remote sensing

MDPI

Correction

Correction: Xiong et al. Probabilistic Tracking of Annual Cropland Changes over Large, Complex Agricultural Landscapes Using Google Earth Engine. *Remote Sens.* 2022, *14*, 4896

Sitian Xiong [1,†], Priscilla Baltezar [1,2,*,†], Morgan A. Crowley [3], Michael Cecil [1], Stefano C. Crema [4], Eli Baldwin [1], Jeffrey A. Cardille [3,5] and Lyndon Estes [1]

1 Graduate School of Geography, Clark University, Worcester, MA 01610, USA; sxiong@clarku.edu (S.X.); mcecil@clarku.edu (M.C.); edddyq@gmail.com (E.B.); lestes@clarku.edu (L.E.)
2 Department of Geography, College of the Social Sciences, University of California, Los Angeles, CA 90095, USA
3 Department of Natural Resource Sciences, McGill University, Sainte-Anne-de-Bellevue, QC H9X 3V9, Canada; morgan.crowley@mail.mcgill.ca (M.A.C.); jeffrey.cardille@mcgill.ca (J.A.C.)
4 Clark Labs, Clark University, Worcester, MA 01610, USA; screma@clarku.edu
5 Bieler School of Environment, McGill University, Montréal, QC H3A 2A7, Canada
* Correspondence: pbaltezar@g.ucla.edu
† These authors contributed equally to this article.

References Correction

In the original publication [1], the reference list provided at the end is incorrect, refs. [48,84] should be removed. Therefore, we are replacing the reference list at the end, while the reference numbers in the text remain largely unaffected, except for the last sentence of Section 4.6, which the online version says "[103–106]", but it should be "[103,104]". The replaced reference list is attached below.

Text Correction

In the original publication, under Section 2.2.1, we reported an accuracy of "81", which should be 81%.

References List

In the original publication, the reference list provided at the end is incorrect. Therefore, we are replacing the reference list at the end. References [16–22,48–57,59–72,75–104] have been modified:

16. Burke, M.; Driscoll, A.; Lobell, D.B.; Ermon, S. Using Satellite Imagery to Understand and Promote Sustainable Development. *Science* **2021**, *371*, eabe8628.
17. Zhu, Z.; Wulder, M.A.; Roy, D.P.; Woodcock, C.E.; Hansen, M.C.; Radeloff, V.C.; Healey, S.P.; Schaaf, C.; Hostert, P.; Strobl, P.; et al. Benefits of the Free and Open Landsat Data Policy. *Remote Sens. Environ.* **2019**, *224*, 382–385. https://doi.org/10.1016/j.rse.2019.02.016.
18. Fu, W.; Ma, J.; Chen, P.; Chen, F. Remote Sensing Satellites for Digital Earth. In *Manual of Digital Earth*; Springer: Singapore, 2020; pp. 55–123.
19. Xu, Y.; Yu, L.; Zhao, F.R.; Cai, X.; Zhao, J.; Lu, H.; Gong, P. Tracking Annual Cropland Changes from 1984 to 2016 Using Time-Series Landsat Images with a Change-Detection and Post-Classification Approach: Experiments from Three Sites in Africa. *Remote Sens. Environ.* **2018**, *218*, 13–31.
20. Jain, M.; Mondal, P.; DeFries, R.S.; Small, C.; Galford, G.L. Mapping Cropping Intensity of Smallholder Farms: A Comparison of Methods Using Multiple Sensors. *Remote Sens. Environ.* **2013**, *134*, 210–223. https://doi.org/10.1016/j.rse.2013.02.029.
21. Lobell, D.B. The Use of Satellite Data for Crop Yield Gap Analysis. *Field Crops Res.* **2013**, *143*, 56–64.

check for updates

Citation: Xiong, S.; Baltezar, P.; Crowley, M.A.; Cecil, M.; Crema, S.C.; Baldwin, E.; Cardille, J.A.; Estes, L. Correction: Xiong et al. Probabilistic Tracking of Annual Cropland Changes over Large, Complex Agricultural Landscapes Using Google Earth Engine. *Remote Sens.* 2022, *14*, 4896. *Remote Sens.* **2023**, *15*, 4692. https://doi.org/10.3390/rs15194692

Received: 27 July 2023
Accepted: 1 August 2023
Published: 25 September 2023

22. Fritz, S.; See, L.; McCallum, I.; Schill, C.; Obersteiner, M.; Van der Velde, M.; Boettcher, H.; Havlík, P.; Achard, F. Highlighting Continued Uncertainty in Global Land Cover Maps for the User Community. *Environ. Res. Lett.* **2011**, *6*, 044005.
48. Roy, D.P.; Kovalskyy, V.; Zhang, H.K.; Vermote, E.F.; Yan, L.; Kumar, S.S.; Egorov, A. Characterization of Landsat-7 to Landsat-8 Reflective Wavelength and Normalized Difference Vegetation Index Continuity. *Remote Sens. Environ.* **2016**, *185*, 57–70.
49. Sarvia, F.; De Petris, S.; Borgogno-Mondino, E. Mapping Ecological Focus Areas within the EU CAP Controls Framework by Copernicus Sentinel-2 Data. *Agronomy* **2022**, *12*, 406. https://doi.org/10.3390/agronomy12020406.
50. Jayne, T.S.; Chamberlin, J.; Traub, L.; Sitko, N.; Muyanga, M.; Yeboah, F.K.; Anseeuw, W.; Chapoto, A.; Wineman, A.; Nkonde, C.; et al. Africa's Changing Farm Size Distribution Patterns: The Rise of Medium-scale Farms. *Agric. Econ.* **2016**, *47*, 197–214. https://doi.org/10.1111/agec.12308.
51. Xiong, J.; Thenkabail, P.; Tilton, J.; Gumma, M.; Teluguntla, P.; Oliphant, A.; Congalton, R.; Yadav, K.; Gorelick, N. Nominal 30-m Cropland Extent Map of Continental Africa by Integrating Pixel-Based and Object-Based Algorithms Using Sentinel-2 and Landsat-8 Data on Google Earth Engine. *Remote Sens.* **2017**, *9*, 1065. https://doi.org/10.3390/rs9101065.
52. Chikowo, R. Zambia—Global Yield Gap Atlas. Available online: https://www.yieldgap.org/zambia (accessed on 26 March 2022).
53. Esterhuizen, Dirk Zambia: Agricultural Economic Fact Sheet. Available online: https://www.fas.usda.gov/data/zambia-agricultural-economic-fact-sheet (accessed on 27 March 2022).
54. FAO. The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets by Food and Agriculture Organization of the United Nations. Available online: https://www.scribd.com/book/470301196/The-State-of-Food-Security-and-Nutrition-in-the-World-2020-Transforming-Food-Systems-for-Affordable-Healthy-Diets?utm_medium=cpc&utm_source=google_search&utm_campaign=3Q_Google_DSA_NB_RoW&utm_device=c&gclid=Cj0KCQjw8_qRBhCXARIsAE2AtRZPzJnrjGz9rAtlS_9BsDxIuyjM4euBqSU1q_ZWk9Rww7pPAtJQg2AaAnOYEALw_wcB (accessed on 26 March 2022).
55. Zulu, Peter Country Presentation on Agricultural Policy—Zambia Second National Agricultural Policy (Snap) N.D. Available online: https://www.wto.org/english/tratop_e/agric_e/presentation_zambia.pdf (accessed on 14 September 2022).
56. Xiong, J.; Thenkabail, P.S.; Tilton, J.C.; Gumma, M.K.; Teluguntla, P.; Congalton, R.G.; Yadav, K.; Dungan, J.; Oliphant, A.J.; Poehnelt, J. *NASA Making Earth System Data Records for Use in Research Environments (MEaSUREs) Global Food Security-Support Analysis Data (GFSAD) Cropland Extent 2015 Africa 30 m V001 [Data Set]*; NASA EOSDIS Land Processes DAAC: Sioux Falls, SD, USA, 2017.
57. Engebretson, C. *Landsat 8 (L8) Level 1 (L1) Data Format Control Book (DFCB)*; USGA: Liberty Corner, NJ, USA, 2017.
59. Engebretson, C. *Landsat Thematic Mapper (TM) Level 1 (L1) Data Format Control Book (DFCB)*; USGA: Liberty Corner, NJ, USA, 2018.
60. Li, J.; Roy, D.P. A Global Analysis of Sentinel-2A, Sentinel-2B and Landsat-8 Data Revisit Intervals and Implications for Terrestrial Monitoring. *Remote Sens.* **2017**, *9*, 902.
61. Kovalskyy, V.; Roy, D.P. The Global Availability of Landsat 5 TM and Landsat 7 ETM+ Land Surface Observations and Implications for Global 30 m Landsat Data Product Generation. *Remote Sens. Environ.* **2013**, *130*, 280–293.
62. Kennedy, R.E.; Yang, Z.; Gorelick, N.; Braaten, J.; Cavalcante, L.; Cohen, W.B.; Healey, S. Implementation of the LandTrendr Algorithm on Google Earth Engine. *Remote Sens.* **2018**, *10*, 691. https://doi.org/10.3390/rs10050691.
63. Flood, N. Seasonal Composite Landsat TM/ETM+ Images Using the Medoid (a Multi-Dimensional Median). *Remote Sens.* **2013**, *5*, 6481–6500. https://doi.org/10.3390/rs5126481.

64. Kennedy, R.E.; Yang, Z.; Cohen, W.B. Detecting Trends in Forest Disturbance and Recovery Using Yearly Landsat Time Series: 1. LandTrendr—Temporal Segmentation Algorithms. *Remote Sens. Environ.* **2010**, *114*, 2897–2910.
65. Rosenqvist, A.; Shimada, M.; Ito, N.; Watanabe, M. ALOS PALSAR: A Pathfinder Mission for Global-Scale Monitoring of the Environment. *IEEE Trans. Geosci. Remote Sens.* **2007**, *45*, 3307–3316.
66. Shimada, M.; Itoh, T.; Motooka, T.; Watanabe, M.; Shiraishi, T.; Thapa, R.; Lucas, R. New Global Forest/Non-Forest Maps from ALOS PALSAR Data (2007–2010). *Remote Sens. Environ.* **2014**, *155*, 13–31.
67. Yang, L.; Meng, X.; Zhang, X. SRTM DEM and Its Application Advances. *Int. J. Remote Sens.* **2011**, *32*, 3875–3896.
68. Filipponi, F. Sentinel-1 GRD Preprocessing Workflow. *Proceedings* **2019**, *18*, 11. https://doi.org/10.3390/ECRS-3-06201.
69. Veloso, A.; Mermoz, S.; Bouvet, A.; Le Toan, T.; Planells, M.; Dejoux, J.-F.; Ceschia, E. Understanding the Temporal Behavior of Crops Using Sentinel-1 and Sentinel-2-like Data for Agricultural Applications. *Remote Sens. Environ.* **2017**, *199*, 415–426.
70. Kankaku, Y.; Suzuki, S.; Osawa, Y. ALOS-2 Mission and Development Status. In Proceedings of the 2013 IEEE International Geoscience and Remote Sensing Symposium—IGARSS, Melbourne, Australia, 21–26 July 2013; pp. 2396–2399.
71. Kankaku, Y.; Sagisaka, M.; Suzuki, S. PALSAR-2 Launch and Early Orbit Status. In Proceedings of the 2014 IEEE Geoscience and Remote Sensing Symposium, Quebec City, QC, Canada, 13–18 July 2014; IEEE: New York, NY, USA, 2014; pp. 3410–3412.
72. Panetti, A.; Rostan, F.; L'Abbate, M.; Bruno, C.; Bauleo, A.; Catalano, T.; Cotogni, M.; Galvagni, L.; Pietropaolo, A.; Taini, G. Copernicus Sentinel-1 Satellite and C-SAR Instrument. In Proceedings of the 2014 IEEE Geoscience and Remote Sensing Symposium, Quebec City, QC, Canada, 13–18 July 2014; IEEE: New York, NY, USA, 2014; pp. 1461–1464.
75. Blaschke, T. Object Based Image Analysis for Remote Sensing. *ISPRS J. Photogramm. Remote Sens.* **2010**, *65*, 2–16. https://doi.org/10.1016/j.isprsjprs.2009.06.004.
76. Csillik, O.; Belgiu, M. Cropland Mapping from Sentinel-2 Time Series Data Using Object-Based Image Analysis. *Environ. Sci.* **2017**, *5*, 3668893.
77. Tamiminia, H.; Salehi, B.; Mahdianpari, M.; Quackenbush, L.; Adeli, S.; Brisco, B. Google Earth Engine for Geo-Big Data Applications: A Meta-Analysis and Systematic Review. *ISPRS J. Photogramm. Remote Sens.* **2020**, *164*, 152–170. https://doi.org/10.1016/j.isprsjprs.2020.04.001.
78. Arthur, D.; Vassilvitskii, S. K-Means++: The Advantages of Careful Seeding. Available online: https://scholar.google.com/scholar?cluster=2144230331745853648&hl=en&as_sdt=0,5 (accessed on 17 August 2022).
79. Ye, S.; Rogan, J.; Sangermano, F. Monitoring Rubber Plantation Expansion Using Landsat Data Time Series and a Shapelet-Based Approach. *ISPRS J. Photogramm. Remote Sens.* **2018**, *136*, 134–143. https://doi.org/10.1016/j.isprsjprs.2018.01.002.
80. Ye, L.; Keogh, E. Time Series Shapelets: A New Primitive for Data Mining. In Proceedings of the 15th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, Paris, France, 28 June–1 July 2009; pp. 947–956.
81. Zakaria, J.; Mueen, A.; Keogh, E. Clustering Time Series Using Unsupervised-Shapelets. In Proceedings of the 2012 IEEE 12th International Conference on Data Mining, Brussels, Belgium, 10–13 December 2012; IEEE: New York, NY, USA, 2012; pp. 785–794.
82. Papagiannopoulou, C.; Miralles, D.; Depoorter, M.; Verhoest, N.E.; Dorigo, W.; Waegeman, W. Discovering Relationships in Climate-Vegetation Dynamics Using Satellite Data. In Proceedings of the AALTD 2016: Second ECML/PKDD International Workshop on Advanced Analytics and Learning on Temporal Data, Riva del Garda, Italy, 19–23 September 2016; p. 46.

83. Grabocka, J.; Schilling, N.; Wistuba, M.; Schmidt-Thieme, L. Learning Time-Series Shapelets. In Proceedings of the 20th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, New York, NY, USA, 24–27 August 2014; pp. 392–401.
84. Hills, J.; Lines, J.; Baranauskas, E.; Mapp, J.; Bagnall, A. Classification of Time Series by Shapelet Transformation. *Data Min. Knowl. Discov.* **2014**, *28*, 851–881.
85. Olofsson, P.; Foody, G.M.; Herold, M.; Stehman, S.V.; Woodcock, C.E.; Wulder, M.A. Good Practices for Estimating Area and Assessing Accuracy of Land Change. *Remote Sens. Environ.* **2014**, *148*, 42–57. https://doi.org/10.1016/j.rse.2014.02.015.
86. Bey, A.; Sánchez-Paus Díaz, A.; Maniatis, D.; Marchi, G.; Mollicone, D.; Ricci, S.; Bastin, J.-F.; Moore, R.; Federici, S.; Rezende, M.; et al. Collect Earth: Land Use and Land Cover Assessment through Augmented Visual Interpretation. *Remote Sens.* **2016**, *8*, 807. https://doi.org/10.3390/rs8100807.
87. Lisle, R.J. Google Earth: A New Geological Resource. *Geol. Today* **2006**, *22*, 29–32.
88. Zambia FAO STAT—Land Use and Agricultural Inputs—Zambia Data Portal. Available online: https://zambia.opendataforafrica.org/yuyskrf/zambia-fao-stat-land-use-and-agricultural-inputs (accessed on 22 August 2022).
89. Potapov, P.; Turubanova, S.; Hansen, M.C.; Tyukavina, A.; Zalles, V.; Khan, A.; Song, X.-P.; Pickens, A.; Shen, Q.; Cortez, J. Global Maps of Cropland Extent and Change Show Accelerated Cropland Expansion in the Twenty-First Century. *Nat. Food* **2022**, *3*, 19–28. https://doi.org/10.1038/s43016-021-00429-z.
90. Azzali, S. *General Features of Agriculture in Zambia*; ICW: Glasgow, Scotland, 1987.
91. De Bernardis, C.; Vicente-Guijalba, F.; Martinez-Marin, T.; Lopez-Sanchez, J.M. Contribution to Real-Time Estimation of Crop Phenological States in a Dynamical Framework Based on NDVI Time Series: Data Fusion with SAR and Temperature. *IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens.* **2016**, *9*, 3512–3523.
92. Debats, S.R.; Luo, D.; Estes, L.D.; Fuchs, T.J.; Caylor, K.K. A Generalized Computer Vision Approach to Mapping Crop Fields in Heterogeneous Agricultural Landscapes. *Remote Sens. Environ.* **2016**, *179*, 210–221. https://doi.org/10.1016/j.rse.2016.03.010.
93. Motohka, T.; Nasahara, K.N.; Miyata, A.; Mano, M.; Tsuchida, S. Evaluation of Optical Satellite Remote Sensing for Rice Paddy Phenology in Monsoon Asia Using a Continuous in Situ Dataset. *Int. J. Remote Sens.* **2009**, *30*, 4343–4357. https://doi.org/10.1080/01431160802549369.
94. Lesiv, M.; Laso Bayas, J.C.; See, L.; Duerauer, M.; Dahlia, D.; Durando, N.; Hazarika, R.; Kumar Sahariah, P.; Vakolyuk, M.; Blyshchyk, V.; et al. Estimating the Global Distribution of Field Size Using Crowdsourcing. *Glob. Change Biol.* **2019**, *25*, 174–186. https://doi.org/10.1111/gcb.14492.
95. Jin, Z.; Azzari, G.; You, C.; Di Tommaso, S.; Aston, S.; Burke, M.; Lobell, D.B. Smallholder Maize Area and Yield Mapping at National Scales with Google Earth Engine. *Remote Sens. Environ.* **2019**, *228*, 115–128. https://doi.org/10.1016/j.rse.2019.04.016.
96. Wang, S.; Chen, W.; Xie, S.M.; Azzari, G.; Lobell, D.B. Weakly Supervised Deep Learning for Segmentation of Remote Sensing Imagery. *Remote Sens.* **2020**, *12*, 207. https://doi.org/10.3390/rs12020207.
97. Kerner, H.; Tseng, G.; Becker-Reshef, I.; Nakalembe, C.; Barker, B.; Munshell, B.; Paliyam, M.; Hosseini, M. Rapid Response Crop Maps in Data Sparse Regions. *arXiv* **2020**, arXiv:2006.16866.
98. Song, C.; Woodcock, C.E.; Seto, K.C.; Lenney, M.P.; Macomber, S.A. Classification and Change Detection Using Landsat TM Data: When and How to Correct Atmospheric Effects? *Remote Sens. Environ.* **2001**, *75*, 230–244. https://doi.org/10.1016/S0034-4257(00)00169-3.
99. Hansen, M.C.; Loveland, T.R. A Review of Large Area Monitoring of Land Cover Change Using Landsat Data. *Remote Sens. Environ.* **2012**, *122*, 66–74. https://doi.org/10.1016/j.rse.2011.08.024.

100. Schmidt, G.L.; Jenkerson, C.; Masek, J.G.; Vermote, E.; Gao, F. *Landsat Ecosystem Disturbance Adaptive Processing System (LEDAPS) Algorithm Description*; U.S. Geological Survey: Sioux Falls, SD, USA, 2013.
101. Elmes, A.; Alemohammad, H.; Avery, R.; Caylor, K.; Eastman, J.R.; Fishgold, L.; Friedl, M.A.; Jain, M.; Kohli, D.; Laso Bayas, J.C. Accounting for Training Data Error in Machine Learning Applied to Earth Observations. *Remote Sens.* **2020**, *12*, 1034.
102. Azzari, G.; Jain, S.; Jeffries, G.; Kilic, T.; Murray, S. Understanding the Requirements for Surveys to Support Satellite-Based Crop Type Mapping. 2021. Available online: https://openknowledge.worldbank.org/handle/10986/35404 (accessed on 17 August 2022).
103. Ye, S.; Rogan, J.; Zhu, Z.; Eastman, J.R. A Near-Real-Time Approach for Monitoring Forest Disturbance Using Landsat Time Series: Stochastic Continuous Change Detection. *Remote Sens. Environ.* **2021**, *252*, 112167. https://doi.org/10.1016/j.rse.2020.112167.
104. Zhu, Z.; Woodcock, C.E. Continuous Change Detection and Classification of Land Cover Using All Available Landsat Data. *Remote Sens. Environ.* **2014**, *144*, 152–171. https://doi.org/10.1016/j.rse.2014.01.011.

Reference

1. Xiong, S.; Baltezar, P.; Crowley, M.A.; Cecil, M.; Crema, S.C.; Baldwin, E.; Cardille, J.A.; Estes, L. Correction: Xiong et al. Probabilistic Tracking of Annual Cropland Changes over Large, Complex Agricultural Landscapes Using Google Earth Engine. *Remote Sens.* **2022**, *14*, 4896. [CrossRef]