Enabling Sustainability Success
with Regenerative Regional GIS

Esri GeoDesign Summit 2021, Wed, Feb. 10th, 9:40a-10a

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Photo Credit ZGF

Note on this “Proceedings” Draft

This draft includes a little extra information that is not in the video version presented at the Esri GeoDesign Summit 2021.

- Two additional slides on the emerging innovation of biophilic city planning & design (Nos. 14 & 15).
- Editing on Slide No. 28 to add “automating” planning to the Procedural Technology point, and reformatting each of the four main points to include their key ideas.
- Slide No. 42, adding the point to Innovation 2 regarding automating regenerative sustainability planning.
- Minor copy editing.

Contents

- Review our Sustainability Predicament
- Describe the Three-Innovation Antidote
  - Regenerative *Systems* Sustainability
  - 3D Geospatial *Systems* Planning & Design
  - Regional GIS Infrastructure (technology + decision process)
- Connect the Innovations for Success
- Session follow up resources:
  - Questions/comments: Scott.Edmondson@sfgov.org or CMa@esri.com
  - More information: http://www.Sustainability2030.com/GeoD2021/

Introduction

Predicament: Humanity's sustainability response stands now at a crossroads.

Response: We must shift to an effective approach & scale it quickly or fail.

Urgency: We must make sufficient progress towards sustainability within 10 years (IPCC).

Three ideas

1. CONNECTING three emerging innovations will create the potential for scaling sustainability success in time.

2. This move is our ONLY ANTIDOTE for our present course, i.e., an accelerating dystopian future of unsustainability.

3. GEODESIGN IS UNIQUELY POSITIONED for this task as a technology and professional practice.

The Unsustainability Antidote's Three-Innovations

1. Shifting to a REGENERATIVE *SYSTEMS* SUSTAINABILITY approach

2. + Shifting to 3D GEOSPATIAL *SYSTEMS* PLANNING & DESIGN

3. + Developing a Global System of REGIONAL GIS INFRASTRUCTURE: technology + decision process

How to connect these innovations is our challenge

Today, I will sketch the high-level connections that reveal:

- our opportunity
- its game-changing value proposition
- and how to generate it

The Three-Innovation Antidote

1. Regenerative *SYSTEMS* Sustainability
2. + 3D Geospatial Digital *SYSTEMS* Planning & Design
3. + Regional GIS Infrastructure: technology + decision process

Innovation 1:

Shifting to Regenerative Systems Sustainability

From static to dynamic

From silos to systems

From buildings to city-regions

What is Regenerative?

- Merriam Webster's—Regeneration function: renewal or restoration of a body, bodily part, or biological system (such as a forest) after injury or as a normal process.

- Regenerative is the core dynamic of living systems that recreates life in perpetuity.

What is Regenerative Sustainability?

It is the success path from our present sustainability crossroads.

It is the new approach needed for sustainability success based on

- Redefining our understanding around regeneration as the core principle
  - needed to *PROTECT* and enhance nature, our primary economy
  - and then to *MIMIC* in realigning the human economy & society for inclusive prosperity
- Redefining our practice to produce ***real*** whole systems sustainability

It is the next big, and final sustainability step.

A regenerative sustainability approach

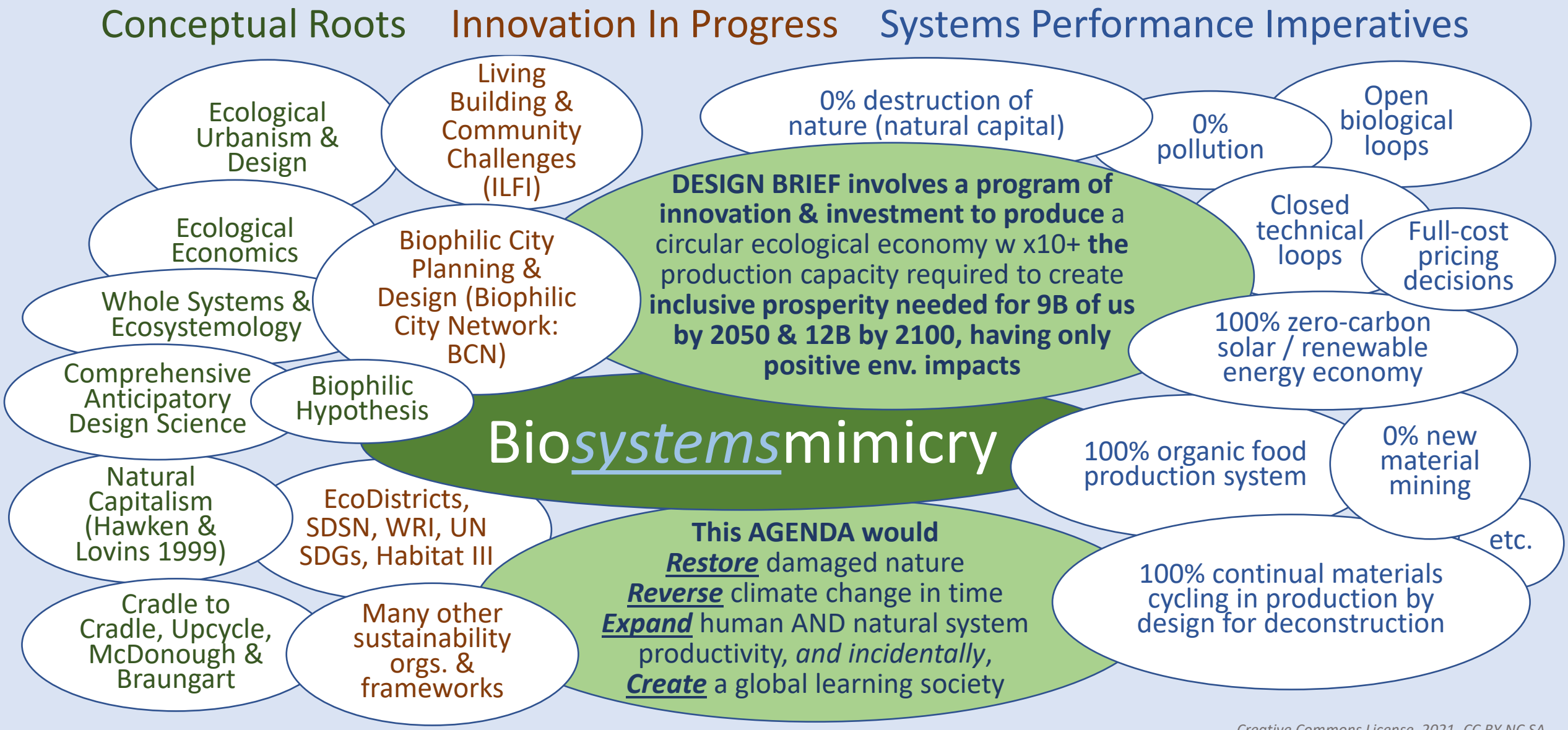
shifts the focus from silos TO systems,

- **From** stocks TO processes
- **From** linear TO circular material flows
- From non-renewable TO renewable energy
- From subsystem TO whole system optimization
- From content TO context
- From problem symptoms TO sources
- From impact reduction TO avoidance by design
- From net negative TO net positive impact
- From static parts TO dynamic systems
- **From** the environment TO the economy
- **From** buildings TO city-region systems
- **From** topical goals TO systems imperatives
- **From** problem solving TO future designing

This shift connects the human economy & society to the larger living system

- not with *end-of-pipe* impact mitigation, as we do now,
- but at the level of operating principles

Regenerative Systems Sustainability Summary



Biophilic City Planning & Design (BCP&D)

Is one key emerging planning innovation for regenerative sustainability. Its full value for public health, sustainability, and even civilized society, has yet be recognized and embraced.

It has four themes[1]:

- Abundant nature in the city & infrastructure
- Pervasive citizen engagement with nature
- A deep "nature" culture rooted in knowledge and values
- Strong biophilic institutions of budgeting & governance to support & reflect those values

On its implications:

"No one has learned more about the intricate relations of the human to nature, as expressed in our architecture, our relation to animals, and the shaping of aesthetics than Stephen Kellert."

E. O. Wilson, Professor of Biology Emeritus, Harvard University

[1] Beatley, *Biophilic Cities*, 2011

Plan & design biophilic neighborhoods & cities full of nature

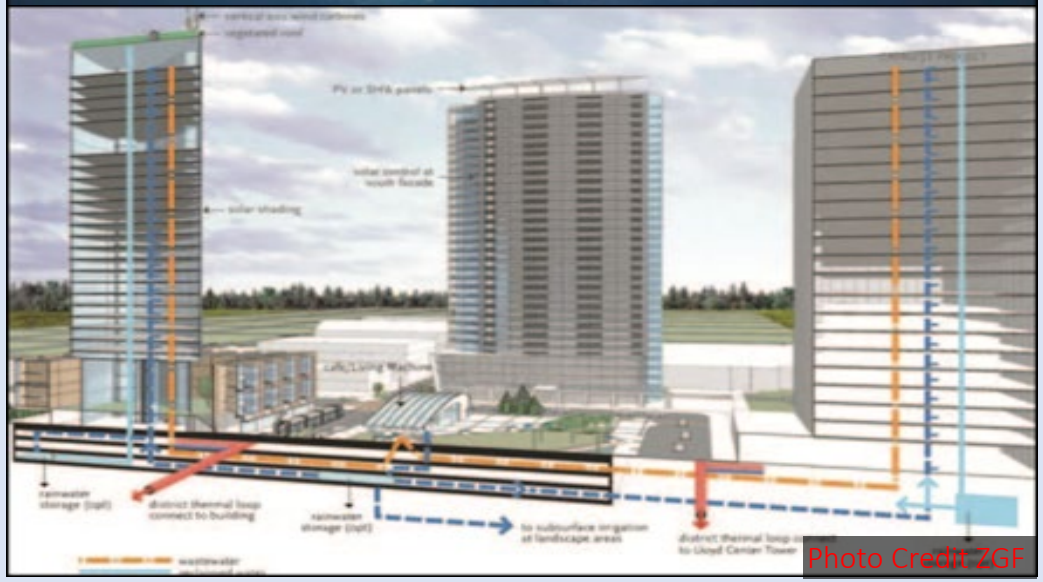
that invite activity, exploration, relaxation, contemplation, and contribute to public health & sanity.

Fortunately, the innovation required for regenerative sustainability is underway

- We do not need to invent it anew.
- It is bubbling up in our plan-design-build practices.
- **BUT we DO need to** recognize it, grab it, learn it, extend it, and scale it quickly.

Regenerative sustainability innovation in practice!

- Planning | Formulating the policies & rules **for planning high-performance settlements** (Eco-Districts, -Cities, -Regions); **Biophilic Pl. & Design to connect health & land use.**
- Urban Design | Adding water & habitat (biophilia) to the urban design palette **to create high-performance living places** as part of a **living systems urban metabolism.**
- Architecture | Prioritizing energy efficiency **to enable the renewable energy economy.** The 2030 Challenge, NZE+T (buildings + transportation), Passive House building tech. etc.; **and biophilia to create living Buildings**/Walls/Roofs.
- Landscape Architecture | Shifting from aesthetics to habitat creation **for biodiversity & human health** (Biophilic Pl. & Design) **in living city-regions.**
- Utilities | Shifting from gray to green urban infrastructure with **nature-based solutions and ecosystem-services to create living urban & regional metabolism.**



Moving from theory to the global practice lab

Cities are now innovating towards regenerative urbanism around the world with bold innovation.

REGENERATION

BURNABY, BC. Adopting an Environmental Sustainability Strategy that anchors an integrated, regenerative, and net positive community vision

ENERGY

VANCOUVER. Leading a comprehensive Renewable City Strategy committed to 100% renewable supply (including transport) using neighborhood energy utilities

WATER

BARANGAROO SOUTH DISTRICT, SYDNEY Utilizing an integrated district water system that exports surplus recycled water to surrounding communities

MATERIALS + WASTE

AMSTERDAM. Designing a local circular economy to eliminate waste, create jobs, and anchor new district developments

FOOD

SUNQIAO DISTRICT, SHANGHAI Integrating large-scale vertical farming systems within the public realm to expand regional foodshed capacities

IT / SMART CITY

KASHIWA-NO-HA, JAPAN. Managing a comprehensive Smart City program that enhances environmental performance and social cohesion

MOBILITY

VIENNA. Providing a coordinated network of emissions-free transit options that eliminate the need for personal automobiles

LAND USE + ECOSYSTEM

SINGAPORE. Employing a 'livable density' approach that integrates the built environment within natural systems

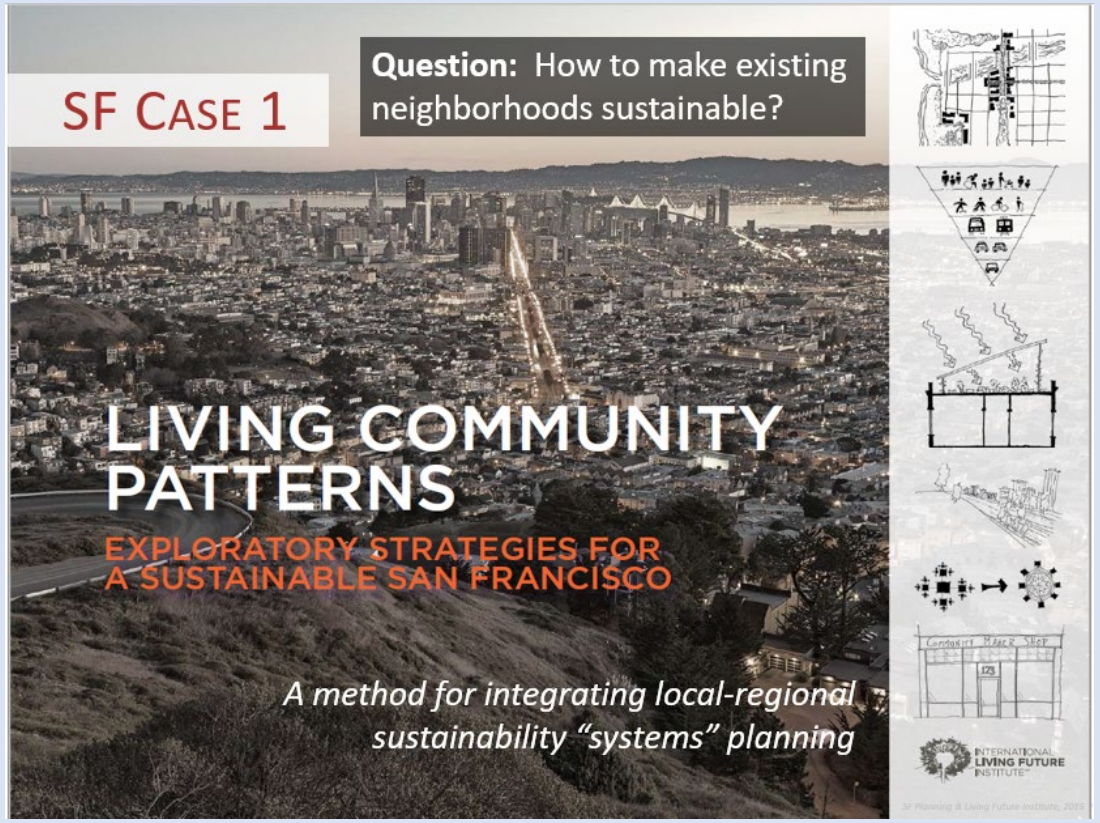
HEALTH + WELLBEING

CHICAGO. Leading a comprehensive wellbeing assessment that embeds health equity into every government agency

MGMT + GOVERNANCE

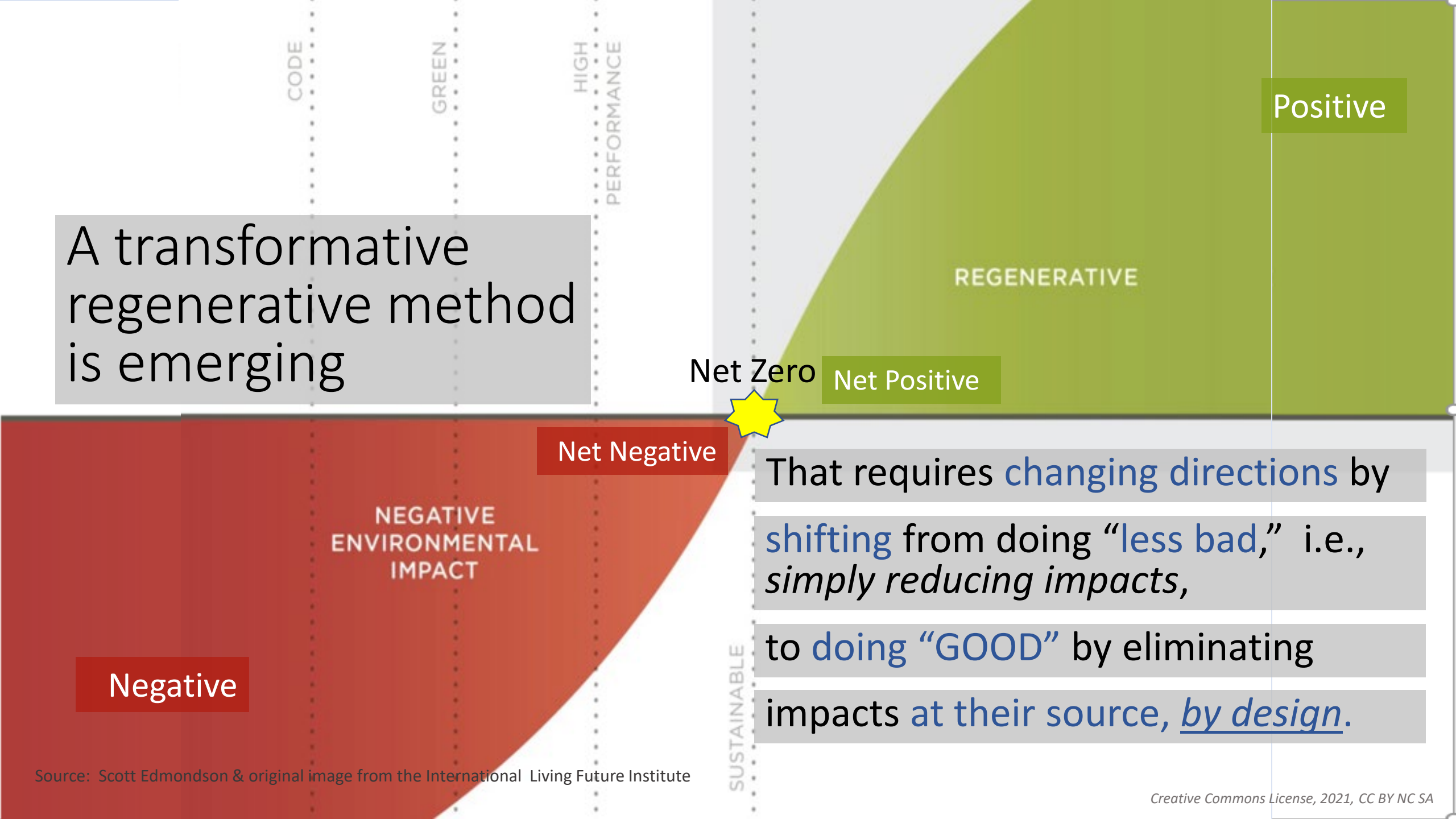
COPENHAGEN. Using an innovative public-private model to finance large-scale community regeneration projects

Explored the idea in two SF planning studies



With the International Living Future Institute and ZGF Architects, respectively, from earlier work with EcoDistricts and a post-Rio92 community SF Sustainability Plan (1997).

A transformative regenerative method is emerging



That requires changing directions by

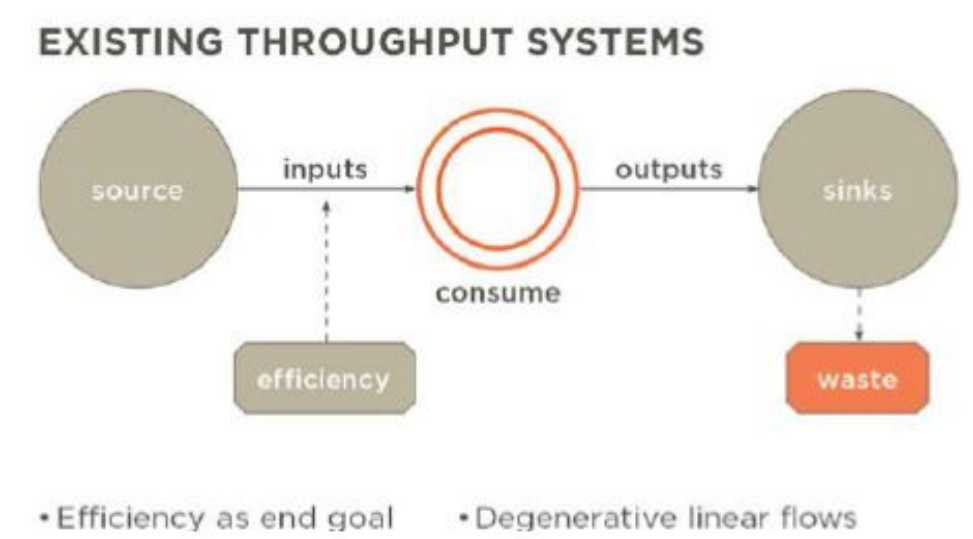
shifting from doing "less bad," i.e., *simply reducing impacts*,

to doing "GOOD" by eliminating

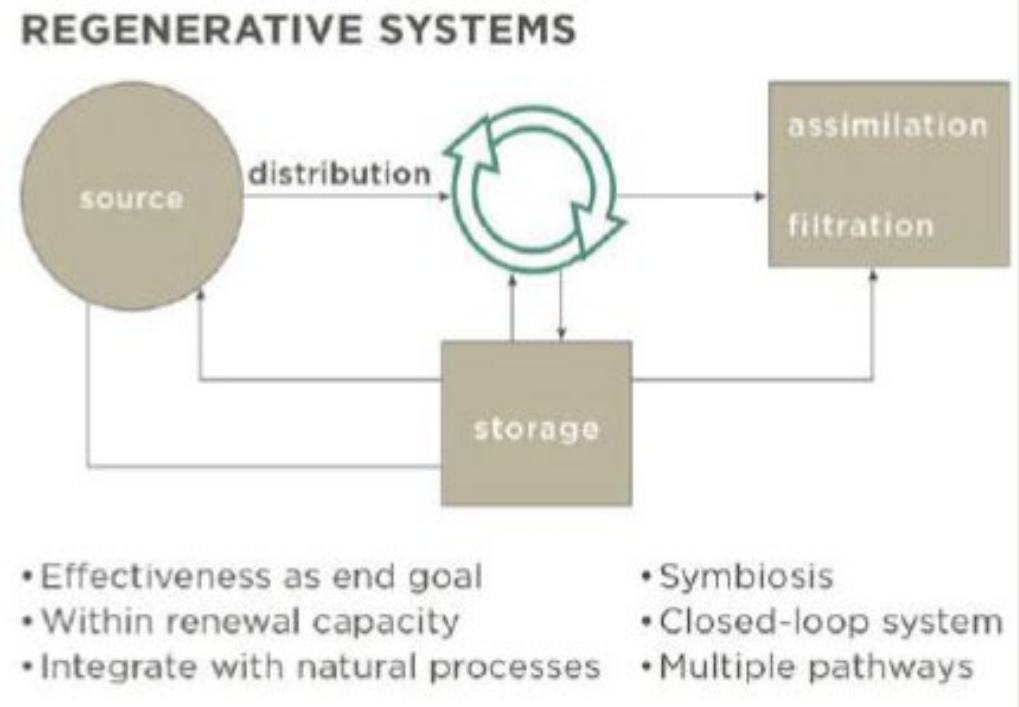
impacts at their source, *by design*.

Source: Scott Edmondson & original image from the International Living Future Institute

Enhance *BOTH* Ecological *& Human Economic* Carrying Capacity *by Design*



Transforming Linear flows in the human system that produce waste & use up finite resources ***by design***

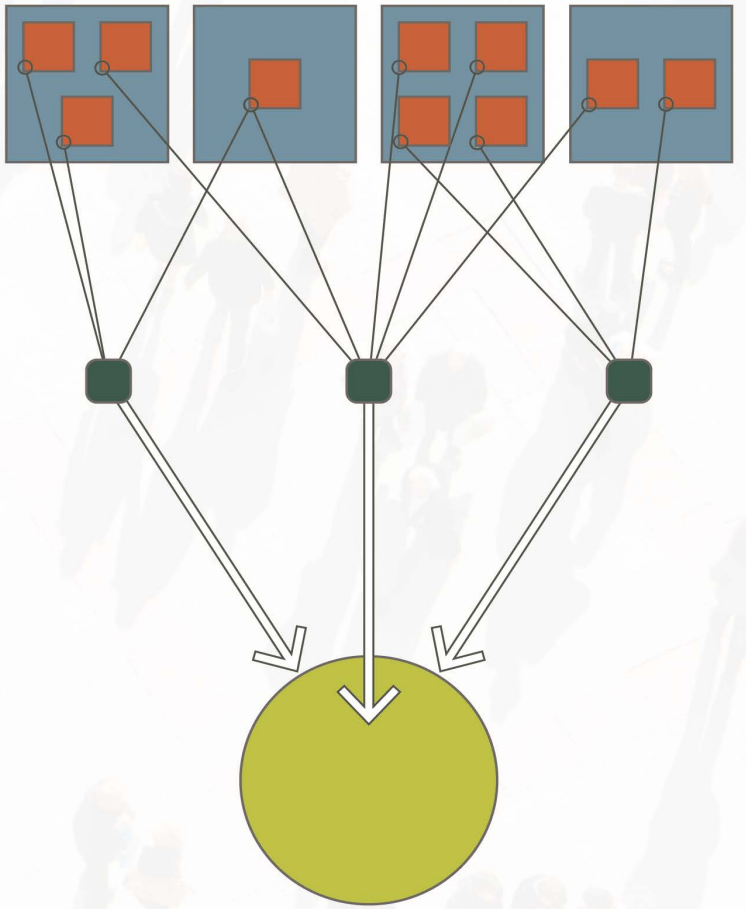


into Circular flows that produce no waste & use infinitely regenerated resources ***by design***

Lyle, John Tillman, *Regenerative Development for Sustainable Development*, Figures 2 & 3, 1994.

Living Community PATTERNS are powerful creativity strategies for regenerative sustainability planning & design

that achieve multiple systems sustain-ability imperatives *simultaneously*.



PETALS

The Petals of the Living Community Challenge represent seven performance areas: Place, Water, Energy, Health, Materials, Equity, and Beauty—that together produce the system conditions of a restorative future.

IMPERATIVES

From the Petals, the Imperatives define the specific performance metrics of success.

PATTERNS

Patterns are strategies, concepts, and templates to create projects that culminate in Living Communities.

PROJECTS

The Petals, Imperatives, and Patterns can be used to design projects that create Living Buildings and Living Communities.

SF Planning & Living Future Institute, 2015

EXAMPLE

Use water and habitat for aesthetics, urban activation, ecosystem services

PATTERN 04

BLUE-GREEN STREETS

Description:

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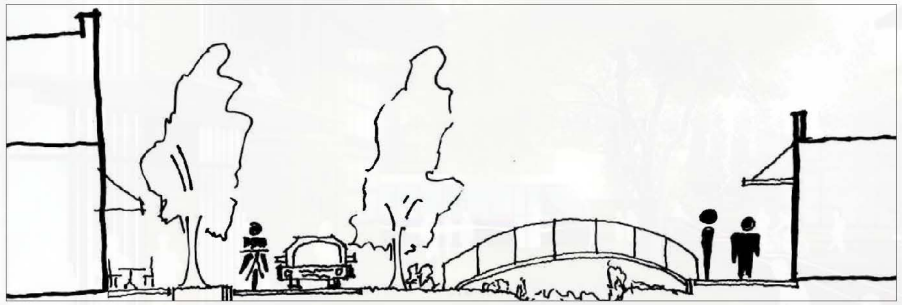


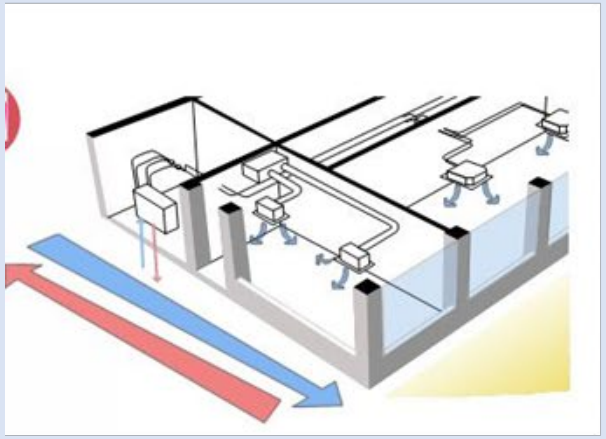
SOME STREETS CAN BE REBUILT AS NEW, MULTI-FUNCTIONAL PLACES OF WATER COLLECTION AND STORAGE, BIOPHILIA, RECREATION, WASTEWATER TREATMENT, AND OTHER ECOSYSTEM SERVICES. The Blue-Green Street integrates stormwater flows, natural or storing stormwater, or that connects a network of eco-machines treating later stages of wastewater. With the provision of water, a lush, wild landscape of large shrubs and tree groves is possible, providing a cooling microclimate on hot days. A Blue-Green Street can be integrated into many street types, from boulevards to neighborhood streets, and from alleyways to bike paths. The result is places that are much more people-centric and biophilic.

Regenerative District *biosystemsmimicry* Ideas

A set of cross-district urban design improvements

- Big Idea 1: District water for cooling and heat exchange
- Big Idea 2: Coordinated blue-green biophilic infrastructure & ecosystem services
- Big Idea 3: Connecting across scales (buildings, blocks, districts, cities, regions)
- Big Idea 4: Circular urban metabolism material flows to create a regenerative economy

that realize multiple values**:** Biophilia, Healthy Choices, Social Mobility, Sustainability, and Resiliency; which, in turn, build the foundation of *the new urban ecological sustainability economy*.



Heat Pump

Black Water Treatment

Heat Sink

Recycled Water

BUT, most importantly, regenerative sustainability creates a new game-changing value proposition

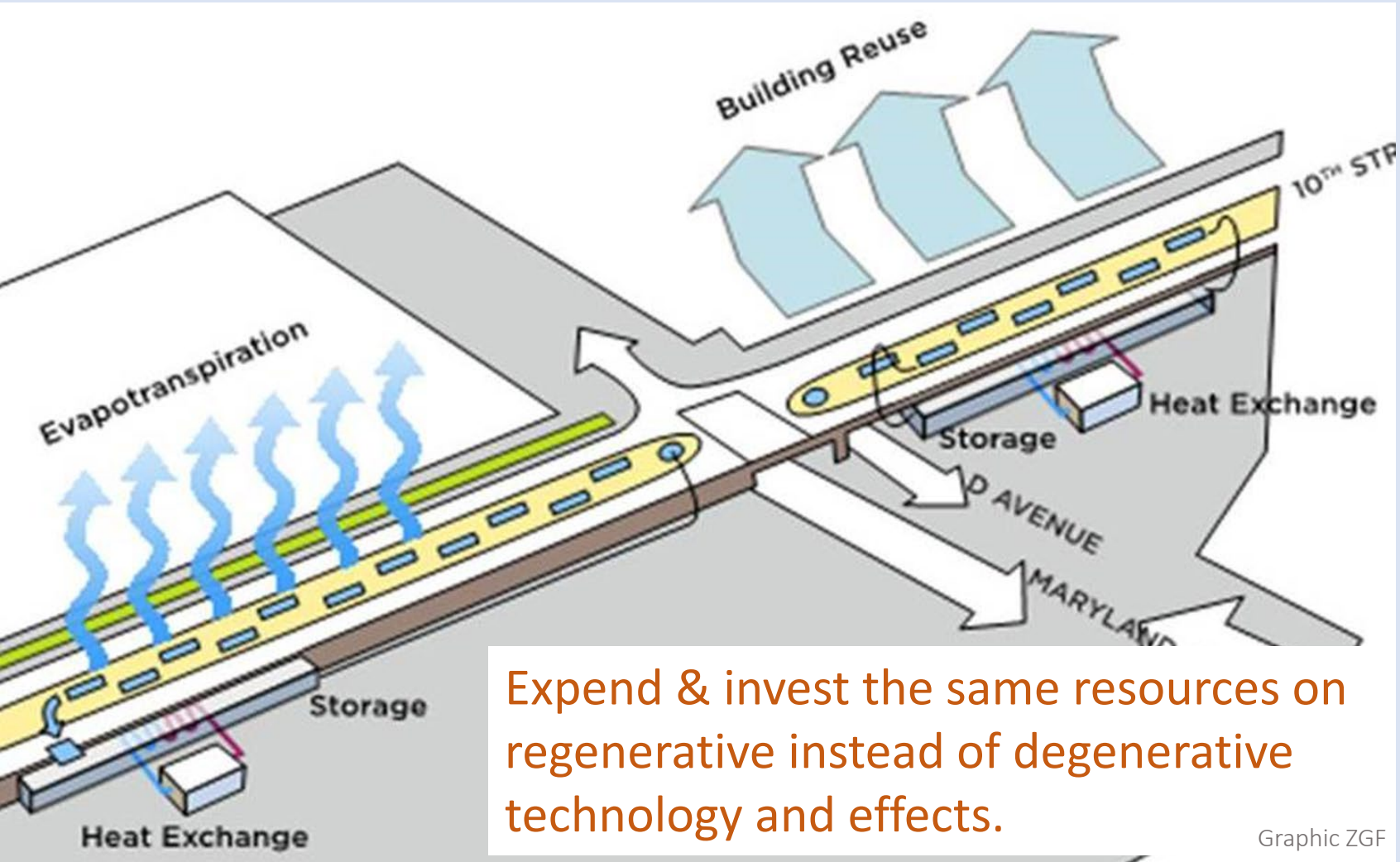
By recognizing sustainability as an economic challenge, not simply an environmental one, and the built environment as integral to the (spatial) economy, not simply incidental, our plan/design/build practices become society's leaders of sustainability success: *economic inclusive prosperity in time*.

Our professions' value propositions change (Plan/Design/Build)

- **FROM** a nice-to-have ***aesthetic*** value creator, that is **often** value-engineered **out**
- **TO** a must-have ***economic*** value creator,
  - of sustainability success
  - of the **sustainability economy** that is
  - the necessary material basis for sustainable cities, regions, planet
  - which ***requires*** value-engineering **IN**

As a result, we can now design a **win/win future** of jobs *AND* the environment (*for the first time in history*!)

Take Away: use all a city-region's planning, development, maintenance, and renewal-investment decisions–*with existing budgets*--to create cities (built environment, infrastructure, and economy) as regenerative life support systems.



Expend & invest the same resources on regenerative instead of degenerative technology and effects.

Graphic ZGF

- by integrating the performance imperatives of regenerative life support systems
- into the city metabolism & economy
- through the built environment and infrastructure.

Innovation 2: *Shifting to 3D Geospatial Systems Planning & Design*

will create a new powerful practice: *digital, object-oriented, urban and regional <u>systems</u> planning, design, and management.*

4 Pillars of 3D Geospatial *Systems* Planning & Design

3D City Base Maps create Digital Twin City-Region *Sand Boxes* for Testing

- a digital data & planning palette
- 2D & 3D features above, on, and below ground
- a new system of record for planning data, analysis, and options

Procedural Technology – democratizes/automates *systems* planning & design

- enables automated, rule-based, digital, "object-oriented" planning & design
- makes complex planning concepts instantly available, visible, editable
- for instance, with ArcGIS Urban modeling & CityEngine CGA script,
  - design/deploy building types and place types across zoning districts or areas
  - code an entire planning concept, such as Complete Streets, and apply it in seconds to any area
  - automate the redesign of 2000 street segments across the whole planning decision workflow

Interconnected WebGIS -- enables easy virtual access & collaboration

- real-time monitoring & decisions with dashboards
- powerful browser-based GIS tools--ArcGIS Urban

"Auto" Automation Tools (a new generation of non-code/lite-code tools) democratize workflow streamlining and app development

- automatically document workflows
- incidentally shift knowledge from personal to institutional

These Components Enable Powerful Planning

- Web- & Browser-based Digital Planning & Design
- Whole City-Region Object-enabled *Systems* Planning & Design
- Whole Practice Workflow Automation (think: Urban Planning)

ArcGIS Urban Demonstration

Powerful browser-based 3D GIS modeling platform

Part of 3D Digital Suite of Geospatial Planning & Design Tools

- ArcGIS Pro for technical desktop GIS
- Esri CityEngine for detailed design and architecture
- Esri CityEngine export to UnReal Engine for immersive VR experience
- Along with HUB, Dashboards, ArcGIS, and other tools to “get” it quickly

Note: Others include

- Systems Dynamics (Stella, etc.)
- UrbanSim Open Source: https://urbansim.com/udst
- BEAM LBL: a next-generation development project (https://beam.lbl.gov/)

Innovation 3: Scaling Up with Regional GIS

Infrastructure: technology + decision process

Regional GIS Infrastructure—the Technology?

- Our familiar desktop GIS
  - but scaled to the region and interconnected with everything (IoT, etc.)
- Creates translation connectors from the local to regional systems
  - Allows locals to work with their own system (data, field names, software)
  - And translates the local a common regional schema for
    - Systems analysis
    - Local-regional-local collaboration & co-creation
- That creates the local to regional systems integration needed for planning:
  - Individual projects are automatically connected to reveal systems implications
  - Provides the systems context and impacts for planning and decisions.
- If we scale regional GIS globally,
  - we create the GIS infrastructure required for the environmental intelligence (sensing, solving, action) needed for planning sustainability success
- *More detail*: see two Esri UC Plenary clips (15 mins each; click or search for)
  - Esri UC 2020 Plenaries, GIS – Interconnecting Our World, Jack Dangermond (2 of 4)
  - Esri UC 2019 Plenaries, GIS: The Intelligent Nervous System, Jack Dangermond

One of Jack Dangermond's observations is that the global growth of GIS is

incidentally establishing a global GIS Infrastructure with the potential to be our planetary sensing nervous system, and that it will profoundly transform our capacity to act effectively in the world -- *locally AND globally*-- if we formally develop it.

***Note*: this f**our-slide mash-up is from two 15-minute Esri UC Plenary clips of Jack Dangermond on GIS Infrastructure (see two Esri UC Plenary clips (15 mins each; click or search for)

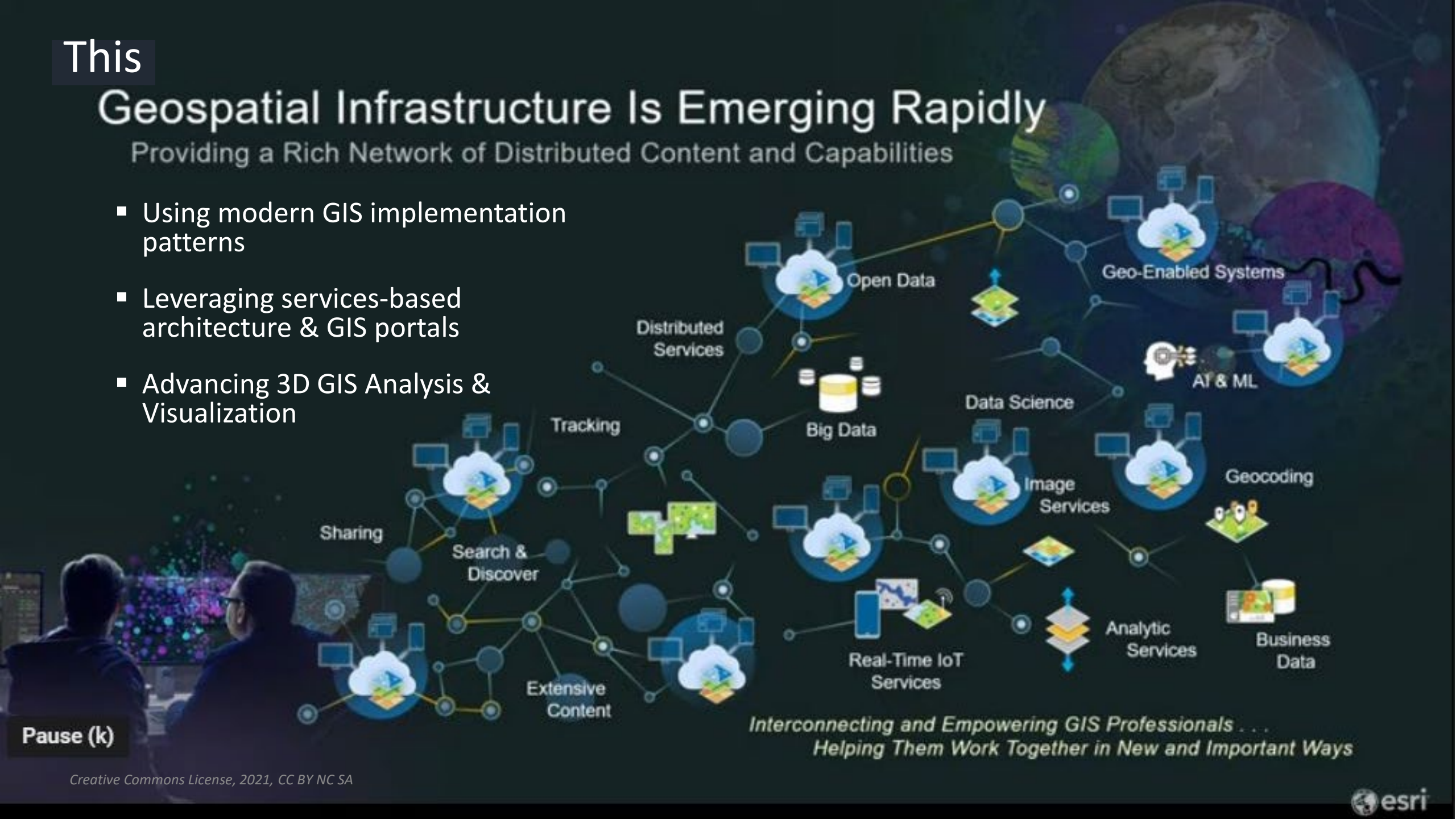
- Esri UC 2020 Plenaries GIS – Interconnecting Our World Jack Dangermond (2 of 4)
- Esri UC 2019 Plenaries GIS: The Intelligent Nervous System, Jack Dangermond

This

Geospatial Infrastructure Is Emerging Rapidly

Providing a Rich Network of Distributed Content and Capabilities

- Using modern GIS implementation patterns
- Leveraging services-based architecture & GIS portals
- Advancing 3D GIS Analysis & Visualization



Pause (k)

It is Transforming Our Organizations

This integration creates

Geo-Enabled Systems

Supporting Specialized Workflows and Applications

in our organizations that transform how we work.

They, in turn, will allow us to transform our global human footprint, and therefore, our sustainability and prosperity.

The planning & decision process part of Regional GIS Infrastructure?

- Our familiar planning processes connected across scales relevant to decisions
- Uses GIS infrastructure technology for environmental intelligence
- Optimizes for the whole system not the subsystem

Examples of Planning & Decision Infrastructure

- California SB 375 Sustainability Strategies
  - On-going resourced workflow: staffed, budgeted, 4-year cycle
  - Required of all 18 regional councils of government
- UN SDGs and Habitat III Implementation
  - On-going routinized workflow: goals, policies, monitoring
  - Will be used for mid-stream adjustments
  - Globalized set of relationships
- Esri/SCAG: Regional Data Platform Project *<next slide>*

SCAG/Esri: Regional Data Platform Project

- Create the integrated local-regional data & services infrastructure
- Enable integrated local-regional systems planning and decisions
- Streamline CA RHNA compliance & General Plan Updates
- StoryMap description: https://arcg.is/18CfiH
- SCAG web page: https://scag.ca.gov/regional-data-platform

A Platform for a Smarter Region

The Regional Data Platform is a robust "system of systems" for regional data sharing and collaboration. It will provide long-range planning tools to all member agencies and facilitate better planning at all levels.

Connecting the Innovations *for Success*

Create capacity to scale rapidly

Connecting these three innovations creates the capacity to scale sustainability success in time:

- i.e., creating sufficient progress towards sustainability by 2030 so that
  - it is not reversible
  - it becomes self-generating
  - and then proceeds to ultimate success.

HOW do we connect these innovations?

Innovation 1: CREATE -- Real Sustainability

We shift to a regenerative sustainability approach to be able ***to create*** real *systems* sustainability.

+ Innovation 2: AUTOMATED PLANNING

We shift to 3D Geospatial *Systems* Modeling to be able ***to automate the planning of*** regenerative *systems* sustainability.

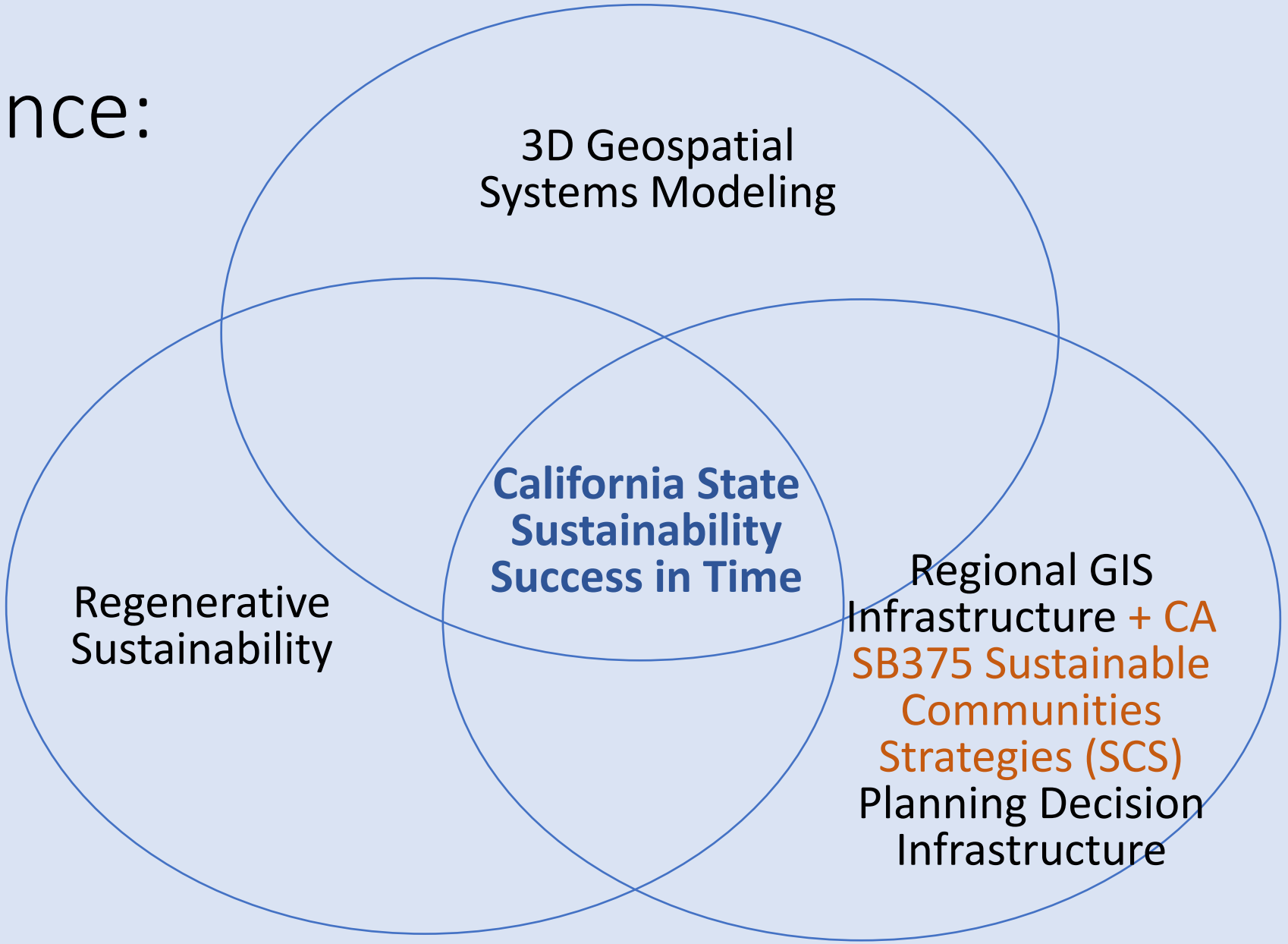
+ Innovation 3: SCALE Planning

We develop & use regional GIS + sustainability decision infrastructures to be able ***to scale*** regenerative *systems* sustainability **planning** from the building to the neighborhood to the city to the region to the planet.

= sustainability success in time

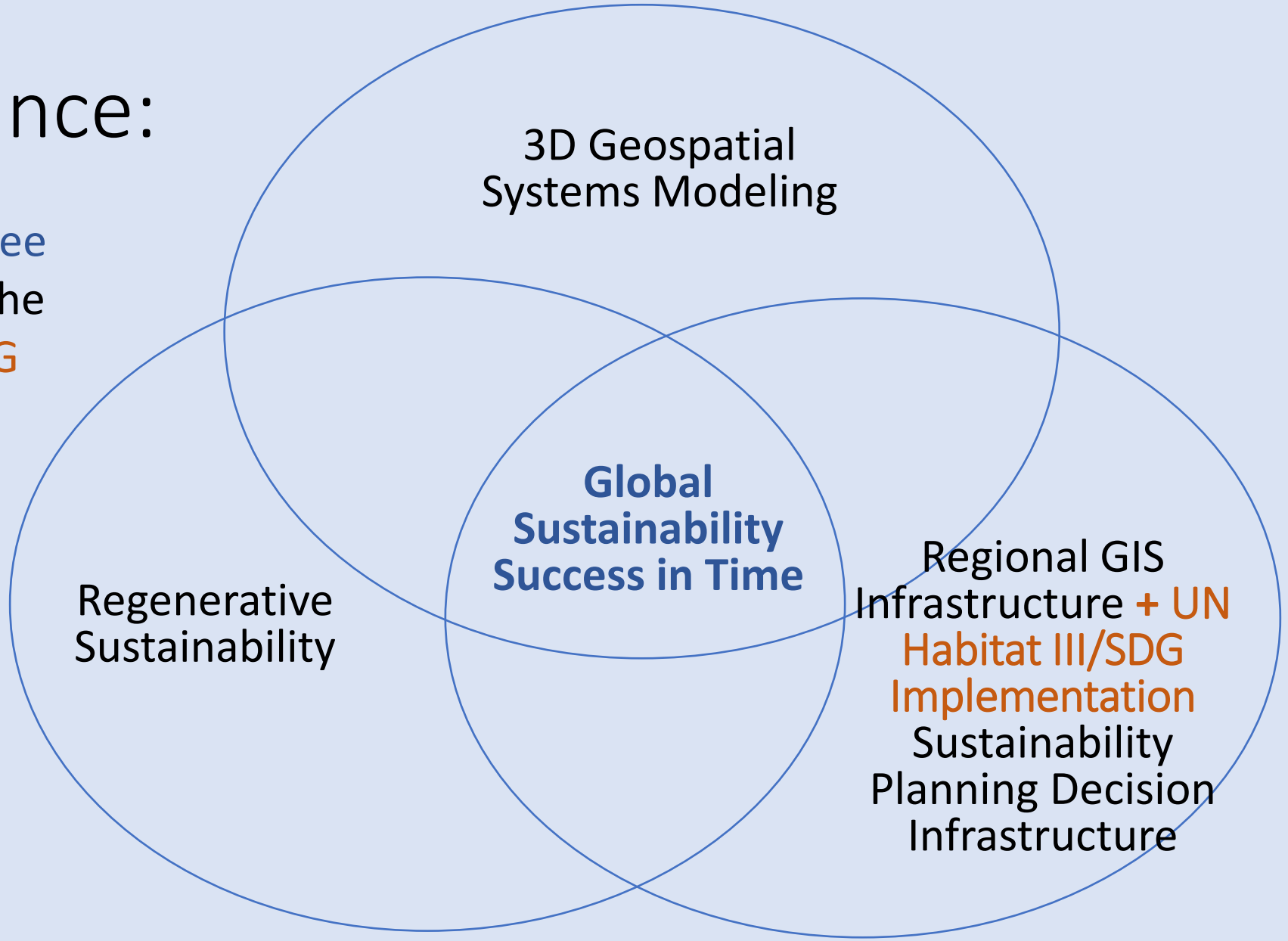
For instance:

Combining the three innovations with the SB375 Sustainable Communities Strategies (SCS) Planning Decision Infrastructure



For instance:

Combining the three innovations with the UN Habitat III /SDG Implementation Sustainability Planning Decision Infrastructure



Our Sustainability Success Program

Our next and final steps to sustainability:

- Shift to a regenerative sustainability approach
- Establish the regenerative regional GIS sustainability planning and decision infrastructure
- Achieve a substantial degree of self-generating regenerative systems sustainability by 2030 and continuing to ultimate success
- Supercharge the process with GeoDesign tools and practices
- Lead, use, and extend regenerative regional GIS with Geodesign -- *across scales, boundaries, and roles, at every opportunity, as needed* -- to create sustainability success in time by 2030, and ultimately.

Thank You

Invitation to Contribute:

- **Your** next step towards sustainability success?
- **Mine:** Launching the Regenerative Regions Initiative demonstration project SF Bay Area: Sustainability2030.com/RegenerativeRegions

Email us your questions or comments:

- Scott.Edmondson@sfgov.org
- CMa@esri.com

More information on presentation topic:

- Sustainability2030.com/GeoD2021