

Land Use/Land Cover Mapping Based on GEE for the Monitoring of Changes in Ecosystem Types in the Upper Yellow River Basin over the Tibetan Plateau

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Table S1. Relationships of changes in ecosystem types.

| 2018 Ecosystem Types | 2020 Ecosystem Types | Ecosystem Types Change |
|----------------------|----------------------|------------------------|
|----------------------|----------------------|------------------------|

| | | |
|----------------------|----------------------|---|
| Barren Ecosystem | Grassland Ecosystem | progressive succession direction change |
| Barren Ecosystem | Wetland Ecosystem | progressive succession direction change |
| Barren Ecosystem | Shrubland Ecosystem | progressive succession direction change |
| Barren Ecosystem | Forest Ecosystem | progressive succession direction change |
| Freshwater Ecosystem | Grassland Ecosystem | progressive succession direction change |
| Freshwater Ecosystem | Wetland Ecosystem | progressive succession direction change |
| Grassland Ecosystem | Shrubland Ecosystem | progressive succession direction change |
| Grassland Ecosystem | Forest Ecosystem | progressive succession direction change |
| Wetland Ecosystem | Shrubland Ecosystem | progressive succession direction change |
| Shrubland Ecosystem | Forest Ecosystem | progressive succession direction change |
| Grassland Ecosystem | Barren Ecosystem | retrogressive succession direction change |
| Wetland Ecosystem | Barren Ecosystem | retrogressive succession direction change |
| Forest Ecosystem | Barren Ecosystem | retrogressive succession direction change |
| Forest Ecosystem | Grassland Ecosystem | retrogressive succession direction change |
| Grassland Ecosystem | Freshwater Ecosystem | retrogressive succession direction change |
| Wetland Ecosystem | Freshwater Ecosystem | retrogressive succession direction change |
| Shrubland Ecosystem | Grassland Ecosystem | retrogressive succession direction change |
| Shrubland Ecosystem | Wetland Ecosystem | retrogressive succession direction change |
| Forest Ecosystem | Shrubland Ecosystem | retrogressive succession direction change |
| Shrubland Ecosystem | Barren Ecosystem | retrogressive succession direction change |

Table S2. The accuracies with different feature combinations in 2018 and 2020.

| Feature Combinations | | Spectral Bands | Spectral Bands + Spectral Indices | Spectral Bands + Spectral Indices + Terrain Features | Spectral Bands + Spectral Indices + Terrain Features + Texture Features |
|----------------------|-------|----------------|-----------------------------------|--|---|
| 2018 | OA | 80.13% | 81.88% | 86.36% | 87.45% |
| | Kappa | 0.776 | 0.7885 | 0.8404 | 0.8551 |
| 2020 | OA | 84.80% | 85.01% | 90.86% | 92.14% |
| | Kappa | 0.8202 | 0.8228 | 0.8939 | 0.9082 |

Table S3. Confusion matrix of LULC first-degree classes accuracy assessment in 2018. The overall accuracy is 90.58% and the Kappa coefficient is 0.88. UA denotes user's accuracy, PA denotes producer's accuracy.

| 2018 Prediction | | | | | | | | | | | |
|--------------------|------------------------|--------|-----------|-----------|------------------------|-------------------|-------------------|--------|--------------|-------|--------|
| First-Degree Class | | Forest | Shrubland | Grassland | Wetland and Water body | Agricultural land | Construction land | Barren | Snow and ice | Total | PA |
| 2018 Reference | Forest | 207 | 6 | 3 | 0 | 10 | 0 | 0 | 0 | 226 | 0.9159 |
| | Shrubland | 6 | 70 | 11 | 0 | 4 | 0 | 2 | 0 | 93 | 0.7527 |
| | Grassland | 11 | 8 | 669 | 5 | 14 | 13 | 7 | 0 | 727 | 0.9202 |
| | Wetland and Water body | 1 | 0 | 9 | 503 | 0 | 11 | 0 | 0 | 524 | 0.9599 |
| | Agricultural land | 12 | 1 | 19 | 1 | 378 | 9 | 0 | 0 | 420 | 0.9 |
| | Construction land | 0 | 1 | 24 | 4 | 19 | 229 | 3 | 0 | 280 | 0.8179 |
| | Barren | 0 | 0 | 4 | 2 | 0 | 4 | 134 | 7 | 151 | 0.8874 |
| | Snow and ice | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 90 | 96 | 0.9375 |
| Total | | 237 | 86 | 739 | 515 | 425 | 266 | 152 | 97 | 2517 | |
| UA | | 0.8734 | 0.8139 | 0.9053 | 0.9767 | 0.8894 | 0.8609 | 0.8816 | 0.9278 | | |
| OA | | 0.9058 | | | | | | | | | |
| Kappa | | 0.8849 | | | | | | | | | |

Table S4. Confusion matrix of LULC first-degree classes accuracy assessment in 2020. The overall accuracy is 93.02% and the Kappa coefficient is 0.91. UA denotes user's accuracy, PA denotes producer's accuracy.

| 2020 Prediction | | | | | | | | | | | |
|--------------------|------------------------|--------|-----------|-----------|------------------------|-------------------|-------------------|--------|--------------|-------|--------|
| First-Degree Class | | Forest | Shrubland | Grassland | Wetland and Water body | Agricultural land | Construction land | Barren | Snow and ice | Total | PA |
| 2020 Reference | Forest | 215 | 1 | 0 | 0 | 8 | 1 | 0 | 0 | 225 | 0.9556 |
| | Shrubland | 3 | 64 | 7 | 0 | 1 | 0 | 0 | 0 | 75 | 0.8533 |
| | Grassland | 3 | 9 | 631 | 7 | 10 | 14 | 7 | 0 | 681 | 0.9266 |
| | Wetland and Water body | 0 | 0 | 9 | 510 | 0 | 4 | 1 | 0 | 524 | 0.9733 |
| | Agricultural land | 8 | 0 | 15 | 1 | 365 | 3 | 0 | 0 | 392 | 0.9311 |
| | Construction land | 0 | 0 | 16 | 3 | 13 | 245 | 2 | 3 | 282 | 0.8688 |
| | Barren | 0 | 0 | 1 | 0 | 0 | 3 | 134 | 0 | 138 | 0.971 |
| | Snow and ice | 3 | 0 | 2 | 0 | 0 | 0 | 7 | 36 | 48 | 0.75 |
| Total | | 232 | 74 | 681 | 521 | 397 | 270 | 151 | 39 | 2365 | |
| UA | | 0.9267 | 0.8649 | 0.9266 | 0.9788 | 0.9194 | 0.9074 | 0.8874 | 0.9231 | | |
| OA | | 0.9302 | | | | | | | | | |
| Kappa | | 0.9141 | | | | | | | | | |

Table S5. Confusion matrix of LULC second-degree classes accuracy assessment in 2018. The overall accuracy is 87.45% and the Kappa coefficient is 0.85. UA denotes user's accuracy, PA denotes producer's accuracy.

| | | 2018 Prediction | | | | | | | | | | | | | | | | | | | |
|---------------------|-------|-----------------|--------|------|--------|--------|--------|--------|--------|--------|--------|------|--------|--------|--------|--------|--------|--------|--------|-------|--------|
| Second-Degree Class | | BLF | NLF | MF | BLS | NLS | Grass | Marsh | Lake | River | Crop | OL | Urban | UGS | IAT | DL | BS | BR | Snow | Total | PA |
| 2018 Reference | BLF | 74 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 83 | 0.8916 |
| | NLF | 0 | 33 | 7 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 0.8049 |
| | MF | 5 | 7 | 81 | 5 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 102 | 0.7941 |
| | BLS | 3 | 0 | 2 | 52 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 | 0.8 |
| | NLS | 0 | 0 | 0 | 2 | 25 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0.8929 |
| | Grass | 1 | 0 | 1 | 2 | 2 | 655 | 2 | 2 | 21 | 18 | 4 | 10 | 0 | 5 | 1 | 0 | 1 | 2 | 727 | 0.901 |
| | Marsh | 0 | 0 | 1 | 0 | 0 | 6 | 93 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 | 0.9029 |
| | Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 82 | 11 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 95 | 0.8632 |
| | River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 304 | 2 | 0 | 3 | 2 | 1 | 1 | 1 | 0 | 12 | 326 | 0.9325 |
| | Crop | 4 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 1 | 277 | 14 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 317 | 0.8738 |
| | OL | 4 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 75 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 103 | 0.7282 |
| | Urban | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 5 | 7 | 1 | 153 | 0 | 3 | 7 | 0 | 0 | 0 | 189 | 0.8095 |
| | UGS | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 23 | 0.8261 |
| | IAT | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 58 | 1 | 1 | 1 | 0 | 68 | 0.8529 |
| | DL | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 59 | 0 | 0 | 0 | 61 | 0.9672 |
| | BS | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 16 | 0 | 0 | 19 | 0.8421 |
| | BR | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 62 | 0 | 71 | 0.8732 |
| | Snow | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 83 | 96 | 0.8646 |
| Total | | 92 | 41 | 100 | 62 | 28 | 715 | 98 | 87 | 347 | 330 | 100 | 173 | 22 | 71 | 72 | 18 | 64 | 97 | 2517 | |
| UA | | 0.8043 | 0.8049 | 0.81 | 0.8387 | 0.8929 | 0.9161 | 0.9490 | 0.9425 | 0.8761 | 0.8394 | 0.75 | 0.8844 | 0.8636 | 0.8169 | 0.8194 | 0.8889 | 0.9688 | 0.8557 | | |
| OA | | 0.8745 | | | | | | | | | | | | | | | | | | | |
| Kappa | | 0.8551 | | | | | | | | | | | | | | | | | | | |

Table S6. Confusion matrix of LULC second-degree classes accuracy assessment in 2020. The overall accuracy is 92.14% and the Kappa coefficient is 0.91. UA denotes user's accuracy, PA denotes producer's accuracy.

| | | 2020 Prediction | | | | | | | | | | | | | | | | | | | |
|---------------------|-------|-----------------|--------|-------|-----|-------|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|------|-------|--------|--------|--------|
| Second-Degree Class | | BLF | NLF | MF | BLS | NLS | Grass | Marsh | Lake | River | Crop | OL | Urban | UGS | IAT | DL | BS | BR | Snow | Total | PA |
| 2020 Reference | BLF | 72 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 80 | 0.9 |
| | NLF | 0 | 44 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 49 | 0.898 |
| | MF | 4 | 1 | 84 | 4 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 96 | 0.875 |
| | BLS | 3 | 0 | 0 | 40 | 2 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 0.8163 |
| | NLS | 0 | 0 | 1 | 2 | 21 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0.8077 |
| | Grass | 2 | 0 | 0 | 4 | 1 | 644 | 11 | 0 | 1 | 5 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 681 | 0.9457 |
| | Marsh | 0 | 0 | 0 | 0 | 0 | 9 | 101 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 112 | 0.9018 |
| | Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 | 0.9444 |
| | River | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 349 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 0 | 0 | 358 | 0.9749 |
| | Crop | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 328 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 347 | 0.9452 |
| | OL | 5 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 37 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 45 | 0.8222 |
| | Urban | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 8 | 0 | 145 | 0 | 4 | 0 | 1 | 0 | 0 | 164 | 0.8841 |
| | UGS | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 30 | 0.7667 |
| | IAT | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 6 | 0 | 75 | 0 | 0 | 0 | 0 | 88 | 0.8523 |
| | DL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 0 | 5 | 0 | 58 | 0.9138 |
| | BS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 17 | 0 | 0 | 18 | 0.9444 |
| | BR | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 54 | 3 | 62 | 0.871 |
| Snow | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 41 | 48 | 0.8542 | |
| Total | | 86 | 48 | 92 | 50 | 24 | 690 | 116 | 54 | 354 | 346 | 46 | 160 | 30 | 86 | 56 | 20 | 62 | 45 | 2365 | |
| UA | | 0.8372 | 0.9167 | 0.913 | 0.8 | 0.875 | 0.9333 | 0.8707 | 0.9444 | 0.9859 | 0.948 | 0.8043 | 0.9063 | 0.7667 | 0.8721 | 0.9464 | 0.85 | 0.871 | 0.9111 | | |
| OA | | 0.9214 | | | | | | | | | | | | | | | | | | | |
| Kappa | | 0.9082 | | | | | | | | | | | | | | | | | | | |

Table S7. Transition matrix of LULC first-degree classes in 2018-2020.

| First-Degree Class Transition Matrix | | 2020 | | | | | | | | |
|---|---------------------------|---------|-----------|-----------|---------------------------|----------------------|----------------------|---------|-----------------|-----------|
| | | Forest | Shrubland | Grassland | Wetland and Water body | Agricultural land | Construction land | Barren | Snow and ice | Total2018 |
| 2018 | Forest | 4427.58 | 125.32 | 170.48 | 111.21 | 134.24 | 80.59 | 133.70 | 69.64 | 5252.76 |
| | Shrubland | 341.98 | 4911.60 | 326.84 | 128.23 | 291.73 | 191.43 | 240.38 | 154.29 | 6586.48 |
| | Grassland | 405.95 | 451.13 | 148317.88 | 217.51 | 197.84 | 294.43 | 395.91 | 62.49 | 150343.14 |
| | Wetland and Water body | 137.74 | 192.51 | 225.62 | 10742.13 | 222.90 | 204.65 | 201.36 | 199.92 | 12126.84 |
| | Agricultural land | 138.49 | 226.37 | 426.84 | 207.75 | 4568.56 | 402.94 | 191.06 | 85.06 | 6247.07 |
| | Construction land | 56.14 | 196.26 | 182.44 | 150.71 | 270.94 | 4547.81 | 251.17 | 94.96 | 5750.42 |
| | Barren | 142.01 | 266.11 | 425.93 | 98.25 | 320.94 | 202.19 | 6093.65 | 392.64 | 7941.73 |
| | Snow and ice | 22.00 | 36.80 | 287.64 | 72.24 | 179.54 | 126.33 | 414.37 | 3913.14 | 5052.07 |
| Total2020 | | 5671.89 | 6406.12 | 150363.67 | 11728.04 | 6186.69 | 6050.36 | 7921.60 | 4972.15 | 199300.51 |

Table S8. Transition matrix of LULC second-degree classes in 2018-2020.

| Second-Degree Class Transition Matrix | | 2020 | | | | | | | | | | | | | | | | | | Total 2018 |
|--|-------|----------------|----------------|----------------|----------------|----------------|------------------|----------------|----------------|----------------|----------------|---------------|----------------|---------------|----------------|----------------|---------------|----------------|----------------|------------------|
| | | BLF | NLF | MF | BLS | NLS | Grass | Marsh | Lake | River | Crop | OL | Urban | UGS | IAT | DL | BS | BR | Snow | |
| 2018 | BLF | 1687.61 | 11.20 | 59.45 | 37.34 | 10.58 | 70.49 | 30.92 | 0.49 | 11.40 | 33.68 | 0.19 | 12.86 | 10.46 | 8.57 | 30.95 | 11.97 | 30.39 | 24.35 | 2082.89 |
| | NLF | 49.68 | 1456.62 | 31.50 | 12.43 | 15.35 | 48.68 | 21.70 | 6.43 | 11.23 | 64.47 | 0.02 | 6.90 | 13.52 | 7.20 | 6.30 | 3.55 | 12.36 | 36.91 | 1804.87 |
| | MF | 37.20 | 6.68 | 1087.62 | 22.35 | 27.27 | 51.32 | 12.49 | 2.16 | 14.39 | 34.69 | 1.19 | 1.93 | 17.96 | 1.19 | 5.27 | 11.03 | 21.88 | 8.38 | 1365.01 |
| | BLS | 117.76 | 60.09 | 11.28 | 3523.83 | 130.28 | 309.08 | 68.13 | 5.02 | 24.06 | 177.40 | 11.72 | 38.09 | 6.22 | 52.10 | 75.68 | 33.65 | 56.38 | 121.51 | 4822.28 |
| | NLS | 10.03 | 121.80 | 21.02 | 129.06 | 1128.44 | 17.75 | 11.01 | 7.00 | 13.01 | 79.43 | 23.18 | 21.00 | 31.00 | 43.02 | 11.38 | 25.69 | 37.61 | 32.78 | 1764.21 |
| | Grass | 267.91 | 76.83 | 61.22 | 344.68 | 106.45 | 148317.88 | 105.69 | 40.64 | 71.18 | 161.27 | 36.57 | 267.45 | 5.62 | 21.37 | 191.16 | 10.86 | 193.89 | 62.49 | 150343.14 |
| | Marsh | 29.53 | 6.00 | 46.29 | 66.92 | 51.19 | 205.11 | 5572.09 | 12.47 | 27.47 | 145.53 | 7.75 | 130.77 | 0.43 | 3.11 | 73.12 | 23.00 | 11.51 | 8.78 | 6421.06 |
| | Lake | 6.01 | 5.01 | 9.39 | 21.01 | 13.01 | 12.80 | 20.30 | 2908.39 | 24.83 | 36.78 | 3.06 | 12.06 | 0.14 | 44.62 | 0.67 | 20.22 | 10.39 | 153.92 | 3302.61 |
| | River | 3.08 | 6.06 | 26.37 | 22.35 | 18.04 | 7.71 | 14.45 | 1.27 | 2160.86 | 28.66 | 1.13 | 7.10 | 0.14 | 6.28 | 2.97 | 11.53 | 47.95 | 37.22 | 2403.17 |
| | Crop | 94.47 | 24.66 | 1.76 | 125.51 | 89.14 | 412.54 | 68.53 | 78.27 | 19.70 | 4440.89 | 9.19 | 147.60 | 94.93 | 144.09 | 127.17 | 44.00 | 11.55 | 85.06 | 6019.07 |
| | OL | 16.82 | 0.02 | 0.77 | 3.04 | 8.67 | 14.30 | 31.19 | 5.00 | 5.06 | 4.35 | 114.13 | 3.41 | 6.76 | 6.15 | 7.00 | 1.33 | | | 228.00 |
| | Urban | 5.59 | 5.00 | 8.11 | 38.68 | 76.34 | 51.89 | 2.79 | 6.62 | 23.92 | 223.83 | 3.46 | 2328.14 | 0.89 | 84.16 | 92.39 | 4.70 | 13.64 | 48.86 | 3019.00 |
| | UGS | 11.34 | 12.00 | 13.14 | 42.00 | 27.01 | 56.71 | 41.91 | 0.14 | 7.15 | 3.29 | 1.60 | 1.30 | 40.23 | 0.05 | | | 28.90 | | 286.79 |
| | IAT | 0.49 | 0.02 | 0.43 | 7.12 | 5.12 | 73.83 | 55.09 | 3.52 | 9.57 | 38.37 | 0.40 | 120.49 | 0.50 | 1972.04 | 30.75 | 11.62 | 69.16 | 46.10 | 2444.62 |
| | DL | 58.01 | 34.07 | 9.11 | 144.75 | 77.04 | 302.02 | 9.32 | 5.73 | 22.81 | 174.38 | 0.04 | 85.09 | | 36.79 | 563.77 | 180.45 | 153.62 | 14.05 | 1871.03 |
| | BS | | | 1.01 | 0.48 | | 45.08 | 12.26 | 1.78 | 11.73 | 112.07 | | 34.15 | | 9.93 | 7.13 | 204.72 | 10.91 | 76.90 | 528.15 |
| | BR | 13.34 | 12.06 | 14.41 | 14.85 | 29.00 | 78.82 | 7.08 | 4.56 | 22.97 | 34.46 | 0.00 | 14.91 | | 21.32 | 343.18 | 189.46 | 4440.42 | 301.69 | 5542.55 |
| | Snow | 11.22 | 2.01 | 8.78 | 28.32 | 8.48 | 287.64 | 23.80 | 31.96 | 16.47 | 172.94 | 6.61 | 84.90 | | 41.43 | 3.41 | 19.78 | 391.18 | 3913.14 | 5052.07 |
| Total 2020 | | 2420.11 | 1840.14 | 1411.65 | 4584.71 | 1821.41 | 150363.67 | 6108.76 | 3121.44 | 2497.83 | 5966.46 | 220.23 | 3318.15 | 228.80 | 2503.41 | 1572.28 | 807.57 | 5541.75 | 4972.15 | 199300.51 |

Table S9. Accuracy comparison (%) of the LULC classification result obtained in this study with the FROM-GLC10 (2017) land cover products in 2018. Same validation points were used to assess the accuracies.

| LULC Types | 2018 LULC Product | | FROM-GLC10 | |
|---------------------------|-------------------|-------|------------|-------|
| | PA(%) | UA(%) | PA(%) | UA(%) |
| Forest | 91.59 | 87.34 | 84.96 | 80.33 |
| Shrubland | 75.27 | 81.39 | 33.33 | 38.75 |
| Grassland | 92.02 | 90.53 | 88.72 | 85.66 |
| Wetland (Marsh) | 90.29 | 94.90 | 63.11 | 54.17 |
| Water Body (River & Lake) | 96.44 | 97.36 | 96.20 | 95.29 |
| Agricultural land | 90.00 | 88.94 | 80.24 | 85.75 |
| Construction land | 81.79 | 86.09 | 76.79 | 83.66 |
| Barren | 88.74 | 88.16 | 84.77 | 81.01 |
| Snow and ice | 93.75 | 92.78 | 86.46 | 90.22 |
| OA(%) | 90.43 | | 83.47 | |
| Kappa Coefficient | 0.89 | | 0.81 | |

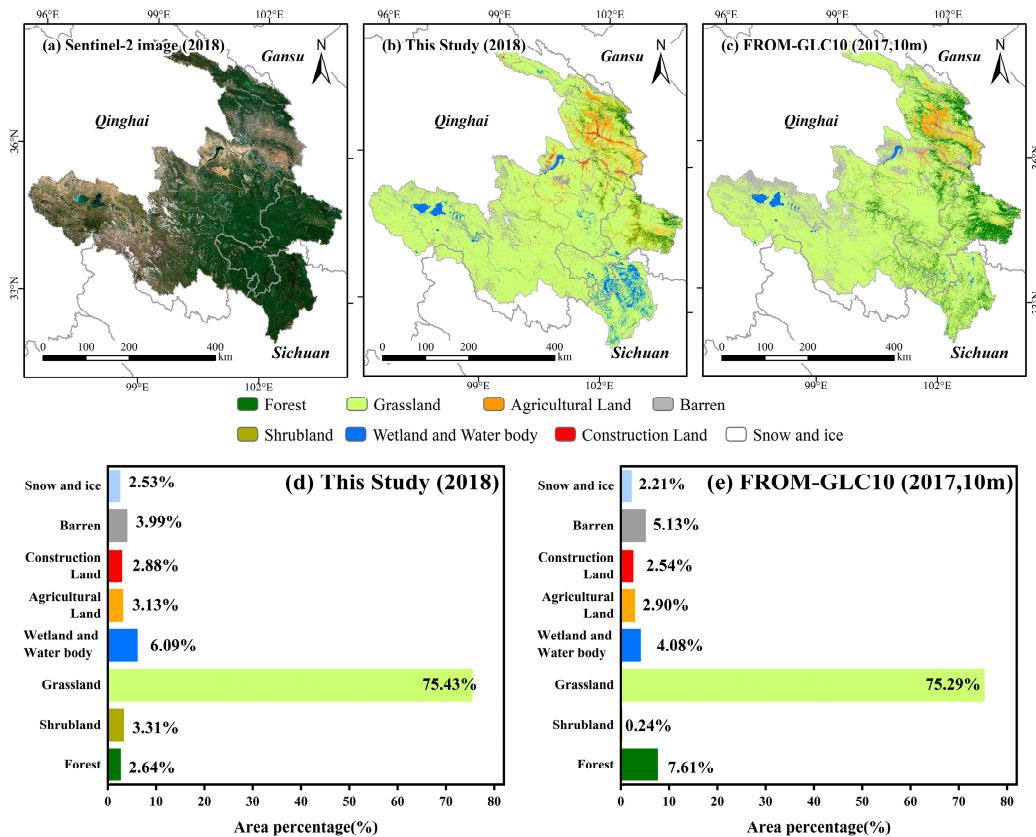


Figure S1. Ratios (%) of different LULC types areas between this study and FROM-GLC10.

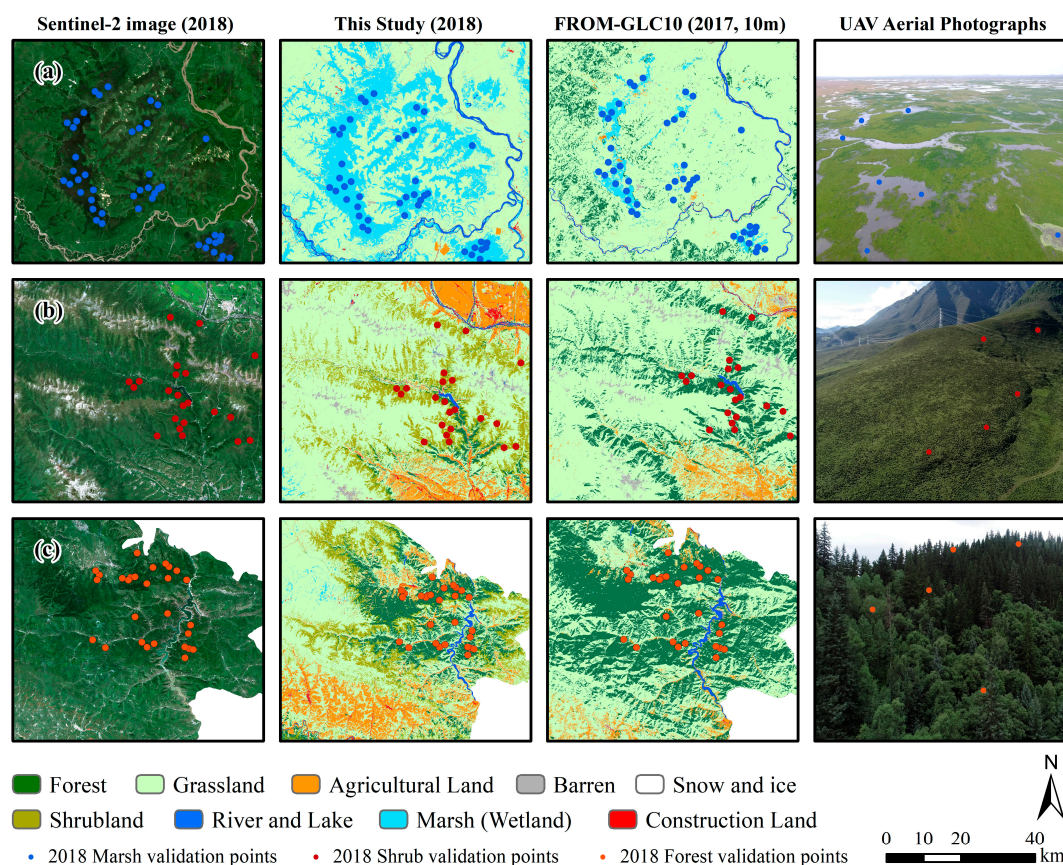


Figure S2. Visual comparison and assessment of this study with Sentinel-2 RGB, FROM-GLC10 products and UAV aerial photographs. Three typical areas were selected for close-ups (a: comparison and validation of marsh (wetland) area, b: comparison and validation of shrub area, c: comparison and validation of forest area).

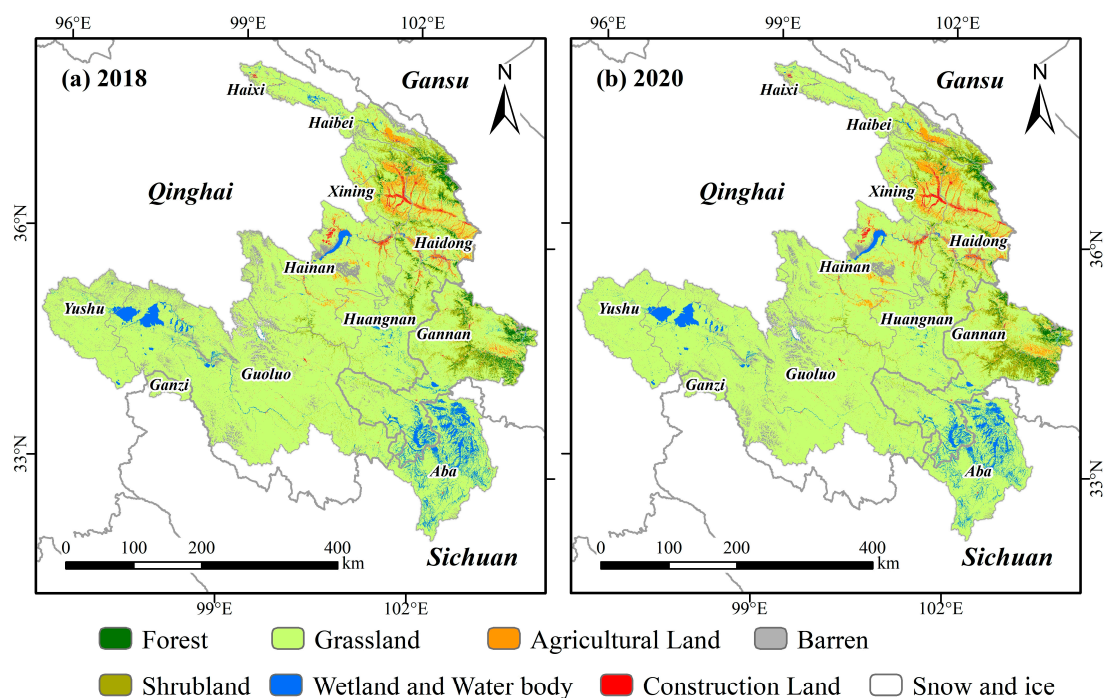


Figure S3. Spatial distribution of LULC first-degree classes in the study area in 2018 (a) and 2020 (b).

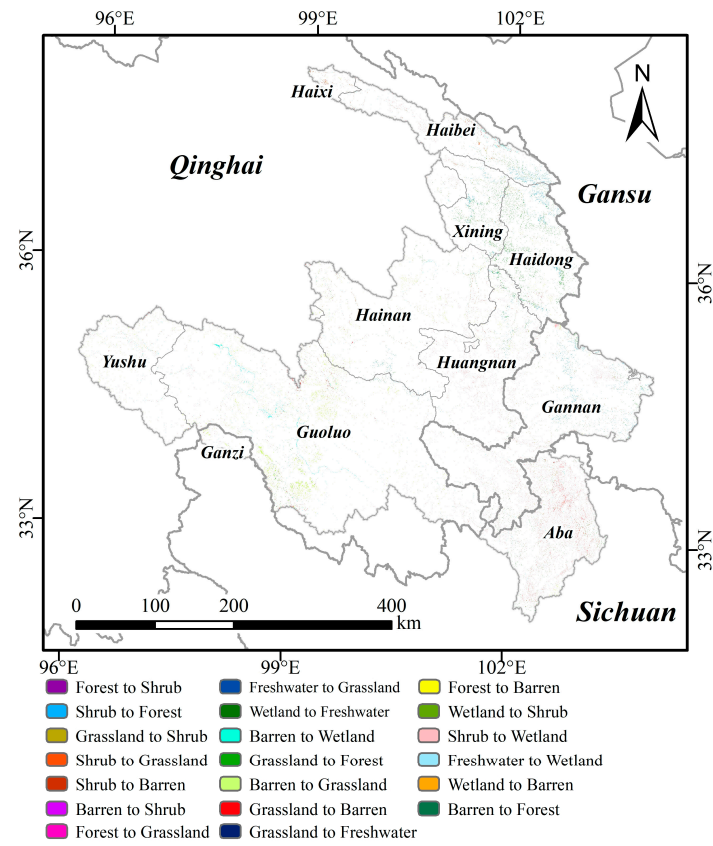


Figure S4. The map of changes in ecosystem types based on LULC types.