Supplement: A step-by-step guidance on the method to create spatially-explicit future land-use map with specified future land area target or prediction.

[Step 1] Define Land-use Change Unit (LUC-Unit) by aggregating grid-cells with grouping by prefecture, city, agricultural commune, zoning (e.g. for land-use change regulation) and land-use type. Calculate area of the LUC-Unit.

Cell ID	Prefecture	City	Agcom [1]	Zone	Soil	Land-use	Cell area	Unit ID	Unit area
1	08	001	101	1	A	PD	1	**1**	**3**
2	08	001	101	1	A	PD	1	**1**	**3**
3	08	001	101	1	A	PD	1	**1**	**3**
4	08	001	101	1	B	UP	1	**2**	**2**
5	08	001	101	1	B	UP	1	**2**	**2**
6	08	001	102	1	B	UP	1	**3**	**1**
7	08	001	102	1	B	PD	1	**4**	**2**
8	08	001	102	1	B	PD	1	**4**	**2**
9	08	001	102	1	C	PD	1	**5**	**1**
10	08	001	103	1	C	PD	1	**6**	**1**
...	...	...	...	...	...	...	...	...	...

[Step 2] Assign Land-use Change Likeliness Index (LUC-LI), either as numeric or integer data type indicating relative likeliness for land-use conversion to occur, according to user-specified model of land-use change trend, land-use planning, and policy implementation. The LUC-LI can be set by many different ways with different objectives. By adding various geographical information as additional attributes of grid cells, e.g. distance from train station, land price, population in city or smaller size local community, and soil types, etc., may help to build more sophisticated and complex model to predict land-use change that takes account multiple geographical attributes data as input parameters.

Cell ID	Prefecture	City	Agcom [1]	Zone	Soil	Land-use	Cell area	Unit ID	Unit area	LUC-LI
1	08	001	101	1	A	PD	1	1	3	
2	08	001	101	1	A	PD	1	1	3	
3	08	001	101	1	A	PD	1	1	3	
4	08	001	101	1	B	UP	1	2	2	
5	08	001	101	1	B	UP	1	2	2	
6	08	001	102	1	B	UP	1	3	1	
7	08	001	102	1	B	PD	1	4	2	
8	08	001	102	1	B	PD	1	4	2	
9	08	001	102	1	C	PD	1	5	1	
10	08	001	103	1	C	PD	1	6	1	
...	...	...	...	...	...	...	...	...	...	...

[Step 3] Define range of grid-cells for which land-use change to occur by the following steps;

Step 3.1 - Select a land-use type listed in land-use change matrix (e.g. Paddy fields (PD)) prepared for a geographical entity (e.g. a zone in a prefecture) and obtain a set of land-use change patterns with specified area of land-use conversions for each. Probability of land-use change (%) is calculated according to relative proportion of the specified area of land-use conversion among all other land-use change patterns, as indicated below in table. In this example, a total 4,000 ha (1,000 + 3,000) of Paddy fields should be converted to other land-use types, with probability to be converted to Upland crop fields and Settlements equal to 25 and 75 %, respectively.

			To								
		Unit	01 PD	02 UP	03 OC	04 MG	05 UG	06 FL	07 WL	08 ST	09 OL
From	01 PD	ha	16,000	1,000	0	0	0	0	0	3,000	0
		%	-	25	0	0	0	0	0	75	0

Step 3.2 - For grid-cells in a geographical entity specified in the land-use change matrix (e.g. a zone in a prefecture), having a land-use type selected in Step 3.1 (e.g, Paddy fields), sort them and calculate cumulative sum of the area of LUC-Unit according to the order of LUC-LI assigned in Step 2.

Cell ID	Prefecture	City	Agcom [1]	Zone	Soil	Land-use	Cell area	Unit ID	Unit area	LUC-LI	Unit area cum. sum
50	08	001	301	1	C	PD	1	15	3	**1**	**3**
51	08	001	301	1	C	PD	1	15	3	**1**	**3**
52	08	001	301	1	C	PD	1	15	3	**1**	**3**
304	08	066	210	1	A	PD	1	87	3	**2**	**6**
305	08	066	210	1	A	PD	1	87	3	**2**	**6**
306	08	066	210	1	A	PD	1	87	3	**2**	**6**
9	08	001	102	1	C	PD	1	5	1	**3**	**7**
126	08	025	003	1	B	PD	1	213	2	**4**	**9**
127	08	025	003	1	B	PD	1	213	2	**4**	**9**
...	...	...	...	...	...	...	...	...	...	...	...
6	08	001	102	1	B	PD	1	3	1	**598**	**4000**
512	08	077	005	1	D	PD	1	462	2	**623**	**4002**
513	08	077	005	1	D	PD	1	462	2	**623**	**4002**
...	...	...	...	...	...	...	...	...	...	...	...

Step 3.3 - For grid-cells showing values of the cumulative sum of the LUC-Unit less than the area of land-use conversion for target land-use type as specified in the Step 3.1 (e.g. 4,000 ha of Paddy fields should be converted), assign new land-use type (e.g. Settlements) based on the probability of land-use change specified for each land-use change patterns defined in the Step 3.1 with random number generation for uniform distribution of integer ranging from 0 to 100. In this example, a grid-cell (or

LUC-Unit?) with the assigned random number ranging from 0 to 24 will be assigned a new land-use type 'Upland Crop Fields (UP)', while those with the random number ranging from 25 to 100 will be assigned 'Settlements (ST)'.

Cell ID	Prefecture	City	Agcom [1]	Zone	Soil	Land-use	Cell area	Unit ID	Unit area	LUC-LI	Unit area cum. sum	Random number	New land-use
50	08	001	301	1	C	PD	1	15	3	1	3	**34**	**ST**
51	08	001	301	1	C	PD	1	15	3	1	3	**12**	**UP**
52	08	001	301	1	C	PD	1	15	3	1	3	**38**	**ST**
304	08	066	210	1	A	PD	1	87	3	2	6	**38**	**ST**
305	08	066	210	1	A	PD	1	87	3	2	6	**91**	**ST**
306	08	066	210	1	A	PD	1	87	3	2	6	**39**	**ST**
9	08	001	102	1	C	PD	1	5	1	3	7	**26**	**ST**
126	08	025	003	1	B	PD	1	213	2	4	9	**90**	**ST**
127	08	025	003	1	B	PD	1	213	2	4	9	**24**	**UP**
...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	08	001	102	1	B	UP	1	3	1	598	4000	**90**	**ST**
512	08	077	005	1	D	PD	1	462	2	623	4002	**-**	**PD**
513	08	077	005	1	D	PD	1	462	2	623	4002	**-**	**PD**
...	...	...	...	...	...	...	...	...	...	...	...	...	...