

Supplementary Information

Evolution and Projection of Carbon Storage in Important Ecological Functional Areas of the Minjiang River Basin, 1985–2050

Xiaobin Huang ^{1,2,3}, Xiaosheng Liu ^{1,*}, Youliang Chen ^{1,*}, Yuanhang Jin ¹, Xue Gao ^{2,3} and Raihana Abbasi ¹

¹ School of Civil and Surveying & Mapping Engineering, Jiangxi University of Science and Technology, Ganzhou 341000, China

² The Engineering & Technical College, Chengdu University of Technology, Leshan 614000, China

³ Southwestern Institute of Physics, Chengdu 610041, China

* Correspondence: liuxiaosheng@jxust.edu.cn (X.L.); chenyouliang@jxust.edu.cn (Y.C.)

Supplementary Figures

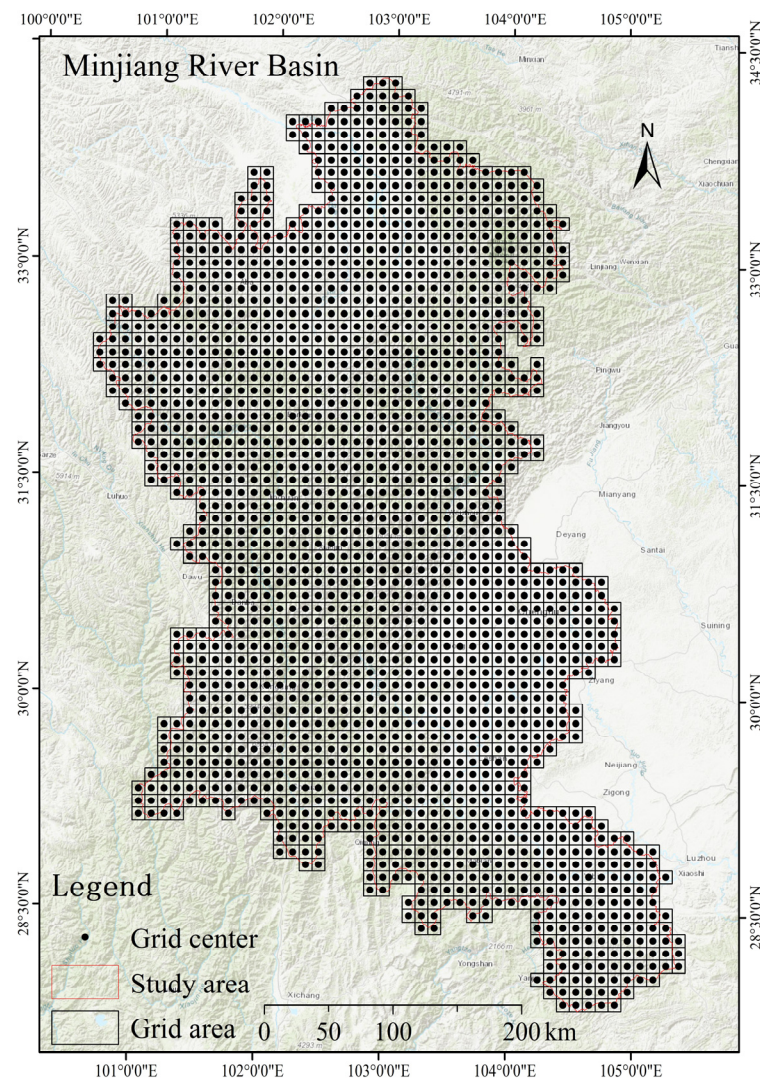


Figure S1. The LERI computational grid in the MJRB study area (MJRB was partitioned into 1845 units of $10\text{km} \times 10\text{km}$, while $30\text{m} \times 30\text{m}$ evaluation units were used for the remaining spatial analysis).

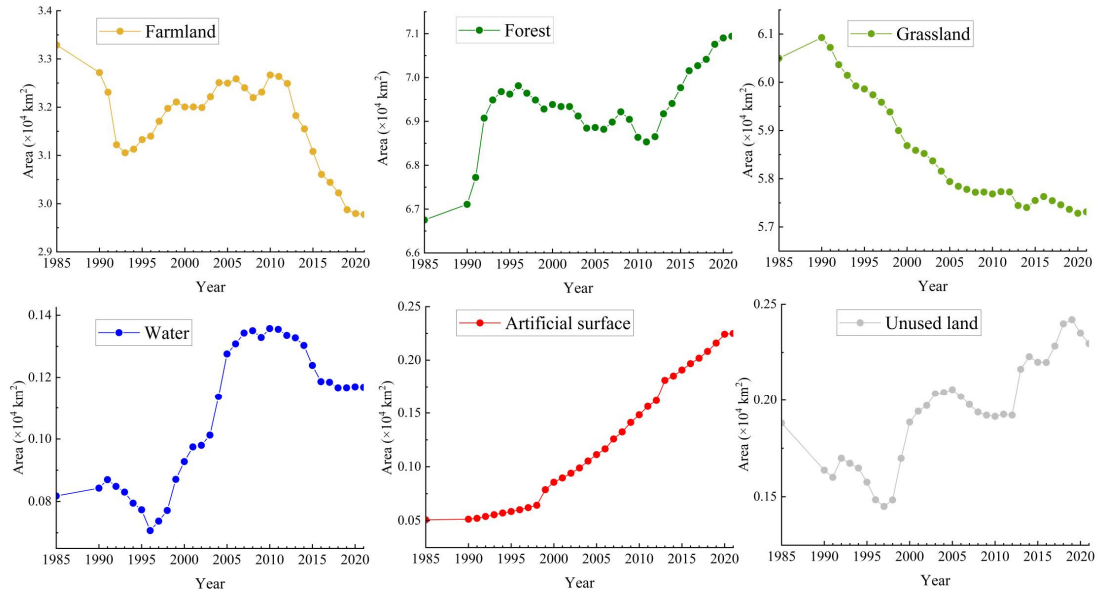


Figure S2. Variation LULC types in MJRB from 1985 to 2020.

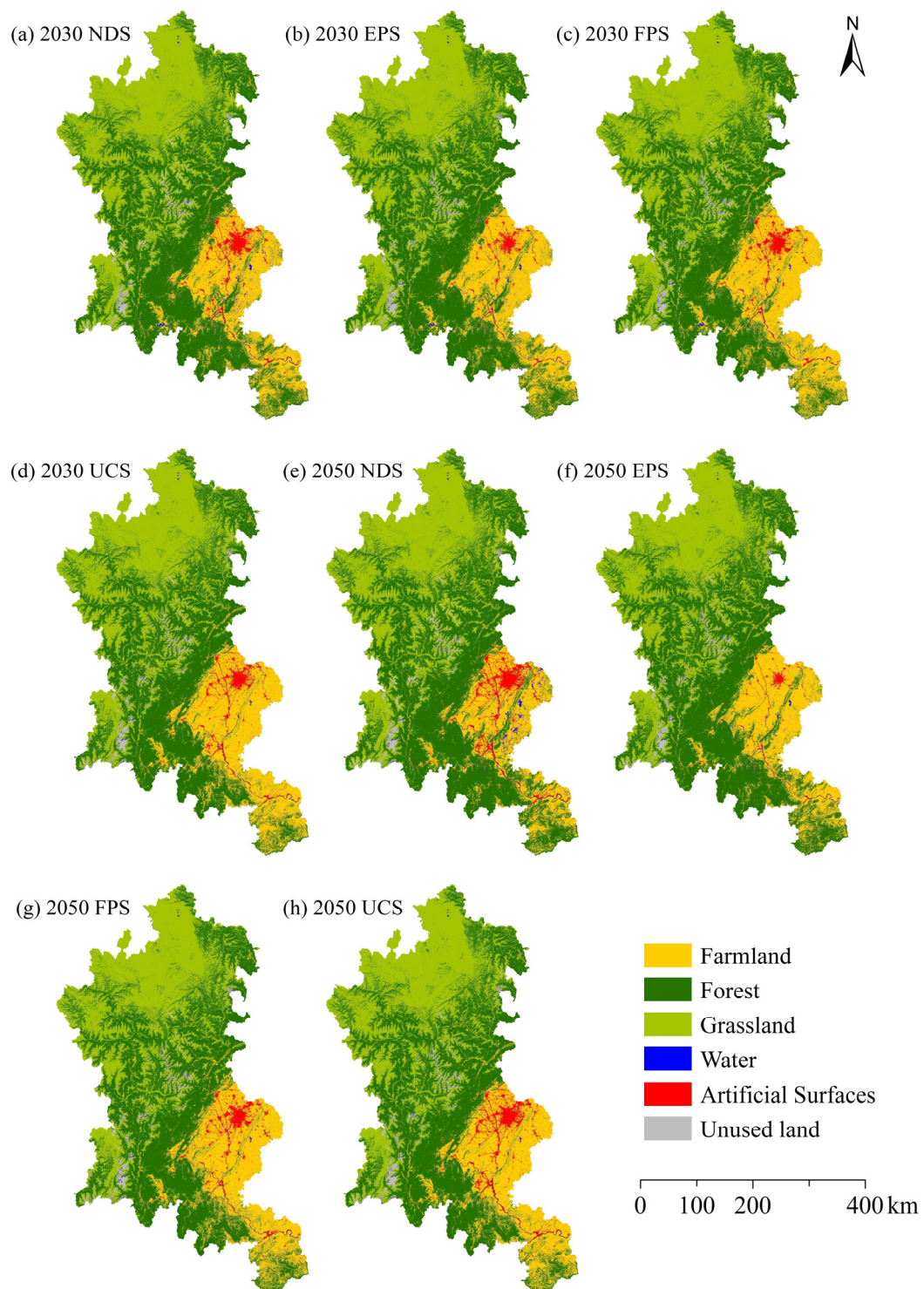


Figure S3. LULC simulation result and land class for different scenarios in 2030 and 2050.

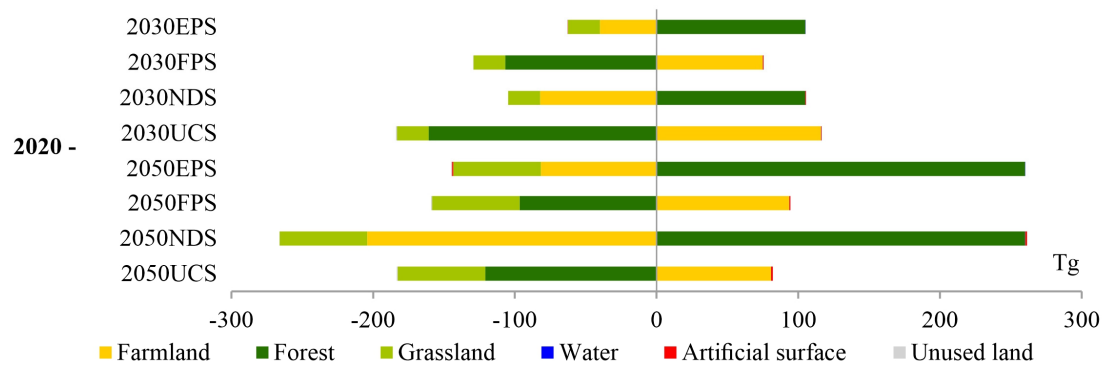


Figure S4. Carbon storage changes caused by LULC changes in different scenarios from 2020 to the future.

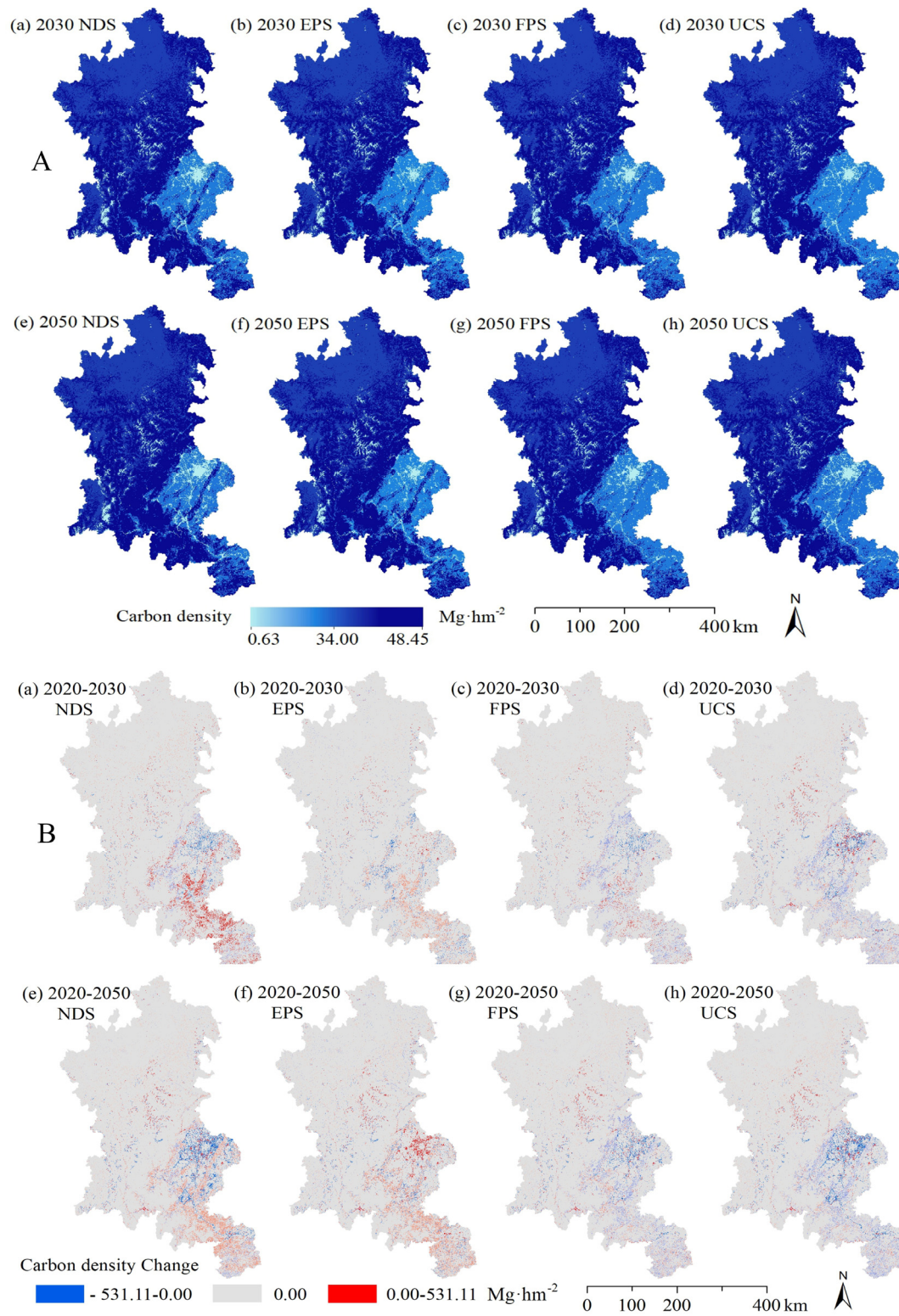


Figure S5. Spatial distribution of carbon storage (changes) in MJRB from 2020 to 2050.

Supplementary Tables

Table S1. Landscape pattern indexes and meaning.

Landscape pattern index	Calculation formula	Ecologically meaning
Number of patches	$NP = n$	(1) Reflecting the heterogeneity and fragmentation of the landscape.
Patch density	$PD = \frac{n}{A}$	(2) Number of patches on the landscape area, and A is the landscape area.
Mean patch size	$MN = \frac{\sum_{j=1}^n x_{ij}}{n_i}$	(3) The mean area of all patches. x_{ij} is each patch area, and n_i is the spatial patch.
Landscape shape index	$LSI = \frac{0.25 \cdot \sum_{k=1}^m e_{ik}}{\sqrt{A}}$	(4) Responding to the complexity of landscape shapes. e_{ik} is the edge length between patches i and k .
Largest path index	$LPI = \frac{\sum_{j=1}^n \max(a_{ij})}{A}$	(5) The percentage of total landscape area comprised by the most significant patch, a_n is the area of peach n .
Landscape Division Index	$DIVISION = \left[1 - \sum_{j=1}^n \left(\frac{a_{ij}}{A} \right)^2 \right]$	(6) Interpret the probability that two randomly chosen pixels in the landscape are not situated in the same patch of the corresponding patch type. a_{ij} is the area of peach ij .
Patch Cohesion Index	$COHESION = \left[1 - \frac{\sum_{i=1}^m \sum_{j=1}^n p_{ji}}{\sum_{i=1}^m \sum_{j=1}^n p_{ji} \sqrt{a_{ij}}} \right] \cdot \left[1 - \frac{1}{\sqrt{A}} \right]^{-1} \times 100$	(7) The patch cohesion index measures the physical connectedness of the corresponding patch type. p_{ij} indicates patch ij 's perimeter, a_{ij} is the area of peach ij , and A is the count of cells in the landscape.
Interspersion & Juxtaposition Index	$IJI = \frac{-\sum_{k=1}^m \left[\left(\frac{e_{ik}}{\sum_{k=1}^m e_{ik}} \right) \ln \left(\frac{e_{ik}}{\sum_{k=1}^m e_{ik}} \right) \right]}{\ln(m-1)} \times 100$	(8) Describe the dispersion and adjacency between section types. e_{ik} is the total length of the edge in the landscape between patch types i and k , m is the number of patch types present in the landscape.
Perimeter Area Fractal Dimension	$PAFRAC = \frac{2 \left[N \sum_{i=1}^m \sum_{j=1}^n (\ln p_{ij} \bullet \ln a_{ij}) \right] - \left[\sum_{i=1}^m \sum_{j=1}^n \ln p_{ij} \left(\sum_{i=1}^m \sum_{j=1}^n \ln a_{ij} \right) \right]}{\left(N \sum_{i=1}^m \sum_{j=1}^n (\ln p_{ij}^2) \right) - \left(\sum_{i=1}^m \sum_{j=1}^n \ln p_{ij} \right)^2}$	(9) a_{ij} is area (m^2) of patch ij . p_{ij} is perimeter (m) of patch ij . N is total number of patches in the landscape.
Shannon's Diversity Index	$SHDI = -\sum_{i=1}^m (P_i \bullet \ln P_i)$	(10) P_i is the proportion of the landscape occupied by patch type i .
Shannon's Evenness Index	$SHEI = \frac{-\sum_{i=1}^m (P_i \bullet \ln P_i)}{\ln m}$	(11) P_i is the same as (10), and m is the number of patch types (classes) present in the

landscape, excluding the landscape border.

Table S2. LULC transfer matrix under different scenarios.

	NDS						EPS						FPS						UCS					
	F	Fo	G	W	A	U	F	Fo	G	W	A	U	F	Fo	G	W	A	U	F	Fo	G	W	A	U
F	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	0	1	0	0	0	1	0
Fo	1	1	1	1	1	1	0	1	1	0	0	0	1	1	1	1	1	0	1	1	1	1	1	0
G	1	1	1	1	1	1	0	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	1	0
W	1	1	1	1	1	1	0	1	1	1	0	0	1	0	0	1	0	0	1	0	0	1	1	0
A	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0	0	0	1	0
U	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1

Notes: F: Farmland; Fo: Forest; G: Grassland; W: Water; A: Artificial surface; U: Unused land.

"1": someone type can be converted to another; "0": someone type cannot be converted to another.

Table S3. Carbon density of each LULC type in China (unit: Mg·C·hm⁻²).

LULC Type	<i>C_{above}</i>	<i>C_{below}</i>	<i>C_{soil}</i>	<i>C_{dead}</i>	References
Farmland	6.83	80.70	108.40	—	[1-3]
Forest	47.76	115.90	73.09	—	[2-5]
Grassland	35.30	86.50	99.90	—	[1-3, 5]
Water	3.00	0.00	0.00	—	[5, 6]
Artificial surface	2.50	0.00	0.00	—	[5, 7]
Unused	1.30	0.00	15.70	—	[1, 5]

Note: The soil carbon density of the forest is MJRB value.

Table S4. Statistics of the types of LULC in MJRB from 1985 to 2020 (unit: km²).

Year	Farmland	Forest	Grassland	Water	Artificial surface	Unused land
1985	33288.33	66751.18	60497.18	817.67	507.38	1880.54
1990	32716.53	67108.01	60924.98	842.63	513.21	1636.92
1995	31326.55	69621.83	59861.12	773.45	584.53	1574.8
2000	32002.98	69383.82	58686.21	927.66	856.13	1885.49
2005	32497.2	68860.66	57939.46	1275.72	1112.76	2056.49
2010	32666.78	68635.86	57684.82	1357.11	1482.59	1915.13
2015	31081.76	69766.84	57548.09	1238.54	1908.02	2199.04
2020	29795.32	70901.38	57283.66	1169.48	2242.09	2350.36

Table S5. LULC transfer matrix of MJRB from 1985 to 2020 (unit: km²).

1985	2020					
	Farmland	Forest	Grassland	Water	Artificial surface	Unused land
Farmland	26759.81	4108.52	434.23	198.50	1785.69	1.58
Forest	2754.60	62243.29	1730.42	14.95	7.30	0.62
Grassland	192.20	4470.71	54741.11	184.61	7.50	901.05
Water	70.66	74.75	53.17	530.54	34.33	54.22
Artificial surface	17.36	0.16	1.19	83.27	405.37	0.03
Unused land	0.69	3.94	323.54	157.61	1.89	1392.86

Table S6. Carbon storage of MJRB from 1985 to 2050 (unit: Tg).

Year & Scenario	Farmland	Forest	Grassland	Water	Artificial surface	Unused land	Total
1985	1236.16	3592.28	2777.55	0.70	0.36	4.03	7611.08
1990	1214.93	3611.48	2797.19	0.72	0.36	3.51	7628.2
1995	1163.31	3746.77	2748.34	0.66	0.42	3.38	7662.88
2000	1188.43	3733.96	2694.40	0.79	0.61	4.04	7622.24
2005	1206.78	3705.81	2660.12	1.09	0.79	4.41	7578.99
2010	1213.08	3693.71	2648.43	1.16	1.05	4.11	7561.53
2015	1154.22	3754.57	2642.15	1.06	1.35	4.72	7558.07
2020	1106.45	3815.63	2630.01	1.00	1.59	5.04	7559.72
2030 NDS	1024.22	3920.54	2607.59	1.08	2.03	5.11	7560.58
2030 EPS	1066.4	3920.54	2607.59	1.13	1.32	4.71	7601.69
2030 FPS	1181.44	3708.9	2607.59	1.06	1.98	4.68	7505.66
2030 UCS	1222.52	3654.79	2607.59	1.02	2.03	4.40	7492.36
2050 NDS	902.24	4075.59	2568.22	1.28	2.80	5.00	7555.14
2050 EPS	1024.78	4075.59	2568.22	1.16	0.76	4.40	7674.90
2050 FPS	1200.17	3719.02	2568.22	1.09	2.19	4.34	7495.01
2050 UCS	1187.31	3694.63	2568.22	1.01	2.80	4.40	7458.37

Supplementary References

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