Resource Sharing Using Geolocation in North Carolina
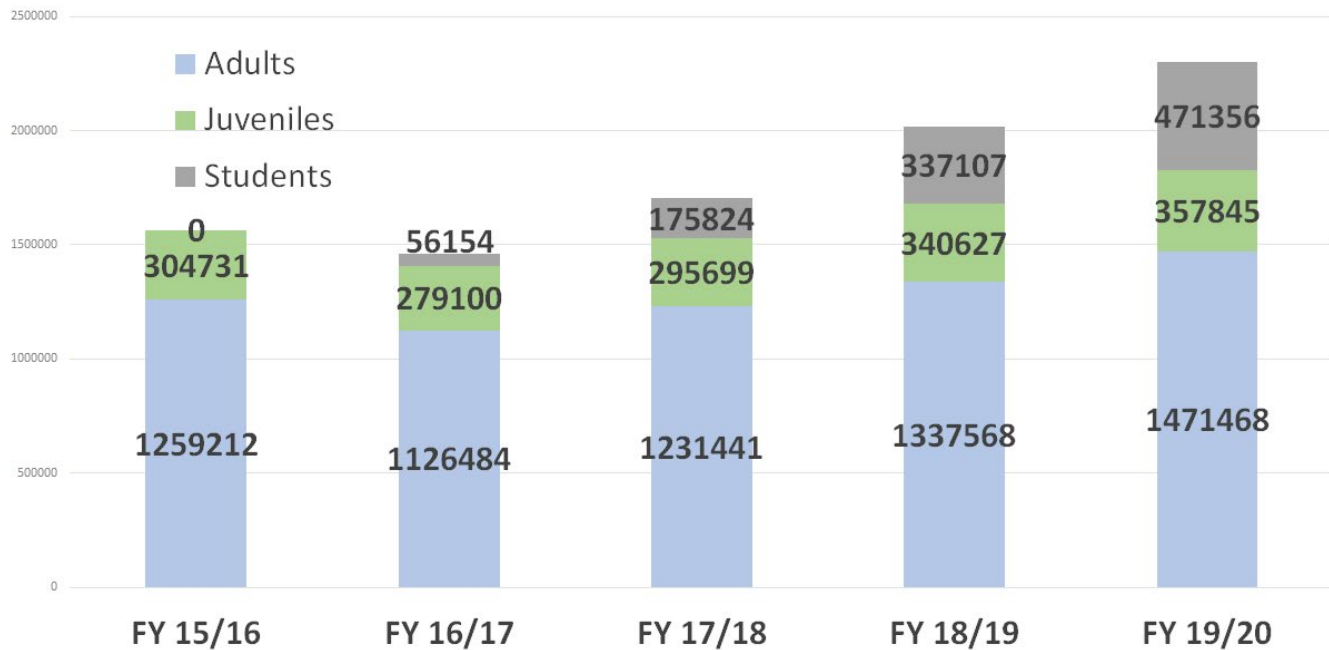
Shipping from the mountains to the sea

NC Cardinal Overview
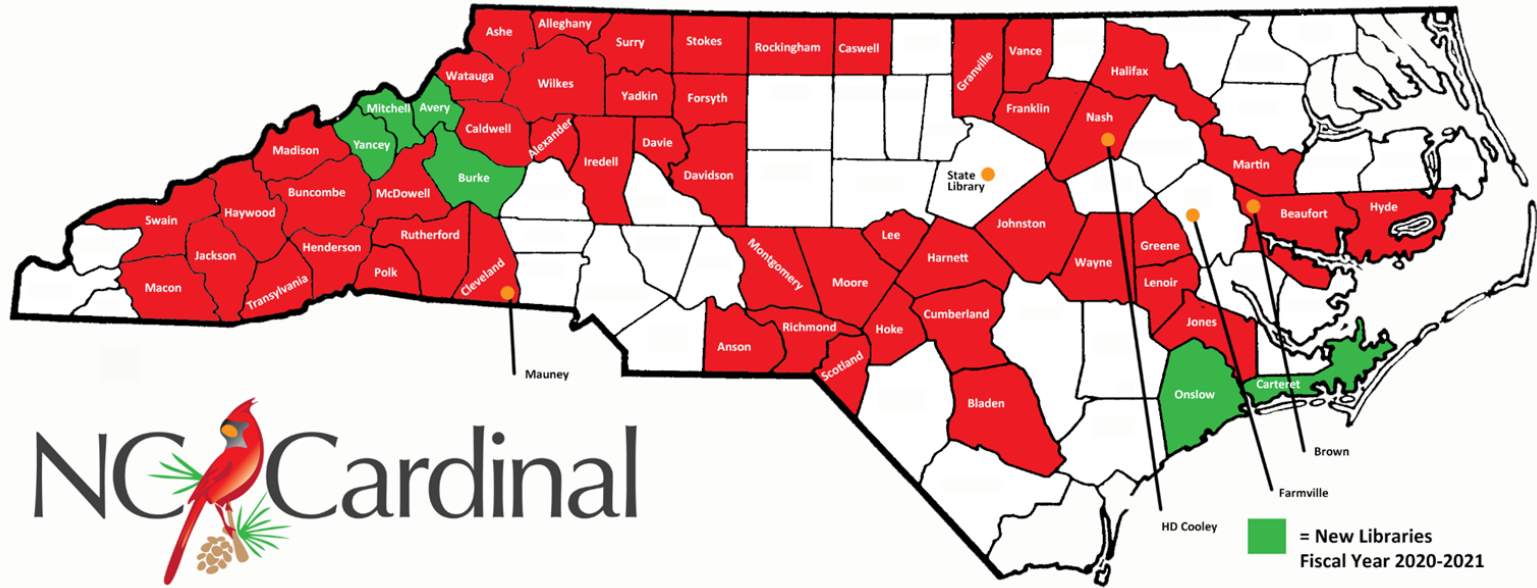
55 Counties, 4 municipalities, 7 Special Libraries

NC Cardinal Overview

Population Breakdown

| System	Active Patrons
Buncombe County Library System	193589
Forsyth County Public Library	177137
Cumberland County Library System	144778
Davidson County Public Library	126371
Sandhill Regional Library System	91778
Iredell County Public Library	89622
Johnston County Affiliated Libraries	82005
Appalachian Regional Library	81711
Harnett County Library System	76405

NC Cardinal Resource Sharing
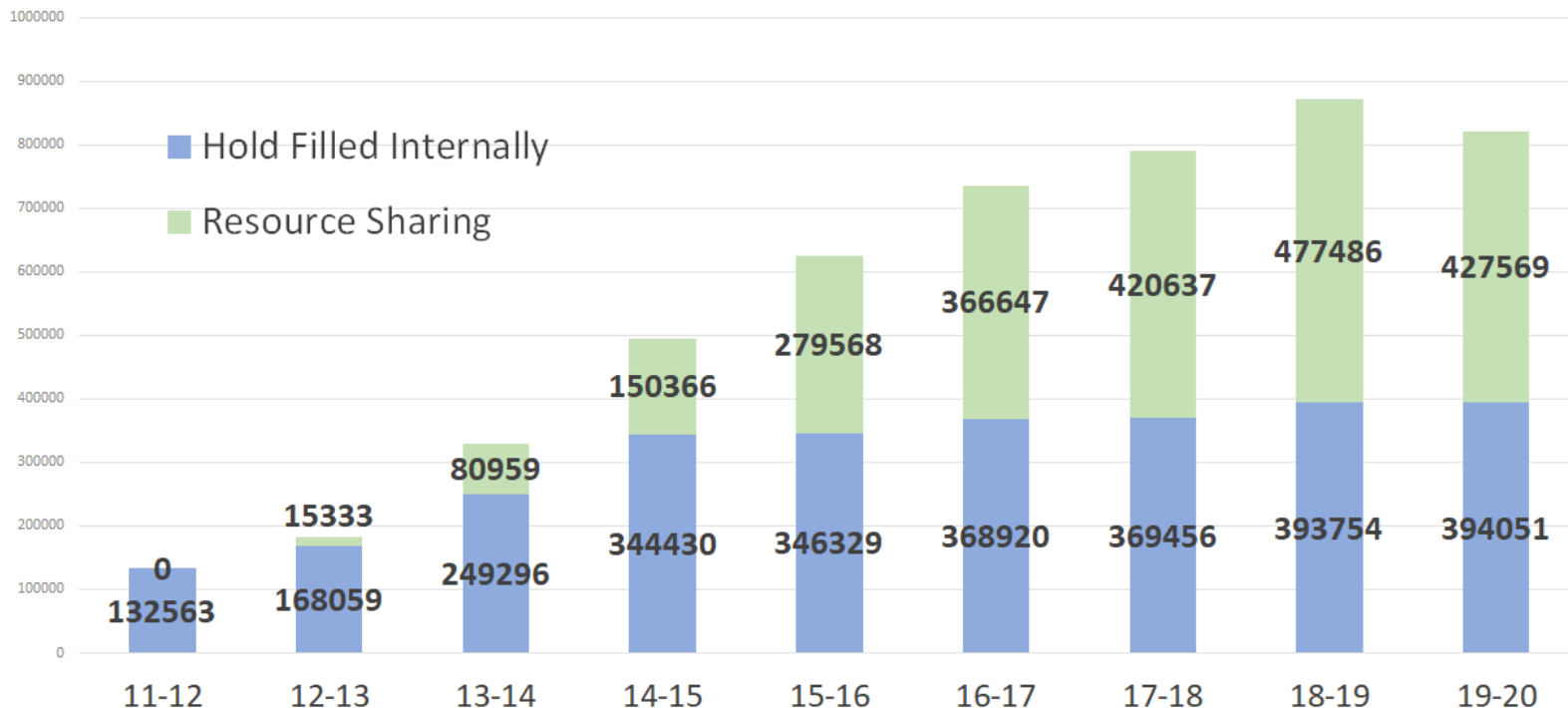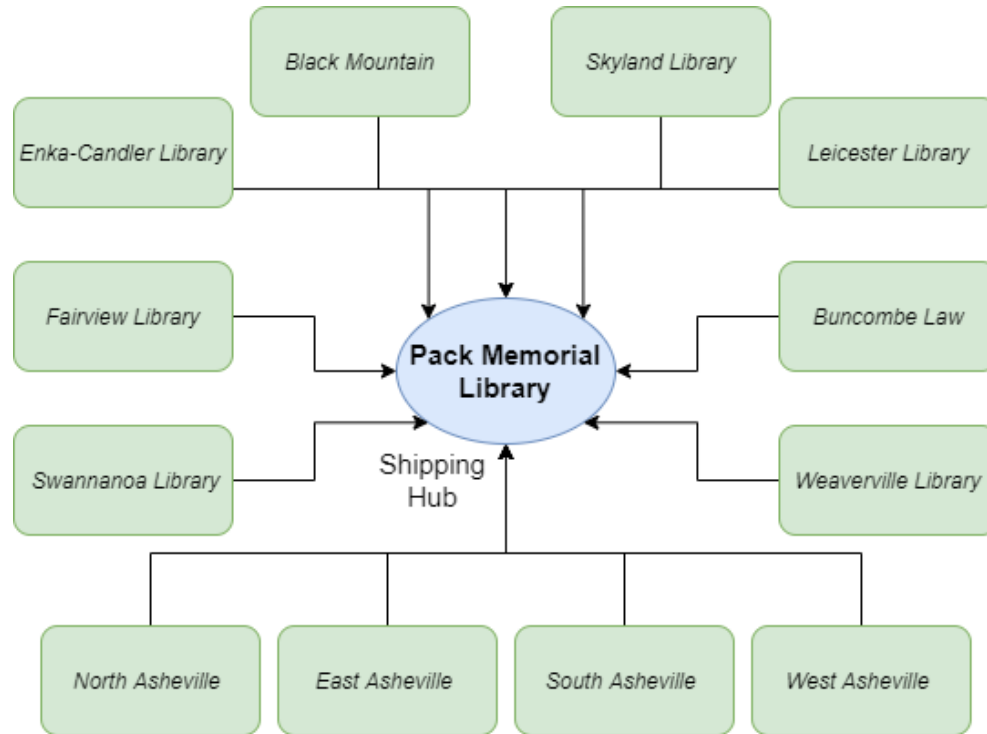
Shipping Hubs

Buncombe County Example
Material arrives at Pack Memorial library before being shipped to other branches in the system.

North Carolina Geography
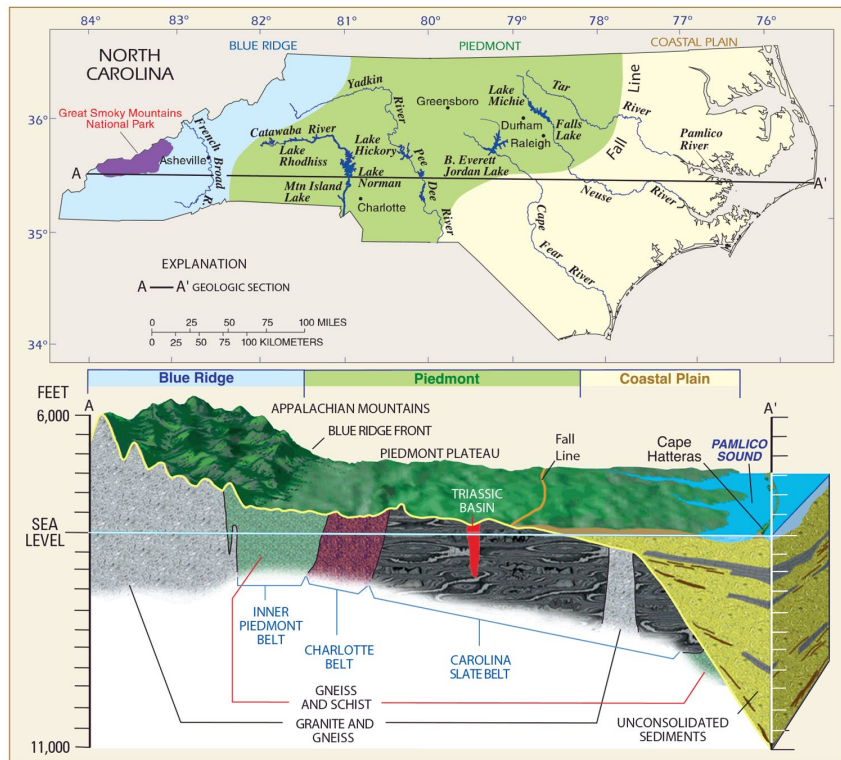
N.C. Fact Sheet
Length
503 miles
Width
150 miles
Height
6,684 feet - 0 feet
Major Rivers
- Chowan
- Roanoke
- Tar
- Neuse
- Cape Fear

Diagram by USGS

North Carolina Geography: West NC

Wilkes County

Asheville, Buncombe County

Photo by Michael Tracey (public domain)

North Carolina Geography: West NC

Highway 321 leaving Boone

Interstate 40 leaving Asheville

Photos from Google Maps

North Carolina Geography: West NC

Photo by California State Department of Transportation

That's gotta hurt!

North Carolina Geography: Central NC

Winston-Salem, Forsyth County

Fayetteville, Cumberland County

North Carolina Geography: Central NC

Map by NCDOT

North Carolina Geography: Eastern NC

Intercoastal waterway, Onslow County

Morehead City, Carteret County

Photo by James Willamor
https://creativecommons.org/licenses/by-sa/4.0/

North Carolina Geography: Eastern NC

Photo by The National Oceanic Atmospheric Administration

Look out below!

The North Carolina Division of Aviation/ABC Television Stations, DRONE VIDEO: I-40 completely flooded after Florence (2018, Sept 18) https://www.youtube.com/watch?v=j4nXX0f28Kk

North Carolina Geography: Outer Banks

Jockey's Ridge, Dare County

photo by Zach Rudisin
https://creativecommons.org/licenses/by-sa/3.0/

Ocracoke, Hyde County
photo by Vbofficial (public domain)

North Carolina Geography: Outer Banks

John Middleton, Ferry Leaving Ocracoke for Cedar Island. (2017, July 16) https://www.youtube.com/watch?v=tKwKrczRYJs&t=130s

North Carolina Geography: Outer Banks

Geographical Conundrums of North Carolina

The Island Conundrum
Carteret County
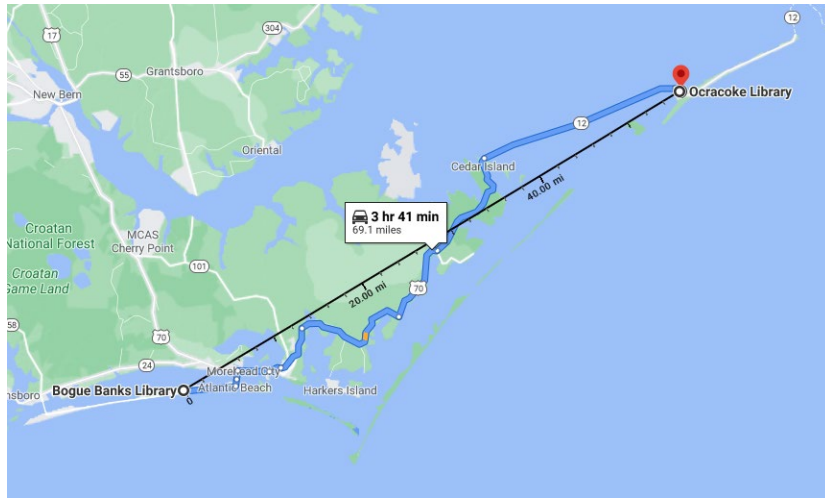
Crow files 55 miles
Truck drives 69 miles
and requires boat

The Mountain Conundrum
Buncombe County

Crow files 5 miles
Truck drives 14 miles

Mid-way Questions

Pilot Mountain, Yadkin & Surry Counties
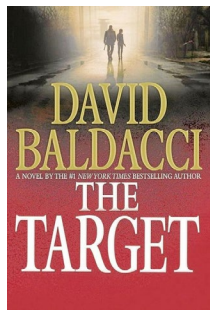

Photo by Christopher Ziemnowicz, https://creativecommons.org/licenses/by/3.0/

Hold Targeter Overview

Image from docs.evergreen-ils.org
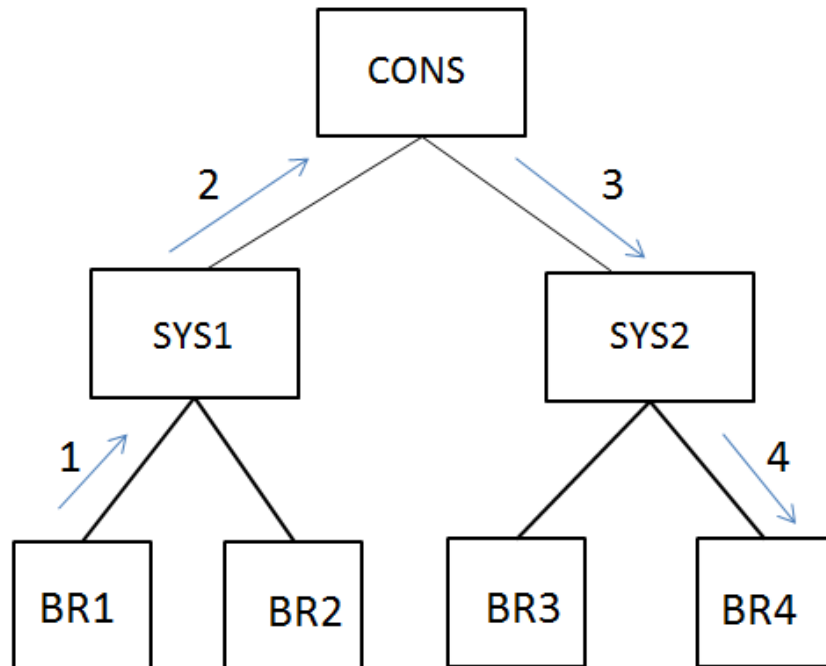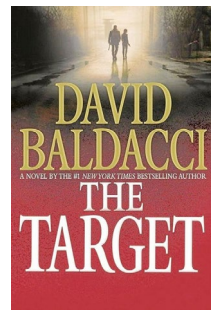
Hold Targeter Issue
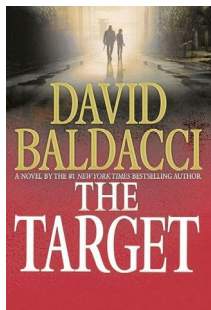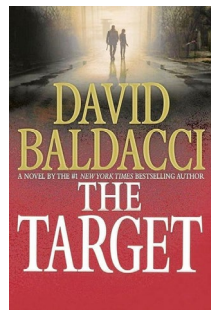
1 mile   5 miles   25 miles   250 miles

Proof of Concept Overview

actor.org_unit_shipping_hub_distance
+ id: primary key
+ orig_hub: actor.org_unit
+ dest_hub: actor.org_unit
+ distance: int

actor.org_unit
+ shipping_hub_ou:actor.org_unit

actor.org_unit_address
+ longitude:numeric
+ latitude:numeric

OpenILS::Application::VicinityCalculator
build_distance_matrix
set_coords
get_all_hubs
get_hub_from_ou
get_distance_between_shipping_hubs

OpenILS::Utils::VicinityCalculator::Matrix
hub_matrix
distance_between_hubs
get_target_hubs
get_hub_from_ou

OpenILS::Utils::VicinityCalculator
calculate_distance_matrix
get_addr_from_ou
get_coord_from_ou
get_all_hubs
get_coord_from_address
set_coord_for_ou
set_coord_for_addr
vicinity_between_coord
_geo_request
vicinity_between_coords
vicinity_between_ou
vicinity_between_hub

Vicinity Calculator
Calls the API to retrieve Longitude/Latitude and calculate driving directions

Vicinity Matrix
Contains the distance between pickup library and shipping hubs of target copies

API Connection

API Connection

```xml
<open-ils.vicinity-calculator>
    <keepalive>3</keepalive>
    <stateless>1</stateless>
    <language>perl</language>
    <implementation>OpenILS::Application::VicinityCalculator</implementation>
    <max_requests>5</max_requests>
    <unix_config>
        <unix_sock>open-ils.vicinity-calculator_unix.sock</unix_sock>
        <unix_pid>open-ils.vicinity-calculator_unix.pid</unix_pid>
        <max_requests>100</max_requests>
        <unix_log>open-ils.vicinity-calculator_unix.log</unix_log>
        <min_children>1</min_children>
        <max_children>15</max_children>
        <min_spare_children>1</min_spare_children>
        <max_spare_children>5</max_spare_children>
    </unix_config>
    <app_settings>
        <key>                                                              </key>
    </app_settings>
</open-ils.vicinity-calculator>
```

Assigning Shipping Hubs

Geolocating Shipping Hubs

Hold Targeting

Patron places hold

Proximities between pickup and circ libs calculated as usual

Pickup Library

✗

no copies at pickup library

Prox 1

Pickup Library System

✗

no copies within system

Prox 2

Vicinity matrix calculated when local copies (prox <= 2) depleted. Matrix calculated for copies in each prox level

Greater Consortium

Potential Copy 1	Potential Copy 2	Potential Copy 3
30 miles away	60 miles away	120 miles away

Potential copies are sorted by the shipping hub's value from the vicinity matrix. No random numbers employed. Typical "hold is permitted" function runs through the copies.

Prox 3+

Testing & Auditing

auditor.hold_request_cardinal_history

+audit_id : PRIMARY KEY
+audit_time : timestamp with time zone
+id : integer
+pickup_lib : integer
+request_lib : integer
+current_shelf_lib : integer
+usr : integer
+requestor : integer
+request_time : timestamp with time zone
+last_update_time : timestamp with time zone
+fufilled : boolean
+potential_copies : bigint
+minimum_proximity : numeric
+minimum_vicinity : numeric
+current_copy_id : bigint
+current_copy_proximity : numeric
+current_copy_vicinity : numeric
+current_copy_lib : integer
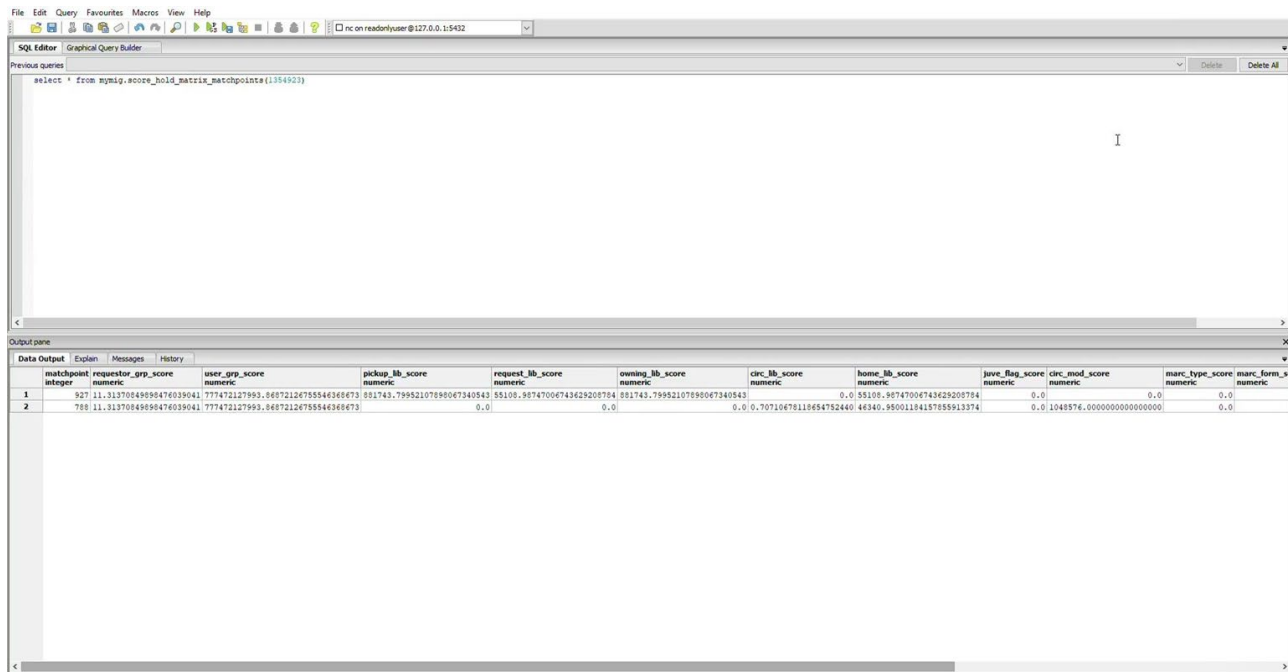+current_copy_hold_policy : integer

Extras table queried when hold is recorded into auditor

auditor.hold_request_cardinal_extras

+audit_id : PRIMARY KEY
+id : integer
+last_update_time : timestamp with time zone
+potential_copies : bigint
+minimum_proximity : numeric
+minimum_vicinity : numeric
+current_copy_proximity : numeric
+current_copy_vicinity : numeric
+current_copy_hold_policy : integer

Testing & Auditing

select * from score_hold_matrix_matchpoints(hold_id)

Future concerns with Resource Sharing

- Zip code surcharge & shipping information support
- Frequency of calculating routes
- Support for other geolocation services
- Systems dependent on other systems
- Distance based hold policies

Flooding in Duplin County, Photo by USDA

Photo by MobiusDaXter, https://creativecommons.org/licenses/by-sa/3.0/

Questions?