Brian Orland
University of Georgia, USA

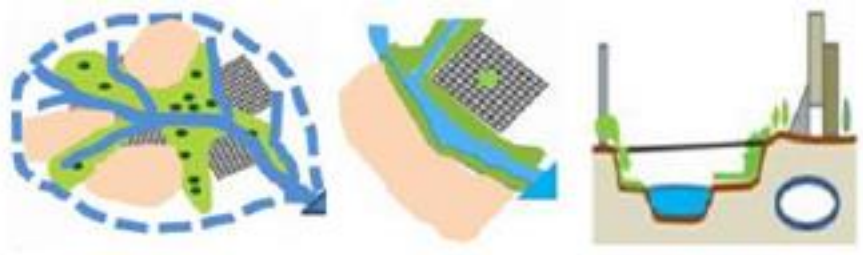
Carl Steinitz
Harvard University, USA;
UCL/CASA, UK

Digital Landscape Architecture

Dessau Campus
Anhalt University

22-26 May, 2019

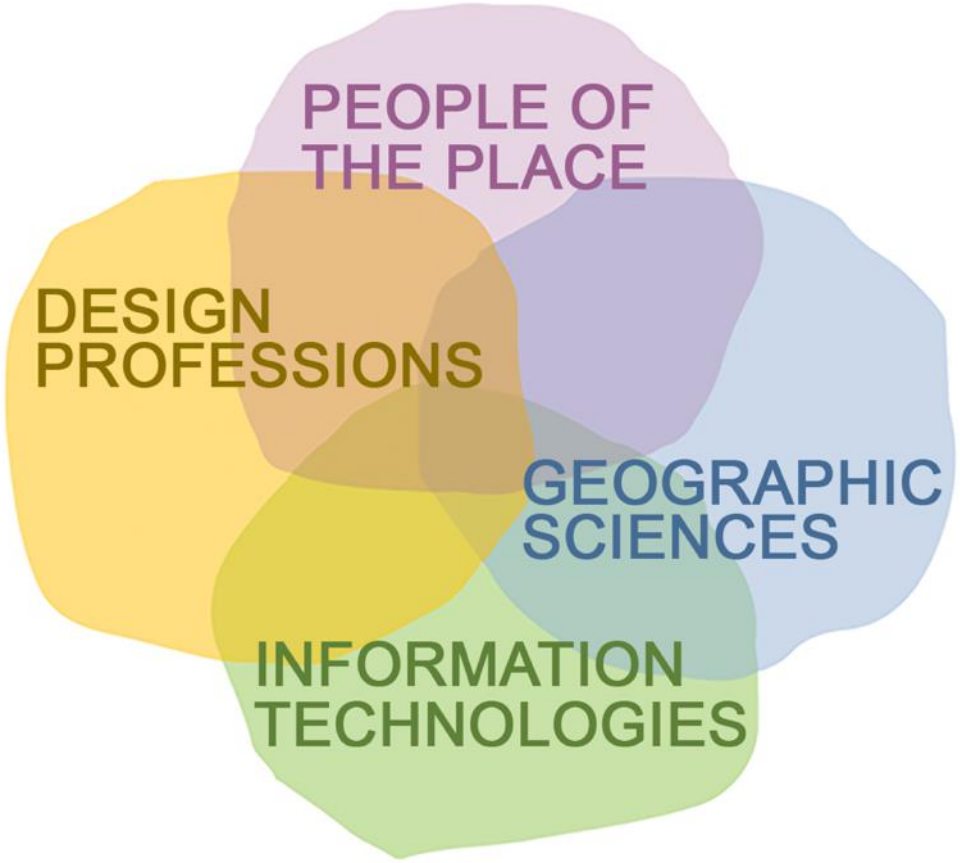
Improving our Global Infrastructure: The International Geodesign Collaboration


The world faces a critical question:

How do we organize ourselves globally to address climate and population challenges that threaten us all?

A major impediment is our inability to share advances in the field quickly and effectively. The International Geodesign Collaboration (www.geodesigncollab.org) was conceived as a means to address this challenge.

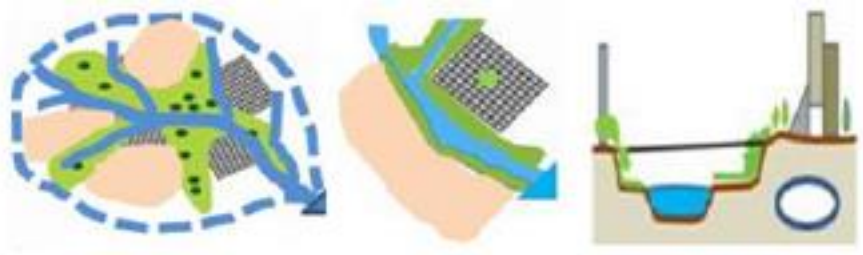


IGC

INTERNATIONAL GEODESIGN COLLABORATION

Changing Geography by Design

Carl Steinitz, Harvard GSD, USA; UCL/CASA, UK
Brian Orland, University of Georgia, USA
Tom Fisher, University of Minnesota, USA
Ryan Perkl, Esri, USA
Michael Gould, Esri, USA/Spain



The International Geodesign Collaboration compares the approaches and experiences of globally dispersed teams.

IGC 2019 teams tackled the projects they would normally do, but using a common framework of guiding assumptions, project sizes, scenarios, analytical systems and presentation formats.

By doing so, they enabled direct comparisons among projects and revealed insights into the different priorities and constraints of teams working in contrasting governmental, climatic and demographic settings.

The IGC Agreement

Objectives:

We need to show how geodesign helps us solve very big problems.

We need to adopt some constraints in order to make meaningful comparisons

Hence we invite you to join and propose:

Adoption of common global future scenarios plus local ones

Studying nested geographic area sizes and scales of common dimensions

Commitment to studying common land use/land cover systems

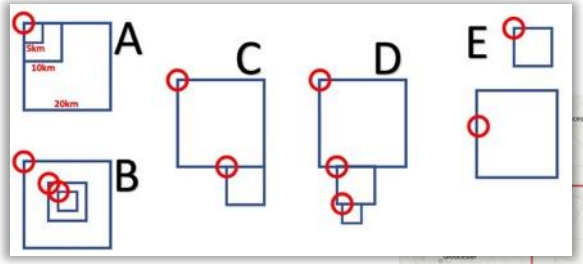
Studying impacts under common scenarios, at common time stages

Publishing/exhibiting the results using common presentation formats

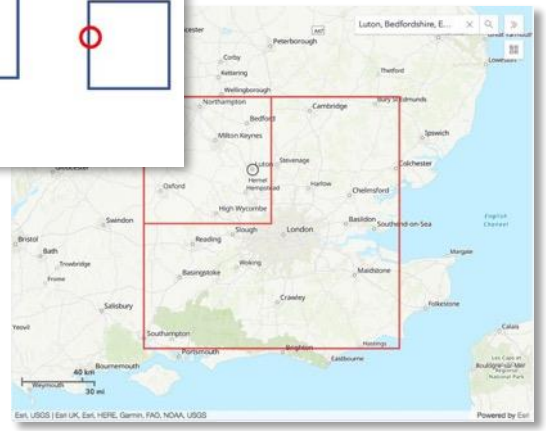
Conducting research to capture what we learn

IGC Project Sizes, Systems, Scenarios, Timelines, and Presentation Formats

IGC PROJECT SIZES



Squares: 0.5, 1, 2, 5, 10, 20, 40, 80, 160km

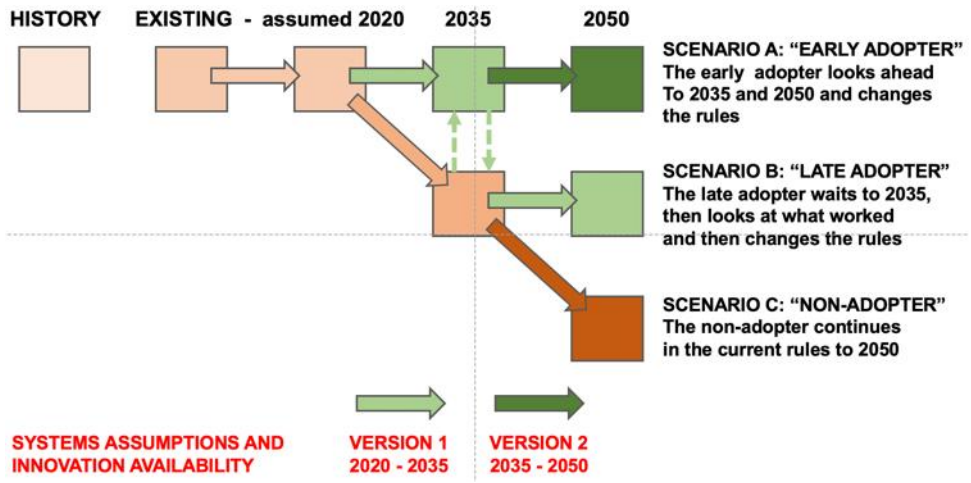


THE TEN IGC SYSTEMS

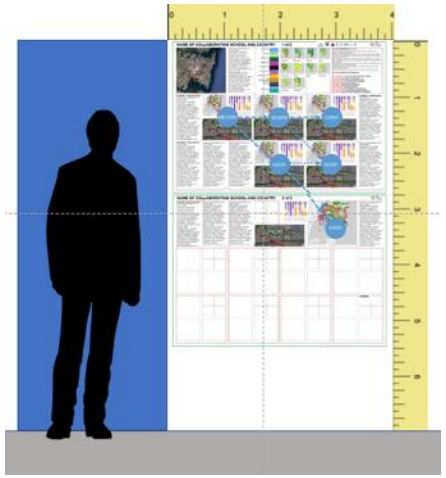
WATER INFRASTRUCTURE	113 184 255	175 215 255	OCEAN, RIVERS, LAKES
		113 184 255	WATER SUPPLY, TREATMENT, RECYCLING
AGRICULTURE	194 230 153	194 230 155	AGRICULTURE
		120 198 121	FORESTRY
GREEN INFRASTRUCTURE	48 163 85	48 163 85	RECREATION
		0 104 55	NATURAL LANDSCAPE
ENERGY INFRASTRUCTURE	205 50 155	225 140 200	ENERGY PRODUCTION
		205 50 155	ENERGY DISTRIBUTION
TRANSPORT INFRASTRUCTURE	13 13 13	64 64 64	RAIL, AIRPORT, SHIP PORT
		175 215 255	ROAD TRANSPORT
INDUSTRY AND COMMERCE	116 45 159	175 111 215	LIGHT INDUSTRY AND COMMERCE
		116 45 159	HEAVY INDUSTRY
RESIDENTIAL, LOWER DENSITY	255 204 0	255 230 153	RESIDENTIAL, RURAL
		255 204 0	RESIDENTIAL, LOW DENSITY
MIXED, RESIDENTIAL WITH COMMERCE	132 60 12	218 128 28	MIXED RESIDENTIAL, MEDIUM DENSITY
		132 60 12	MIXED RESIDENTIAL, HIGH DENSITY
INSTITUTIONAL	36 73 110	59 119 179	INSTITUTIONAL, GOVERNMENT, MILITARY
		36 73 110	INSTITUTIONAL, EDUCATION, HEALTHCARE
FLEXIBLE	AS NEEDED	222 45 38	COMMERCIAL, OFFICES
		252 146 114	COMMERCIAL, SHOPPING
		0 166 162	TOURISM, CULTURAL
		0 102 102	TOURISM, HISTORICAL
		225 182 113	SPECIAL LANDSCAPE, E.G. DESERT
		115 155 50	SPECIAL LANDSCAPE, E.G. MANGROVE

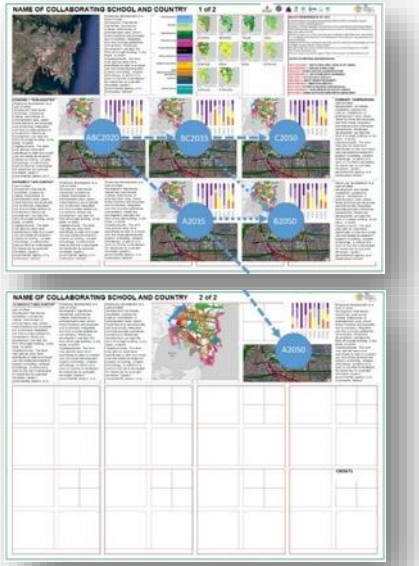
News

IGC SCENARIOS AND TIME STAGES

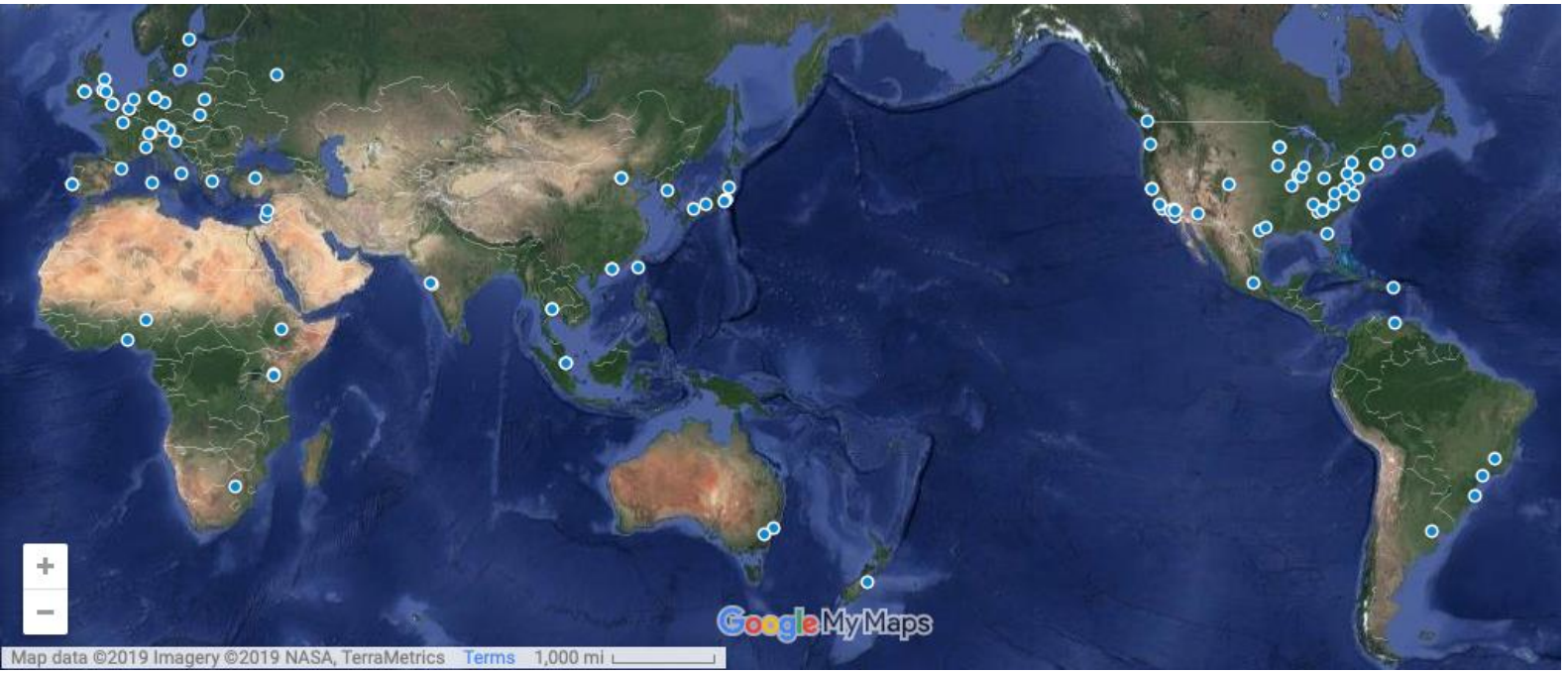


IGC PRESENTATION FORMATS





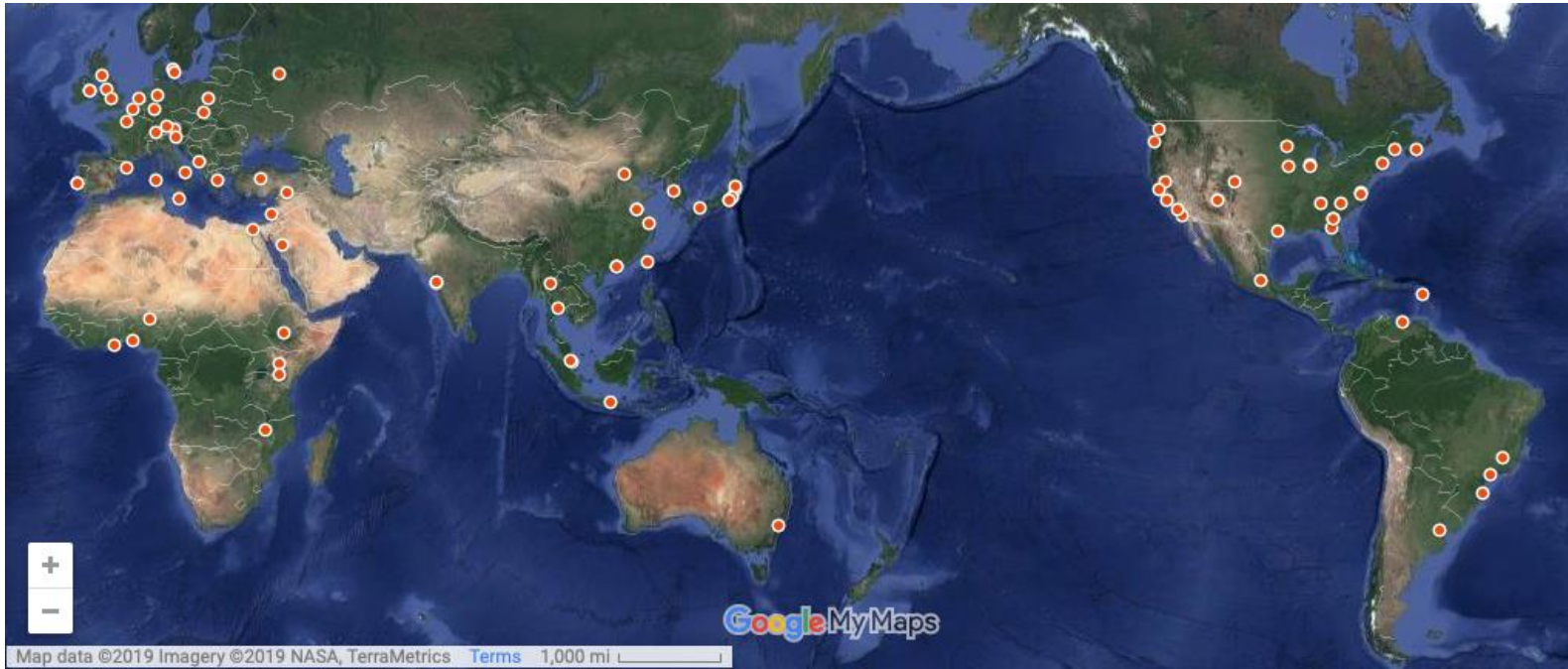
IGC PARTICIPATING SCHOOLS



102 Schools
39 Countries

IGC PROJECTS

91 Projects
39 Countries



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IGC

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University of Salzburg	**Austria**	Josef	Strobl
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Santa Catarina State University	**Brazil**	Rodrigo	Pinheiro Ribas
Universidade de São Paulo (USP)	**Brazil**	Paulo	Pellegrino
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Peking University	**China**	Liyan	Xu
The Chinese University of Hong Kong	**China**	Hui	Lin
Tongji Univeristy	**China**	Hui	Li
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Leibniz Universität Hannover	**Germany**	Julia	Wiehe
Leibniz Universität Hannover	**Germany**	Joerg	Rekittke
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School of Environment and Architecture, Ur	**India**	Dipti	Bhaindarkar
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University of Lagos	**Nigeria**	Maggie	Dunlap
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Warsaw University of Life Sciences	**Poland**	Agata	Cieszewska
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Project team participants			
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National University of Singapore	**Singapore**	Jessica	Diehl
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Blekinge Institute of Technology	**Sweden**	Christer	Persson
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King Mongkut's University of Technology Th	**Thailand**	Kanjanee	Budthimedhee
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University of Illinois at Urbana-Champaign	**USA**	Brian	Deal
University of Illinois Chicago	**USA**	Nedovic-Buc	Zorica
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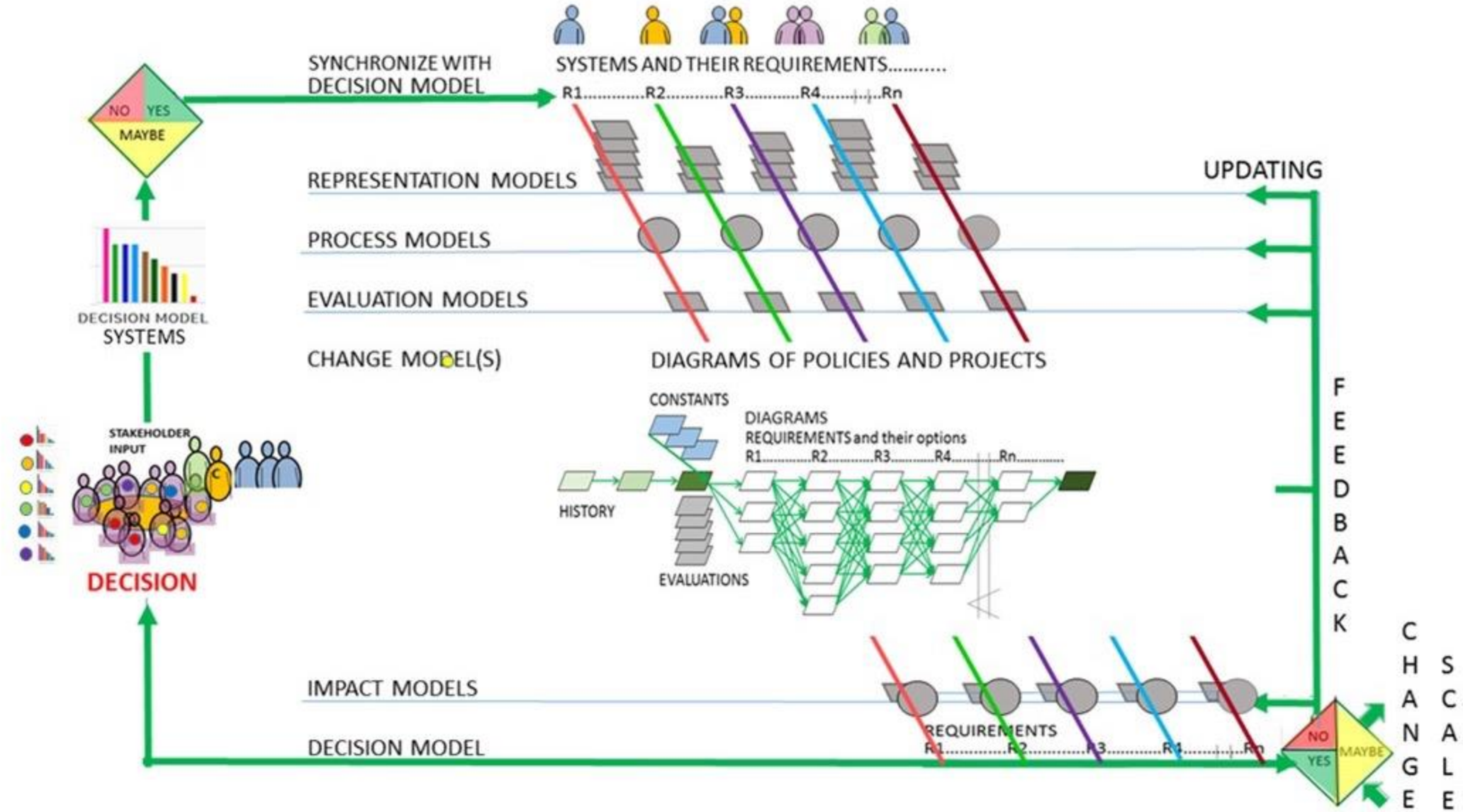
University of North Carolina at Charlotte	**USA**	Ming-Chun	Lee
University of Redlands	**USA**	James	Spee
University of Southern California	**USA**	John	Wilson
University of Tennessee Chattanooga	**USA**	Charlie	Mix
University of Virginia	**USA**	Guoping	Huang
University Washington	**USA**	Tim	Nyerges
Virginia Tech	**USA**	Mintai	Kim
Universidad Simon Bolivar	**Venezuela**	Paez	Luisa

IGC Projects Sorted by Largest Study Site Areas

ID	University/Organization	Country	Study title	0.5	1	2	5	10	20	40	80	160
61	University College London	UK	Oxbridge									
66	Cornell University	USA	Expanding City Limits: Using Scenario									
78	Texas A&M University	USA	Environmental and social resilience b									
79	University of Florida	USA	Alternative Futures for Northeast Flo									
80	University of Georgia	USA	Alternatives Futures for a Coastal City									
18	Leibniz Universität Hannover	Germany	Hannover Region									
28	Università di Cagliari	Italy	Alternative Futures for the Cagliari m									
29	University of Basilicata	ITALY	New Urban Agenda for the city of Pot									
48	National University of Singapo	Singapore	Biodiversity and urbanization in Singa									
50	University of Ljubljana	Slovenia	Alternative futures for Soča rivershed									
62	Arizona State University	USA	Gallup Regional Development Plan									
68	Harvard University	USA	Al-Ula Regional Landscape plan									
72	Pennsylvania State University	USA	Alternative Futures for the Lake Taho									
73	Portland State University	USA	The Water Nexus in Alternative Clima									
11	Peking University	China	Alternative Futures for Mentougou D									
12	Tongji Univeristy	China	Alternative Futures for the Urban Tra									
13	University of Hong Kong	China	Alternative Futures for Malang, East J									
16	Anhalt University	Germany										
26	Politecnico di Milano	Italy	Scenarios for the Polestine, the Po Ri									
27	Politecnico di Torino	ITA	Montenegro component of the UNES									
30	Hiroshima University	Japan	Alternative Futures for the Takehara,									
32	Ritsumeikan University	JAPAN	Reconstruction from the 2011 Great									
33	Tohoku University	Japan	Alternative Future for Sendai Metoro									
45	Warsaw University of Life Scie	Poland	Study of Green Infrastructure Potenti									
46	University of Lisbon (Portugal	Portugal	South Tagus (Portugal) Alternative Fu									
47	People's Friendship University	Russia	New Moscow									
52	Blekinge Institute of Technolo	Sweden	Future Studies FM 2606									
53	Swedish University of Agricult	Sweden	Geodesign for Integrated Catchment									
54	Hochschule für Technik Rappe	Switzerland	climate change scenario for the regio									
90	Harran University	Turkey	Alternative Futures for the Şanlıurfa I									
63	Cal Poly Pomona	USA	Climate Change Impact of the Greenv									
65	Colorado College	USA	Pikes Peak Region Urban Watersheds									
69	Iowa State University	USA	Agriculture and Energy in the Anthro									
81	University of Illinois at Urbana	USA	Regional Geodesign Studio for Chicag									
82	University of Minnesota	USA	sharing economy infrastructure strate									
85	University of Tennessee Chatt	USA	Alternative Futures for the Chattanoo									
88	Virginia Tech	USA	Resilience Plan for Virginia Beach are									
17	Leibniz Universität Hannover	Germany	Lahn River Landscape, Germany									
1	University of Buenos Aires	Argentina	Alternative futures for the south-east									
2	University of New South Wale	Australia	Climate Futures for Western Sydney									
3	University of Salzburg	Austria										
19	Leibniz Universität Hannover	Germany	Cairo Mega-urban Landscape									
20	Weihenstephan-Triesdorf Uni	Germany	Munich region									
21	University of Thessaly	Greece										
24	University College Dublin	Ireland	South County Dublin									
25	Technion - Israel Istitute of Te	Israel	Alternative Futures for Emek Hefer, Is									

ID	University/Organization	Country	Study title	0.5	1	2	5	10	20	40	80	160
34	University of Tsukuba	Japan	Alternative Futures for Tsuchiura, Iba									
40	Universidad Autonoma Metrc	Mexico	Alternative Futures for Tlalnepantla									
42	Ahmadu Bello University	Nigeria	Landscape Change in Zaria and Envirc									
43	University of Lagos	Nigeria	Alternative Futures for Urban Lagos									
44	Cracow University of Technolc	Poland	The impact of varoius development s									
51	Universitat Autònoma de Barc	Spain	Ordinary Landscapes and Digital Heri									
55	National Sun Yat-sen Universit	Taiwan	Alternative Futures for the Edge Citie									
56	Chulalongkorn University	Thailand	Alternative Futures for the Chiang Ma									
60	University of Manchester	UK	Climate Ready Manchester									
64	College of the Atlantic	USA	City of Ellsworth Green Plan Develop									
76	University of California, Santa	USA	Marine Spatial Planning for the Islanc									
4	University College Gent Archit	Belgium										
5	Santa Catarina State Universit	Brazil	Managing an alternative future to Ra									
8	Dalhousie University	Canada	Coastal Communities and Climate Ch									
10	Beijing Forestry University	China	Alternative Futures for Xiamen City, C									
14	Addis Ababa University	Ethiopia	Integrated Infrastructure									
15	Ministry of Culture and Comn	France	Impact of Reinvent Paris projects on I									
22	Amity University Mumbai	India										
31	National Institute for Environr	Japan	Tokyo Smart City: International Urbar									
35	University of Tokyo	Japan	Agricultural urbanism: Re-designing T									
38	University of Seoul	Korea	Nakseang Valley, Dongmak Stream									
41	Vrije Universiteit	Netherlands	Arena									
57	King Mongkut's University of	Thailand	Klongsan-Tungkru-Bangkhuntien dist									
59	Newcastle University	UK	Alternative Futures for the River Wan									
77	Cal Poly San Luis Obispo	USA	Strategies for sustainabile groundwat									
67	Georgia Institute of Technolog	USA	Georgia Tech Shenzhen Eco Campus									
71	Old Dominion University	USA	Envisioning Coastal Resilience Alterna									
70	Thomas Jefferson University	USA	MCHD: Designing for Healthcare Res									
75	University of California Berkel	USA	Adaptation to Sea Level Rise in East C									
86	University of Virginia	USA	Uniting Landscape and City, Winneba									
89	Universidad Simon Bolivar	Venezuela	Choroni, Aragua State									
6	Federal University of Minas G	Brazil	Pampulha case study: Co creation of									
7	Universidade de São Paulo (U	Brazil	Intelligent Landscapes: Plan for the H									
23	School of Environment and Ar	India	Environmental Information System fo									
36	Jomo Kenyatta U of Agricultur	Kenya	University City									
37	The Technical University of Ke	Kenya	Measuring the benefits of Nairobi pu									
39	American University of Beirut	Lebanon	e.g. Green opportunities in prospect									
58	Ankara University	Turkey	Protecting Urban Valleys as Ecologica									
92	University of Illinois Chicago	USA	Water Management and Economic G									
83	University of North Carolina a	USA	North End Smart District, Charlotte									
84	University of Southern Califor	USA	Urban Renewal in Los Angeles-Boyle									
49	National University of Singapo	Singapore	Land use planning towards sustainab									
87	University Washington	USA	Infrastructures in the Puget Sound Re									
9	The Chinese University of Hor	China	Remote sensing of mangrove forests									
74	San Diego State University	USA	Mission Valley stadium site: a new									

A Workflow for Geodesign (Steinitz, 2012)



Steinitz, C., A Framework for Geodesign (2012)

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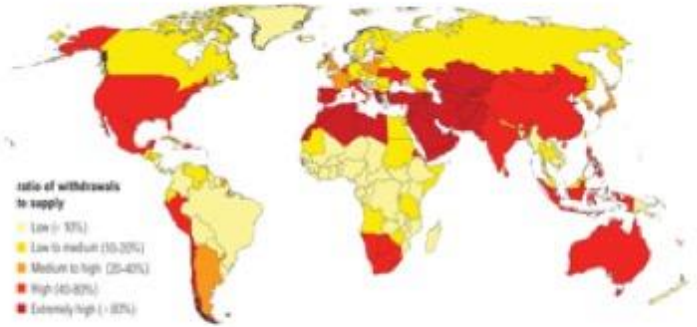
Twelve Global Assumptions

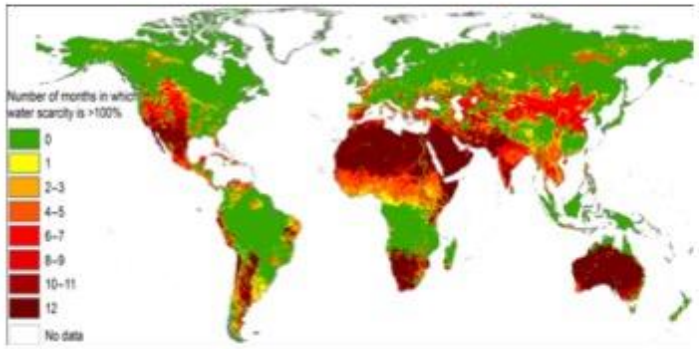
GLOBAL ASSUMPTIONS

GLOBAL 2035/2050 10 FRESHWATER SCARCITY WILL BECOME MORE PREVALENT

Water security remains a challenge for many countries today coping with complex water issues that cut across sectors. The combined effects of growing populations, rising incomes, and expanding cities will see demand for water rising exponentially, while supply becomes more erratic and uncertain.

By 2025, about 1.8 billion people will be living in regions or countries with absolute water scarcity. Estimates show that with current population growth and water management practices, the world will face a 40% shortfall between forecast demand and available supply of water by 2030.



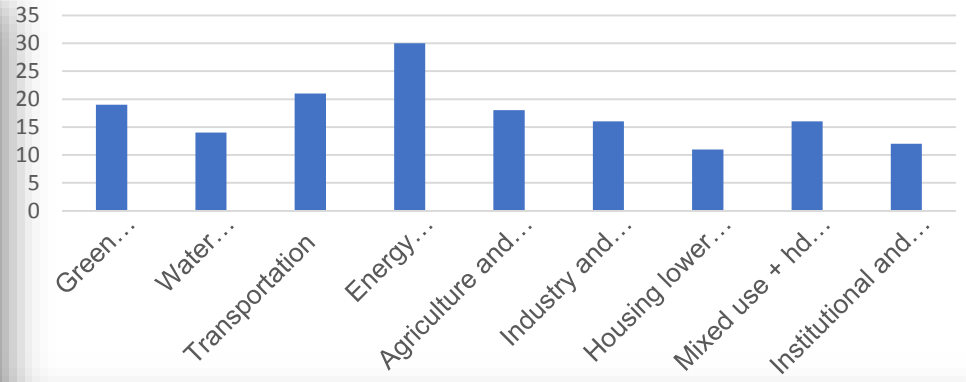


Feeding 9 billion people by 2050 will require a 60% increase in agricultural production and a 15% increase in water withdrawals.

~ World Bank, ttp://www.worldbank.org/en/topic/water/publication/high-and-dry-climate-change-water-and-the-economy

157 System Innovations

AGRICULTURE



AGR 2035 8 ECOLOGICAL PEST MANAGEMENT

Agricultural pests blemish, damage or destroy more than 30 percent of crops worldwide. This annual loss has remained constant since the 1940s, when most farmers and ranchers began using agrichemicals to control pests.

While every farming system is unique, the principles of ecological pest management apply universally. Ecologically based pest management illustrates the strategies used by farmers around the world:

Source
https://www.sare.org/Learning-Center/Books/Manage-Insects-on-Your-Farm/Text-Version

- Increasing on-farm diversity above and below ground
- Encouraging beneficial insects to attack their worst pests
- Enhancing plants' natural defenses against pests
- Managing soil to minimize crop pests

Other references: https://www.sare.org/Learning-Center/Topic-Rooms/Sustainable-Production-and-Use-of-On-Farm-Energy; https://www.sare.org/learning-center/pest-management

AGRICULTURE #8

Typical projects – University College-London, Universita di Cagliari

UNIVERSITY COLLEGE LONDON/CASA - UNITED KINGDOM

The East-West Arc, Re-thinking Growth in the London Region[1]

The East-West Arc, named by the U K National Infrastructure Commission, refers to the Cambridge-Milton Keynes-Oxford Corridor, hereafter the CAMKOX Corridor. It spans 38 local councils comprising the growth corridor from Oxford through Milton Keynes to Cambridge. Its population is over three million, and it is the fastest growing region in the United Kingdom. It forms the northern fringe of the greater London city region to which it is profitably tied, just north of the Green Belt. History, knowledge, technology, agriculture and nature combine in a rich tapestry that has long contributed to the commonwealth of the United Kingdom.

The National Infrastructure Commission (NIC) report from 2017, Partnering for Prosperity: A new deal for the Cambridge-Milton Keynes-Oxford Arc, set out one vision and approach to infrastructure-led development linked to place making. It also set out new thinking on the housing challenge in the region that is equivalent to a new city the size of Birmingham.

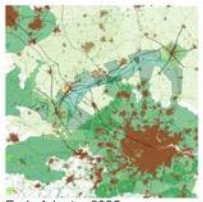
Traversing the corridor from south to north is the proposed high-speed rail line HS2, as well as the planned east-west rail east-west rail line linking Oxford to Cambridge through Milton Keynes. These transport links, taken together, are intended to enhance connectivity, mobility and productivity across the region. Other impacts of growth also need to be addressed, such as last mile connectivity and multi-modal transport, social inequities, land consumption of agriculture and forests, greater flood risk, pollution, and loss of ecological function and integrity of this historical region including its villages and towns. These impacts need to be addressed by an assessment of growth scenarios and their impacts, in advance of major infrastructure projects.

The Centre for Advanced Spatial Analyses of University College London organized the CAMKOX workshop within the guidelines of the international Geodesign Collaboration. It was conducted by Carl Steinitz, Hrishi Ballal and Tess Canfield in a two-day workshop in November 2018 using Geodesignhub technology. The assumptions of the National Infrastructure Commission were accepted: to add 780,000 housing units in the CAMKOX Corridor and 1,450,000 people to the existing population of around 3,300,000.

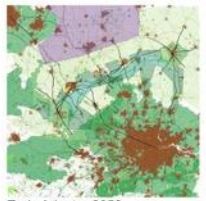
Requirements

Major Innovation Assumptions

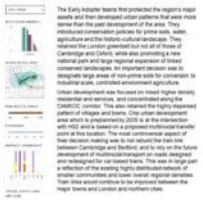
Existing 2020



Early Adopter 2035



Early Adopter 2050



There are important complications

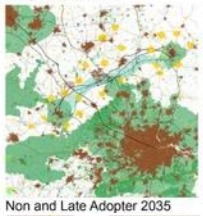
The high speed train HS2 project does not connect with the CAMKOX Corridor's current train, and it is not planned and will not be built to do this.

The right-of-way of the prior train linking Cambridge with Bedford (and to Milton Keynes and Oxford) was sold when the train closed in the 1980s. It is no longer available for a train.

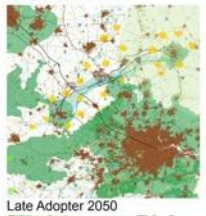
There is considerably more travel demand from CAM, MK and OX to London, and into CAM, MK and OX from their immediate sub-region, than from CAM to MK to OX or the reverse.

The London policy to maintain its greenbelt is under pressure from many proposed developments, and the availability and price of London housing is a major political issue.

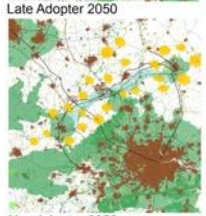
There is highly organized opposition to the proposed development of the region.



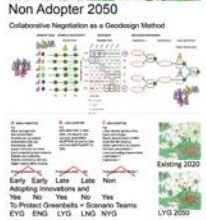
Non and Late Adopter 2035

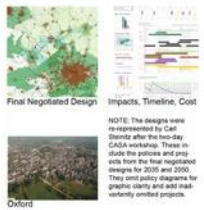


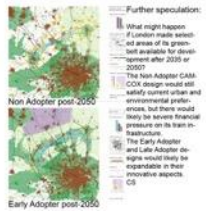
Late Adopter 2050



Non Adopter 2050







Sources:

1. Neuman, M., Tchapi, M., Sharkey, M., Gelgota, A., Itova, I. 2018. East West Arc: Re-thinking Growth in the London Region. London: University of Westminster.
2. The National Infrastructure Commission, 2017, Partnering for Prosperity: A new deal for the Cambridge-Milton Keynes-Oxford Arc

https://competitions.malcolmreading.co.uk/cambridgeoford-connection/news/2017/national-infrastructure-commission-re-veals-gallery-of-final-design-concepts

Participants:

UNIVERSITÀ DI CAGLIARI

New scenarios for the Metropolitan City of Cagliari

South East Coast

The recently established (2016) Metropolitan City of Cagliari (MCC) comprehends 17 Municipalities of South Sardinia, including Cagliari, the regional capital. The population is approximately 430k inhabitants, and an area of 1,248 km². The area is surrounded by mountains to the East and on the West, by the Gulf of Cagliari to the South, and by the agricultural Campidano plain to the North.

In 2018, the MCC started the works for its first planning initiative, the Territorial Strategic Plan, which is going to set the development framework for future physical planning. However to date, no inter-municipal planning have been carried on. Hence, developing a new strategic plan for the area represents a challenge and an opportunity for innovation, both in technical and socio-cultural terms for the local community.

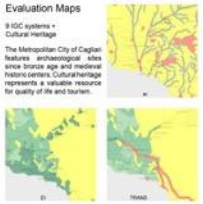
This study represents a first attempt to reasoning on possible future development scenarios, in line with the IGC assumptions and perspective on territorial technology innovation.

Existing situation: 2020

General Assumption

Population growth and ageing, spatial concentration, water resource scarcity, increase in food demand, increase in (green) energy demand.

- **Water infrastructure**: reduce hydrological risk and limit resource pollution – The MMC currently does not have supply issues anymore.
- **Agriculture**: protect prime soils, promote bio products and foster innovation in production to address desertification processes, climate change, and possible future reduction of water.
- **Green Infrastructure**: enhance connectivity, and expand protection to natural or semi-natural areas
- **Energy**: increase green production through technology innovation, promote local production
- **Transport Infrastructure**: improve accessibility to most populated areas, and the level of service of current road infrastructure. Improve the light-rail network. Foster active travelling in recreation to leisure and cultural heritage accessibility.
- **Industry and Commerce**: promote technology innovation and balance spatial distribution of the MMC's productive activities.
- **Residential/Low-Density**: accommodate demography growth limiting fragmentation
- **Mix Residential with commerce and services**: accommodate demography growth with densification, and enhance accessibility to commerce and services.
- **Institutional**: Promote locational accessibility and balanced spatial distribution
- **Cultural Heritage**: preserve historic centers and protect archaeological sites enhancing fruition



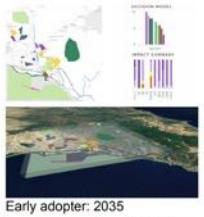
Evaluation Maps

9 IGC systems + Cultural Heritage

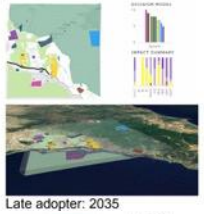
The Metropolitan City of Cagliari features archaeological sites since bronze age and medieval historic centers. Cultural heritage represents a valuable resource for quality of life and tourism.

Study process model

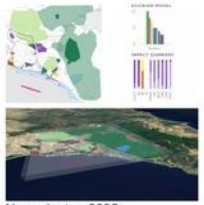
High level model of the geodesign study process in Business Process Model and Notation (BPMN) language.



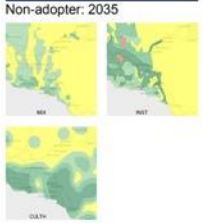
Early adopter: 2035



Late adopter: 2035



Non-adopter: 2035



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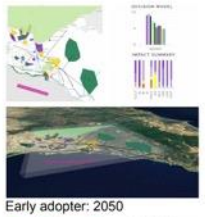
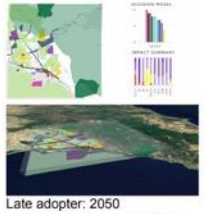
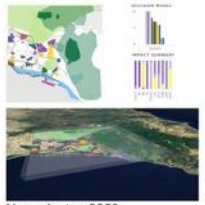


Early adopter: 2050



Late adopter: 2050



Non-adopter: 2050

Collaborative Negotiation as a Geodesign Method

Features

- Design studio: 2 classes (58 MSc + 76 BSc students)
- Short time: 15 class hours each
- No previous knowledge by participants

Results

- Very fast learning curve on planning issues, geodesign methods (e.g. collaboration, negotiation) and technology
- Excellent group-working experience
- Awareness rising and capacity building
- Complete reporting by groups
- Success of teaching experience above expectations
- (Some) scale coordination (i.e. 80x80, 20x20 Km.)
- Good data produced for further research

Limitations

- Space for improvement in final design quality
- Students involved only in the intervention phase

Future developments

- New geodesign studio in 2019
- 50 class hours
- Students involvement since the assessment phase (i.e. full geodesign workflow)
- Possibility for the students to participate to real-world study

Requirements

3 Territorial dynamics scenarios

Population	Low	as-is	Fast
2035	-10-15%	+25,000	+10-15%
2050	-20-25%	+50,000	+20-25%

Major Innovation Assumptions

Change of scale

During each design session of the 20x20 area design studio, each group aimed at being consistent with the design development of correspondent team working in the 80x80 area.

The Early Adopter team developed the first design focusing mainly on coastal and marine areas, also developing a submarine infrastructure for energy production and a big submarine crop, responding to the need to increase food production despite water scarcity. They also provided for a flora coastline protection green infrastructure and a cycle network along the whole coastline, connecting the archaeological heritage of the area, which represent an important asset for tourism. The restoration of the natural waterways project and the rainwater reuse project was located in the inland and north-west territory, where the main residential areas are concentrated, together with industrial plants and services.

In the scenario planned for 2050, agriculture was developed in a large northern area, where the team located an underground crop. In the Eastern part of territory they planned two green parks. They also increased the areas for institutions, low density housing and services in the western part of the study area and, as a consequence, increased the accessibility through a complex transport system, including vehicle accessible roads, cycle networks and an infrastructure for fast magnetic levitation trains.

The Late Adopter team mainly focused on preservation of natural resources, through a green infrastructure policy involving an extended north-east part of the study area, and food production, through the localization of a great number of organic farms and a submarine crop in the sea. They also planned for taking advantage of renewable energy sources, through the creation of a tidal power station. The low density residential areas were located in a big central area, while the main services and industries further north. For the transport system, the team defined sustainable mobility infrastructures concentrated mainly along the coast, where fast trains and cycle networks were planned.

In the 2050 scenario they confirmed the initial asset of the study area and planned for further sustainable transport infrastructures (i.e. the hyperloop), connecting also the coastal zone with the inland ones. Also an increase in renewable energy production system was foreseen, which will meet the needs of the new residential areas and industries, together with two important blue infrastructures intended to reduce flood risk.

The Non Adopter team started localizing three macro areas: a very extended band running from north-east to south-east which includes green infrastructure policies and projects, a large area dedicated to agriculture land-uses in the north-west, and eventually a central zone with mixed and residential big areas, mostly located in the coastal part, and scattered institutional and industry projects. Lastly, in order to connect the macro-areas, they designed two main routes.

In the evolved scenario, the three macro areas were confirmed with some minor changes. The agricultural area were extended to the east part, while in the central area an increased number of projects were localized, including: low density housing areas in the inland places, new institutional projects (i.e. the hospital and the university campus), and green energy infrastructures. Moreover, along the coastal areas, an extended blue infrastructure was planned in order to canalize the rainwater, to react efficiently against to climate change-related extreme events (i.e. extreme storms and heavy rainfall) and protect the built-up areas.

Study area 20x20 Km - 5 Sessions * 3 hours:

S 1- Diagrams: 3/each by participants by system // with technology available in 2020 + 1with innovations available by 2035 + 1 with innovations available in 2035-2050

S 2/3/4 – Synthesis v1/2/3

S 5 – Negotiation: (E/L/N) A35- (E/L/N) 50

Coordination team

Michele Campagna, Università di Cagliari – DICAAR, UrbanGIS
Chiara Cocco, Università di Cagliari – DICAAR, UrbanGIS
Elisabetta Di Cesare, Università di Cagliari – DICAAR, UrbanGIS

with thanks to Houda Bibi and Abdellatif Dashmouh – UrbanCDC internship students

Workshop participants

Typical projects – UAM-Mexico City, University of Southern California

UNIVERSIDAD AUTÓNOMA METROPOLITANA - MEXICO

Project Area 5 x 5 km.

Tepotzotlan Urban Center Alternatives to Climatic Change

Tepotzotlan is a town in the State of Mexico located 42 kilometers north of Mexico City (at 19.713°, long -99.223°, alt 2290 m). It has an important historic patrimony formed by the San Francisco Javier College founded in 1584 (World Heritage Site 2010) now transformed into the National Museum of Colonial Period (Museo Nacional del Virreinato), the Chapel of Santiago in Calpula (XVI C.), the Xalpa aqueduct (XVIII C) and the haciendas of San Jose La Teja, Xochimanga and La Concepcion (XVII and XVIII C). Additionally, there are two prehispanic sites named La Presita and Momoxtle, and cave paintings.

Its environmental assets include Sierra de Tepotzotlan State Park (13,175 ha) and Xochitla Ecological Reserve (70 ha.).

In 2001, Tepotzotlan was declared "Pueblo Magico" by the Ministry of Tourism as one of the most attractive towns in the country and the closest to the capital, giving Tepotzotlan a great touristic potential.

Tepotzotlan green area constitutes one of only six major state parks around Mexico City's Valley. The state park system is fundamental for the environmental quality and climatic stability of a population of nearly 20 million people.

For this studio an area of study of 5 x 5 km (25 km2) was set including the historic core, part of Mexico-Queretaro highway, Xochitla Ecological Park, the south east corner of the Sierra State Park and the Capula Neighborhood. It also includes the south border to the Cuautitlan Municipality divided by the Hondo River. The area is the entrance to the Valley of Mexico of all major land routes from the north and center of the country. Uncontrolled industrial growth has happened next to the Mexico-Queretaro highway, producing a major impact in the area of study. Industry has expanded on farmland, isolating the housing area and historic core from their main communication roads and affecting environmental systems, particularly on hydrology. A newly developed (2015) industrial zone that borders with the State Park is a major concern, as it starts a trend for uncontrolled industrial development in both sides of the highway.

In 2005, the studio Alternative Futures for Tepotzotlan was developed by the University of Harvard and the Universidad Autonoma Metropolitana. Given the fifteen-year interval between scenarios of the present study, the previous work is a very valuable tool that allows us to evaluate past, present and future scenarios (2005, 2020, 2035 and 2050). Some of the original proposals have already been implemented, but others that were fundamental for environmental quality and sustainability of the area were ignored.

Five Major Requirements by 2050

1. Limit Industrial growth.
2. Protect and reforest Sierra Park and Waterways.
3. Maintain the natural hydrological system connecting Sierra and River.
4. Separate truck traffic from buses and cars.
5. Protect and Reuse historic buildings.

Major Assumptions and Innovations

GRE 1.1. Strict Enforcement of State Park Limits (above 2350 m).
WAT 2.1. Identify limits of restricted areas to keep natural drains (green corridors).
GRE 3.2. Implement an integral municipal mobility system that includes public transportation, cycling and pedestrians.
GRE 3.4. Forbid transit of industrial vehicles in urban centers.
IND.6.1. Limit the industrial corridor and promote green industries.
IND.9.1. Promote buildings transformed into hotels, restaurants, museums and commerce with a maximum of two levels.
HOU 7.3. No high density housing developments.
TUR 10.2. Diversify tourist offer in cultural, ecological, adventure, religious and gastronomy, among others, with emphasis in national and international young and elderly people.


Existing Situation: 2020.


Early Adopter: 2035.


Early Adopter: 2050.


Historic & Cultural Elements in Tepotzotlan.


Late Adopter: 2035.


Late Adopter: 2050.

Early Adapter Scenario, 2050

Based on early analysis, authorities, investors and general population understand risks and opportunities to adapt for climate change and mitigation measures immediately.

Strict measures are enforced to preserve Sierra de Tepotzotlan State Park. Reforestation of all critical causeways is done. Ravines, rivers and waterways are preserved as the natural hydrological system.

Public mobility is re-organized. A second local-foreign bus terminal is developed on the west side of the highway. A new bridge provides direct access to the heavy traffic of the industrial area. Industrial land use is limited to keep Tepotzotlan's touristic character and avoid isolation of the central core from the rest of municipality.

Use of solar water heaters and photovoltaic systems is promoted. Strong capital groups are invited to invest in Tepotzotlan on green industries.

Tax incentives for reusing ancient buildings for tourism-oriented uses. New services and better communications attract a more diversified tourism. Training people for hospitality services.

Late Adapter Scenario, 2035

State Park suffers plagues and wildfires reducing its borders due to illegal occupation by housing and industry. Late adoption of a reforesting program of the state park borders is started with local species and labels identifying it as a federal area. Green corridors and natural causeways are obstructed by industrial buildings and housing. Flooding increases. Only parts of the natural green-hydraulic system remain due uncontrolled industrial and housing growth. Connection with the river is lost and the hydraulic natural system is broken. Municipal mobility is saturated by trucks, buses and cars. A new bridge in the industrial area is built. The possibility of a public transportation connection node on the west side of the highway is lost. Traffic jams and insecurity, discourage visitors. Many historic buildings are damaged or destroyed. Remaining historic buildings are catalogued, restored and given tourist compatible uses as lodging, restaurants, museums or stories.

Tourism decreases due to the industrial buildings and less attractive context on the entrance and around historic and natural sites. Implementation of a photovoltaic public lighting increases security and emphases historic elements in the access and historic core.

Climate Change

The urban center of Tepotzotlan has a tempered humid climate with rains in summer (Köppen C(w0)(w)b(i')g) and a mild-cold bioclimate. Historical data from 1965 to 2015, shows a 0.6ºC increase in dry bulb temperature, coinciding with the urbanization period of the areas located at the intersection of Hondo and Chiquito rivers. Dry bulb temperature projections were made for the 2020, 2035 and 2050 scenarios showing an estimated temperature increase of 1.1ºC for 2050, possibly caused by the loss of tree mass and agricultural areas, over densification of housing and growth of areas destined for industry, as well as the increase of greenhouse gases by transport. The behavior of rainfall in the same period of time (1965 to 2015) shows a more unstable performance in the last 15 years, with more extreme records in minimum and maximum annual rainfall. The atypical rainfall patterns of the last years and the erosion of the natural areas of water ways have caused floods in the low residential and industrial zones in the raining season. Wildfires in the Sierra Park have happened nearly every year, uncontrolled due to difficult access to the sierra park and lack of appropriate equipment such as helicopters with large water tanks.

Methodology

Following geodesign methodology, as structured by Dr. Steinitz (2010), throughout 2019 a series of workshops were developed to identify groups of interest from the local government, ONG´s, investors and academia. A diagnostic of the most relevant threads and opportunities was georeferenced. The location of proposals and possible key projects was set, then working groups of students were organized to develop initial design concepts.


Geodesign Workshop.


Non-Adapter Scenario: 2050.

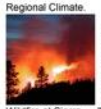
Non-Adapter Scenario, 2050

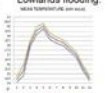
No attention has been given to climate change. A single one to five degrees temperature increase alters weather behavior. Heat island phenomenon further increases energy consumption. Uncontrolled industrial and housing buildings, heavy traffic, disrupted Sierra Park and loss of farmland. Industrial developments constrain urban area and restrict historical center access. Severe traffic of trucks and public transportation affects the entire city. Flooding is the main liability, difficulting evacuation and emergency equipment access in case of natural disasters. Industry has been extended over the river and high lands, west of the municipality, consequently heavy trucks drive along the inner roads.

Tourism is almost lost due to the difficult access and deterioration of historical buildings. River and watercourses are heavily polluted and brooked by housing and industrial debris. The natural hydrological system is broken. Trees and vegetation next to the river are dying. Industry has blocked watercourses; constant flooding affects several urban areas. Many mini-dumps are used as an industry support workshop. Local production tends to disappear.


Regional Climate.

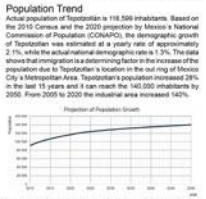

Lowlands flooding.


Wildfire at Sierra.


Temperature 2020-2050

Population Trend

Actual population of Tepotzotlan is 116,599 inhabitants. Based on the 2010 Census and the 2020 projection by Mexico´s National Commission of Population (CONAPO), the demographic growth of Tepotzotlan was estimated at a yearly rate of approximately 2.1%, while the actual national demographic rate is 1.3%. The data shows that immigration is a determining factor in the increase of the population due to Tepotzotlan´s location in the out ring of Mexico City´s Metropolitan Area. Tepotzotlan's population increased 28% in the last 15 years and it can reach the 140,000 inhabitants by 2050. From 2005 to 2020 the industrial area increased 140%.


Projection of Population Growth 2010-2050

Key Projects

The following key projects were identified and developed:

1, 2 and 3. Capula Neighborhood Downtown. An ancient town within walking distance to the historic core and entrance to Sierra Park, includes the old chapel of Nuestra Señora del Refugio, a Seminar House and the Civic Center.

4. The Water Trail. A linear park following a 400 years old irrigation channel next to the border of Sierra Park.

5. Capula Water Trail Museum. A support and educational facility that is a view point for the Old Town, Valley and Sierra.

6. La Presita Archeological Museum and Arroyo Seco Linear Park. An underveloped green corridor between Sierra and Hondo River.

7. Downtown Youth Hostel. A series of new facilities for young national and international tourism

8. Municipal Market. Improvement of a major culinary attraction selling local farming products.

9. Rio Chiquito Linear Park. A shaded promenade linking the ancient Puente de los Jesuitas with the main access.

10. Puente de los Jesuitas and Camino Real. Conservation and improvement project of these important historical elements that are endangered by heavy traffic and alterations.

11. New bridge over the highway. For access to heavy traffic to the industrial area.


Key Projects' Location.

Previous Scenario, 2005

In 2005, a diagnostic of the main problems and opportunities was matched with proposed actions for growth in an orderly and sustainable municipal development. Actions include: the creation of a system of green corridors on runoff areas and natural causes; the development of a linear park in the Rio Hondo; the construction of dams and levees to control possible flooding and to create water reservoirs; dotonate the tourist vocation of the municipality with other emblematic points like State Park and Xalpa Aqueduct; creation of hotels and tourist services of quality in the historic center.

For the northern area, it was proposed the construction of a new bridge over the motorway, a regional hotel and a contrabus station, among others. In order to promote investment and employment, it was planned the creation of an industrial corridor paralleling the Highway. Its entrance depended on the relocation of the highway toll booth and the construction of a second bridge which would give access to the heavy traffic and free the car and bus access to the village.

Unfortunately, some important parts of the proposal have not been carried out such as: the green corridors on water causes, a linear Park Rio Hondo, exotourism in the State Park, relocation of the tollbooth and the second bridge to access industrial corridor.


Previous Scenario: 2005.

2005 Plan Now

Fifteen years later some of the proposals have been carried out such as: the central bus station, the regional hotel, a new access bridge at the highway, some hotels and inns in the historic center, a new crafts market, enlargement of the municipal market, the development of an industrial corridor parallel to the motorway with the construction of a wide avenue.

However, industry was not contained in the proposed corridor area invading agricultural land to the borders of the State Park, the urban area and even the historical center.

Instead the Rio Hondo Park, local and state government built a "Southern Beltway" trying to give access to the towns located towards the west without passing through the historic center. None the less, due to land speculation and the lack of regulation, industry has taken over the land on the southern beltway and the Rio Hondo, blocking access to the river from the historic core.

In 2004 population was 90,200, for 2018 it has increased to 113,010. However, in the same period the land occupied by industry doubled. For these reasons, this zone of study was chosen again to find alternatives that solve current problems and take into account the effects of climate change and urban growth in the short and medium term.

Participants and Collaborators

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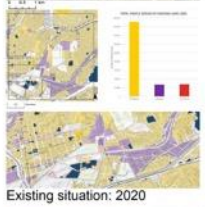
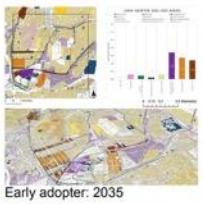
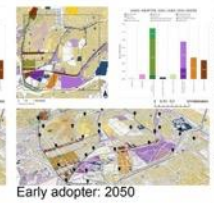
Roberto Solís T.
Daniel González J.

UNIVERSITY OF SOUTHERN CALIFORNIA - USA

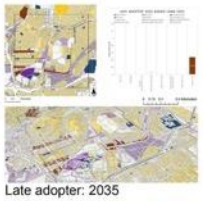

Study Area Background

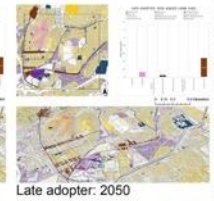

Existing situation: 2020

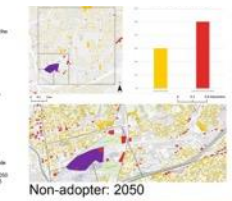

Early adopter: 2035


Early adopter: 2050


Existing Demographics


Late adopter: 2035


Late adopter: 2050


Non-adopter: 2050

Stakeholders

Typologies and Innovations

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Participant Team Credits

Directed by Vasso Cone, Kenjamin Friedman, Julia Frothingham, Rebekkah Castellanos, Felix Goldbrenner, and Emily Ly. With contributions from Dr. John Wilson, Dr. Jennifer Swift, and Beau MacDonald.


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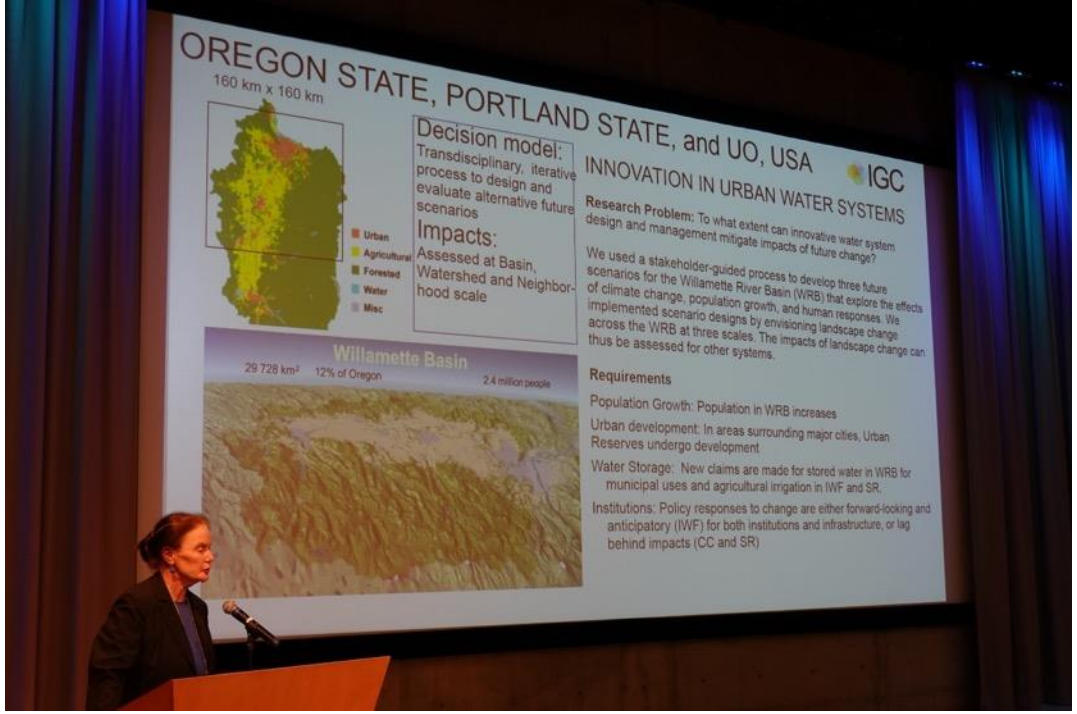
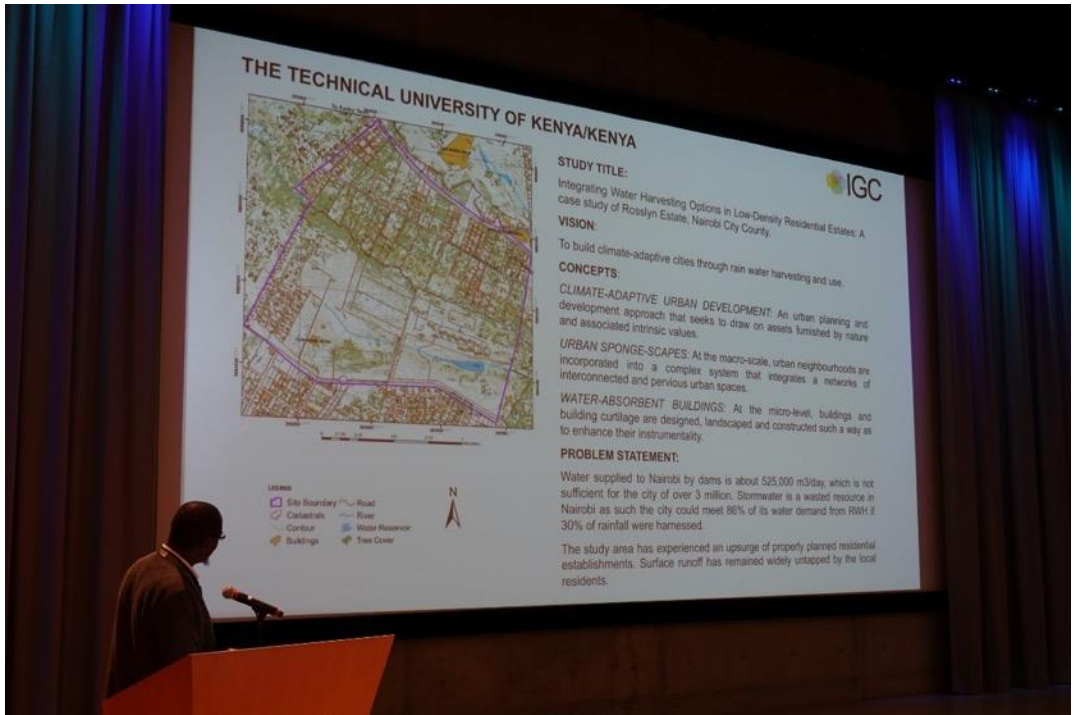
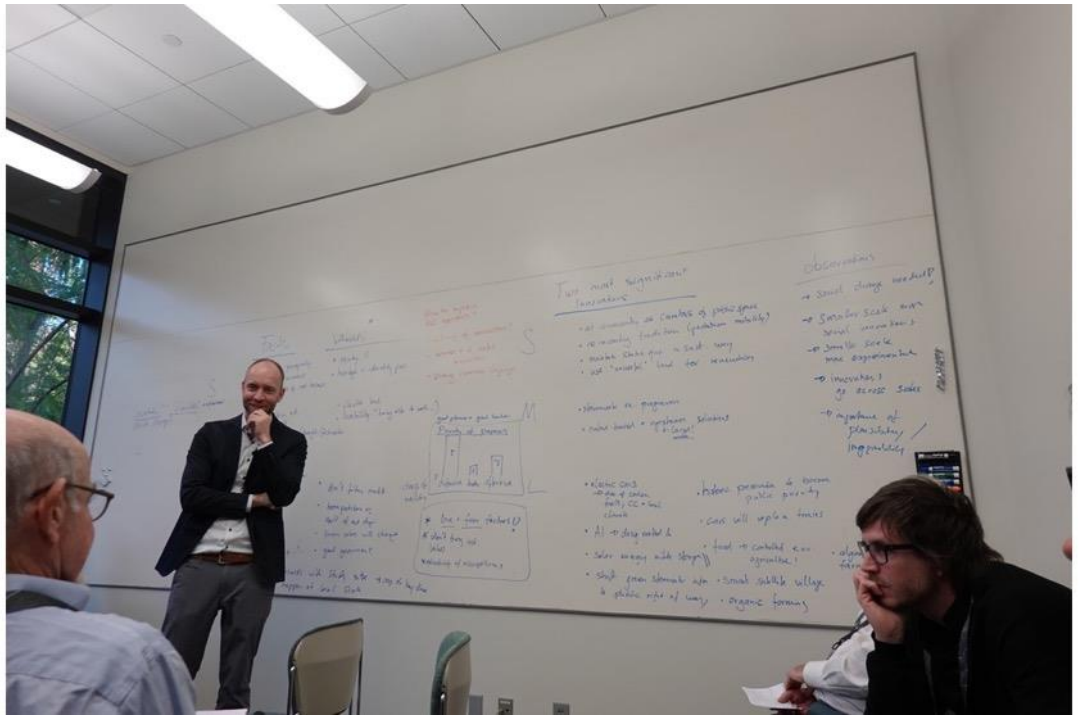
LEIBNIZ UNIVERSITY HANNOVER, GERMANY
IGC
Hannover Region
9.172701111, 52.7617425
60x60 km
Climate diagram
City
100 Kilometers
0
50
100 Kilometers
• high level of biodiversity in its landscape, with fertile soils in the south and old forests in the north
• positive starting point for the development of a sustainable region up to the year 2050
• there are negative impacts on the environment like the agricultural use of the peatlands in the north
• groundwater is polluted with high nitrate levels due to intensive agriculture
• the region's transport infrastructure is one of the most important traffic junctions in Germany for rail and road traffic →led to problems of fragmentation, greenhouse gas emissions and exhaust and noise pollution for the region's inhabitants
• last conversion measures to a „bicycle-friendly" city were carried out 20 years ago
• global sustainable development goals (SDGs) from the „2030 Agenda for Sustainable Development" are aimed


OREGON STATE, PORTLAND STATE, and UO, USA
IGC
160 km x 160 km
Urban
Agricultural
Forested
Water
Misc
Decision model:
Transdisciplinary, iterative process to design and evaluate alternative future scenarios
Impacts:
Assessed at Basin, Watershed and Neighbor-hood scale
Willamette Basin
29 728 km²
12% of Oregon
2.4 million people
INNOVATION IN URBAN WATER SYSTEMS
Research Problem: To what extent can innovative water system design and management mitigate impacts of future change?
We used a stakeholder-guided process to develop three future scenarios for the Willamette River Basin (WRB) that explore the effects of climate change, population growth, and human responses. We implemented scenario designs by envisioning landscape change across the WRB at three scales. The impacts of landscape change can thus be assessed for other systems.
Requirements
Population Growth: Population in WRB increases
Urban development: In areas surrounding major cities, Urban Reserves undergo development
Water Storage: New claims are made for stored water in WRB for municipal uses and agricultural irrigation in IWF and SR.
Institutions: Policy responses to change are either forward-looking and anticipatory (IWF) for both institutions and infrastructure, or lag behind impacts (CC and SR)

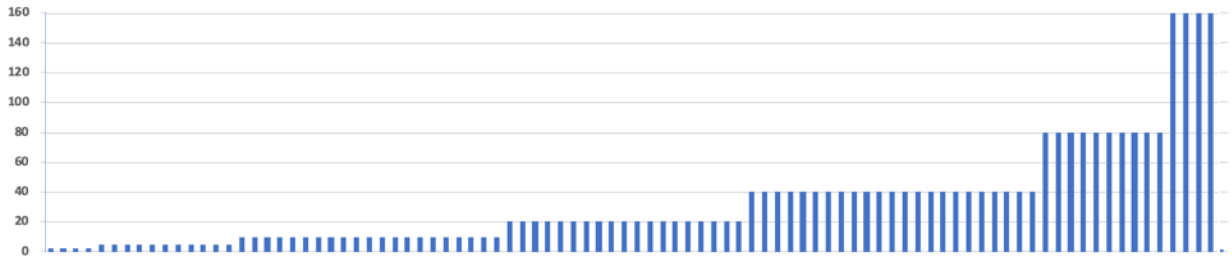

UNIVERSITY OF BASILICATA, LISUT / ITALY
URBAN REGENERATION PROGRAM IN "GRAVINA IN PUGLIA"
IGC
Relevant problems for the change program
Currently the historic center has different levels of degradation due to the decay and abandonment of the building fabric. The main causes are related to: inadequacy of infrastructural networks; social degradation, consequence of an alteration of the original social con-text and a strong depopulation.
In general, the historic center is lacking in public spaces and services. The morphological characteristics of the roads impose restrictions on vehicular traffic. There are no adequate parking areas and pedestrian mobility is not very safe.

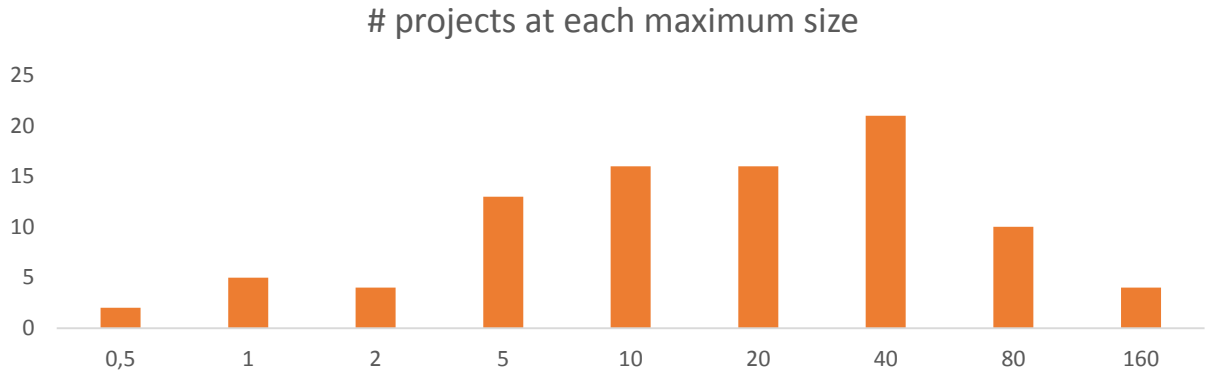

THE TECHNICAL UNIVERSITY OF KENYA/KENYA
IGC
STUDY TITLE:
Integrating Water Harvesting Options in Low-Density Residential Estates: A case study of Rosslyn Estate, Nairobi City County.
VISION:
To build climate-adaptive cities through rain water harvesting and use.
CONCEPTS:
CLIMATE-ADAPTIVE URBAN DEVELOPMENT: An urban planning and development approach that seeks to draw on assets furnished by nature and associated intrinsic values.
URBAN SPONGE-SCAPES: At the macro-scale, urban neighbourhoods are incorporated into a complex system that integrates a networks of interconnected and pervious urban spaces.
WATER-ABSORBENT BUILDINGS: At the micro-level, buildings and building curtilage are designed, landscaped and constructed such a way as to enhance their instrumentality.
PROBLEM STATEMENT:
Water supplied to Nairobi by dams is about 525,000 m3/day, which is not sufficient for the city of over 3 million. Stormwater is a wasted resource in Nairobi as such the city could meet 86% of its water demand from RWH if 30% of rainfall were harnessed.
The study area has experienced an upsurge of properly planned residential establishments. Surface runoff has remained widely untapped by the local residents.
N

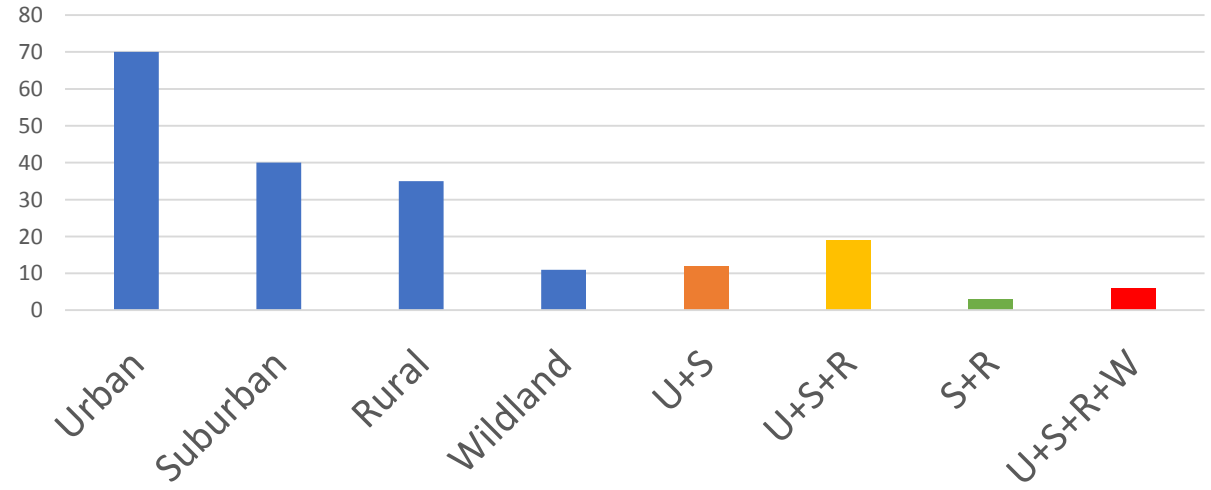

INTERNATIONAL
GEODESIGN
COLLABORATION
Changing Geography by Design



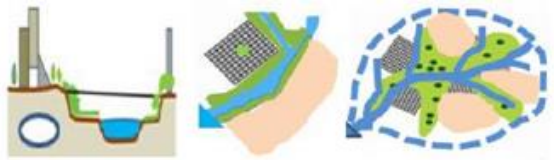
What did we learn – how big is a geodesign project?



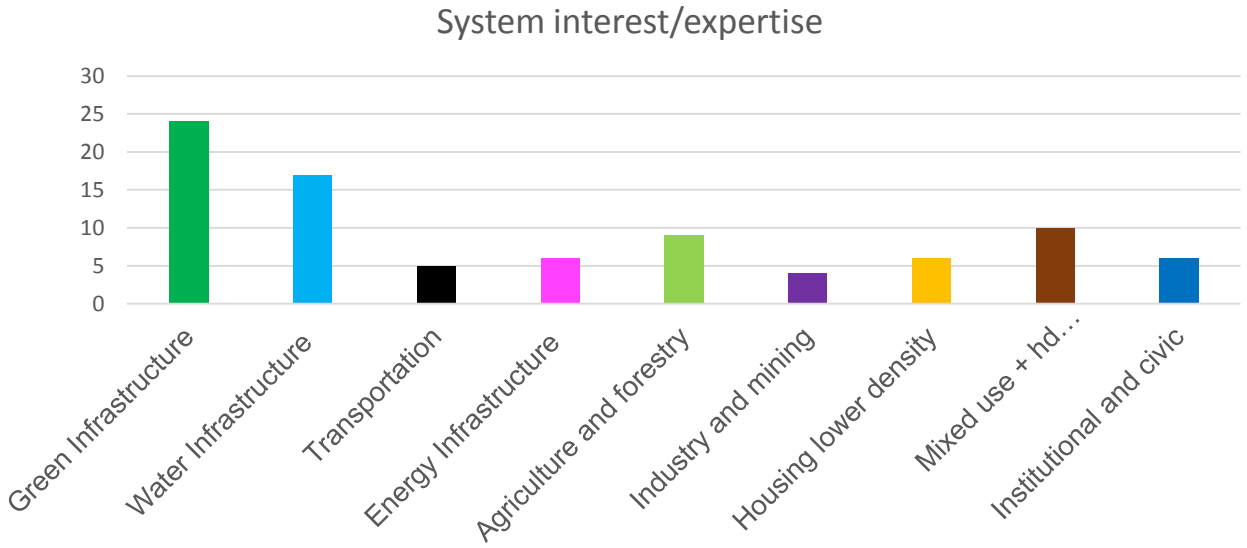




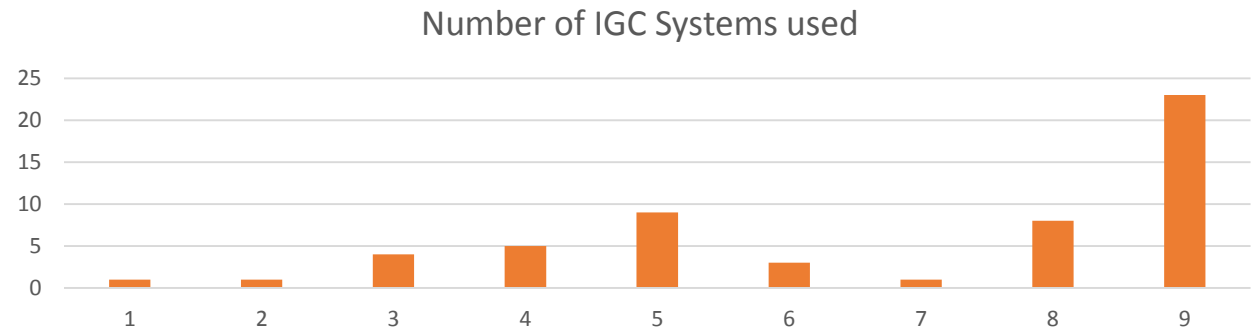
- Projects addressed a wide range of scales, from urban projects only 0.5 x 0.5km to rural and wildland projects covering 160 x 160km.
- The majority of projects fell in the range 5 x 5km to 40 x 40km.
- While the majority had Urban components, many addressed Suburban and Rural areas. Larger project areas tended to cover a continuum from urban to rural or wildland.

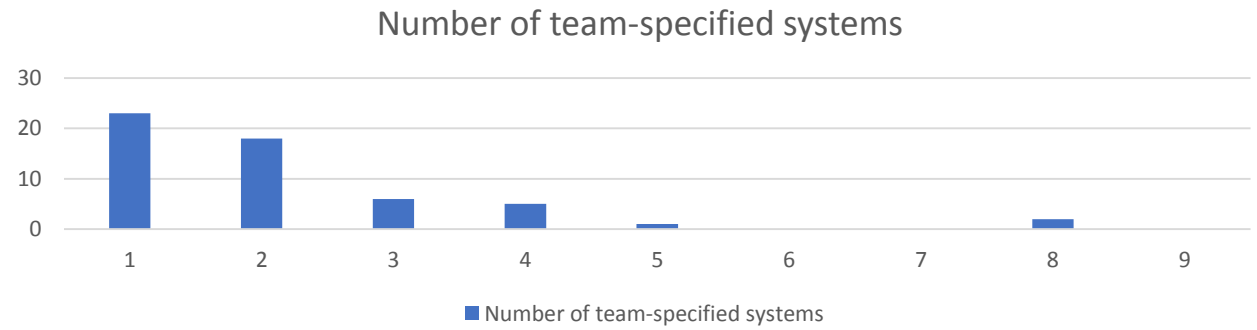


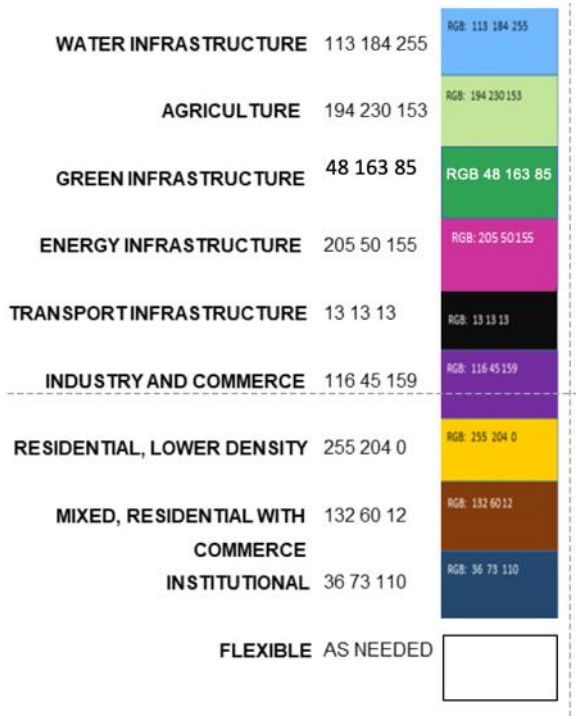
What did we learn about geodesign systems?



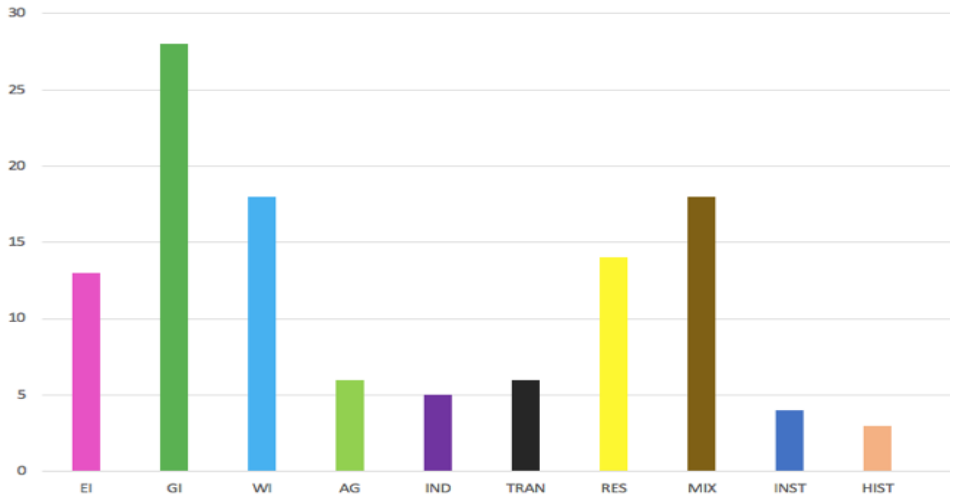
- Although participant expertise was mostly in green and water infrastructure, overall there was expertise in all nine systems.
- Most project teams addressed the nine systems specified in the IGC agreement.





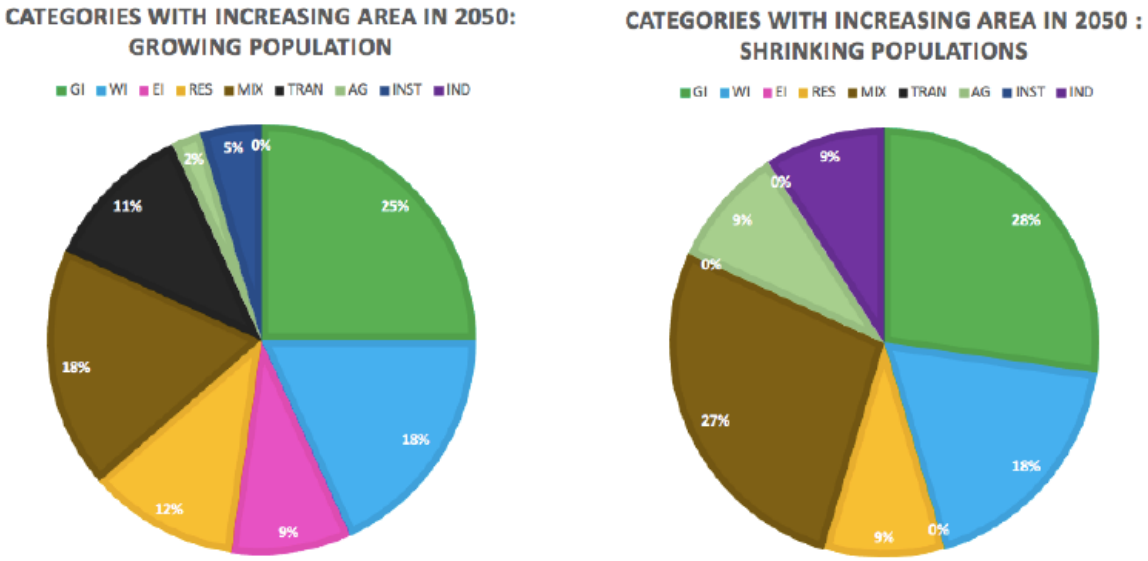


What did we learn about geodesign?

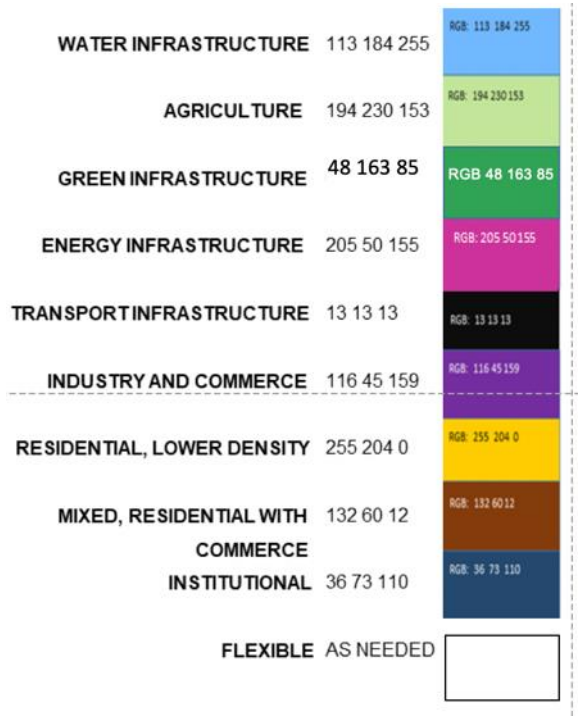


Dominant Land Systems by 2050 (Early Adopter scenarios)

- Although participant expertise was mostly in green and water infrastructure, overall there was expertise in all nine systems.
- Most project teams addressed the nine systems specified in the IGC agreement.



Design for growing (left) vs. shrinking (right) populations



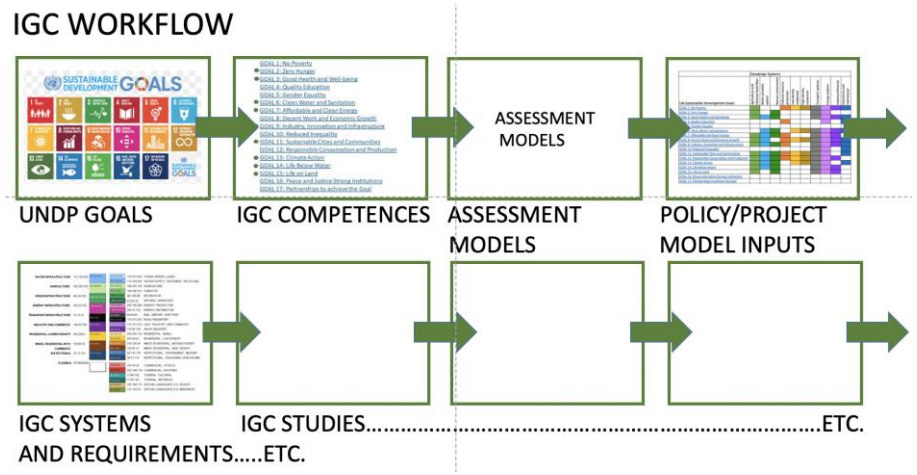
Graphics by Kristina Hill, Richard Kingston, Alenka Poplin

IGC 2019 Materials Available via geodesigncollab.org

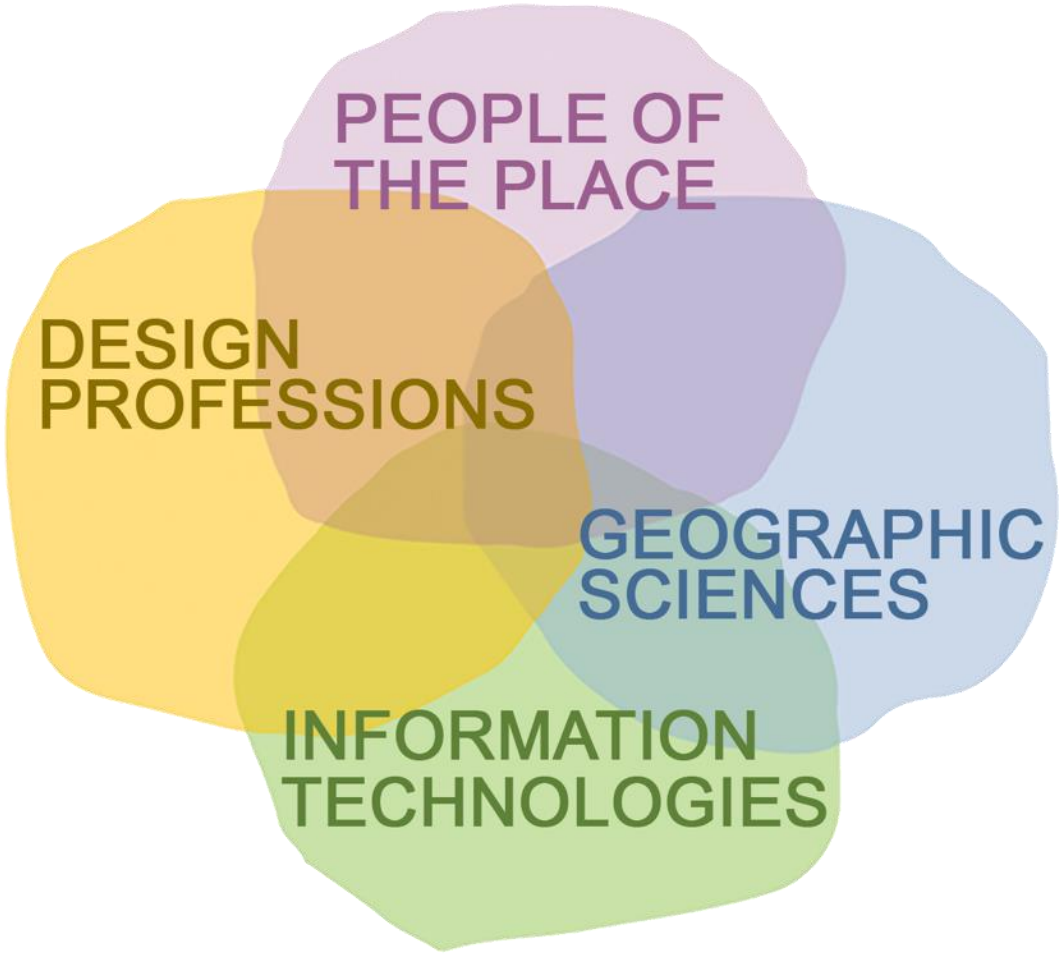
All presentation materials will be available in their original INDESIGN, POWERPOINT, and ILLUSTRATOR formats, enabling machine-translation of text. All collaborators in the IGC agree that any participant can translate, print and exhibit the work of any other school, provided that credit is always given to IGC and the originating school.

Joining IGC 2020

- Retain project area sizes
- Retain design scenarios and timelines
- Evaluate and update innovations
- Adopt UNDP Sustainable Development Goals as IGC goals
- Re-think systems in light of SDGs
- Evaluate and update workflow



	Geodesign Systems									
UN Sustainable Development Goals	Agriculture and Fisheries-food+fiber	Water provision system	Nature conservation	Cultural resource protection	Low-density residential	High-density residential	Transport systems	Energy systems	Industry+Minerals	Commerce and Institutional
GOAL 1: No Poverty										
GOAL 2: Zero Hunger										
GOAL 3: Good Health and Well-being										
GOAL 4: Quality Education										
GOAL 5: Gender Equality										
GOAL 6: Clean Water and Sanitation										
GOAL 7: Affordable and Clean Energy										
GOAL 8: Decent Work and Economic Growth										
GOAL 9: Industry, Innovation and Infrastructure										
GOAL 10: Reduced Inequality										
GOAL 11: Sustainable Cities and Communities										
GOAL 12: Responsible Consumption and Production										
GOAL 13: Climate Action										
GOAL 14: Life Below Water										
GOAL 15: Life on Land										
GOAL 16: Peace and Justice Strong Institutions										
GOAL 17: Partnerships to achieve the Goal										



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Changing Geography by Design