Supplementary Material

## Supplementary Tables

**Table S1.** Landsat metadata for 1994 and 2021.

**(A)** Landsat metadata for 1994.

|  |  |  |  |
| --- | --- | --- | --- |
| S/N | LANDSAT\_ID | Date | Time |
| 1 | LT05\_L1TP\_141054\_19940114\_20170116\_01\_T1 | 1994-01-14 | 04:14:55 |
| 2 | LT05\_L1TP\_141054\_19940130\_20170116\_01\_T1 | 1994-01-30 | 04:14:45 |
| 3 | LT05\_L1TP\_141054\_19940404\_20170114\_01\_T1 | 1994-04-04 | 04:13:48 |
| 4 | LT05\_L1TP\_141054\_19940420\_20170115\_01\_T1 | 1994-04-20 | 04:13:30 |
| 5 | LT05\_L1TP\_141054\_19940506\_20170115\_01\_T1 | 1994-05-06 | 04:13:12 |
| 6 | LT05\_L1TP\_141054\_19940522\_20170114\_01\_T1 | 1994-05-22 | 04:12:55 |
| 7 | LT05\_L1TP\_141054\_19940607\_20170113\_01\_T1 | 1994-06-07 | 04:12:37 |
| 8 | LT05\_L1TP\_141054\_19940623\_20170114\_01\_T1 | 1994-06-23 | 04:12:16 |
| 9 | LT05\_L1TP\_141054\_19940709\_20170113\_01\_T1 | 1994-07-09 | 04:11:50 |
| 10 | LT05\_L1TP\_141054\_19940810\_20170113\_01\_T1 | 1994-08-10 | 04:10:57 |
| 11 | LT05\_L1TP\_141054\_19940826\_20170112\_01\_T1 | 1994-08-26 | 04:10:34 |
| 12 | LT05\_L1TP\_141054\_19940911\_20170214\_01\_T1 | 1994-09-11 | 04:10:10 |
| 13 | LT05\_L1TP\_141054\_19940927\_20170112\_01\_T1 | 1994-09-27 | 04:09:44 |
| 14 | LT05\_L1TP\_141054\_19941013\_20170111\_01\_T1 | 1994-10-13 | 04:09:15 |
| 15 | LT05\_L1TP\_141054\_19941029\_20170111\_01\_T1 | 1994-10-29 | 04:08:42 |
| 16 | LT05\_L1TP\_141055\_19940114\_20170115\_01\_T1 | 1994-01-14 | 04:15:19 |
| 17 | LT05\_L1TP\_141055\_19940130\_20170116\_01\_T1 | 1994-01-30 | 04:15:09 |
| 18 | LT05\_L1TP\_141055\_19940404\_20170114\_01\_T1 | 1994-04-04 | 04:14:12 |
| 19 | LT05\_L1TP\_141055\_19940420\_20170114\_01\_T1 | 1994-04-20 | 04:13:54 |
| 20 | LT05\_L1TP\_141055\_19940506\_20170114\_01\_T1 | 1994-05-06 | 04:13:36 |
| 21 | LT05\_L1TP\_141055\_19940522\_20170114\_01\_T1 | 1994-05-22 | 04:13:19 |
| 22 | LT05\_L1TP\_141055\_19940607\_20170113\_01\_T1 | 1994-06-07 | 04:13:01 |
| 23 | LT05\_L1TP\_141055\_19940623\_20170114\_01\_T1 | 1994-06-23 | 04:12:40 |
| 24 | LT05\_L1TP\_141055\_19940709\_20170114\_01\_T1 | 1994-07-09 | 04:12:14 |
| 25 | LT05\_L1TP\_141055\_19940810\_20170113\_01\_T1 | 1994-08-10 | 04:11:21 |
| 26 | LT05\_L1TP\_141055\_19940826\_20170113\_01\_T1 | 1994-08-26 | 04:10:58 |
| 27 | LT05\_L1TP\_141055\_19940911\_20170112\_01\_T1 | 1994-09-11 | 04:10:34 |
| 28 | LT05\_L1TP\_141055\_19940927\_20170112\_01\_T1 | 1994-09-27 | 04:10:08 |
| 29 | LT05\_L1TP\_141055\_19941013\_20170112\_01\_T1 | 1994-10-13 | 04:09:39 |
| 30 | LT05\_L1TP\_141055\_19941029\_20170111\_01\_T1 | 1994-10-29 | 04:09:06 |
| 31 | LT05\_L1TP\_141055\_19941130\_20170110\_01\_T1 | 1994-11-30 | 04:08:02 |
| 32 | LT05\_L1TP\_141055\_19941216\_20170110\_01\_T1 | 1994-12-16 | 04:07:32 |
| 33 | LT05\_L1TP\_142054\_19940630\_20170114\_01\_T1 | 1994-06-30 | 04:18:16 |
| 34 | LT05\_L1TP\_142054\_19940716\_20170114\_01\_T1 | 1994-07-16 | 04:17:49 |
| 35 | LT05\_L1TP\_142054\_19940817\_20170112\_01\_T1 | 1994-08-17 | 04:16:58 |
| 36 | LT05\_L1TP\_142054\_19940918\_20170112\_01\_T1 | 1994-09-18 | 04:16:10 |
| 37 | LT05\_L1TP\_142054\_19941004\_20170112\_01\_T1 | 1994-10-04 | 04:15:43 |
| 38 | LT05\_L1TP\_142054\_19941020\_20170111\_01\_T1 | 1994-10-20 | 04:15:12 |
| 39 | LT05\_L1TP\_142054\_19941121\_20170111\_01\_T1 | 1994-11-21 | 04:14:04 |
| 40 | LT05\_L1TP\_142054\_19941207\_20170110\_01\_T1 | 1994-12-07 | 04:13:36 |
| 41 | LT05\_L1TP\_142054\_19941223\_20170110\_01\_T1 | 1994-12-23 | 04:13:05 |

**(B)** Landsat metadata for 2021.

|  |  |  |  |
| --- | --- | --- | --- |
| S/N | LANDSAT\_ID | Date | Time |
| 1 | LC08\_L1TP\_141053\_20210124\_20210305\_01\_T1 | 2021-01-24 | 04:53:16 |
| 2 | LC08\_L1TP\_141053\_20210209\_20210305\_01\_T1 | 2021-02-09 | 04:53:13 |
| 3 | LC08\_L1TP\_141053\_20210225\_20210304\_01\_T1 | 2021-02-25 | 04:53:08 |
| 4 | LC08\_L1TP\_141053\_20210313\_20210317\_01\_T1 | 2021-03-13 | 04:53:00 |
| 5 | LC08\_L1TP\_141053\_20210329\_20210402\_01\_T1 | 2021-03-29 | 04:52:55 |
| 6 | LC08\_L1TP\_141053\_20210414\_20210424\_01\_T1 | 2021-04-14 | 04:52:49 |
| 7 | LC08\_L1TP\_141053\_20210430\_20210508\_01\_T1 | 2021-04-30 | 04:52:40 |
| 8 | LC08\_L1TP\_141053\_20210516\_20210525\_01\_T1 | 2021-05-16 | 04:52:43 |
| 9 | LC08\_L1TP\_141053\_20210601\_20210608\_01\_T1 | 2021-06-01 | 04:52:52 |
| 10 | LC08\_L1TP\_141053\_20210617\_20210622\_01\_T1 | 2021-06-17 | 04:52:58 |
| 11 | LC08\_L1TP\_141053\_20210703\_20210713\_01\_T1 | 2021-07-03 | 04:53:01 |
| 12 | LC08\_L1TP\_141053\_20210719\_20210729\_01\_T1 | 2021-07-19 | 04:53:04 |
| 13 | LC08\_L1TP\_141053\_20210804\_20210811\_01\_T1 | 2021-08-04 | 04:53:12 |
| 14 | LC08\_L1TP\_141053\_20210820\_20210827\_01\_T1 | 2021-08-20 | 04:53:17 |
| 15 | LC08\_L1TP\_141053\_20210905\_20210910\_01\_T1 | 2021-09-05 | 04:53:22 |
| 16 | LC08\_L1TP\_141053\_20210921\_20210925\_01\_T1 | 2021-09-21 | 04:53:25 |
| 17 | LC08\_L1TP\_141053\_20211007\_20211013\_01\_T1 | 2021-10-07 | 04:53:31 |
| 18 | LC08\_L1TP\_141053\_20211023\_20211103\_01\_T1 | 2021-10-23 | 04:53:33 |
| 19 | LC08\_L1TP\_141053\_20211210\_20211215\_01\_T1 | 2021-12-10 | 04:53:29 |
| 20 | LC08\_L1TP\_141053\_20211226\_20211230\_01\_T1 | 2021-12-26 | 04:53:24 |
| 21 | LC08\_L1TP\_141054\_20210108\_20210307\_01\_T1 | 2021-01-08 | 04:53:45 |
| 22 | LC08\_L1TP\_141054\_20210124\_20210305\_01\_T1 | 2021-01-24 | 04:53:40 |
| 23 | LC08\_L1TP\_141054\_20210209\_20210305\_01\_T1 | 2021-02-09 | 04:53:37 |
| 24 | LC08\_L1TP\_141054\_20210225\_20210304\_01\_T1 | 2021-02-25 | 04:53:32 |
| 25 | LC08\_L1TP\_141054\_20210313\_20210317\_01\_T1 | 2021-03-13 | 04:53:23 |
| 26 | LC08\_L1TP\_141054\_20210329\_20210402\_01\_T1 | 2021-03-29 | 04:53:18 |
| 27 | LC08\_L1TP\_141054\_20210414\_20210424\_01\_T1 | 2021-04-14 | 04:53:13 |
| 28 | LC08\_L1TP\_141054\_20210430\_20210508\_01\_T1 | 2021-04-30 | 04:53:04 |
| 29 | LC08\_L1TP\_141054\_20210516\_20210525\_01\_T1 | 2021-05-16 | 04:53:07 |
| 30 | LC08\_L1TP\_141054\_20210601\_20210608\_01\_T1 | 2021-06-01 | 04:53:16 |
| 31 | LC08\_L1TP\_141054\_20210617\_20210622\_01\_T1 | 2021-06-17 | 04:53:22 |
| 32 | LC08\_L1TP\_141054\_20210703\_20210713\_01\_T1 | 2021-07-03 | 04:53:25 |
| 33 | LC08\_L1TP\_141054\_20210719\_20210729\_01\_T1 | 2021-07-19 | 04:53:28 |
| 34 | LC08\_L1TP\_141054\_20210804\_20210811\_01\_T1 | 2021-08-04 | 04:53:36 |
| 35 | LC08\_L1TP\_141054\_20210820\_20210827\_01\_T1 | 2021-08-20 | 04:53:41 |
| 36 | LC08\_L1TP\_141054\_20210905\_20210910\_01\_T1 | 2021-09-05 | 04:53:46 |
| 37 | LC08\_L1TP\_141054\_20210921\_20210925\_01\_T1 | 2021-09-21 | 04:53:49 |
| 38 | LC08\_L1TP\_141054\_20211007\_20211013\_01\_T1 | 2021-10-07 | 04:53:55 |
| 39 | LC08\_L1TP\_141054\_20211023\_20211103\_01\_T1 | 2021-10-23 | 04:53:57 |
| 40 | LC08\_L1TP\_141054\_20211210\_20211215\_01\_T1 | 2021-12-10 | 04:53:53 |
| 41 | LC08\_L1TP\_141054\_20211226\_20211230\_01\_T1 | 2021-12-26 | 04:53:48 |
| 42 | LC08\_L1TP\_141055\_20210108\_20210307\_01\_T1 | 2021-01-08 | 04:54:09 |
| 43 | LC08\_L1TP\_141055\_20210124\_20210305\_01\_T1 | 2021-01-24 | 04:54:04 |
| 44 | LC08\_L1TP\_141055\_20210209\_20210305\_01\_T1 | 2021-02-09 | 04:54:01 |
| 45 | LC08\_L1TP\_141055\_20210225\_20210304\_01\_T1 | 2021-02-25 | 04:53:56 |
| 46 | LC08\_L1TP\_141055\_20210313\_20210317\_01\_T1 | 2021-03-13 | 04:53:47 |
| 47 | LC08\_L1TP\_141055\_20210329\_20210402\_01\_T1 | 2021-03-29 | 04:53:42 |
| 48 | LC08\_L1TP\_141055\_20210414\_20210424\_01\_T1 | 2021-04-14 | 04:53:37 |
| 49 | LC08\_L1TP\_141055\_20210430\_20210508\_01\_T1 | 2021-04-30 | 04:53:28 |
| 50 | LC08\_L1TP\_141055\_20210516\_20210525\_01\_T1 | 2021-05-16 | 04:53:31 |
| 51 | LC08\_L1TP\_141055\_20210601\_20210608\_01\_T1 | 2021-06-01 | 04:53:40 |
| 52 | LC08\_L1TP\_141055\_20210617\_20210622\_01\_T1 | 2021-06-17 | 04:53:46 |
| 53 | LC08\_L1TP\_141055\_20210703\_20210713\_01\_T1 | 2021-07-03 | 04:53:49 |
| 54 | LC08\_L1TP\_141055\_20210719\_20210729\_01\_T1 | 2021-07-19 | 04:53:52 |
| 55 | LC08\_L1TP\_141055\_20210804\_20210811\_01\_T1 | 2021-08-04 | 04:54:00 |
| 56 | LC08\_L1TP\_141055\_20210820\_20210827\_01\_T1 | 2021-08-20 | 04:54:05 |
| 57 | LC08\_L1TP\_141055\_20210905\_20210910\_01\_T1 | 2021-09-05 | 04:54:10 |
| 58 | LC08\_L1TP\_141055\_20210921\_20210925\_01\_T1 | 2021-09-21 | 04:54:13 |
| 59 | LC08\_L1TP\_141055\_20211007\_20211013\_01\_T1 | 2021-10-07 | 04:54:19 |
| 60 | LC08\_L1TP\_141055\_20211023\_20211103\_01\_T1 | 2021-10-23 | 04:54:21 |
| 61 | LC08\_L1TP\_141055\_20211210\_20211215\_01\_T1 | 2021-12-10 | 04:54:16 |
| 62 | LC08\_L1TP\_141055\_20211226\_20211230\_01\_T1 | 2021-12-26 | 04:54:12 |
| 63 | LC08\_L1TP\_142053\_20210131\_20210306\_01\_T1 | 2021-01-31 | 04:59:26 |
| 64 | LC08\_L1TP\_142053\_20210216\_20210304\_01\_T1 | 2021-02-16 | 04:59:22 |
| 65 | LC08\_L1TP\_142053\_20210304\_20210312\_01\_T1 | 2021-03-04 | 04:59:16 |
| 66 | LC08\_L1TP\_142053\_20210320\_20210328\_01\_T1 | 2021-03-20 | 04:59:07 |
| 67 | LC08\_L1TP\_142053\_20210405\_20210409\_01\_T1 | 2021-04-05 | 04:59:03 |
| 68 | LC08\_L1TP\_142053\_20210421\_20210501\_01\_T1 | 2021-04-21 | 04:58:57 |
| 69 | LC08\_L1TP\_142053\_20210507\_20210517\_01\_T1 | 2021-05-07 | 04:58:47 |
| 70 | LC08\_L1TP\_142053\_20210523\_20210529\_01\_T1 | 2021-05-23 | 04:58:58 |
| 71 | LC08\_L1TP\_142053\_20210608\_20210615\_01\_T1 | 2021-06-08 | 04:59:06 |
| 72 | LC08\_L1TP\_142053\_20210624\_20210630\_01\_T1 | 2021-06-24 | 04:59:11 |
| 73 | LC08\_L1TP\_142053\_20210710\_20210720\_01\_T1 | 2021-07-10 | 04:59:13 |
| 74 | LC08\_L1TP\_142053\_20210726\_20210804\_01\_T1 | 2021-07-26 | 04:59:19 |
| 75 | LC08\_L1TP\_142053\_20210811\_20210819\_01\_T1 | 2021-08-11 | 04:59:25 |
| 76 | LC08\_L1TP\_142053\_20210827\_20210901\_01\_T1 | 2021-08-27 | 04:59:30 |
| 77 | LC08\_L1TP\_142053\_20210912\_20210916\_01\_T1 | 2021-09-12 | 04:59:35 |
| 78 | LC08\_L1TP\_142053\_20210928\_20211001\_01\_T1 | 2021-09-28 | 04:59:38 |
| 79 | LC08\_L1TP\_142053\_20211014\_20211019\_01\_T1 | 2021-10-14 | 04:59:43 |
| 80 | LC08\_L1TP\_142053\_20211115\_20211125\_01\_T1 | 2021-11-15 | 04:59:39 |
| 81 | LC08\_L1TP\_142053\_20211201\_20211208\_01\_T1 | 2021-12-01 | 04:59:40 |
| 82 | LC08\_L1TP\_142053\_20211217\_20211223\_01\_T1 | 2021-12-17 | 04:59:38 |
| 83 | LC08\_L1TP\_142054\_20210131\_20210306\_01\_T1 | 2021-01-31 | 04:59:50 |
| 84 | LC08\_L1TP\_142054\_20210216\_20210304\_01\_T1 | 2021-02-16 | 04:59:46 |
| 85 | LC08\_L1TP\_142054\_20210304\_20210312\_01\_T1 | 2021-03-04 | 04:59:40 |
| 86 | LC08\_L1TP\_142054\_20210320\_20210328\_01\_T1 | 2021-03-20 | 04:59:31 |
| 87 | LC08\_L1TP\_142054\_20210405\_20210409\_01\_T1 | 2021-04-05 | 04:59:27 |
| 88 | LC08\_L1TP\_142054\_20210421\_20210501\_01\_T1 | 2021-04-21 | 04:59:20 |
| 89 | LC08\_L1TP\_142054\_20210507\_20210517\_01\_T1 | 2021-05-07 | 04:59:11 |
| 90 | LC08\_L1TP\_142054\_20210523\_20210529\_01\_T1 | 2021-05-23 | 04:59:22 |
| 91 | LC08\_L1TP\_142054\_20210608\_20210615\_01\_T1 | 2021-06-08 | 04:59:30 |
| 92 | LC08\_L1TP\_142054\_20210624\_20210630\_01\_T1 | 2021-06-24 | 04:59:34 |
| 93 | LC08\_L1TP\_142054\_20210710\_20210720\_01\_T1 | 2021-07-10 | 04:59:36 |
| 94 | LC08\_L1TP\_142054\_20210726\_20210804\_01\_T1 | 2021-07-26 | 04:59:42 |
| 95 | LC08\_L1TP\_142054\_20210811\_20210819\_01\_T1 | 2021-08-11 | 04:59:49 |
| 96 | LC08\_L1TP\_142054\_20210827\_20210901\_01\_T1 | 2021-08-27 | 04:59:54 |
| 97 | LC08\_L1TP\_142054\_20210912\_20210916\_01\_T1 | 2021-09-12 | 04:59:58 |
| 98 | LC08\_L1TP\_142054\_20210928\_20211001\_01\_T1 | 2021-09-28 | 05:00:02 |
| 99 | LC08\_L1TP\_142054\_20211014\_20211019\_01\_T1 | 2021-10-14 | 05:00:07 |
| 100 | LC08\_L1TP\_142054\_20211115\_20211125\_01\_T1 | 2021-11-15 | 05:00:03 |
| 101 | LC08\_L1TP\_142054\_20211201\_20211208\_01\_T1 | 2021-12-01 | 05:00:04 |
| 102 | LC08\_L1TP\_142054\_20211217\_20211223\_01\_T1 | 2021-12-17 | 05:00:02 |

**Table S2.** Error matrix for the classified LULC maps of 1994 and 2021.

**(A)** Error matrix for the classified LULC map of 1994.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | Agriculture | Scrub land | Forest | Other land | Waterbody | Total | User’s Accuracy |
| Agriculture | 100 | 4 | 6 | 6 | 7 | 123 | 81.3 |
| Forest | 8 | 4 | 215 | 2 | 4 | 233 | 92.3 |
| Other land | 7 | 0 | 1 | 25 | 0 | 33 | 75.8 |
| Scrub land | 1 | 26 | 5 | 1 | 2 | 35 | 74.3 |
| Waterbody | 0 | 0 | 10 | 1 | 55 | 66 | 83.3 |
| Total | 116 | 34 | 237 | 35 | 68 | 490 |   |
| Producer’s accuracy (%) | 86.2 | 76.5 | 90.7 | 71.4 | 80.9 |   |   |
|   |   |   |   |   | Overall Accuracy (%) | 85.9 |

 **(B)** Error matrix for the classified LULC map of 2021.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2021 | Agriculture | Scrub land | Forest | Other land | Waterbody | Total | User’s Accuracy |
| Agriculture | 140 | 4 | 4 | 3 | 7 | 158 | 88.6 |
| Forest | 8 | 4 | 170 | 2 | 4 | 188 | 90.4 |
| Other land | 7 | 0 | 1 | 30 | 0 | 38 | 78.9 |
| Scrub land | 1 | 55 | 2 | 1 | 2 | 61 | 90.2 |
| Waterbody | 0 | 0 | 6 | 1 | 50 | 57 | 87.7 |
| Total | 156 | 63 | 183 | 37 | 63 | 502 |   |
| Producer’s accuracy (%) | 89.7 | 87.3 | 92.9 | 81.1 | 79.4 |   |   |
|   |   |   |   |   | Overall Accuracy (%) | 88.6 |

## Supplementary Figures



**Fig. S1** GIS-based concentric rings from the centre of the study area and four quadrants to extract multidirectional LULC to analyse LULC change.