Natural Capital Singapore

From system knowledge to transformation – how advanced are we in integrating Natural Capital in decision-making

27th April 2021

Photos: Tan Puay Yok, Fung Tze Kwan, Dan Friess

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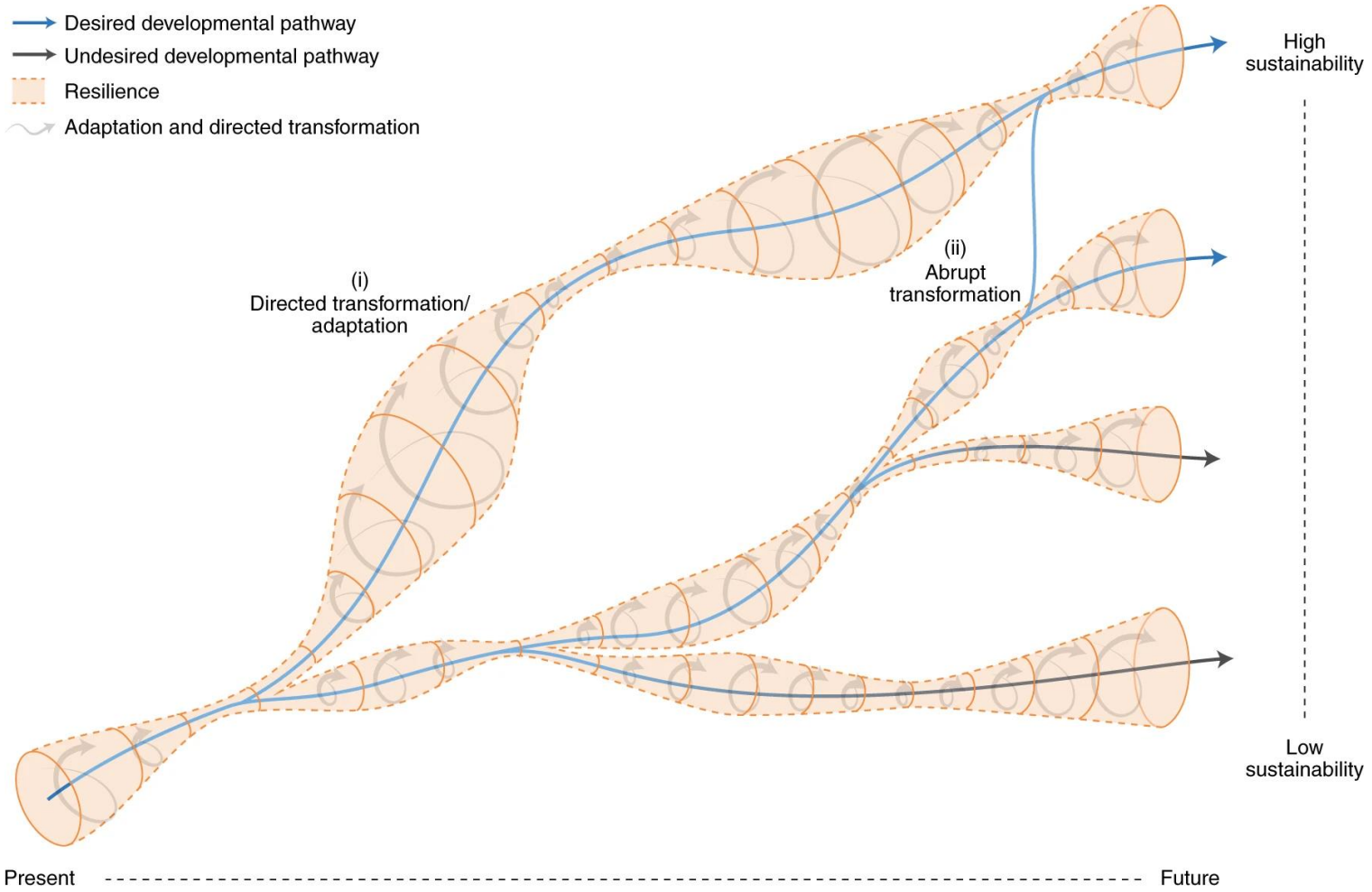
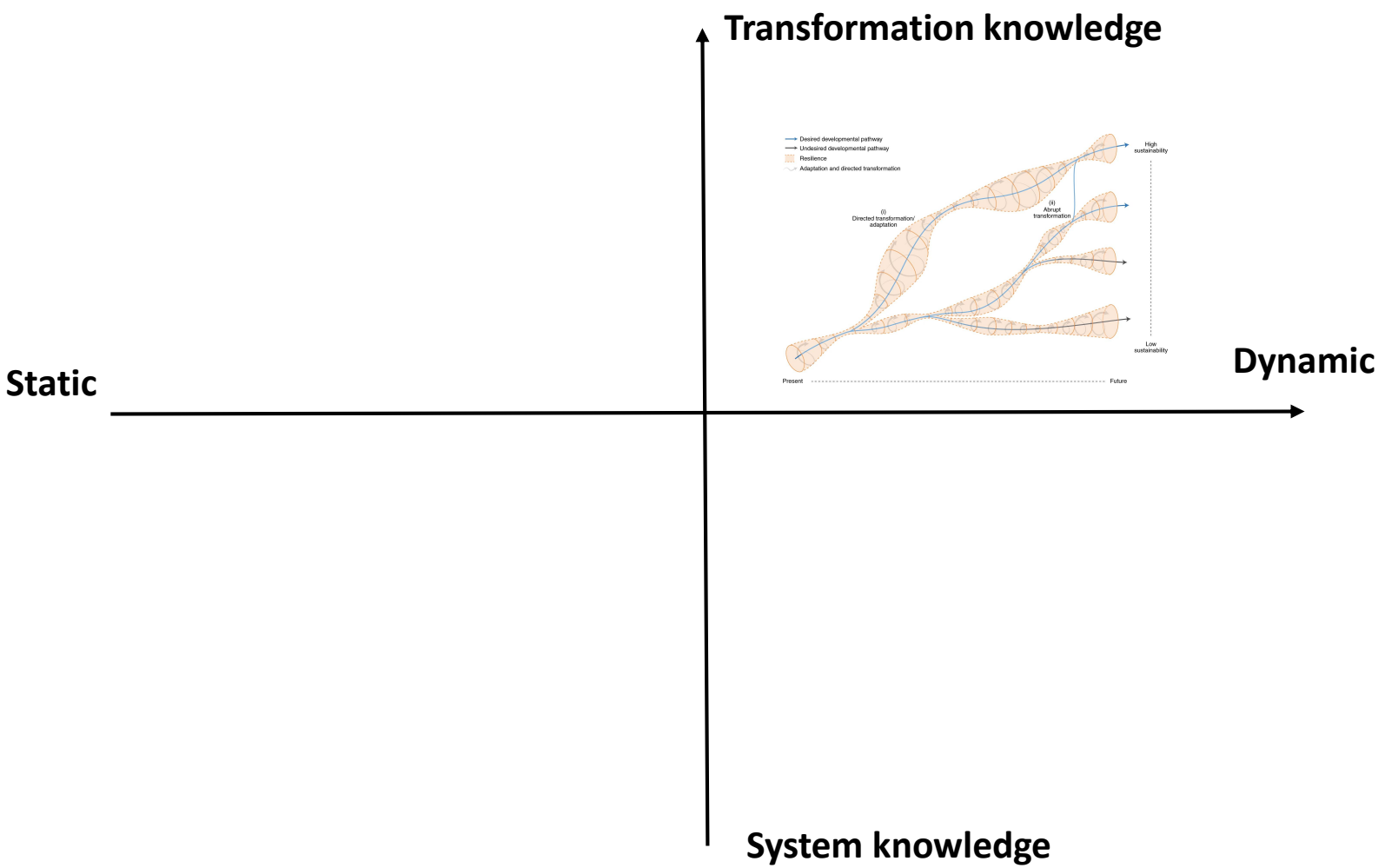
Aim of integrating NC into decision-making

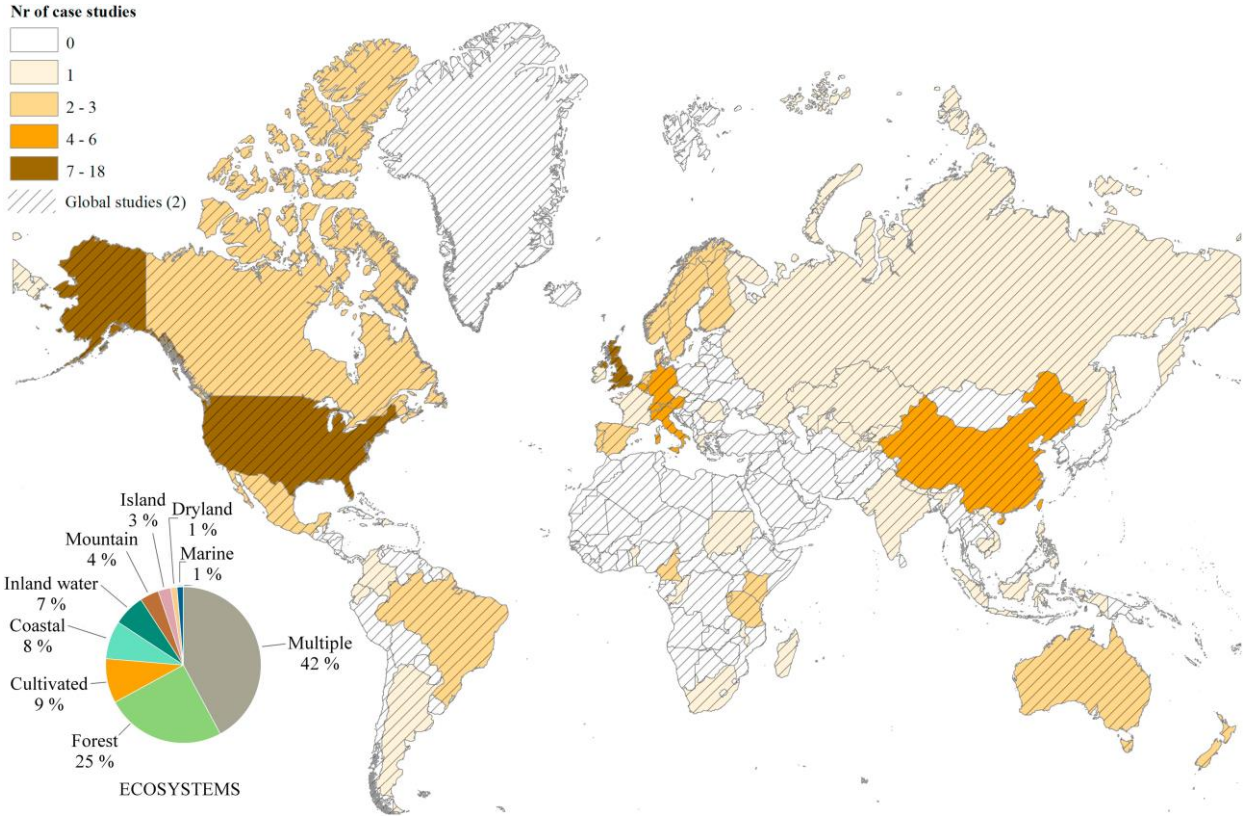


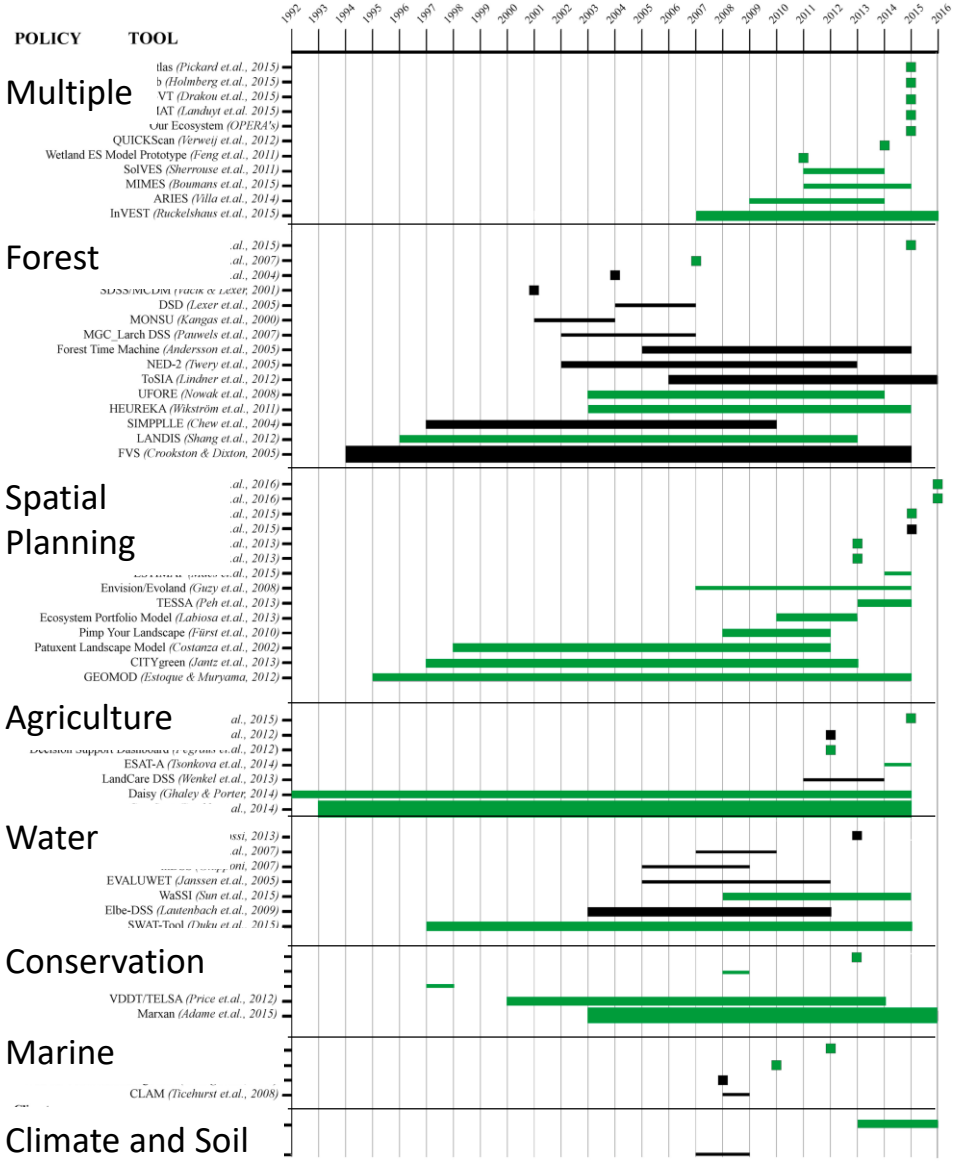
Elmqvist et al., Nature Sustainability, 2019

How advanced are we in integrating NC into decision-making?



Availability of NC Decision Support Tools

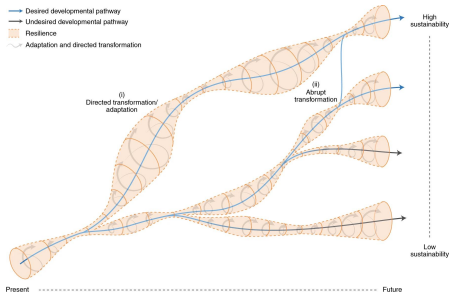




Grêt-Regamey et al., Ecosystem Services, 2017

How advanced are we in integrating NC into decision-making?

Transformation knowledge



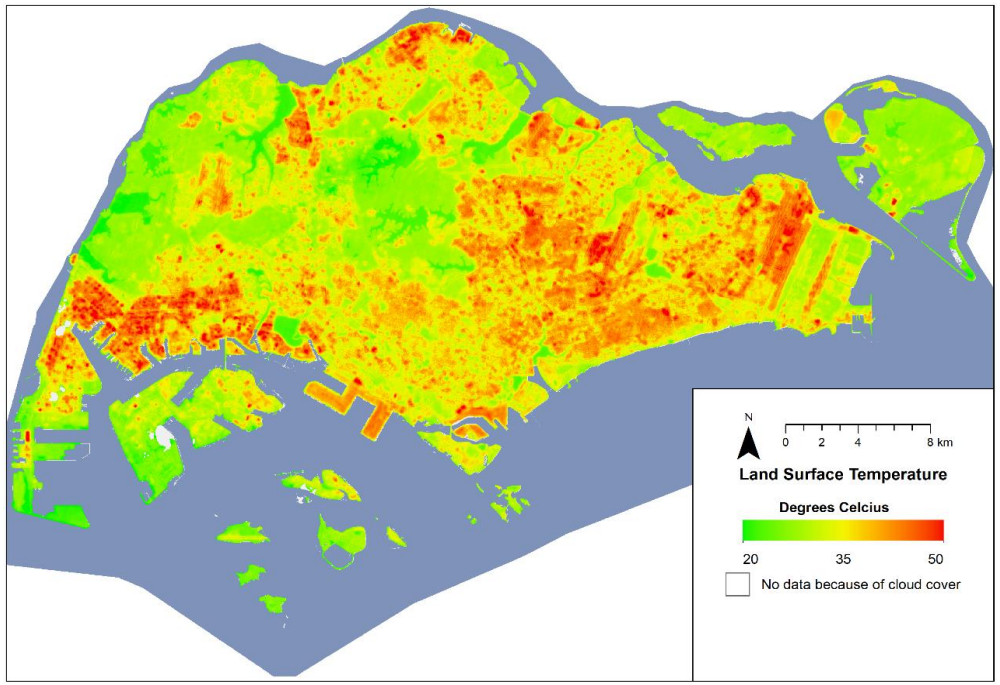
Static

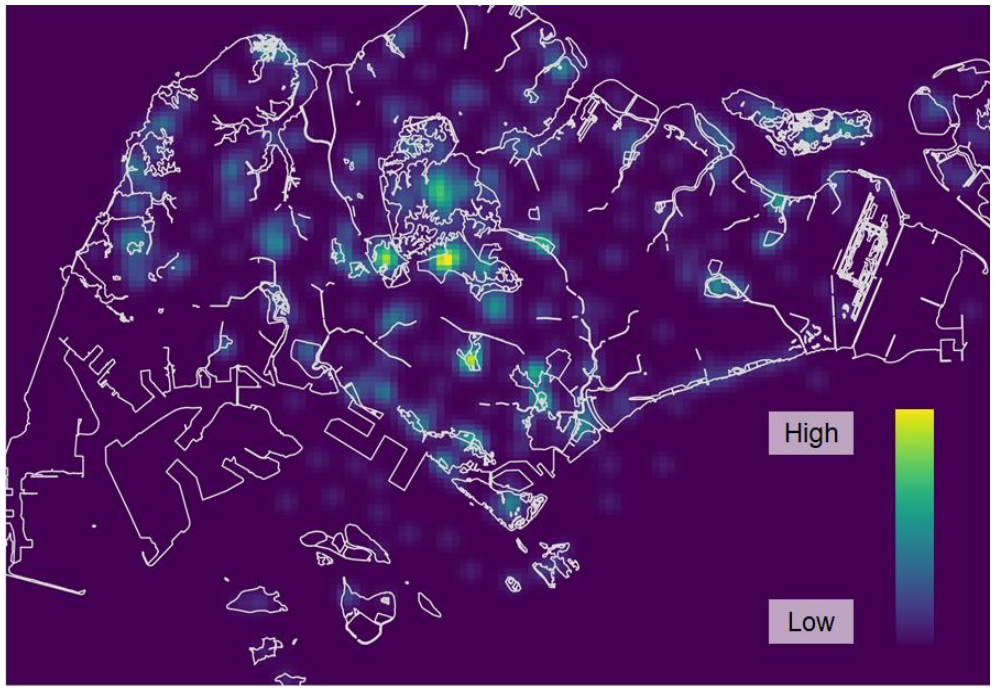
Dynamic

System knowledge

Static – System knowledge

Q: What is the value of Singapore's NC?

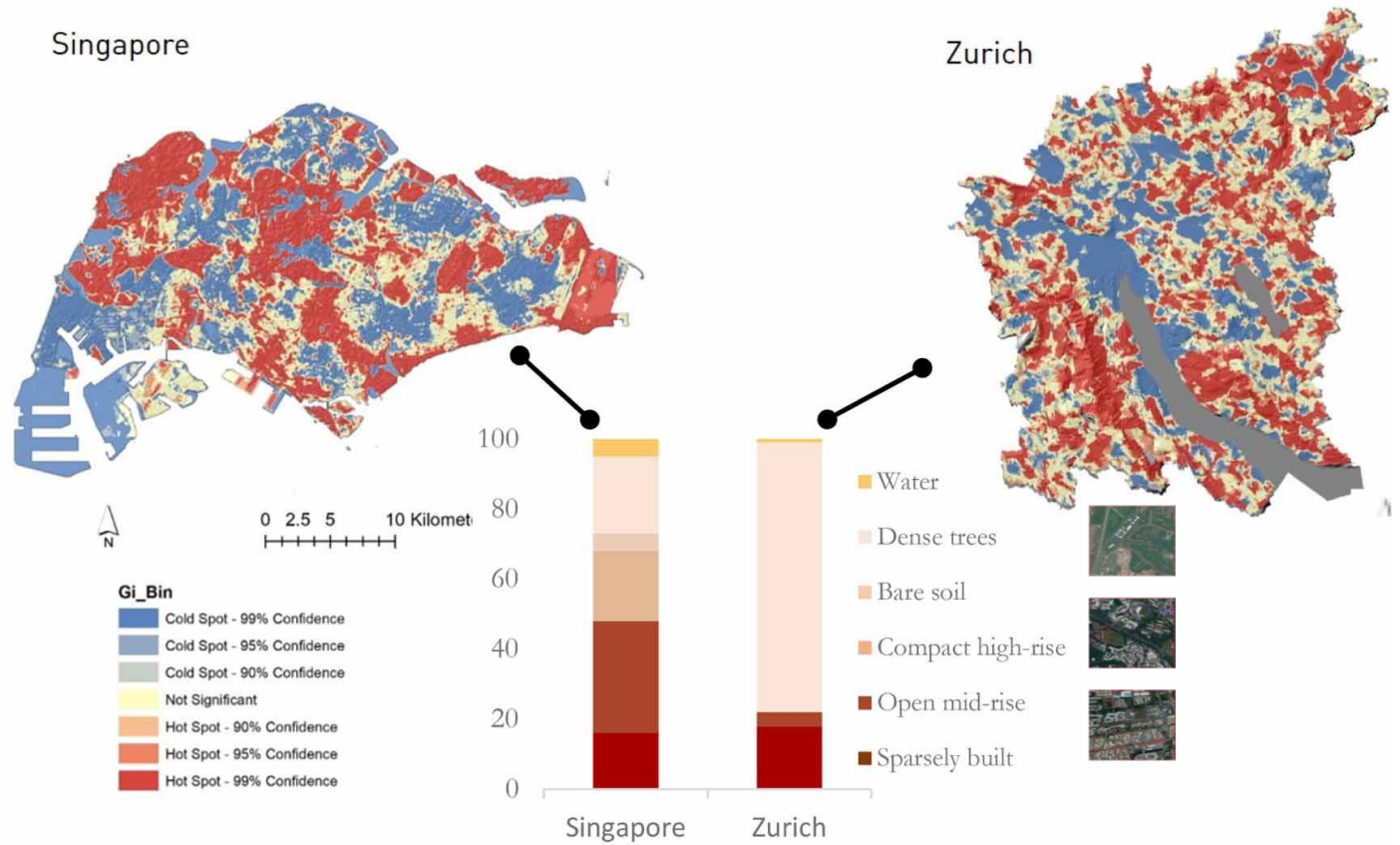




NatCap Team

Static – System knowledge

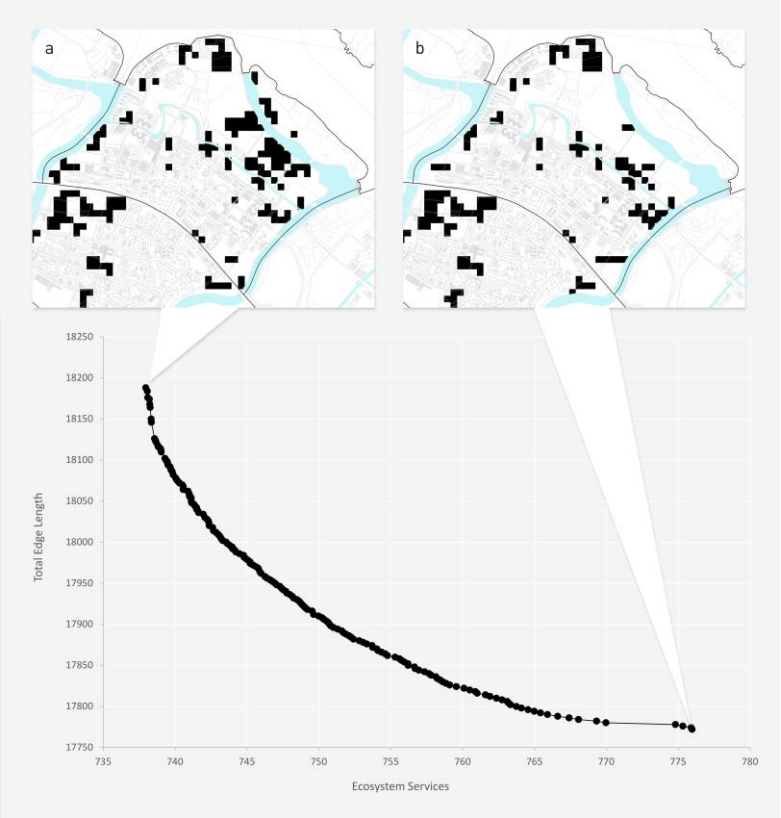
Q: What urban development types do we need to foster NC?

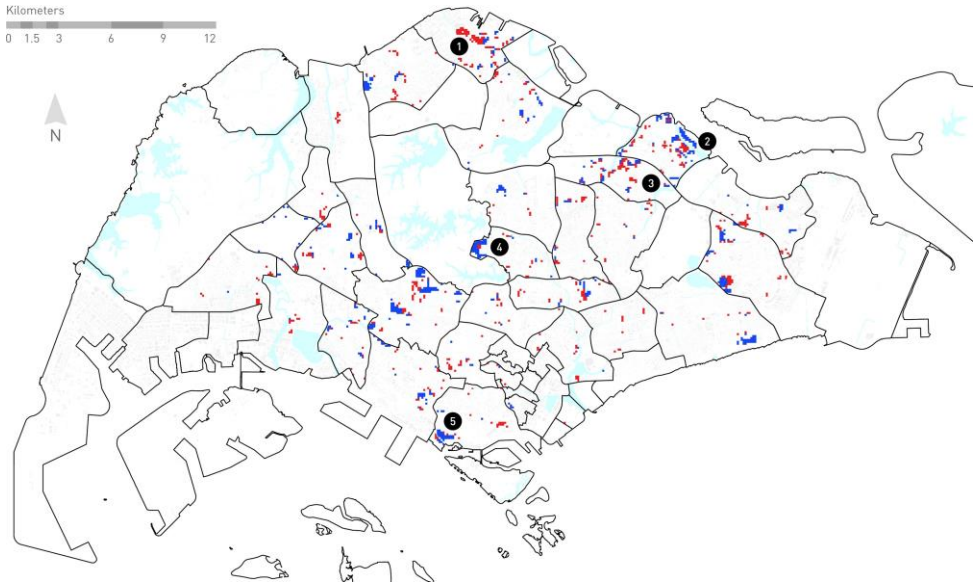


Grêt-Regamey et al., Environmental Research Letters, 2020

Static – System knowledge

Q: Where are good locations for sustainable urban development?





Wicki et al., Journal of Environmental Planning and Management, 2021

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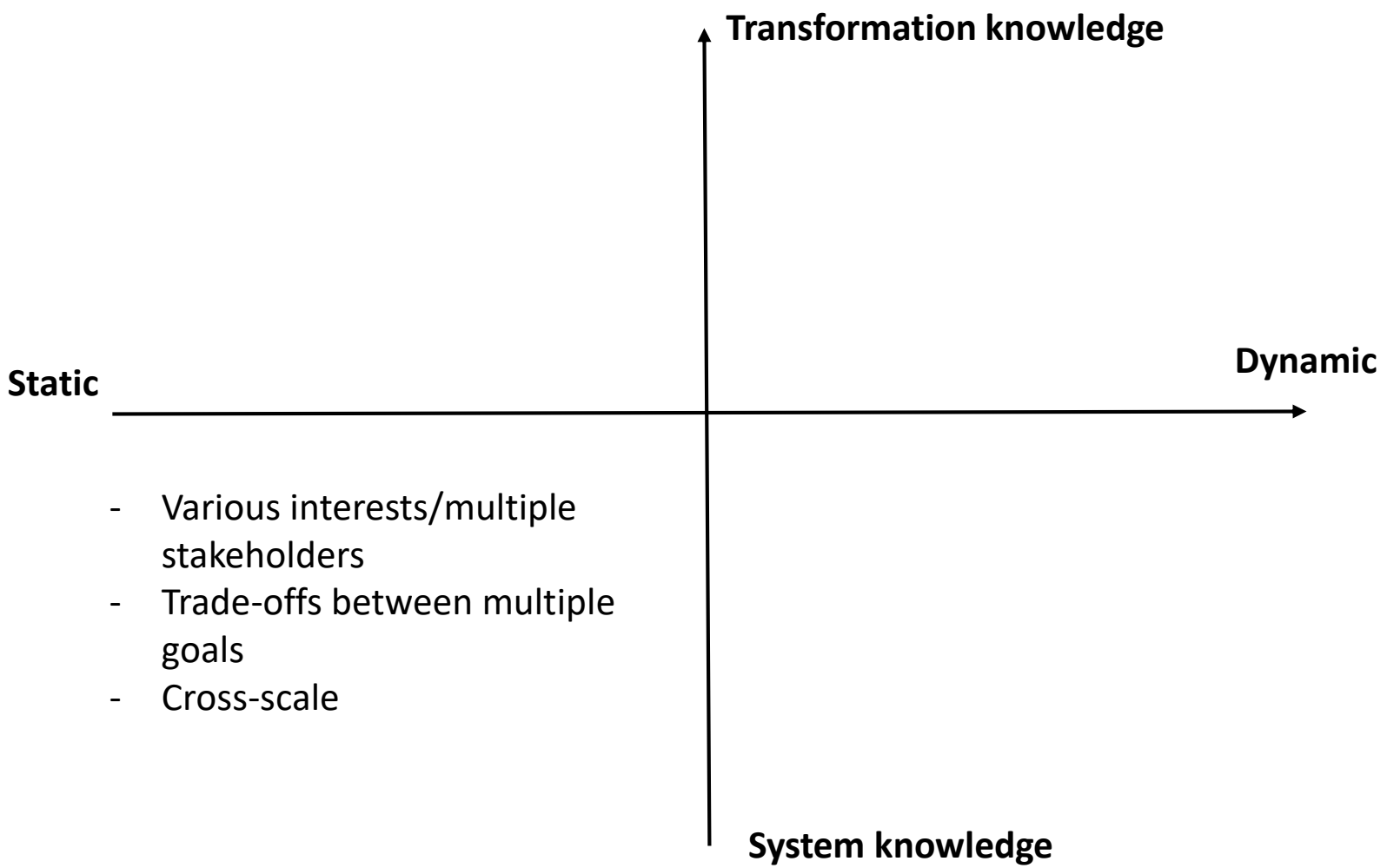


How advanced are we in integrating NC into decision-making?

Transformation knowledge

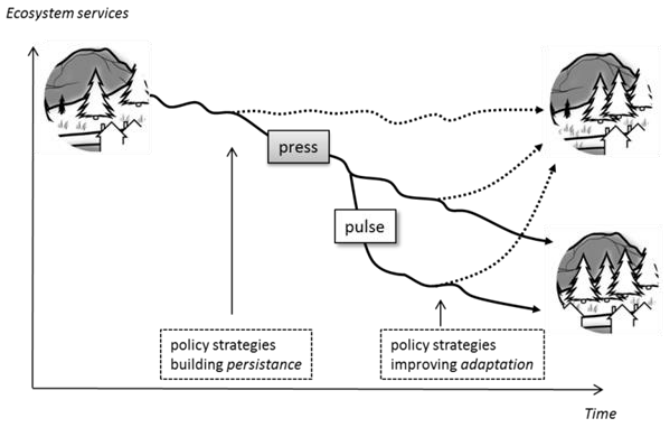
Static

Dynamic

System knowledge

Dynamic – System knowledge

Q: How can we manage mountain landscapes to supply demanded ecosystem services under global change?

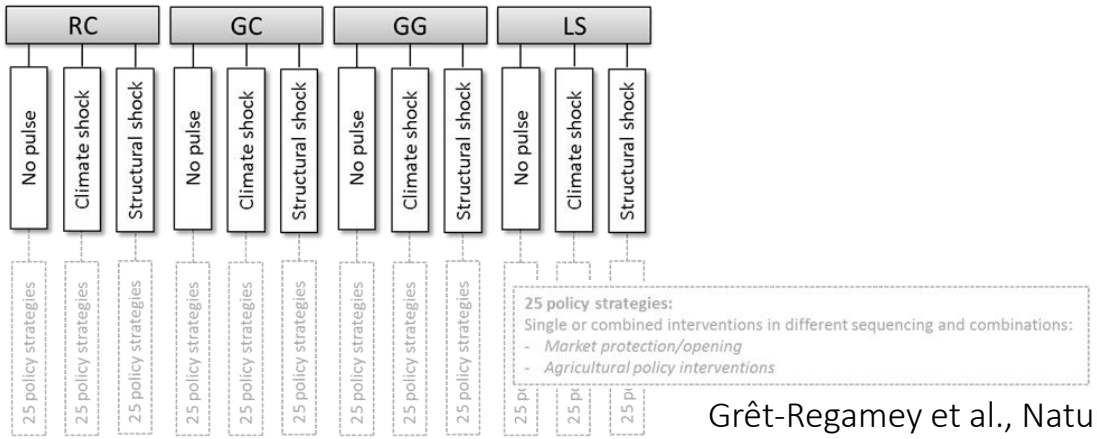


Valais, Switzerland

Level 1: global scenarios

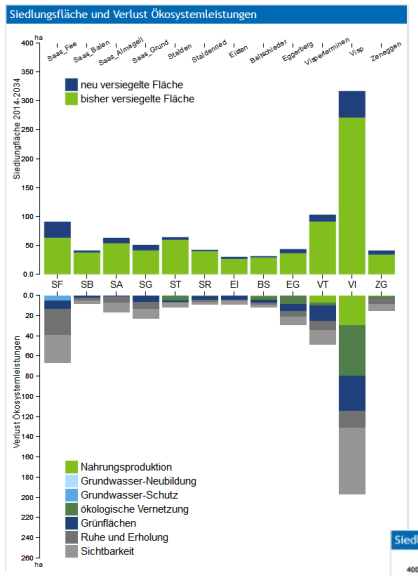
Level 2: shocks

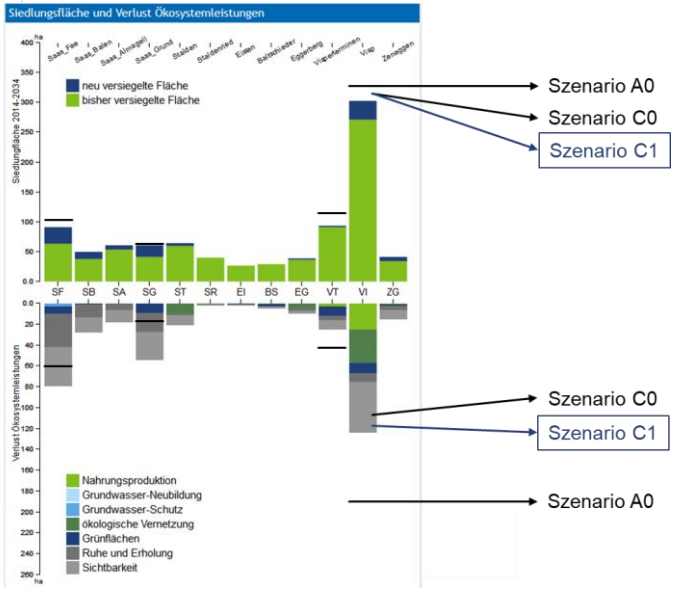
Level 3: policy strategies



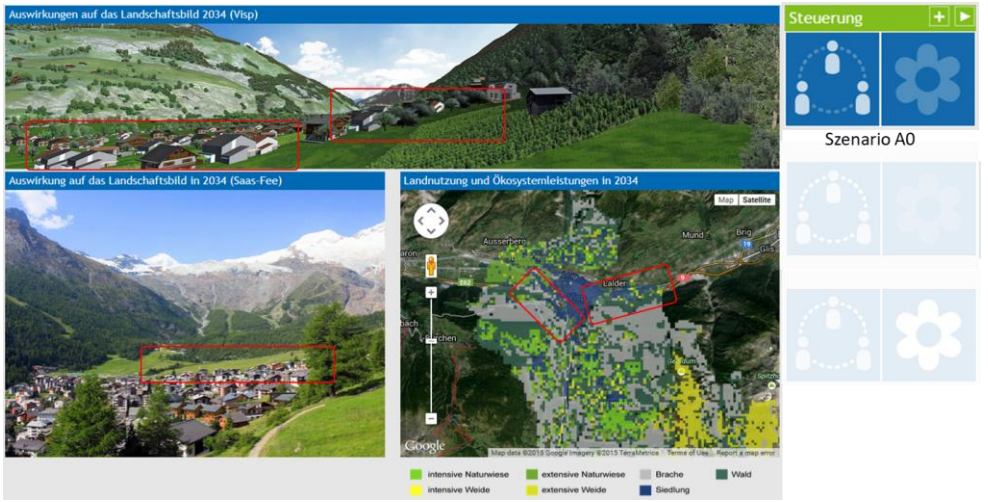
Grêt-Regamey et al., Nature Sustainability, 2019

Dynamic – System knowledge

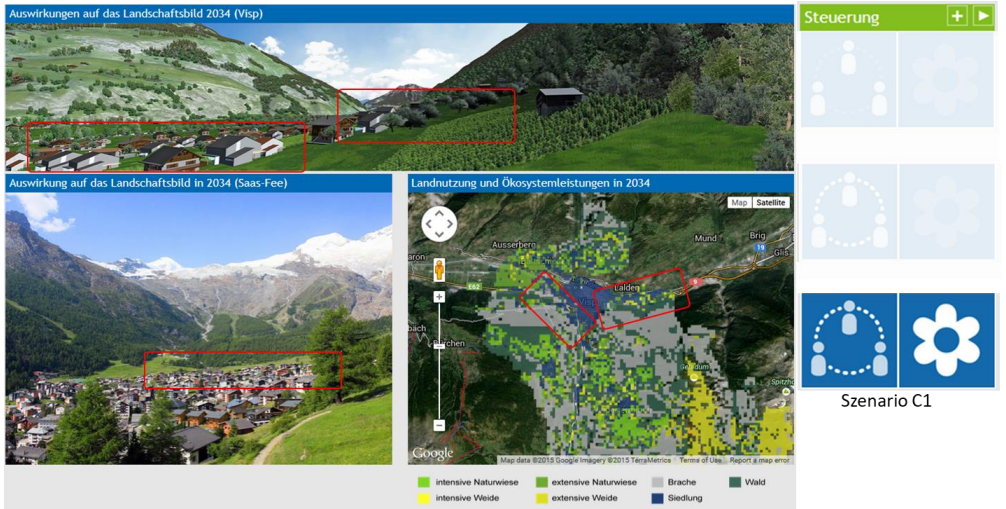




Szenario A0
Szenario C0
Szenario C1
Szenario C0
Szenario C1
Szenario A0

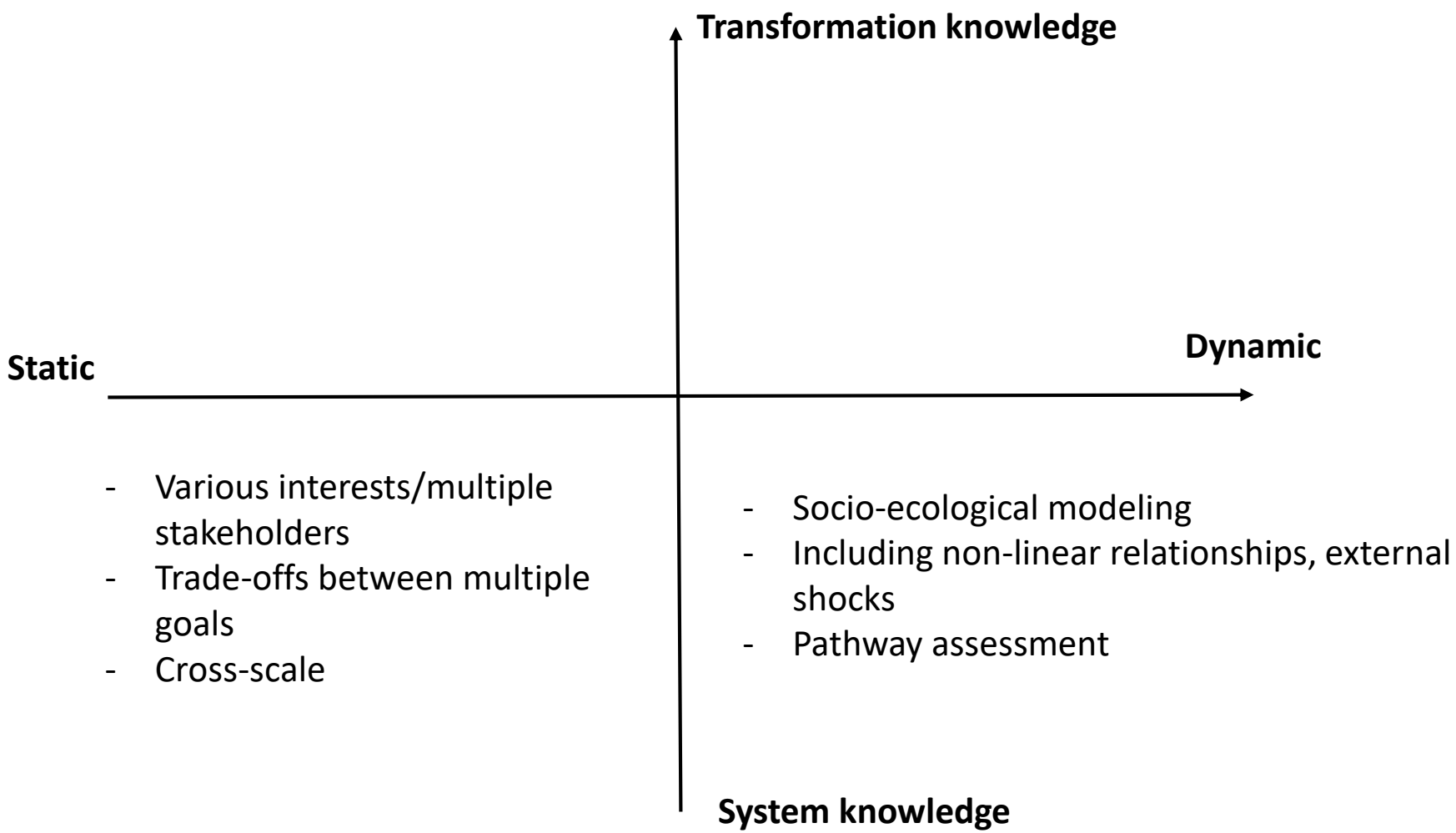


Szenario A0



Szenario C1

How advanced are we in integrating NC into decision-making?



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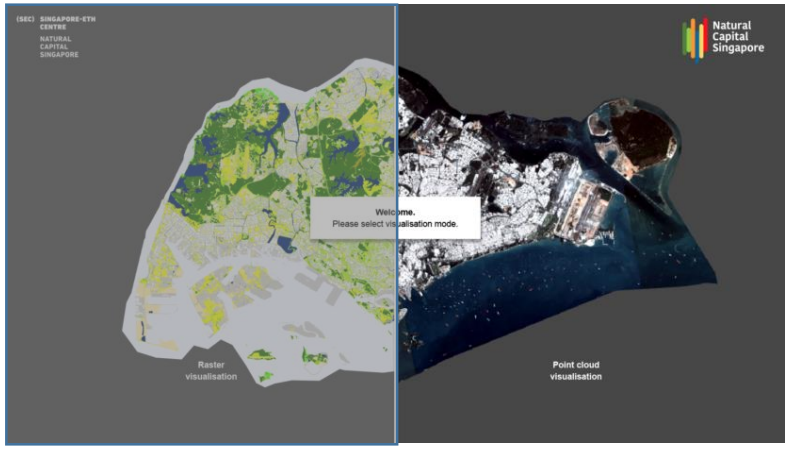
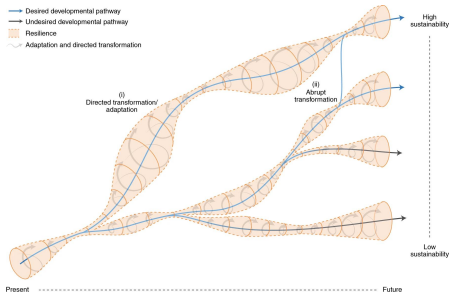


Transformation knowledge



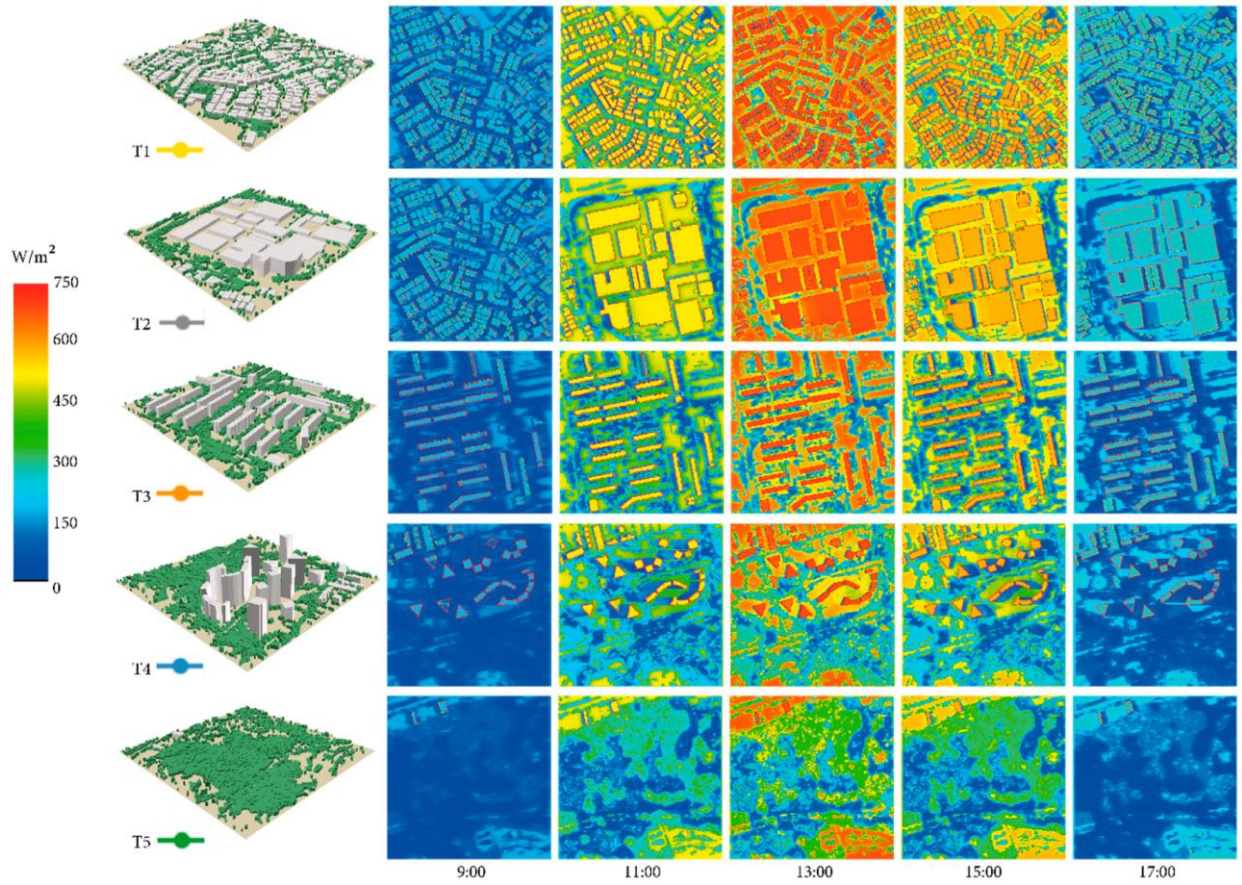
Static

Dynamic

System knowledge

Static – Transformative knowledge

Q: How can we improve our cities to foster NC?

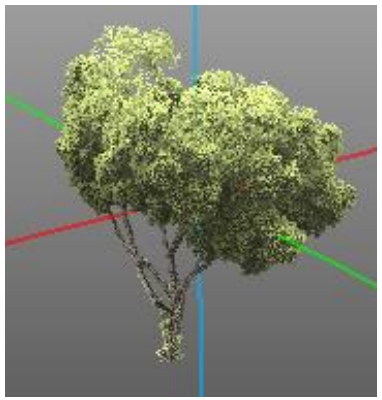


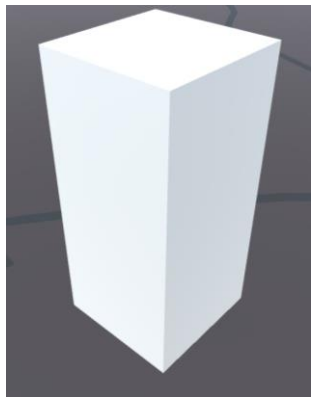
How can we use such knowledge in designing cities?

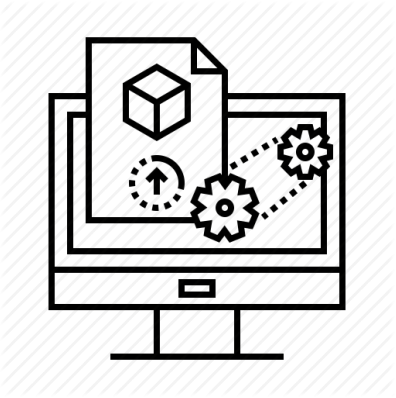
Dissegna et al., Forests, 2019

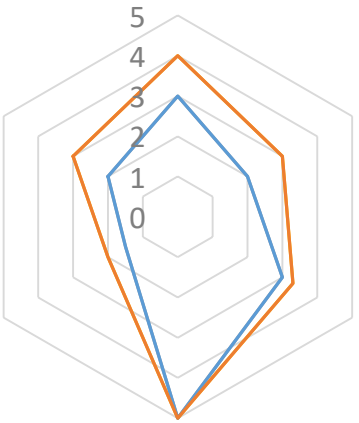
Static – Transformative knowledge

Add or remove tree or building → ES model → Compare









NatCap Tool
Developed by CIVAL

Natural Capital Singapore

Natural Capital Singapore

Map
Singapore

Legend

NatCap Tool

Developed by CIVAL

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Natural Capital Singapore

Topology Modifications
Database

CLOSE

TREE TYPE

- Adenanthera pavonina — Saga
- Albizia saman — Rain tree
- Alstonia scholaris — Indian pulai
- Andira inermis — Brown-heart
- Arfeuillea arborescens — Hop tree
- Azadirachta excelsa — Giant neem tree
- Callistemon citrinus — Crimson bottlebrush
- Callistemon spp. — Bottlebrush
- Calophyllum — Penaga laut

FILTERING PARAMETERS — RESET ALL

- General Characteristics
- Carbon Storage
- Net Carbon Sequestration

MatchesCount

Topology Modifications
Modification

CLOSE

TREE TYPE

Filter by Categories

TREE SIZE

Small

Camera Lock

Trees

Buildings

+ Save as New

Map
Singapore

Topology Modifications
Inputs

+ Add New

New Topology

Topology Modifications
Outputs

+ Add New

Legend

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Optimizations

- Optimizations

Ecosystem Services Calculations

- Air Temperature
- Carbon Storage
- Runoff

Point Clouds

- Bukit Merah (reduced)

Point Clouds

- Topology Modification

- [x] Show Ortophoto
- [ ] Show Point Cloud
- [ ] Show LandCover
- [ ] Show Point Cloud Tools

Singapore Elements

- 3D Buildings Models
- Building Floorplans
- Road Network

Natural Capital Singapore

Topology Modifications
Modification

CLOSE

TREE TYPE

Adenanthera pavonina

TREE SIZE

Small

Camera Lock

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Singapore

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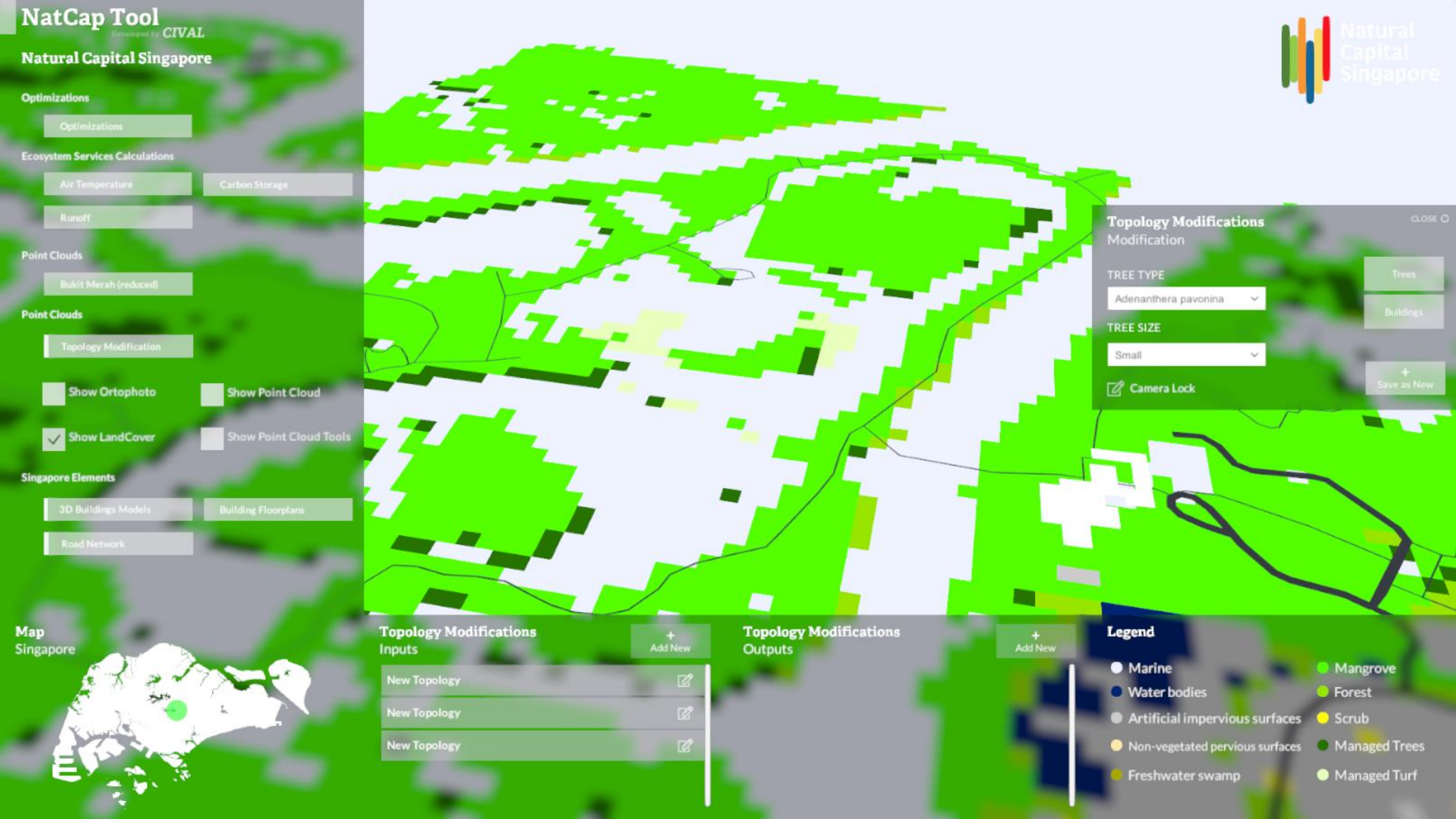
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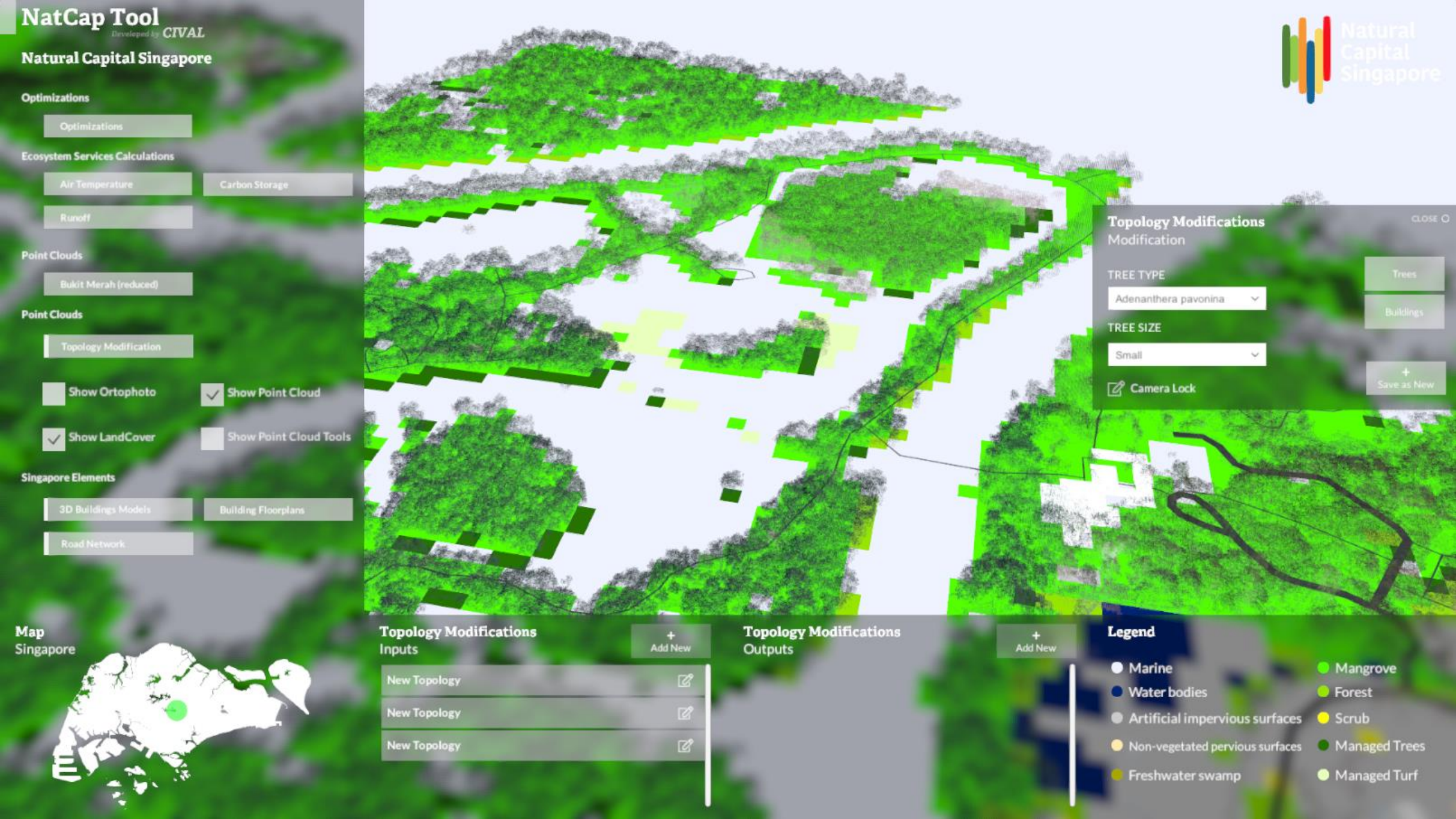
Legend
Marine
Water bodies
Artificial impervious surfaces
Non-vegetated pervious surfaces
Freshwater swamp
Mangrove
Forest
Scrub
Managed Trees
Managed Turf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+ Add New
New Topology
New Topology
New Topology
Topology Modifications
Outputs
+ Add New
Legend

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ES Calculations
Work-in-Progress

CLOSE

- [ ] Air Quality
- [ ] Runoff Reduction
- [x] Air Temperature
- [ ] Soil Erosion
- [x] Carbon Storage

Calculate

Map
Singapore

Topology Modifications
Inputs

+ Add New

- New Topology
- New Topology
- New Topology

Topology Modifications
Outputs

+ Add New

- Original Landcover | Calculated Landcover
- Carbon Sequestration | Storage | Storage Value
- Air Temperature | Reduction | Reduction Value

Legend

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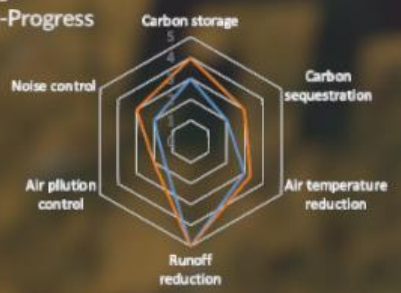
ES Comparison
Work-in-Progress
CLOSE



Map
Singapore

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Inputs
+ Add New

- New Topology
- New Topology
- New Topology

Topology Modifications
Outputs
+ Add New

- Original Landcover | Calculated Landcover
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Legend

Willingness-to-pay for redution of Air Temperature due to Ecosystems

Units: Singapore Dollars

0.000 — 26.985

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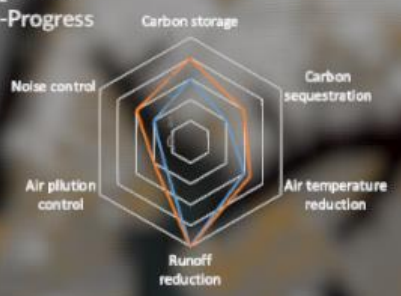
ES Comparison

Work-in-Progress

CLOSE



Map

Singapore

Topology Modifications

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Topology Modifications

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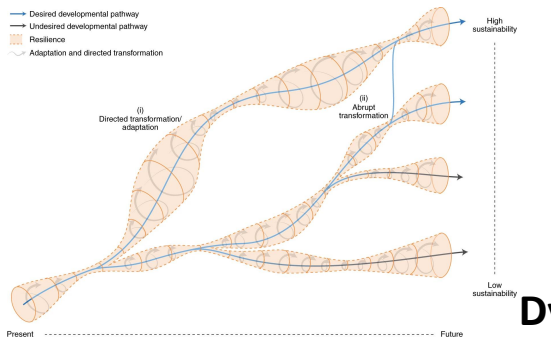
How advanced are we in integrating NC into decision-making?

Transformation knowledge

- Informed design
- Iterative loop between design-science – allow learning (adaptation)
- More immersive representations (visual/acoustic)
- Shared concern as entry point



Static **Dynamic**

- Various interests/multiple stakeholders
- Trade-offs between multiple goals
- Cross-scale

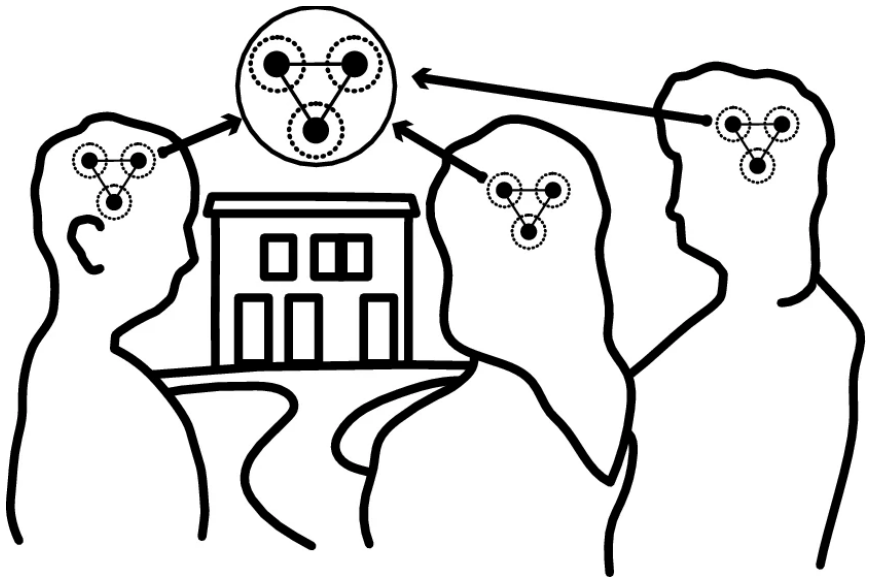
- Socio-ecological modeling
- Including non-linear relationships, external shocks
- Pathway assessment

System knowledge

Characteristics of decision support systems activating transformation

- Enable multiple iterations to negotiate trade-offs
- Include informed design across scales
- Start with common shared vision to strengthen trust among stakeholders
- Explicit consideration of (resilient) pathways

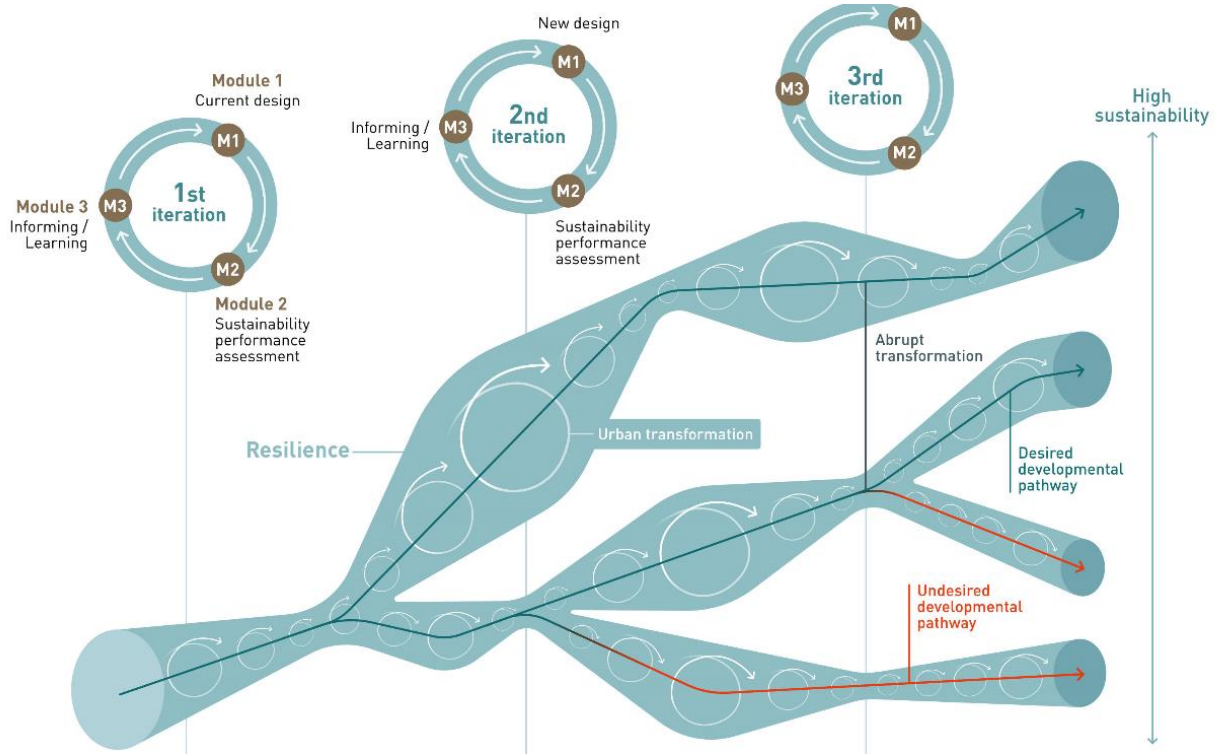
…..a process out of which places emerge



Switalski and Grêt-Regamey, Sustainability Science, 2020

Dynamic – transformative DSS tools

…leads to a process informed by science but shaped by human values and aspirations.



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Thank you!

www.naturalcapital.sg

Twitter: @NatCapSG

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gret@ethz.ch

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