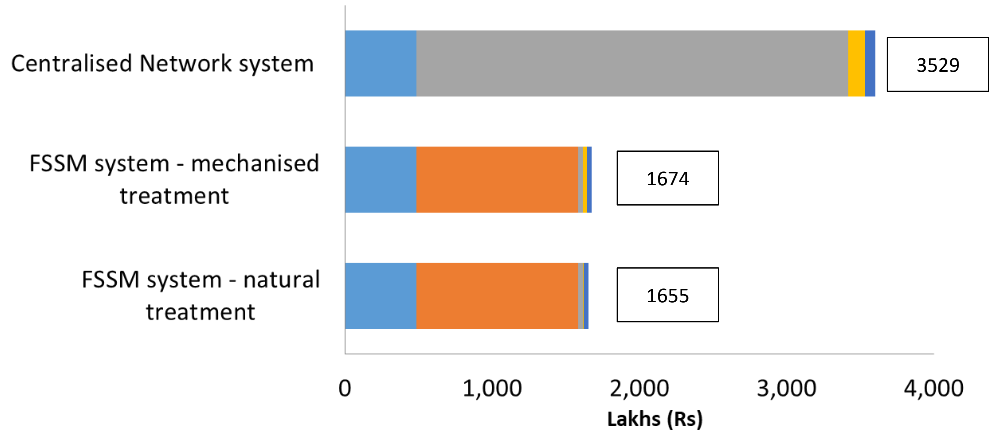
Sanitation pre-feasibility assessment

Guiding Assumptions

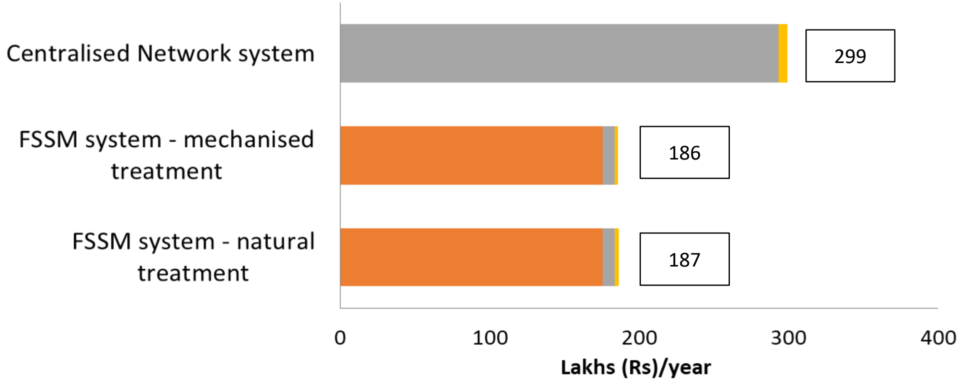
- Systems and their technologies chosen based on city’s physiology
- Unit costs, treatment efficiency and resource requirements vary across technologies
- Estimated plant capacity, water required vary based on type of system
- In each scenario, selected system serves 100% of the unserved population

Results: Kolar

Capital Costs



Operation & Maintenance Costs



	FSSM system - natural treatment	FSSM system - mechanised treatment	Centralised Network system
Land requirement for treatment (acres)	0.10	0.04	2.03
Treated wastewater generated (tonne/yr)	5,805	5,805	7,05,138
Treated sludge generated (kl/year)	6,530	6,530	1,322

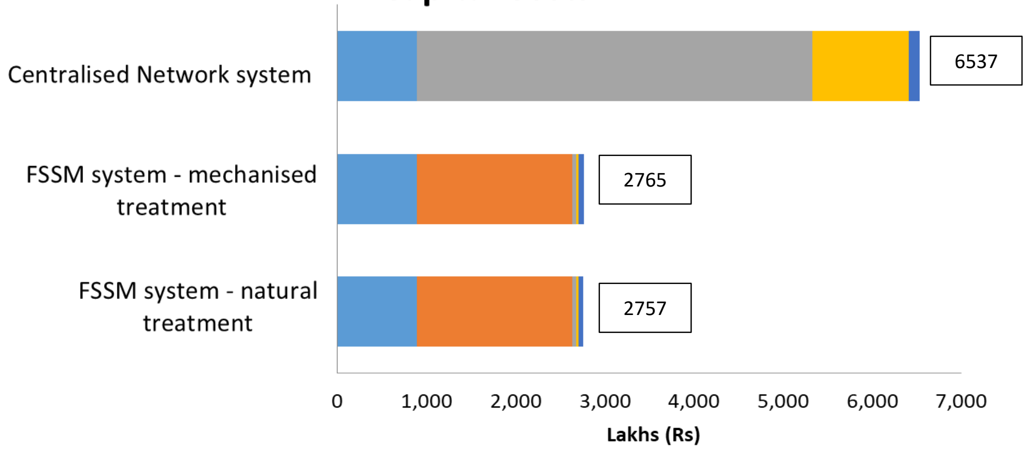
Legend

🟦 Toilet CAPEX 🟧 Storage CAPEX ⬜ Conveyance CAPEX

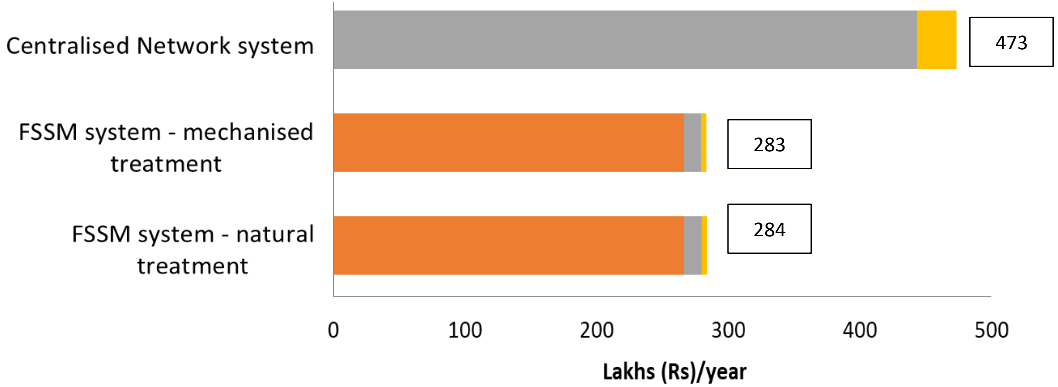
🟨 Treatment CAPEX 🟦 Contingency

Results: Chitradurga

Capital Costs



Operation & Maintenance Costs



	FSSM system - natural treatment	FSSM system - mechanised treatment	Centralised Network system
Land requirement for treatment (acres)	0.32	0.05	1.84
Treated wastewater generated (tonne/yr)	13964	13964	22,24,979
Treated sludge generated (kl/year)	15,710	15,710	4,172

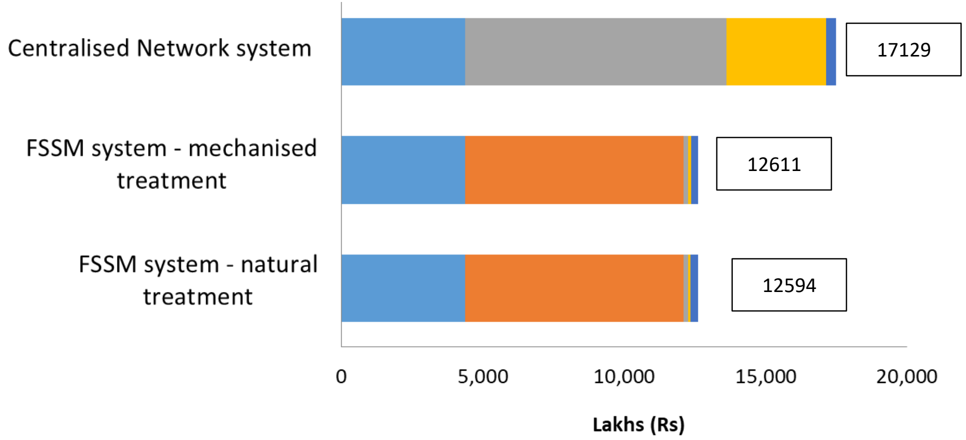
Legend

🟦 Toilet CAPEX 🟧 Storage CAPEX ⬜ Conveyance CAPEX

🟨 Treatment CAPEX 🟦 Contingency

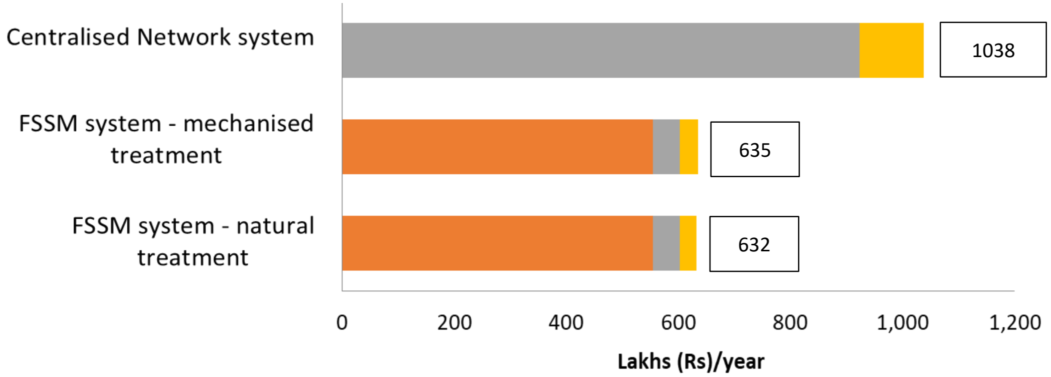
Results: Raichur

Capital Costs



	FSSM system - natural treatment	FSSM system - mechanised treatment	Centralised Network system
Land requirement for treatment (acres)	1.04	0.19	6.21
Treated wastewater generated (tonne/yr)	59,145	59,145	75,61,889
Treated sludge generated (kl/year)	66,539	66,539	14,179

Operation & Maintenance Costs



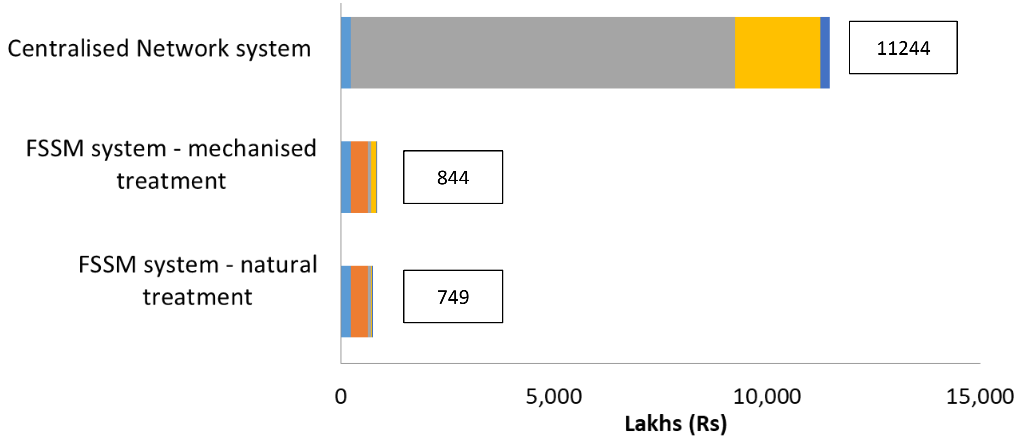
Legend

🟦 Toilet CAPEX 🟧 Storage CAPEX ⬜ Conveyance CAPEX

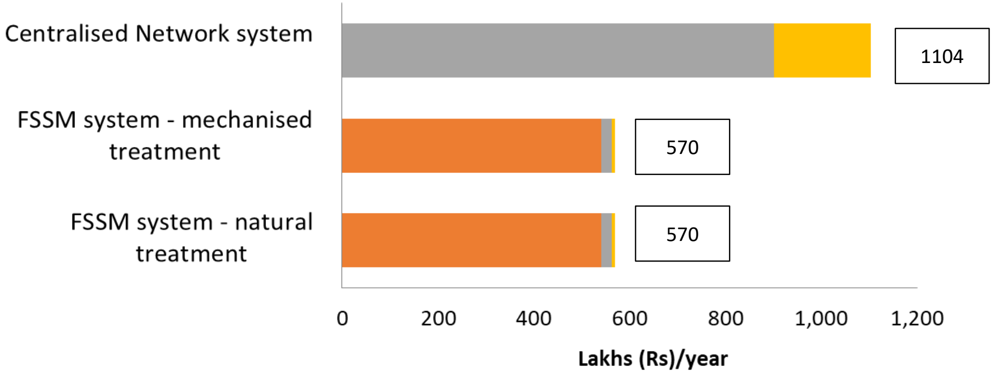
🟨 Treatment CAPEX 🟦 Contingency

Results: Udupi

Capital Costs



Operation & Maintenance Costs



	FSSM system - natural treatment	FSSM system - mechanised treatment	Centralised Network system
Land requirement for treatment (acres)	0.19	0.09	4.86
Treated wastewater generated (tonne/yr)	22,572	22,572	46,08,185
Treated sludge (generated (kl/year)	25,394	25,394	46,08,185

Legend

🟦 Toilet CAPEX 🟧 Storage CAPEX ⬜ Conveyance CAPEX

🟨 Treatment CAPEX 🟦 Contingency

Recommendations & Conclusions

- Decentralised FSSM systems are recommended for water-stressed regions
- Lower land and water requirements for Decentralised FSSM systems
- Need to invest in greywater management systems alongside FSSM
- Potential for revenue for networked systems from waste water reuse
- A list of strategies and technologies can be accessed in a toolkit format, available in the following link (http://cstem.cstep.in/uoapp/#/state)

Thank You