

# Assessing Multiple Kinds of Agricultural Land-Cover Change in Egypt Using LandTrendr

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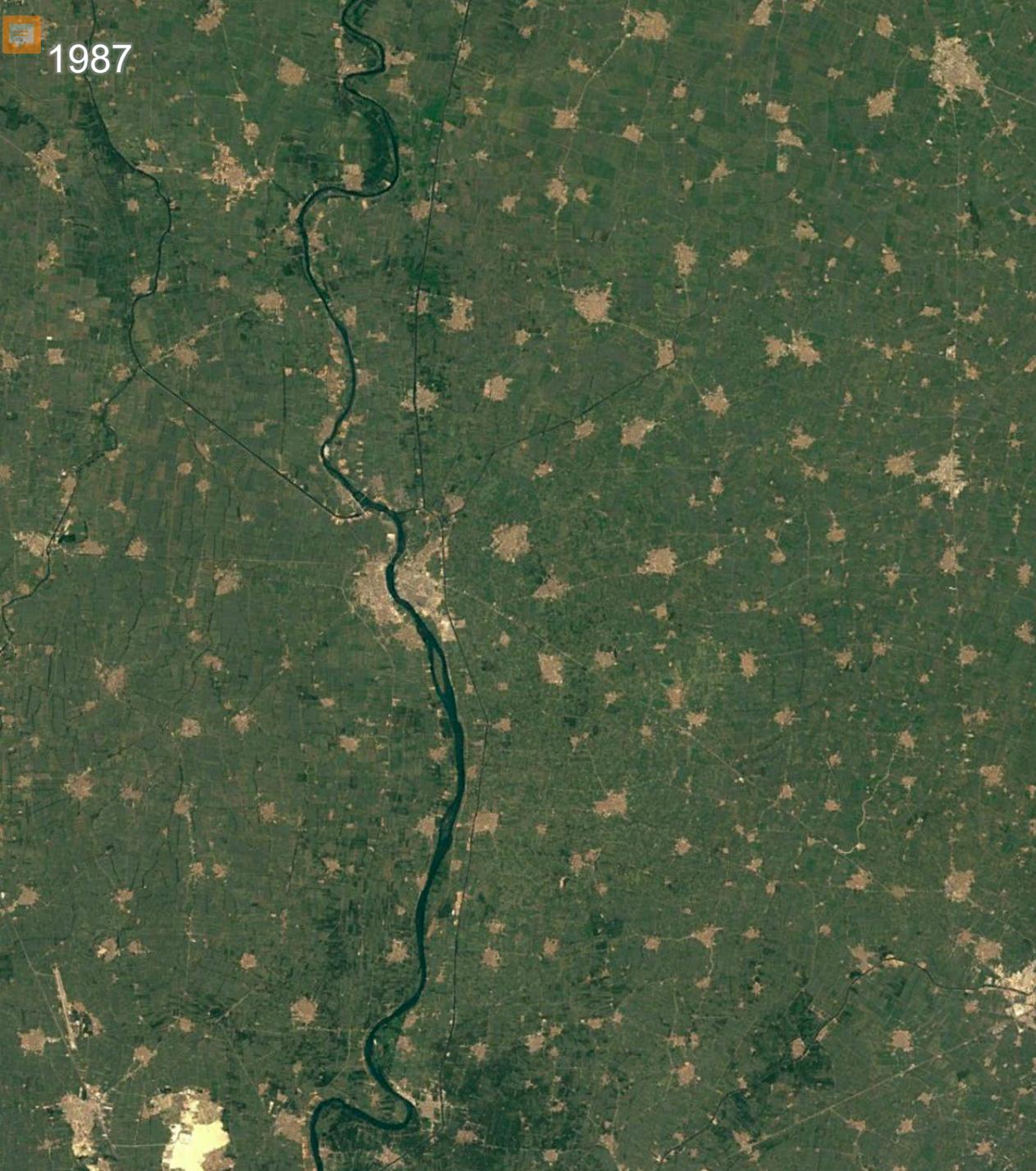


# ***Egypt's Limited Supply of Agricultural Land***

*(Photo by the International Space Station via Wikimedia Commons)*



1987



2019





# Overall Goal

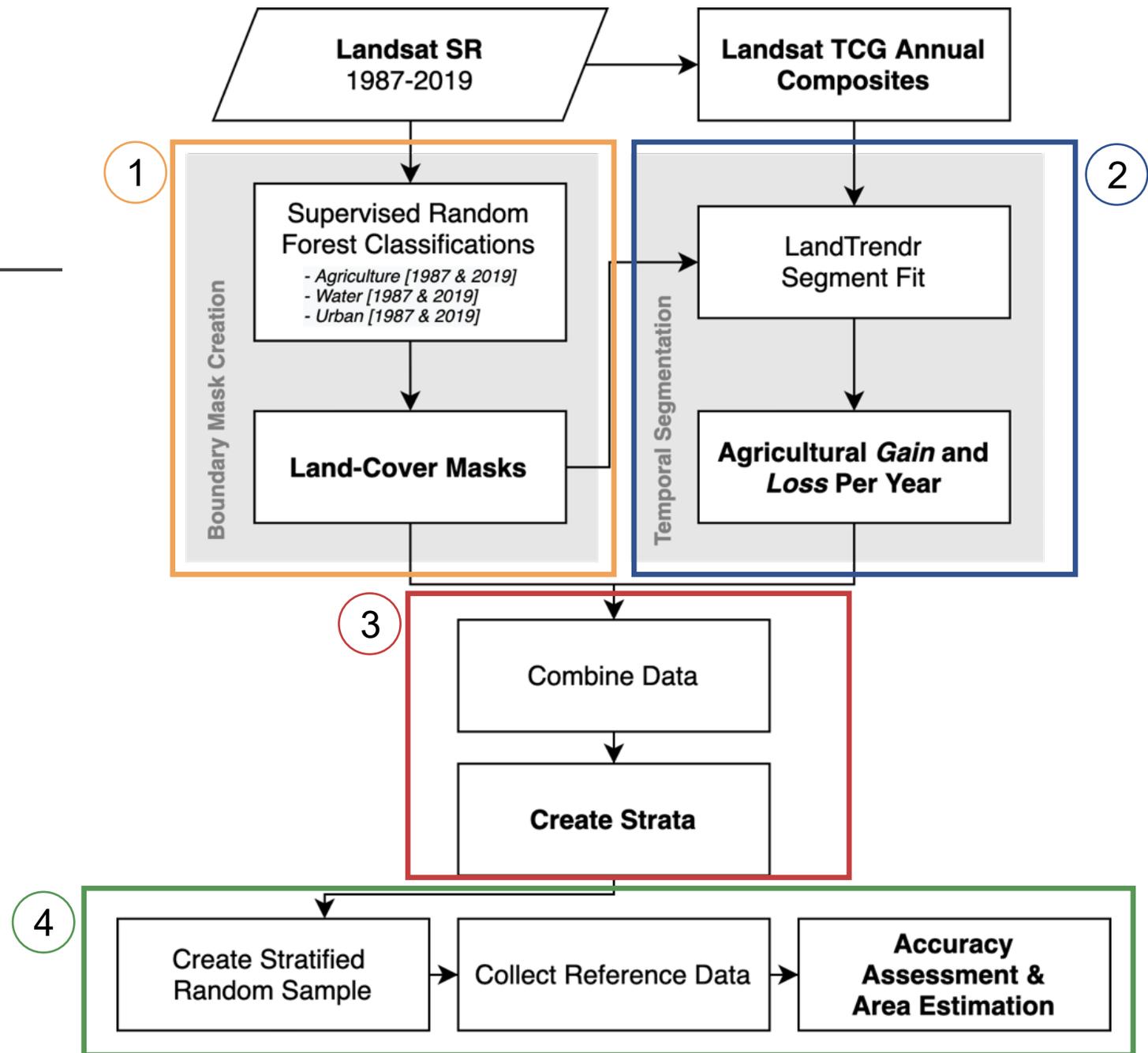
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Test an approach for mapping multiple kinds of agricultural land-cover change—gain from agricultural expansion and loss from urban growth and crop decommissioning — using the Landsat-based detection of trends in disturbance and recovery (LandTrendr) time series segment-based approach.



# Methods Overview

1. Create boundary masks
2. Apply the LandTrendr algorithm
3. Postprocessing
4. Accuracy assessment





Create Masks



LandTrendr  
*Agricultural Gain & Loss*



Post Processing



Accuracy Assessment



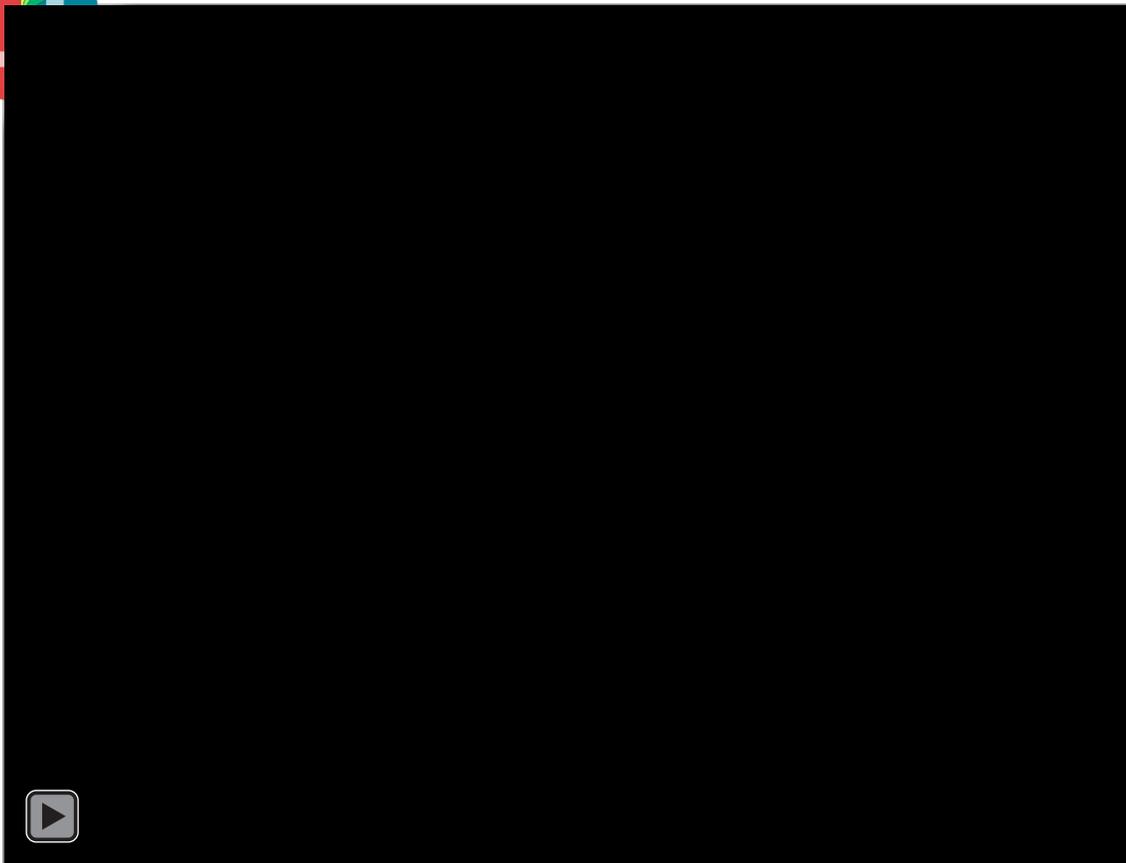
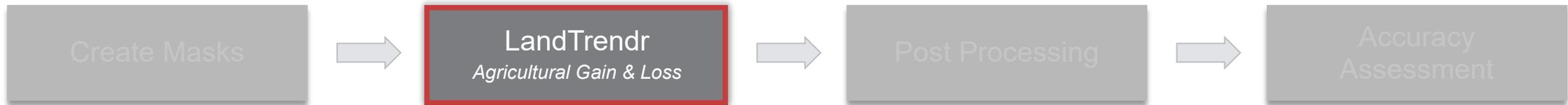
**Agriculture 1987 & 2019**



**Water 1987 & 2019**

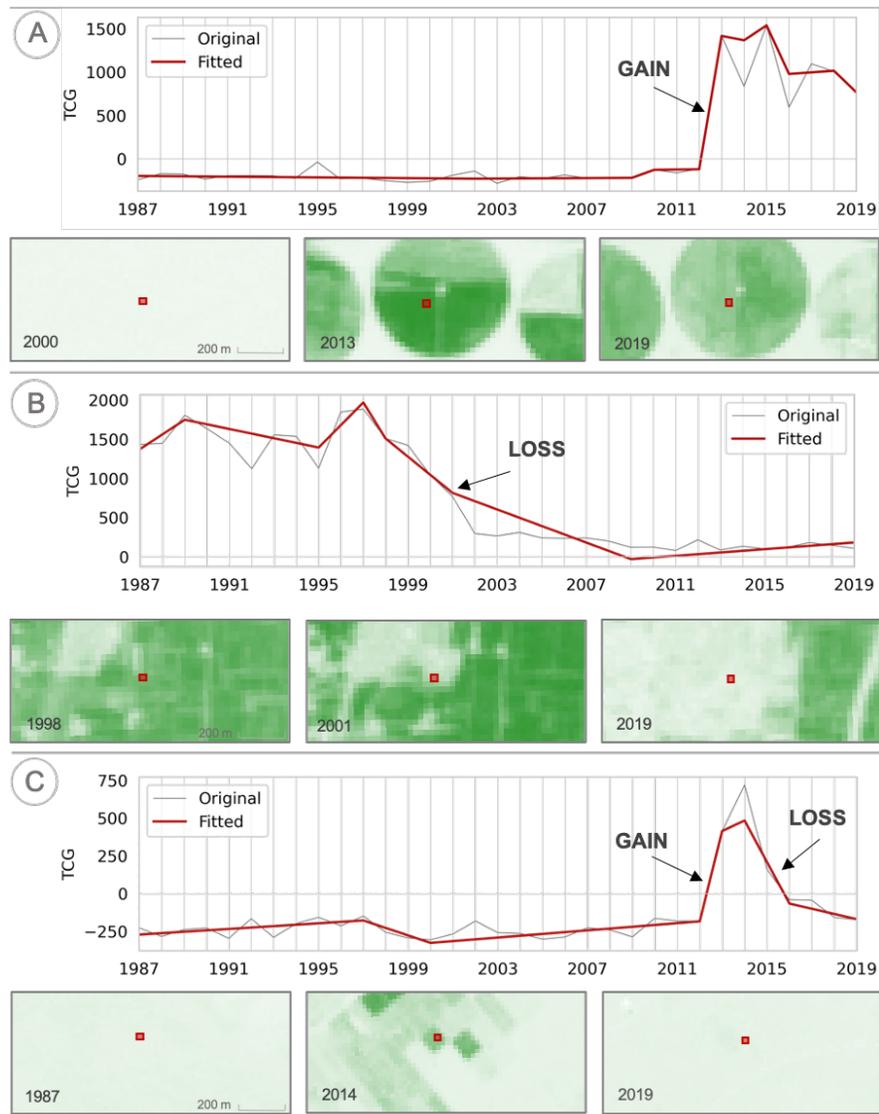


**Urban 1987 & 2019**

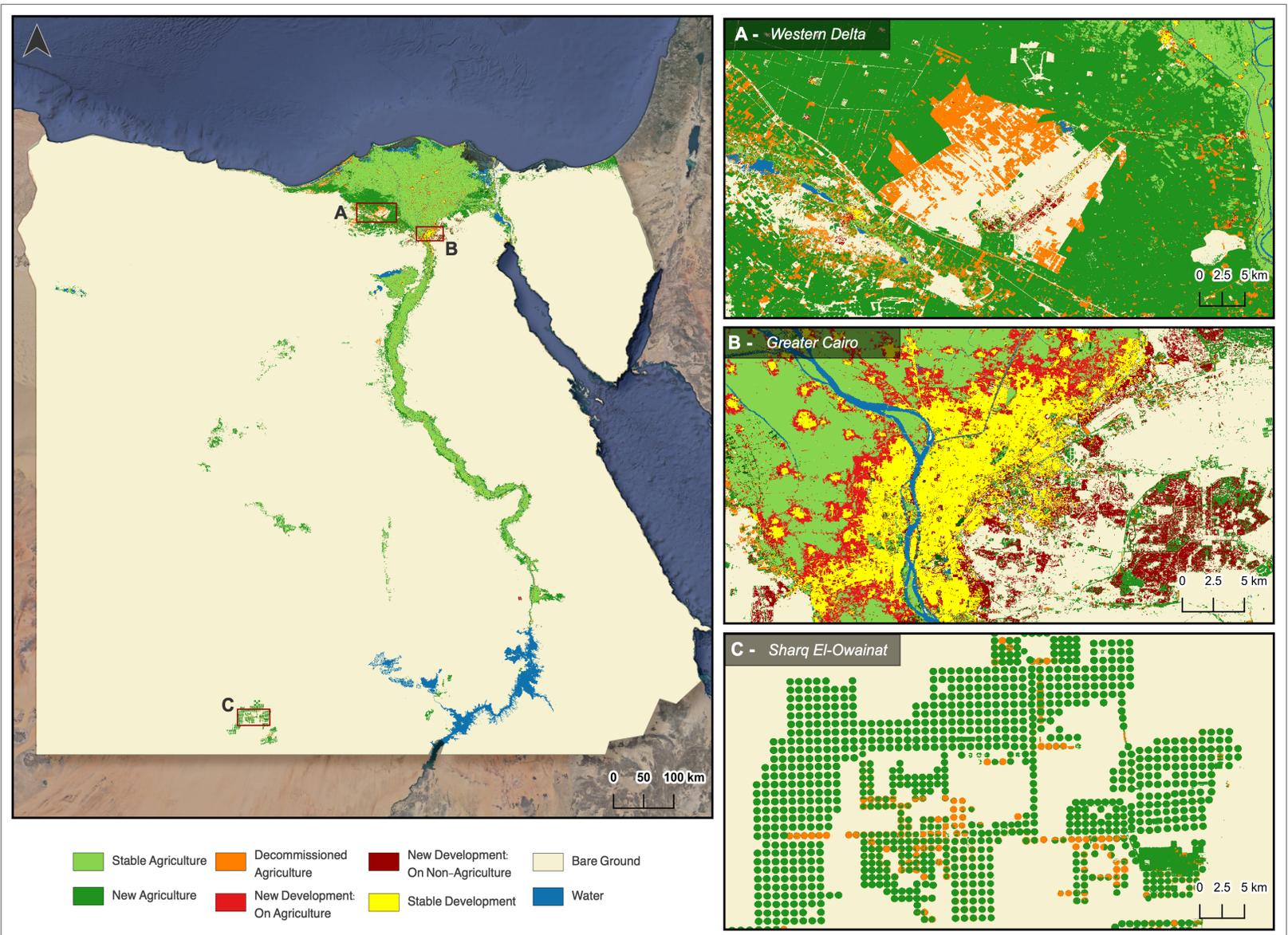
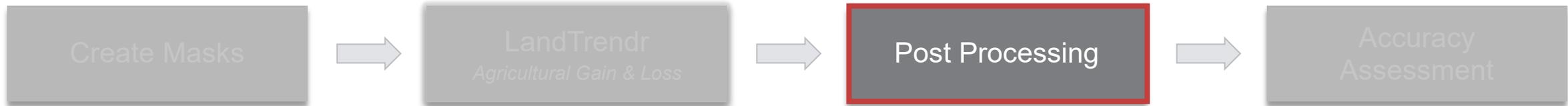


**Applied annual maximum TCG composites to LandTrendr (Kennedy, 2010)**

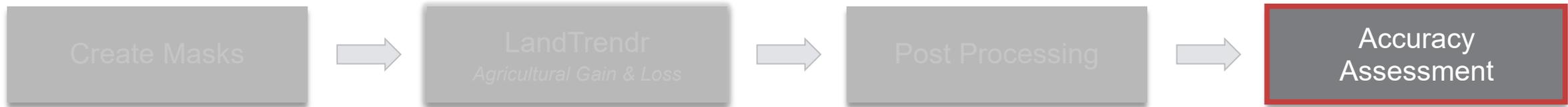
- *Created using entire C1 Landsat Archive*



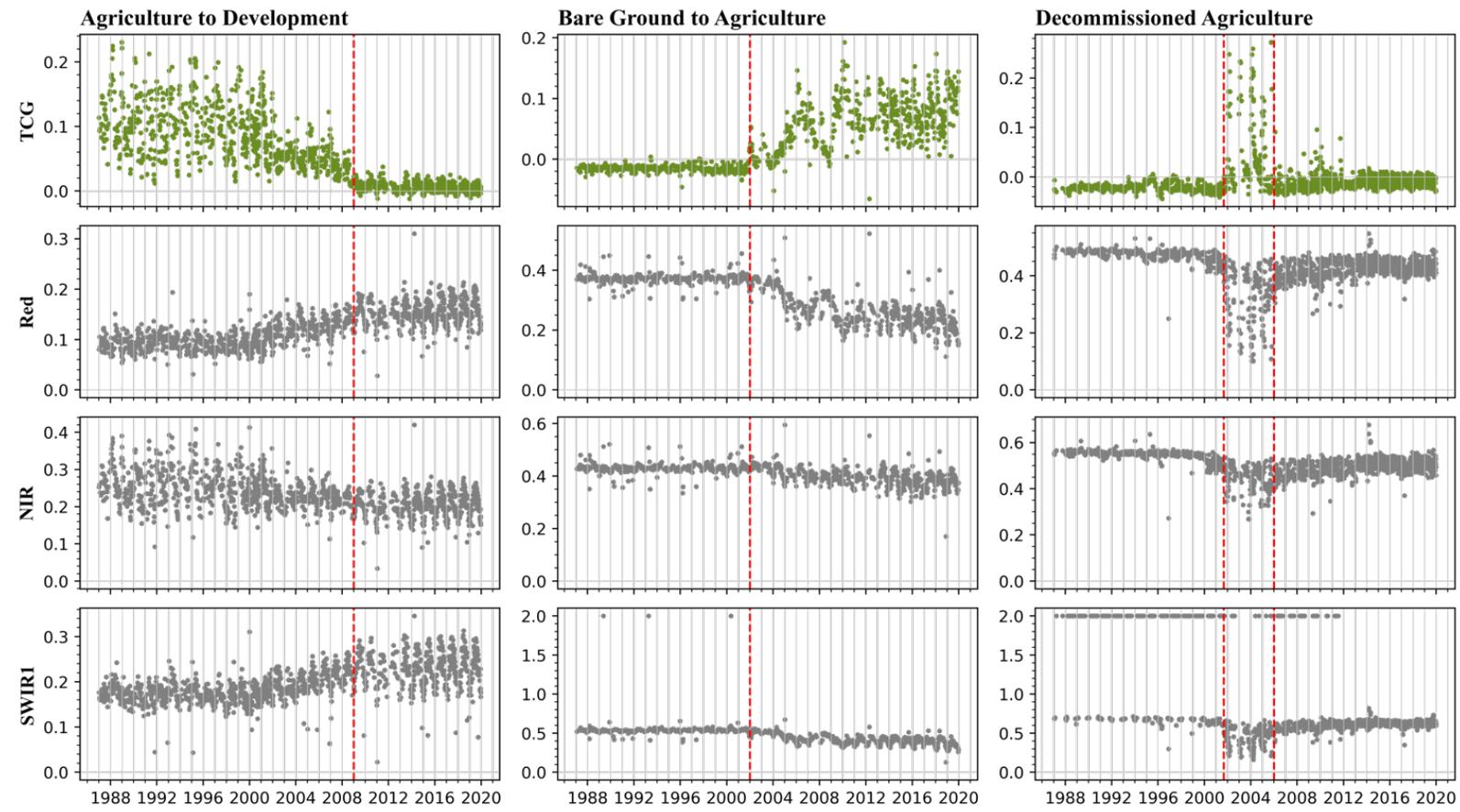




- A land-cover change map was created by combining the *LandTrendr* outputs and the *final land-cover masks*.
- Various masking techniques applied to classify change identified in the *LandTrendr* results.



- Conducted a comprehensive accuracy assessment using a stratified random sampling approach.
- Interpreted ~3,500 samples using high resolution imagery.
- Modified the map after initial stratification— necessitated applying a ratio estimator and indicator functions to improve precision of the area estimator (Stehman, 2014).

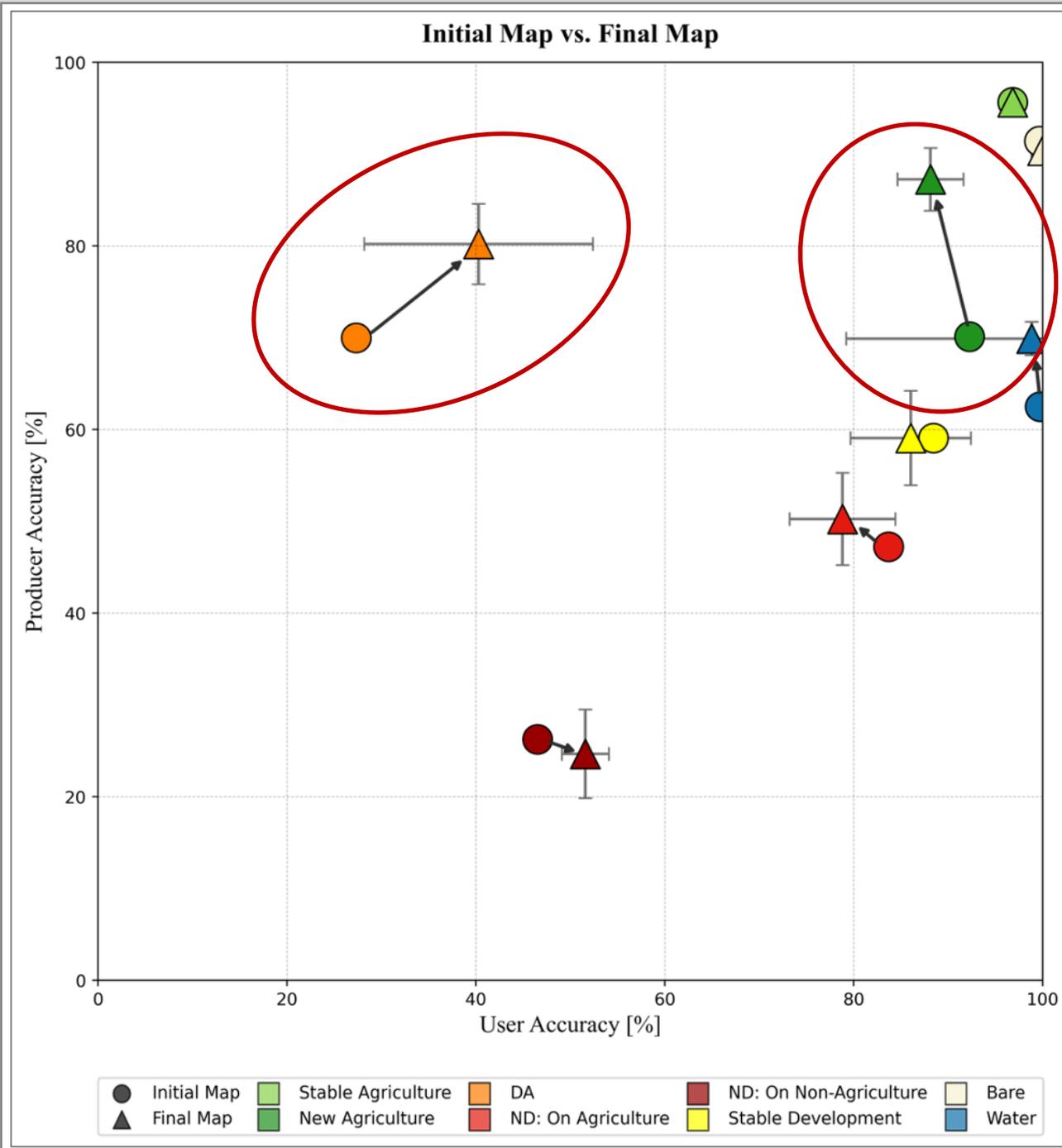


		Reference								
		Water	Stable Agriculture	New Agriculture	DA	ND: On Agriculture	ND: On Non-Agriculture	SD	Bare Ground	Total
M a P		403 (384)	0	0	1	0	0	0	1 (0)	405 (385)
	Water	4	762	2	2	15	0	2	0	787
	Stable Agriculture	1 (2)	30 (27)	429 (358)	1 (0)	1 (0)	4 (1)	0	5 (0)	471 (388)
	New Agriculture	2 (17)	6 (8)	25 (89)	51 (50)	6 (3)	4 (5)	4 (3)	8	106 (183)
	DA	0	7 (6)	1 (0)	1	130 (118)	4 (1)	24 (15)	0	167 (141)
	ND: On Agriculture	0	3	2	0	4 (16)	63 (67)	36 (45)	11	119 (144)
	ND: On Non-Agriculture	0	1 (0)	1 (0)	0	4	12	130	1	149 (147)
	SD	1	0	0	0	0	1 (0)	0	344 (299)	345 (300)
	Bare Ground	18 (20)	0 (3)	17 (26)	2 (4)	0 (4)	6 (8)	4 (5)	824 (875)	871 (945)
	Buffer									
	Total	428	809	477	38	160	94	200	1194	3420
	User Accuracy	98.85 (99.74)	96.82	88.13 (92.27)	40.28 (27.32)	78.81 (83.69)	51.59 (46.53)	86.04 (88.44)	100 (99.67)	
	Producer Accuracy	69.90 (62.47)	95.65	87.24 (70.10)	80.20 (69.97)	50.25 (47.23)	24.66 (26.23)	59.07	90.38 (91.42)	
Area Estimate [km <sup>2</sup> ]	15,464.48	32,911.03	16,286.03	1,731.51	2,343.58	1,504.47	2,601.19	1,029,930.22		
Area CI [km <sup>2</sup> ]	3,183.29	320.10	561.59	256.94	264.71	295.48	245.00	3,252.55		
Margin of Error [%]	40.35%	1.91%	6.76%	29.08%	22.14%	38.49%	18.46%	0.62%		

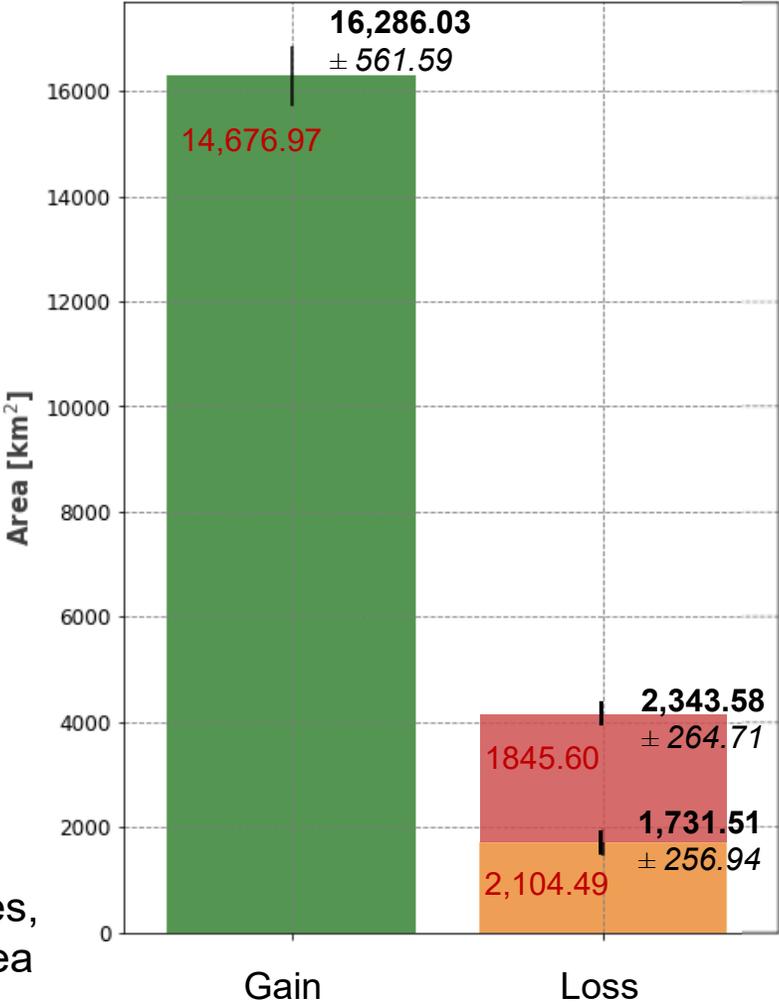
**Table 1.** Error matrix in sample counts for the final map with a buffer. Sample counts for the initial map are shown in parathesis. Cells without a parenthesis value represent no change between the initial and final maps. DA: decommissioned agriculture, ND: new development, SD: stable development.



Map modifications improved accuracies in target agricultural classes



# Agricultural Change Area Estimates



Of the **16,000 km<sup>2</sup>** that have been added in *agriculture*, **~24%** have been lost to *urban growth* and *agricultural decommission* combined

Text in **black** represents area estimates,  
Text in **red** represents original map area

- New Agriculture
- Decommissioned Agriculture
- New Development: On Agriculture

# Conclusion

Our results indicate a highly effective approach for mapping multiple kinds of agricultural change.



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