Taking a Look at Waste Disposal in Virginia Counties

Hi I am Elizabeth Goernemann and I did my GIS Capstone on taking a look at waste disposal in Virginia counties.

Why This Topic?

- Where does our trash go?
- Is it distributed effectively?
- What are the determining factors?

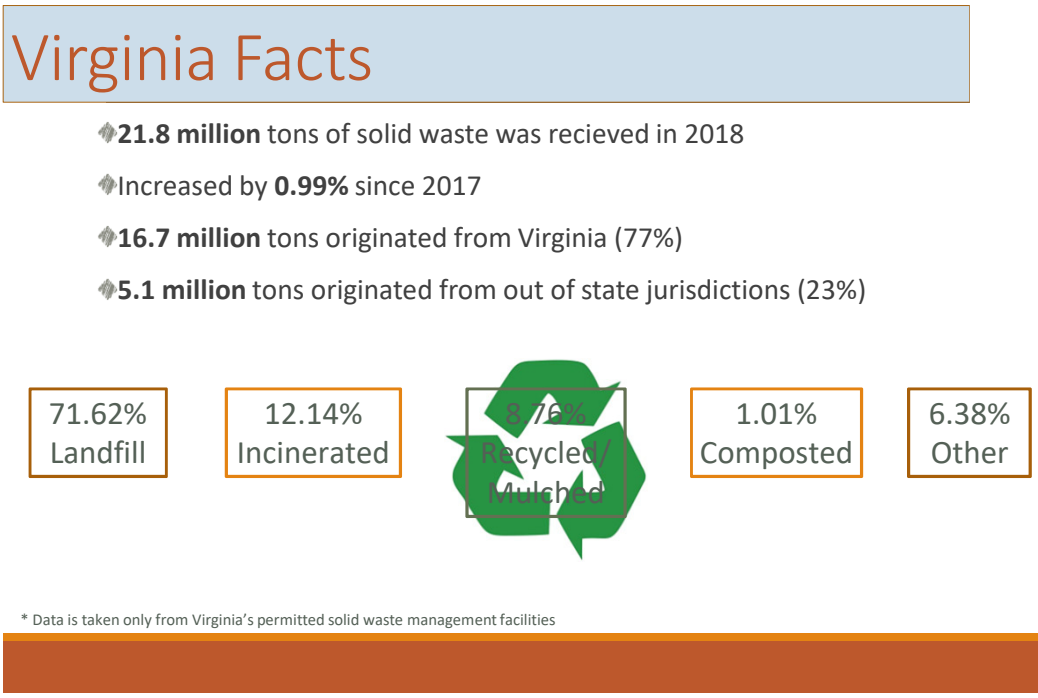
The questions on the board are the 3 main reasons why I wanted to investigate this topic.

Trash services and waste disposal are not talked about frequently because they don't hold that glamourous quality about them. However the process of collecting our trash and solid waste is essential and must happen on a daily basis. There are no days off for this process because we are always creating trash and excess waste. I wanted to shed some light on just how complex this process is and what it looks like in the state of Virginia.

So as a result the 3 questions that really got me thinking about this project were:
1. Where does our trash go?
- I've always seen the trash trucks and I've driven by a few landfills but I never thought of where someone's trash goes as a result of their geographic location.

2. Is it distributed effectively?
-This questions led me to think about other questions such as… With certain areas having a higher population density does that have to do with where the waste goes? What if there's too much trash in a certain area?

And 3. What are the determining factors?
- This last question is really what I decided to focus my capstone on. I want to know if there may be certain patterns or attributes that determine how trash gets disposed of and if there are better processes than others.



To begin I have a few important facts to convey how Virginia is doing on managing solid waste disposal.

The facts on this slide were taken from the VDEQ, 2019 Annual Solid waste report for CY2018 (calendar year 2018).

Over 21 million tons of solid waste was received by Virginia's permitted solid waste management facilities.
This total increased by 0.99% since the year before (2017).
Over 16 million tons originated from inside the state and 5 million tons came from out of state jurisdictions such as neighboring states like Maryland.

Already we see how distribution of solid waste crosses over state borders, proving that distribution must be relying on if the area can handle the amount of trash they are producing. I think it's interesting to see an agreement like this because it's a big responsibility to take on someone else's trash while land availability isn't getting any bigger.

With all the solid waste that gets collected, it's no surprise that about 70% goes directly into the landfill.
Incineration is the second most popular method with about 12% and only 8% is recycled/ mulched.

Now let's see how these numbers add up to the national average…

According to the EPA in 2017 on a nation wide scale the total municipal solid waste generated was 267.8 million tons.

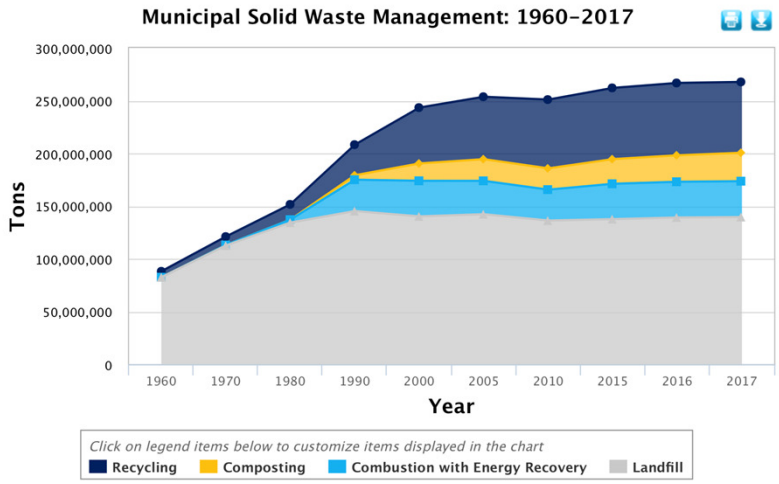
This averages out to everyone in the country producing 4.51 pounds of waste per day! This number is a 2.1% increase in the total since 2015.

What's really interesting to note is that the distribution of the waste collected looks a little bit different than Virginia in 2018.
Only 50% of the waste gets put directly into a landfill.

Recycling and composting take up 35%, this is a huge increase compared to VA. What's also different is they describe combustion with energy recovery, meaning that some places in the country have made an effort to make incinerating more efficient and environmentally friendly and this percentage is very close to the same number in

both VA and nationally being around 12% for both.

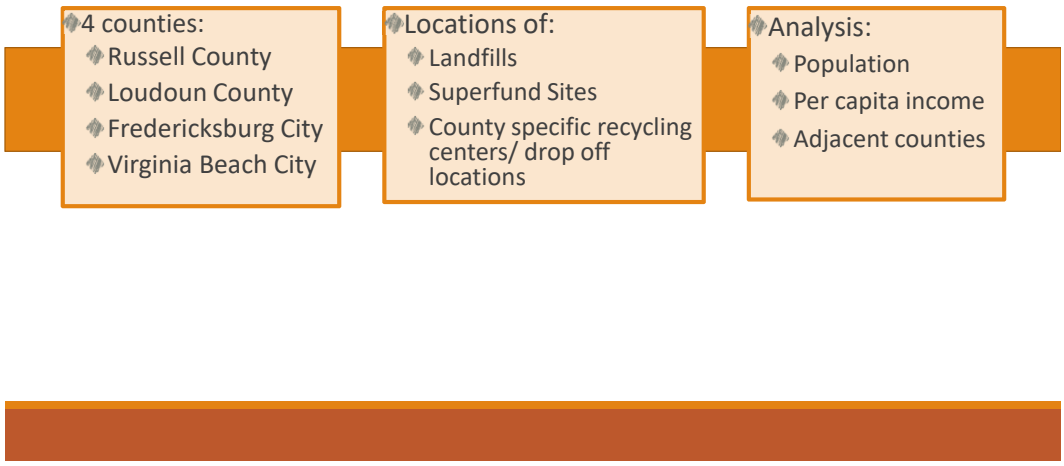
1960 - 2017 Trends



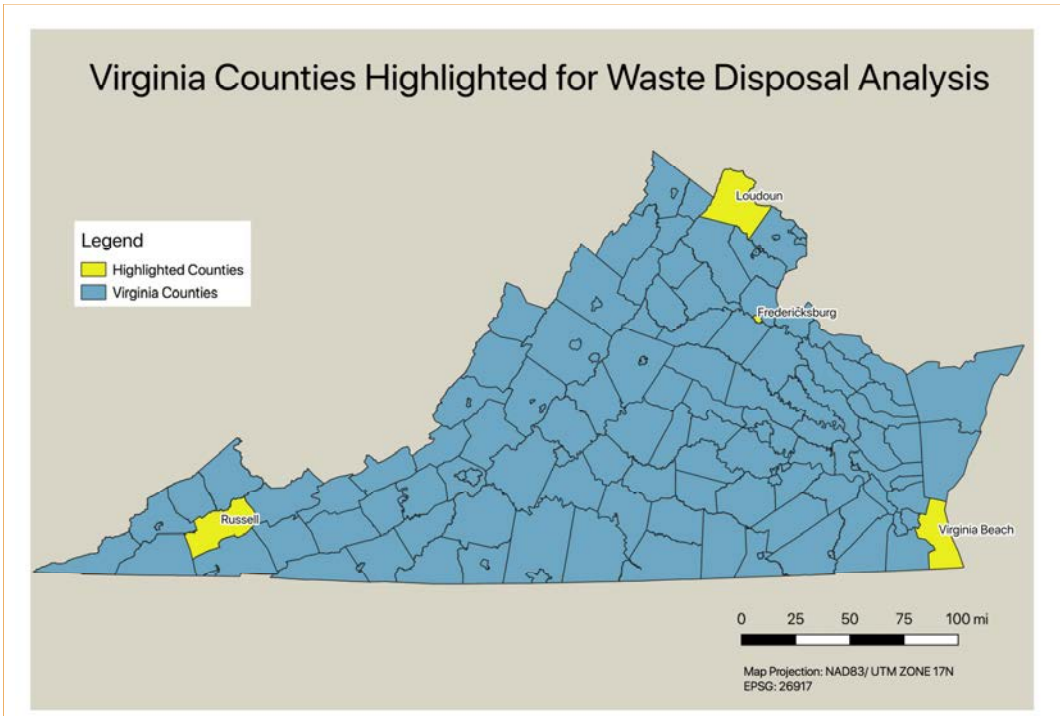
Before moving on this graphic is really important in understanding the trend of waste disposal in the country over time. It wasn't too long ago (just a little over 50 years) that recycling was barely an option in waste disposal. However with our population increasing worldwide it is important to increase the percentage of recycled materials.

In this graph even as the years go on the the same of amount of waste is being put into landfills, it would be really great in the next few years to see recycling and composting go up while also having landfill waste go down.

Overview



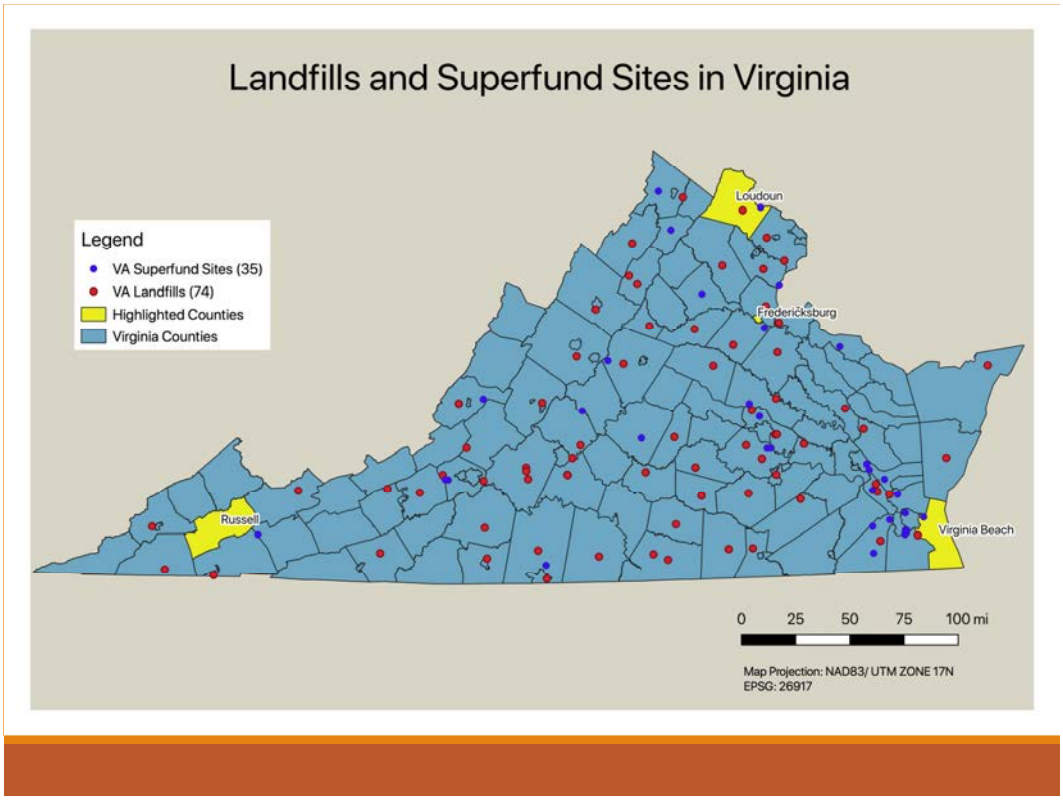
So with that said, I decided that in order to understand where trash goes and why certain methods are used,
I would investigate 4 counties in different geographic regions in VA while finding the locations of landfills, recycling centers and superfund sites and then comparing it to total population as well as per capita income to see if there are any patterns or even any concerns of trash maintenance in the future.



This is the first map I wanted to show because it introduces the 4 Counties. I tried to choose a diverse collection so we can see the similarities and differences within each county.

As a result I choose to investigate Russell county in south west VA,
Fredericksburg City because this is where Mary Washington is located
Virginia Beach City because it is a coastal town and

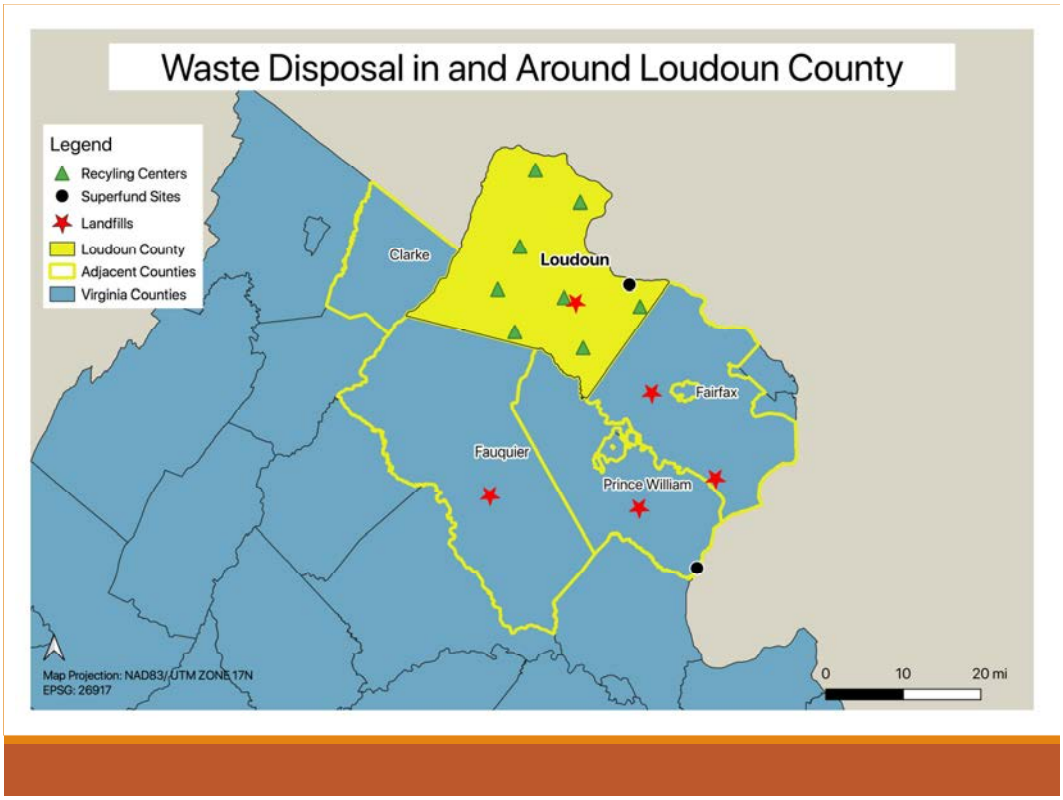
Loudoun County because it's located in northern Virginia.



The next map I choose to create is one that shows both landfills and superfund sites in Virginia.

I got the landfill locations from the EPA website through the landfill methane outreach program. (LMOP)
What's interesting about this map is the red dots (which are the landfills) show that there is not one landfill per county. There are only 74 landfills total compared to 133 counties. This tells us right off the bat that transportation and distribution is taking place on a regular basis.

I also decided to add Superfund sites to the map because I think it's a great indicator of the environmental health of the area , and gives insight on the history of the region. Superfund sites are areas where high levels of toxic wastes have been dumped and polluted. These pieces of land were once mismanaged disposal areas and therefore I thought they would be interesting to analyze as well.



The first county we are going to look deeper into is Loudoun County

It's important to note that I only added recycling centers/ pickup locations for each county just because there was so much variation and so many sites between the 4 counties.

Earlier I mentioned that the VDEQ only took data from Virginia's permitted solid waste management facilities.

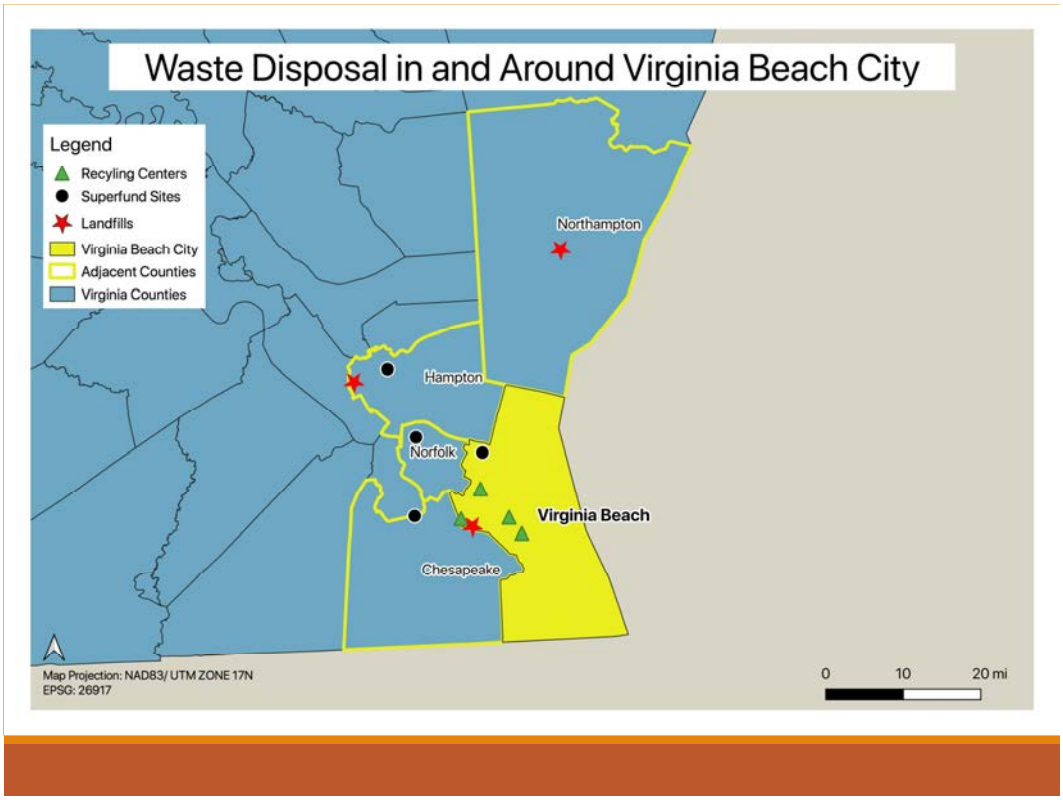
When researching in each county the majority of the biggest landfills also had recycling centers included in their process. (You can see this on the maps when the green triangle is directly next to a red star) Within counties however there are many recycling centers where you can turn in appliances, electronics or specific materials to small drop off locations. These are not official centers so I only tried to include permitted solid waste facilities when mapping. To do this recycle center mapping I used the counties official website where they listed the trash and recycling services that they provide.

For the remainder of the maps, the legend shows that landfills are symbolized with a red star, recycling centers are a green triangle and superfund sites are symbolized as black dots.

This map shows that there are 5 landfills in and around Loudoun which is a high number. It also has 2 Superfund sites and 8 recycling centers within Loudoun. When looking at Loudoun's website the county does not provide trash or recycling pickup. It is up to town governments to decide if they want to provide it or not. Private waste

pickup companies and even home owner associations can provide these services for some neighborhoods as well but it's not consistent throughout the county. This may be the reason there are so many provided recycling centers/ drop-off locations in the county.

Later we will see how this compares to population numbers and per capita income…

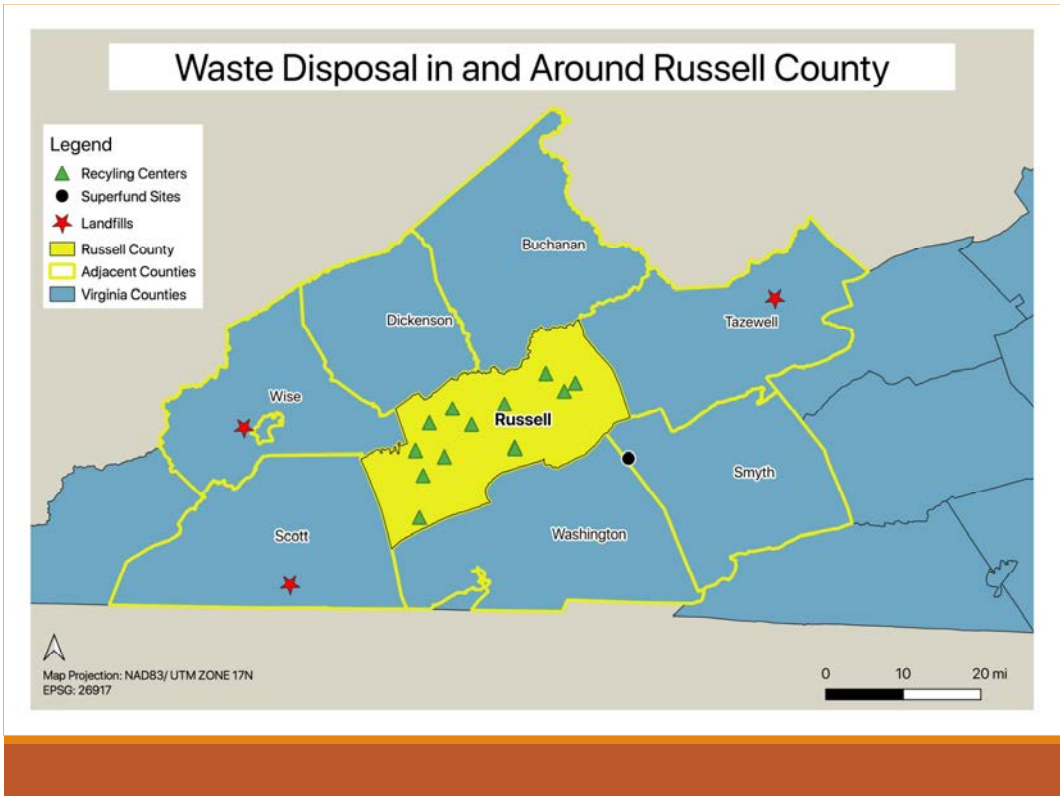


In the second county, right away the thing to notice is the 4 superfund sites in the surrounding area and only 3 landfills. Compared to Loudoun, Virginia Beach has fewer recycling centers. This may have to do with it being a coastal city. Virginia Beach transports much of their trash outside the county. They have recently partnered with the South eastern public service authority (SPSA) which is a regional landfill that transports solid waste from the surrounding area.

Unlike Loudoun the government of Virginia Beach does provide trash/ recycling pickup. As a result this may be a reason why we see less recycling centers/ drop off locations in the city because there is less of a need for them.

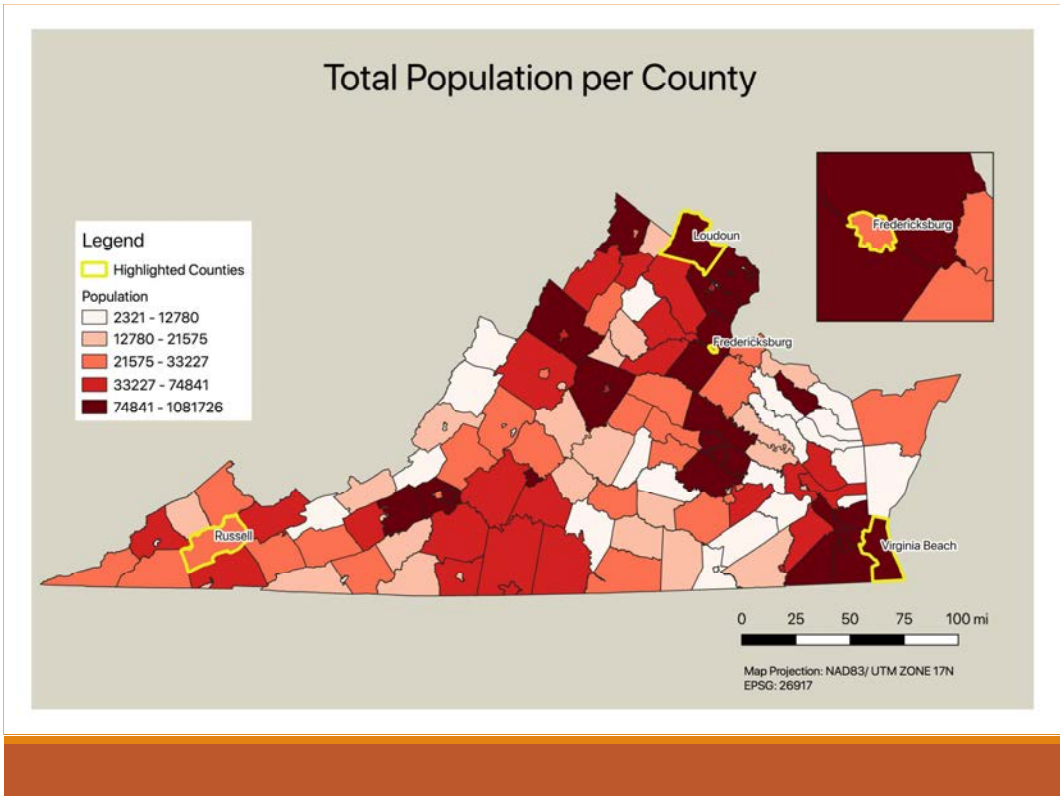
Fredericksburg is much different from the last two counties we just looked at. Because Fredericksburg is so small, they really have to rely on the surrounding counties. Fredericksburg has partnered with Rappahannock regional solid waste management board. This joins Stafford and Fredericksburg together in waste management. Therefore, Fredericksburg waste is transported to the R-board regional landfill. On the map this is the landfill marked with a red star in Stafford.

Fredericksburg also provides trash and recycling pickup for this city as well, and this partnership with the R-board has made for the most cost effective and environmentally beneficial process they have has thus far.



The last county to look at is Russell. There are only 3 landfills for the 7 counties that are in the area. Within Russell there are many recycling centers however almost all of these are drop off locations.

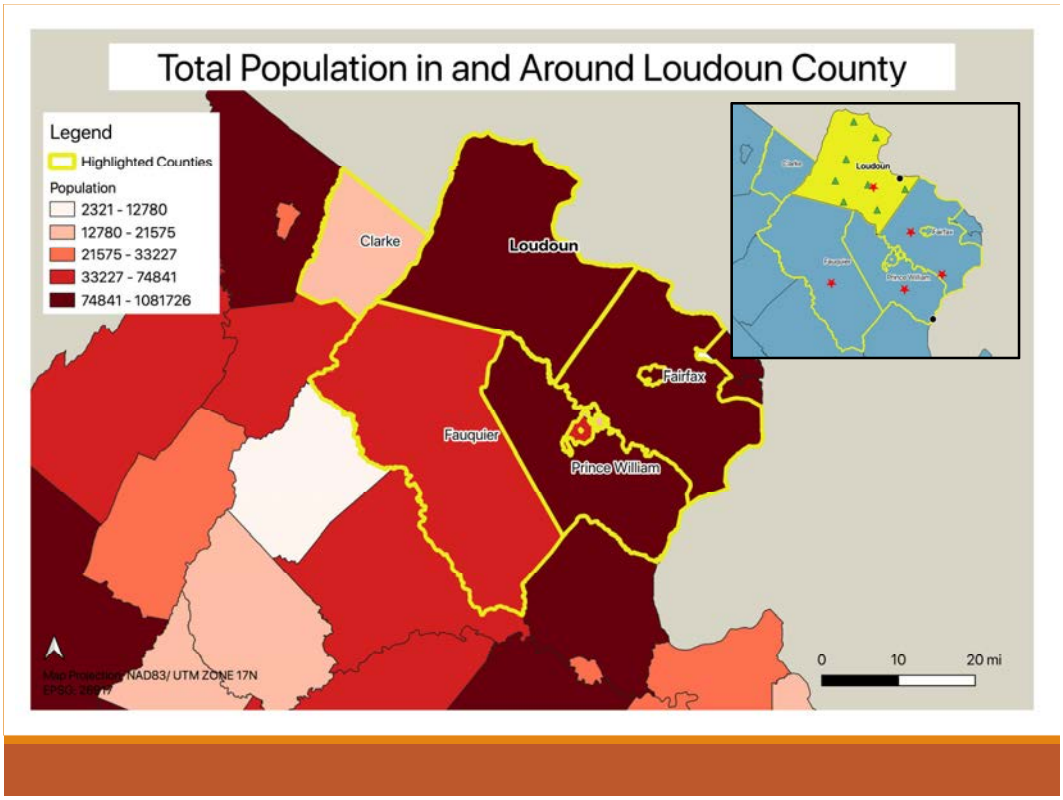
Russell does not provide trash and recycling pick up, but they have provided many convenience stations where you can drop off trash/recycling, which is then transported outside the county. They even have the Russell county transfer station that transports most of the waste.



Now let's look at how populations in each county may also effect how they run their waste disposal services.

This map shows the population of each county. With darker red showing larger populations and lighter colors showing smaller populations.

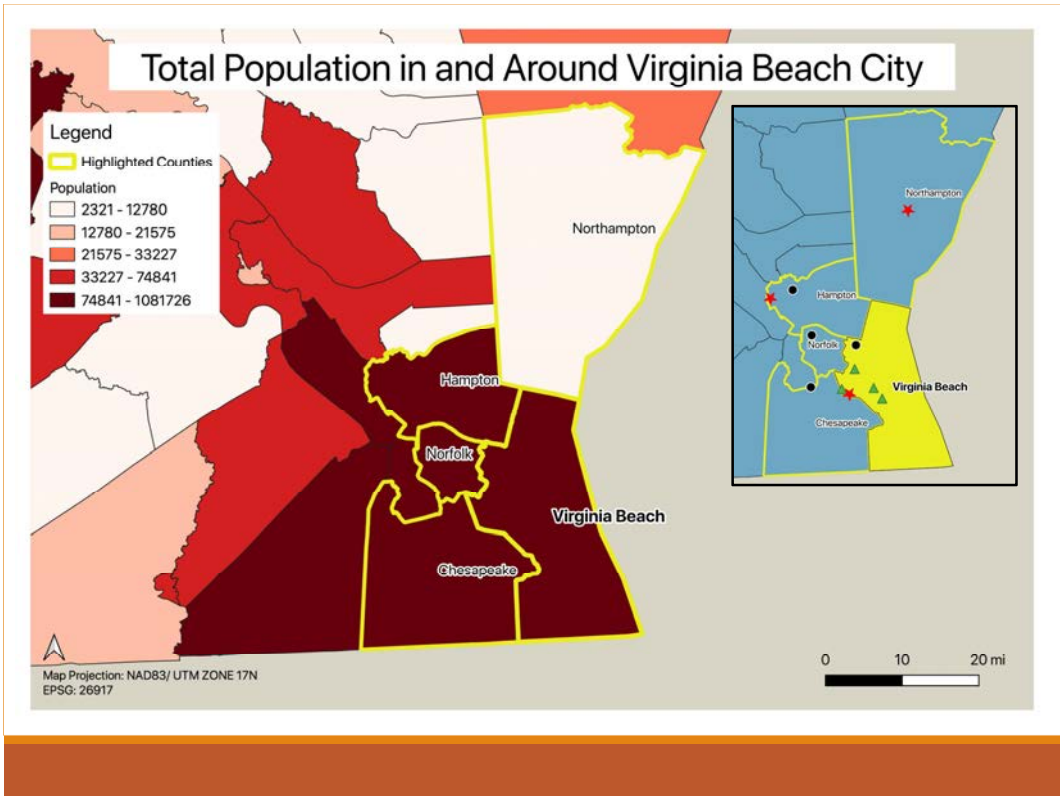
Virginia Beach and Loudoun both have very large populations while Fredericksburg and Russell have medium size populations.



Let’s take a deeper look at the population numbers in each county and the surrounding area.
In the upper right hand corner of these maps are snippets of the previous waste disposal maps so a clear and easy comparison can be made while the data is presented side by side.

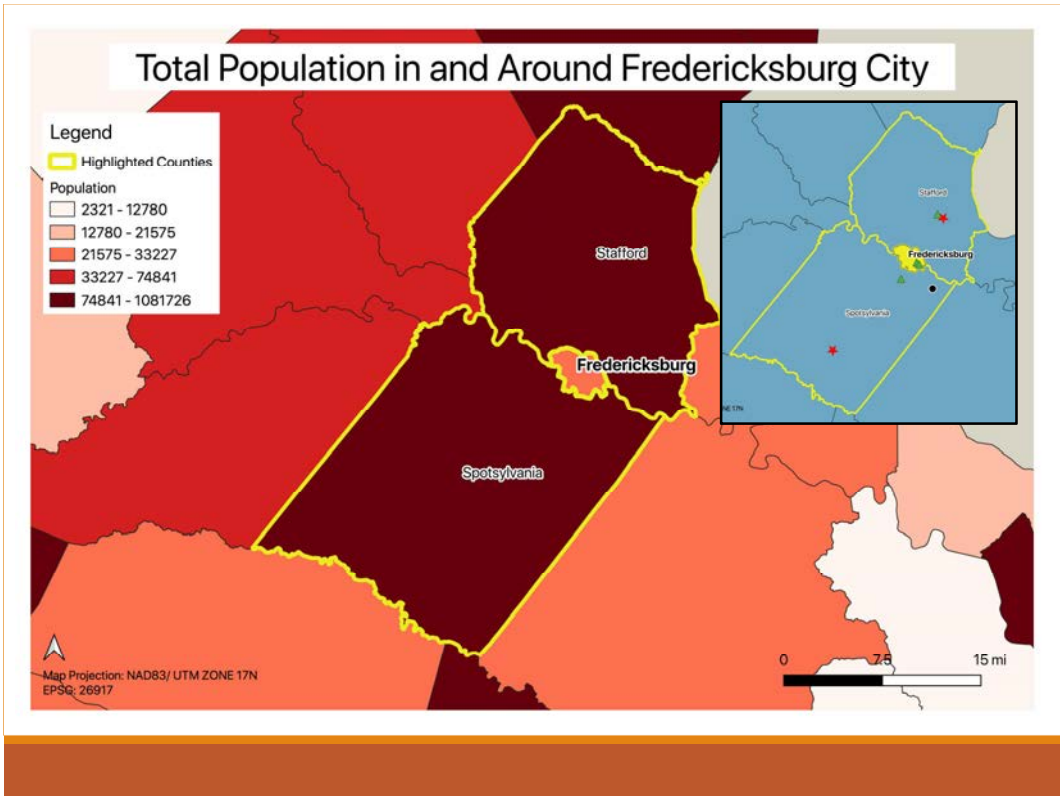
When taking a look at the area surrounding Loudoun we can see that it is a very populous area , so it makes sense that 5 landfills are in the area because they are receiving such a high volume of solid waste.

This also may be why the county government does not provide pickup and rather delegates it to the town governments, just because there are so many people, and residences to manage.

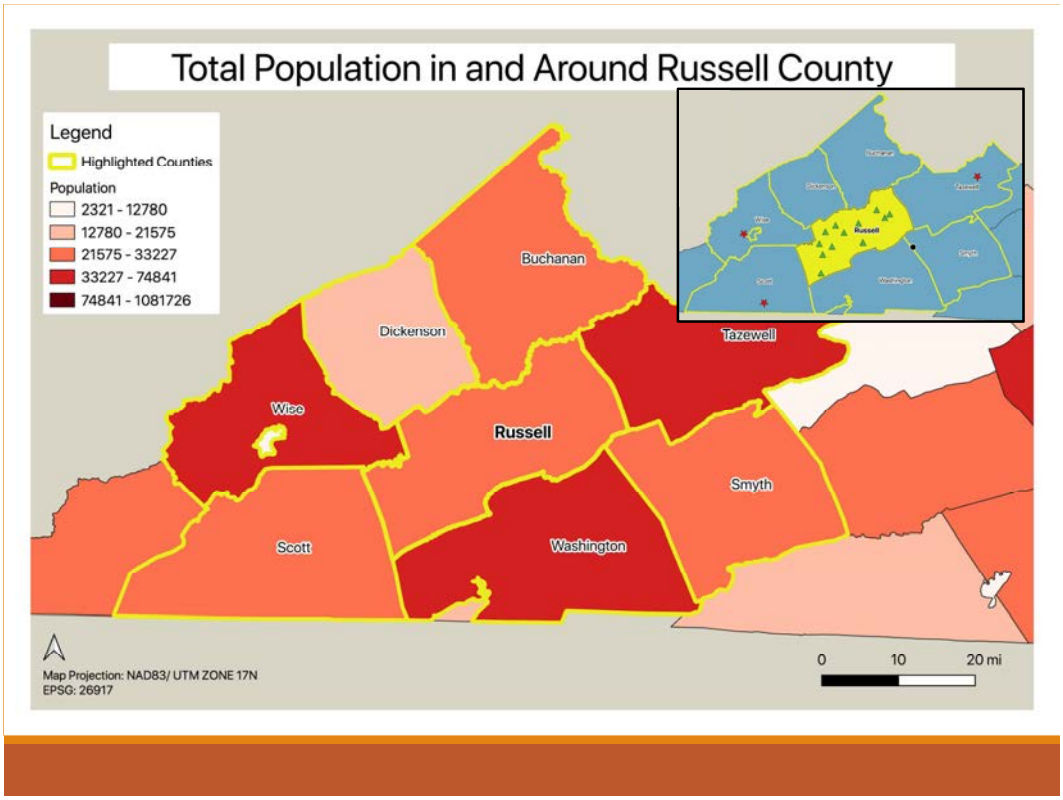


Virginia Beach is just as populous except for Northhampton (which sits directly above Virginia Beach).

As I mentioned earlier Virginia Beach uses the services of SPSA, the landfill is located in Suffolk which is the county to the left of Chesapeake. This is farther away than other shared landfills between counties however, with a large population and so few landfills near the coast it makes sense that solid waste would travel farther inland.

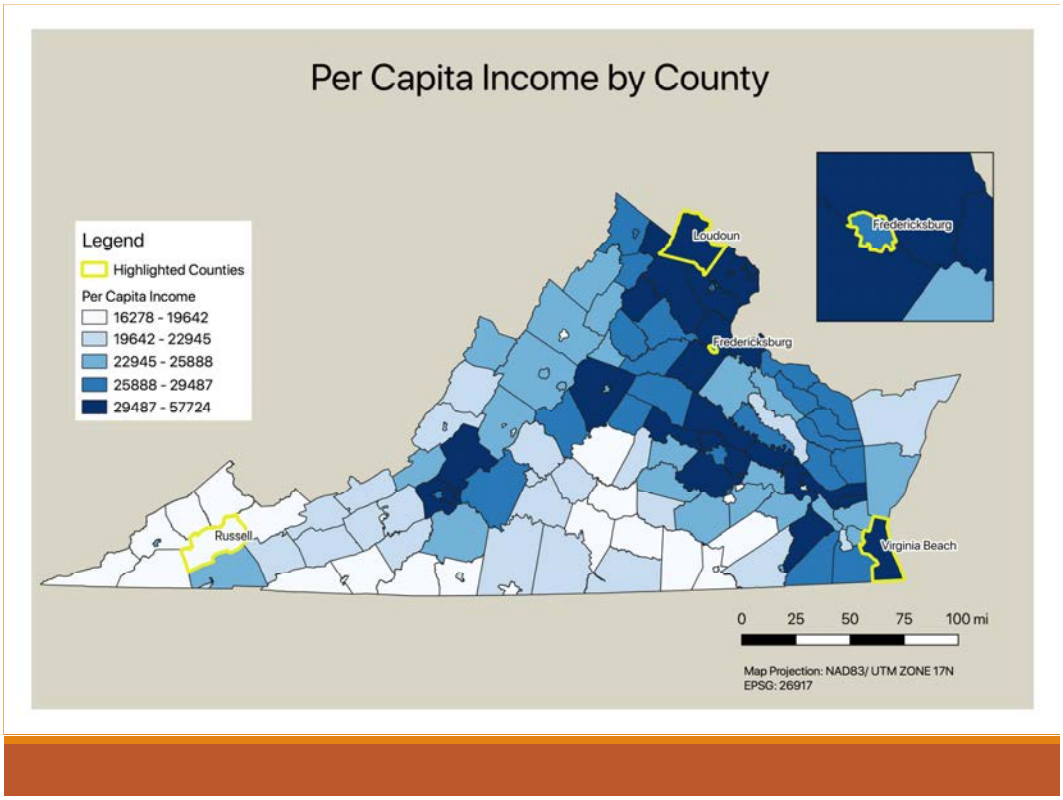


Fredericksburg's surrounding area is also very populous and has landfills in either adjacent county. Because Fredericksburg is smaller in size and population it makes sense that they rely on the neighboring counties



Russell and the surrounding region is the least populous and makes sense as to why their landfills are so spread out. Based on population numbers the area as a whole is producing less waste per person, especially if we apply the national average of 4.51 pounds of waste per person per day.

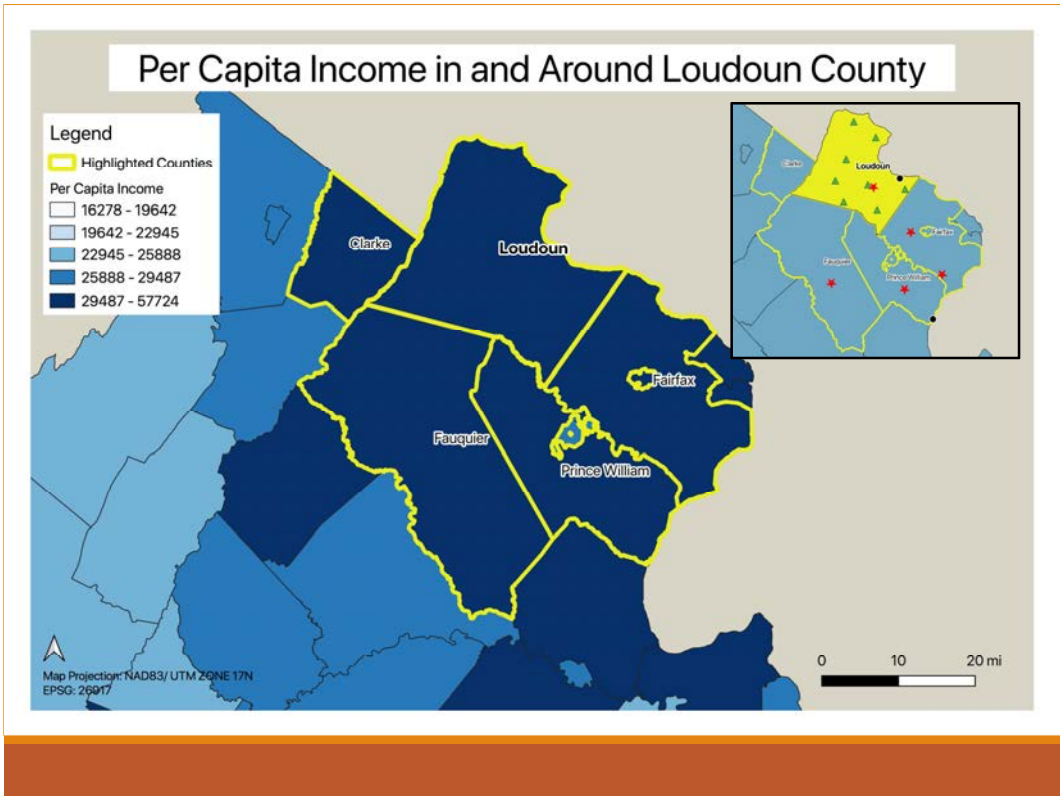
When looking back a the distribution of Superfund sites and populations, Loudoun and Virginia Beach had the most sites in their surrounding areas. This is interesting to note and could potentially lead to a future project of whether mismanaged disposal happened because there was a lot of hazardous waste from a large population or if a certain location just became the designated spot for waste disposal. Looking at the population growth of an area over time would help with that determination as well.



Moving on to comparing the counties with per capita income.

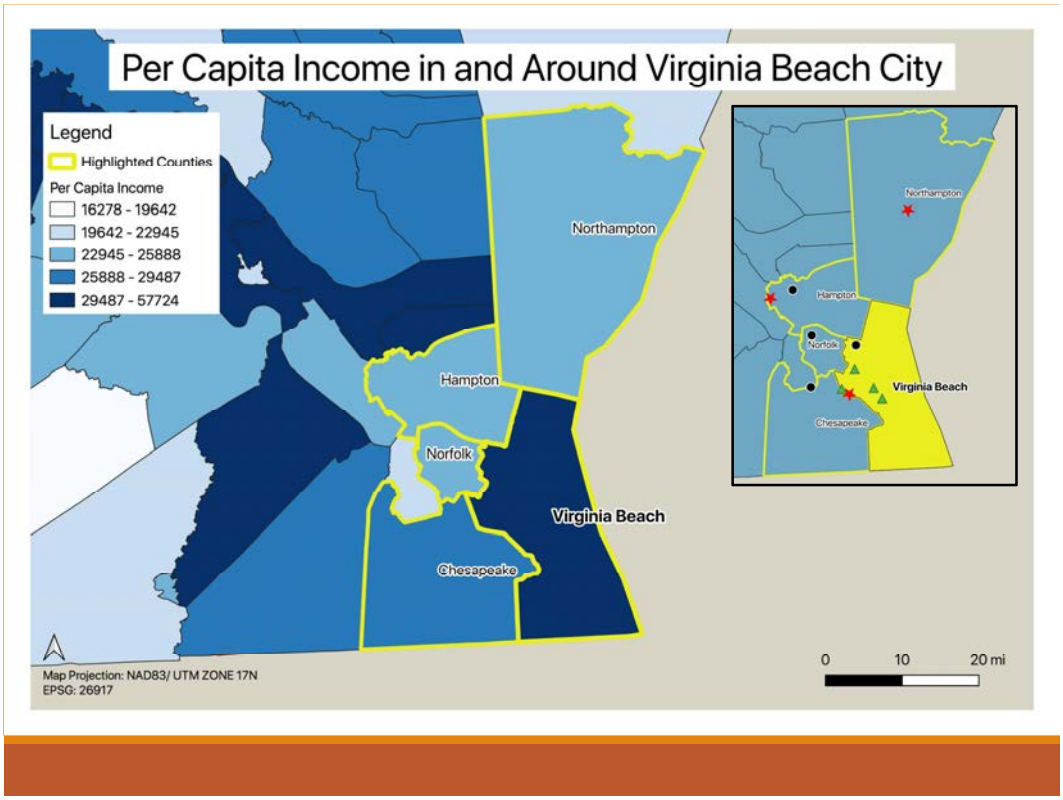
The per capita income gradient looks very different than the population distribution. Southern and southwest Virginia have a much lower per capita income than northern-mid VA.

Loudoun and Virginia Beach are still in the highest gradient range while Fredericksburg is the second highest and Russell is in the lowest gradient.

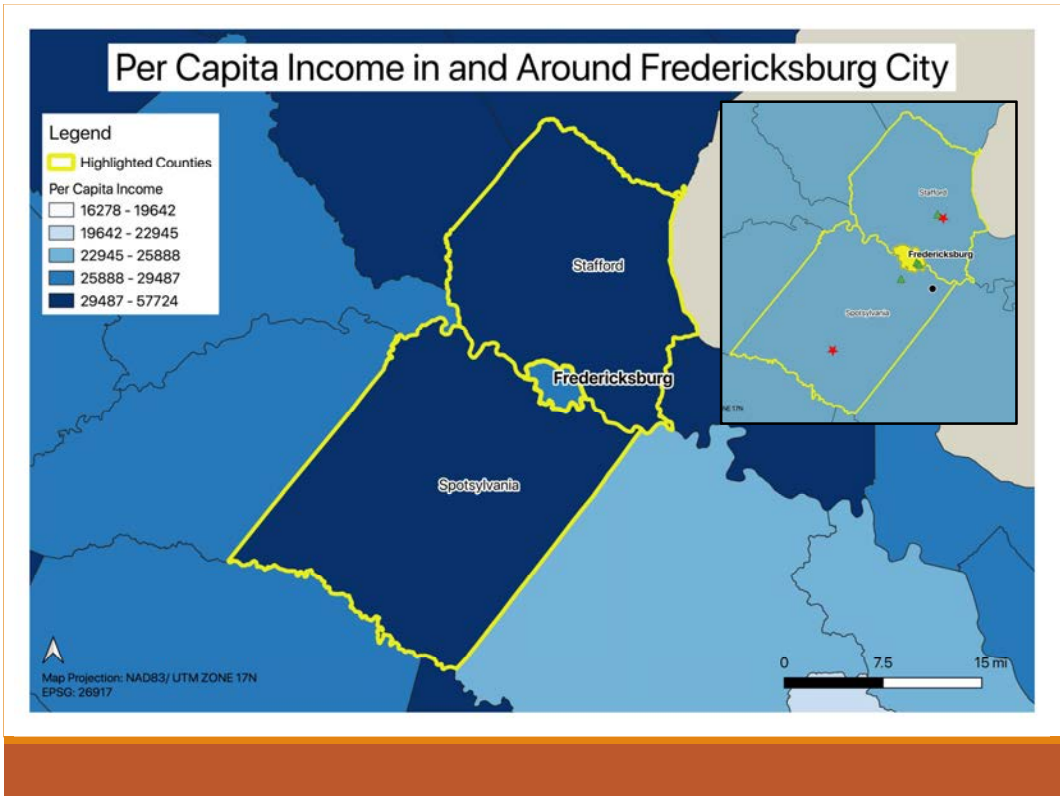


Loudoun not only has a large population but is also wealthy county.

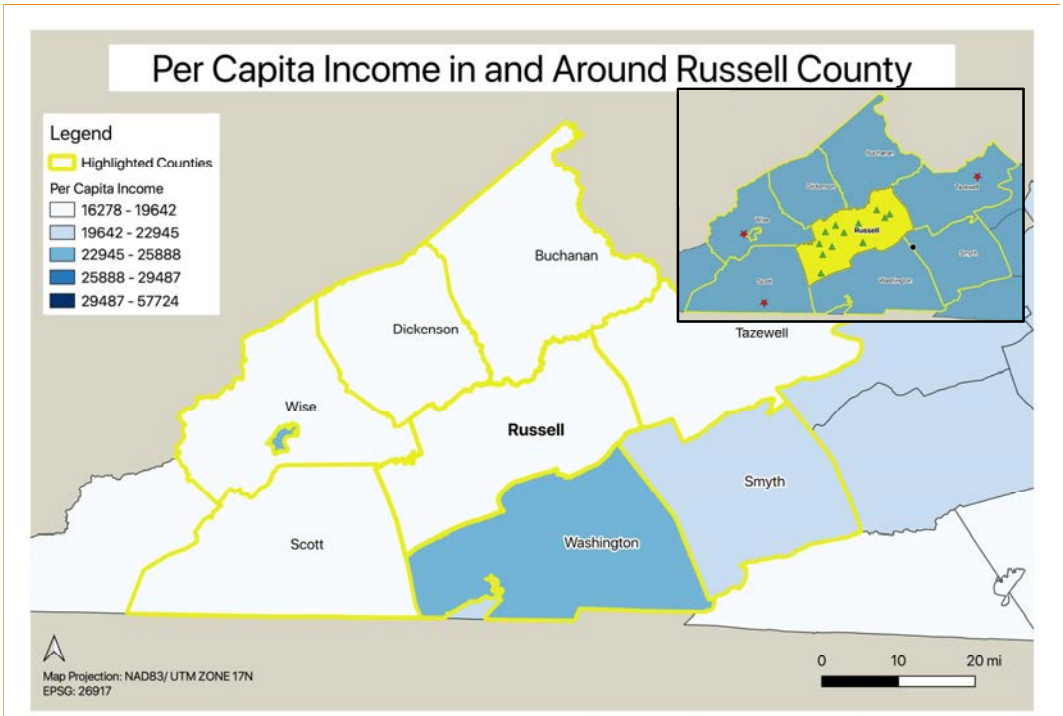
Private trash services have the potential to make a lot of money in this area as a result because residents are more likely to be able to afford the additional fee.
I also mentioned previously that in Loudoun HOA is another popular way to have pickup trash/ recycling since the county government does not provide it. Since we now know that this is a wealthier region it does make sense that the management of trash and recycling is easily taken care of because the per capita income allows many people to pay in different ways to get trash and recycling collected.



Virginia Beach my have a high per capita income but none of the surrounding counties are as high. This is a very interesting relationship. This may be because Virginia Beach has a larger tourism economy than the surrounding counties.



Like Loudoun, Fredericksburg and the area around have a high per capita income. When comparing the per capita income to the waste disposal map I do not see anything surprising about the amount or placement of landfills recycling centers or superfund sites. It seems that because Fredericksburg is so small the partnership with the R-board makes sense and is not putting any extra stress on Stafford.



Russell and the surrounding areas are drastically different than the 3 other counties previously looked at. Combined with the smaller population there may be less landfills because they don't have as much money.

When doing my research Russell's website was not as updated and it was more difficult to find information about their waste management. I actually had to call them to get addresses for convenience stations because they hadn't updated the website yet.

The lower per capita income could also be the reason they have so many drop off locations.

Final Thoughts

- Recycling centers/ drop off locations vs. Virginia recycling percentage
- Drop off locations popular in Loudoun and Russell County
- Coastal vs. Inland

After looking at all the maps and the data on each there are a few takeaways I have learned about the waste disposal service in Virginia.

First of all when looking up recycling centers/ drop off locations in counties, just because there are a lot of locations does not necessarily mean that a good percentage of recycling is actually taking place. Only 8% is being recycled which is much lower than the national average.

Drop off locations for trash and recycling was also very popular in Russell and Loudoun however the 2 counties had very different per capita income and population totals. So why are both counties using the same method? Is it because it is easiest for the counties to manage in both circumstances? Or does it just appear that way because all the pickup services in Loudoun are done by private services?

This project also uncovered that coastal sites may have an added layer of complication. Virginia Beach had a large population and per capita income however, it heavily relied on counties farther away to process its' solid waste. It made more sense for Fredericksburg and Russell to rely on other counties because Fredericksburg is so small and Russell has less trash and money. I think that whenever you are in an area with a delicate environment such as a coastal region, less land will be available to use for waste disposal for the risk of contaminants spreading and harming these habitats. But what we also saw is that in this region there were the highest amount of superfund

sites, indicating the disposal could have been mismanaged before and now they are relying on larger regional landfills as a result.

Overall Virginia definitely has room to improve! I would love to see in the future the amount of recycling going up and landfill use going down. It seems that partnerships between counties and regions is becoming a more popular method. This allows for everything to be sorted in one location however in order to get the highest amount of recycling and trash local pickup or drop-off must be consistent. In future research I would love to look into what is the best way for the public to increase their recycling so it increases statewide. One thing for sure is that the waste disposal service is a massive and complicated operation and it takes everyone working together to get the job done day in and day out.

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Here are my works cited. This does include where I found and downloaded my online data.

It is important to note that at the end of March the US Census got rid of Fact finder and did not put all of the previous data on the census.gov up in a timely manner. As a result I cited a Wikipedia page because this is the only place where you can view the data today since it was archived and saved on the Wikipedia page

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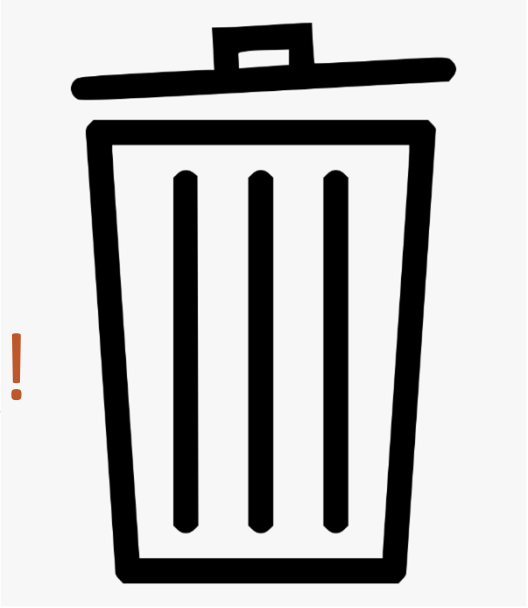
Works Cited continued…

Thank You!



Thank you for reading along, I hope you enjoyed it and please let me know if you have any questions.

I just want to say thank you to UMW, the Geography department and my Advisor Dr. Whipkey for all the support. It's unfortunate that the semester ended like it did however it's so great to work with a program that can be accessed from anywhere, proving that GIS is such a powerful tool to use!

And fun fact it was actually because of the Pandemic that I was able to gain a great amount of experience working with QGIS on my MacBook. It was great to learn another tool within the huge field of Geographic Information Science and I was really pleased with how easy QGIS was and how many online resources there were to learn how to do different functions within the application.