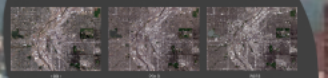
Vegetation in the Denver Metro Area

By Adam Lehman

Natural Color

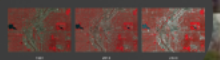


Introduction

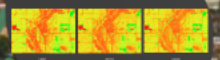
- How much has Denver's growth changed vegetation over the years?
- Changes I've seen over the years
- Preservation of parks and vegetation
- Landsat 5 and Landsat 8 Data
- Looked at the years, 1991, 2013, and 2023
- All Data in WGS 1984 UTM Zone 13N

Methods

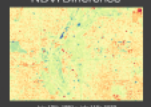
False-Color Infrared



NDVI



NDVI Difference



July 12th, 1991 - July 11th, 2023

Conclusion

- Keep vegetation construction
- Don't expect to see as many new parks
- Protection of green spaces
- Incorporation of vegetation into urban landscape
  - Parks, trees, etc.
  - Flooding problems
- Thinking more environmentally friendly in the future
- Continue to monitor vegetation and effects of urban sprawl

Sources

- USGS Earth Explorer
  - https://www.usgs.gov/
- ESRI
  - https://www.esri.com/
- NASA
  - https://svs.gsfc.nasa.gov/31196/
- Image from Visit The USA
  - https://www.visittheusa.com/experience/10-urban-adventures-and-around-denver-colorado

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Methods

1. Downloaded Landsat data from Earth Explorer

2. Used the "Composite Bands Data Management Tool" to create composite images of all bands for each year

3. Set ROI to Downtown Denver with a ~3.5 mile radius

4. Created Natural Color images
   - 4-3-2 for Landsat 8 and 3-2-1 for Landsat 5

5. Created NDVI Images
   - "Indices Tool" using corresponding bands
     - 5-4 for Landsat 8 and 4-3 for Landsat 5

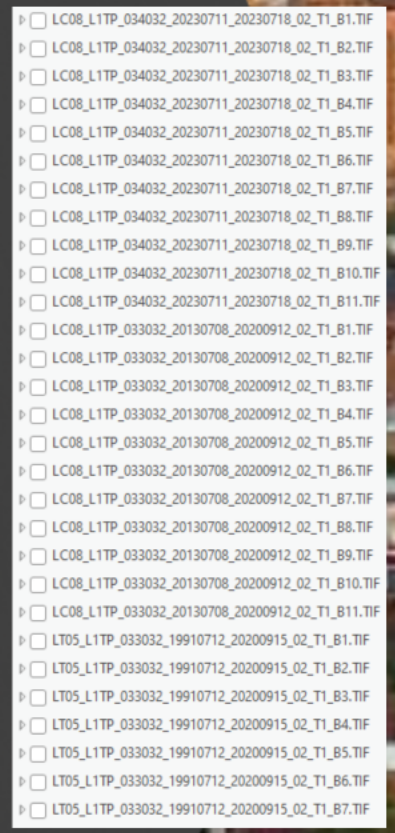
6. Created False Color Infrared images
   - 5-4-3 for Landsat 8 and 4-3-2 for Landsat 5

7. Created NDVI Difference image
   - "Difference Tool" comparing 1991 to 2023

8. Analyzed results

Landsat 4-5 Thematic Mapper (TM)	Bands	Wavelength (micrometers)	Resolution (meters)
	Band 1 - Blue	0.45-0.52	30
	Band 2 - Green	0.52-0.60	30
	Band 3 - Red	0.63-0.69	30
	Band 4 - Near Infrared (NIR)	0.76-0.90	30
	Band 5 - Shortwave Infrared (SWIR) 1	1.55-1.75	30
	Band 6 - Thermal	10.40-12.50	120* (30)
	Band 7 - Shortwave Infrared (SWIR) 2	2.08-2.35	30

Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) Launched February 11, 2013	Bands	Wavelength (micrometers)	Resolution (meters)
	Band 1 - Coastal aerosol	0.43 - 0.45	30
	Band 2 - Blue	0.45 - 0.51	30
	Band 3 - Green	0.53 - 0.59	30
	Band 4 - Red	0.64 - 0.67	30
	Band 5 - Near Infrared (NIR)	0.85 - 0.88	30
	Band 6 - SWIR 1	1.57 - 1.65	30
	Band 7 - SWIR 2	2.11 - 2.29	30
	Band 8 - Panchromatic	0.50 - 0.68	15
	Band 9 - Cirrus	1.36 - 1.38	30
	Band 10 - Thermal Infrared (TIRS) 1	10.60 - 11.19	100
	Band 11 - Thermal Infrared (TIRS) 2	11.50 - 12.51	100



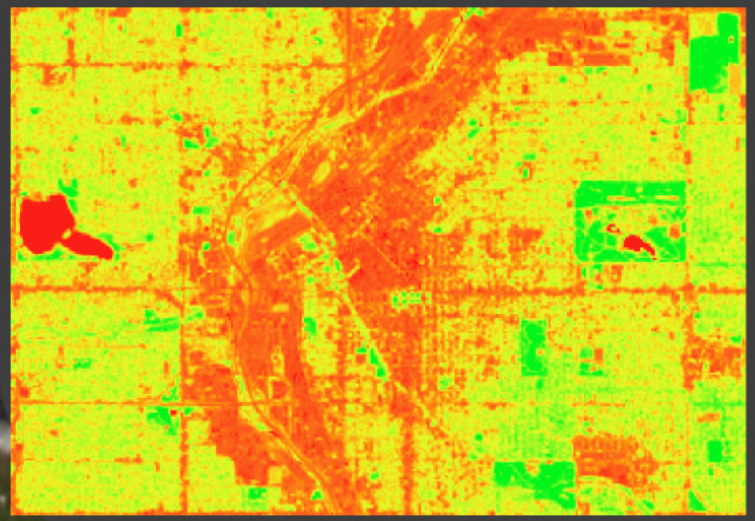
Natural Color

1991
July 12th

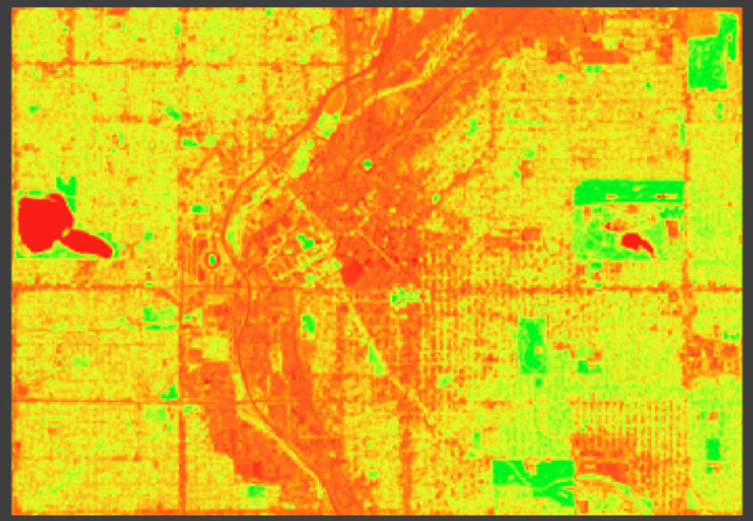
2013
July 8th

2023
July 11th

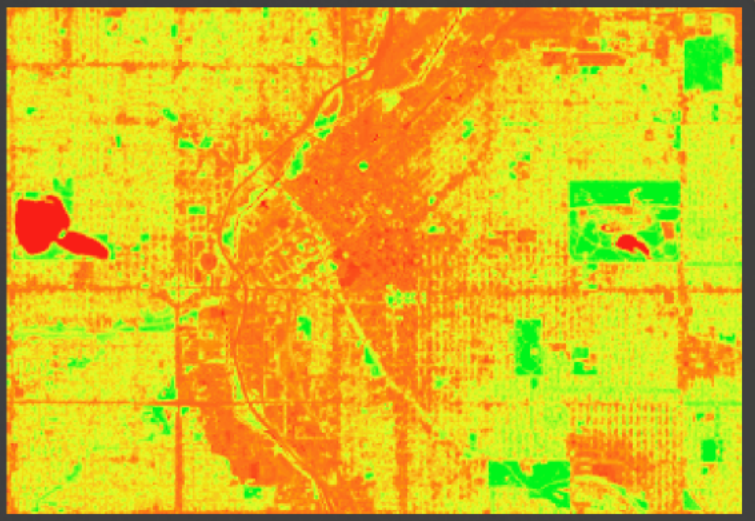
NDVI



1991
July 12th

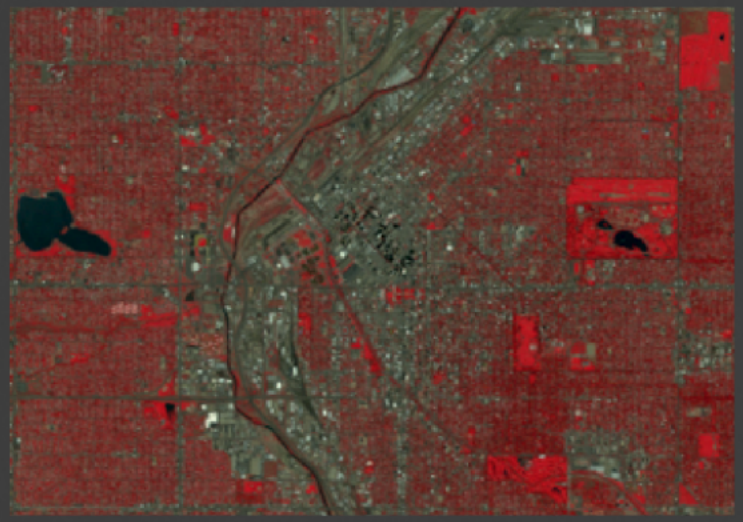


2013
July 11th



2023
July 11th

False-Color Infrared



1991
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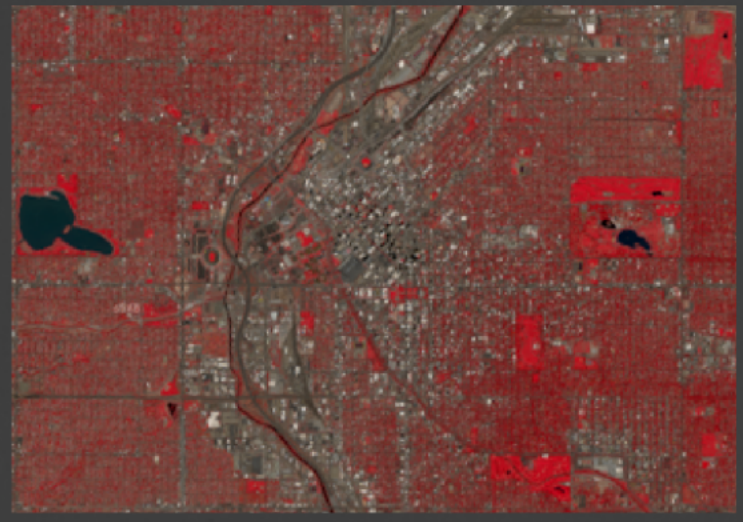

2013
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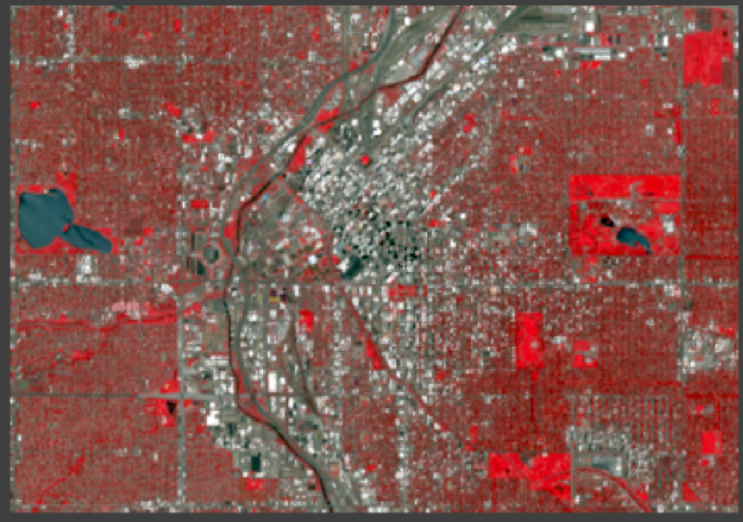
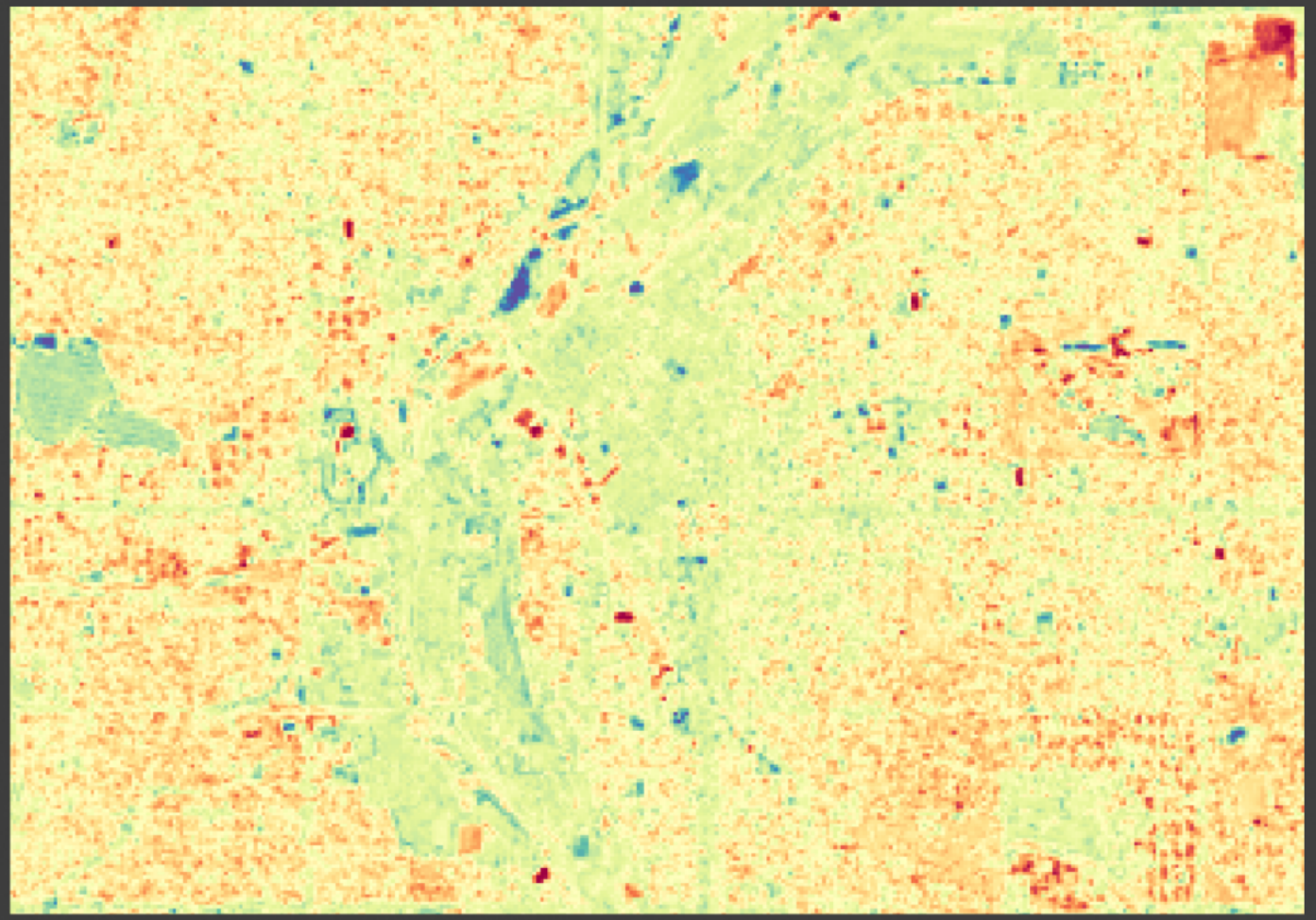


2023
July 11th

NDVI Difference



July 12th, 1991 - July 11th, 2023

Conclusion

- Less vegetation, more urban
- I did not expect to see as many new parks
- Protection of greenspaces
- Incorporation of vegetation into urban landscape
  - One River North
  - Rooftop gardens
- Thinking more environmentally friendly in the future
- Continue to monitor vegetation and effects of urbanization

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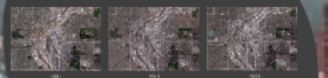

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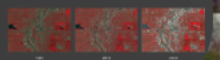

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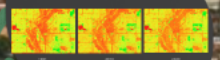

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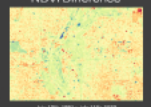

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