2019 Report

HUGSI

Husqvarna Urban Green Space Index

www.hugsi.green

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HUGSI – Husqvarna Urban Green Space Index – an index to safeguard green spaces in urban areas

Imagine New York without Central Park, London without Hyde Park, or that the little pocket park closest to your own home would be replaced with a new office building or a parking lot. As urbanization continues, the battle for land and resources intensifies, putting parks and all types of green spaces at risk.

Green spaces, trees and plants are the lungs of our cities, improving air quality, managing rainwater, and contributing to the physical and mental health of the citizens. With more people sharing the same space, it becomes vital to safeguard the green spaces, ensuring that the green space per capita is not jeopardized.

Peter Drucker said, "What gets measured, gets managed". That is exactly why we developed HUGSI. By applying computer vision and deep learning techniques on satellite images, HUGSI unveils insights about the current state and historic development of vegetation and their surrounding environment in urban areas. This makes it possible to find out how green cities really are and if densification is reducing the amount of urban green spaces.

We hope and believe, that this index will empower city representatives with the data needed to safeguard green spaces. We also believe that using this technology will make parks greener, safer, and enable resources to last longer through prediction of future growth and taking preventive actions. Knowing the health status of a tree can not only minimize the risk of dead branches falling but also compliment, and in some cases replace date scheduled maintenance with need-based care to improve the green spaces and give landscapers time for other tasks.

For HUGSI, we have monitored 98 cities around the world. As a baseline, we used the cities that are members of C40, the network of the world's megacities committed to addressing climate change, representing 700+ million citizens and one quarter of the global economy. Imagine the positive effects when these cities collaborate with the insights and opportunities from HUGSI and begin employing the benefits of digitalization in their green spaces.

Digitalization, robotics and autonomous solutions will play a key role in making the green spaces of cities more sustainable, HUGSI is a milestone on the journey.

Anders Johanson
CTO, Husqvarna Group

Viewing green space from above

What is HUGSI

HUGSI stands for Husqvarna Urban Green Space Index — a digital innovation initiative developed by Husqvarna in collaboration with 20tree.ai. The ambition is to help safeguard and improve maintenance of green spaces in urban areas. By applying computer vision and deep learning techniques on satellite images, HUGSI unveils insights about the size, proportion, distribution, and health of green space in urban areas.

Why HUGSI matters

Urbanization is happening at an unprecedented pace. Cities are increasingly focused on sustainable development. With proven environmental and recreational value, the development and management of urban green space is becoming a focus area for cities across the globe. It takes political guidance, citizen participation and cross-sector collaboration to turn the vision for urban green space into reality.

That's why we created HUGSI – to raise the awareness about the value of urban green space among citizens, support city officials and politicians to make data informed decisions and facilitate the collaboration across industries and organizations to together make "smart and sustainable city" a reality.
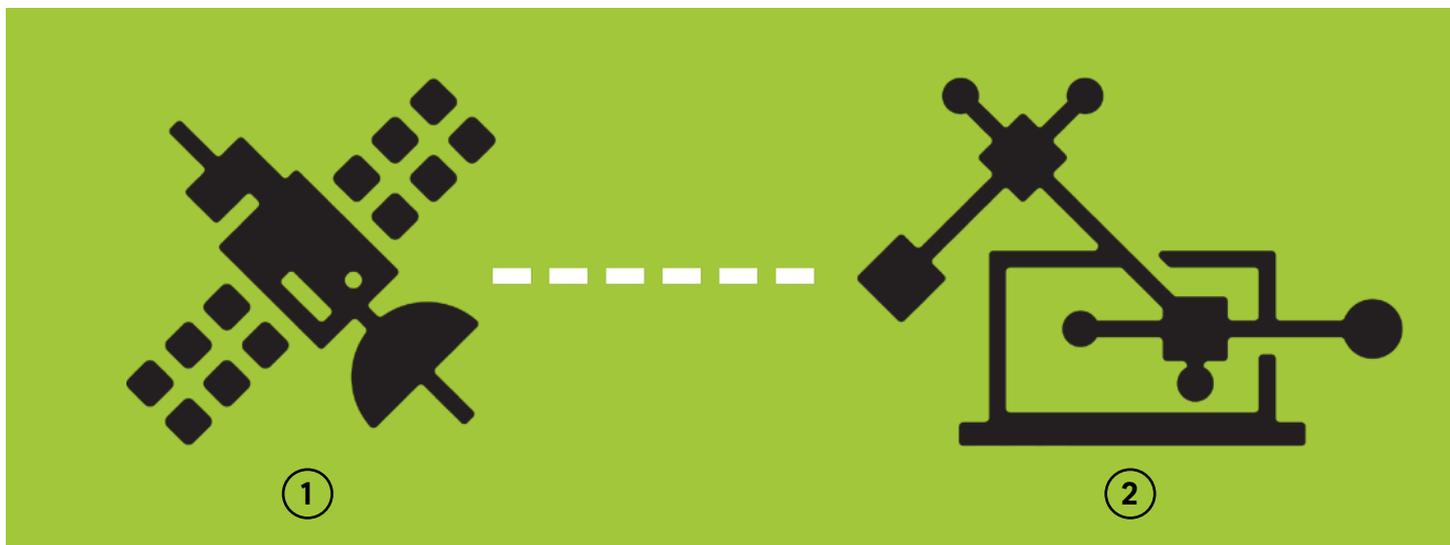
Highlighting cities
with "green" commitment

How the cities were chosen

The index includes 98 cities in 51 countries. The city selection is based on C40 members*, including temporarily inactive cities. Since the C40 cities also care a lot about sustainability it was a perfect match for us. In addition, we have added Geneva (Switzerland), Brussles (Belgium), Gothenburg (Sweden) and Marseille (France) to allow domestic comparisons in key European countries.

How urban area of a city is defined

City boundaries in HUGSI are defined based on OSM Boundaries dataset provided by Open Street Map. Population data from Global Human Settlement Layer (GHS-POP) is used to adjust city boundaries so we only take into consideration urban areas where citizens actually reside.

Read more about C40: https://www.c40.org/

Read more about OSM Boundaries data:
https://wambachers-osm.website/boundaries/

Read more about Global Human Settlement Layer:
https://ghsl.jrc.ec.europa.eu/ghs_pop2019.php

*C40 is a network of the world's megacities committed to addressing climate change. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change.

How it works

1. Satellite image data is acquired from Copernicus project supported by European Commission and European Space Agency (ESA).

2. Computer vision and machine learning techniques are applied to turn satellite image data into a range of urban green space metrics.

3. The overall greenness scores are calculated and are used to rank select cities.

Global ranking

The HUGSI-index compares the level of greenness in 98 cities from 51 countries, divided into 7 regions. By identifying and recognizing these green heroes, we hope that the top ranking cities in this index can serve as inspiration for others on how to increase and distribute green spaces in urban areas.

As the cities are located in different climate zones, we have used data for the index from the greenest day of each individual city.

Hence, all cities are assessed when they are at their greenest.

The index calculation is based on the percentage of vegetation (trees and grass) and weighing in the average health and distribution of the urban vegetation.

To learn more about the index, visit hugsi.green.

Category winners

	Highest percentage of green space **Durban**		Best health of vegetation **Brussels**		Highest percentage of urban area covered by grass **Jaipur**
	Best distribution of green space **Dhaka**		Most green space per capita **Austin**		Highest percentage of urban area covered by trees **Durban**

Top 10

Rank	City	Score	Type of vegetation			
			Grasses	Trees	Water	Other
1st	Durban	84.0 p	17.5%	42%	1.6%	38.9%
2nd	Rio de Janeiro	78.2 p	13.3%	38.6%	2.8%	45.3%
3rd	Austin	77.4 p	13.4%	41.7%	0.8%	44.1%
4th	Beijing	77.3 p	11.9%	37.5%	2.2%	48.4%
5th	Geneva	76.5 p	30.2%	25.8%	5.5%	38.5%
6th	Dalian	76.1 p	14.2%	35.8%	4.8%	45.2%
7th	Gothenburg	75.5 p	11.3%	38.3%	6.1%	44.3%
8th	Heidelberg	75.0 p	13.9%	37.4%	3.1%	45.6%
9th	Qingdao	74.4 p	10.7%	34.4%	4.2%	50.7%
10th	Caracas	74.3 p	10.1%	39.1%	0%	50.8%

Durban South Africa

City area
1030 km2

Population
3301769

City area and population

Congratulations Durban, and foremost, congratulations to everyone living in the city of Durban (eThekwini), South Africa. Not only is Durban the global winner of the first HUGSI index, the African megacity with more than 3 million inhabitants also scored the highest percentage of green space in urban areas and highest percentage of urban area covered by trees.

The vision for this coastal city is to be Africa's most caring and livable city by 2030. As part of a five-year strategic plan to develop and sustain spatial, natural and built environment, the city is implementing several projects to make eThekwini a green-leading city. The city has specifically focused on urban forestry, and to engage the community in greening their environment.

To learn more about Durban's commitment to green spaces, visit: http://parks.durban.gov.za

1st place

Statistics

Percentage of green space
60%

Distribution score/value
14%

Health of vegetation score
0.73

Green space per capita
0.00019 m2

Type of vegetation

🌱 Grasses 🌲 Trees 💧 Water ⛰ Other

| 17.5% | 42% | 1.6% | 38.9% |
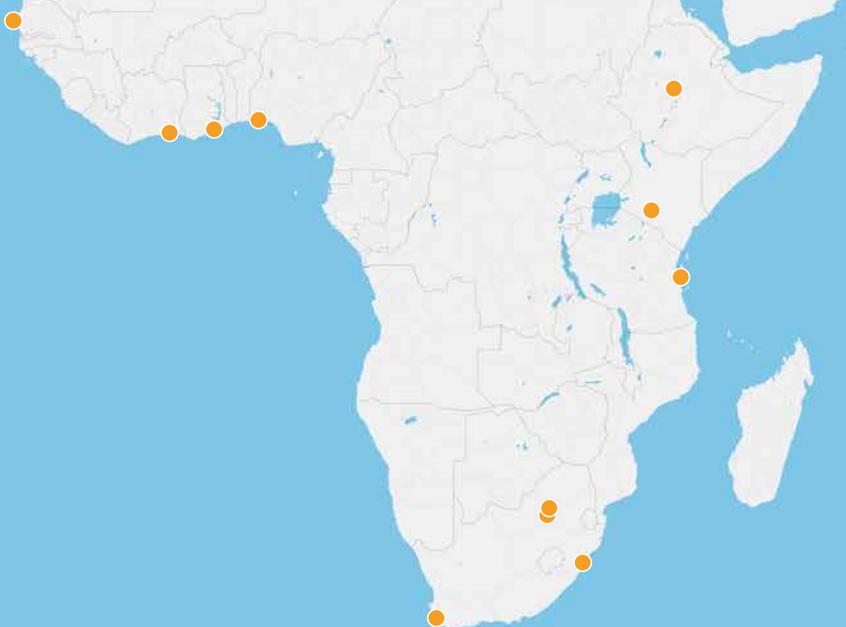
Results from
Africa

Category winners

 Highest percentage of green space
Durban

 Best health of vegetation
Durban

 Highest percentage of urban area covered by grass
Dakar

 Best distribution of green space
**Durban**

 Most green space per capita
Durban

 Highest percentage of urban area covered by trees
Durban

Top 10

Rank	City	Score	Type of vegetation — Grasses / Trees / Water / Other			
1st	**Durban**	84.0 p	17.5%	42.0%	1.6%	38.9%
2nd	**Dar es Salaam**	72.0 p	21.2%	28.3%	2.5%	48%
3rd	**Tshwane**	71.1 p	10.2%	32.5%	0.2%	57.1%
4th	**Johannesburg**	70.6 p	15.1%	27.4%	0.3%	57.2%
5th	**Cape Town**	61.1 p	14.5%	21.0%	2.2%	62.3%
6th	**Nairobi**	47.4 p	4.8%	25.4%	0.1%	69.7%
7th	**Addis Ababa**	47.2 p	16.5%	12%	0.1%	71.4%
8th	**Dakar**	29.2 p	23.8%	1.7%	9.4%	65.1%
9th	**Accrea**	26.4 p	13.2%	6.1%	3.9%	76.8%
10th	**Lagos**	18.8 p	12.2%	2.4%	19.9%	65.5%
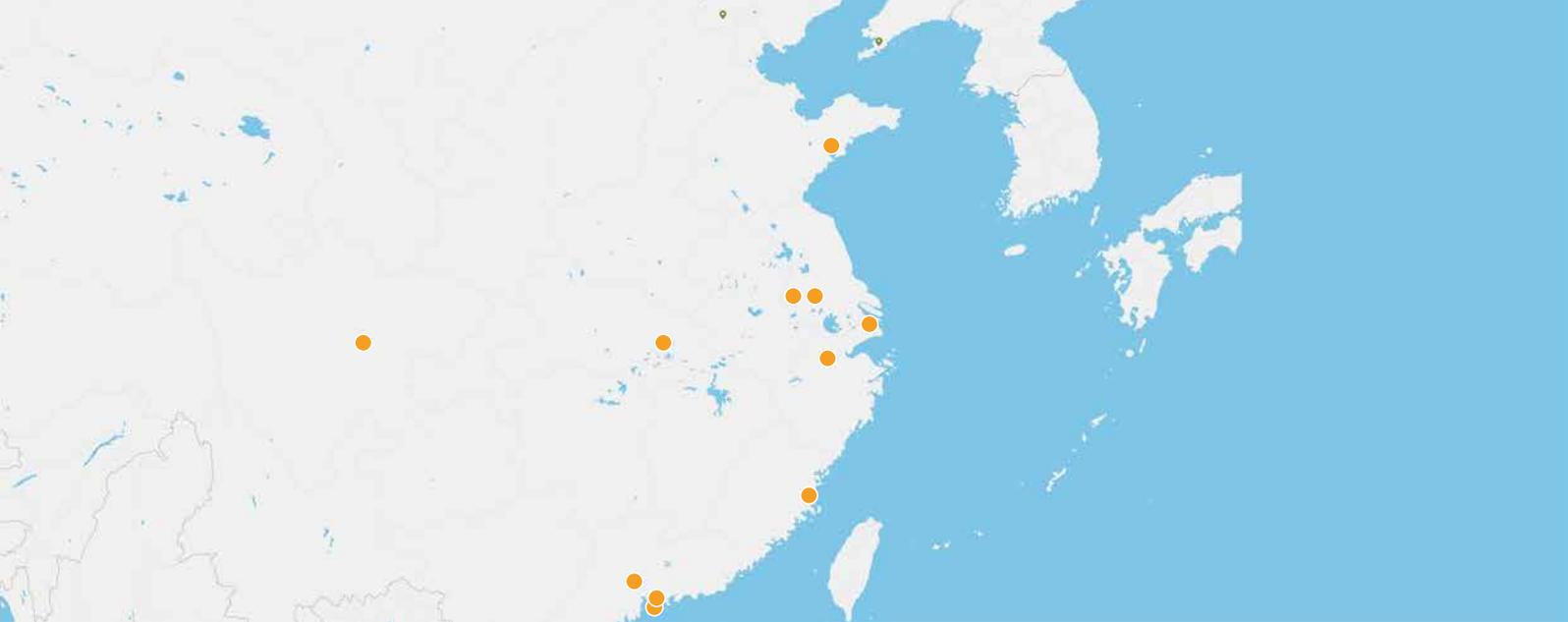
Results from
Central East Asia

Category winners

🌿 Highest percentage of green space
Dalian

🍃 Best health of vegetation
Nanjing

🌱 Highest percentage of urban area covered by grass
Zhenjiang

�️ Best distribution of green space
Dalian

👥 Most green space per capita
Zhenjiang

🌲 Highest percentage of urban area covered by trees
Beijing

Top 10

Rank	City	Score	Type of vegetation	Grasses	Trees	Water	Other
1st	**Beijing**	77.3 p		11.9%	37.5%	2.2%	48.4%
2nd	**Dalian**	76.1 p		14.2%	35.8%	4.8%	45.2%
3rd	**Qingdao**	74.4 p		10.7%	34.4%	4.2%	50.7%
4th	**Nanjing**	73.5 p		14.9%	30.4%	8.7%	46.0%
5th	**Fuzhou**	73.2 p		19.8%	28.2%	9%	43.0%
6th	**Hong Kong**	71.6 p		18.4%	29.6%	11.4%	40.6%
7th	**Zhenjiang**	70.5 p		24.5%	22%	8.4%	45.1%
8th	**Shanghai**	67.5 p		20.2%	20.5%	7%	52.3%
9th	**Wuhan**	66.3 p		23.6%	17.9%	10.8%	47.7%
10th	**Chengdu**	66.1 p		11.1%	27.4%	2.9%	58.6%

Results from
Europe

Category winners

Highest percentage of green space
Geneva

Best health of vegetation
Brussels

Highest percentage of urban area covered by grass
Rome

Best distribution of green space
Geneva

Most green space per capita
Gothenburg

Highest percentage of urban area covered by trees
Berlin

Top 10

Rank	City	Score	Type of vegetation — Grasses	Trees	Water	Other
1st	Geneva	76.5 p	30.2%	25.8%	5.5%	38.5%
2nd	Gothenburg	75.5 p	11.3%	38.3%	6.1%	44.3%
3rd	Heidelberg	75.0 p	13.9%	37.4%	3.1%	45.6%
4th	Warsaw	73.1 p	13.1%	37.9%	1.8%	47.2%
5th	Oslo	72.3 p	9.5%	38%	3.8%	48.7%
6th	Barcelona	70.4 p	22.3%	20.7%	2.1%	54.9%
7th	Berlin	68.9 p	9.2%	40.6%	3.9%	46.3%
8th	Stockholm	67.6 p	8.4%	35.9%	9.9%	45.8%
9th	Marseille	66.3 p	12.8%	28.2%	4.7%	54.3%
10th	Moscow	65.9 p	7.8%	37.2%	3.1%	51.9%

Results from
East, Southeast Asia & Oceania

Category winners

Highest percentage of green space
Hanoi

Best health of vegetation
Auckland

Highest percentage of urban area covered by grass
Hanoi

Best distribution of green space
Hanoi

Most green space per capita
Auckland

Highest percentage of urban area covered by trees
Ho Chi Minh City

Top 10

Rank	City	Score	Type of vegetation — Grasses / Trees / Water / Other			
1st	Auckland	66.0 p	8.3%	28.7%	11.3%	51.7%
2nd	Ho Chi Minh City	65.3 p	11.7%	28.8%	8.6%	50.9%
3rd	Hanoi	65.1 p	31.4%	19.0%	11.2%	38.4%
4th	Bangkok	61.9 p	11.5%	19.5%	5%	64%
5th	Singapore	59.3 p	9.6%	27.1%	4.7%	58.6%
6th	Kuala Lumpur	54.8 p	6.2%	25.9%	2%	65.9%
7th	Seoul	52.6 p	4.6%	26.6%	5.5%	63.3%
8th	Quezon City	42.1 p	4%	19.0%	2.3%	74.7%
9th	Sydney	37.6 p	7.1%	13.0%	8.4%	71.5%
10th	Yokohama	35.2 p	3.7%	15.5%	5.4%	75.4%
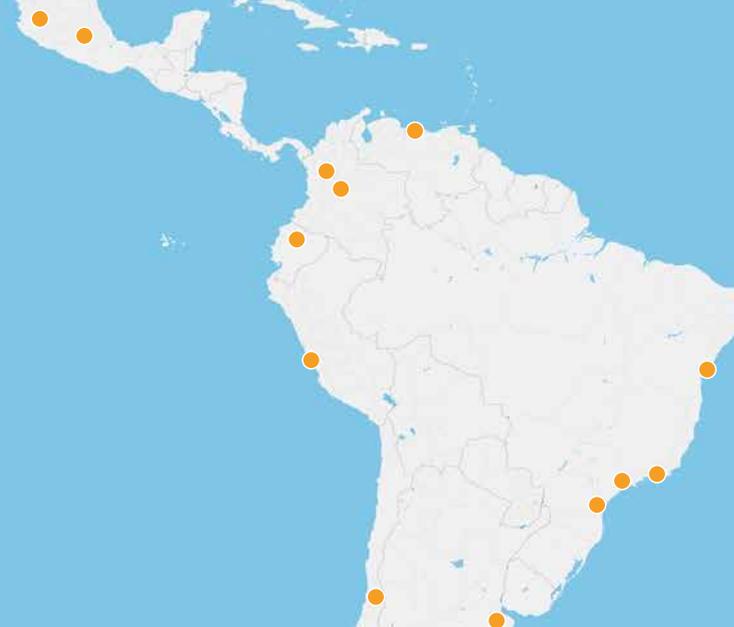
Results from
Latin America

Category winners

Highest percentage of green space
Rio de Janeiro

Best health of vegetation
Salvador

Highest percentage of urban area covered by grass
Bogota

Best distribution of green space
Rio de Janeiro

Most green space per capita
Rio de Janeiro

Highest percentage of urban area covered by trees
Caracas

Top 10

Rank	City	Score	Type of vegetation — Grasses / Trees / Water / Other			
1st	**Rio de Janeiro**	78.2 p	13.3%	38.6%	2.8%	45.3%
2nd	**Caracas**	74.3 p	10.1%	39.1%	0%	50.8%
3rd	**Sao Paulo**	66.3 p	10.8%	26.6%	1.4%	61.2%
4th	**Quito**	65.2 p	12.8%	22%	0.1%	65.1%
5th	**Curitiba**	63.9 p	11.7%	22.4%	0.5%	65.4%
6th	**Medellin**	56.9 p	13.4%	16.9%	0.3%	69.4%
7th	**Salvador**	56.5 p	5.6%	27.1%	7.3%	60%
8th	**Bogota**	47.7 p	17.1%	15.8%	0.6%	66.5%
9th	**Mexico City**	44.0 p	3.6%	25.1%	0.2%	71.1%
10th	**Buenos Aires**	23.9 p	4.2%	9.9%	4.4%	81.5%
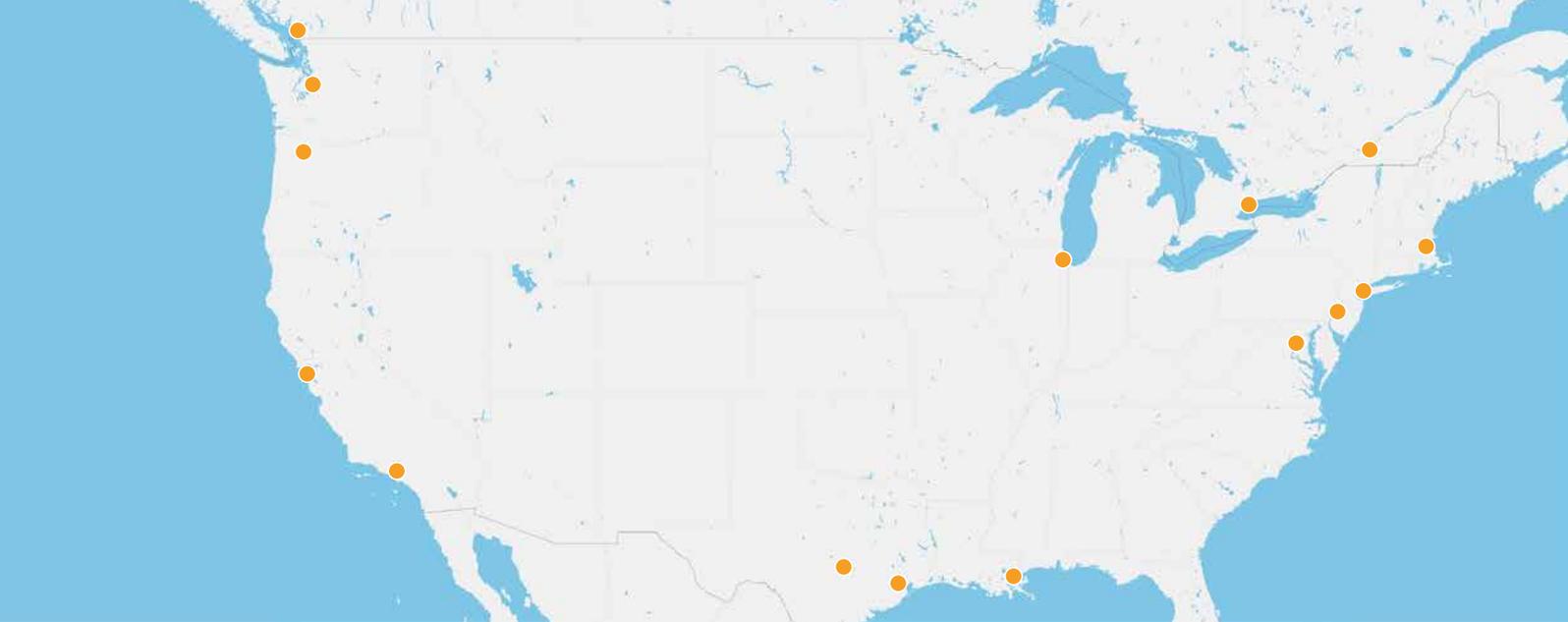
Results from
North America

Category winners

Highest percentage of green space
Austin

Best health of vegetation
Vancouver

Highest percentage of urban area covered by grass
New Orleans

Best distribution of green space
Austin

Most green space per capita
Austin

Highest percentage of urban area covered by trees
Austin

Top 10

Rank	City	Score	Type of vegetation — Grasses	Trees	Water	Other
1st	**Austin**	77.4 p	13.4%	41.7%	0.8%	44.1%
2nd	**Houston**	71.8 p	14.8%	32.3%	0.8%	52.1%
3rd	**Washington, DC**	68.1 p	7.2%	38.2%	1.9%	52.7%
4th	**Toronto**	66.0 p	12.6%	22.3%	1.9%	63.2%
5th	**Portland**	62.4 p	6.6%	30.6%	2%	60.8%
6th	**Vancouver**	62.0 p	13.4%	24.4%	4.6%	57.6%
7th	**Philadelphia**	55.6 p	6.8%	25.9%	1.6%	65.7%
8th	**New Orleans**	53.5 p	23.4%	12%	7.7%	56.9%
9th	**Seattle**	53.2 p	4.7%	27.9%	12.5%	54.9%
10th	**Boston**	51.7 p	5.1%	27.1%	7.9%	59.9%
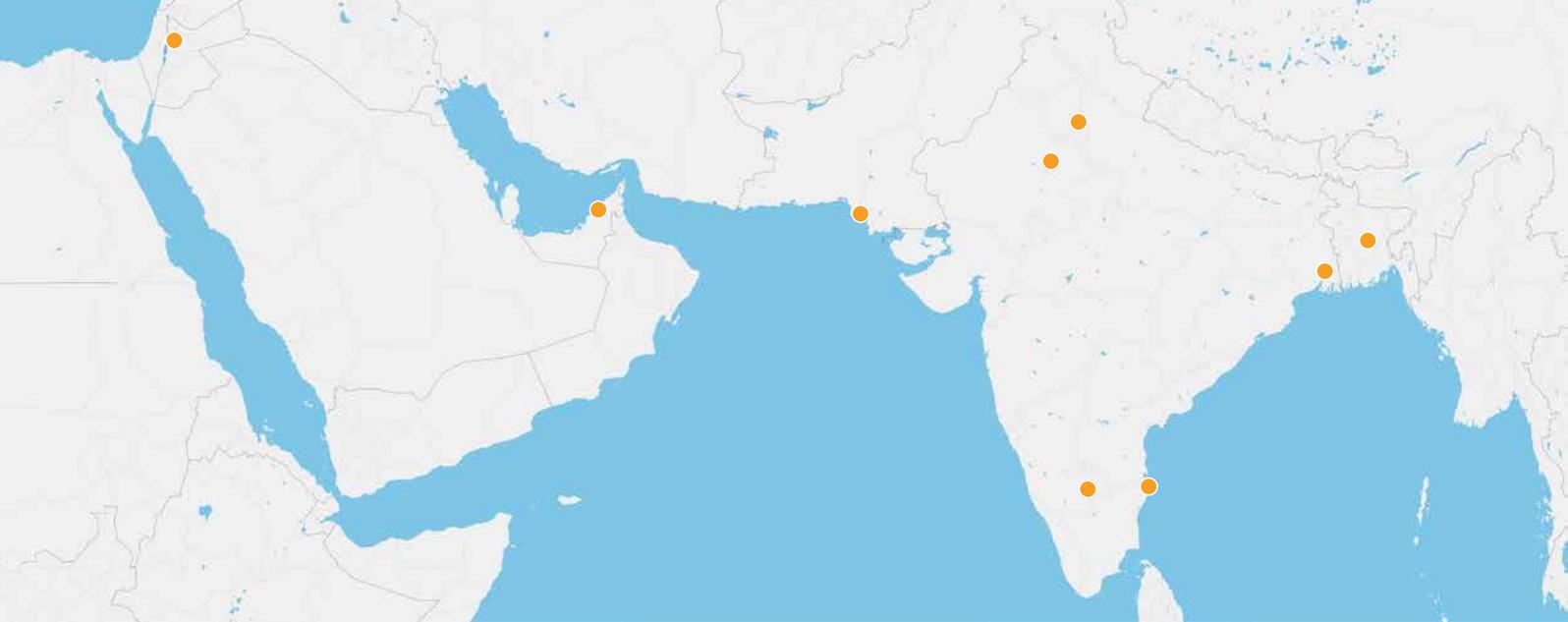
Results from
South and West Asia

Category winners

Highest percentage of green space
Dhaka

Best health of vegetation
Bengaluru

Highest percentage of urban area covered by grass
Jaipur

Best distribution of green space
Dhaka

Most green space per capita
Amman

Highest percentage of urban area covered by trees
Dhaka

Top 10

Rank	City	Score	Type of vegetation			
			Grasses	Trees	Water	Other
1st	Dhaka	73.1 p	26.4%	28%	6.8%	38.8%
2nd	Delhi NCT	60.1 p	18.8%	19.8%	2.4%	59%
3rd	Bengaluru	59.5 p	13.7%	19.2%	1.5%	65.6%
4th	Chennai	46.8 p	13.9%	12.1%	6%	68%
5th	Amman	36.8 p	19.3%	7.2%	0%	73.5%
6th	Jaipur	32.4 p	43.4%	5.7%	0.4%	50.5%
7th	Kolkata	20.2 p	1.9%	10.9%	9.1%	78.1%
8th	Karachi	1.6 p	3.8%	1%	1.5%	93.7%
9th	Dubai	1.0 p	3.9%	0.5%	5.3%	90.3%

About Husqvarna

Husqvarna is a brand within Husqvarna Group. Since 1689, Husqvarna has manufactured high performing products and delivered industry-changing innovations such as anti-vibration and automatic chain-break on chainsaws, as well as robotic mowers. Today, Husqvarna offers a broad range of high performing outdoor power products for parks, forest and garden, and represents technological leadership in the key areas; chainsaws, trimmers, ride-on mowers and robotic mowers. Husqvarna products are sold in more than 100 countries, mainly through servicing dealers.

About Husqvarna Group

Husqvarna Group is a global leading producer of outdoor power products and innovative solutions for forest, park and garden care. Products include chainsaws, trimmers, robotic lawn mowers and ride-on lawn mowers. The Group is also the European leader in garden watering products and a global leader in cutting equipment and diamond tools for the construction and stone industries. The Group's products and solutions are sold under brands including Husqvarna, Gardena, McCulloch, Poulan Pro, Weed Eater, Flymo, Zenoah and Diamant Boart via dealers and retailers to consumers and professionals in more than 100 countries. Net sales in 2018 amounted to SEK 41bn and the Group has around 13,000 employees in 40 countries.

What is HUGSI?

HUGSI stands for Husqvarna Urban Green Space Index — a digital innovation initiative developed by Husqvarna in collaboration with 20tree.ai. The ambition is to help safeguard and improve maintenance of green spaces in urban areas. By applying computer vision and deep learning techniques on satellite images, HUGSI unveils insights about the size, proportion, distribution, and health of green space in urban areas.

Husqvarna