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Part I

Creative Academic Work

Odyssey of Helper T

By Trevor Stanley

Our T cell floats, receptor prepped,
Defense is what T cells do best.
But this one's young, still in the Thymus
Where T cells mature their bindings.
Here, exams test what they notice,
Failure is swift apoptosis.
Each must pass a common test
Of competence and tolerance.
Before it helps a convalescence,
T must bind with confidence
To MHCs on APCs
That signal T, "I'm on your team."
Each gives context with this complex
That displays a protein object.
T must read this peptide fragment
And determine if it has been
Gleaned from enemies on offence
Or is honest and endogenous.
Failing either of these pieces,
Ends our tale with cell deletion.

Once T cell has passed these tests
Of immunocompetence and self-tolerance,
It leaves the thymus for a lymph node,
Where it waits for signals it knows:
A dendritic cell with an epitope
Presented on its envelope.
And not just any antigen,
The perfect one for T cell's scan.
The only T cell prepped for this
Particular invader's risk.
But lone cells can't, a defense make,
So dendritic cell helps T proliferate.

IL-12, an interleukin
Tells leukocytes what they're doing.
This one tells T cells to be
A stimulus for IgG:
A protein for immunity.
It cannot make this on its own,

But knows the body needs this antidote.
So T becomes T helper 1
And searches for a B cell of
Particular IgD, with MHCs that bind to T
And, of course, match dendritic's warning.

It signals B cell, when it binds,
With IF-gamma cytokines.
B cell starts proliferation,
Much like T did: saving data,
Keeping copies, memory cells
That make things faster next alarm bell.

In fact, this speed is most important
When disease is quick to portend
Much cell death and great distress
That can't be fought with IgM
Days after pathogens ingress.
No, much too late for plasma cells,
To quell with antibody swells
When virus multiply inside
Our tissues and our alveoli.
Too late for turning back the tide,
Without the lungs, the body dies.

But wait, there is no danger yet,
Dendritic cell found adjuvants
And antigens, but no paths cross
With pathogens or cells we've lost.
It was a run of first response
To prep adaptive and ensconce
The memory T and B cells that
Will start the secondary attack.

When the virus finally comes,
It will not make it to the lungs,
Nor will it spread its deadly breath,
For T and B hunt every speck.
They do not know of our vaccine,
To them it's all the same as being
Infected with an actual bug,
Without the risk of dying young.
So thank your body, thank your cells,
But thank a microbiologist most of all.

The Good Flowers

Lily Chesley

The good flowers took her deep into the woods, where she came across the meadow.

The bees were at work, the birds nesting in the redwood trees nearby, clovers ready to bloom.

Spring crept slowly towards the solstice; this valley was nowhere as far as men know.

Nature untouched and bustling, small communities of peacefulness hidden just behind the mountainous gloom.

The smell of daisies was thick in the air; an adornment of sunflowers and dandelions crowned her hair.

A waterfall in the distance caught her eye, it was strange as it made no noise, and the water was thick and the color of amber.

The sun beamed down the meadow and shined iridescent off the surface ever so somber.

Transfixed by the warm glow of the river, the girl ran, not a care in the world for the wildflowers were with her.

With every step, her crown blossomed ever brighter, and the bees buzzed so frantically.

Laughter made the flower child step even lighter as her clothes were replaced by rose vines.

The good flowers clung to her, for the meadow is where no man should go, as the natural magic writhes.

They stripped her bare as a fox ran away with her linens back to their den.

She was one with nature now; her feet ran deep into the soil, rooting her in place.

The sun is setting now, as the good flowers led and carried her to somewhere new again

The valley fades as moonlight washes over the land and her glowing face

She noticed that the moonlight nurtured the land in a way that sustains.

The flowers dropped, and the moisture upon them fell to gravity and seeped into the earth.

She looked to the sky, expecting it to be empty for naught but the stars.

What she found excited her even more than the strangeness of the place

The bees had been replaced by creatures of the night, owls and bats joining in the natural festivities.

The girl expected silence around her, and what she experienced was a cacophony of noise.

In the distance, she heard the intimidating sound of a wolf; nearby, she heard a twig snap, a rustle of leaves that definitely didn't come from the wind.

She did not fear the darkness as the good flowers were with her, protecting her at all times.

She blended into nature, existing just as nature does, steadfast and robust, changing when necessary only for survival.

It was easy to get Lost; she hailed from the city after all.

As time passed in the meadow, the girl learned from Autumn as she did Spring.

She feared Winter and Summer as though they were the best versions of herself, and they were only visiting.

It was clear that the seasons were important to the meadow, the water in the brook changing colors through time.

Pink, green, cerulean, amber, indigo, every color the water shouldn't be as far back as the girl remembers, the color of the water became.

In the spring, the redwoods would wither and fall, and from their roots, cherry blossoms sprang, as if time had no hold on this place.

The valley became the mentor, teaching the name of the wind, the song of the trees, the purring of the grass.

Over time the animals of the valley accepted her as though the girl raised them and not the valley itself

Disillusions shattered, the leaves of the trees fell to the earth, but the girl did not lose her sense of mirth.

Magic is fickle and often not so simple, so she continues with a crown of thistle.

The path through the valley was not straight but long and winding, matching that of the river.

And if flowers don't work, it's time to try something new; the girl's crown withered into a cocoon.

Her powers were peculiar just as her fate; her sight could bring that of a shiver.

Butterflies came to be, protecting her as the good flowers had against a coming monsoon.

The grass was thick and brown and tall as could be, so the girl turned slick and black as night.

Purring, she continues tail high in the air and monarchs marching through the reeds.

The harvest moon was approaching, and the water was showing signs of blight.

The cherry blossoms changed to orange and fell withering, allowing Nature to watch from her perch.

From the crumpled remains sprouted oak trees with bare branches

The valley was angry; the girl wasn't supposed to be here, shedding vegetation to help in its search.

The girl pressed on camouflaged as best she dares, dashing glances and enemy combatants.

Wolves as dark as night, stags with ferocious might, and owls up high silently in flight

The girl was not supposed to be here; she knew the longer she spent, the more dangerous the valley would become.

She knew the longer she spent here, the more dangerous she would become.

It did not matter. It had to be done. She pressed on, ready to shatter.

Nature had won before, or rather, the girl had just chosen to run.

Fraught with fright, she declared, "I have made up my mind!

You will not stop this goal of mine! So, let the light shine!"

Lost in light, she prepared, "You shall let me through!"

I am not trying to subdue! I am not forcing something anew!"

Wrought with worry, she impaired, "I'm trying to help you! It would be best for us to combine!"

Nature gave her her ear, and the sun shines again as oak trees turn to pine.

"I am sorry that it has come to this; I am sorry that my creations have gone amiss."

"I did not wish you harm; I just meant to learn from you as my creatures do."

The meadow grew and flourished as snow fell on a canopy of purple leaves.

Flowers of night and flowers of might, but not a single white flower in sight

Nightshades mixed with morning glory turned the butterflies black.

Roses blossomed, and snapdragons grew, and then the bees came back.

It was then the girl knew that Nature will always prevail.

Nature does not bend. It does not break.

It simply lives and breathes as the world allows and enables.

The girl would not return to the city of Lost; she had found her place.

Another year crept by before the girl realized that the meadow is her creation, and the creatures that lived there were of her own volition.

To Believe is Half the Battle

C. Michelle Michalski

Around this time last year, I began to acknowledge my passion to write and how enjoyable of a life that would be for me. If only I could turn my curiosity into passion, my passion into vocation. Could I ever believe in myself enough to do this? I began to ask God and the universe to send me the signs and clues on where to begin. As always, the rule of 'Ask and you shall receive' applied itself divinely and memorably.

I had written a few short pieces about my life, memories that I tried to search out of the voids of my mind. I thought that they were good, but did not feel I had read enough written works to make a valid comparison. I decided before I wrote, I must read. This thought bored me, I wanted to write not read. Why didn't I just have the confidence to do that? Then it happened. My mind formed a link, search for writers that used the words I would use in the way I might use them.

Search for Virgo writers

The story really began when a friend took me out for a birthday dinner. Sitting across from each other in a booth, my hunger turning to growls in my belly as I contemplated the menu. I looked up to find my friend staring impatiently at me, his fingers excitedly tapping a package that sat upon the table. "I can't wait, just open it now." He said, so, I set my hunger aside and opened my present. It was a brand new beautiful signed copy of Paulo Coelho's book, *The Alchemist*. A brand-new leather-bound hard copy. The leather was one of my favorite colors of deep burgundy red with shiny embossed gold design and title. The tips of the pages, shiny gold, forming a river around the cover that looked like a gold bar. A gold satin ribbon neatly tucked at the halfway point of its pages. Lost in time, I stared at the book's glory. His voice brought me out of the mystic haze of divine will. For I knew instantly, this book was to be part of the answer to my prayer. "Open it! Look at the signature!" I shifted my soul back into the 'now' of the moment and opened the cover. "CRACK!" I had never heard a sound so loud in my life. As if Thor himself sent a lightning bolt crashing into the restaurant! I had never

been the first to break a book's binding. The experience was surreal, as if I had just given life to the book itself, thrust it into existence, at that very moment it had breath. I know it's strange but my eyes began to tear up with emotion at that sound, which hopefully my friend took as gratitude for the perfect gift.

Really, the sentiment was much deeper. Deep as the ripple upon the burnt sienna satin that lined the inner cover and the first page, that, when turned revealed the penned signature of Paulo Coelho himself. Now, you must understand that at that moment, the author's name meant nothing to me, having never read the book, but I knew deeply that it would. My friend then explained his reasoning for buying it, the author was a Virgo, like me. Out of curiosity he then looked up Paulo's exact birthday and we both found ourselves dumbstruck with awe, it was August 24th, my exact birthday! The rest of dinner was a blur. I ate, but my hunger was not satisfied as it had become new. An insatiable desire to discover what first word awaited me on page one.

It was the perfect evening to cuddle up and begin to read. Tucked into my bed, my six pillows encasing me in comfort. My silver-grey satin comforter provided a cool chill to the hot August heat outside. It was still too hot for scented candles but a few drops of magnolia scented oil drifted through the air of my room. The light, casting a gentle ambiance for the experience. I was ready.

I began to read, instantly his words seemed as though they came from my own mouth, my own mind. His thoughts and fears, the same as mine. The way he wrote of landscapes and the simplicity of conversations and thoughts, exactly how I would write them. I thought, I could be him, I could have written this word for word. I could write this. I don't need to wait, until time is missed and opportunity passed. I don't need to get better or be perfect! I could tell my stories in my words and a reader just like me could find inspiration in them.

Paulo Coelho writes of a young shepherd named Santiago and his search to find purpose and treasure. His journey sends him on a mystical adventure to the pyramids of Egypt. Along the

wayhe meets many very interesting characters who help him to look deeper into the veil of life's mysteries. By looking deeper, he learns to recognize signs and symbolism that deepen his understanding of his experience through life's journey. It is a beautiful and prophetic tale that is wonderfully written.

The story was of things that I have had an understanding for my whole life. His words captured me and placed me in comfort and confidence. I would find within its pages permission to be me. As Santiago learned a deeper meaning of himself and his journey through life, so did I. Each page revealed a lesson and adventure that I could apply to my life and my purpose. In breaking the binding of this book, a connection was made that also broke a binding within me. I found the symbolism to be perfect.

I have since looked up other Virgo writers, and there are so many. So many that share sociologic values and a search for purpose. So many with a comforting compatibility to my own personality. So many that have found successful vocations in writing. I hope to be next. This experience has given me courage to write in my own voice and also a stronger passion to read the voices of others. Reading has become a pleasure rather than a chore. In the book, *Between the world and me*, Ta-Nehisi Coates writes: "*I wished I had known more, and I wished I had known it sooner.*" He writes, "*I have spent much of my studies searching for the right question by which I might fully understand the breach between the world and me.*" I too felt that breach between the world and myself. I have wasted much time trying to define how I felt different and why I struggled with acceptance. This experience really helped me to look inward, to those haunting places. To dig out the memories from my youth that had left damaging imprints. To simplify them, and transform them, into vision that I can draw from and give words to. Now I am beginning to see that there is no 'world and me', that I am part of the world, like any other. As Coates realized, I too, realized "***That writing***" ... is simply "***the art of thinking***".

Moments like the one I had, reading that line in his book, are so amazing! When I paused and

re-read the sentence with a deep inhale. I let that breath change me, as I exhaled, I became new, anew understanding spread through my body. To transform my fear and doubt through six simple words. One more deep breath, as I read them again. I do not want to ever forget them. I *think* so much that sometimes it feels dangerous. I am an *artist* in my heart. When I *write*, it is hard to stop.

Vocation is a response to a call from beyond oneself. To use my God given gifts to leave an imprint of passion upon the world. To understand that life is about more than me, that humanity will always be bigger. That if I am able to respond to my happiness and my passion, letting go of all other thoughts. That vocation will be automatic and life will take care of me. Just like life took care of Santiago. In every moment of my journey, I have the opportunity to create a story to share. I feel extreme gratitude for that. My story will end well.

Impacts of Southwestern Wildfire



Environmental Causes:
Natural influences such as drought and lightning strikes can increase the likelihood of ignition of wildfires.



Natural Debris:
Removal of natural debris that is not necessary for ecological functioning, such as leaves and fallen trees in high risk areas is a necessary precaution that should be administered by city infrastructure and maintenance.



Infrastructure Maintenance:
Infrastructure items such as telephone and power lines should be monitored for fire safety including repair and removal of damaged or outdated technology. Placements and spacing from natural resources is also an important fire safety factor.



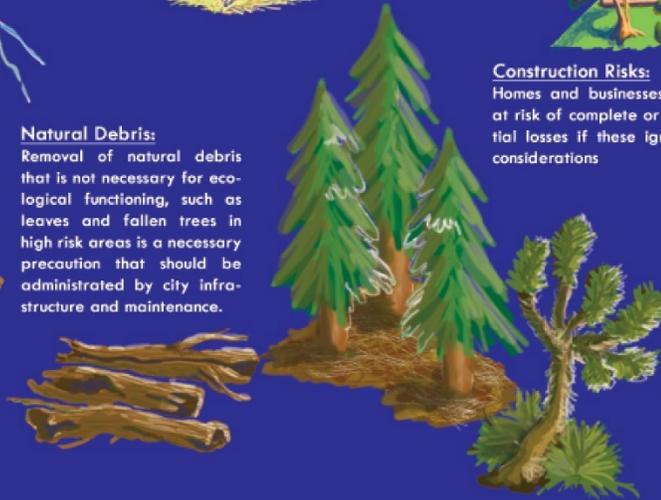
Inappropriate Fires:
Fires lit without proper precautions due to size, containment, or weather conditions increase the chance of fire spread.



Construction Risks:
Homes and businesses are at risk of complete or partial losses if these ignition considerations are

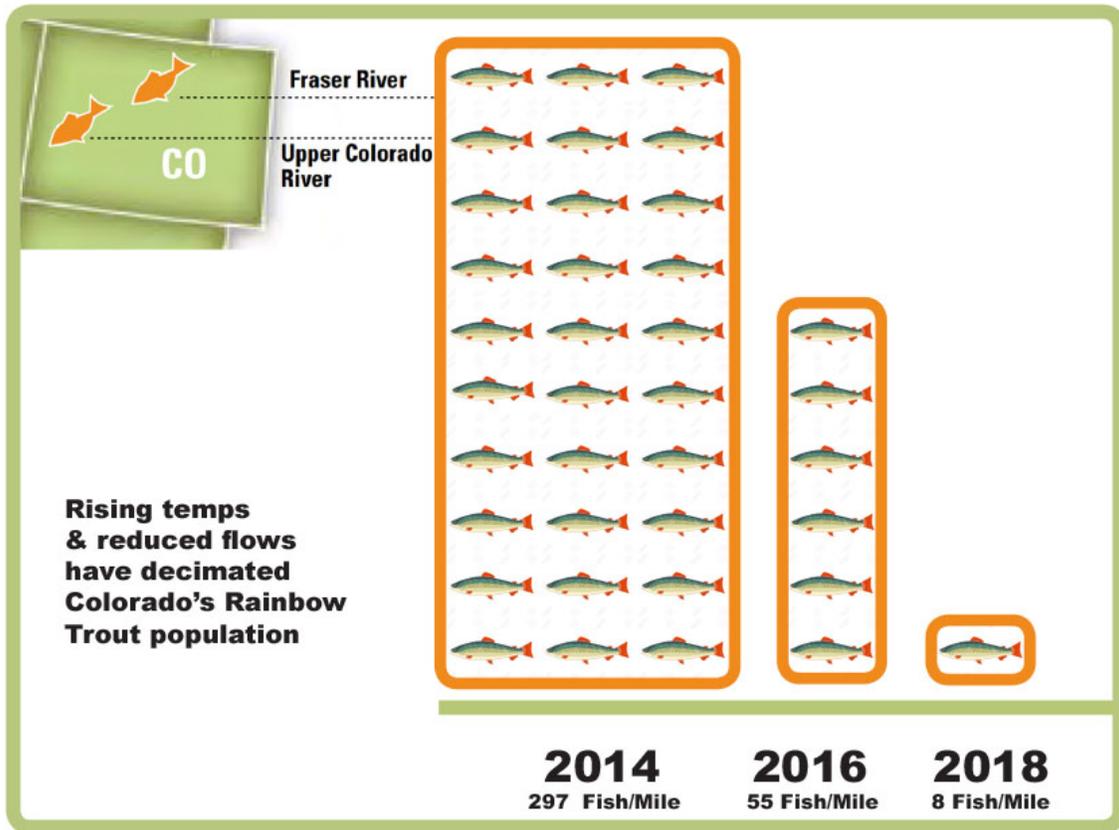


Species Devastation:
Loss of plant and animal species is a direct result of wildfires. Human causes can be altogether prevented. Otherwise this leads to loss of rare and endangered species in the southwestern biosphere.



Written & Illustrated By: Tiffany A. Lovett for the Trefny Honors Program at Red Rocks Community College

Impacts of Southwestern Wildfire Infographic by Tiffany Lovett



J. Ewert, *Fraser River Fishery Management Report*, Colorado Parks and Wildlife, March 2020

What is Happening in the Fraser River?
 Infographic by Sen O'Neil

Gentrification happens when a neighborhood suddenly becomes more affluent and pushes out long term residents. This is a big problem in urban areas.



A study found over 27% of neighborhoods in the Denver-Aurora area were gentrified. While the focus has been on Denver's Five Points neighborhood, western and northern parts of the city are now being impacted.



Homelessness is up 8.25 in the Denver Metro Area.



Denver, Colorado is number 2 in the nation for gentrification.



Gentrification can have harmful effects on the environment. First of all it takes a lot of work to completely redo an area, let alone large areas, thus creating more CO2 into the atmosphere.



Low income people are displaced.



Low income people both contribute to and are negatively effected by pollution.



Often people who are in poverty reap the negative effects of climate change, this is called environmental injustice..



Gentrification is a waste of resources, both natural and manmade.



Gentrification is not only bad for people, it is bad for the world.

Gentrification

Infographic by Jean Jones

Part II
Undergraduate Research

RRCC Campus Floristic Survey

Maeve Wilder

Abstract

The Red Rocks Community College (RRCC) campus is a small snapshot of the low-elevation habitat along the edge of Rocky Mountains. A large part of it has been relatively undisturbed since the opening of the college in 1969. Approximately 166,000 square meters of campus were surveyed over the collection period from October of 2019 through April 2020. The purpose was to document present flowering or fruiting plant species and preserve identifiable samples of each. Collection did not discriminate between natives and non-natives. The survey noted twenty-one native plant species and nine non-native plant species. The collected samples were preserved according to herbarium standards and will be stored as a collection at RRCC. Commentary on the present species and possibilities for conservation is discussed. The results of the survey could facilitate future documentation and restoration efforts on campus.

Background

The majority of the natural areas of campus are in the plains shortgrass prairie life zone. This community type is adapted to massive disturbance regimes in the form of fires and grazing. Extreme temperatures are a formative influence also. Trees are not well-suited to survive in these conditions so, other than the occasional juniper, grasses dominate. Annual precipitation is approximately 38 cm resulting in a drier life zone the mixed grass or tallgrass prairies farther East. Seventy to ninety percent of the plants growing here will typically be grama grass or buffalo grass. These grasses are vital to the health of the entire ecosystem as their deep root systems stabilize the topsoil and allow them to survive harsh environmental conditions. This prolific root zone provides habitat for many burrowing creatures common to this vegetation type, such as prairie dogs and burrowing owls. At the surface, ungulates like mule deer and elk graze while red tailed hawks hunt and meadowlarks sing. Historically, wolves and grizzly bears would have been the top predators in the ecosystem, but they have been pushed out by human activity and coyotes flourish in their absence.

A seasonal creek flows through campus and allows for a small riparian area. Dense patches of shrubs and trees, comprised mostly of willows and cottonwoods, populate the steep draw along the creek

with some cattails in the wider, marshy parts. Great horned owls have nested beside the creek for many years.

Methods

For the floristic survey, only portions of campus whose plant community had never been significantly impacted were included. Areas such as the lawns in front of the building and the newly landscaped areas around the rec center were excluded. All other parts of campus, including ditches along back roads and the field of prairie dogs near 6th Avenue, were surveyed. A map of the survey area was produced using ArcGIS Pro (Fig. 1). The boundaries of the area are shown in yellow with a grid of 30m squares covering the area. This was a loose guideline for the survey process.

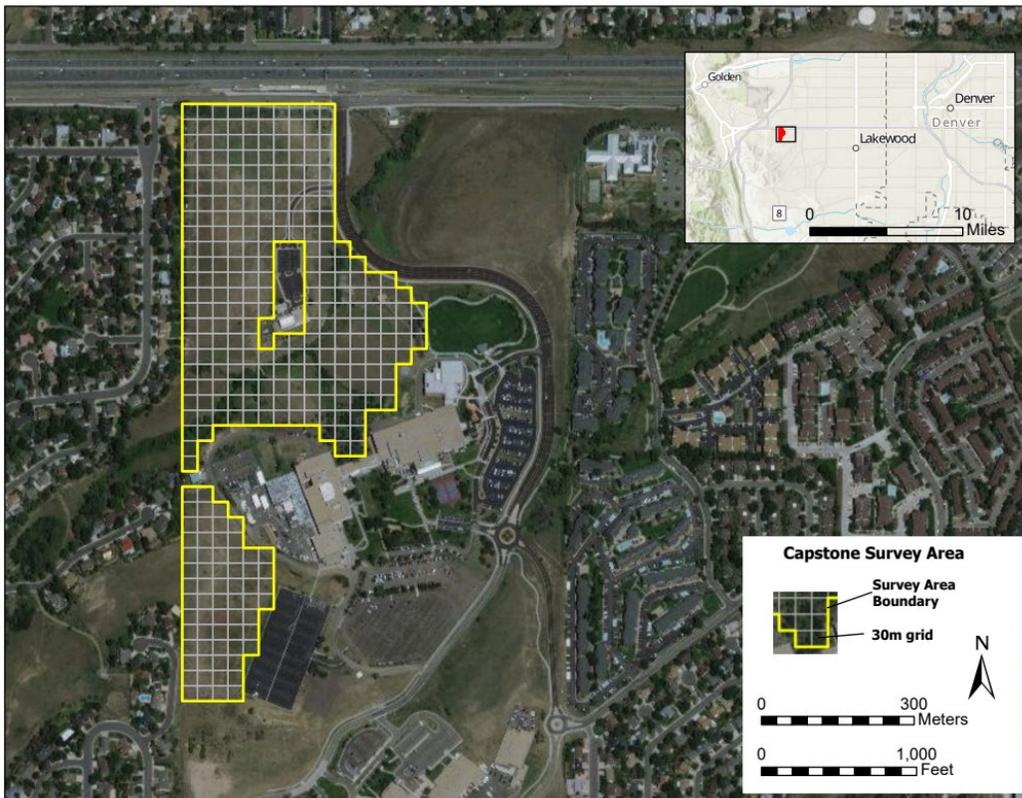


Fig. 1 RRCC aerial with survey area grid

Plant sample collection was started prior to completing research preparation due to weather conditions. On the afternoon before the first severe freeze of the winter, samples and photographs were taken of all the late flowering and/or fruiting plants on campus. Samples of existing seeds were collected as well.

A meander search method was used to survey the designated areas of campus. This non-random selection of sites yields a greater diversity of documented plant species and provides a more complete picture of what is present in the survey area. Field collection tools utilized during the survey were a trowel, a pair of stem clippers, a soft brush, a camera with GPS location data and collection bags. Although the ideal way to collect plant samples is with a field press in which samples are flattened on newspaper and carried until they can be transferred to a permanent press, lack of access to a field press meant that samples were placed in temporary sample storage bags to be prepared at the conclusions of the day's survey.

While out in the field, the first step was locating a plant with the fruiting or flowering bodies necessary for proper identification. A minimum of one photograph with attending geopositioning data was taken for each plant collected. The stem, leaf, and petal structures were captured. Characteristics of the plant that could be lost during the sample preservation process such as petal color and the presence of pollen production were documented with the photograph. If no other members of its species were growing in the area, the plant was not collected so that the area's plant population would not be permanently affected. If only a section of the plant required sampling, as in the case of bushes and trees, a portion was clipped that had the structures necessary for identification, such as flowers and fruits. Ideally the sample consisted of material sufficient to fill a significant portion of a piece of mounting paper. If the entire plant could be collected, the trowel was used to dig up at least a portion of the root system and as much dirt as possible was gently removed with a soft brush. The sample was placed in its own plastic bag. Each bag was labeled with a collection number which is specific to the collector.

Once the flowering plants in the survey area had been documented and/or collected, they were processed immediately for preservation in a plant press. A delay in transferring samples to the press can allow wilting and browning to occur, which may make identification more difficult. The needed tools for pressing were a scalpel, a cutting board, bent and straight probes, blotting paper or newspaper, cardboard, and a permanent press. The samples were removed one at a time from their bags and prepared for mounting. Excess dirt was removed and, if the root or any part of the plant was too large to be pressed, it was bisected to ensure effective pressing. If the specimen had a fruit that was too large to be pressed, the fruit was also bisected, and the seeds and pulp were removed. Seeds were saved in labeled envelopes for later use.

The plants were pressed between layers of newspaper with cardboard separating each sample. Specimens were arranged on the press paper to allow for easy identification by ensuring the front and back of leaves and the reproductive structures of flowers were visible. Since a press containing samples

must be very tightly cinched, standing on the press while pulling the straps taut was the best way to provide proper pressing. Plant samples remained in the permanent press until there was no moisture remaining. For especially moist or succulent samples, newspaper holding the plants had to be changed regularly to allow for proper drying. Use of a drying cabinet would have helped compress the drying process, but since survey collection was accomplished over an extended schedule with long periods of pressing available, the low humidity of Colorado's ambient air was sufficient to preserve the specimens.

Once the samples were pressed and dried, they were ready to be mounted as species specimens. Sample mounting tools included mounting paper, clear-drying glue, bent and straight probes, small brushes, envelopes, and ID tags. Prior to mounting each specimen, a small portion of the plant was removed for retention as a tissue sample. The ideal method for acquiring a tissue sample is to remove it at initial collection and dry it separately from the rest of the plant but, for this survey it was removed after the pressing to allow for efficient use of space in the single plant press available. A thin layer of glue was applied to the side of the pressed plant that less clearly showed identifying features and then the plant was gently applied onto the mounting paper. Plant fragments of a single sample were mounted not touching each other when possible and the entire specimen was centered on the page. Space allowances were retained in the upper left and lower right corners. The tissue sample was placed in a paper envelope and glued in the upper left corner of each mounted specimen and the lower right was labeled with the sample number for future ID tag placement.

The initial plan for identifying plant specimens was to visit the research department at the Denver Botanic Gardens to view identified herbarium samples and consult with volunteer staff. The current pandemic restrictions rendered that impossible. Instead, online resources were used to identify the specimens. [Wildflowers of Colorado](#), an extensive database of Colorado wildflowers organized by flower color, was particularly useful. It should be noted that the identities of the specimens are educated guesses only. Identification tags were created with the scientific name, family name, GPS location data, habitat information, name of the collector, collection number, and date collected and adhered to the lower right corner of the corresponding mounted specimen. The data for each species were paired with their field collection photos for easier viewing (see Appendix A).

Results

Below is a list of species identified and collected on the Red Rocks Community College Lakewood campus. Non-native species are starred. Noxious weeds also include their State of Colorado Noxious Weed List group letter (see Appendix B).

Collected species

*Alyssum simplex**
Amelanchier sp.
Artemisia frigida
Astragalus shortianus
Chrysothamnus Greenei
*Erodium cicutarium** - List C
*Euphorbia myrsinites** - List A
Juniperus scopulorum
Lomatium concinnum
Mertensia brevistyla
Opuntia phaeacantha
Rosa Woodsii
Solidago multiradiata
Solidago nana
Symphyotrichum porteri
*Taraxacum officinale**
Thermopsis rhombifolia
Townsendia sp.
Viola nuttallii
Yucca glauca

Additional Observed Species

Acer negundo
*Bromus inermis**
*Dipsacus fullonum** - List B
Ferocactus sp.
Muscari sp.*
Populus angustifolia
*Rumex crispus**
Salix discolor
Typha latifolia
*Verbascum thapsus** - List C

Three of the collected specimens could not be identified and have been labeled as unknown for further identification. These specimens, collected during the fall, did not have plant characteristics seen in other seasons which would have made identification more likely.

Several non-native plants were identified in the campus survey. Invasive species are exploiting increased moisture levels near the creek to expand and push out native species. With no natural enemies and opportunistic growth characteristics, non-native invasives often have an advantage over native plants for populating disturbed areas and reproducing in undisturbed areas once established. The two invasive species of most concern identified on campus are *Dipsacus fullonum* (common teasel) and *Euphorbia myrsinites* (Myrtle spurge) (Fig. 2).



Fig. 2 Estimated distribution of teasel and Myrtle spurge

Myrtle spurge, a List A noxious weed in Colorado, is of greatest concern and is required by law to be immediately eradicated with no reproduction allowed. Removal efforts on campus should focus on this species to ensure that its presently limited population is completely destroyed. It is a rapidly growing plant which propagates very quickly, requires little water and is tolerant of poor soils, making the RRCC natural areas an ideal habitat for its spread. If its spread is unhalted, it will increase substantially in a relatively short time and push out native species currently found on campus. As well as being prohibited by law and environmentally harmful, this species has a sticky white sap that is a severe irritant when it comes in contact with eyes and skin and if ingested will cause serious gastric distress.

The myrtle spurge population on campus is predominantly located on the triangle of land in the fork of two gullies to the North of the main building. There are also a few plants on the West side of the

gully. No spurge was discovered to the East of the fork but it is possible that spreading to this area is occurring so removal crews should survey thoroughly to identify new recruits.

Of secondary concern, teasel is a List B noxious weed in Colorado and relatively wide-spread in the survey area. Teasel is most dense around the creek junctions and is a dominant species in the portions of the natural area where it is located. Removal efforts are ongoing to reduce the population and limit further spread. Once the Myrtle spurge is eradicated, removal efforts of teasel should continue to prevent further spread of this species at the expense of native plant populations. Some native species will be indicators for past disturbance. Invasive distribution shows where recent disturbance has occurred while native species like the Nuttall's Violet are only present when terrain has not been disturbed. The parts of campus that were slightly higher elevation have fewer invasive species.

Conclusion

The Red Rocks Community College campus is fortunate to host sizable areas of undisturbed plains shortgrass prairie with a relatively healthy native plant community. Removal of invasives, especially Myrtle spurge and teasel, is needed but the overall diversity of the flora on campus is encouraging. Additional surveying during the late spring, summer and early fall months would be beneficial for a more complete picture of the campus plant community. Also, additional preservation of flowering plants is needed to produce a complete herbarium collection. It is essential to designate a permanent and safe storage location on campus to ensure documentation of campus plant communities for future reference.

Finally, this capstone project for the Trefny Honors program has been a very educational and enjoyable experience. It was a pleasure to use skills and knowledge acquired through last summer's internship with the Denver Botanical Gardens to document the important natural plant communities on the Red Rocks Lakewood campus. I have learned so much about project planning and implementation as a result of completing this project and hope that the information and herbarium samples produced by this project will prove useful to future students who wish to protect and preserve the natural resources of our campus.

Annotated Bibliography

Colorado College. Ecological Life Zones. Retrieved from

<https://www.coloradocollege.edu/other/senseofplace/ecology/ecological-life-zones.html>

This article describes the life zone that encompasses the land at the base of the Rockies. It included descriptions of the plains shortgrass prairie ecosystem. Information on climate, common plants and animals, and accompanying riparian zones is also included.

This site was useful for the background research for my survey. Knowing the ecosystem I was going to be surveying in gave me an idea of what plants I might be encountering.

Domangue, B. & McMullen, C. (2013) Floristic Survey of the Vascular Plants of Shenandoah County, Virginia. *Castanea*, 78(4), 312-322. Retrieved from <http://eds.a.ebscohost.com.rccc.idm.oclc.org>

In the 2011 and 2012 growing seasons over 1,000 plant species were collected in Shenandoah country, Virginia. The results were compared to existing documentation on the distribution of plant species in the county. Invasive species abundance and distribution were noted.

This survey had very detailed methods that will be useful in informing the methods of my own floristic survey. It also demonstrated yet again how a floristic survey should be carried out professionally. It is helpful to have multiple examples of surveys that were carried out successfully so I can see the different methods and what worked and didn't work.

Dubler, M (2020). Wildflowers of Colorado. Retrieved from <http://www.wildflowersofcolorado.com/index.html>

This website is a photo collection of wildflowers in Colorado. It was extremely useful for identification as it organized the species by flower color. As an amateur trying to identify species on my own this was invaluable. The scientific name was included for each species with photos of the flowers and the full plants. The site is continually being updated with additional species.

Hogan, T. (2019) A floristic survey of the Boulder Mountain Park: with notes on its conservation and management (Boulder, Colorado, U.S.A.). *Journal of the Botanical Research Institute of Texas*, 13(1), 279-314. Retrieved from <http://eds.b.ebscohost.com.rccc.idm.oclc.org>

In this article the author Tim Hogan aims to make a comprehensive list of the flora within Boulder Mountain Park. Hogan had made a list of Boulder Mountain Park flora in 1993 but since then human visitation has increased and recent fires and floods have changed the landscape. The article provides an overview of the climate and recent environmental history of the region. The dominant vegetation types at different elevations throughout the park are also detailed.

This article was useful for my project because it showed me how a floristic survey can be fashioned into a scientific article. When you first mentioned the journal that students can have their work

published in I was interested but disappointed that what I will be doing would not fit nicely into the question-hypothesis-methods-results model that most scientific articles are written in. This article didn't have specific research questions that it was trying to test, it was just about making an extensive collection and compiling data for future use. It also had the names of a bunch of plant manuals which will be useful in the identification process of my project.

LandScope America. Central Shortgrass Prairie. Retrieved from

http://www.landscape.org/explore/natural_geographies/ecoregions/central_shortgrass_prairie_eco_region/

This website has information on the shortgrass prairie ecosystem. It went over characteristic plants and animals and discussed the way humans have impacted the ecosystem. What has happened to the shortgrass prairie today was also included. This article was helpful for my background research into the ecosystem I would be surveying in.

Mayberry, B. (2020, May 5). Interview over Zoom.

Dr. Blake Mayberry is the head of the Geography department at Red Rocks Community College. He was my advisor for this project and reviewed and made suggestions on my work. We discussed the distribution of invasives on campus and comments on them which needed to be included in my write up. He also made observations on the implications of certain species for the history of disturbance on campus. His insights were very useful for crafting my results section.

Paces, M. (2020, May 2). Interview over text message.

Margo Paces is a graduate student working at the Denver Botanic Gardens. She originally taught me how to conduct a floristic survey when I interned under her last summer. She provided an educated opinion on several specimens I was having trouble identifying.

Plant Care today. Euphorbia Myrsinities. Retrieved from

<https://plantcareday.com/euphorbia-myrsinities.html>

This article discusses the status of Myrtle spurge as an invasive and ways to care for it should you want to cultivate it. The origins, the environment in which it thrives, and the toxicity of the plant were

included. I needed more information on this noxious weed when I found it on campus. This article gave me the background I needed.

Pryer, S. & Snow, N. & Kartesz, J. (2019) FLORISTIC SURVEY OF VASCULAR PLANTS IN CRAWFORD AND CHEROKEE COUNTIES IN SOUTHEASTERN KANSAS, U.S.A. *Journal of the Botanical Research Institute of Texas*. 13(2) 545-591. Retrieved from <http://eds.a.ebscohost.com.rrcc.idm.oclc.org>

This study involved a floristic survey of Crawford and Cherokee counties in Kansas in the 2014 and 2015 growing seasons. They found that documentation of vascular plant species on state and county levels were not as thorough as had previously been thought. That leads to problems because interpretations and distribution patterns of abundance could be inaccurate as a result. Small plants without big showy flowers were the most commonly overlooked which isn't surprising.

My own floristic survey will involve many of the same methods as the survey in this study. Using this as a model I can develop a smaller scale version of what was done in Kansas and apply it to the Red Rocks Community College campus. This paper had the same sort of information as the other papers on floristic surveys that I have looked at.

Red Rocks Community College (2019). 50 Years of Red Rocks Community College. Retrieved from <https://www.rrcc.edu/50/history.html>

This site shows the major events in the history of RRCC. I found photos of how the campus was disturbed during the construction of the main building at the Lakewood campus.

Simbiota (2020). SEINet. Retrieved from <http://swbiodiversity.org/seinet/index.php#>

SEINet offers access to many data resources. Collections, museums, and agencies contribute to create a network of data for environmental research. I used SEINet to find more photos of the plant species I was trying to identify. This was helpful because google images cannot always be trusted. With this website I could be sure I was looking at the right plant. It also showed photos of mounted samples which made it easier to identify my own mounted samples.

Southwest Colorado Wildflowers, *Townsendia*. Retrieved from <https://www.swcoloradowildflowers.com/White%20Enlarged%20Photo%20Pages/townsendia.htm>

The different species of *Townsendia* and where they are found was the focus of this website. It includes photos of *Townsendia* species with delightful descriptions such as “there is no disagreement about the delicately cute character of this *Townsendia*”. This article helped me realize I should not be trying to identify the specie of *Townsendia* I found because the species of this genus are notoriously difficult to differentiate between.

State of Colorado (2019). Noxious Weed Species. Retrieved from

<https://www.colorado.gov/pacific/agconservation/noxious-weed-species#a>

This is a list of all the recognized noxious weeds in Colorado. It lists species by their classification and shows photos of each. This was useful as it told me how harmful each of the non-native species I found were. I encountered 4 of the species on this list.

Zorio, S. & Williams, C. & Aho, K. (2016) Sixty-Five Years of Change in Montane Plant Communities in Western Colorado, U.S.A. *Arctic, Antarctic & Alpine Research*, 48(4) 703-722.

Retrieved from <http://eds.a.ebscohost.com.rrcc.idm.oclc.org>

In *Sixty-Five Years of Change in Montane Plant Communities in Western Colorado* the authors resampled 121 transects surveyed by Jean Langenheim from 1948 to 1952 in the East River Basin near Crested Butte, Colorado. Four plant communities, sagebrush, spruce-fir, upland-herbaceous, and alpine were focused on. It was found that all four communities have greater diversity than 65 years ago and have experienced significant changes in species composition and dominance. Species' mean elevations shifted upward 41m.

This article was useful to my project because it demonstrates the value of preliminary research that can then be built off of by future surveys. The fact that specie’s mean elevations shifted is significant as it could be an indication of climate change progressing. With my project I hope to allow future data to document the progression of climate change and its effects on the plant communities of the Red Rocks Community College campus.

Dedication

My sincere thanks to Barbra Sobhani, director of the RRCC Trefny Honors program. Her enthusiasm for this idea at the very beginning spurred me on to pursue it for my capstone project.

Without her support, ideas, and the storage of my specimens as they were pressing this project would not have taken flight.

I would also like to thank Dr. Blake Mayberry, my advisor for this project. His experience and insight on map creation, plant communities, and surveying were critical to the success of this project.

Thank you to my parents: Doug Wilder, who helped me wrangle ArcGIS Pro to produce a map, and my deepest thanks to Yvonne Wilder, my mom. Without her help over many months with collecting and mounting samples the herbarium collection would still be in its early stages. Her edits and suggestions for my final write up were also invaluable to my project. I'm so grateful to have had so much support and assistance over the months of this project, it couldn't have happened without them.

Appendix A - Species List with Collection Photos

Scientific Name: *Chrysothamnus Greenei*
Family: Asteraceae
Common names: Greene's rabbitbrush
Location: 39°43'17.22"N, 105° 9'4.69"W
Collection Number: 1
Collection Date: 10/28/19



Scientific Name: *Yucca glauca*
Family: Asparagaceae
Common names: small soapweed, soapweed yucca, Spanish bayonet, Great Plains yucca, beargrass
Location: 39°43'17.29"N, 105° 9'4.08"W
Collection Number: 2
Collection Date: 10/28/19



Scientific Name: *Opuntia phaeacantha*
Family: Cactaceae
Common names: tulip prickly pear, desert prickly pear
Location: 39°43'16.89"N, 105° 9'5.33"W
Collection Number: 3
Collection Date: 10/28/19



Scientific Name: *Rosa Woodsii*
Family: Rosaceae
Common names: Woods' rose, interior rose
Location: 39°43'16.78"N, 105° 9'5.27"W
Collection Number: 4
Collection Date: 10/28/19



Scientific Name: *Artemisia frigida*
Family: Asteraceae
Common names: fringed sagebrush, prairie sagewort, arctic sage and pasture sage
Location: 39°43'17.66"N, 105° 9'2.43"W
Collection Number: 5
Collection Date: 10/28/19



Scientific Name: *Amelanchier Sp*
Family: Rosaceae
Common names: shadbush, shadwood, shadblow, serviceberry, sarvisberry (or just sarvis), juneberry, saskatoon, sugarplum, wild-plum, chuckley pear
Location: 39°43'16.58"N, 105° 9'5.97"W
Collection Number: 6
Collection Date: 10/28/19



Scientific Name: *Solidago nana*
Family: Asteraceae
Common names: baby goldenrod, dwarf goldenrod
Location: 39°43'17.00"N, 105° 9'4.49"W
Collection Number: 7
Collection Date: 10/28/19



Scientific Name: *Symphyotrichum porteri*
Family: Asteraceae
Common names: smooth white American-aster
Location: 39°43'17.33"N, 105° 9'2.14"W
Collection Number: 8
Collection Date: 10/28/19



Unidentified
Location: 39°43'17.95"N, 105° 9'3.28"W
Collection Number: 9
Collection Date: 10/28/19



Unidentified
Location: 39°43'17.73"N, 105° 9'2.62"W
Collection Number: 10
Collection Date: 10/28/19



Scientific Name: *Ericameria nauseosa*
Family: Asteraceae
Common names: rubber rabbitbrush, goldenbush
Location: 39°43'17.50"N, 105° 9'3.12"W
Collection Number: 11
Collection Date: 10/28/19



Unknown
Location: 39°43'16.93"N, 105° 9'4.11"W
Collection Number: 12
Collection Date: 10/28/19



Scientific Name: *Alyssum simplex*
Family: Brassicaceae
Common names: European madwort,
small flowered madwort
Location: 39°43'17.06"N, 105° 9'3.33"W
Collection Number: 13
Collection Date: 4/15/19



Scientific Name: *Juniperus scopulorum*
Family: Cupressaceae
Common names: Rocky Mountain juniper
Location: 39°43'14.38"N, 105° 9'3.89"W
Collection Number: 14
Collection Date: 4/15/19



Scientific Name: *Townsendia Sp*
Family: Asteraceae
Common names: townsend daisy.
Location: 39°43'18.0"N 105°09'03.0"W
Collection Number: 15
Collection Date: 4/15/19



Scientific Name: *Erodium cicutarium*
Family: Geraniaceae
Common names: redstem filaree, pinweed,
redstem stork's bill, common stork's-bill
Location: 39°43'19.0"N 105°09'01.0"W
Collection Number: 16
Collection Date: 4/15/19



Scientific Name: *Euphorbia myrsinites*
Family: Euphorbiaceae
Common names: Myrtle spurge,
blue spurge, broad-leaved glaucous-spurge
Location: 39°43'16.0"N 105°09'07.0"W
Collection Number: 17
Collection Date: 4/15/19



Scientific Name: *Astragalus shortianus*
Family: Fabaceae
Common names: Short's milkvetch
Location: 39°43'17.60"N, 105° 9'1.91"W
Collection Number: 18
Collection Date: 4/25/19



Scientific Name: *Taraxacum officinale*
Family: Asteraceae
Common names: dandelion,
common dandelion
Location: 39°43'19.26"N, 105° 9'1.73"W
Collection Number: 19
Collection Date: 4/25/19



Scientific Name: *Mertensia brevistyla*
Family: Boraginaceae
Common names: short-style bluebell,
small bluebell
Location: 39°43'19.04"N, 105° 9'1.81"W
Collection Number: 20
Collection Date: 4/25/20



Scientific Name: *Viola nuttallii*
Family: Violaceae
Common names: Nuttall's Violet,
Yellow prairie violet
Location: 39°43'18.0"N 105°09'03.0"W
Collection Number: 21
Collection Date: 4/25/20



Scientific Name: *Thermopsis rhombifolia*
Family: Fabaceae
Common names: yellow banner plant,
prairie golden-banner, prairie thermopsis
Location: 39°43'18.48"N, 105° 9'2.64"W
Collection Number: 22
Collection Date: 4/25/20



Scientific Name: *Lomatium concinnum*
Family: Apiaceae
Common names: Adobe desert-parsley,
salt and pepper flowers
Location: 39°43'10.0"N 105°09'13.0"W
Collection Number: 23
Collection Date: 4/25/20



Scientific Name: *Solidago multiradiata*
Family: Asteraceae
Common names: mountain goldenrod,
alpine goldenrod.
Location: 39°43'08.0"N 105°09'13.0"W
Collection Number: 24
Collection Date: 4/25/20



Appendix B - Colorado Noxious Weed List

A, B, and C Listings The State of Colorado has designated 73 plants as Noxious Weeds, and has categorized them into three lists based on priority for management in Colorado. These lists have been named Lists A, B, and C. Most simply put:

- **List A** plants are newly arrived and/or less common in Colorado and must be eradicated from all lands in the State.
- **List B** includes plants whose continued spread in Colorado should be halted.
- **List C** plants are those for which local governments have authority to decide the management strategy.

The purpose of such categorization is to guide the State and local governments in developing Management Strategies for each weed. The Management Strategy of a particular weed in an area may be one of the following (see Appendix E for more complete definitions):

- **Eradication** (complete elimination of all populations of a weed)
- **Containment** (confinement of populations of a weed to a defined area)
- **Suppression** (attempt to limit the vigor and spread of populations within a region)

All List A species have been designated by the Colorado Commissioner of Agriculture (“the Commissioner”) for eradication. This means that it is a violation to allow any List A species to produce seed or develop other reproductive means such as roots, shoots and runners. Many List A weeds are not yet present in Colorado, but have become a problem in neighboring states. Others are present in small isolated populations. It is the intent of the Commission to eliminate these species before they become widespread. *The Rules* allow the local governing authority to file for a compliance waiver if it is determined that eradication is not a practical management objective for specific populations.

List B weed species may be designated for eradication, suppression, or containment, depending on the extent of their presence in a particular county. The local Management Strategy for each List B species in each county is determined by the Commissioner (in consultation with the State Noxious Weed Advisory Committee, local governments, and other interested parties). From these local Management Strategies, the Commissioner develops a State-wide noxious weed management plan for each List B species. This Plan is designed to stop the continued spread of List B species, making it a violation to allow any List B species to spread into any un-infested area.

Local governments are left to decide whether to require management of List C weed species, and, if so, whether the Management Strategy will be Eradication, Containment, or Suppression. State Management Plans for List C weed species developed by the Commissioner are designed to support the weed management efforts of local governing bodies. The goal of such plans is not to stop the continued spread of these species. Rather, they are meant to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species.

B. Colorado List A Noxious Weeds

African rue (*Peganum harmala*)
Camelthorn (*Alhagi pseudalhagi*)
Common crupina (*Crupina vulgaris*)
Cypress spurge (*Euphorbia cyparissias*)
Dyer's woad (*Isatis tinctoria*)
Giant salvinia (*Salvinia molesta*)
Hydrilla (*Hydrilla verticillata*)
Meadow knapweed (*Centaurea pratensis*)
Mediterranean sage (*Salvia aethiopsis*)

C. Colorado List B Noxious Weeds

Absinth wormwood (*Artemisia absinthium*)
Black henbane (*Hyoscyamus niger*)
Bouncingbet (*Saponaria officinalis*)
Bull thistle (*Cirsium vulgare*)
Canada thistle (*Cirsium arvense*)
Chinese clematis (*Clematis orientalis*)
Common Buckthorn (*Rhamnus cathartica*)
Common Tansy (*Tanacetum vulgare*)
Common Teasel (*Dipsacus fullonum*)
Corn Chamomile (*Anthemis arvensis*)
Cutleaf teasel (*Dipsacus laciniatus*)
Dalmatian toadflax (*Linaria dalmatica*)
Dalmatian toadflax (*Linaria genistifolia*)
Dame's rocket (*Hesperis matronalis*)
Diffuse knapweed (*Centaurea diffusa*)
Eurasian watermilfoil (*Myriophyllum spicatum*)
Glossy Buckthorn (*Rhamnus frangula*)
Hoary cress (*Cardaria draba*)
Houndstongue (*Cynoglossum officinale*)
Leafy spurge (*Euphorbia esula*)
Mayweed chamomile (*Anthemis cotula*)

D. Colorado List C Noxious Weeds

Chicory (*Cichorium intybus*)
Common burdock (*Arctium minus*)
Common mullein (*Verbascum thapsus*)
Downy brome (*Bromus tectorum*)
Field bindweed (*Convolvulus arvensis*)
Halogeton (*Halogeton glomeratus*)
Johnsongrass (*Sorghum halepense*)

Medusahead (*Taeniatherum caput-medusae*)
Myrtle spurge (*Euphorbia myrsinites*)
Orange Hawkweed (*Hieracium aurantiacum*)
Purple loosestrife (*Lythrum salicaria*)
Rush skeltonweed (*Chondrilla juncea*)
Sericea lespedeza (*Lespedeza cuneata*)
Squarrose knapweed (*Centaurea virgata*)
Tansy ragwort (*Senecio jacobaea*)
Yellow starthistle (*Centaurea solstitialis*)

Moth mullein (*Verbascum blattaria*)
Musk thistle (*Carduus nutans*)
Oxeye daisy (*Chrysanthemum leucanthemum*)
Perennial pepperweed (*Lepidium latifolium*)
Plumeless thistle (*Carduus acanthoides*)
Quackgrass (*Elytrigia repens*)
Redstem filaree (*Erodium cicutarium*)
Russian knapweed (*Acroptilon repens*)
Russian olive (*Elaeagnus angustifolia*)
Salt cedar (*Tamarix ramosissima*)
Scentless chamomile (*Matricaria perforata*)
Scotch thistle (*Onopordum acanthium*)
Scotch thistle (*Onopordum tauricum*)
Spotted knapweed (*Centaurea maculosa*)
Spurred anoda (*Anoda cristata*)
Sulfur cinquefoil (*Potentilla recta*)
Tatarian Honeysuckle (*Lonicera Tatarica*)
Venice mallow (*Hibiscus trionum*)
Wild caraway (*Carum carvi*)
Yellow nutsedge (*Cyperus esculentus*)
Yellow toadflax (*Linaria vulgaris*)

Jointed goatgrass (*Aegilops cylindrica*)
Perennial sowthistle (*Sonchus arvensis*)
Poison hemlock (*Conium maculatum*)
Puncture Vine (*Tribulus terrestris*)
Velvetleaf (*Abutilon theophrasti*)
Wild proso millet (*Panicum miliaceum*)

Gender Studies: The Mythology of Gender

Lily Chesley

The understanding of gender throughout human history has been one of constant debate. The social construct of gender and the roles attached to it has been similar in other cultures, but it can also vary massively. Some cultures find reverence in a third gender, and other cultures stick to rigid, often binary gender-norms. However, the existence of those who circumvent the gender-norms of their given culture has also been present since the beginning of human literature. Examples of gender-transgressing individuals exist before 1980, when the psychological diagnosis of gender dysphoria was first given the name gender-identity disorder. Understanding that gender is inherently a way to institute a structured class is extremely important because dismantling that power structure or the classes pertaining to it brings about social and cultural change. The gender diverse and queer people throughout human history found ways to coexist with those who would wish them harm or describe them as outlaws.

Gender as a social construct

A current understanding of gender is that gender is a social construct invented by humans to perpetuate society through the differences the sexes present with. Through the evolution of language, the meaning of gender and the roles attached to it has changed throughout time. Gender can be socially constructed through stories, but it can also be constructed through the laws that pertain to that culture. Han Koehle says that “it’s important, when talking about oppressive laws and policies, to name start dates in addition to end dates” (Koehle, 2020). The importance of doing this allows us to look at how cultures constructed gender in the past, as laws were established for specific reasons. Without doing so we might assume laws have always been that way instead of “arising specific times for specific political reasons” (Koehle, 2020). The importance of asking when and why a law exists allows us to understand how “Criminalizing gender expression supported goals related to the subjugation of racialized and gendered others” (Koehle, 2020).

Examples of laws pertaining to gender norms have a long history. For example, a law from 13th century Scandinavia suggests a “condemnation and recommended punishment of cross-dressing recorded in Grágás” (Frankki J, 2012) is translated as, “If in order to be different a woman dresses in men's clothes or cuts her hair short... or carries weapons, the penalty for that is lesser outlawry.... The same is prescribed for men if they dress in woman's clothing” (Frankki J., 2020). This law’s existence suggests that there are instances where the law was broken. The law also suggests that the culture has some

understanding of what a man's dress and what a woman's dress looked like. We will later look at how Frankki describes scenarios where cross-dressing may become acceptable, or even revered in the pagan religion. Another example from Roman times are laws that pertain to the aspects of "castrati, religious or secular, ...barred from rights accorded to either sex and were not recognized in Roman law because of their unknown gender" (Wade, 2019).

The *hijra* of India, from reverence to disdain

The *Ramayana* was written in the Indus valley, and belongs to one of the oldest civilizations that is surviving today. Captured within the *Ramayana* is the practice of Hinduism and the caste system pertaining to it. Another subset of people captured within the text are the *hijra* of India. When Lord Rama "asks all the 'men and women' to return to the city...Among his followers, the *hijras* alone did not feel bound by this direction and decide to stay with him." (Singh & Kumar). The *hijra* identity has existed for as long as the *Ramayana* has been read and studied and the *hijra* were rewarded "the power to confer blessings on people on the auspicious occasions like marriage and child birth," (Singh & Kumar) by Lord Rama. The *hijra* identity has also been marginalized within their own history as once they held "high positions in the Islamic religious institutions [and were] able to influence state decisions and also received large amounts of money" (Singh & Kumar) to a darker history in more recent times when "European travelers showed disgust" at the sight of the *hijra*. It can be seen that "in the second half of the 19th century, the British colonial administration aggressively sought to criminalize [the] *hijra* community and to deny them civil rights" (Singh & Kumar). The effect of these laws and practices can still be seen today as the *hijra* are now seen as members of a lower class within the caste system of India.

The criminalization of their identity has had damaging effects that have only started to be made right again with the acceptance of the term legally. Since 2014 the term "is applied to people displaying a wide range of morphology, gendered and sexual behavior, and sexual orientation, (e.g., Loh, 2014; Nanda, 1999), including transsexual, transgender, transvestite, homosexual, asexual, and intersex people in addition to eunuchs" (Wade, 2019). A study has found that "The suicide rate among transgender individuals in India is about 31%, and 50% of them have attempted suicide before their 20th birthday" (H G Virupashka, 2016). The *hijra* of India have survived from ancient times until today despite a history of being revered and then later seen as members of an outcast society. Spiritually they are feared or respected through their ability to curse or bless a marriage. Their identity has been carried down through their culture and survived the criminalization of British Rule and as such, they lead poorer lives than they did before.

Gender diversity in Scandinavia.

In the *Poetic Edda* we can look at instances of Thor and Loki cross-dressing despite this being a way to be labeled an outlaw by Scandinavian standards. Often these instances of cross-dressing contained within the skaldic poetry are described as an attempt at parody, but their inclusion in the story is important in understanding when it becomes acceptable for members of the culture to don the opposite sex's dress. In the *Poetic Edda* Thor has his hammer stolen by a giant and to get it back Loki comes up with a plan to put him in a bride's veil. Thor objects to this saying "The *AEsir* will call me *pervert*, if I let you put a bride's veil on me" (Frankki, 2012). Thor's objection to being dressed in woman's dress is understandable, as the word he uses "*argr*." Being a slur, *argr*'s definition is debated. Some would say *argr* most closely resembles the English word for pervert. *Argr* is "one of three epithets listed in *Gragas* that were considered so offensive that manslaughter by the offended party was thought justified" (Frankki, 2012). Frankki turns to the work of Vern Bullough to understand what could compel Thor to take such a risk in the *Edda* if we assume that the inclusion of this in the story is not just parody. Bullough says that "In effect ... male cross-dressing was only allowed when other more dearly held values of society otherwise would have been threatened" (Frankki, 2012).

During his cross-dressing stint Thor does indeed win his hammer back from the frost giant, but in a way that does not emasculate him fully. Frankki suggests that "Thor was not a 'real' cross-dresser, but rather a male god disguised (rather poorly) as a goddess" (Frankki, 2012) on the basis that Thor acts rather manly during the entire stint. Indeed, the frost giant does not even notice Thor's beard when the veil is pushed to the side. While the instance is rather humorous Frankki finds that the "second principle of cross-dressing" (Frankki, 2012), from Vern Bullough's work also applies when we look at "functionality and necessity" (Frankki, 2012). The gendered others of Scandinavian society must have had some sort of place previously otherwise the laws and codes held in *The Gragas* would not have arisen. Therefore, while a god's epic story of the retrieval of his most prized possession and the often-phallic imagery that Thor's weapon could provoke is humorous, it is also a snapshot of when the pagans found it acceptable to cross-dress. Thor has bested the frost giant and won his masculinity back in the process.

Loki is another member of the skaldic poetry who has instances of gender transgression and as such he too has been labeled *argr*. Loki's gender transgressions are tied with his ability to use *seidr* or magic. Frankki states that "[Loki's] magic manifest[s] little similarity, yet when one considers that the men who participated in *seidr* rituals engaged in cross-dressing and that the practice of *seidr* was viewed as a predominately feminine activity," (Frankki, 2012) than a greater understanding of when it becomes

acceptable to cross-dress becomes clearer. In the article magic is seen as an ability normally belonging to the female sex, so the men who perform it are risking being branded *argr*. *Argr* is an insult pertaining to the sexual function of a man, or his magic ability. The idea that there used to be gender-transgressing shamans in the pagan religion is also fiercely debated as Jenny Wade finds that the priests described by other mythologists do not have substantial literary evidence. She brings up examples of priests who “dressed as women and wore their hair in a feminine hairstyle,” (Wade, 2019) but says that “no basis for such a conjecture exists in any of the Norse or contemporary Christian literature, which would surely have called attention to such practices” (Wade, 2019). We know that the intermingling of societies, seen with the *hijra* of India and the European travelers that came to their continent has manifested social change. One wonders if a queer identity such as the *hijra* of India could have survived in the times of Loki and Thor.

The Galli.

The *galli* of Rome are a religious cult dedicated to the Phrygian goddess Cybele. Like the *hijra* of India an account of the *galli* can be examined in a snapshot of history using Apuleius’s *The Golden Ass*. Like Loki, the *galli* of Rome have historically been labeled “perverts” or rather in the native Latin, *cinaedus*. Romans used the word as an insult that encapsulated “both gender presentation and sexual orientation, as well as a whole host of generally untoward behavior unrelated to sexual orientation and gender, not dissimilar to the recent flexibility of the English word ‘fag’” (Christian, 2019). Unlike the *hijra* of India the *galli* have not survived into the present. However, we know that the *galli* contained *castrati* and that “All castrati, religious or secular, were barred from rights accorded to either sex and were not recognized in Roman law because of their unknown gender” (Wade, 2019). Lillian Mardöllsdottir, a queer author on Facebook shares the belief that “the way that Rome treated Cybele and Her Galli is a fantastic lesson in imperialism, misogyny, transmisogyny, transphobia, patriarchy, and cultural appropriation” (Mardöllsdottir, 2020). The *galli* took part in religious castration that denoted them special powers with their goddess, not unlike the *hijra* of India. Knowing that Christianity eventually spreads to Rome, one wonders if the *galli* were ostracized even further than what they were shown to have gone through in *The Golden Ass*.

Through Jenny Wade’s *The Castrated Gods and Their Castration Cults, Revenge, Punishment, and Spiritual Supremacy*’s claim of “body modification and increasing acceptance of anatomical, sexual, and gendered expression beyond sexual dimorphism in certain modern Western culture,” and the apathetic way she refuses to read into anything saying that we must “separate from any claims- most of them highly speculate indeed” (Wade, 2019) and Blood Christian’s statement of “evidentiary problems

are especially acute for anyone who works on alternate sexualities[or gender], as we lack what [72] calls ‘the opinions of the condemned’” (Christian, 2019) Christian goes on to say that “part of the difficulty of reading the *galli* is that they themselves were subject to multiple levels of dislocation within their Roman context: They were poor and foreign, in addition to being sexual and gender minorities” (Christian, 2019) Gender identity has always existed, and through perhaps, high, speculation over the use of language in Apuleius’s *Golden Ass* we can look at a historical account of gender identity in ancient Rome.

A society’s ability to perpetuate gender norms relies heavily on a hetero-normative mindset of working to replace your family unit through the use of birth. Being castrated in a “highly gendered” society where their members are expected to father children, would be utterly humiliating. Rome had a history of being a highly gendered society, having classifications for all of the different reasons why someone would no longer be considered a man, all of them being eunuchs for different reasons, “spadones, thlibiae, thladae, and castrati with distinctions based on two different axes: the extent of the genital alteration and the etiology of these alterations” (Christian, 2019) A castrati, in this case, would be a man who made the conscious choice to remove their genitalia, thus no longer making him a man under Roman law.

Conclusions

Gender roles have their place in society and those that break those gender roles have been recorded through human history. The *hijra* of India and the *galli* of Rome are just a few accounts of such people, however the existence of gender transgressions in Norse and Scandinavia are still debated. Whether or not the inclusion of gender-transgressions by the gods by Snorri is an example of parody remains to be said until evidentiary woes are further researched. The intolerance of western civilization has bought about rigid gender-norms throughout the world, and as such the existence of transness and other queer individuals throughout history can be described as frustrating to say the least. The intolerance of gender diversity in western civilization can be seen through the spread of Christianity and the effects it has had on the *hijra* of India. Cross-dressing, sexuality, and transness today is becoming more acceptable, however the quality of life of trans individuals is a far outcry than the reverence the *hijra* were once known to have.

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Human Impact on the Environment

Catherine Burke

The carbon footprint demonstrates the impact a person or family has on the environment. Upon researching my family's carbon footprint, I found that it is lower than I had anticipated; it is even lower than the average household. My mother and I are the only two people in the household and we live in a fairly small townhome, but we do use a lot of energy, so I thought that we would lose points on that. While we did lose points, it was not enough to push us over the average. The carbon footprint for my household was 45 tons of CO₂ per year.

The carbon footprint is heavily weighted in the consumption of a household; consumption is a complex web of information that accounts for the things consumed and how much of CO₂ is emitted in the process of making and shipping these goods. For example, one could eat a lot of red meat and drive a hybrid car and think they are doing well for the environment, yet their meat consumption leads to a lot of greenhouse gases emitted by cattle. This fact is often overlooked or unknown to the average consumer. The other complexity is the sheer volume of things that impact the environment that people use or do including: energy use in the form of electricity, oil, and gas; traveling by car and plane; consumption of meat, grains, dairy, fruits, vegetables, and other food; consumption of goods and use of services. I think it would be hard for people to change their carbon footprint because a lot of people live their lives out of necessity, meaning they only consume and use what they need. On the other side, there are definitely some people that use goods and services in excess when they may not necessarily need to (like going shopping for clothes, using services such as massages, car washes, nail appointments, etc.), and while they could change these things, it is often a routine and it is hard to break routine. There is also the factor of people being unwilling to change their habits. For example, a person who loves steak may be simply not willing to change their dietary habits. People may also not be able to afford to do what is right for the environment; a person driving an old gas-guzzler may not be able to afford to purchase a newer car with better gas mileage. As evident, there are a lot of obstacles in the way of reducing the carbon footprint of the masses.

Ecological impacts involve every item we consume. To demonstrate, I deconstructed an item to show the origins, materials, and impacts of a single item in the ecosystem. The item I chose was Starbucks coffee beans. They are sourced from Guatemala, Rwanda, and Timor (*Starbucks Coffee Company*). The impacts this product has on the environment includes natural decomposition, disposal to waste containers and landfills, energy used for coffee machines/roasters, energy for packaging, the packaging itself (a foil/plastic), and the energy needed for transport, which includes traveling by truck

and plane. This also impacts people, which includes the store managers, cashiers, stockers, baristas, truckers, roaster management and team, packing management and team, farmers, and consumers. I chose this product because it is a product that I use on a near-daily basis and I was curious to see how it impacted the environment. I found the origins by looking up the source of the coffee beans. I found the impacts by connecting the consumption of coffee beans with the general supply chain of the item itself, and by connecting the steps of making and roasting coffee beans to the people who make it all happen. It was surprising to see how many people and how many environmental impacts were attached to the making of just one bag of coffee beans.

Renewable energy will help the environment heal. There are many types of renewable energy that are available to us today. One type is biofuel. Biofuel is energy that is sourced and made from organic matter (Energy Informative). The two main fuels that are made are biodiesel and ethanol, which can be used to power machines and vehicles. (“Biofuels Basics”) The advantages to biofuels are numerous. Resources are renewable and abundant, which means that the source of them is always there, a nearly endless source of resources; the resources don’t generally get ‘used up’ (Energy Informative). They are also carbon-neutral, which means they are not creating more carbon emissions, they are just using other sources of carbon to power what is needed to be powered, and then they recycle the carbons from the organic matter back into the environment. (Energy Informative) This fuel source is also cost-effective, meaning it costs less to harvest biofuels than it does to harvest coal and fossil fuels. This is because a lot of the organic matter is already there, or is planted and grows, which is much cheaper than crafting a mine or an oil rig (Energy Informative). Now, in contrast to all these advantages, there are some disadvantages. While biofuels are cost-effective for harvesting, they are expensive to make, therefore passing the cost on to the consumer (Energy Informative). They also may require a lot of space, especially for corn-based biofuels, as tons of acres are needed to manufacture the corn that is needed for the fuel making process (Energy Informative). In addition, there is some environmental damage, as the manufacturing and burning of the fuels release non-carbon gases into the air and byproduct chemicals into the environment, though they may not be as harmful as their fossil fuel and coal counterparts (NS Energy Staff Writer). Lastly, the harvesting of the organic matter used for biofuels may be seasonal, depending entirely on the growth cycle and seasons required to grow corn and other organic matter. This could be solved with building large greenhouses, but that would be expensive and take up a lot of space and materials.

Another type of renewable energy is wind-powered energy. Wind energy is the process of generating electricity using the wind via wind turbines. The turbines capture the kinetic energy in the

wind to generate usable energy. There are a lot of advantages to wind energy, the first one being that it creates jobs. Being a relatively newer technology, there are not many turbines that are old and need to be repurposed, so each turbine is likely needed to be manufactured and built, which in turn creates jobs (“Advantages and Challenges of Wind Energy”). Wind energy also emits no pollution after the turbines are built and working, so it is a clean fuel (“Advantages and Challenges of Wind Energy”). Wind energy is also available to be harvested on any available patch of land, and therefore is a domestic energy source, reducing our dependence on foreign sources of energy (“Advantages and Challenges of Wind Energy”). It is also cost-effective, meaning the price for wind energy does not change since it is not dependent on other materials prices (like how gas is dependent on the price of oil). Finally, it is sustainable. There will likely never be a time where the wind “dries up,” making wind energy infinitely available (“Advantages and Challenges of Wind Energy”). While there are many advantages, there are some disadvantages. The first one is that the wind turbines require a lot of land, which can be a problem in big cities where the power is needed. There are a lot of wind farms outside of cities, but they may be too far away from the cities to make use of that energy (“Advantages and Challenges of Wind Energy”). There is also the time and resources needed to make and maintain the wind turbines, which can be costly (American Wind Energy Association). Lastly, there is the unfortunate fact that birds have been known to fly into the turbines and be killed. Though, this could be true of all tall structures, it is a bit more ironic when trying to sell an environmentally friendly fuel source. (“Advantages and Challenges of Wind Energy”)

Finally, there is one more notable renewable energy resource is solar power. Solar power is thermal or electrical energy that has been converted from the energy released from the sun. The energy is captured on solar panels (Solar Energy Industries Association). There are great advantages to solar power, the main one being that it works in most places and the panels are able to be placed on any structure that receives sunlight (SunPower). Since it is available to be harvested wherever there is sunlight, panels can be placed on private homes and businesses, which can increase their property values (SunPower). These panels can also harvest enough energy to power a private home or the power can be sold to the power company to power entire cities. This makes it more affordable, since some solar panel owners get money back from the power company each month. Speaking of affordable, the solar panels are the most affordable source of renewable energy for individuals to use, as it can be done on a small or large scale (SunPower). With every good, there is bad, and there are a few disadvantages to solar energy. The main one being that it only works in the daytime. Once the sun goes down, the capturing of energy stops. If it is cloudy, the capturing of energy drastically decreases as well (SunPower). Solar energy also needs professional installation and has been called an eyesore in some neighborhoods, though those

being a disadvantage is subjective (SunPower). Last, there is an environmental impact of manufacturing the panels (via the byproducts and resources used during the manufacturing process), as with manufacturing all items (SunPower). All these renewable energy sources are vital to helping the environment, and must be used in conjunction with each other.

Along with renewable energy, another thing that affects the environment is sustainable agriculture. The first problem with agriculture is greenhouse gases. Greenhouse gases are gases, or chemical compounds, that are in the atmosphere and allow sunlight to enter the atmosphere but do not allow the energy from the sun to exit the atmosphere, which results in the trapping of heat (National Geographic Society). This is a problem because the heating being trapped in the environment is causing the planet to heat up, which has a domino effect of warming the oceans, which causes ice caps to melt, and reefs and biodiversity to die off. It can also cause draughts, more severe weather, and more numerous forest fires due to plant life drying out (EPA). The best way to prevent the greenhouse gases is to reduce the pollutants that are emitted into the environment. This can be done by people reducing their carbon footprint. Another way to solve the greenhouse gas issues is to capture the greenhouse gases and convert them into a beneficial product, which is still being researched and is in progress (O'Leary). Solving the greenhouse gas issue is vital to saving our planet.

Aside from greenhouse gases, another issue agriculture is facing is deforestation. Deforestation is the mass destruction of trees and forests by man and Mother Nature (Nunez). This is an issue because animals are losing their habitats and the destruction of trees is taking away the oxygen produced by trees and the carbon dioxide consumed by trees during photosynthesis (Nunez). There are thankfully a few solutions to this problem. One is to eliminate the cutting down of trees, or if trees have to be cut down, requiring new trees to be planted in their place. This will help save or restore the forests. Preventing the cutting down of trees can be done by protecting designated areas, meaning there is to be no logging (Friedman). Another way to reduce deforestation is to reuse and recycle all materials possible. The reuse and recycling of materials that are already in circulation can mean that we do not need to cut down more trees for the same purpose (Matter of Trust).

Another agricultural problem is pollution. This can include air pollution, land pollution, and water pollution. Pollution is the chemicals or substances that are not naturally occurring in an environment, present in that environment (Bradford). This is an issue because pollution is destroying habitats, poisoning wildlife, and contributing to greenhouse gases and global warming. (Bradford) There are solutions for each type of pollution. For water pollution, solutions would be to stop the use of chemicals in daily life and switch to more environmentally-friendly products (such as fertilizers, cleaning

products, and pesticides) (Sciencetopia). Another way is to more meticulously enforce environmental laws when it comes to disposal of chemicals and products. In addition, controlling the water runoff can help because the runoff water feeds into the creeks, rivers, and lakes, and that water can be contaminated with vehicle liquids, chemicals, and other waste (Sciencetopia). A way to prevent land pollution is by recycling and reusing material instead of sending it to a landfill, which will reduce the solid waste that is in landfills and scattered across the planet (Stephen). Another way to reduce land pollution is to reduce the amount of pollutants used – be it fertilizers, pesticides, cleaning products, and the likes. Lastly, one way to prevent air pollution is to reduce greenhouse gases as mentioned previously, reducing the carbon footprint, and putting tighter regulations on factories and their emissions (NHDES).

Finally, the last problem in agriculture to list is the loss of biodiversity. This means the loss of diversity of organisms in the ecosystem, meaning there are species that are being killed or drastically reduced in numbers (Rafferty). This is bad because it can cause the loss of habitats, can cause the ecosystem to be thrown out of balance, and allows for more things like fires and natural disasters to occur due to loss of keystone species. One solution to this is protecting the species and the habitats in which they live. This will help maintain the ecosystem and will also help maintain the habitats, which will help with other agricultural problems (like deforestation and pollution). Another way to prevent this from happening is to prevent hunting of species that may be over-hunted, such as elephants. This can be done by placing stricter regulations and putting harsher penalties when those regulations are violated (“Causes, Effects, and Solutions for Biodiversity Loss). All in all, these issues are all intertwined with each other and the environment itself.

Now, the outlook may look bleak due to all of the negatives that are present in the ecosystem, but there are some good outcomes. Humans are learning how to coexist with the environment every day. The first example of that is the utilization of green roofs and urbanization. Green roofs are roofs in cities that are wholly or partially covered with vegetation (National Parks Service). A specific example of this is the green roofs in an Australian study that show succulents can survive at a rate of 100% on roofs in Adelaide, demonstrating that green roofs are possible even in the extreme warm and cold weather. Rain water was recycled and used to irrigate the vegetation on that green roof. In fact, in that study, all of the species of vegetation survived on the roof (Razzaghmanesh et. al). This shows that humans can urbanize and still create nature, even in the concrete jungle.

Another example of humans coexisting with nature is the presence of protected areas. In fact, 3.8% of the world’s surface area is protected (Gaston, et. al). This means that the environment may not be altered (like mining or cutting down trees), hunted on, or lived on. It is the government’s way of

protecting the environment. It can also mean using national parks as a safe haven for species. In a study done by Colorado State University in the 1990s, they used national parks to relocate bighorn sheep populations that were dwindling in hopes of them being able to repopulate and restore themselves. They chose the sites by a Geographic Information System (GIS) to assess whether or not these sites would be sufficient for the sheep. This experiment did end up working for many sheep populations, with some of them experiencing 10% growth rate annually (Singer and Gudorf). This shows that national parks are not only used to protect land, but to restore the animals that live on the land itself, which sometimes requires the help of humans.

In addition, conservation biology is also needed for the coexistence of humans and ecosystems. Conservation biology is the science where humans make an effort to conserve the environment a species lives in, in order to conserve the species and vice versa. One specific example is a study done on the relationship between bees (the pollinators) and the flowers in which they pollinate. They have a mutually beneficial relationship, and if one suffers, they both do. They are both needed to conserve each other; bees pollinate plants to aid in reproduction, and plants provide pollen to bees for sustenance (Kearns, et al). It is important for humans to monitor and help with this ecological relationship, as humans are really the only species who can protect other species in such a manner.

Last, restoration ecology is needed for people to coexist with the environment. Restoration ecology is using resources to help repair or upgrade an ecological system that is damaged or destroyed. In a study done by the University of Manitoba, different wetlands were observed to have depleted nutrients, like the soil found in a San Diego wetland. Restoring the nutrients in the soil is what restoration ecology is all about – helping the environment in order to help the species living in it. There was also a restoration in North Carolina where the soil was restored (Zedler). This may be the most impactful interaction between humans and the ecosystem, as the humans are directly and deliberately changing the damaged environment to be back to what it is naturally supposed to be, though all interactions are extremely important.

All of those conservation, restoration, and protection efforts help the ecosystem. Those generally take many people making an effort, but there are many things that can be done on an individual level at home, school, or work to change their carbon footprint. The first thing is that one could obtain a more fuel-efficient vehicle. Car emissions are a big problem in the world and cause cities especially to experience pollution. If everyone had a more fuel-efficient car, there would be less car emissions and the air would become less polluted than before. This does not require much time, other than the purchasing of a car, but it does have a heavy cost. Generally, newer cars are more fuel efficient and therefore more

expensive. This could put a financial burden on a household or individual, as not everyone has enough money to upgrade his or her current vehicle. On the flip side, it will result in spending less money on gasoline, though it is unclear if those costs offset each other.

Another way individuals can change their carbon footprint is by eating less meat, specifically beef. Beef plants are a large source of carbon emissions and pollution via methane and nitrous oxide. (Singh, et al.) There is very minimal time needed to make this change, if any. Meal planning can take a while to get used to not using beef, but it likely would not take much more time than already allotted for that chore. It may be less or more expensive, depending on what is substituted for the meat. A lot of meat substitutes are expensive, especially vegan options, but depending on the type of meat that is routinely bought, it may not be more expensive. The impact that this will have on a household is just a change in day-to-day life, which may be difficult for some.

Lastly, adjusting the thermostat is something that individuals can do, as well as their employers. Adjusting the thermostat means setting it at a cooler temperature during the winter and setting it at a warmer temperature during the summer so that less air conditioning/heating is used. The main obstacle and impact would be that the people subjected to these temperatures will experience discomfort, regardless of age, gender, or race (Kennedy, et. al). The upsides, however, may outweigh the downside. For instance, it would save money; utility costs would go down because the utilities are being used less often. No real time input is required; it is as fast as just walking to the thermostat and turning it up or down. This can be done on a small scale in the home or on a larger scale in offices, schools (like RRCC), and other large buildings. All of these ideas will help make the earth a more livable place, as the carbon footprints of everyone would be much lower.

Speaking of livability, the impacts on biodiversity that population growth has had are astounding. Increased population means more land is needed to accommodate more people, which can lead to deforestation and destruction of habitats. An increase in population also puts strains on resources such as food and water, which are vital to all of the ecosystem (Population Action). The increase of population has also led to a higher consumption of resources, which indicates a higher ecological footprint. Even organic resources, such as vegetables, can have a high impact on the environment when you take into account the use of pesticides and amount of land it takes to farm these products (BBC News). Now, when it comes to technology in the ecosystem, it is a double-edged sword. The amount of resources used to make one smartphone or computer have a lot of negative byproducts and waste, therefore being harder on the environment. However, there is also the need for technology to preserve biodiversity and it is being used to help preserve that biodiversity and the ecosystem by making the manufacturing and harvesting

processes more efficient and by creating new ways to tackle ecological problems (Leipzig). All of these are important to show concern over because they all have a negative impact on the environment. In having a negative impact on the environment, there is a negative impact on the animals and organisms that live in the environment, which are vital to human life. For example, if a human's actions downgrade the environment, say, mushrooms live in, and those mushrooms are the ones used to make penicillin, then the humans lose the ability to make penicillin, resulting in deaths from infections. This is just a small example that has a huge implication -- that we are not alone, and that we rely on the earth and all its natural resources for daily life. Not to mention, if we cause the environment to produce an unfavorable place to live, many species could die off, resulting in downgrading of the entire world, which will eventually become uninhabitable.

Finally, I honestly do not know if it is possible for us to maintain our economy and reach a point of sustainability as a planet. I like to hope that it is possible, as evident in the many examples of renewable energy and conservation, but the overall outlook is grim. In order for us to be able to live sustainably, the rest of the world would have to even out, our economies would have to be more equal to each other, and there would have to be a level playing field. That's where it would start and then the carbon footprint of each individual and each country would be able to be measured more accurately. Even the most ecologically friendly countries do not meet the needs of their people. Growth often adds more numbers to the carbon footprint. How can we stop growing when the rest of the world is still growing? We cannot (Kaplan). Not only that, but people would have to start caring about the environment and make a conscious decision to change. I think it is too soon for me to say whether there is a possibility of ecological and economical equilibrium in one country, when there is not an economical equilibrium throughout the planet and when people just do not care or think about the environment.

All in all, the ecosystem is a complex thing that we are still trying to understand. Humans have a huge impact on the environment and something needs to be done before it is too late for our planet.

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Additive Manufacturing Characterization in Suborbital Spaceflight and Re-entry

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Abstract

While suborbital flights are a growing research platform, the cost to fly a payload is prohibitive to many commercial and educational entities. Additive manufacturing (AM) in suborbital applications is revolutionizing this platform, making research tools more available and affordable. Flight components made from 3D printed filaments allow more design freedom and fast prototyping, cost significantly less to manufacture and weigh less than their metal, machine-milled counterparts. Since there is limited data on the thermal effects of re-entry on additive manufactured materials, the Community Colleges of Colorado RockSat-X team designed a sounding rocket payload using AM components and experimental artifacts with a goal of testing and documenting key characteristic properties. Our payload flew on an Improved-Terrier Malemute suborbital rocket at NASA Wallops Flight Facility on August 12, 2019. Upon recovery and post-flight analysis, we found that all internally housed electrical components remained functional throughout the entire flight and that deformation in most structures was nominal. The temperature data collected by the five onboard temp sensors were used to create a temperature profile of the flight as experienced by structurally unique artifacts composed of either acrylonitrile butadiene styrene (ABS) or polyethylene terephthalate with a glycol modification (PETG), two common, inexpensive 3D filaments. Both thermal sensors housed in PETG experienced only 22.7% of the heat registered by the unhoused sensor, and sensors in the ABS cube and ABS dome recorded 17.6% and 22.2% of the heat, respectively. The PETG cube and ABS cube retained the max temperature 5.8 and 10.4 times as long as the unhoused sensor, while the PETG dome and ABS dome retained max temperature for 2.7 times as long, suggesting that the dome shape dissipates thermal buildup significantly faster, regardless of filament type. Cost analyses of our AM components versus aluminum 6061 alloy milled counterparts resulted in a savings of \$5,481.04 or 66.9% on materials and \$5,184.04 in fuel (projected). Data such as these are crucial for creating data libraries that can be used by educational institutions

and commercial organizations, eager to explore this affordable and available research tool.

1. Introduction

1.1. Background

Suborbital research is growing experimental platform that provides a period of one to four minutes of microgravity at a substantially lower cost. [1] Possible studies that can be conducted suborbitally include a breadth of experiments in human physiology, materials science, Earth observations, characterization of the upper atmospheres, technological tests in microgravity and qualification of on-board space equipment. [1] The use of additive manufacturing in this growing field is revolutionizing the industry, making research tools more available and affordable. [2] Flight components made from 3D printed filaments are significantly less expensive and weigh less than their metal, machine-milled counterparts. Additive manufacturing (AM) technologies, are ideal for space applications as it allows for weight and material volume minimization, the primary financial drivers in component production, payload weight and fuel requirements. Additionally, 3D printing allows for iterative and novel strategies in the design and prototyping. [3]

1.2. Mission

Our goal was to test and record the effects of thermal build-up on the rocket and its payload during re-entry from suborbital space in order to determine the viability of common 3D printed materials and stay within our budget of \$1500. This budget required creative problem-solving to complete all prototyping, testing and final component procurement and additive manufacturing was the solution. Educational, aerospace and small business communities could benefit greatly by thermal re-entry data and its effects on 3D-printed materials allowing for less expensive space missions. [2]

2. Methods

Our team participated in a national suborbital research program called RockSat-X, sponsored by the Colorado Space Grant Consortium fall 2018 till summer, 2019. During this time, we designed, prototyped, tested and built a payload that was launched on an Improved-Terrier Malemute sounding rocket at NASA Wallops Flight Facility in Wallops Island, VA. Our experimental goals were to: a) Change the path of a non-ferrous trajectory using passive electrostatic charge and b) Characterize rocket thermal data and observe changes in different 3D filaments after re-entry. Distinct filament structures, composed of either acrylonitrile butadiene styrene (ABS) or polyethylene terephthalate with a glycol modification (PETG) were printed, measured and affixed to mounts installed on the payload deck, as seen in the CAD and payload build in Figure 1, below.

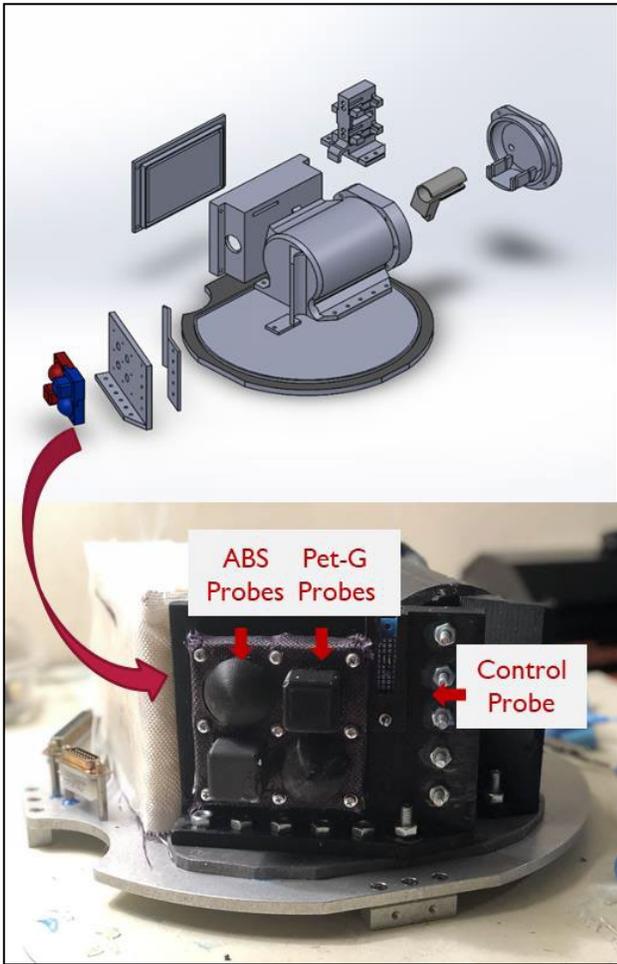


Figure 1: Exploded SolidWorks CAD of the payload and photo of the thermal sensor locations.

The vertical orientation of this deck allowed for full exposure of the material and each design had a centered cavity containing an RTD 100 thermal temperaturesensor. In addition, an unhoused sensor was mounted adjacent to the filaments structures as a control. Temperature data prior to launch was collected as an internal baseline and temperature probes collected data again after the rocket had reached apogee and the entire decent to splash down. Temperature telemetry was sent to verify functionality and all temperature data was stored on an onboard SD card. Upon retrieval of the deck, printed structures were measured again, and deformation and change in shear strength were analyzed and reported. In addition, latitude, longitude and altitude data provided by Wallops Flight Facility were integrated into the data analysis using Python.

3. Results

3.1. Thermal Characterization

Based on the logged temperature measurements stored on onboard SD card, the following suborbital temperature profiles were generated using the Wallops Flight Facility rocket flight profile information provided by NASA Wallops Flight Facility.

Initially we plotted all five sensors in concert with the rocket altitude in Excel, as seen in Figure 2. This graph shows the flight trajectory and all five sensors in altitude and temperature both graphed with respect to time.

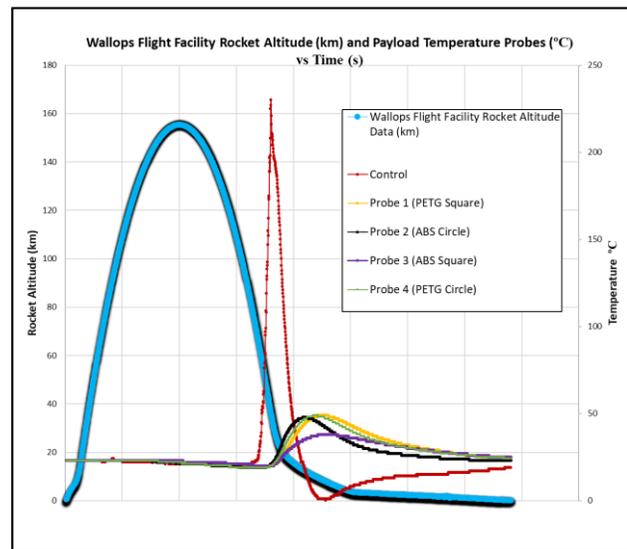


Figure 2: Wallops Flight Facility rocket altitude and payload temperature sensors data graphed with respect to time.

Using Python, we plotted all ~68,000 data points from our rocket launch, provided by NASA Wallops Flight Facility, in three dimensions (latitude, longitude and altitude (m) vs time (s)) to visualize the flight trajectory.

We then incorporated our unoused temperature sensor data as a heat signature, as seen in Figure 3, to show where in flight each probe was experiencing the highest temperatures and for how long.

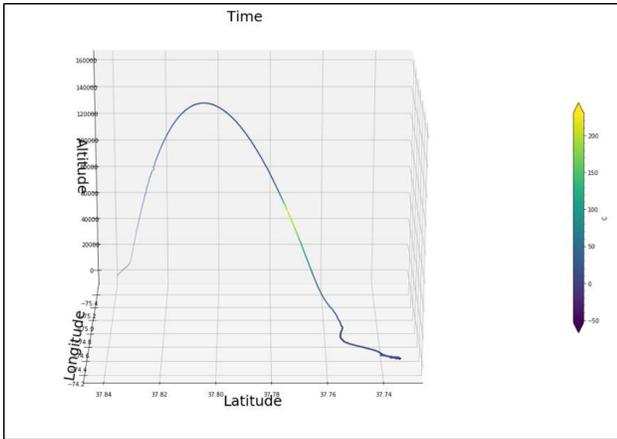


Figure 3: Unoused temperature sensor data graphed in three dimensions over time, with heat signature information included.

We analyzed and visualized our sensor data in the same manner while including the shape of the filament structure and the type of filament used, shown in Figure 4 below.

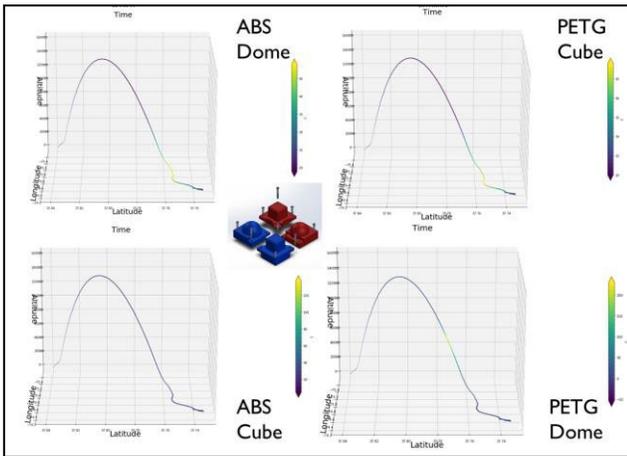


Figure 4: Encapsulated RTD 100 Temperature Sensor Trajectory and Heat Map

The information from the heat maps above is summarized in Table 1, below. The maximum temperature the probe experienced, at what altitude it experienced this maximum and for what duration, providing insights into filament characterizations and the effect shape has on thermal diffusion.

Table 1: Summary of temperature probe data including the max temp, average altitude at max temp and duration at max temp.

	Ctrl	PETG Cube	PETG Dome	ABS Cube	ABS Dome
Max Temp (°C)	216	49	49	38	48
Average Altitude (m)	35081.1	8502.6	10040.8	7570.2	12377.5
Time at Max Temp (s)	3.42	19.76	9.5	35.72	9.12

Based on the data above, both thermal sensors housed in PETG experienced only 22.7% of the heat registered by the unoused sensor, and the sensors in the ABS cube and ABS dome recorded 17.6% and 22.2% of the heat, respectively. The PETG cube and ABS cube retained the max temperature 5.8 and 10.4 times as long as the unoused sensor, while the PETG dome and ABS dome retained the max temperature for 2.7 times as long, suggesting that the dome shape dissipates thermal buildup significantly faster, regardless of filament type.

3.2. Cost Comparison

In order to stay within our budget, we used 3D printed payload components for prototyping, testing and construction, which is not typical for the program we participated in. After we got our payload back to conduct postflight analysis, we performed comparisons of payload components for weight and structural changes and performed cost analysis in both manufacture and fuel costs. We spoke with the Subtractive Manufacturing Lead at Colorado School of Mines, Shelby Ryan to get quotes on our payload components if we had used aluminum milling as opposed to 3D printing. The 3DPrint Lead Technician at Red Rocks Community College, Riley Brugger, provided machine costs for the AM we used for our components. Table 2 shows a direct comparison of these costs, which include specific materials, machine use and hourly labor required. The use of 3D printed parts on our payload resulted in a savings of \$5,481.04 on materials.

Table 2: Cost comparison of 3D printed (AM) payload components and aluminum milled components. Cost includes materials, machine use and labor costs.

Component	Additive Manufactured	Aluminum Milled
Earth Air Chamber	\$1466.99	\$3883.22
Earth Air ChamberLid	\$295.12	\$832.26
Electronics box	\$401.81	\$1505.90
Electronics Box Lid	\$382.10	\$1329.07
Launcher	\$282.04	\$758.64
Total Cost	\$2828.06	\$8309.10

Since a key challenge to achieving space research and exploration objectives is the expense of lifting cargo into Earth orbit or low-earth orbit, we also created a fuel cost analysis of AM versus aluminum milled components. [3] We determined the dollar per kg of our payload based on the cost we were charged (\$14,000) to send 15 lbs of weight up in our rocket. We determined the weight of our milled components using the CAD in SolidWorks to change the material to Aluminum 6160 alloy. We used the actual mass of our 3D printed components before flight and visualized that comparison in Figure 5, below.

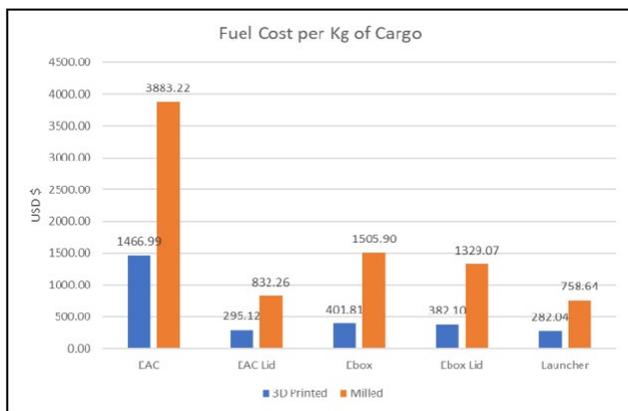


Figure 5: Fuel cost comparisons for our flight of AM versus aluminum milled components.

Based on this analysis, the use of AM parts saved an average of 65.96% or \$5184.04 in fuel. In addition, Mr. Ryan informed us that our debris launcher would not be able to be milled due to the structural complexity and sizes. The entire experiment would have been redesigned to accommodate these milling restrictions.

[6] National Research Council. 2014. 3D Printing in Space. Washington, DC: The National Academies Press. <https://doi.org/10.17226/18871>.

4. Discussion

Companies and schools are investing in novel additive manufacturing techniques and specific designs to reduce launch requirements and costs, making suborbital research a more easily obtained possibility.[4] Due to the inherent elastic and weight properties, 3D materials are also being considered to build orbital structures like satellite shields and deflectors to protect against space debris. [5] Our experiment provides key characteristic material data on the effects of thermal re-entry on 3D printed structures demonstrating that use of these filaments in future experimentation is a viable option over other cost and design prohibitive requirements.

“Additive manufacturing can also help to reimagine a new space architecture that is not constrained by the design and manufacturing confines of gravity, current manufacturing processes, and launch-related structural stresses.” [6]

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Generalized Anxiety Disorder: An Overview

Catherine R. Burke

Generalized anxiety disorder is a mental illness that exhibits physical, mental, and cognitive symptoms. It is influenced by outside sources such as consumables, physical ailments, and infectious agents. It can affect daily life in the form of sleep disturbances, mood changes, and outlook. Thankfully, there are many ways to treat generalized anxiety disorder.

Generalized anxiety disorder is a chronic mental illness that presents as hyper-vigilance, racing thoughts, excessive fears, and excessive worry; it can range from mild to severe, though often has more of a severe exhibition. (Meyer, A., et al., 2018) These symptoms, along with apprehension towards events or activities, must be present for at least six months before the diagnosis of generalized anxiety disorder can be made. (Akaltun, Ismail et al., 2018) It is estimated that about 6% of the population is affected by generalized anxiety disorder, with women being twice as likely than men to be affected. (Oji, O., et. al., 2018) Generalized anxiety disorder is associated with comorbidity, as 50-90% of people diagnosed with generalized anxiety also have been diagnosed with another mental illness. (Oji, O., et. al., 2018) 94% of patients report physical symptoms, which include headache, trembling, fatigue, nausea, sweaty palms, hyperventilation, restlessness, irritability, sleep disturbances, rapid heart rate, dizziness, muscle tension, and hot flashes. (Akaltun, Ismail et al., 2018) (Latas, M., et al., 2018) (Oji, O., et. al., 2018) Generalized anxiety disorder can also affect cognition, with patients exhibiting irritability, difficulty concentrating, poor coping skills, persistent pessimism, and hypersensitivity. (Oji, O., et. al., 2018)

It is thought that humans were born with a set of innate fears that are related to our primal need for survival. (Hogue, D. 2014) There are also sets of fears that we learn. For example, one can fear an animal that they have witnessed being aggressive. The witnessing of aggression can lead us to feel that all animals that look or act that way are a threat. This is called conditioned stimuli. (Hogue, D. 2014) These stimuli and fears are natural and normal responses to our environments and are traits of generalized anxiety disorder. Another trait exhibited by people with generalized anxiety disorder is social anxiety, which is an anxiety that focuses on social fears and the automatic stimulus response of interaction between

multiple individuals. (Hogue, D. 2014) We need, as a species, to connect with others, so overcoming this fear is essential to survival. (Hogue, D. 2014)

There may be a difference in the clinical characteristics of generalized anxiety disorder when it comes to age, as well. A study done by U. Altunoz, et al., in 2018 studied 102 subjects over age 65, and 64 patients under age 45 who were diagnosed with generalized anxiety disorder. This study showed that older subjects had more sleep issues than the younger subjects, as well as more severe depression. Despite this, it was shown that the older subjects had less severe generalized anxiety disorder than the younger subjects. In fact, the severity of generalized anxiety disorder decreased as the subjects aged, evidenced when they conducted a follow-up study 14 years later. (Altunoz, U. et al., 2018) The older and younger subjects also worried about different things, with younger people worrying about other's health and the future, while the older people worried more about their family and their own health. (Altunoz, U. et al., 2018)

Generalized anxiety disorder, has long been diagnosed at more advanced stages, but not at the first onset — until recently. A study done in adolescent females indicted that there is a neural response to making errors and the presence of generalized anxiety disorder. (Meyer, A., et al., 2018) Scientists studied 457 females with no history of generalized anxiety disorder between 13.5 and 15.5 years of age. The study began with scientists evaluating their mental state via the structured clinical interview from the DSM-IV and the expanded inventory of depression and anxiety symptoms over the last two weeks. (Meyer, A., et al., 2018) The scientists had the females perform laboratory-based tasks involving reaction time via the Eriksen flanker's task, focusing on when the girls made mistakes. They then used the monitoring of the fronto-central sites via EEG of the brain to measure the error-related negativity (ERN) response after the females made these mistakes. (Meyer, A., et al., 2018) This response measured the heights and directions of the peaks of the waveforms in the electrical activity elicited after making a mistake. (Meyer, A., et al., 2018) They then had the girls come back 18 months later to perform the same interview about anxiety, at which time 27 elicited first-onset generalized anxiety disorder. (Meyer, A., et al., 2018) The higher the ERN, the more likely the female was to be diagnosed with generalized anxiety disorder, leading to believe that the ERN is a biomarker of early-onset generalized anxiety disorder. (Meyer, A., et al., 2018)

Physiologically, there are players at work when it comes to anxiety and generalized anxiety disorder. Anxiety is thought to be related to the fight-or-flight mechanism, which is initiated by the release of adrenaline, which is from the adrenal glands, which also release cortisol. (Greaves, L. K., et al., 2009) Curiously, the overall cortisol levels assessed in 1768 individuals did not predict future anxiety levels. However, those with increased persistent anxiety exhibited lower evening cortisol levels than those without anxiety. (Greaves, L. K., et al., 2009) In addition, those with increasing short-term anxiety levels showed higher morning cortisol levels than those with lower short-term anxiety. (Greaves, L. K., et al., 2009) This study could not conclude if cortisol had anything to do with anxiety.

In addition to cortisol, dyspnea has been noted to be a physiological symptom of generalized anxiety disorder. (Alius, M. G., et al., 2013) The dyspnea is noted to be related to hyperventilation, which occurs when anxiety elevates to a panic attack, or with a panic disorder. (Alius, M. G., et al., 2013) A study was conducted using an apparatus that had varying intensities of resistances for inhalation and exhalation, which then measured the respiratory rate in low and high anxiety individuals. Those with high anxiety did exhibit an “elevated minute ventilation compared to low [anxiety] participants.” (Alius, M. G., et al., 2013) The individuals in the high anxiety group also reported to have symptoms of panic and anxiousness, indicating that difficulty breathing can not only be a symptom of generalized anxiety disorder, but can also contribute to anxiety experienced. (Alius, M. G., et al., 2013)

There may also be outside influences that can initiate the onset of generalized anxiety disorder, as well. A study done by Akaltun, Ismail et al. in 2018 indicated that the presence of *Toxoplasma gondii* IgG antibodies was related to mental illness. *Toxoplasma gondii* is a protozoan parasite that lives in mammals as intermediate hosts, with the final host being the house cat. (Akaltun, Ismail et al., 2018) This study included 60 subjects with OCD, 60 subjects with generalized anxiety disorder, and 60 control subjects. 31.7% of the subjects studied with generalized anxiety disorder tested positive for antibodies to *Toxoplasma gondii*, which indicated they were exposed to the protozoan parasite. (Akaltun, Ismail et al., 2018) In fact, subjects that tested positive for the *Toxoplasma gondii* antibodies were shown to have over four times the incidence of generalized anxiety disorder than those who were negative for these antibodies. (Akaltun, Ismail et al., 2018) It is proposed “this may be due to both toxoplasma migrating to the brain and forming cysts and to the changes it produces in

neurotransmitters.” (Akaltun, Ismail et al., 2018) It is apparent that the presence of *Toxoplasma gondii* may influence the presence of generalized anxiety disorder in individuals.

Another outside influence on the prevalence of generalized anxiety disorder is the presence of low amniotic fluid during pregnancy, also known as oligohydramnios. A study done in 2017 by Uguz, F., et al., investigated whether oligohydramnios was linked to higher rates of generalized anxiety disorder in the mother. The study included 53 pregnant subjects with oligohydramnios and 80 healthy pregnant subjects, all of which were free of infection, previous medical conditions, or fetal malformation. (Uguz, F., et al., 2017) The women were evaluated by psychiatrists to determine the prevalence of generalized anxiety disorder; it was found that women with severe oligohydramnios had a significantly higher rate of generalized anxiety disorder at 44.4%. (Uguz, F., et al., 2017) Generalized oligohydramnios also had a higher overall rate of generalized anxiety disorder, with 30.2% having generalized anxiety disorder; the control group had an incidence of 3.8% generalized anxiety disorder. (Uguz, F., et al., 2017) It appears that the human body’s state may have an influence on the prevalence of generalized anxiety disorder.

It is thought that what people consume may also affect the level of anxiety they have, but does it really? A study done in 2004 by M. Lyvers, et al. shows how heavy and light caffeine consumption affects anxiety. Caffeine is the most widely used psychoactive drug globally. (Lyvers, M., et al., 2004) This particular study studied 22 heavy caffeine consumers (HCCs) and 26 light caffeine consumers (LCCs) after drinking decaffeinated coffee or decaffeinated coffee plus 300mg of caffeine. (Lyvers, M., et al., 2004) Surprisingly, there was little difference between LCCs and HCCs after consuming caffeine; this was supported by another study reviewed by M. Lyvers. (Lyvers, M., et al., 2004) On the other hand, another study reviewed by Lyvers indicated that those who did not use caffeine for two weeks did exhibit more anxiety when being given caffeine after being caffeine-free. (Lyvers, M., et al., 2004)

A lesser-known thing about generalized anxiety disorder is that sleep disturbance is a large part of it. One study reviewed that focused on 789 outpatient psychiatric patients noted the incidence of insomnia and the effect it had on daily life. In fact, 85.3% of patients in this study with generalized anxiety disorder reported sleep disturbances, which is oftentimes a key to confirming diagnosis in generalized anxiety disorder. (Ferre Navarrete, F., et al.,

2017) The sleep disturbances in this study include insomnia, restless sleep, waking early, and difficulties initiating or maintaining sleep. It was found that those who suffered from sleep disturbances related to their generalized anxiety disorder found a decrease in the quality of life, including but not limited to cognitive decline and impaired physical health. (Ferre Navarrete, F., et al., 2017) It was also found that patients with more severe generalized anxiety disorder experienced more severe insomnia. (Ferre Navarrete, F., et al., 2017)

Psychiatrists have different preferences of treatments when it comes to managing and treating generalized anxiety disorder. A study done in three Balkan countries involving 221 psychiatrists indicated that there are two main ways to treat generalized anxiety disorder: medically (with pharmaceuticals) and behaviorally (with therapy). (Latas, M., et al., 2018) The study showed that most of these doctors chose to use SSRIs, or selective serotonin reuptake inhibitors to treat generalized anxiety disorder when it came to monotherapy. Other pharmaceutical options included norepinephrine reuptake inhibitors, benzodiazepines, antipsychotics, beta-blockers, herbal preparations, azapirones, and pregabalin. (Latas, M., et al., 2018) (Oji, O., et. al., 2018) Nearly half of these doctors chose to use both SSRIs/SNRIs with benzodiazepines together, and one-third chose to use pharmacotherapy with psychotherapy combined. 33.9% of doctors opted to treat generalized anxiety disorder solely with psychotherapy alone (including cognitive behavioral therapy, or CBT). (Latas, M., et al., 2018) It was noted that the availability of Pregabalin in the Balkans was lower than in other developed countries, which may have skewed the results on that therapy being used. (Latas, M., et al., 2018)

In conclusion, generalized anxiety disorder presents as a mental and physical illness, affecting more women than men, and is influenced by outside forces such as comorbidity, physical changes, consumables, and infection. Anxiety disorder can affect the somatic system, sleep, and mood, and while incurable, can be treated with a variety of medications and methods.

The Mediated Culture of Duck Dynasty

Becky Young

Reality TV became a recognizable genre of television in the 1990s and continues to be more popular with shows like the *Bachelor*, *Survivor*, *Love Island*, and *Alone*. The reality show *Duck Dynasty* follows the Robertson family in Louisiana after their duck calling business turned them into millionaires. This paper serves to analyze the show *Duck Dynasty* through an ethnographic perspective to discover the participants' beliefs, values, norms, and behaviors within their culture. In addition, discuss how reality television frames the Robertson family and their subculture of being *rednecks*. Observations on the Robertson family are based on season 1 of *Duck Dynasty* and the family's use of the term *redneck* (southerners from a rural area). The traditional beliefs and practices of the Robertson family present unusual behavior that is seen as entertaining because of their dedication to following the unique, wealthy *redneck* lifestyle.

In the filming of the docu-episodes, the family themselves encourage a simpler image of *rednecks* and stereotypes of people from the rural south. Each episode ends with some form of positive messaging after solving a conflict. In *Duck Dynasty*, they live the celebrity reality where people can live vicariously through them. As the show was aired during the 2008 recession, people turned to reality television where individuals were living the American Dream. Despite portraying the Robertson family lavishly, A&E continues to frame them as rural, poor, whites, pre-modern, and overtly "redneck." The members of the Robertson family do accept the title and use the derogatory term as a form of empowerment (Hernandez, 2014). The show places *redneck* qualities and stereotypes as a source of comedy and entertainment. Purposefully displaying the family using unsophisticated words serves to make them seem uneducated (White, 2020). The term *redneck* started in the early 1900s with

coal miners fighting for the right to organize and stop the practice of using mine guards. Additionally, they desired alternative stores to shop outside of coal company stores. “Redneck” originated from the red bandanas around their necks when they protested (Todd, 2015). Before the conversion to a derogatory term for the uneducated, working-class, *rednecks* were people fighting for their beliefs. Since the beginning, *rednecks* have been left behind and discredited. Despite mending a more positive outlook for *rednecks*, A&E still capitalizes off the stereotypes of *rednecks*.

In a stereotypical *redneck* culture, there are strong masculine dimensions and distinctions between men and women. Hofstede labeled masculine cultures as those that strive for maximal distinction between what women and men are expected to do. Cultures that place high values on masculine traits stress assertiveness, competition, and material success (Jandt, 2018). In the duck calling business (**Duck Commander**), only men were considered employees and women were the occasional helpers. Women tend to focus on the well-being of others and are often seen in the kitchen. Men value women who can cook and learn recipes of traditional *redneck* cuisines. The need for culinary skills in women can be seen from the focus on Kay Robertson’s at home cooking videos. Women are expected to enjoy tea parties, cooking, and taking care of their appearances. Compared to men, women dressed and participated in their upper-class status (White, 2020). Conversely, manhood and humble roots are very important to *redneck* men. Generationally older men have conservative values. For example, they find men who like to cook as “girly men” and dislike women wearing makeup. They have a heavy influence over their children and promote masculine and feminine separation.

Rednecks find identity necessary and look down on those who don't follow the typical behavior. Behavioral elements are important. For example, hunting is a staple hobby. Along with being assertive and having an unkempt appearance, *redneck* men must build a masculine identity that has behavioral elements of the *redneck* reality. Acting as the typical "Southern Christian Gentleman" in addition to excelling at being one with wilderness in terms of hunting and killing signifies true southern manhood (Hernandez, 2014). Proof of being related to family is the passing of generational and specialized skills. To enter the world of manhood, young boys go through hunting rituals that promote a bonding experience similar to sports (Hernandez, 2014). There are expectations for men to have full, long beards, long hair, wear camouflage, and have patriotic accessories. Additionally, in this instance, there is a requirement to have strong national pride in America and place honor on past successes (White, 2020). People in the rural south learn traditional beliefs about being a *redneck*. Straying away from the typical *redneck* identity results in social consequences like being considered an outcast or a "yuppie" as said by Phil Robertson.

The Robertson family is characterized by a highly wealthy group of people working leisurely within the duck calling business and living indulgently. They have a focus on materialism and often have economic pursuits on items like goats, ATVs, and renting out places like football fields to suit their leisurely needs. The fixation on goods and interactions constitutes the family as quite indulgent rather than restrained. The Robertson family has relatively higher happiness compared to many fellow Americans due to their ability to have free gratification. Indulgence is a tendency to allow relatively free gratification of basic and natural human desires related to enjoying life and having fun. In indulgent cultures, there tends to be a higher percentage of very happy people, greater importance placed on leisure,

and having friends (Jandt, 2018). When buying goods, they began to view money as a symbol of value, which creates new spending habits. Self-interest becomes a priority resulting in a need for self-sufficiency and an increase in the chance of breaking the law (Curtis, 2018). Most behave in short-term orientation as they live in the moment and make irrational purchases. According to Hofstede, short-term orientation is consistent with spending to keep up with social pressure, fewer savings, preference for quick results, and concern with public perception (Jandt, 2018). The new income results in a desire to prove wealth and live an affluent lifestyle.

The family anchors to social status and obligations by feeling the need to refute negative impressions and flaunt their wealth. They have the desire to respect traditions. Despite being comfortable in their lifestyle, they score high on uncertainty avoidance when it comes to culture as they have strict moral codes. Hofstede's fourth dimension, uncertainty avoidance, explains the extent to which people in a culture feel threatened by uncertain or unknown situations. Hofstede describes that this feeling is expressed through nervous stress and a need for predictability or a need for written and unwritten rules (Jandt, 2018). They end up straying away from the typical *redneck* identity by losing key components of being underclass and uneducated (MacGillis, 2016). The change from being poor to wealthy has them adhere to a *redneck* identity in every other aspect. Outside of money, the Robertson family follows traditional *redneck* behavior of hunting and looking unkempt. The family rejects elitism and focuses on the *redneck* lifestyle to follow their traditional structure and the one media presents.

For the family, the fundamental belief underlying the whole system is that the collective matters the most. According to Hofstede, in a collectivist culture, the interest of the

group prevails over the interest of the individual. People are integrated into strong, cohesive in-groups that continue throughout a lifetime to protect in exchange for unquestioning loyalty (Jandt, 2018). They have strong values of social and family bonds being paramount. The men in the Robertson family also tend to be very possessive over their children and are hypercritical of their children's romantic partners as a way of looking out for their kids. Along with regional identity, poverty is associated as a characteristic of a collective identity. In terms of work, people operate in large groups rather independently and follow a high-power distance hierarchical structure (Vandello, 1999). High power distance is the extent to which less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally. High power distance is learned early in families and children are expected to be obedient toward parents (Jandt, 2018). Collective behavior continues into the Robertson family's religious identities. In the South, religion and religious rituals are common. The church promotes strong group ties in collective events like gatherings (Vandello, 1999). The Robertson family follows collective rituals such as communal prayer before meals and going to church to worship.

In conclusion, their typical Robertson family values and activities have peculiar behaviors and norms that are considered amusing as they adopt the unique, affluent *redneck* lifestyle. The mixing of the two identities, rednecks versus upper class, results in constrained identities that the media exploits for profit. Reality television discredits and frames the family as stereotypical *rednecks* despite originally being hard working. When observed, the Robertson family culture is masculine by there being a distinction between men and women and having unique *redneck* expectations for men. Additionally, they live in a collectivistic culture by focusing on harmony and group effort over individual gains. The family lives in

indulgent culture as they spend their wealth on leisurely items and have free gratification. They score high on uncertainty avoidance as they express a need for traditions and predictable behavior. Ultimately, the Robertson family are wealthy people that are living their new affluent life but still uphold *redneck* traditions because of their need to remain true to their culture.

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In a World at Odds: Part I

In a World at Odds...How Can We Make a Difference?

Jean Jones

Fredrick Douglass said, “For revolting barbarity and shameless hypocrisy America reigns without a rival.”

We are facing a lot in the world today; from climate change to civil unrest, from the COVID 19 pandemic to the opioid epidemic, from media bias to not knowing who or what to trust within our own government. It does indeed feel like the world is falling apart around us—both the physical world and the people in it. It feels like America is ground zero. Maybe it feels that way because I live here, but I stay up to date on current events around the world and it feels like, from the stand point of humanity and human decency, it is lacking in both. We might not be war torn, but at least in those war-torn counties the people know where they stand. Here in the U.S., we can all feel and see that something is off but we can’t quite put our finger on why. I for one, am sick of seeing other people suffer, I am sick of hearing about the suffering that is going on in this country and in the world. We as human beings can do far better than this, we can create a world where life thrives, not where life is destroyed, not where the quality of life is snuffed out. These questions loom in my mind: Is money really so important that we would rather let some go hungry just to get ahead by a few bucks? Why can’t come together as human beings and set aside all of our petty differences, to unify, to become whole, as one, as a people? What could I possibly do, as I am only one person? What can we do as a whole to make a difference?

It can be unimaginably difficult to understand what it is like to live in someone else’s shoes. It can be unfathomable to try to feel what it would be like to live in certain circumstance and situations that one has never experienced. Though we all feel pain, sometimes when we see others who come from difficult backgrounds it is hard to imagine what it is like for them. Humans tend to minimize others difficulty, thinking that we could handle anything or do better than someone else, even if we really have no idea how hard their lives might really be. This is part of the human condition—being egotistical. Just as the

teenager who drinks and drives, believes that they are untouchable, people go through life looking in on situations thinking “I could handle that” or “That would never happen to me”. When people think this way, it can lead to the belief that the other person is bad or somehow unworthy. Then we have political parties and other social constructs that back up these feelings and cement them into people’s worldview. In the world as it is today, I believe we are seeing just how unhealthy these worldviews can become.

As a woman of color, I have experienced many hardships in my life. From a young age I was very aware that I was different than most of the girls in my elementary school. I just wanted to be like them, I wanted to look like them. Looking back over the course of my life, now that I am older and wiser, I realize how much sexism and racism I was subjected to in my younger life. I recall going to a family reunion with a friend of mine, when I walked into the room his grandfather asked “Who brought the pepper?”, and I never understood what that even meant until years later. The sad part is in my younger years, I never realized that I was being treated differently until I went to school with more African American students and open-minded teachers when I was in the 6th grade. I recall the experience of feeling different but not really being able to put my finger on why. In my more recent years, I look back with a whole new set of eyes and can see things that I was too young and naive to understand. It makes me feel so bad for my younger self. There were many other situations that I faced when I was still a child, that we just don’t have time to get into here, but since I know how it affected me, I want to prevent it from happening to other people. Speaking with my father about his childhood also made me feel badly for the young boy my dad was back in the 1970s. His family was not only the only black family in the small town of Bristol, Vermont, but the only black family for “200 miles in every direction” as he explained it to me. As he was trying to find his place in the world he tried to just blend in, which can be hard to do when you stand out so much. Other kids his age would be so mean to him. Later in life, at his high school reunion, 3 woman he asked on dates in high school told him that they had actually liked him too, but their parents never would have allowed them to go on a date with a black boy.

I have had conversations with many people who believed that racism had gone away and somehow made a resurgence, this is in fact a misconception. Racism didn’t go anywhere. According to the Oxford Dictionary, racism is “prejudice, discrimination, or antagonism

directed against a person or people on the basis of their membership in a particular racial or ethnic group, typically one that is a minority or marginalized” (Simpson & Weiner, 1997). This year alone we have seen stark and stunning examples of racism right on our television screens and in newspaper headlines. Ahmaud Arbery, a 25-year-old African American man, was chased down and shot to death by two armed white men. Arbery, was in fact unarmed (Fausset, 2020). The father and son who gunned Arbery down in cold blood had ties to the police force and were not arrested until 3 to 4 months later and we can speculate that the arrest was only made because of the sudden media response to the shooting and a video that was somehow leaked (Fausset, 2020). Another shocking example is what happened to George Floyd. Since these two events have happened more people are calling for justice and the end of all racism.

There are many ways to discriminate, many ways to be prejudiced, many ways that bias can creep into hearts and minds. Though those three things go hand in hand; they are different and are not mutually exclusive. Prejudice is preconceived opinion that is not based on reason or actual experience (Kim, 2019). Prejudice happens when people make an assumption based on things that they think are true (Kim, 2019). Discrimination is the unjust or prejudicial treatment of different categories of people or things, especially on the grounds of race, age, or sex (Kim, 2019). There are other reasons that people base their discrimination on, such as social class, weight, and religion, to name a few (Kim, 2019). Bias is prejudice in favor of or against one thing, person, or group compared with another, usually in a way considered to be unfair (Kim, 2019). The truth is we all have implicit biases that we don’t even realize. What we need to do is recognize our implicit bias and prejudice because once we are able to see it we are much more likely to consciously change our way of thinking.

Social injustices have been happening since the dawn of American culture. I think as a people, most of us can come to the understanding that slavery happened for far too long. But, even after slavery, there were other ways to keep American’s of color down. The thirteenth amendment was adopted in 1865, which essentially ended slavery, except for when it comes to the punishment of the law (*13th Documentary*, 2016). The documentary, *13th*, which can be accessed via Netflix, describes how the 13th amendment to the constitution has been in effect since the end of the Civil War and how this law [not the ending of mass slavery, but the part where people can still be slaves as a punishment by law] has perpetuated

social injustices and caused systemic racism. As the system itself has been built on the belief held by many when slavery was abolished—that they still needed to find a way to have their slaves even if it meant throwing a person of color in jail regardless of if they committed a crime or not. This has caused mass incarceration and punishment by law to people of color [and other minorities] to this very day (*13th Documentary*, 2016). This is just one small example of how injustices have been built into our society.

One would be inclined to think that there has been much headway in social equality since 1865, but the harsh reality is that systemic racism abounds. Systematic racism is defined as “Today’s. continuing inequalities in education, housing, employment, healthcare, wealth, and representation in leadership positions that are rooted in our country’s shameful history of slavery and racism” (Koppelman, 2020). Systematic racism is racism that is embedded and ingrained in the systems that help our country function. One of the biggest reasons that there is such a focus on race when discussing the inequalities embedded in each of the aforementioned institutions is because of the disproportionate disadvantage that minorities are submitted to, and it is not to say that Caucasian people do not experience those types of inequalities as well, it just isn’t at such a high rate (Koppelman, 2020).

When speaking with Theresa Palmer, a social worker and professor at the University of North Carolina, she was very concerned, telling me that she works with many people who are affected by systematic racism “Systematic racism is present in all aspects of society—including in my work in higher education. But it is also present in the healthcare system, the criminal justice system, and everywhere else because the United States was founded on racial inequality and much more of this country’s wealth was predicated on racism. The New York Times 1619 Project offers a wonderful, concise, and compelling understanding of not only our country’s. origins related to systematic racism but how it is present today.” She along with many other people in “helping professions” want to dive deeper into these issues and share their findings with others in order to make an impact on the world, I believe that we all need to take this stance in order to learn and grow into a better society.

Then we have the issue of white privilege, a phrase that in itself is a trigger to those who hear it, weather they are black or white. White privilege is defined as inherent advantages possessed by a white person on the basis of their race in a society characterized by racial inequality and injustice (Dillard, Collins, & Shuler, 2020). “White privilege is—

perhaps most notably in this era of uncivil discourse—a concept that has fallen victim to its own connotations. The two-word term packs a double whammy that inspires pushback. 1) The word *white* creates discomfort among those who are not used to being defined or described by their race. And 2) the word *privilege*, especially for poor and rural white people, sounds like a word that doesn't belong to them—like a word that suggests they have never struggled” (Dillard, Collins, & Shuler, 2020). We have to admit that this phrase must be re-termed in order to have wide changing effects. David Jones is a person of color and has experienced many instances of racism and discrimination during his life. When he worked as the President of First Horizon Home Loans back in the late 90s and early 2000s, and he would talk to people over the phone to offer people a job, formulate deals and come up with contracts. When they would come into the office and meet him for the first time, they would see he was black, and more than once he was told that the person/people he was working with would have never accepted had they known he was black (*Jones, personal communication, 2020*). Jones said in an interview with me, that he is very against the term white privilege “Because the concept of white privilege is unbeknownst to the people who are white. I prefer minority discouragement, which is a very important distinction to make moving forward if we want to implement change. People who are white who hear about white privilege feel as though they are supposed to feel sorry for something. The concept of white privilege is not to make people who are white feel sorry, it is to awaken them to the realization that being a person of color carries with it elements of a major problem that don't exist for people who are white.”

Another thing that people of color and other minorities are subjected to disproportionately is income and job inequality. According to Inequality.org, “income inequality refers to the extent to which income is distributed in an uneven manner among a population” (2020). African Americans own about one-tenth of the wealth that white Americans do (Hanks & Solomon, 2018). The black-white wealth gap has not recovered from the Great Recession, before the Great Recession the median wealth for people of color was nearly 14% of Caucasian people and as of 2016 people of color own less than 10% of Caucasian wealth at the median (Hanks & Solomon, 2018). When I talk about the wealth gap in these terms, I am not saying that Caucasian people do not experience poverty, I am saying that people of color experience poverty at much higher rates.

According to the U.S. Census Bureau, in 2019 the African American wealth demographic has reached all-time lows—18.8%. Why is this happening and why isn't there anything that is being done to stop it? When asked what an idea was to help cease such declines in minority wealth brackets, Dr. Khaleelah Jones answered “Reparations for all black Americans, to assist in the growth and parity of wealth opportunities that can pass generation to generation. Intensive community outreach and educational programs on wealth generation and management and income creation. Honestly, in our very capitalistic society, I don't see there being equality and an end to racism until minorities are rich enough to be heard by en masse. Money talks.” When you really think about the gravity of this statement, it becomes something disturbing and devastating. America is supposed to be the place of dreams, a place where people can become successful and be able to make money in an honest fair way. The farther into the future we roam, the more inequality threatens to break the United States.

As a woman of color, who owns her own business, *Careful Feet Digital*, Dr. Khaleelah Jones has found it prejudices within the business sector difficult “I do think prejudices against woman of color impact my ability to grow my business in terms of being seen as a business owner to invest in, network with, and hire” she told me over a zoom call. Ms. Jones has been asked on several occasions “What are you really?” and on another occasion, a work occasion, she was asked if she was Jamaican, as if that had any bearing on her abilities. During a separate interview with the Financial Times, Dr. Jones described the intensity of the lack of support for people of color who had businesses that they were trying to receive grants and funding for (Bounds, 2020). It just happens so rarely, and it seems that many black owned businesses have to struggle to build because there are not many funding programs willing to work with them (Bounds, 2020). Dr. Khaleelah Jones recently spoke to the British Parliament about these issues, and soon plans to speak with the American Government as well.

I recall when I was in a college class, my teacher told us that often people will have their applications thrown out if their name sounds too ethnic. When it comes to getting jobs, people of color and other minorities are not only paid less but they also have to jump through more rigorous hoops to acquire these jobs (Weller, 2019). African American workers also have a higher unemployment rate the those if white workers (Weller, 2019). As well as the

fact that black women are caught between bad jobs and widespread financial burdens (Weller, 2019). These issues are in large part due to the fact that African Americans have less access to jobs than their white counterparts (Weller, 2019). One has to ask themselves why this is?

I recently read this quote in a book and it spoke volumes to me “By the time Jared Kushner and Ivanka Trump, in their mid-thirties, joined the White House staff, it was getting harder and harder in the United States to transcend the social class of one’s birth.” (Bernstein, 2020). As described by Matthew Stewart in 2018 article in the Atlantic: “Contrary to popular myth, economic mobility in the land of opportunity is not high, and it’s going down. Imagine yourself on the socioeconomic ladder with one end of a rubber band around your ankle and the other around your parent’s rung. The strength of the rubber determines how hard it is for you to escape the rung on which you were born. If your parents are high on the ladder, the band will pull you up should you fall; if they are low, it will drag you down when you start to rise.” According to City University of New York economist Miles Corak, the rubber band was far weaker half a century ago: he rated it as 0.3 out of 1 then and 0.5 now. The more unequal society gets, the harder it is to travel among the layers” (Bernstein, 2020). This explains so much of what we are experiencing in a nut shell. As we progress the rich get richer and the poor don’t just stay poor, they get poorer.

As you will read more in depth in part two, minorities and people who are low income are also disproportionately affected by environmental issues such as toxins and other harmful pollutants. When speaking with Dr. Khaleelah Jones she said, “Environmental issues disproportionately effect minorities and people who are low income, which I first saw first-hand working at the US Department of Justice, when adjudicating water law for Native Americans. I believe this happens because they lack the voice to be heard. With minorities also often being in the low-income bracket, they are more focused on meeting their immediate needs such as housing and food, and don’t have the time or money to address issues that arise—hiring a lawyer is expensive and onerous, doing research takes time away from other more immediate priorities.” Theresa Palmer, MSW, agreed with Dr. Jones, “Yes, environmental issues disproportionately impact minorities and low-income groups in many different ways. These groups are more likely to live in areas impacted by pollution and other environmental hazards such as industrial areas, landfills, and Superfund sites while having

less power and financial means to combat these disparities. They also have fewer resources to respond to climate change that may bring droughts, flooding, food insecurity, and conditions that spread disease. Black people are exposed to 50% more pollution than white people and are three times more likely to die from pollution than white people. Black children are 2-3 times more likely to suffer from lead poisoning than white kids and 10 times more likely to die from complications from asthma. Black folks pay more of their income on their energy bills than whites; and their families, homes, businesses are more vulnerable to climate impacts. These are just some of the ways in which environmental issues disproportionately impact marginalized groups.”

Armed with this information, what are we supposed to do? I don't believe that there is any one big fix for these circumstances that plague our communities of color and minority communities. This isn't like the climate change issue where there is a set path that we can follow to make the world healthier again. This is something that effects the minds and hearts of many and yet there is no one size fits all fix. There are several areas that need to be focused on that could help; such as fighting for equal employment and pay rights, fighting to raise the national minimum wage, eliminating hunger, supporting your local black owned businesses, promoting equality not just of race but of class, gender, and everything else that there are prejudices against. Spend time learning about these issues so that you can brainstorm ways to solve the issues, as well as being open to talking to other people. Volunteering your time for organizations that are fighting these issues is also important, this will not only allow you to help, but it will also ensure that you are gaining knowledge on the issues while helping prevent them. Always be willing and open to hear someone else's experience and perspective, because you never know when there is something that you can learn from their words. Remember that no one person has all the answers. I realize that our society seems to have taken a downturn, but that which is broken can always be fixed and it is up to us as a group to implement those changes. My hope for the future that we together can make these changes together, in hopes for a better tomorrow. I see a future where the world is thriving along with every single person in it. I realize that these things will not happen if we do not work towards them, so all you and I can do is strive to impact people to want to be able to make changes so that together we can all make a difference.

Helpful Resources

Implicit Bias Test Harvard

<https://implicit.harvard.edu/implicit/takeatest.html>

The New York Times 1919 Project

<https://www.nytimes.com/interactive/2019/08/14/magazine/1619-america-slavery.html>

<https://www.nytimes.com/2020/01/23/podcasts/1619-podcast.html>

Your Stories of Racism

<https://www.theatlantic.com/national/archive/2015/07/your-stories-of-racism/398117/>

Teaching Tolerance

<https://www.tolerance.org/>

Racial Equality Resource Guide

<http://www.racialequityresourceguide.org/organizations/organizations/sectionFilter/Racial%20Healing>

Books

The Price of Inequality

By: Joseph E. Stiglitz

Social Inequality

By: Louise Warwick-Booth

The Spirit Level: Why Greater Equality Makes Societies Stronger

By: Richard Wilkinson & Kate Pickett

How to Be an Anti-Racist

By: Ibram X. Kendi

Stamped From the Beginning

By: Ibram X. Kendi

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In a World at Odds: Part II

Environmental Justice

Jean Jones

Every time I think about these issues, my heart sinks to the pit of my stomach. These are topics that perpetuate my thoughts on a daily basis, things that I think about often. These topics give me such gut-wrenching anxiety, that I find myself ruminating on every new news headline, on every article that I come across, on every notification that pops up on my phone. Forming the actual words about how I feel about these issues is difficult. As the thoughts perpetuate in my mind, I find myself longing to dissociate because I am only one person, what could I possibly do? Where did the world go so wrong? Why does it seem like the people in power don't care? Are human beings so egotistical that they believe their actions will not have severe consequences? Or can they just continue this destructive way of life because it seems easier or better in some kind of way—maybe this way of life is addicting? Why are more people not panicking about our impending demise, the impending demise of the world around us? What can I do? How can I make people listen when they don't want to hear? What can we, as a group of human beings, do to make a difference? Can we, together, save the world? Some of these questions I find myself asking time and time again. I do not have the full answers for them. Some of them I have theories for. Some, I have facts. Gandhi said “Be the change you want to see in the world”. Part of that is being willing to learn, be willing to listen, and be willing to teach even if you are afraid people won't want to listen, won't want to learn. Though I do not have all the answers, what I can do is spread the facts, share ideas and theories and start a conversation we are literally dying to have.

When speaking to Dr. Khaleelah Jones, of *Careful Feet Digital*, a black owned, environmentally sustainable marketing firm, she shared with me her fears for our future “I think it is the biggest challenge humanity has ever faced, and I'm very pessimistic about our abilities to solve it. People are too selfish and big corporations want to make money too much to make the medium-term sacrifices needed to ensure future generations' safety on this planet. Change is not happening fast enough, misinformation is spread by ignorant forces or, even worse, by people who know better but want to turn a buck more than save the planet. I have chosen not to have children because I honestly personally believe it is selfish to bring a child into a world where they will have a worse quality of life than I did, primarily because of climate change and environmental ruin”.

The world is falling apart around us and not enough people are paying attention. We have such societal disfunction and deformation, it feels like it's not even real. It feels like we are living in a horror movie where only some of us can foresee the impending doom that lies ahead of us, while the majority are blind to the truth. As discussed in the first part of this paper, we can see how people are warring with one and other, unable to put themselves in

others shoes, unable to unify for the greater good, selfishly stuck in the cycle of the human condition. But is it really human nature to be so destructive? Why wouldn't a person want to live in a less polluted world, where our ice caps weren't melting and our forests weren't burning away? (In a world where our natural beauty wasn't being destroyed). Why is [race and] climate change such an emotionally and politically charged topic? Has humanity sunk so low into the us versus them mentality that we are going to polarize every life changing topic to be a fight and not a discussion, without taking into consideration the science behind the information being presented? Just as with the turmoil of racism today, where some people believe that history has been erased in the hearts and minds of the many, science is no longer being regarded like it once was.

Greta Thunberg said, "We can treat a crisis like a crisis, as we have been because of the coronavirus. Treating the climate crisis like a crisis — that could change everything overnight." (Carrington, 2020). Though we can see through the COVID-19 pandemic, not everyone is taking it seriously, there are many people who believe that it is a farce, that it is some conspiracy theory to control the people, or to take away their rights by asking them to wear a mask, even though there are many scientists and health professionals who back up the claims that the novel coronavirus is exactly what it has been presented to be and wearing a mask in public is crucial for the dissipation of the viruses. Just like the coronavirus, many people don't believe in the climate crisis. Why is that?

Part of the issue is that we put our trust in the wrong people. I have done it countless times in my life and to the point where I am usually able to spot red flags early on. No one can be blamed for being trusting, it is good to want to trust, but when the red flags start popping up you have to pay attention and realize that nothing good can come out of putting your trust in someone who doesn't have your best interests at heart. We have seen many red flags over the past four years, though not all of this is our current presidential administration's fault, these were issues we have had for years, if not decades. We are witnessing the symptoms of years of distrust in the government and the media. This is causing major issues for not just us, human beings, but all life forms in the world.

If the media was more concerned with presenting actual facts instead of wondering where they are going to get their next bonus from, things would be a lot different. It is the media's job to inform us of facts, not to entertain or pick sides. Infotainment, a word combining information and entertainment, is what we now have to look to for our "facts". This new way of news media has an odd reminiscence of kayfabe from the WWF wrestling days. If our politicians and governmental agencies actually took issues more seriously and stopped thinking about money, power, and who can be precured for their pocket or whose pocket they currently reside in, I truly believe more people would be on board for creating a better world. I supposed I could just be fantasizing of some utopian society because the reality is those in power, those who have the pull to implement real, big changes on gigantic levels are more worried about their public image with whatever political party and societal

class that they are in bed with. I have come to the conclusion that we as individuals are the ones who have to step it up, we have to unify and stick together to implement the change that we crave, the change that is necessary, the change the world is dying for, by any means necessary. Or, pretty soon, there is not going to be a world to fight for. When thinking in terms such as this, it is very overwhelming and I am triggered to shut down and let it all go, but there is no longer any time left to get too overwhelmed to deal with the situation at hand. It is time to get the message across. We want change and if they won't give it to us, we will just have to take it. With that being said, I believe that it is a good rule of thumb not to mix politics with science.

I wonder how many people know that the highest number of climate crisis activist assassinations took place in 2019 (Godin, 2020)? These murders have been going on for decades, since around the 1960s, but 2019 was a record high, with 212 environmental activists and land defenders being murdered within the year, averaging out to 4 murders per week (Godin, 2020). Although none of these killings happened in the United States (Greenfield & Watts, 2020), we can get a feel for what a large portion of the American people thinks of people like Greta Thunberg, Vic Barrett, Phil Torres, and other climate activists, by the way the current Presidential Administration has regarded anyone speaking up about the climate crisis. At one of his infamous rally's, President Trump said, and I quote, "This year I got beaten out by Greta—you know Greta?" referring to the fact that Greta Thunberg had won a honors reward from a magazine that President Trump had also been nominated for, and went on to say "Last year I got beaten out—I've won it, but when the world revolves around all of us, we should be chosen, I mean, we've won it. But we should win it every single year" all while the crowd of thousands of people were venomously booing and berating Greta (Mindock, 2020). He also tweeted things about Greta like, "So ridiculous. Greta must work on her Anger Management problem, then go to a good old-fashioned movie with a friend! Chill Greta, Chill!" (Noor, 2019). If the situation wasn't bad enough, where the United States President, a grown man in one of the highest positions of power, was bullying a teenage girl. This wasn't an isolated incident and due to the media having a heyday with these occurrences and propaganda that spread around the slip ups that President Trump has had, it has caused a great amount distain and even hate for climate and environmental activists (Elbaum & Chuck, 2019).

We need more people, like Greta, fighting this fight for environmental justice. The fight against climate change and the destruction and pollution of our Mother Earth it is the very same fight we are fighting for minorities, people who are low income, and the inequalities and injustices that we face in matters of social and economic justice. In the May 2006 issue of *Vanity Fair* titled *Green Issues*, they highlighted actors and actresses like Julia Roberts and George Clooney, but failed to highlight African American people, and other minorities in the issue (Finney, 2014). This is a stark example of what American's think about where minorities stand when it comes to environmental issues.

When people think of injustices, they think of the things I mentioned in the first part of this paper. They think of racism, job inequality, sexism, xenophobia. They think of the person of color who is more qualified for the position not getting the job because those who are doing the hiring had to choose between them and a Caucasian person with light hair and light eyes. They think of people like Emmitt Till, George Floyd, and Ahmaud Arbery. They think of many things but rarely do they think of the environmental factors that come with being a minority or low-income. Environmental justice tackles just that; “Environmental justice is a recognition that access to a clean, healthy environment is a fundamental right of all human beings” (Cunningham & Cunningham, 2018). Often times when people think of Cancer Alley or Flint, Michigan they think of issues involving the State governments, when in reality these are environmental injustices, making them environmental justice issues. Unfortunately, people who are lower-income are often catalysts of environmental degradation and also, are the ones who most feel the effects of the changing climate (Cunningham & Cunningham, 2018). Environmental justice is not just a concept but a movement in response to environmental racism, which is the disproportionate impact of environmental hazards on people of color and other minorities (Beech, 2020).

“Environmental racism [injustices, and toxic communities] are a link in the chain of acts of unsustainable development; it involves the denial of human rights, environmental protection, and economic opportunists the communities where people of color [and people who are low-income] live and work” (Bullard, 2008). “Many Americans recognize that environmental discrimination is unfair, immoral, and unethical” though still many do not (Bullard, 2008). Environmental justice is a civil rights and human rights issue, thus making environmental issues a social justice issue. (Bullard, 2008). Since Bullard wrote the book ‘*The Quest for Environmental Justice*’, issues revolving around environmental injustices haven’t improved.

The Environmental Protection Agency (EPA) take data every year and requires large industrial factories to report the volume of toxic chemicals they release into the environment (Priceconomics, 2017). The EPA is able to consolidate the data into the TRI, or Toxic Releases Inventory—which is supposed to keep environmental policy set in place (Priceconomics, 2017). Since the decay and devaluation of environmental policy, not that it was very strong to begin with, I believe what we can truly use this information for is what areas are the most toxic. As you can see if figure 5.1, as of 2016 Alaska is the most toxic state in the United States (Figure 5.1). Figure 5.2 is just a written reflection of the map in figure 5.1 (Figure 5.1 & 5.20). Though the map does not reflect the actual cities and counties that are most devastated by toxic pollution. Figure. 5.3 shows the top 50 most toxic counties in the United States, with Northwest Arctic Arkansas coming in at number one and Salt Lake City Utah at number two (Figure 5.3). Figure 5.4 shows the top 50 most toxic cities in the United States, number one Kotzebue, Arkansas and number two is Bingham Canyon, Utah (Figure 5.4). According to the American Community Survey, Arkansas is the 3rd poorest state in the United States and Utah is the 10th poorest state (American Community. Survey, 2016).

A toxic community is an area, city, county, several counties, or state, that is targeted because it is low-income and/or a community of minorities that are disproportionately targeted to be exposed to toxic chemicals and waste.

Cancer Ally is a toxic community. “Located along the Mississippi river between Baton Rouge and New Orleans, in the River Parishes of Louisiana, which contains many industrial plants” (Baurick, 2019). Cancer ally was nicknamed due to the rash of cancer cases that clustered the area along with the industrial plants, this area is also an extremely impoverished area. When the industrial plants started popping up in the 1990s, many people decided to move, but many didn’t have that option, so they had to stay and wait it out. Today there are over 30 plants within a 10-mile radius (Baurick, 2019). “The risk of cancer in the area is up to 1,505 cancer cases per million people, which is nearly 50 times the national average” (Baurick, 2019). The biggest question that pops into my mind is how is this even legal? Also, why has this been going on for over 30 years and instead of the issue being remedied, it only gets worse.

With examples like cancer ally looming over the history of the United States, I supposed we should not have been so shocked when the Flint, Michigan water crisis blew up our news feeds in 2014 (Denchak, 2018). Another stark example of environmental injustice and racism, as well as another toxic community, the city was rife with illness and disease because the drinking water was compromised (Denchak, 2018). For over 18 months people were subjected to foul-smelling, colored water that didn’t taste right (Denchak, 2018). As complaints flooded into city officials, nothing was done (Denchak, 2018). Though today, 6 years later, officials say that the drinking water is fine, people are still paranoid and suspicious and there have been reports that the issue has not yet been fixed (Biers, 2020).

Those were two of the most notorious examples of toxic communities. One of the biggest issues with Cancer Ally, Flint Michigan, and places like them isn’t just the impending, deadly health concerns. Toxic communities and environmental racism are an “assault on the mind” (Washington, 2020). According to Harriet A. Washington, toxic communities and environmental racism actually have effects on the mental and intellectual health of the individuals that are exposed to these chemicals and toxins (Washington, 2020). There is an estimation of about 60,000 commonly used industrial chemicals that have never been tested for their effects on humans in the United States (Washington, 2020). As of 2020, there are a wealth of current studies that show there are many chemical and/or environmental factors that can affect intelligence and IQ (Washington, 2020). There are “23 million lost IQ points every year caused by environmental poisoning” and these chemicals and toxins can not only drop IQ but also dramatically effect intelligence to the point of sever loss of intelligence, behavior problems, loss of cognition, all of which destroy human potential (Washington, 2020). If deadly illnesses weren’t enough, these communities are also being exposed to “brain-drainers” that impact not only their ability to function in the world but also impacts their chances of success.

Minorities and low-income people disproportionately suffer from climate change (Cunningham & Cunningham, 2018). Since the 1880s the Earth's temperature has risen by about 2 degrees Fahrenheit, and though that doesn't seem like an extensively large rise, it has caused effects all over the globe that are nearly devastating and, and will be completely devastating if we don't work to reverse some of these changes; ice caps/sheets melting, ocean levels rising, heavier rainfall, and droughts (Anastasia, 2018). As the Earth's climate shifts, we experience global warming, which is mainly due to the effects of human activity (Anastasia, 2018). Humans do many things that contribute to climate change, such as putting pollution into the air, land, oceans, and other waterways, using up and hoarding natural resources, emitting gasses such as CO₂ into the air, deforestation, wasting perfectly good food, one use throw away materials, plastic...oh the plastic of it all, the list goes on and on.

Pollution, according to Dictionary.com, is the presence in or introduction into the environment of substances or things that have harmful or poisonous effects (Dictionary.com, 2020). "Many things that are useful to people produce pollution. Pollution is a global problem, although urban areas are usually more polluted than the country side and can spread to remote places where no people live" (National Geographic Society, 2012). As we slowly poison our planet, many people wonder why it seems so much hotter in November than it did when they were younger, why it seems like there is less wildlife roaming areas that used to be flush with numerous species, why it seems like their favorite plants have become more sparse or hard to find, or why their loved one died of lung cancer when they never smoked a day in their life. They wonder why these and similar things are happening, when science plainly tells us the side effects of pollution are, among other things, a wide variety of health issues, climate change, loss of wildlife, and loss of plant life (Rinkesh, 2020 & World Health Organization, 2018). When a climate scientist says that climate change is happening mostly due to human activity, they are referring to pollution. We need to change our ways before we, human beings of developed countries, catalyze the sixth extinction, the extinction of human beings—otherwise known as the Anthropocene extinction, which is the sixth mass extinction, an ongoing extinction event of species during the recent past and present epoch, as a result of human activity (Carrington, 2017), which I will discuss more in depth later. Pollution is the most dangerous thing we face as a society today and it must be dealt with before it's too late.

One of the main ways that human beings create pollution is the emission of CO₂, which is secreted into the air in many ways including burning fossil fuels, driving gas cars, and meat production (Dunbar, 2009). I recall my biology teacher stating that CO₂ acts like a blanket, thus causing the heat to be trapped around the Earth, the more CO₂, the heavier the blanket, the heavier the blanket, the higher the temperature will be (Gray, 2020). We usually hear a lot about greenhouse gasses when exploring the topic of emissions, like CO₂, but in order to understand greenhouse gases, it is important to understand the greenhouse effect. The greenhouse effect is a natural procedure which causes the warming of the Earth's surface (NRDC, 2019). "When the Sun's energy reaches the Earth's atmosphere, some of it is

reflected back to space and the rest is absorbed and re-radiated by greenhouse gasses—which include water vapor, carbon dioxide, methane, and nitrous oxide. The absorbed energy warms the atmosphere and the surface of the Earth” (The Australian Government: Department of Agriculture, Water, and the Environment, 2020). This wouldn’t be an issue if all the gasses that are being emitted into the atmosphere were natural. The issue that we are currently facing is the human activities, especially the burning of fossil fuels, agriculture, and land clearing, are all increasing the emission of greenhouse gasses (The Australian Government Department of Agriculture, Water, and the Environment, 2020). This increased emission of greenhouse gasses due to human activity can be referred to as the enhanced greenhouse effect and is contributing to global warming, which is a symptom of climate change (The Australian Government Department of Agriculture, Water, and the Environment, 2020).

Greenhouse gasses are chemical compounds that are emitted into the Earth’s atmosphere, they are gasses in Earth’s atmosphere that trap heat (NRDC, 2019). It is important to note that many greenhouse gasses occur in the world naturally but can also be made by humans (NRDC, 2019). The main greenhouse gasses are water vapor, carbon dioxide, methane, ozone, nitrous oxide, and chlorofluorocarbons (NRDC, 2019). You see, this is where things start to get very dangerous for the Earth. Greenhouse gas emissions accelerate the rate of global warming, thus propelling climate change, which has become one of the leading issues in the climate crisis. Some of the leading human activity that creates greenhouse gasses are meat production (cow flatulence), cars, airplanes, and industrial factories. When humans partake in day to day activity, they create a lot of greenhouse gas emissions, especially in developed countries. Scientists agree that human activities are the primary source for the rise of CO₂ in the atmosphere (Dunbar, 2009). 85% of all human production of CO₂ emissions comes from the burning of fossil fuels, the remainder comes from the clearing of forests and other land and industrial processes (Dunbar, 2009). Humans add about 1.4 metric tons of carbon per-person per-year into the atmosphere (Dunbar, 2009). According to the EPA, human activities are responsible for almost all of the increase in greenhouse gasses into the atmosphere over the last 150 years, with the United States taking the cake for the largest source of emissions in the world (EPA, 2020).

I conducted an experiment to reconstruct the ramifications of extra CO₂ in the atmosphere and the results were astonishing. I found the instructions online and followed them, my lab results cannot be found online (SERC Carleton, 2020). I took three, clear two-liter bottles that were all the same size, I drilled holes in the cap and inserted thermometer probs, cut small pieces of sponge the filled half of the bottom of each bottle and allowed each sponge to dry. Each bottle was to be prepped differently; for the air bottle I made sure the air was dry by using a blow dryer, for the saturated air bottle I poured a small amount of water in the bottle, making sure that the sponge was completely saturated but without excess water in the bottom of the bottle, and for the CO₂ bottle, I created a mixture of vinegar and baking soda, a thick paste—this paste created CO₂ in the bottle. I left each bottle in a shaded

location for 25 minutes and each minute I recorded temperature, then I took the bottles and placed them under a light for 15 minutes, still recording the temperature every minute, then I took the bottles and placed them back in the neutral shaded area for another 10 minutes, and recorded that temperature every 10 minutes. What I learned from this experiment showed me directly how the extra CO₂ being emitted into Earth's atmosphere.

Figure 1.1-1.3 show the results that I gathered from the CO₂ bottle, the temperature dramatically dropped for no apparent reason and though I was not able to figure out why I was able to see, even with that drop, that the air in the CO₂ bottle raised more rapidly (Figure 1.1, 1.2, & 1.3). After taking the bottle away from under the lamp the temperature dropped rather rapidly for the first 5 minutes, then it started slowing down until the temperature started to stabilize (Figure 1.1, 1.2, & 1.3). I was able to see that the CO₂ bottle seemed to retain the temperature more than the other two bottles (Figure 1.1, 1.2, & 1.3).

Figure 2.1-2.3 show the results that I gathered from the saturated air bottle (Figure 2.1, 2.2, & 2.3). Though the saturated air bottle rose extremely high and fast, it didn't seem as though the bottle was able to retain the heat, though this bottle was able to retain more heat than the normal air bottle (Figure 2.1, 2.2, & 2.3). Though there was a spike in the saturated air bottle when it was in the neutral area at first, the temperature quickly declines and stabilize (Figure 2.1). Under the lamp the temperature grew extremely fast as well (Figure 2.2). But when put back in the stable area the temperature stabilized at a lower temperature (Figure 2.3). This bottle made me think of the hot muggy air in Virginia and in the Southern states of the east coast, I believe the air was able to get so hot so quickly because there was water involved (Figure 2.1, 2.2, & 2.3).

Figure 3.1-3.3 shows the results that I gathered from the (regular) air bottle (Figure 3.1, 3.2, & 3.3). I know that the temperature started off high because I had to dry the air with a blow dryer (Figure 3.1). Even though the temperature did get higher than the CO₂ bottle it did not retain the heat (Figure 3.2). I was also able to see from the results that the cooling and warming happened at the same rates, the temperature rose and fell (Figure 3.1, 3.2, & 3.3). I do believe that the results from this experiment show the shocking results when excess CO₂ is released into the atmosphere.

Air pollution happens way too much all over the world, especially in developed countries. "Air pollution is a mixture of solid particles and gasses which consists of car and plane emissions, chemicals from factories, dust, pollen, and mold spores, which may be in suspended particles—and can be manmade and natural sources" (MedlinePlus, 2020). Air pollution is not just an environmental hazard, but also a health too. The main types of pollutants that are emitted into the air are particulate matter, PM10 and PM2.5, ozone (O₃), nitrogen dioxide (NO₂), carbon monoxide (CO), and sulphur dioxide (SO₂) (MedlinePlus, 2020).

According to New South Wales Health (NSW Health), PM10 is a very small particle, about 10 micrometers in diameter (or less) which are small enough to pass through the nose and throat to enter the lungs—which includes PM2.5 and could eventually affect the heart

and lungs (NSW Health, 2013). PM2.5 is roughly 2.5 micrometers (or less) and these can make their way deep into the lungs and even the bloodstream, which can be very harmful to the human body (NSW Health, 2013). PM10 and PM2.5 have harmful effects on the environment as well. Many ecosystems are already very delicately balanced and when these ecosystems are exposed to particulate pollution, it can have a devastating impact of the plant and wild life in that area (Lafond, 2018).

Ozone when found in the atmosphere is a good thing. When found in the atmosphere, ozone is what protects all life on Earth from the Sun's ultraviolet radiation (Newman, 2018). Although, ozone can also be found at ground level, on the surface of the Earth, and when this happens it is very toxic and unhealthy for humans and all other life forms. Since ozone is made up of three oxygen atoms, the third atom causes ozone to be unstable, which is what causes it to be toxic (NSW Health, 2013). The ozone that is found at ground level is what smog is made out of—which is not just damaging to human health but the health of all living beings' plant and animal alike (NSW Health, 2013).

“Nitrogen oxide is an extremely reactive gas” formed by the emissions of motor vehicles, industrial waste, as well as some common household appliances such as gas heaters and stove tops (NSW Health, 2013). Large amounts of nitrogen oxide are exceedingly bad for the respiratory system (NSW Health, 2013). “High levels of nitrogen oxide are harmful to vegetation—damaging foliage, decreasing growth, and/or reducing crop yields” (Queensland Government, 2013).

Carbon monoxide is hazardous and we can die from carbon monoxide poisoning. What I believe is a lot less well known, is the fact that there is carbon monoxide floating around in our air in an atmosphere everywhere, all the time. Carbon monoxide forms when fuels don't completely burn, such as forest fires, cigarette smoke, and burning heaters (NSW Health, 2013). People who are exposed to large amounts of carbon monoxide are likely to become very ill, such as nausea, dizziness, headache, and vomiting, could become unconscious and/or die, as well as suffer from heart problems (*OSHA Fact Sheet- Carbon Monoxide Poisoning* 2020). “When carbon monoxide is released into the atmosphere it affects the amount of greenhouse gases, which is linked to climate change and global warming” (NPI, 2018).

Sulphur dioxide is a reactive gas with a bad smell and is formed by fossil fuel combustion (NSW Health, 2013). Sulphur oxide has been around for millennia, as it comes from volcanoes when they erupt (Australian Queensland Government, 2017). “When sulfur dioxide combines with water and air, it forms sulfuric acid, which is the main component of acid rain” (Australian Queensland Government, 2017). Acid rain can be very devastating and destructive—it can cause deforestation, acidify waterways which will kill off aquatic life, and corrode building materials and paints (Australian Queensland Government, 2017). Sulphur dioxide can also cause many serious health conditions including cardiovascular disease (NSW Health, 2013).

Air Quality Index, or AQI, is a way to test the amount of pollution in the air and rates it on how dangerous it is. AQI ratings range from; 0-50 good (green), 51-100 moderate (yellow), 101-150 unhealthy for sensitive groups (orange), 151-200 unhealthy (red), 201-300 very unhealthy (purple), and 301 and higher is hazardous (maroon) (AQI Basics, 2019). Please see figure 4 for the full chart (AQI Basics, 2019). Each type of rating has a different description and it is important to follow along with the air quality ratings—you can usually sign up for AQI daily updates through your city and state weather alert website, you can also view websites like <https://www.airnow.gov/aqi/aqi-basics/>, and also do a simple google search for the AQI in your area. It is extremely interesting to me on red days in Denver, Colorado I can always tell because it becomes difficult to breathe when I go outside. On red days and above we should always do our best to stay indoors, especially if you have underlying health conditions, are older, or have small children because the bad days are extremely dangerous to our health. The higher the rating the greater level of pollution in the air and therefore it should be cause for great concern as you experience increasing AQI. AQI can increase due to an increase of air emissions, due to a lack of dilution of air pollutants, and if it is hot outside (AQI Basics, 2019).

Forest fires are contributing to unhealthy—and even hazardous in some areas—air quality. It used to be that the occasional forest fire was good for the land and the vegetation, as the fires would cause a re-gensis for the vegetation in the areas they occurred, they bringing back healthier and denser foliage (Cunningham & Cunningham, 2018). Unfortunately, with climate change impacting the amount and the ferocity of the forest fires they are becoming more of a threat. Forest fires are increasing the amount of carbon dioxide being released into the atmosphere, contributing to the greenhouse effect and climate change (Perez, 2017). Ash is destroying much of the nutrients in the soil, as well as eroding the soil causing more flooding and landslides (Perez, 2017). More areas are being burned, the areas that used to be natural forest fire areas are expanding and the magnitude of the fires are much more severe than ever before (Perez, 2017). According to the Spanish National Research Council (CSIC), the use of chemicals to stop the spread of forest fires is also having detrimental effect on these areas; flame retardants accumulate in soil for years and they have started to find ammonium polyphosphate in the soil which is altering the fertility of the soil (Perez, 2017).

There are any different forms of water pollution but the most pressing issue that we face today is plastic. Not only is plastic fouling up our land and air, but it has also almost completely taken over our oceans and waterways—though there is still a lot of water left in the world, almost all of the Earth’s waterways have some form of plastic in them, from large physical amounts to microplastics. Over 90% of the worlds bottled water is full of microplastics, and the World Health Organization (WHO) is “unsure” if these plastics are harmful (Cassella, 2019). To be honest, it is an extremely foolish thing for the WHO to say [that they are unsure if plastic in our drinking water is unsafe] that they are unsure if this plastic invading our waterways is harmful. Of course, it is, with all the different chemicals

and carcinogens that are in plastic it would be utterly dangerous and unhealthy to consume, the human body cannot digest plastic. We also can see many examples of how unhealthy it is for a living being to ingest plastic by all the issues we have witnessed over the years of land and aquatic animals dying from plastic poisoning. Everyday over 8 million pieces of plastic find their way into the ocean and other waterways (Plastic Facts, 2018). There are over 5.25 trillion tons of macro and micro-pieces of plastic in our oceans, with 46,000 pieces every square mile of ocean, weighing up to 269,000 tons (Plastic Facts, 2018). I have no idea why I have to write this, it should be simple common sense, but it does need to be said, we human beings need water to survive, without it we will go extinct. If you ask me, all plastic and single use materials need to be done away with. Yes, they might make life a little more convenient for the time being, but I ask you, is it really worth the long-term damage?

We also have to take into consideration that as human beings, we have a duty to protect the biodiversity of every ecosystem that we come into contact with. Even though animal and plant life do not have the same intellectual capacity we do does not mean that we cause them suffering by our actions and decisions. It is very difficult to pinpoint extinction rates because every day we are discovering new species on the Earth, and there is still so much of the Earth that remains uncharted, so it is hard to tell how many species are truly being affected by human actions, but scientists estimate that about 15,000 species are threatened or extinct (National History Museum, 2018). We should be taking care of the animals and plant life around us as they are an integral part of the way the world works, everything is connected, much more than many people realize. Biodiversity helps ecosystems operate, and when we take one element out of an ecosystem it can be detrimental to the entire ecosystem and the different life forms that inhabit it. We can also learn so much from all the different life in the world, we still have so much to learn and I believe that biomimicry, the design and production of materials, structures, and systems that are modeled on biological entities and processes, can help us learn not just about the world around us, but also how to lead more sustainable lives. I believe that part of the answer to the environmental issues that we are facing today can be found through the plant and animal life around us. Also, and probably the saddest point that I have to make about plant and animal life, is that once they are gone, they are gone and we have no way of ever getting them back. One day we might look back and realize we really needed that animal (or plant) that went extinct due to our negligence for their care and for their environment.

Over the past half-billion years there have been 5 mass extinctions, scientists have been monitoring the next extinction, the Holocene Extinction (also known as the Anthropocene Extinction or the Sixth Extinction), one that is supposed to be more devastating than the extinction that killed the dinosaurs (Kolbert, 2015). Unfortunately, the catalyst for this extinction is us, human beings, and we and all other life that we know of will also become extinct from this planet. The Sixth Extinction is due to human actions and the effects of what humans have been doing to the Earth. I can tell you now, I don't want to be around for the apocalypse, it will most likely be even more horrific than we can even

imagine. I ask you this, if we can see it coming why can we not stop these catalyzing actions that are propelling us close and close to our very own demise? It is as if human kind—especially from developed countries—is addicted to things that are calamitous for the Earth, harmful for homo sapiens, destructive for wildlife and plant life, and yet we cannot seem to get things under control. Fear makes people do crazy things, yet it does not propel people to do the right thing, which is very interesting when you stop and think deeply about it.

Carbon footprint is the amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuel by a particular person or group of people (The Nature Conservancy, 2020). “Ecological footprint is the impact a person or community has on the environment, expressed as the amount of land they require to sustain their use of natural resources” as well as other natural and environmental resources that they may use (Oxford Dictionary, 2020). Ecological footprint deals in terms of measuring human activity based on what they are taking from the environment and how much space they are using; examples may be things like trees to produce lumber for a house, land use, water consumption, how much is being consumed and what waste is being generated (waste in terms of food and natural resources). Whereas, carbon footprint has to do with the types and amounts of pollution that are being generated. A good way to think of it is, ecological footprint is what is being used and carbon footprint is what is being put back out into the world that is unhealthy. It is very helpful to check out your carbon and ecological footprints and you can do this by doing a quick Google search for a carbon/ecological footprint calculator—you can also find the links to my favorite calculators at the end of this paper in the helpful resources section.

I recently did an ecological and carbon footprint test online and I learned, to my dismay, that I need two Earths to keep living the lifestyle that I am living. I was stunned and confused because it seemed impossible, I retook the test to make sure that I input everything correctly, only to be faced with the same results. How could this be? I am only one person and I don't live a lavish lifestyle. I am a single mother who is low-income, with the three jobs I worked around a full-time school schedule last year I was just starting to see the national poverty line, due to COVID I lost two jobs and the job I was lucky to keep had a grant cut in half and therefore my hours were cut in half. It just didn't make any sense at all that I could need two whole Earths to live, it was eye opening and I have committed myself to more mindful practices when it comes to the use of resources, food, my car, single use products, plastic (which I have nearly cut completely out of my life since checking my footprint(s) status). This led me a thought that sickened me to my core though—how many Earths would it take to sustain everyone in the United States? There are 328.2 million people the U.S. alone. What about the entire world, which contains an estimated 7.594 billion people? It is a truly stressful thought. I can't even imagine how many Earths it would take to sustain everyone in the whole world. Regardless, if the answer is more than one, it is too many because we only have the one Earth.

Now that you are armed with some background information on the severity of the environmental issues that we face today—and this is only a small portion of a much larger situation, a much larger issue—I want to give you some ideas on how to lead a more sustainable life. Number one, cut back on all plastic intake, if you can cut plastic out of your life completely. I know that it can be difficult as we have grown so accustomed to plastic in our daily lives, it can be difficult at first, but the more you work towards weeding it out of your life the easier it becomes. It is very important to reduce, reuse, and recycle; there are many ways to recycle and repurpose materials right at home without having to throw anything away—and it can be fun! As we know most materials do not get recycled when we put them in the recycling bin, we should repurpose what would be perceived as trash right at home to prevent further trash being poured into landfills and oceans. Start composting in your backyard, if you live in an apartment look into purchasing a small composting bin that you can keep inside. Quit using one use, throw-away materials, start by cutting back, take things slow as to not become overwhelmed.

Change the foods you eat; buy local foods, go to the farmer's market, be open to buying and eating ugly fruits and vegetables. Ugly produce are fresh fruits and vegetables that usually get thrown out because they don't look perfect, the 'conjoined twin' strawberries or the 'crooked carrots', since they do not look what is perceived as presentable they usually get thrown away (Kateman, 2020). You can Google different subscription boxes where you can get ugly produce sent right to your door monthly. Eat less meat, "animal agriculture creates about 14.5% of all human emissions, of which beef contributes to about 41%" (Waite, Searchinger, & Ranganathan, 2019). In general, stop wasting food all together.

Use less energy; there are many ways to do this, turn off all electronics when you are not using them, turn off your lights when you are not in a room. You could cut down on your AC or heat, in the summer turn your AC a little warmer than you usually would, in the winter make it a little cooler than you usually would. Switch to renewable energy sources. It can also be incredibly helpful to invest in eco-friendly technology, it can be a little more expensive. I tend to look at it as an investment, not just in the environment—which is the number one investment that I do see it as—but also a lot of times eco-friendly tech options are not single use so you will overtime be spending less money by not buying the same products repetitively. Take the rocket smart reusable notebook for instance they are about \$30 USD, this is much more expensive than a regular notebook, but since you can reuse it continuously, over time you will actually be saving money. Carpool, rideshare, take public transportation, or bike; these all can reduce emissions being emitted into the atmosphere.

A good rule of thumb is to choose eco-friendly options whenever possible, transition to eco-friendly products if it is within your budget; do this for all option when you can, when buying a car, when choosing household products, when buying foods, when picking out technology and home appliances, even when choosing businesses that you regular, find eco-friendly companies and restaurants.

Communication is key; be open minded and willing to listen, be willing to start conversations and join in on conversations, share your ideas, you never know when someone might say something that never crossed your mind, or sparks an idea, or changes your perspective. You never know when you might learn something new or form a new idea based on someone else's opinion. You never know when you might impact someone's way of thinking or spark inspiration within them. One of the most important things that we can do is to gain as much knowledge as possible about these issues by learning what is going on, by staying atop current events and researching deeper into each issue, and then speaking about them with others. Be loud about your beliefs and don't ever stop fighting.

There are small changes that we can all make on a daily basis; this is the exact same thing as creating new and healthy habits. I realize that I do not have all the answers, I am just one of few who are searching for the answers, the right path, the perfect course of action to save the world for not just us, but all future generations to come. I can only pray that together with younger generations we can find the answer, be heard and lead others down a path of world saving sustainability. I can only pray that it is not too late. Greta Thunberg said all younger generations, herself included, have been betrayed by politicians [and voters] who failed to prevent climate change (Runciman, 2019). She is right we have been betrayed, we have been betrayed for the seduction of what those want here and now, without any regard for the future. We have been betrayed in that, multitudes of youth and young adults have been taught that there is no other way then the way it is, and they too get sucked in to the mindset of the masses, because our social constructions ingrain this in them, almost like being brain washed. Things never should have gotten this far, and yet they have. The only way we can fix it is if we unify and rise above the plastic.

Figure 1.1

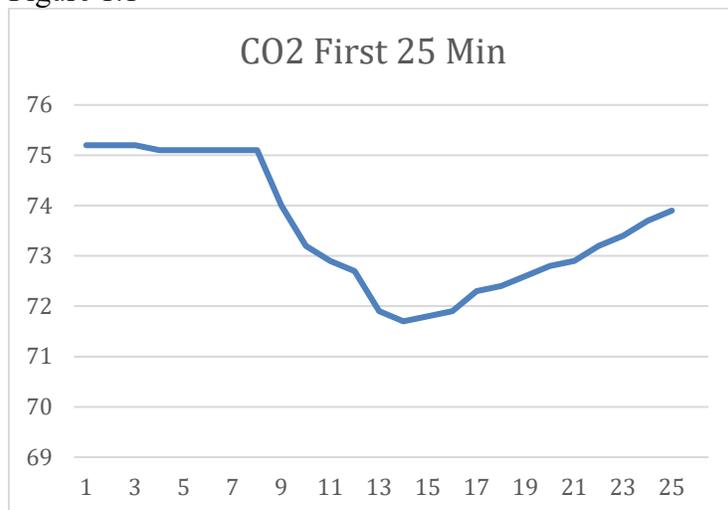


Figure 1.2

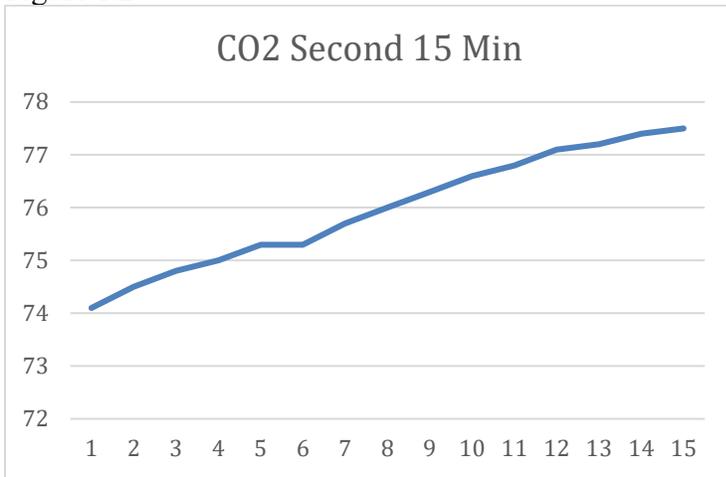


Figure 1.3

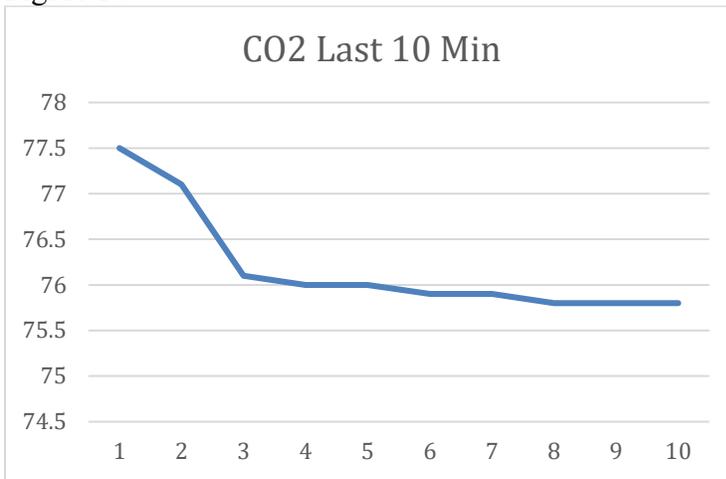


Figure 2.1

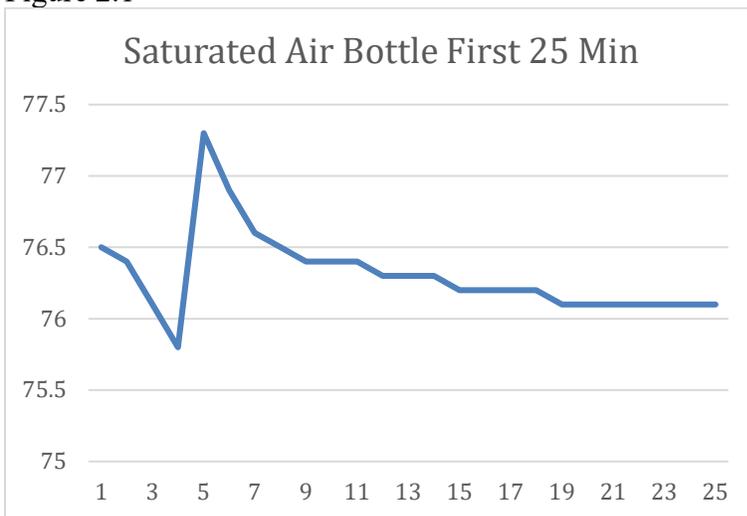


Figure 2.2

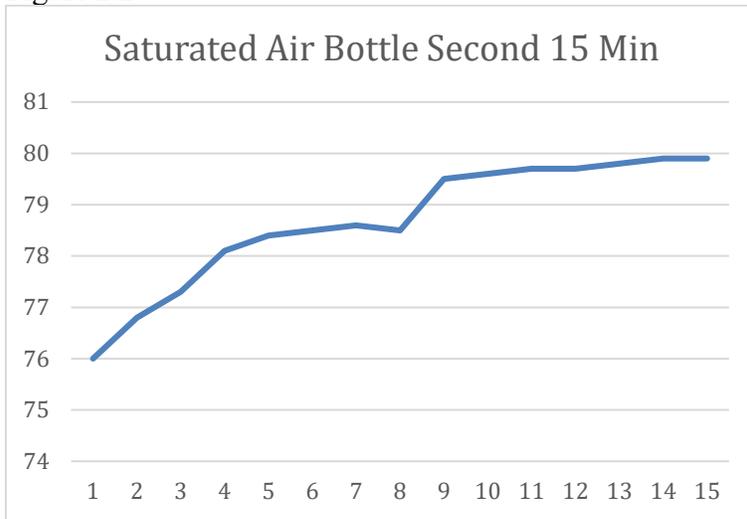


Figure 2.3

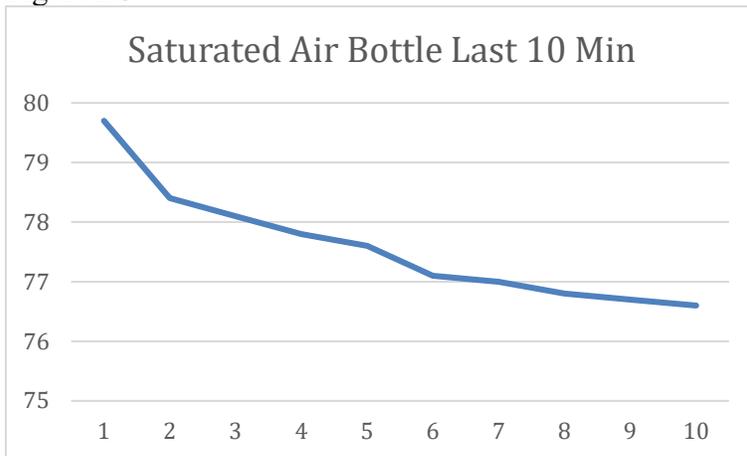


Figure 3.1

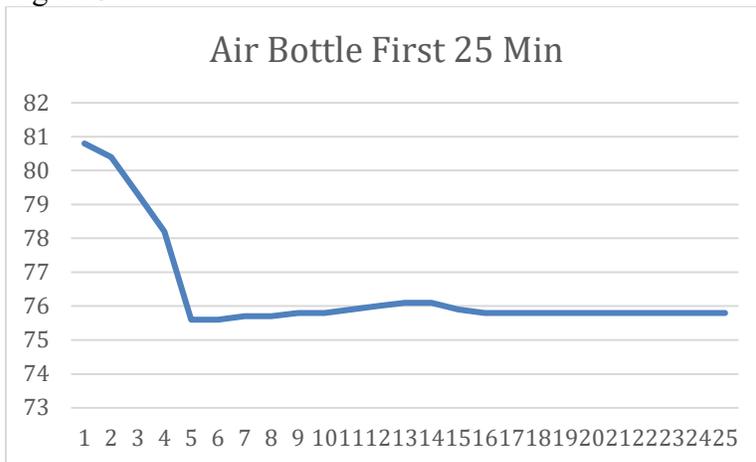


Figure 3.2

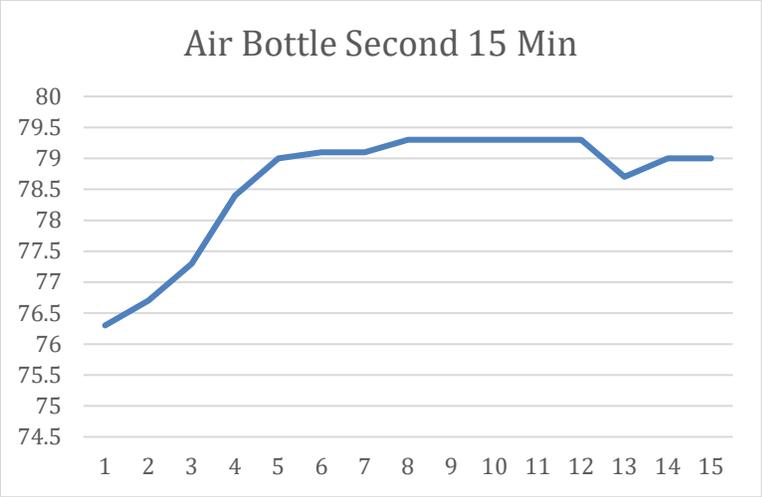


Figure 3.3

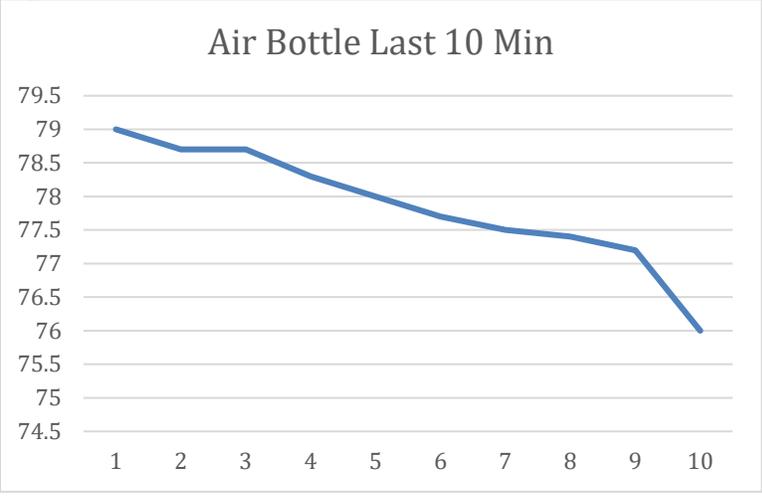


Figure 4

Air Quality Index		
AQI Category and Color	Index Value	Description of Air Quality
Good Green	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Moderate Yellow	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups Orange	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Unhealthy Red	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy Purple	201 to 300	Health alert: The risk of health effects is increased for everyone.
Hazardous Maroon	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

AQI Basics. (2019). AQI Basics. Retrieved December 06, 2020, from <https://www.airnow.gov/aqi/aqi-basics/>

Figure 5.2

The United States of Toxins

Total pounds of toxic chemicals released into the environment by state in 2016

Rank	State	Toxins (lbs.)	Rank	State	Toxins (lbs.)
1	Alaska	834,000,000	26	Montana	34,500,000
2	Nevada	317,000,000	27	Colorado	32,700,000
3	Utah	273,000,000	28	West Virginia	32,300,000
4	Texas	210,000,000	29	Wisconsin	32,000,000
5	Louisiana	147,000,000	30	Arkansas	31,500,000
6	Indiana	133,000,000	31	Iowa	31,400,000
7	Illinois	112,000,000	32	Oklahoma	30,300,000
8	Ohio	104,000,000	33	Minnesota	26,700,000
9	Arizona	86,000,000	34	Oregon	24,700,000
10	Alabama	85,400,000	35	New Mexico	19,500,000
11	Tennessee	82,300,000	36	Kansas	19,300,000
12	Michigan	72,300,000	37	Nebraska	18,900,000
13	Missouri	68,000,000	38	Wyoming	18,300,000
14	Florida	64,300,000	39	New York	16,900,000
15	Mississippi	57,100,000	40	New Jersey	14,600,000
16	Pennsylvania	56,900,000	41	Maryland	10,000,000
17	North Carolina	56,000,000	42	Maine	9,600,000
18	Kentucky	55,200,000	43	South Dakota	6,200,000
19	Georgia	55,000,000	44	Massachusetts	4,500,000
20	Idaho	47,000,000	45	Delaware	4,000,000
21	California	45,400,000	46	Hawaii	3,000,000
22	Virginia	44,000,000	47	Connecticut	2,000,000
23	North Dakota	42,000,000	48	Rhode Island	560,000
24	Washington	35,200,000	49	Vermont	500,000
25	South Carolina	35,000,000	50	New Hampshire	290,000

Data: U.S. Environmental Protection Agency's TRI reporting form (2016)



Priceonomics. (2017, November 08). The Most (And Least) Toxic Places In America.

Retrieved December 06, 2020, from

<https://www.forbes.com/sites/priceonomics/2017/11/07/the-most-and-least-toxic-places-in-america/>

Figure 5.3

Counties that produce the most toxins

Total pounds of toxic chemicals released into the environment (2016)

Rank	County	State	Toxins (lbs.)	Rank	County	State	Toxins (lbs.)
1	Northwest Arctic	AK	756,000,000	26	Humphreys	TN	19,000,000
2	Salt Lake	UT	250,000,000	27	Calcasieu Parish	LA	18,900,000
3	Humboldt	NV	101,000,000	28	Reynolds	MO	18,000,000
4	Lander	NV	77,800,000	29	Ouachita Parish	LA	16,100,000
5	Eureka	NV	55,900,000	30	Nueces	TX	16,000,000
6	Gila	AZ	54,900,000	31	Montgomery	TN	15,700,000
7	Juneau	AK	43,500,000	32	Jefferson Parish	LA	15,200,000
8	Brazoria	TX	38,500,000	33	Pend Oreille	WA	15,100,000
9	Lake	IN	38,400,000	34	Nye	NV	13,300,000
10	Harris	TX	37,900,000	35	Mobile	AL	13,300,000
11	Escambia	FL	34,000,000	36	Carroll	KY	12,900,000
12	Fairbanks North Star Boro	AK	33,400,000	37	Sumter	AL	12,900,000
13	Elko	NV	31,000,000	38	Jefferson	TX	12,900,000
14	Mercer	ND	30,700,000	39	Montgomery	VA	12,600,000
15	Wayne	MI	28,200,000	40	Marquette	MI	12,500,000
16	Ascension Parish	LA	25,000,000	41	Tooele	UT	11,700,000
17	Silver Bow	MT	23,400,000	42	Calhoun	TX	11,700,000
18	Iron	MO	23,300,000	43	Kern	CA	11,400,000
19	Peoria	IL	22,300,000	44	Allen	OH	11,200,000
20	Shoshone	ID	21,900,000	45	Marion	IN	10,900,000
21	St Charles Parish	LA	21,600,000	46	Sandusky	OH	10,900,000
22	Washington	IL	21,100,000	47	Monroe	MS	10,700,000
23	Spencer	IN	20,600,000	48	Clark	NV	10,600,000
24	White Pine	NV	20,600,000	49	Posey	IN	10,300,000
25	Harrison	MS	20,200,000	50	East Baton Rouge Parish	LA	10,100,000

Data: U.S. Environmental Protection Agency's TRI reporting form (2016)



Priceonomics. (2017, November 08). The Most (And Least) Toxic Places In America.

Retrieved December 06, 2020, from

<https://www.forbes.com/sites/priceonomics/2017/11/07/the-most-and-least-toxic-places-in-america/>

Figure 5.4

Cities that produce the most toxins

Total pounds of toxic chemicals released into the environment (2016)

Rank	City, State	Toxins (lbs.)	Rank	City, State	Toxins (lbs.)
1	Kotzebue, AK	756,000,000	26	Metaline Falls, WA	14,800,000
2	Bingham Canyon, UT	201,000,000	27	Peoria, IL	14,200,000
3	Golconda, NV	100,000,000	28	Geismar, LA	13,500,000
4	Carlin, NV	83,600,000	29	Sterlington, LA	13,200,000
5	Battle Mountain, NV	56,900,000	30	East Chicago, IN	13,200,000
6	Magna, UT	47,700,000	31	Emelle, AL	12,900,000
7	Juneau, AK	43,500,000	32	Ghent, KY	12,700,000
8	Alvin, TX	33,800,000	33	Deer Park, TX	12,400,000
9	Hayden, AZ	33,700,000	34	Radford, VA	12,300,000
10	Cantonment, FL	33,500,000	35	Westwego, LA	12,200,000
11	Boss, MO	32,000,000	36	Sulphur, LA	12,000,000
12	Beulah, ND	28,900,000	37	Champion, MI	11,900,000
13	Gary, IN	23,900,000	38	Grantsville, UT	11,600,000
14	Fairbanks, AK	23,500,000	39	Donaldsonville, LA	11,200,000
15	Butte, MT	23,400,000	40	Lima, OH	11,200,000
16	Marissa, IL	21,100,000	41	Indianapolis, IN	10,900,000
17	Crescent Valley, NV	20,900,000	42	Buttonwillow, CA	10,500,000
18	Rockport, IN	20,600,000	43	Henderson, NV	10,400,000
19	Claypool, AZ	20,200,000	44	Hamilton, MS	10,300,000
20	Pass Christian, MS	20,100,000	45	Mount Vernon, IN	10,300,000
21	Ruth, NV	18,600,000	46	Vickery, OH	10,200,000
22	Luling, LA	17,700,000	47	Beatty, NV	10,100,000
23	New Johnsonville, TN	17,000,000	48	Port Lavaca, TX	9,800,000
24	Clarksville, TN	15,700,000	49	Delta Junction, AK	9,300,000
25	Mullan, ID	15,600,000	50	Augusta, GA	9,300,000

Data: U.S. Environmental Protection Agency's TRI reporting form (2016)



Priceonomics. (2017, November 08). The Most (And Least) Toxic Places In America. Retrieved December 06, 2020, from <https://www.forbes.com/sites/priceonomics/2017/11/07/the-most-and-least-toxic-places-in-america/>

Helpful Resources

Websites:

Carbon Footprint

<https://www.carbonfootprint.com/calculator.aspx>

Ecological Footprint

<https://www.footprintcalculator.org/>

The Ugly Fruit & Veg Campaign

<https://www.facebook.com/UglyFruitAndVeg/>

Misfit Market; Ugly Produce

<https://www.misfitsmarket.com/>

20 Step Guide For Sustainable Living

<https://www.goodenergy.co.uk/blog/2017/08/22/ultimate-guide-eco-friendly-living/>

10 Keys To An Eco-Friendly Diet

<https://emagazine.com/10-keys-to-an-eco-friendly-diet/>

Eco-Friendly Household Items

<https://mightynest.com/>

Recommended Reading:

‘We Are the Weather’

By: Johnathan Safran Foer

‘The Soil Will Save Use’

By: Kristin Ohlson

‘Environmental Injustice in The United States’

By: James P. Lester, David W. Allen, & Kelly M. Hill

‘The Sixth Extinction’

By: Elizabeth Kolbert

‘A Plea for The Animals’

By: Matthieu Ricard

‘Toxic Communities’

By: Dorceta E. Taylor

‘Sustainability Made Simple’

By: Rosaly Byrd & Lauren DeMates

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