Geodesign: IGC – Global-to-Local-to-Global (GLG) Update

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Abstract: This brief report on the status of the International Geodesign Collaboration (IGC)'s Global-to-Local-to-Global (GLG) project is based on the experience of a two-(half)-days Climate Geodesign Workshop at Harvard University, in January 21 – 23, 2025.

1 Introduction

In 2022, at the urging of Harvard GSD Professor Emeritus Carl Steinitz and several colleagues, a number of individuals, institutions and organizations around the world agreed to undertake an international collaboration (the IGC https://www-igcollab.hub.arcgis.com/) to pursue the broad question(s):

"Which concepts, methods, and digital tools in spatial planning / geodesign can contribute to the mitigation of Earth's climate change in the next decades?" (DABOVIC 2024).

Since climate change writ-large is a global existential phenomenon, and no nation can control its own climate, and each nation's actions contribute to overall global change in complex and non-linear ways, if climate mitigation is to succeed, all nations must act in collaboration. This is inherently a multi-jurisdiction, multi-scalar geodesign (STEINITZ 2012) problem; guided by climate science, and with the aid of a digital Decision Support System (DSS). It requires multiple stakeholders looking and thinking ahead in time globally, to locally, to globally, and planning now to act at multiple interlocking scales, for the future of everyone.

Since 2024, the IGC-GLG project has begun to organize a systematic design and planning framework (DSS) to support the flow of information, collaboration, and action across scales and regions, from Global 'down' to Local, and from Local 'up' to Global. The assumption is that it will take all scales, acting in concert, across many societal and industrial sectors to achieve meaningful results, and that these scales are far better off coordinated and communicating than not.

Several ideas and assumptions are at the core of the GLG project:

- Climate mitigation plans are more valuable than climate adaptation plans in the long run. In the short term some adaptations may reduce human misery, and facilitate mitigation efforts, but only mitigation has any hoping of reversing the worst predictable impacts of global climate change.
- Mitigation efforts need to start immediately, and will need to be substantially implemented by the year 2050 and based on projected and planned conditions by 2050.
- Three key issues for survival demand immediate and lasting attention:

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- o atmospheric carbon change via reduced emissions on one hand, and sequestration into terrestrial and oceanic sinks on the other;
- o healthy / effective ecological systems, services, and species habitat, and robust global and local biodiversity;
- o financial and governance issues including coordinated multi-scalar and -jurisdictional management, implementation and maintenance policies, mechanisms, and costs.

- When fundamental conditions are changing, both locally and globally, (as they ARE) and big data-based scientific models predict future problems (as they DO), the endgame of environmental design and planning requires purposely designed, locally implemented spatial temporal strategies for future actions across multiple scales, involving both physical changes and socio-political processes, and impacts assessments, including costs and benefits, financial and other, across multiple scales and sectors.

2 Design Workshops

To promote the deeper exploration of these ideas, the GLG project has undertaken a series of intense design workshops at several scales, around the world. Working with assistance from Esri and Geodesignhub, software has been designed to enable the rapid absorption of both global- and local- scale data and raster and vector spatial data; to facilitate the allocation of a menu of feasible 'climate-actions' across broad regions of the planet; and to simulate time-based impact assessments of effectiveness and cost at both local and global scales.

Typically, such studies/workshops employ:

- Moderately coarse (e. g. 1 km^2) resolution raster base maps of fundamental landscape attributes (e. g. topography , soils and hydrology; land use / landcover; industrial, transportation, and energy infrastructure ; and bio/ecological processes, including species habitat.) These base maps are typically available both for 'existing current conditions', and as predicted for c. 2050.
  (See https://igcglg.maps.arcgis.com/home/index.html for several of these maps in the ArcGIS platform, e. g. "Projected World Climate Regions Viewer" and others.)
- A map of combined political borders and climatic regions, or 'management units'; these may be aggregated or disaggregated at a wide range of scales, (global -> local) depending on the study.
- A finite menu of pre-identified feasible climate actions at a relatively high abstraction level (such as "wetland conservation", "decarbonize energy systems", "public transportation subsidies", "sequestration incentives", etc.) These are intended to be 'global' directives, that will be refined and specified within subsequent 'local' projects.
- A facilitated 'discussion and negotiation' process wherein various participants representing various viewpoints and priorities are encouraged to engage in dialog and negotiation, to achieve a better overall plan than any one or small groups of participant(s) might.

Typically, one or more participants (students, professionals, residents, etc.) is assigned to evaluate a specific region, or location, and to select and prioritize appropriate climate-actions, including start dates and timing. These selections are based on both bio-regional physical / climatic attributes, and evaluations of local social / political / financial 'readiness'.

At the more 'global' end of the scale, the 'design' is basically a spreadsheet of selected climate actions with start dates – a 'Gantt chart'. At this scale, no particular sub-regions (polygons) are selected or designed; the management units (combined political/climate zones) are fixed. At the more 'local' scale, part of the exercise is to select or designate areas, regions or sites, which necessitates a map of polygons with attributes identifying proposed climate actions, which includes temporal information indicating implementation timing. These spreadsheets, and maps as required, serve as the input to high-level impact simulation programs, which return predictable mitigation effects (benefits) and costs for the proposed study area(s).

One case study will serve to illustrate this process: The Charlestown (Boston) Design Workshop at Harvard University GSD. This workshop, at the more 'global' scale, was organized in January 2025, at the beginning of the semester for a Landscape Architecture Design Studio led by Professor Lorena Bello Gomez, and facilitated by Professors Carl Steinitz, Tijana Dabovic, Michele Campagna, and Pedro Arsenio, from the GLG team.

3 Charlestown (Boston) Urban Landscape Studio: Climate Geodesign Workshop

This studio, identified in the curriculum as an 'urban landscape' studio, is required in the 4^{th} semester of all MLA students at GSD, and forces them to confront the messy complexities of urban waterfront mixed-use settlement. The once-working-class, now-gentrifying Charlestown neighborhood is under stress from increased pressure on all infrastructure systems, limited greenspace, and imminent sea-level rise. Change proposals must address long term global climate change and its effects, as well as street-level comfort, health, accessibility and resilience for a growing population. The studio itself requires students to identify specific sites and local interventions; this workshop was designed to provide a global perspective as a starting point.

In the first half-day workshop, an overview was provided by Carl Steinitz (Figure 1, Figure 2) Students were then divided into 11 groups of four (more or less), and each group was assigned a city in some climate zone somewhere in the world. (The selection was guided by the known nationalities of the students, so that each city-group had at least in principle one person who was in theory familiar with the climate zone, if not the specific city.) The City of Charlestown (Boston) was just one of 11 selected cities (Figure 3).

Fig. 1: Harvard Workshop Venue

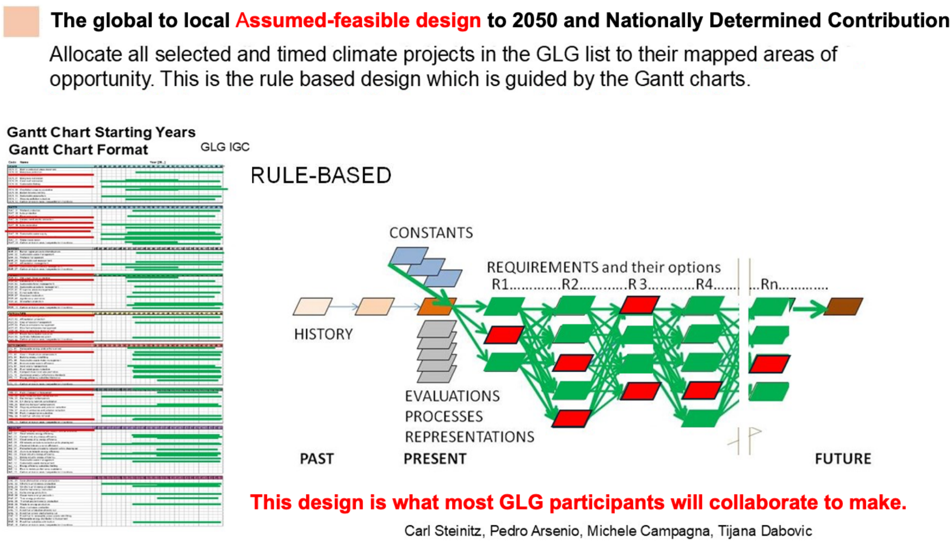


Fig. 2: Rule-Based Design

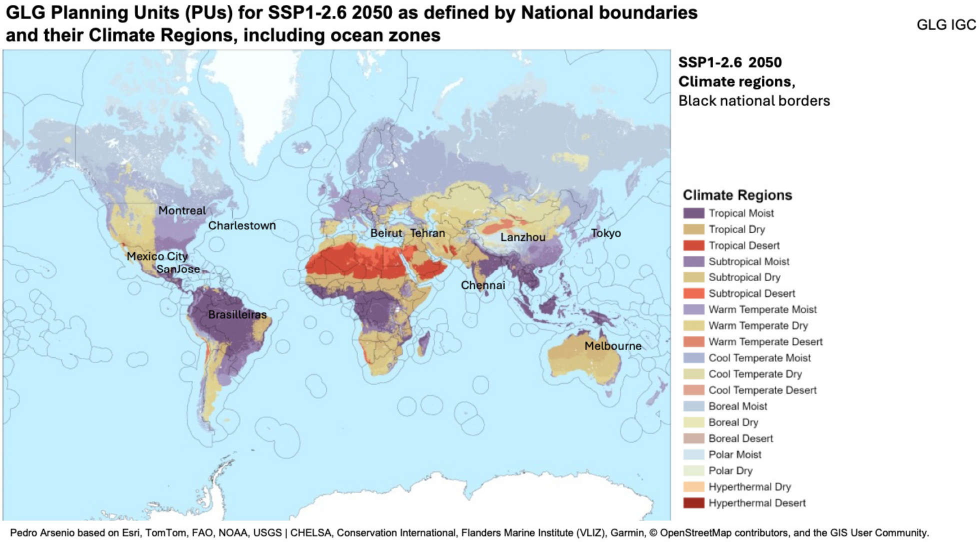


Fig. 3: GLG Planning Units and Selected Cities Project Types

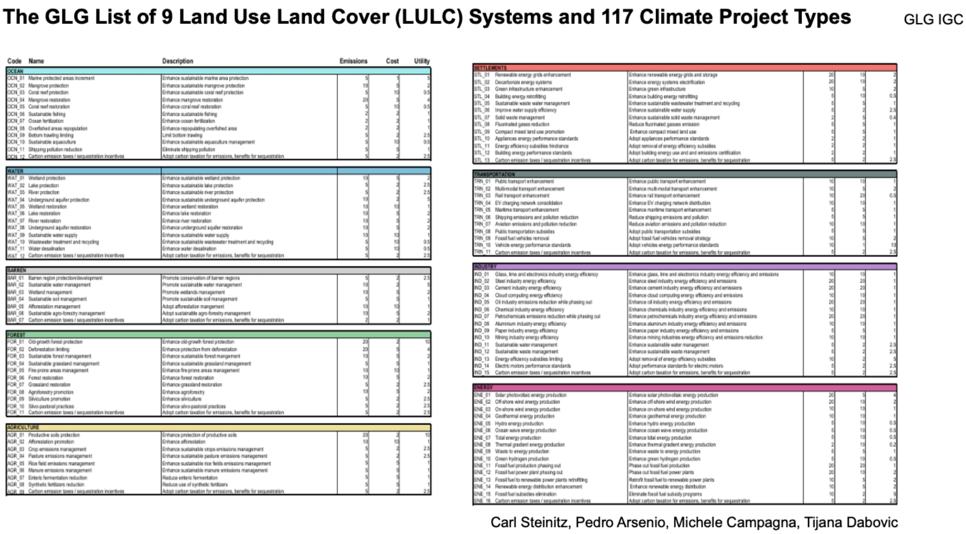
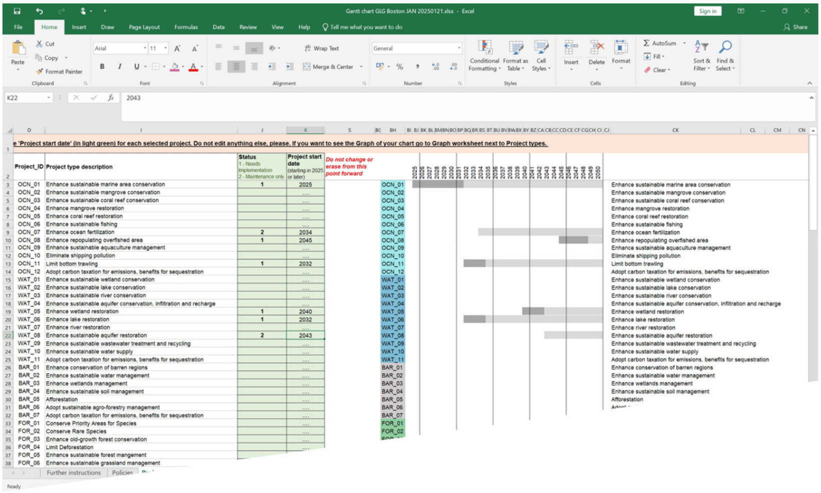


Fig. 4: LULC Systems and Climate

Orientation to the 11 global regions was via the GLG Global Explorer, which included projections on land use land cover, climate and ecosystem change to 2050. These changed conditions were the design objective of the rule-based geodesign exercise. The student group's task was to review the list of 117 climate actions organized in nine global systems, select and prioritize them for application to their city, organized by time of implementation between now (2025) and 2050, on a 'Gantt chart' in spreadsheet format (Figure 4, Figure 5). The climate actions were organized with more ‘sequestration’ projects at the top of the list; more ‘mitigation’ projects at the end. Students were encouraged to consider a range of criteria, including both physical suitability and administrative, financial and governmental ‘readiness’ for climate actions.

GLG Excel Gantt chart format



Pedro Arsenio

Fig. 5: Excel Gantt Chart Format

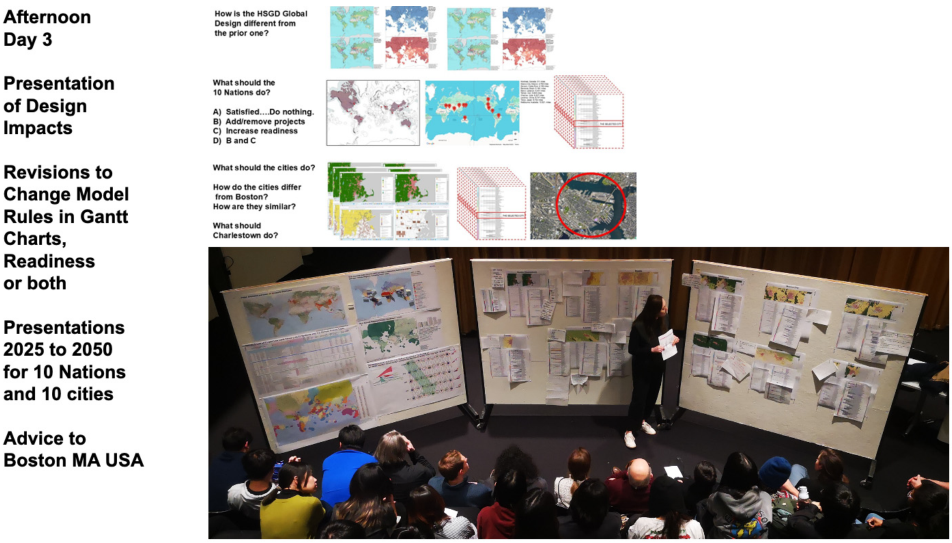


Fig. 6: Presentation of Design Impacts

Fig. 7: Design Impacts Presentations

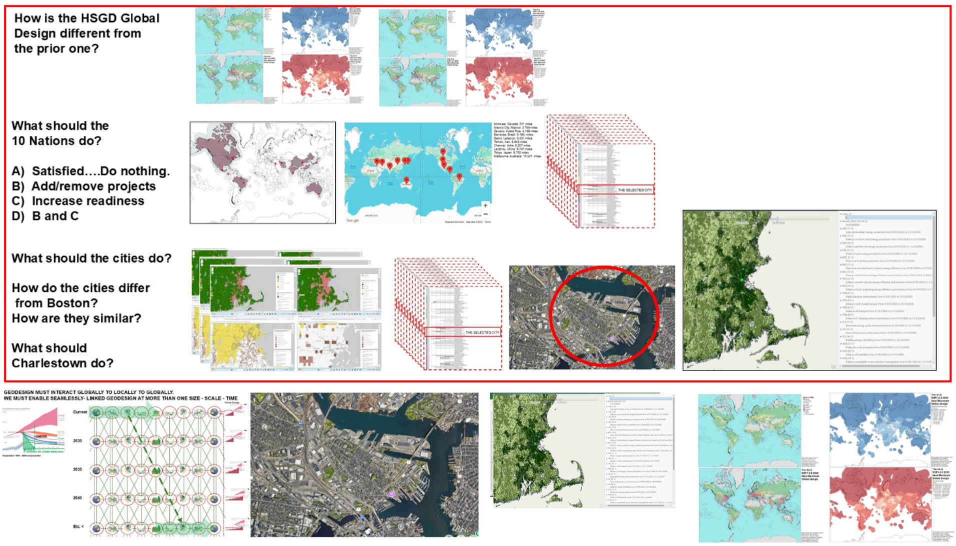


Fig. 8: Workshop Conclusion

After the first (half) day of the workshop, these city-specific plans were fed into an off-line computer system for evaluation; simulation software was used to predict likely benefits and costs associated with the proposals. In the second (half) day of the workshop, these results were presented and discussed, and the student groups given a final exercise: to consider the results and propose even more aggressive modified plans, if possible, to produce even more benefits, and likely costs. (Naturally these costs, at this scale, and in this compressed time, were extremely rough numbers, meant to guide qualitatively, not quantitatively.)

Since there were ten other cities around the world studied, in addition to Charlestown, the second day of discussion involved comparative learning from other socio-economic realities in other climatic zones (Figures 6, 7, 8).

4 Discussion

This brief workshop was designed to introduce both emerging methods, relevant data sources, and decision criteria to landscape architecture students, who are necessarily finding that the global climate crisis affects and will continue to affect all dimensions of their work. The particular case of Charlestown, Massachusetts was chosen since it was already the planned site for a semester-long design studio, and to maximize the potential for Global-to-Local decisions and strategies to emerge. The workshop also served as a proof-of-concept trial of the technical workflow, which is still in active development. The details of student teams' designs and workshop conclusions are not important; the introduction of the context and the multi-scalar thinking was the primary intention, given the short time and constrained logistics. Anecdotally, GSD students and their instructors found the workshop 'useful' and 'worthwhile'.

The IGC-GLG framework is an ambitious undertaking, in its early stages. The necessary science, the real-world constraints, and the available software, are evolving literally daily. In its full manifestation, the Global-to-Local-to-Global workflow would involve the development of multiple local projects, operating with the results of the global phase, refining and implementing them, and returning local results back to a cumulative global assessment, and so on iteratively and cumulatively. The logistics, politics, engineering, and financing of such multi-scalar hybrid analog-digital mega-projects is daunting, but they may be the only feasible way out of otherwise certain global disaster. This workshop, and others like it, constitute the very thin tip of a quite substantial iceberg, whose depths are yet to be plumbed.

Many questions remain; and substantial real-world problems await. Both theoretical and extremely practical questions about the relationship(s) between global plans and local designs, and vice-versa, must be explored. What are the most productive possible climate actions, and how might they be combined in real-world application? What short-term adaptation measures might ease the way for longer term mitigation projects? How can nation-states work across borders on large projects? How do small projects add up over the face of the globe? There are many imponderables in this undertaking. But as a case study in the real-world application of geodesign principles and methods, one could not ask for a better / more timely / more challenging project with truly existential dimensions!

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