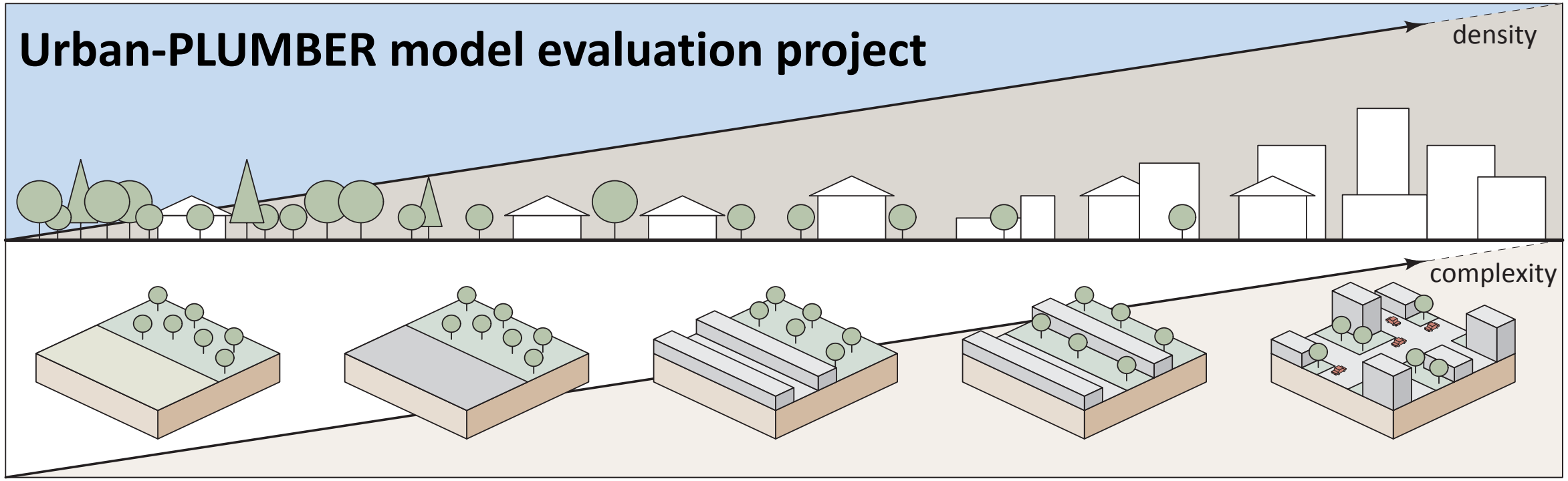
Calling for participants:



A new multi-site evaluation project for land surface models in urban areas

Mathew Lipson[1,2], Sue Grimmond[2], Martin Best[3]

with

Gab Abramowitz, Andrew Pitman, Martin De Kauwe, Aristofanis Tsiringakis, Andrew Coutts, Helen Ward

1: UNSW THE UNIVERSITY OF NEW SOUTH WALES 2: University of Reading 3: Met Office

Get involved, email: **met-urban-plumber@lists.reading.ac.uk**

Background

In 2010/2011 **PILPS-Urban**[1] evaluated 32 models at two urban sites.

Since then:

- new and improved models have been developed, many including vegetation
- a growing interest for regional weather/climate simulations to include urban systems

This project will ask:

1. How do different modelling approaches compare across a wide range of sites?
2. Does providing more detailed site morphology information improve performance?
3. Are models utilising available meteorological information effectively?
4. Have recent model developments improved performance?

[1]PILPS-Urban: The First International urban Land Surface Model Comparison Project (Grimmond et al. 2011) doi: 10.1002/joc.2227

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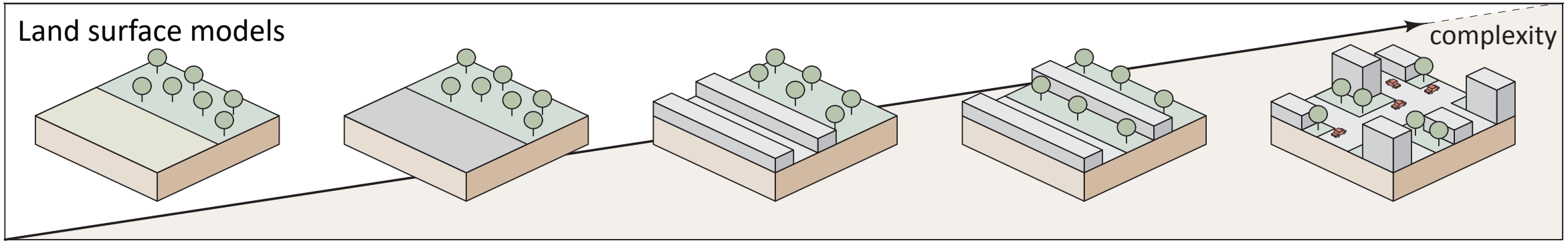
Who should get involved?

- Those with models:
  - that simulate exchange between land/atmosphere from meteorological inputs
  - can output a single point representative of neighbourhood-scale exchange
  - can model different urban forms, density, amount of vegetation etc.
  - can model long periods (10 years)
  - i.e. **land surface models predicting energy partitioning at the Earth's surface**



Participating models will range from those focussed on modelling vegetation to complex urban systems

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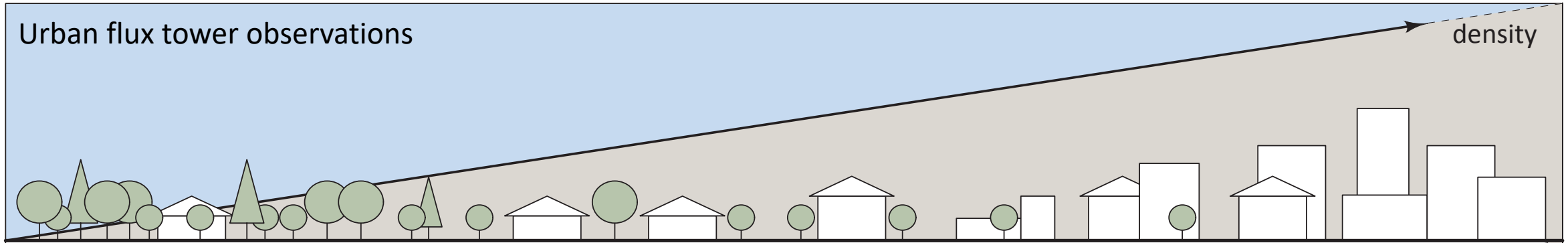
Who should get involved?

- Those with observations:
  - including radiant/turbulent fluxes, temperature, humidity, pressure, rainfall & wind
  - above roofs in the inertial sub-layer (constant-flux layer), representing neighbourhood
  - Should be 30-60 min intervals for > 1 month, preference for multi-year
  - willing to share data with modelling participants
  - i.e. **urban flux tower observations**



Sites will range from highly vegetated to highly urbanised in various climates

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Project outline

- All simulations are offline (not coupled to full atmosphere model)
- Two phases:
  - **Phase 1:** (May 2020 – Nov 2020) a single site – Preston Melbourne, Australia[1]
  - **Phase 2:** (Nov 2020 – Mar 2021) multiple (10-20) sites

- In both phases, two experiments:
  - A **baseline** simulation using primarily model default configuration
  - A **specific** simulation configured with more detailed site information

- Modellers may choose to participate in either or both phases

[1]Observations from Coutts et al. 2007: doi: 10.1002/joc.2227

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Participants will be provided with:

- Site data table (in text form)
  - information is standard at all sites, allowing for automated configuration of models
- Meteorological forcing (in text and netCDF form)
  - Meteorological forcing includes 10-year spinup period derived from ERA5[1].
  - Spinup will help soil equilibrate to local conditions
- Python scripts to help convert input/output and automate model configuration

[1]ERA5: Copernicus Climate Change Service (C3S) (2017): https://cds.climate.copernicus.eu/cdsapp#!/home

Example of site data table (site 1)

id	parameter	value	units	source
Parameters 1-10 should be used in the baseline simulation only				
1	latitude	-37.73	degrees_north	Coutts et al. 2007a
2	longitude	145.01	degrees_east	Coutts et al. 2007a
3	ground_height	93.0	m	Coutts et al. 2007a
4	measurement_height_above_ground	40.0	m	Coutts et al. 2007b
5	utc_standard_time_offset	10.0	hour	timeanddate.com
6	impervious_plan_fraction	0.62	1	Grimmond et al. 2011
7	tree_plan_fraction	0.225	1	Grimmond et al. 2011
8	grass_plan_fraction	0.15	1	Grimmond et al. 2011
9	bare_soil_plan_fraction	0.0	1	Grimmond et al. 2011
10	water_plan_fraction	0.005	1	Grimmond et al. 2011
Any or all parameters 11-25 can be used in the specific simulation (optional)				
11	roof_plan_fraction	0.445	1	Grimmond et al. 2011
12	road_plan_fraction	0.13	1	Grimmond et al. 2011
13	footpath_plan_fraction	0.045	1	Grimmond et al. 2011
14	building_mean_height	6.4	m	Grimmond et al. 2011
15	tree_mean_height	5.7	m	Nice et al. 2018
16	roughness_length_momentum	0.4	m	Grimmond et al. 2011
17	displacement_height	4.57	m	Macdonald et al. 1998
18	canyon_height_width_ratio	0.42	1	Grimmond et al. 2011
19	wall_to_plan_ratio	0.4	1	Grimmond et al. 2011
20	average_albedo_at_midday	0.15	1	Grimmond et al. 2011
21	resident_population_density	415.78	person/km2	Grimmond et al. 2011
22	anthropogenic_heat_flux_mean	11.0	W/m2	Best and Grimmond 2016
23	topsoil_clay_fraction	0.18	1	openlandmap.org
24	topsoil_sand_fraction	0.72	1	openlandmap.org
25	topsoil_bulk_density	1230	kg/m3	openlandmap.org

Meteorological forcing (sample)

Date	Time	SWdown	LWdown	Wind_E	Wind_N	PSurf	Tair	Qair	Rainf	Snowf
YYYY-MM-DD	HH:MM:SS	W/m2	W/m2	m/s	m/s	Pa	K	kg/kg	kg/m2/s	kg/m2/s
2003-01-01	00:00:00	368.06	354.68	6.15	-4.13	99048	290.43	0.00748	4.05E-05	0
2003-01-01	00:30:00	439.75	348.56	6.34	-3.88	99066.2	290.86	0.007403	4.08E-05	0
2003-01-01	01:00:00	511.43	342.43	6.53	-3.63	99084.4	291.29	0.007326	4.12E-05	0
2003-01-01	01:30:00	544.41	349.29	6.19	-3.1	99094.1	291.56	0.007328	4.78E-05	0
2003-01-01	02:00:00	577.4	356.15	5.85	-2.58	99103.9	291.83	0.00733	5.43E-05	0
2003-01-01	02:30:00	518.66	360	5.74	-2.19	99093.2	291.96	0.007304	4.78E-05	0
2003-01-01	03:00:00	459.92	363.84	5.62	-1.8	99082.6	292.08	0.007279	4.12E-05	0
2003-01-01	03:30:00	425.05	359.56	5.61	-1.39	99089.7	291.92	0.007334	4.64E-05	0
2003-01-01	04:00:00	390.18	355.28	5.59	-0.98	99096.8	291.75	0.007389	5.16E-05	0
2003-01-01	04:30:00	355.15	359.89	5.76	-0.6	99113.6	291.73	0.00745	4.69E-05	0
2003-01-01	05:00:00	320.13	364.5	5.94	-0.22	99130.5	291.7	0.007511	4.22E-05	0
2003-01-01	05:30:00	274.34	362.01	5.7	0.33	99156.6	291.23	0.007458	2.42E-05	0
2003-01-01	06:00:00	228.55	359.51	5.46	0.89	99182.7	290.76	0.007404	6.23E-06	0
2003-01-01	06:30:00	195.9	366.41	5.47	1.4	99209.3	290.5	0.007505	7.61E-06	0

Outputs

- **Paper 1:** Comparison of urban and non-urban LSM performance at a suburban site. This will also assess how developments have affected urban model performance since the last major comparison at the same site (Grimmond et al., 2011)[1].
- **Paper 2:** Model performance at multiple sites. This will assess how different modelling approaches perform at different points along the urban/vegetation fraction continuum. Analysis will draw on the benchmarking evaluation methods of PLUMBER (Best et al., 2015).
- **Paper 3 (potential):** For observational participants that are interested; a synthesis of gap-filled, quality-controlled flux tower observations useful for driving models.

Those providing model or observational data will be invited as authors on relevant papers

[1]PILPS-Urban: The First International urban Land Surface Model Comparison Project (Grimmond et al. 2011) doi: 10.1002/joc.2227

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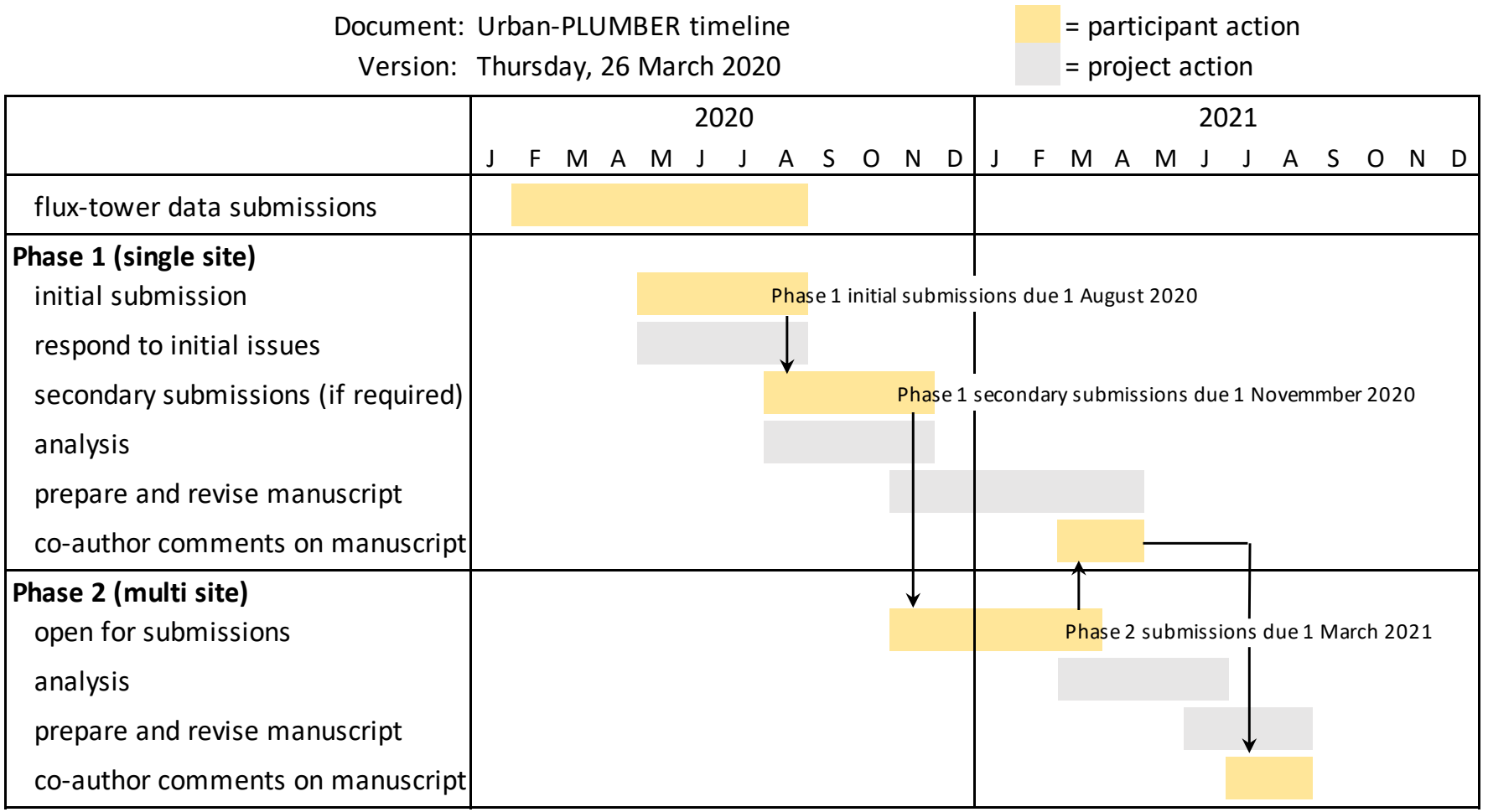
Timeline



Phase 1 opens this month

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Thank you

Register your interest in providing model or observational data, email:

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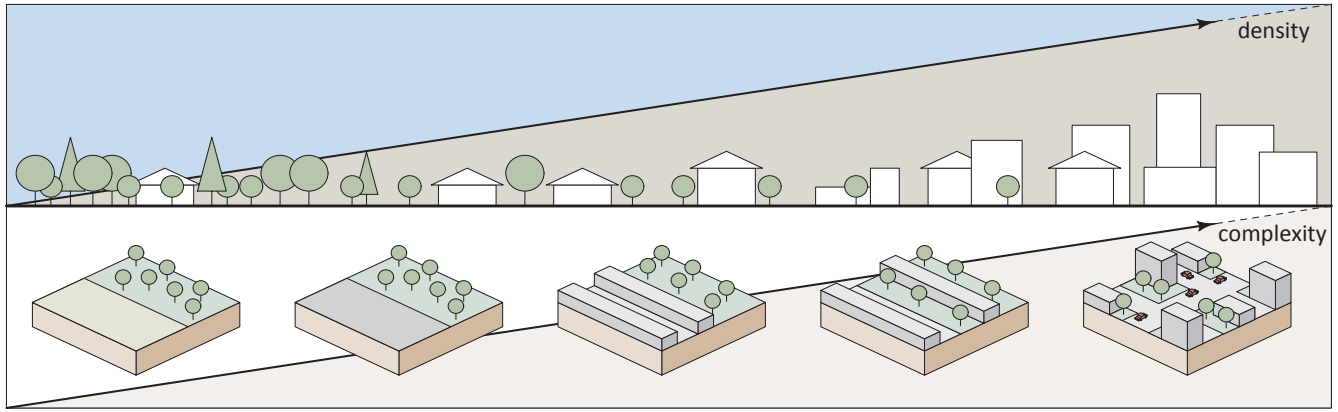

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