

Assignment 2 Report

4603 / 5603 GIS in the Social and Natural Sciences

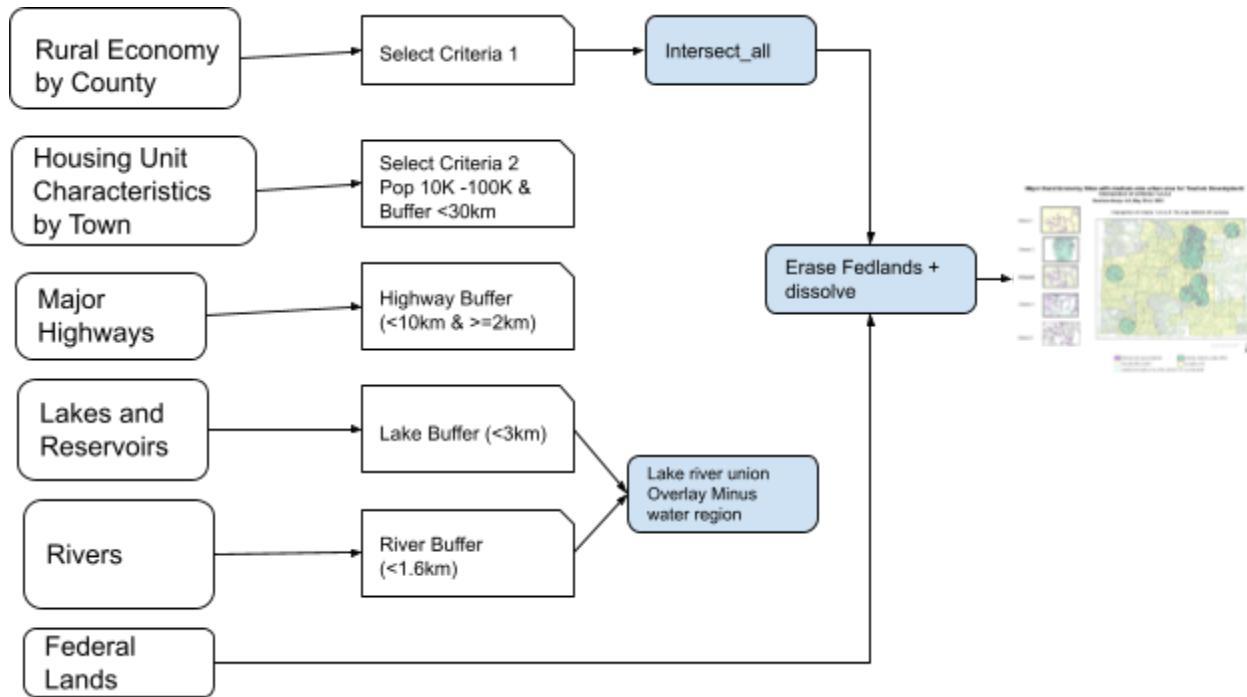
Professor: Stefan Leyk, TA: Caitlin McShane, Student: Sushma Akoju

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Introduction:

The goal is to map suitable sites for Tourism development in Colorado state, to investigate the local real estate market and other conditions related to accessibility, land cover and land use. There are cities, types of rural economies by counties, housing unit characteristics, major highways, lakes, rivers and federal lands.

Model Diagram:



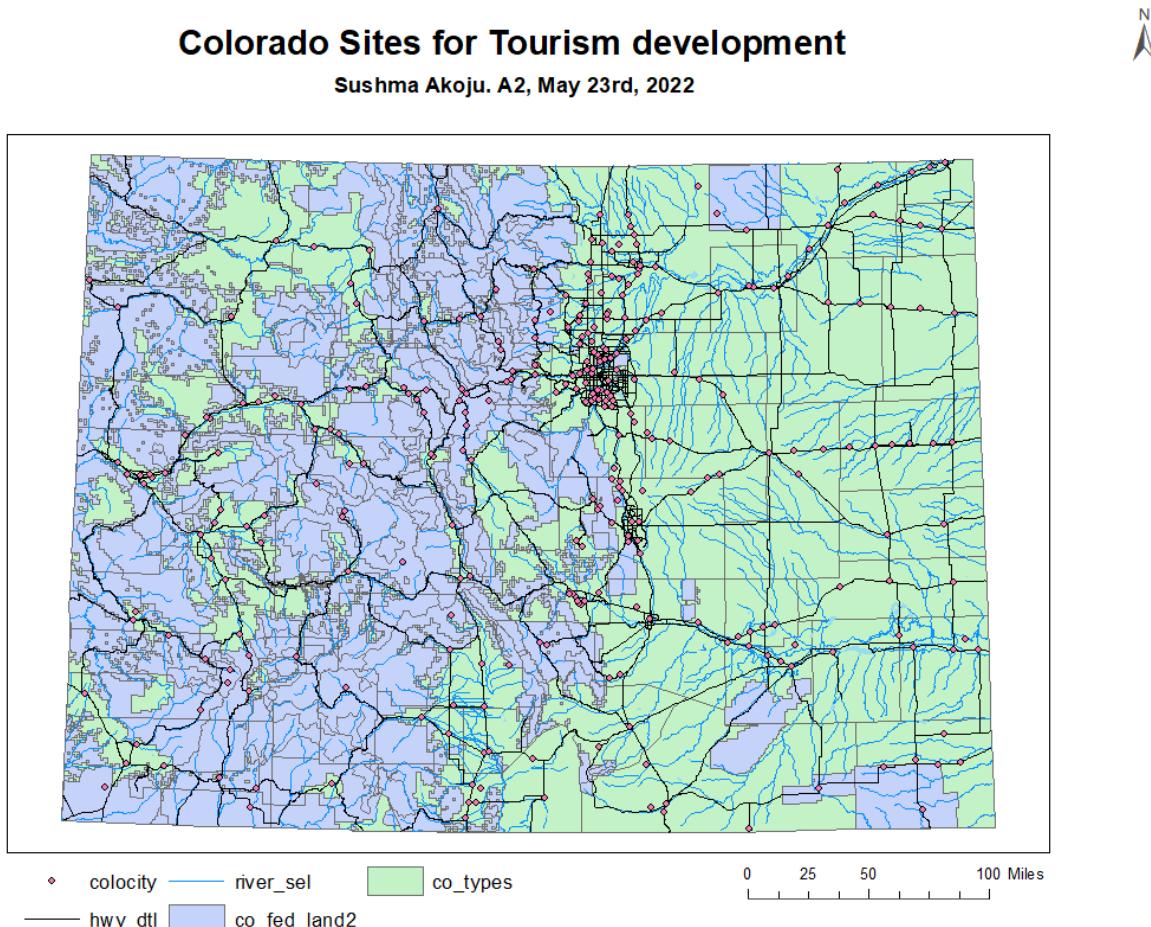
Analysis:

To explain the process, results and criteria all along, I will begin by explaining each criteria along with results, analysis. To perform this analysis, I discussed with an expert colleague Caitlin Mc Shane

and arrived at a couple for strategies to gain a more specific idea about what is the most reasonable approach for this task. Caitlin suggested a 2 approaches how the final intersection can be applied. One was to apply intersection before applying criteria 5. Another approach was to follow exercise 8 approach (approachable areas).

After the discussion, while I was planning on how to execute this, I found that since criterias seem to be the heart of this task, I have prepared to create a map for each criteria and experiment a little to find out what are the options. So for each of the following criteria, I created a map alongside with the approaches I experimented as well as any problems I noticed.

The first map with all layers of interest looks as follows:

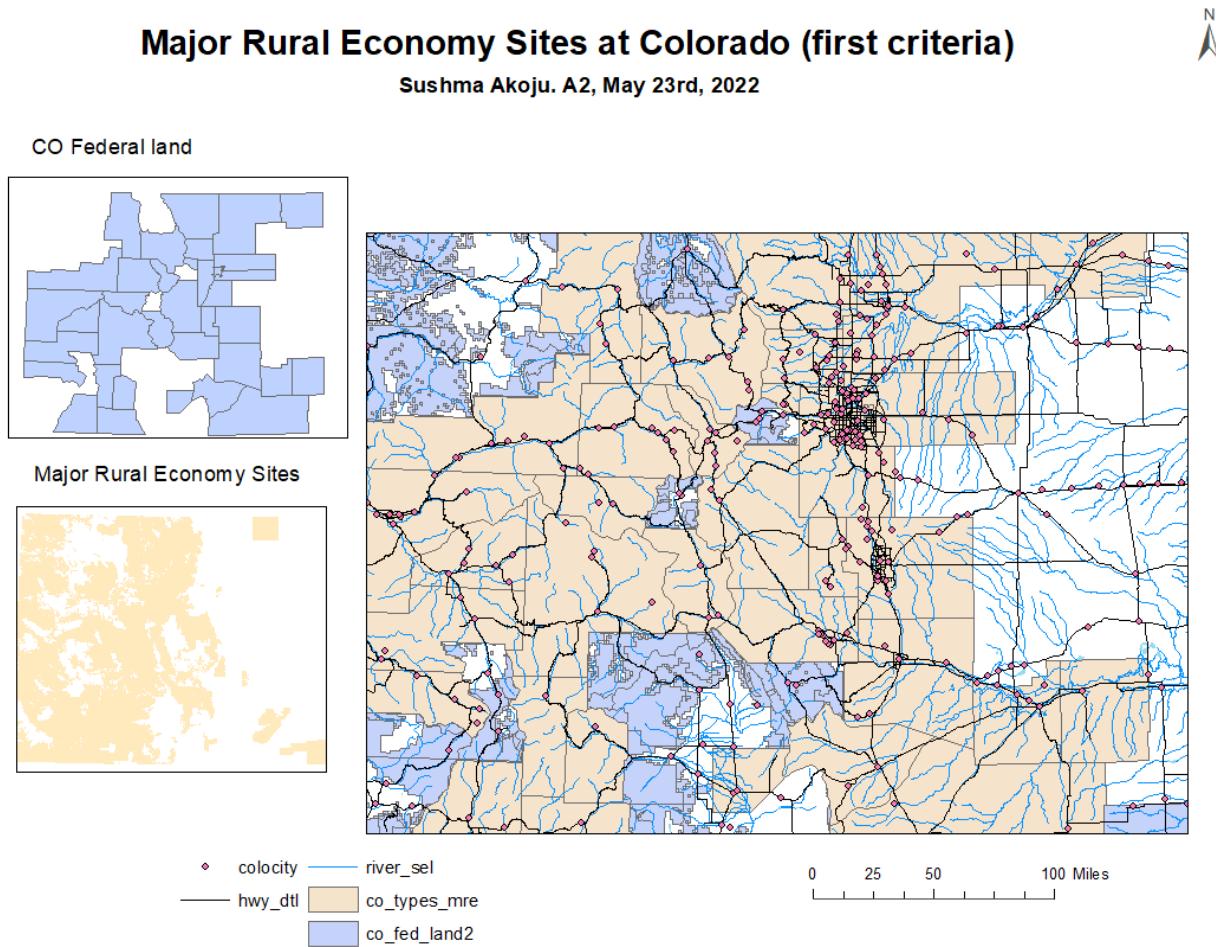


Here in this map, there seems to be vast amounts of Federal lands as well as rural economy regions. There are a significant number of river

streams, and many towns. Thus this leaves less scope of available or possible sites after applying all of the criterias.

Criteria 1:

The first criteria is to select "Government", "Metropolitan" or "Services" as major rural economies from co_types.shp). For this criteria, I used Selection over data to match the 3 options for column RURL_ECON. The resulting tan colored region here shows Major rural economy regions, which are the regions of interest here. Generating this map with selection seemed simple yet more important.



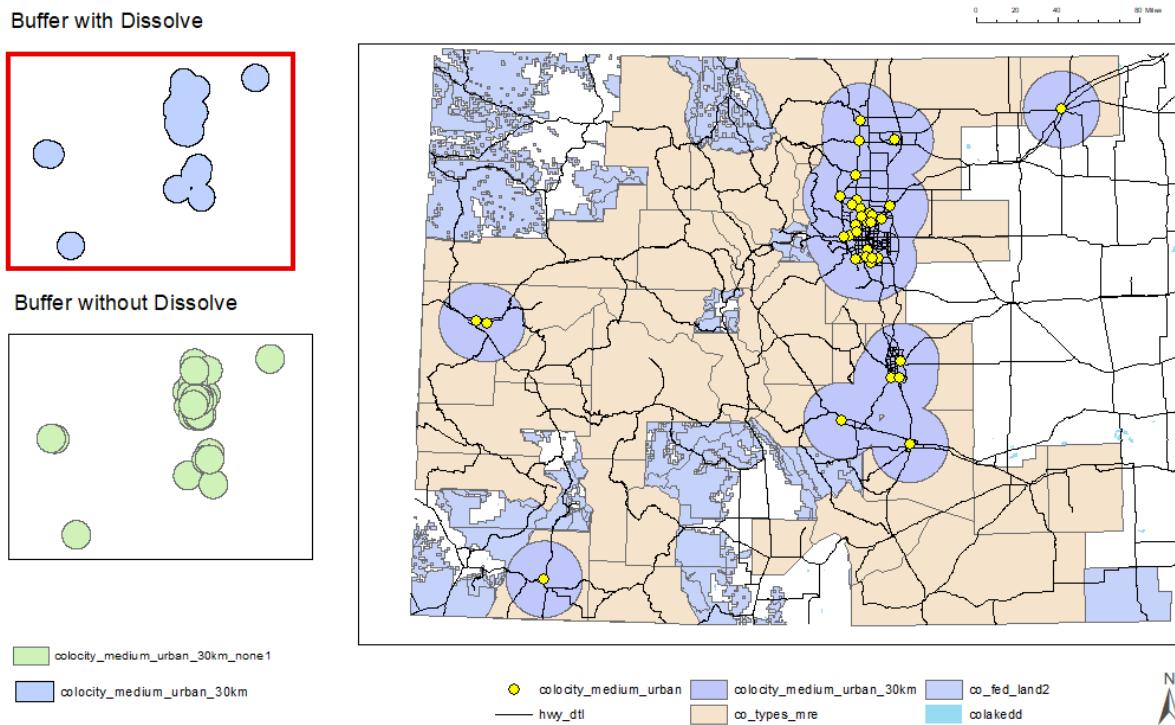
Criteria 2:

For second criteria, the site has to be less than 30 km away from a medium-size urban area. A medium-size urban area is defined as a place

with a population between 10,000 and 100,000 people. So for this, I extracted population selection from 10,000 - 100,000 over colocity.shp. Then for the resulting shp file I used a buffer for less than 30 km criteria. The resulting map after applying criteria 2 is as follows:

Major Rural Economy Sites with medium-size urban area with Buffer (second criteria w.r.t Population between 10,000 - 100,000)

Sushma Akoju. A2, May 23rd, 2022



The map shows Buffer with dissolve and without. I was hoping to find some information about what type of Buffering would be more suitable here. It seems that the dissolve option set to ALL, seems to be more relevant here since we want to go around the outer edges to perform intersection.

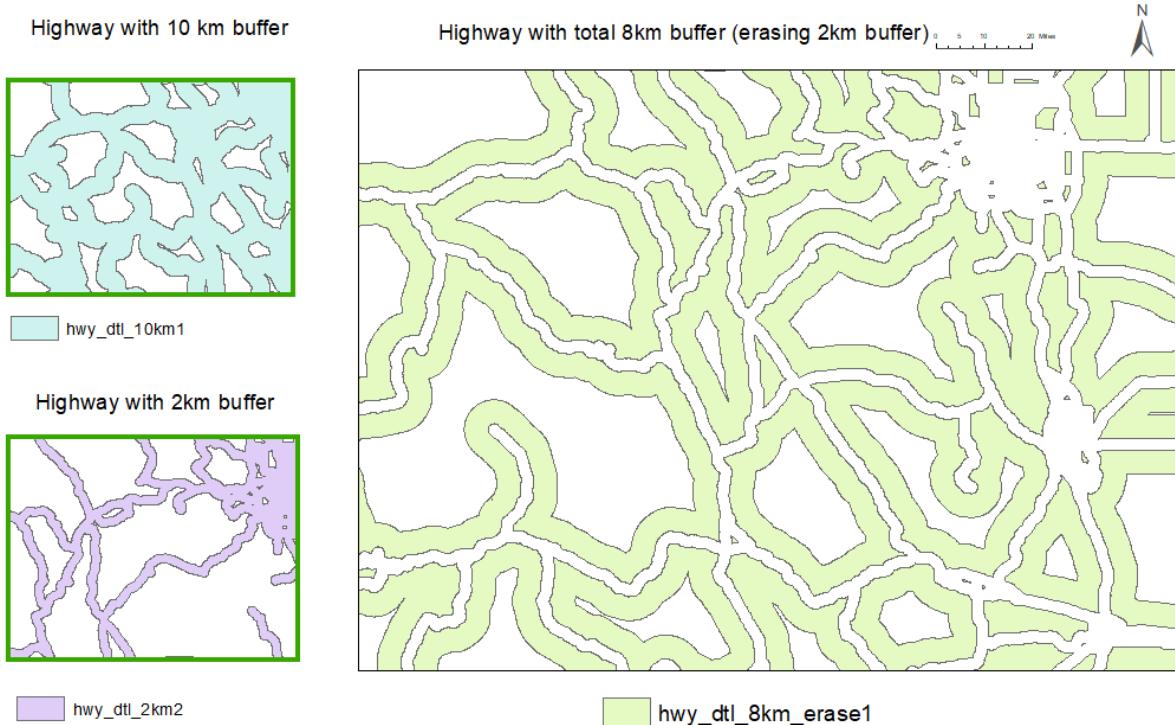
Criteria 3:

The site has to be less than 10 km from a major highway (hwy_dt1.shp) but not closer than 2 km. All roads are assumed to be major highways.

So for this, first I created separate buffers for each of 10 km and 2km for highways. Then I applied an Erase from Overlay options to make sure the highways exclude that 2 km region. The resulting map shows highways after erase options which is the main map and the two smaller maps are for each of 10km and 2km buffers for understanding each of the operations visually.

Major Rural Economy Sites with medium-size urban area for Tourism Development
Third Criteria: sites less than 10 km away from a lake but no closer than 2km

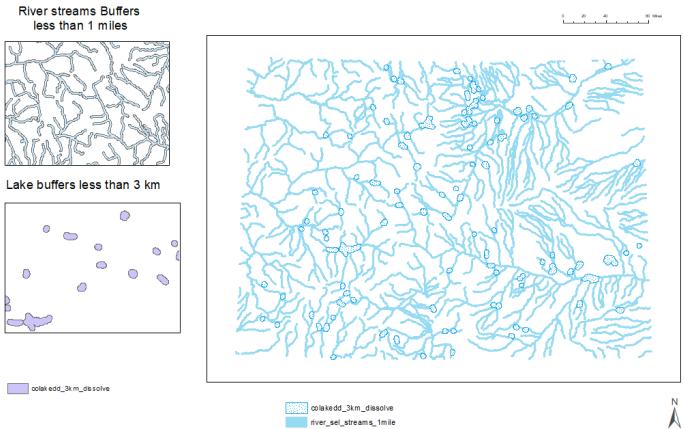
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I additionally explored the MultiRing buffer for highways, however I used 1 mile instead of 1.6km for buffers over river. The above map is the corrected one

Major Rural Economy Sites with medium-size urban area with Buffer
(Fourth criteria less than 3 km away from a lake or closer than 1 mile from a stream)

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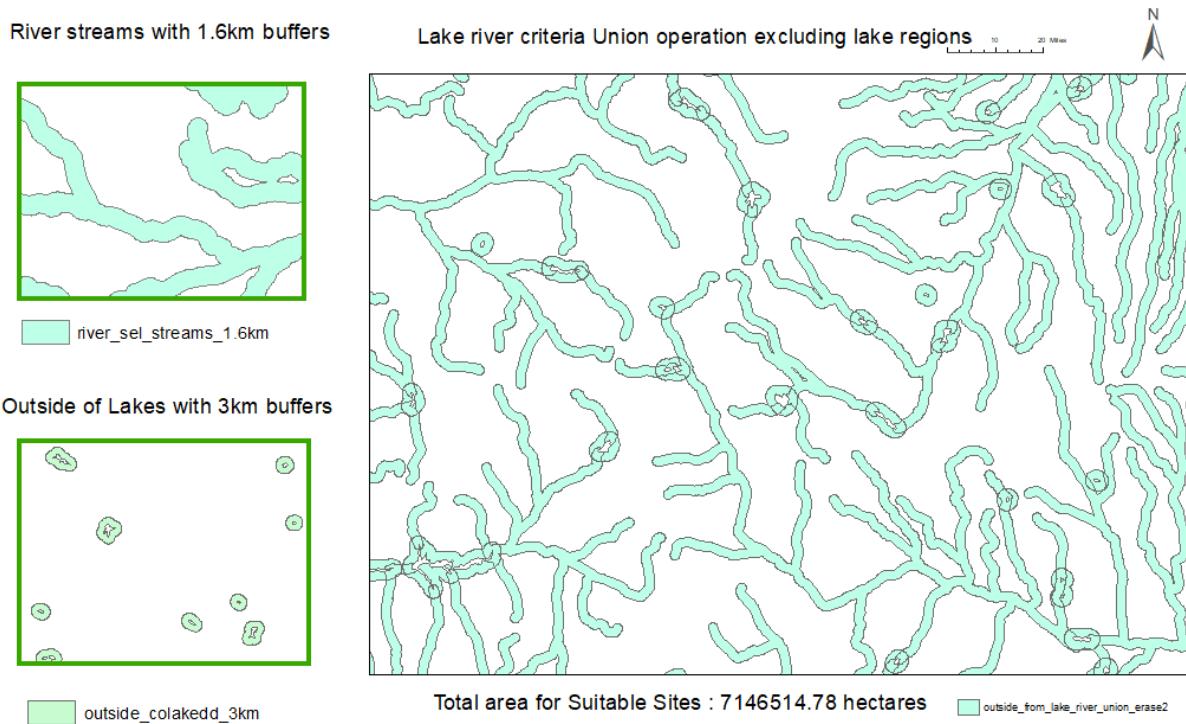


Criteria 4:

The site has to be less than 3 km away from a lake (`co_lakedd.shp`) or closer than 1 mile to a major stream (`river_sel.shp`). So for this criteria, I first created a 3km buffer over lakes data and then created a buffer for rivers data. I first created 1 mile which gave me 0 results for unions. So tracing back a little and I found out I should normalize the units of measurements to kilometers. So I created a buffer of 1.6 km for rivers. I then applied an Overlay Union operation since the criteria seems to look for Logical OR operation for the two conditions. Since the goal of the task is to investigate the land cover for the possible sites, I applied an Erase operation over resulting Union data to remove the water regions, so the buffers show the true land area.

Major Rural Economy Sites with medium-size urban area for Tourism Development
Fourth Criteria: sites less than 3 km away from a lake or closer than 1 mile to a major stream

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Intersection of criterias 1,2,3,4:

First I applied Intersection over all 4 criterias, which resulted inf following map:

Major Rural Economy Sites with medium-size urban area for Tourism Development Intersection of criterias 1,2,3,4

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Highway criteria
(10km \geq buffdist \geq 2km)



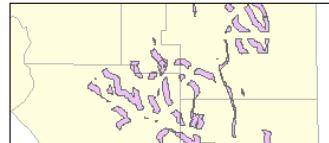
Lake river criteria
($<3k$ from lake or $<1.6km$ from river stream)



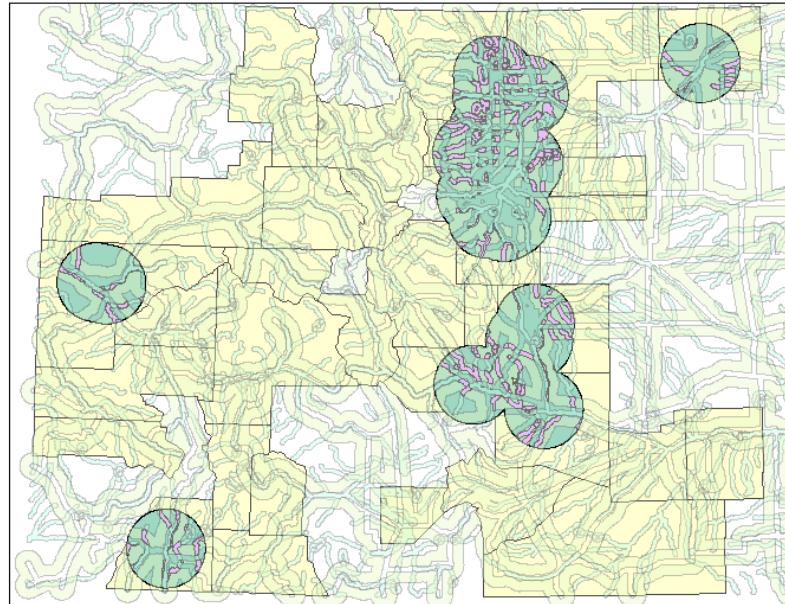
Medium Urban area criteria
($<30km$)



Major rural economy criteria



Intersection of criteria 1,2,3,4: Tot Area 4713600695.77 hectares



█ intersect_all █ hwy_dtl_8km_erase1 █ outside_from_lake_river_union_erase2	█ colocity_medium_urban_30km █ co_types_mre
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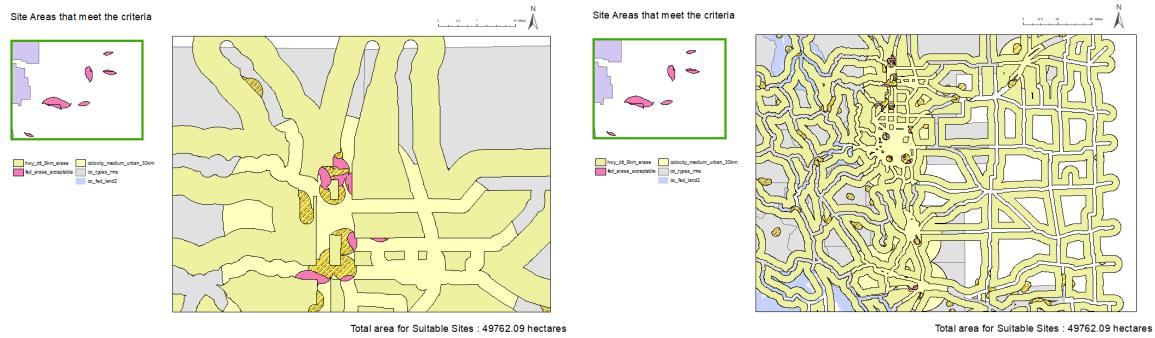
Criteria 5:

In this criteria, Federal land regions should be excluded from the sites created so far.

I applied Erase operation over two approaches:

- 1) I used the same approach as discussed in Ex08, i.e. created Acceptable areas and then using Multipart to singlepart conversion, which gave following results.

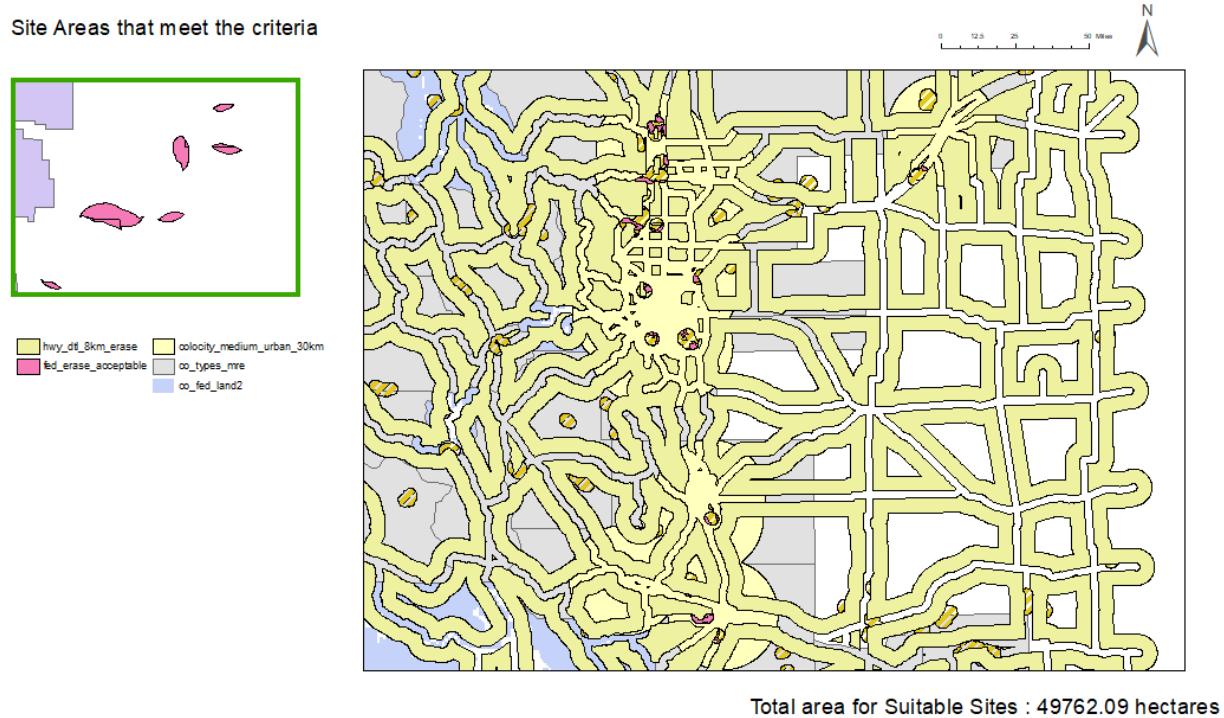
**Major Rural Economy Sites with medium-size urban area
for Tourism Development**
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- 2) Another approach was to run an Overlay Erase over the resulting regions after Overlay intersection of 4 criterias.
- 3)

Major Rural Economy Sites with medium-size urban area for Tourism Development

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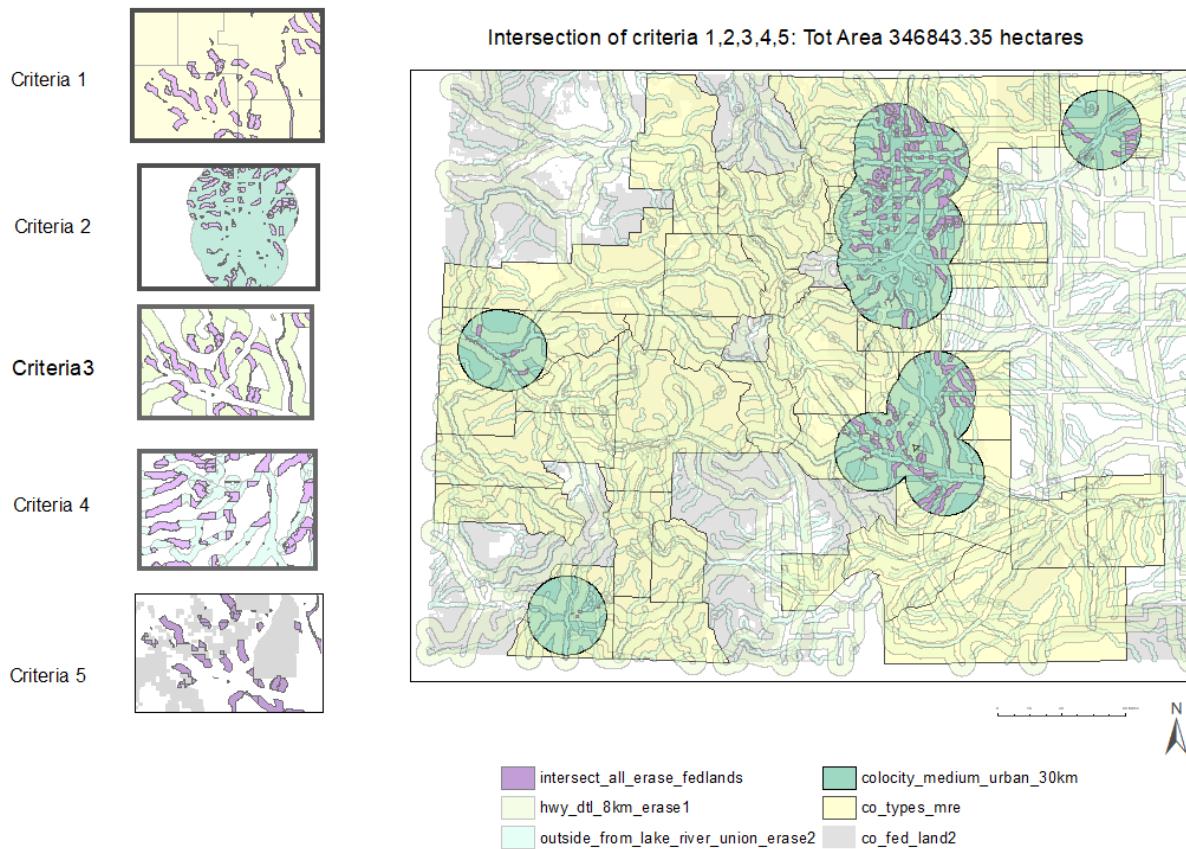


The combined final map with each of criterias maps placed next to main map is as follows:

Major Rural Economy Sites with medium-size urban area for Tourism Development

Intersection of criterias 1,2,3,4

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Data Quality:

Data quality seems fine, to create maps. Since Colorado is known for a lot of outdoor activities, a lot more information could have been added. There are varieties of pine trees in Colorado, there are also skiing sites, resorts etc. So if we had information about busy tourism areas as well as plant cover, altitude information, it might provide more plausible as well as visually compelling information to make decision making easier.

Data generated from all of the operations seems to be fine, data quality generally seemed sufficient, to discuss and plan the next course of actions.

Total site area is 346843 hectares, which seems large.

Uncertainty

1. It seemed difficult to know for sure if the resulting area is correct, resulting regions/sites were correct or not.
2. One approach I used was after applying each criteria, I verified if I made the right decision of operations or not.
3. There seems to be not much information about existing tourism sites on land, so that we can eliminate the existing sites which already have some tourism activities in the final map.

Limitations:

1. It is not clear how the suitable sites adhere to other city planning guidelines such as neighboring schools, residential areas, what policies exist for river streams, lakes, and if altitude measurements might have helped to better assess what kind of tourism development is possible more specifically.
2. I think this type of task needs additional comparative research since we would like to gain better ideas from existing tourism sites, so that this can help the company even better.
3. It was tedious to manually create and analyze the details from each criteria.
4. It is not clear if we can adapt some new data to the existing map: for example, if I had new data from the past 1 month, then how do I add the data to the map seemed difficult to answer at the moment.
5. It would be nice to have some programming support to ArcGIS to write a script and repeat for recurring tasks or operations for creating the maps.
6. We also would like to consider climate change and natural disasters as well for considering or planning the tourism sites. If there was evidence of more wildfires in the area, it may be important to note such observations.

Recommendations:

Additionally, one solution was to benchmark the base map from past years. For example, if there was a Colorado map which had all of the

information available, from past years, then we simply re-use that as a basemap and append new data to the map. This is especially helpful to see recent trends in real estate, tourism sites.

References:

1. Exercise/Lab 08:

[https://drive.google.com/file/d/1he2ntBeUlu0qjlqvt4eahdP4sIT41M05
/view?usp=sharing](https://drive.google.com/file/d/1he2ntBeUlu0qjlqvt4eahdP4sIT41M05/view?usp=sharing)

Presentation 2 (Assignment 2)

GEOG 4603-5603

— University of Colorado Boulder —

Prof. Stefan Leyk

Student: Sushma Akoju

Goal: Identify Suitable Sites for Tourism development.

- To investigate the local real estate market
- To investigate other conditions related to accessibility, land cover and land use.

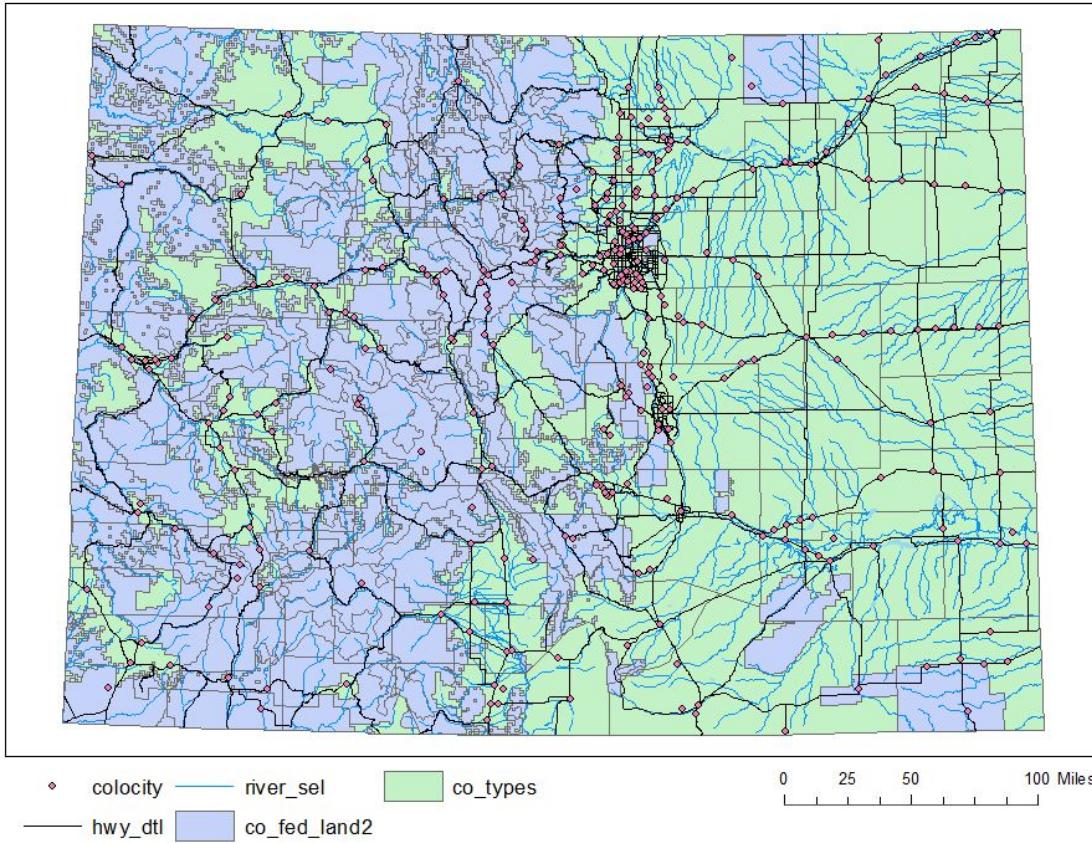
Criteria

1. The county in which the site is located should have “Government”, “Metropolitan” or “Services” as major rural economy.
2. The site shall be less than 30 km away from a medium-size urban area. A medium-size urban Area that meet population between 10,000 and 100,000 people.
3. The site shall be less than 10 km from a major highway but not closer than 2 km.
4. The site shall be less than 3 km away from a lake or closer than 1 mile to a major stream
5. The site must not be within any Federal Land geographical extents.

Colorado Sites for Tourism development

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N



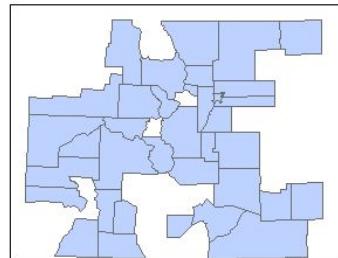
Major Rural Economy Sites at Colorado (first criteria)

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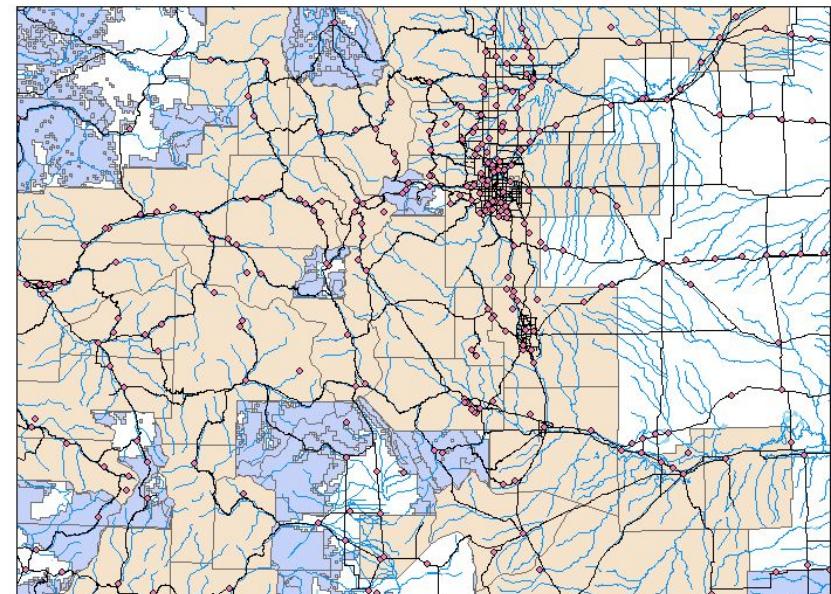
Criteria 1

1. “Government”,
2. “Metropolitan”
3. “Services”

CO Federal land



Major Rural Economy Sites



◆ colocity
— hwy_dtl
— river_sel
■ co_types_mre
■ co_fed_land2

0 25 50 100 Miles

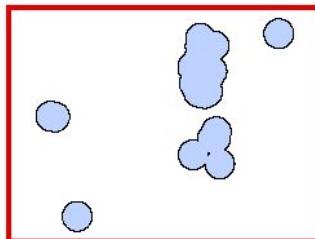
Major Rural Economy Sites with medium-size urban area with Buffer (second criteria w.r.t Population between 10,000 - 100,000)

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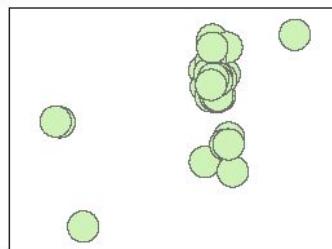
Criteria 2

less than 30 km

Buffer with Dissolve

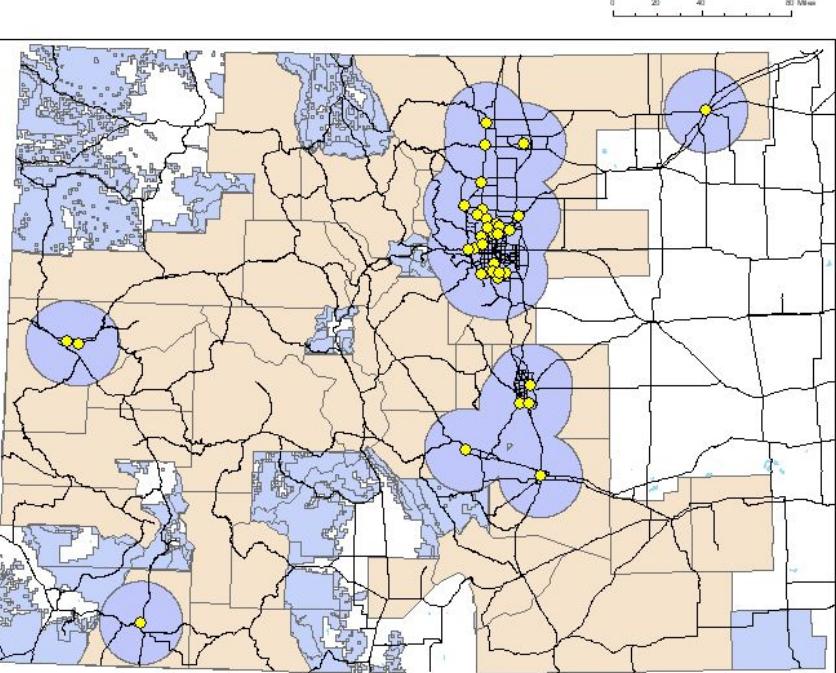


Buffer without Dissolve



colocity_medium_urban_30km_none1

colocity_medium_urban_30km



colocity_medium_urban

hwy_dtl

colocity_medium_urban_30km

co_types_mre

co_fed_land2

colakedd



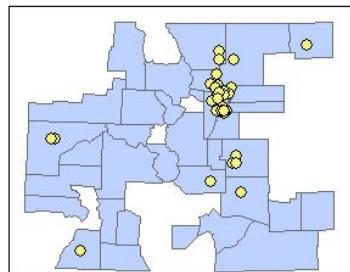
Major Rural Economy Sites with medium-size urban area (second criteria w.r.t Population between 10,000 - 100,000)

Sushma Akoju, A2, May 23rd, 2022

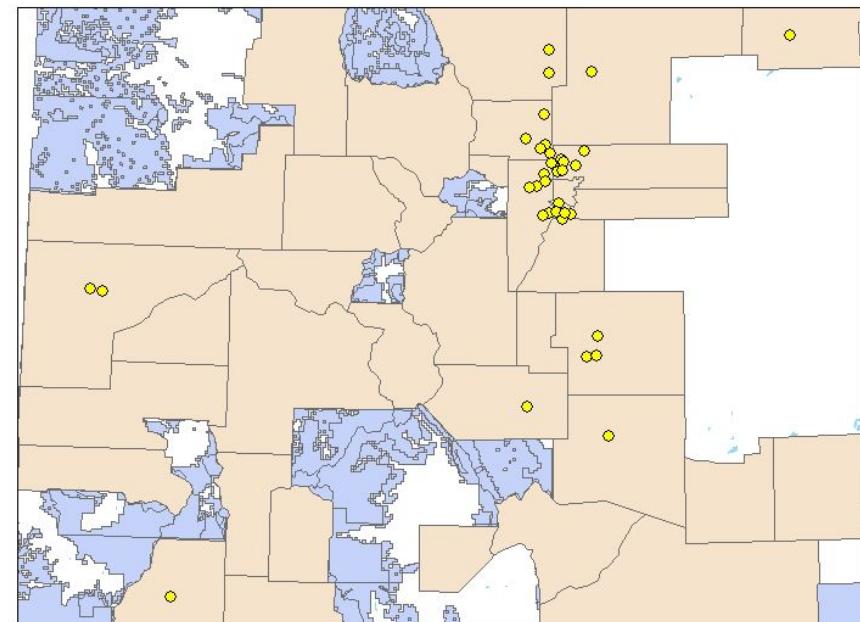
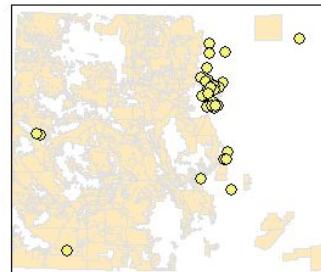
Criteria 2

population between
10,000 and 100,000

CO Federal land



Major Rural Economy Sites



- colocity_medium_urban
- co_types_mre
- co_fed_land2

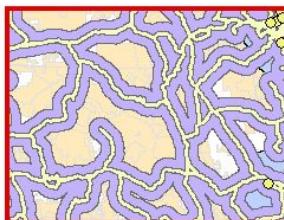
0 25 50 100 Miles

Major Rural Economy Sites with medium-size urban area with Buffer (Third criteria Highway buffer less than 10 km from a major highway & not closer than 2 km)

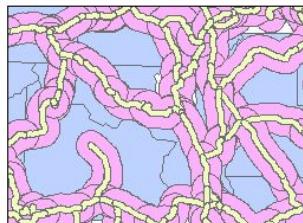
Criteria 3

less than 10 km from
a major highway
but not closer than 2 km

Buffer with Dissolve



Buffer without Dissolve



<all other values>
distance
2
10

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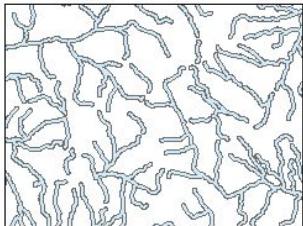


Major Rural Economy Sites with medium-size urban area with Buffer (Fourth criteria less than 3 km away from a lake or closer than 1 mile from a stream)

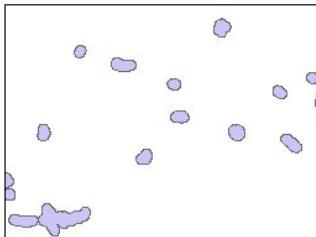
Criteria 4

be less than 3 km away
- from a lake and
closer than 1 mile to a
Major stream

River streams Buffers
less than 1 miles



Lake buffers less than 3 km



colak_edd_3k_m_dissolve

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0 20 40 60 Miles



colak_edd_3km_dissolve

river_sel_streams_1mile



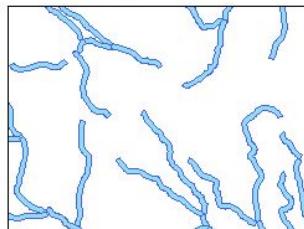
Major Rural Economy Sites with medium-size urban area with Buffer (Fourth criteria less than 3 km away from a lake or closer than 1 mile from a stream)

Criteria 4

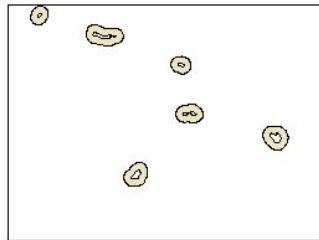
Removing the lakes
From buffered lakes
(Only land sites, since
Focus is on land cover,
Land use)

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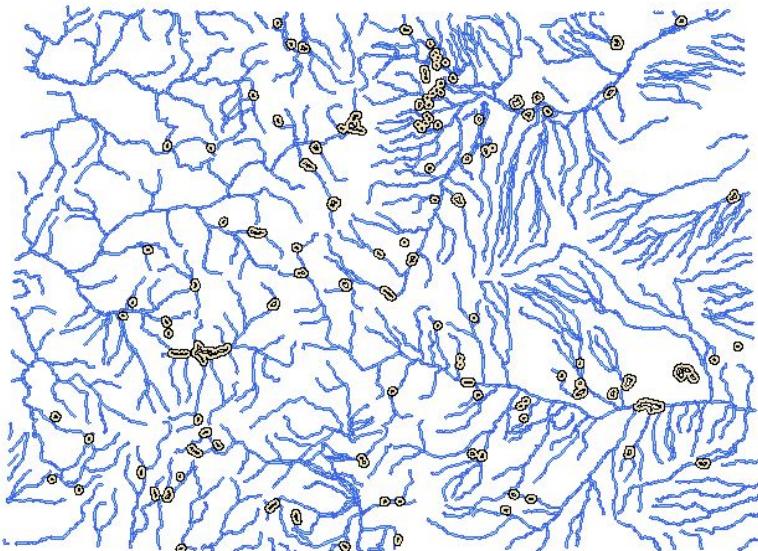
River streams Buffers
less than 1 miles



Outside Lake buffers less than 3 km



0 20 40 60 80 100 km



outside_colakedd_3km
river_sel_streams_1mile_none



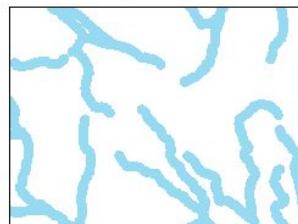
Criteria 4

Combined River and
Outside Lake buffers
(union)

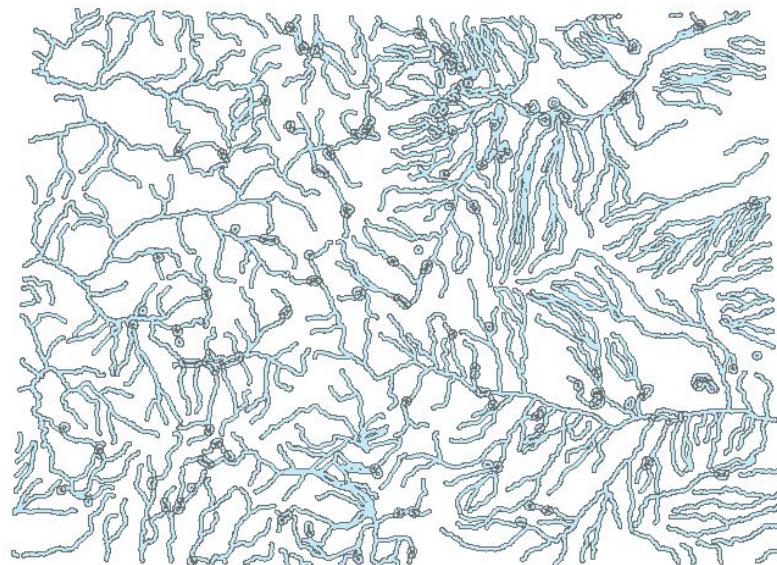
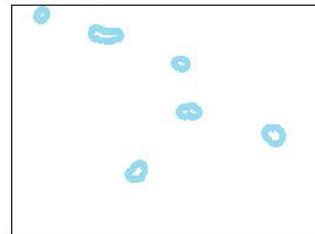
Major Rural Economy Sites with medium-size urban area with Buffer
(Fourth criteria less than 3 km away from a lake or closer than 1 mile from a stream)

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River streams Buffers
less than 1 miles



Outside Lake buffers less than 3 km



 outside_lake_river_union

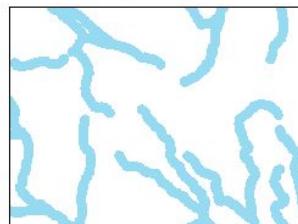
Criteria 4

Combined River and
Outside Lake buffers
(Union Operation)

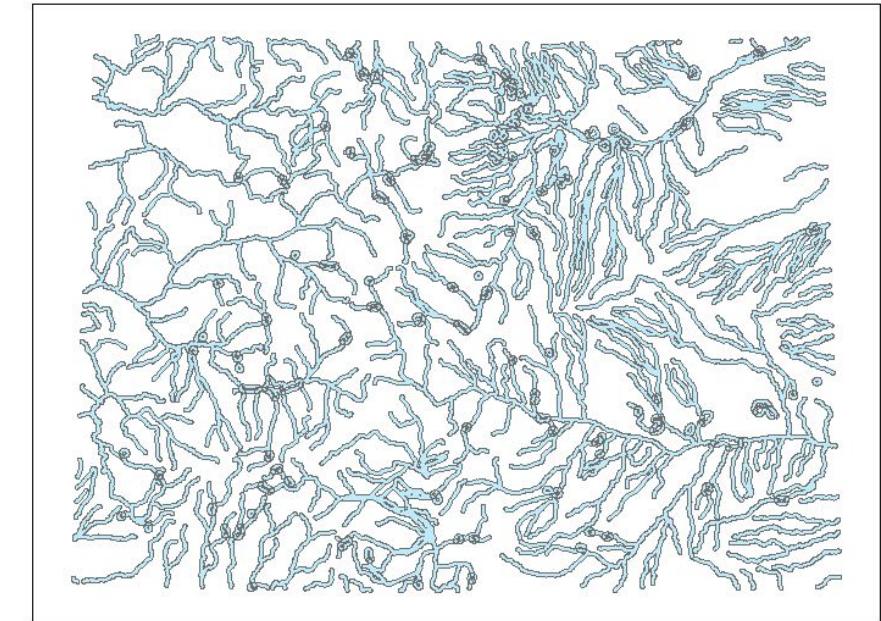
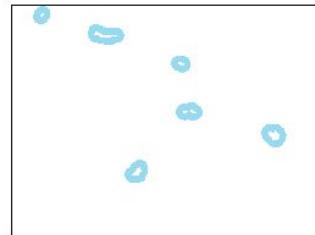
Major Rural Economy Sites with medium-size urban area with Buffer
(Fourth criteria less than 3 km away from a lake or closer than 1 mile from a stream)

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River streams Buffers
less than 1 miles



Outside Lake buffers less than 3 km



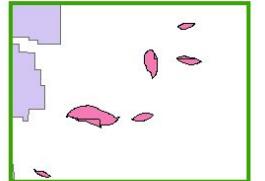
 outside_lake_river_union

Criteria 5 & Final Map

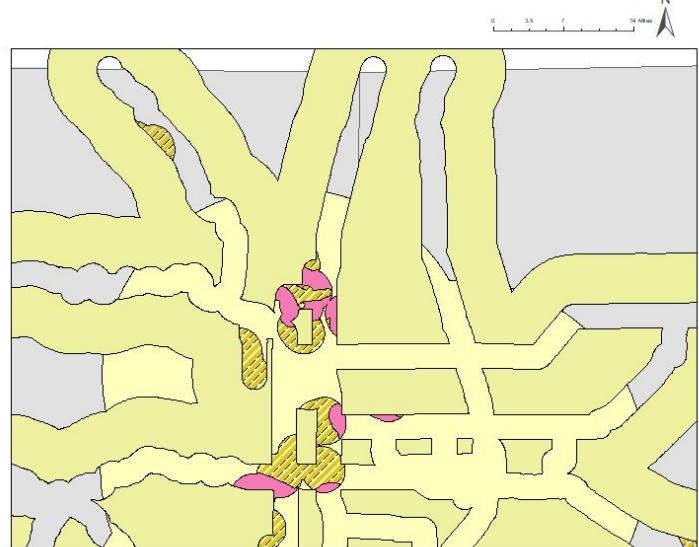
Combined River and
Outside Lake buffers
(Union Operation)

**Major Rural Economy Sites with medium-size urban area
for Tourism Development**
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Site Areas that meet the criteria



Legend for Site Areas:
hwy_dt_8km_erase (light green)
ed_erase_acceptable (pink)
co_types_mre (purple)
co_fed_land2 (blue)



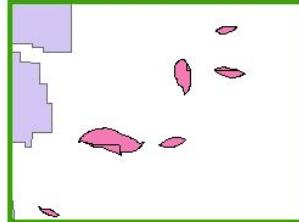
Total area for Suitable Sites : 49762.09 hectares

Major Rural Economy Sites with medium-size urban area for Tourism Development

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Final Map

Site Areas that meet the criteria



Legend:

- hwy_dt_8km_erase
- coicity_medium_urban_30km
- fed_erase_acceptable
- co_types_mre
- co_fed_land2



Total area for Suitable Sites : 49762.09 hectares

Future work

To develop more maps depending on feedback from this meeting.

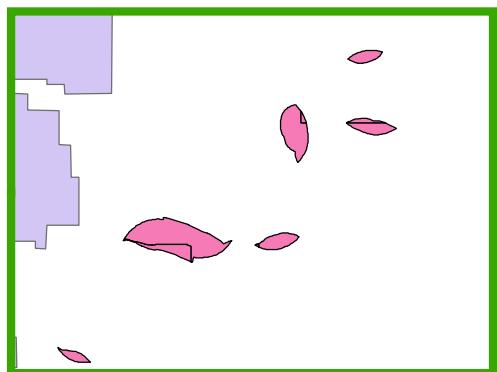
To develop more techniques to distinguish between prioritizing criterias.

Major Rural Economy Sites with medium-size urban area for Tourism Development

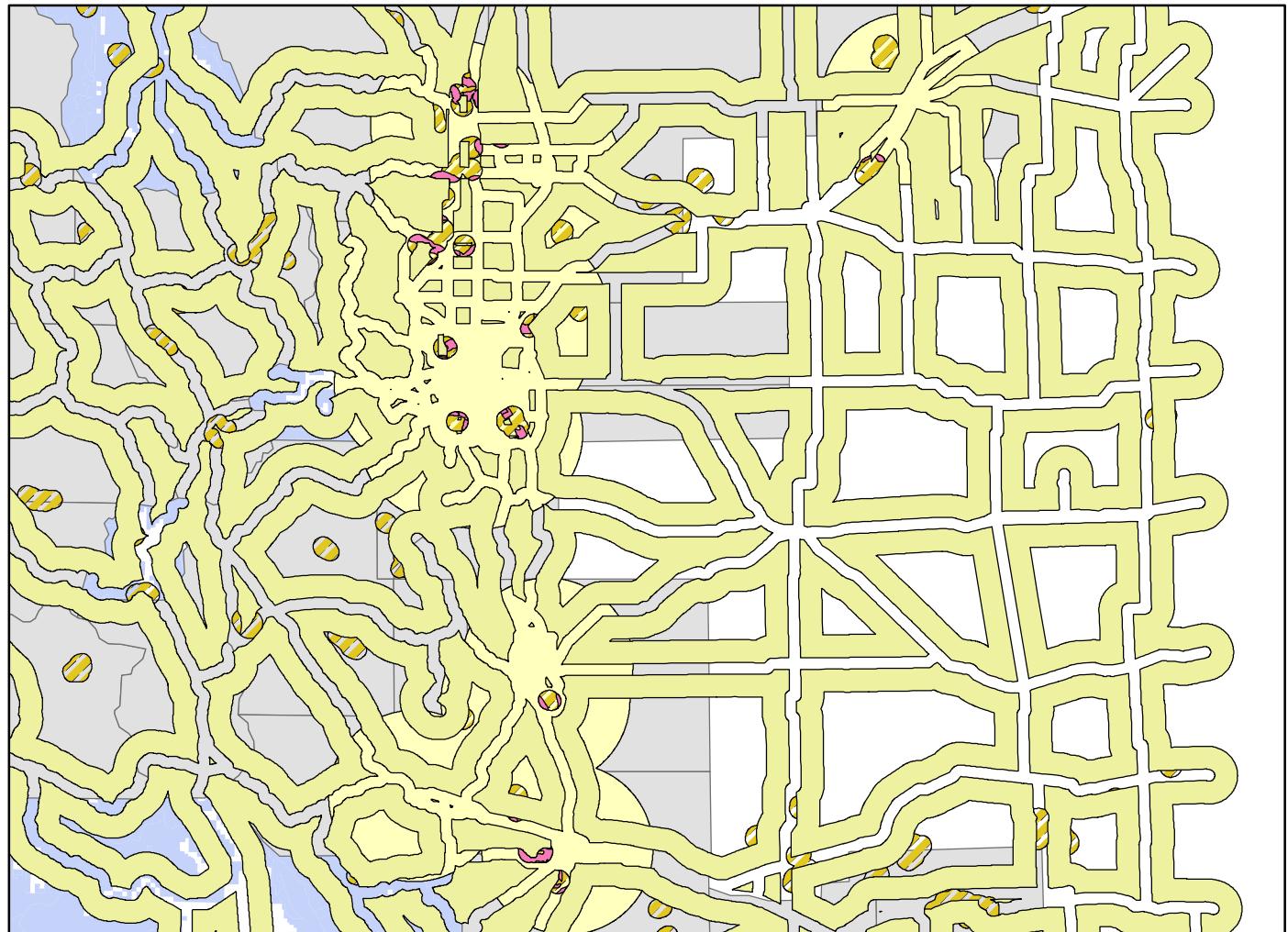
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Site Areas that meet the criteria

0 12.5 25 50 Miles



hwy_dtl_8km_erase	colocity_medium_urban_30km
fed_erase_acceptable	co_types_mre
co_fed_land2	

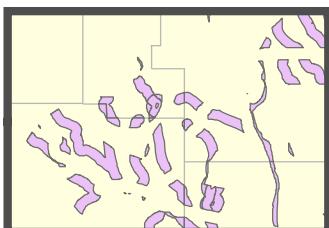


Total area for Suitable Sites : 49762.09 hectares

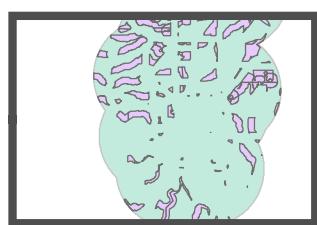
Major Rural Economy Sites with medium-size urban area for Tourism Development

Intersection of criterias 1,2,3,4

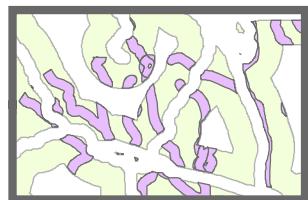
Sushma Akoju. A2, May 23rd, 2022



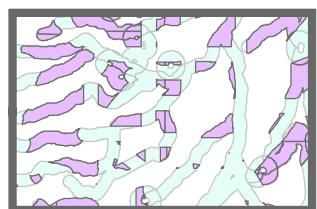
Criteria 1



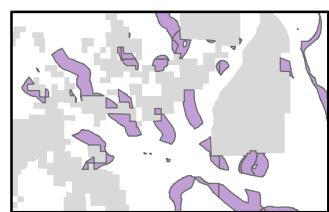
Criteria 2



Criteria3

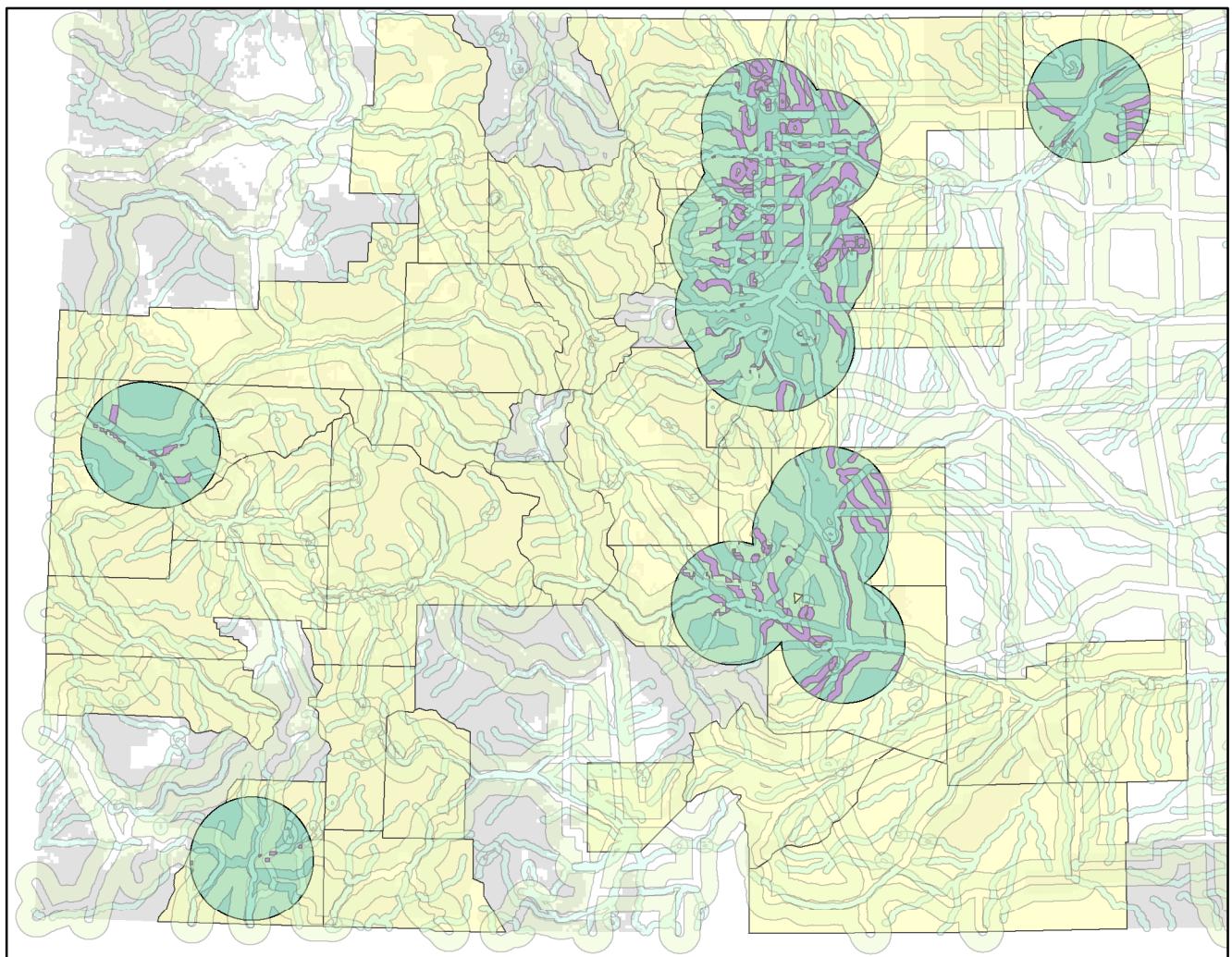


Criteria 4



Criteria 5

Intersection of criteria 1,2,3,4,5: Tot Area 346843.35 hectares



0 15 30 60 Miles

N

intersect_all_erase_fedlands

hwy_dtl_8km_erase1

outside_from_lake_river_union_erase2

colocity_medium_urban_30km

co_types_mre

co_fed_land2