



Bringing Subsurface Information Models and Climate Adaptation Design into LADM Part 5 Spatial Plan Information

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 **TU**Delft

























TNO innovation
for life



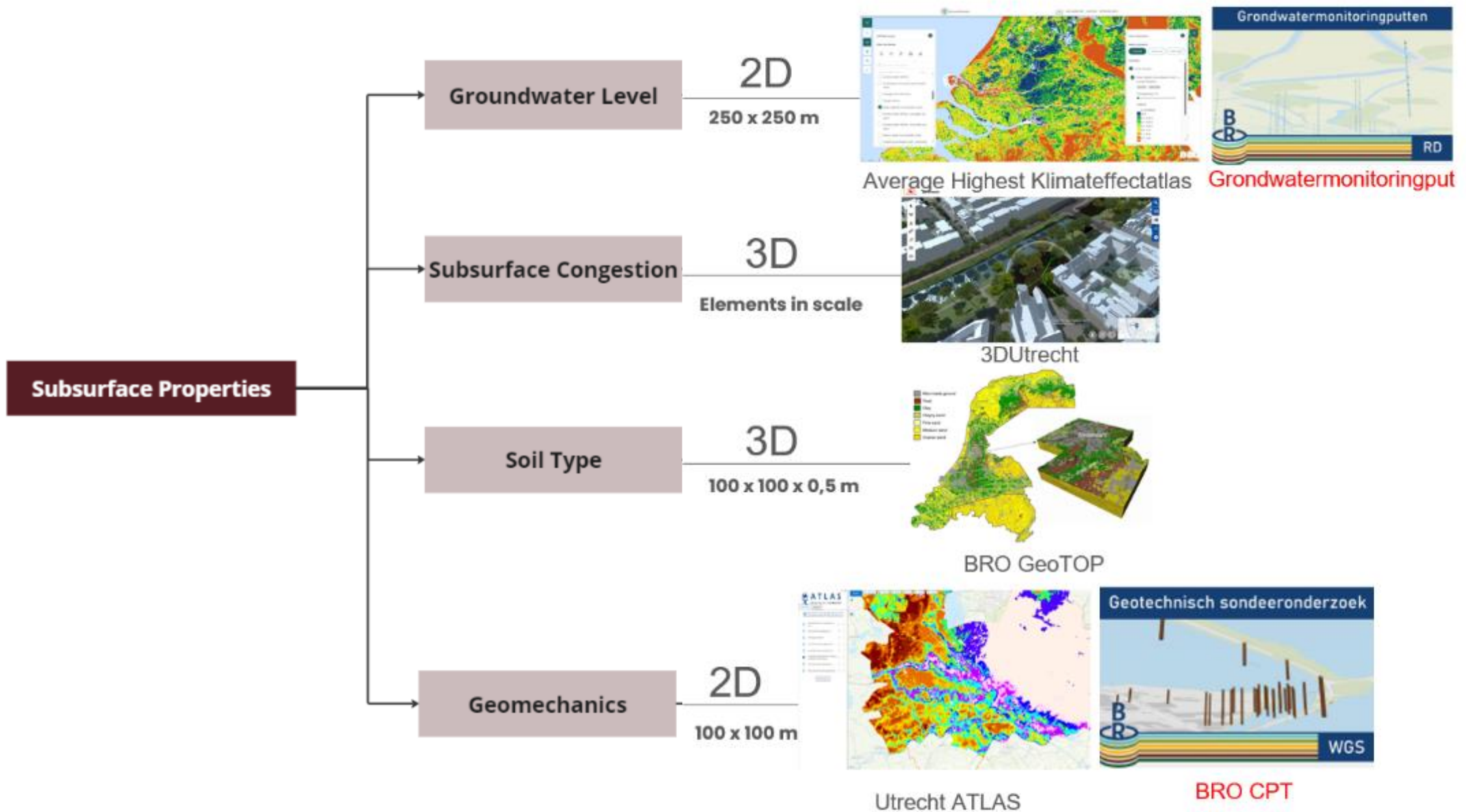
I. Introduction

Climate Adaptation in the NL

** Medium intervention i

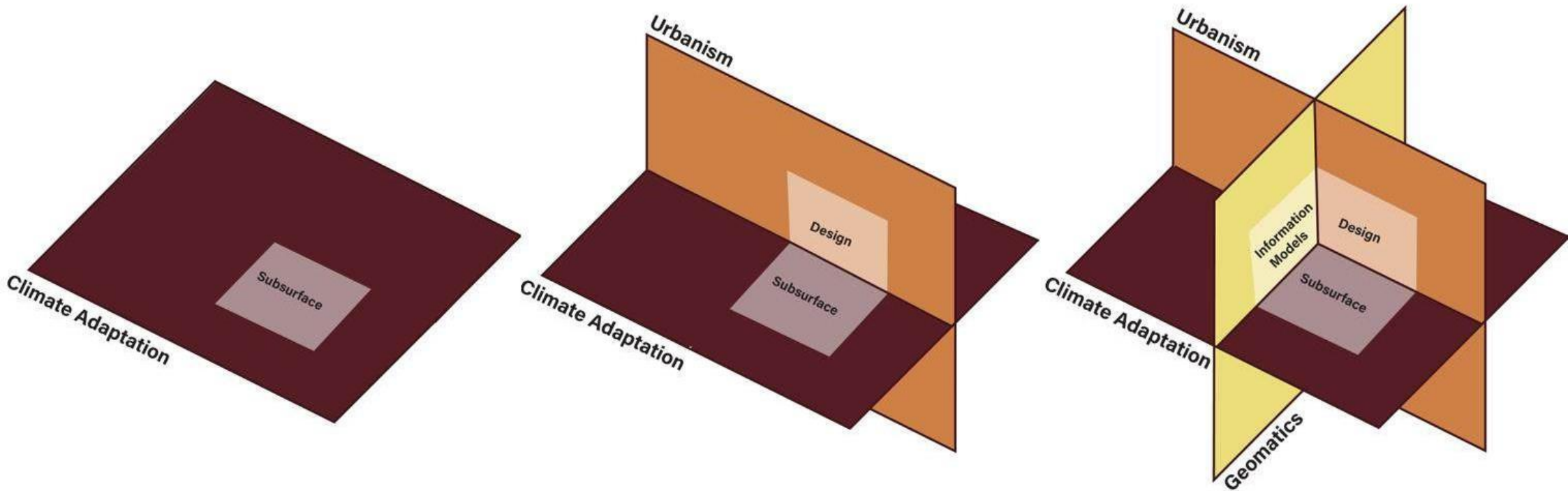
Climate-adaptive measure	Application	Indicative investment costs	Indicative management and maintenance costs	Soil type	Points
 GREEN ROOF	 	€2,500-€5,000 per home, roof garden €5,000-€10,000 per home	€4 /m ² for extensive green roof, €6 /m ² for polder roof/roof garden	N/a.	In the case of new construction, weight calculation must be determined in advance. Maintenance 4 times a year. Extensive and intensive vegetation possible. Existing construction: not always possible due to the load-bearing capacity of the roof.
 COOL PLACES	 	-	Limited increase	All	See also Basic MRA safety requirements: Minimum 200 m ² and within walking distance (300m).
 SHADOW ROUTES	 	€150-€220 /m ²	Limited increase	All	See also Basic Safety Requirements MRA, Programme of Requirements for Construction Adaptive Zuid-Holland: at least 30% shade for important slow traffic routes and places to stay during the highest sun position in the summer.
 NATURAL PLAYGROUND	 	€500-€12,000 per playground	€3 - 6 /m ²	All	Whether or not in combination with local water collection (nature-friendly wadi).
 (NATURE-FRIENDLY) WADIS	 	€100-€145 /m ³	€0,37 /m ²	High sandy soils, riverbeds	Space demand, especially for existing buildings; Especially applicable at low groundwater levels. Grass swale requires regular mowing in the summer, nature-inclusive swale biennial maintenance.
 APPLYING (MORE) SURFACE WATER	 	€160 /m ³ incl. sheeting	No increase	All	Demand for space when widening.
 INFILTRATION CRATES AND WELLS UNDER (UN)PAVED SURFACE	 	€330-€400 /m ³ for paved, €165 /m ³ for unpaved surface	-	-	Pay attention to maintenance: risk of clogging. Low groundwater level necessary: max. 20cm above GHG. The water storage capacity of the subsoil increases by a factor of 3.5. Existing building: apply to refurbishment / maintenance.
 WATER STORAGE UNDER (UN)PAVED SURFACE	 	€120 /m ³	-	-	For example, hollow constructions under roads, water storage in granulate. Existing building: apply in refurbishment / renovations.

Climate Adaptation and Subsurface



II. Methodology

Identified issues

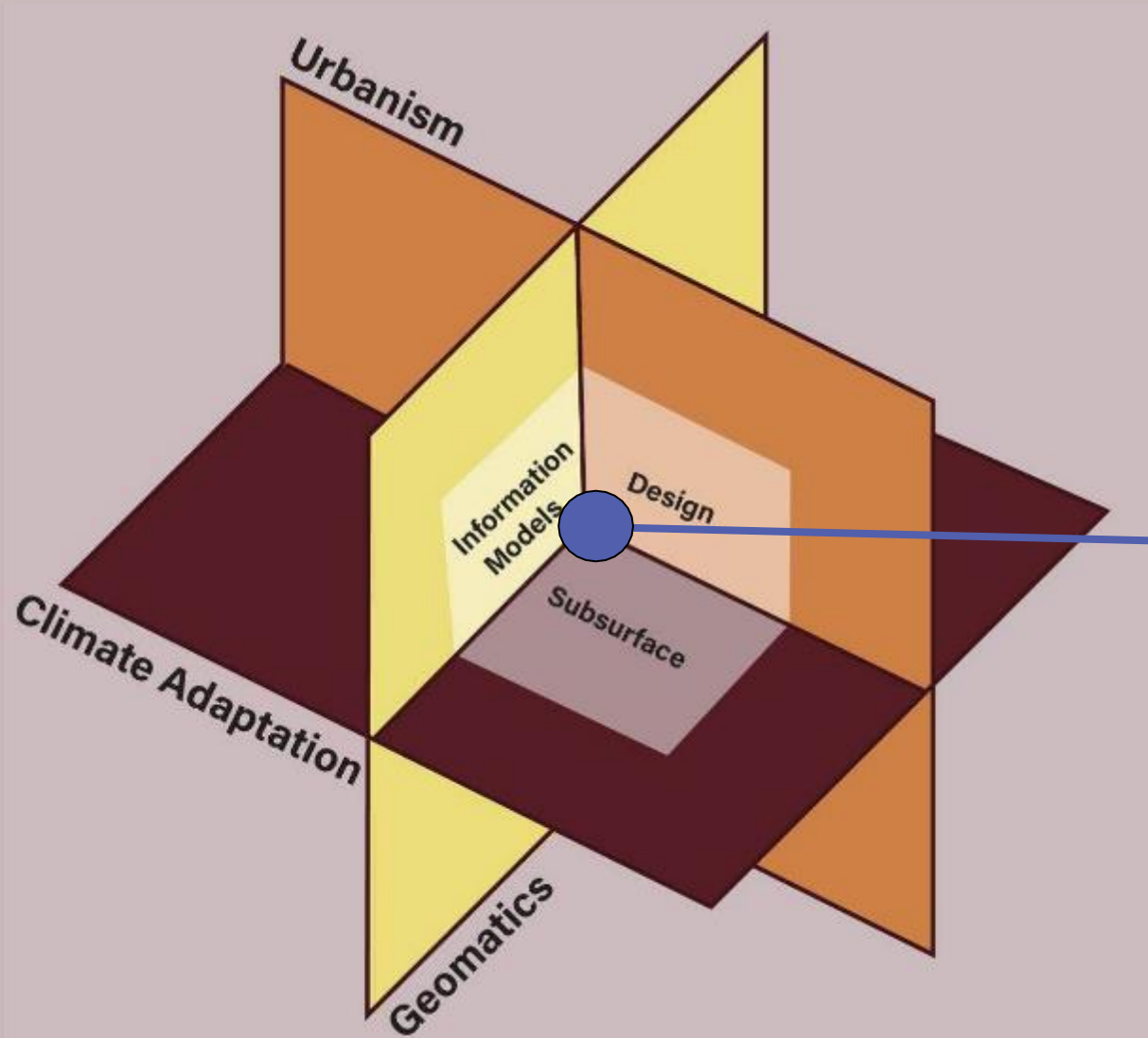


1. Subsurface models
→ but underused in
climate adaptation

2. Guidelines on
climate interventions
→ but not subsurface

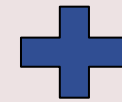
3. Existing standards
on models/design →
but not compatible

Dual Approach



Integrated Framework

Design Portal (CLIMACAT)



Standards (e.g. LADM Pt. 5)

Standards

Standardized Climate Adaptation Design

Leidraad 2.0, Maatlat, Klimateffectatlas, and Klimateadaptieve Maatregelen → define climate themes/design.

**bouw
adaptief**

**GROENBLAUWE
NETWERKEN**
voor veerkrachtige steden

 Klimateffectatlas

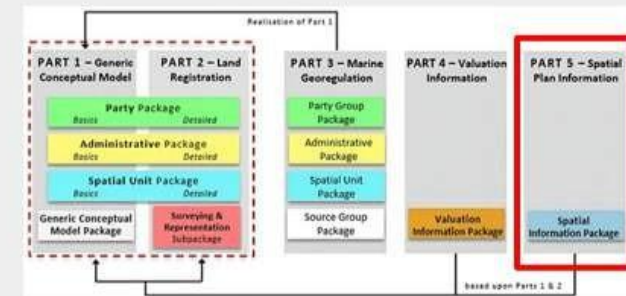
Standardized Subsurface Information

Key Registry for the Subsurface (TNO), and other subsurface data models (Utrecht) → suitability assessment.



Standardized Urban Plans

LADM Part 5 → exchange of urban planning information + climate design interventions.



III. CLIMACAT

Online Catalog: CLIMACAT

 ArcGIS StoryMaps

CLIMACAT

Digital Dutch Climate Adaptation Catalog

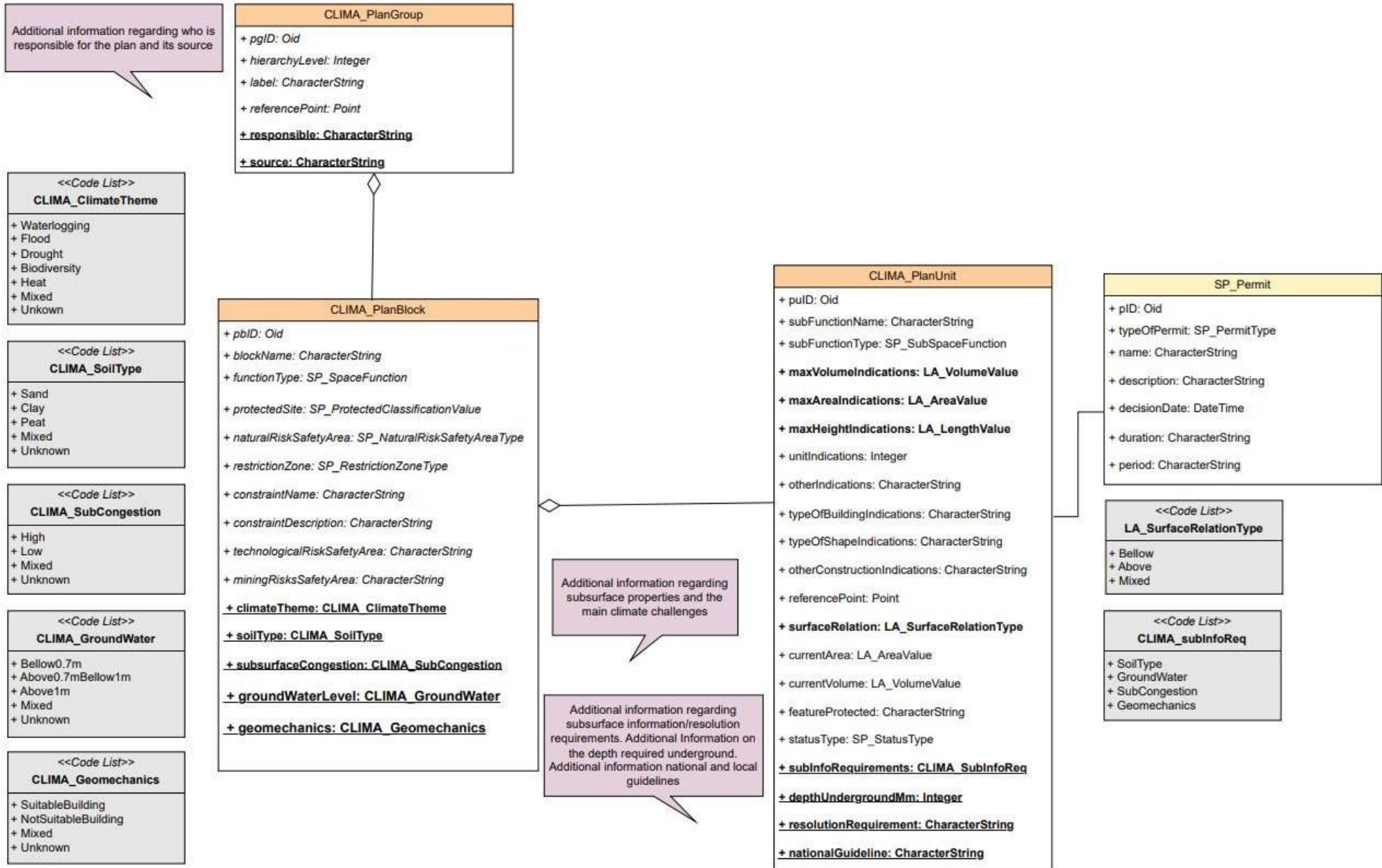
Maria Luisa Tarozzo Kawasaki

March 14, 2024



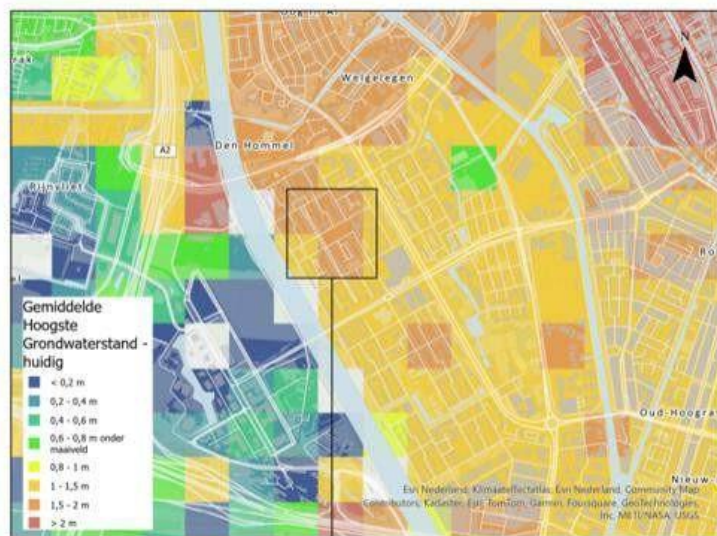
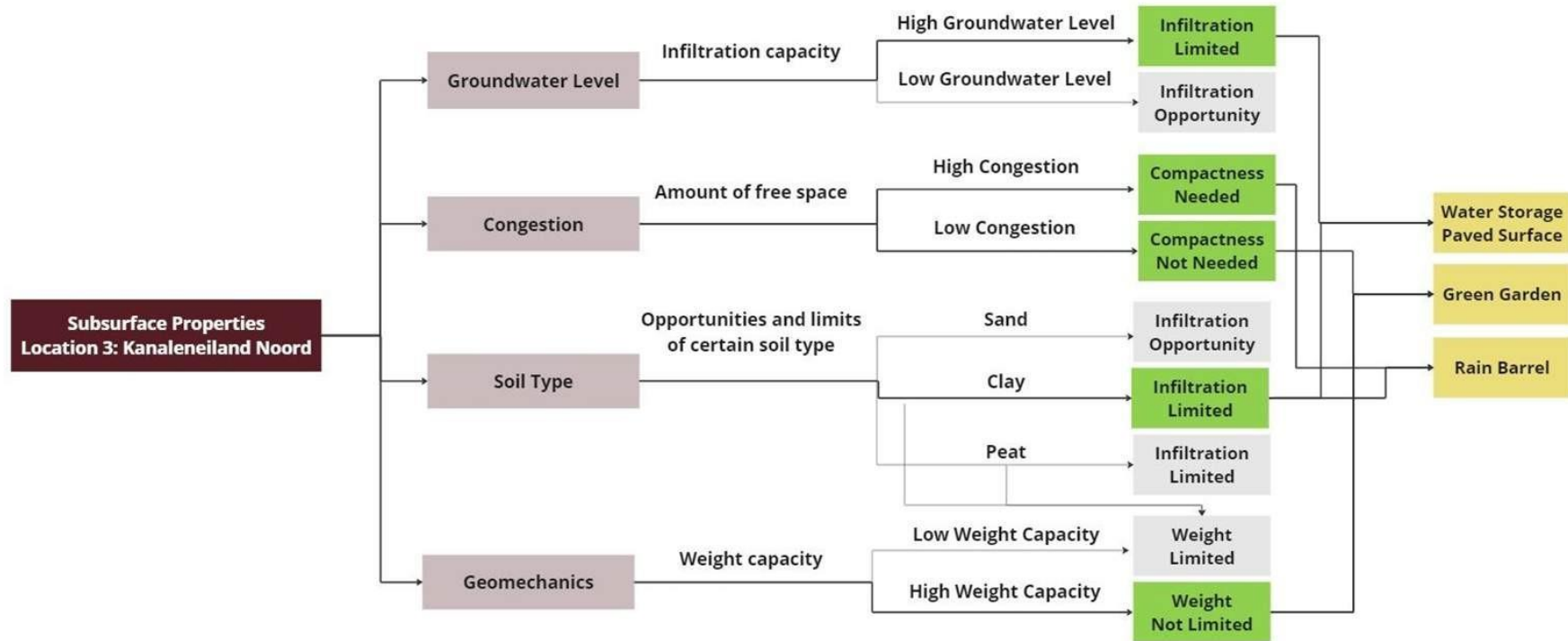
IV. LADM Part 5

LADM Part 5 Climate Adaptation Subclasses



V. Results & Evaluation

Designing with CLIMACAT



Storing Design: LADM Part 5

1) Storing masterplans (hierarchy) → CLIMA Plan Group

pgid	hierarchylevel	label	referencepoint	responsible	source
MU2040	1	Utrecht2040		Municipality Utrecht	Utrecht 2040

2) Storing local plans (made of interventions) → CLIMA Plan Block

pbid	blockname	functiontype	p...	naturalrisk...	r...	c...	c...	t...	m...	climatetheme	soiltype	su...	ground...	geomechanics	plangr...
UVoord001	VoordorpPlan001	cultivationPublicFacility		stormRiskZone						Waterlogging Heat	Sand	Low	Above1m	SuitableBuilding	MU2040

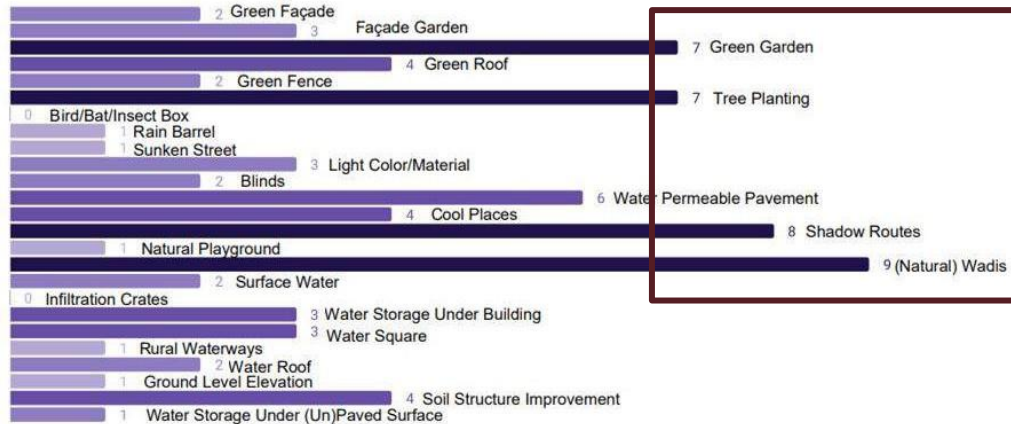
3) Storing climate adaptation interventions → CLIMA Plan Unit

puid	subfunctionname	subfun...	maxvol...	maxarea...	maxhel...	u...	o	t	f	e	r	surfacere	currenta...	currentvol...	f	status	subinforequirements	depthundergroundmm	resolutionrequirement	nationalguideline	localguideline	planblock_id
InfiltrationCrates	underPlayground	education	190	159	1							Bellow	159	0		InUse	GroundWater SoilTyp...	1000	0.5x0.5x0.5	Maatlat	N1 N2 N3 D1 D2	UVoord001
TreePlanting	treePlayground	education	1	1	10							Mixed	0	0		InUse	Geomechanics SoilTy...	1500	0.5x0.5x0.5	Maatlat	B1 B2 B3 H1 H2	UVoord001
NaturalPlayground	naturalPlayground	education	250	120	3							Mixed	120	232		InUse	SoilType SubCongestl...	500	0.5x0.5x0.5	Maatlat	B1 B2 B3 N1 D1	UVoord001

Survey Results

Only 12.5% of designs recognized the need for subsurface information

Results Lunetten Zuid



Information Requests

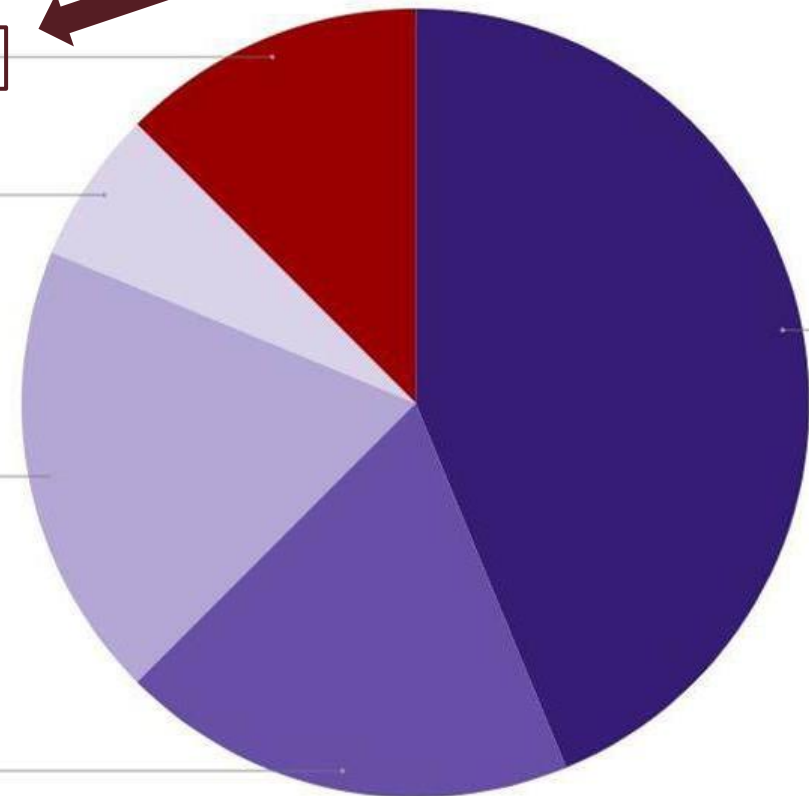
Subsurface Data
12.5%

Aerial Images
0.3%

Ecological Data
16.8%

Buildings Data
16.8%

Demographic Data
43.8%



- Increase greenery for natural infiltration but infiltration capacity is very low → Artificial Infiltration is more suitable
- Increase trees for shadowing but trees require subsurface information → Artificial shadowing
- Soil structure improvement **NEEDS** soil information → Basic information need not provided

VI. Conclusions

Conclusions

Design Portal (CLIMACAT)

Enhances the accessibility and usability of essential data through an user-friendly portal, fostering interdisciplinarity

Standardized Planning Information (LADM Part 5)

Ensures that climate adaptation plans are documented in a manner that facilitates sharing and interoperability. Can include subclasses tailored for climate adaptation design.

Dual Approach (CLIMACAT + LADM Part 5)

Together, they ensure climate adaptation designs are well-informed, standardized, and easily shared.

Thank you!

Paper in a nutshell:

- States that **subsurface and standards** can support climate adaptation design.
- Proposes **a dual framework** for this integration: **online portals + standardized urban plans**
- Provides **tools** to support integration: **CLIMACAT + LADM Part 5**
- Uses **design proposals** in the city of Utrecht are to exemplify and evaluate this integrated approach.

