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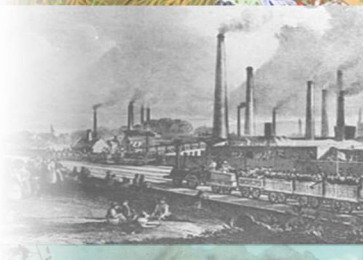
This Fading Florida World





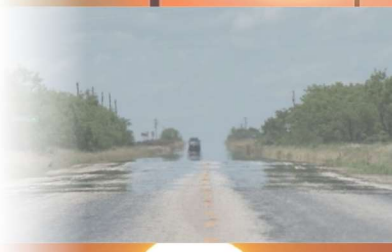

Once the world was water with spits of land. Vast expanses of blue; a watercolor painting in cyan and indigo and white. This was a time when sleek spotted fish ruled the underwater palace of rainbow coral sculptures and swaying pillars of seagrass. This was a time when humans didn't walk the earth. Every day this past threatens to become the present as we carry on into this time of changing climate. Nature warns us that we have a debt to pay and each day her power begins to challenge our safe and cozy existence. We are traversing a road that, with every step, will turn back the hands of time until our shoes become invisible under salty water and we fade into the dark blue world that wraps its cool tentacles around our hearts. Since the Industrial Revolution we have induced changes we cannot undo, we have created an incubator of disaster out of a once self-sustaining sphere of green and blue. We have tipped the scales and now we are paying— we, specifically Floridians, are experiencing hotter days and hotter nights and our oceans are warming and spilling out onto once dry land on which we humans have built our lives. These effects of climate change threaten ecosystems and their biodiversity and put in danger our daily lives, wellbeing, economic structures, and cultures. If we continue down the same path of burning fossil fuels, polluting, and keeping the consequences of our actions in the back of our minds, human life as we know it will inevitably collapse. But hope is not lost for as we are traversing this road together there are side paths that we can choose to take. They might be overgrown and look at first to be uninviting, but these paths will alter our thoughts and actions and hearts, they will challenge our habits and ways of life, but ultimately, these paths will shape us into residents of

this Earth rather than dominators of it. Instead of fading into a salty sea of blue we will emerge from it standing on dry land.

humans | environment
a divided world we are for now content
according to our legislature
humans are not nature
environment = our life blood
which to us means turn green land to mud
we pollute
until it does us suit
with our houses so grand
we might seem distanced from the land;
we might seem very far
from the land that we scar
we can keep chugging along
to our same old song
creating levees and sea walls
and elevating roads and school halls
these environmental pressures
we put behind a wall of great measures
hidden from eye
but piling high to the sky
we can try to hide
but in the end these worlds will collide
the human world will meet its match—
the great environment will from us snatch
the sea will bear down on us
and consume our luxuries of lust
and so we will have to better choose
or simply choose to lose.








Part I: 35 Degrees C

Since the Industrial Revolution began in the late 18th century we have been burning fossil fuels and releasing various gases into the air including carbon dioxide, nitrous oxide, methane and ozone. These gases, known as greenhouse gases, reside in the atmosphere for long periods of time, effectively creating a blanket that surrounds the earth, trapping in heat and driving up red lines of thermometers around the world. Since 1895 when temperature records for the United States began, the average US temperature has risen 0.7 to 1 degrees C and if we keep dancing to the beat of the same tune, average US temperatures will rise 1.7 to 5.5 degrees C over the next 80 years.[1] This temperature change will greatly affect the range of many ecosystems and will limit species diversity.[14] As for humans, some may think that adaptability is the key to surviving this new Earth sauna but it has been determined through scientific research that if wet bulb temperatures, which take into account humidity, are consistently above 35 degrees C (the highest global wet bulb temperature today is 30 degrees C with rare exceptions reaching 31 degrees C), [2] then the human temperature regulatory system will fail, leading to death in some cases. Some parts of the world will begin to experience this when average global temperatures increase by about 7 degrees C so we must keep in mind as we move forward into the future— some ecosystem functions as well as humans have a maximum expiration date: the time at which we reach 35 degrees C.[2]

I. Nothing Green Can Stay… If We Don't Change

In my mind I imagine tall green pines standing proudly in the summer sun, the rays of sunlight releasing their sweet spicy scent that drifts down to me on a light breeze. From behind my eyelids I see lizards scurrying up the geometric sections of the brown bark of longleaf pines and hear red

cockaded woodpeckers chipping away at pine branches in the distance. But when I open my eyes in the clammy heat of the Florida summer there are barren longleaf pines everywhere. A desolate, drab, lifeless landscape. A landscape that, in the mid—summer months, should be composed of furry green longleaf pines is now a forest of limp rust brown foliage. The culprit— a small black beetle about the size of a grain of rice.[3] This beetle, known as the southern pine beetle, poses a major threat to longleaf, loblolly, pitch, and shortleaf pine trees in the southeast region of the United States[3] under the right conditions— conditions which are now emerging more frequently in Florida due to climate change. Since the early 20th century, Florida summers have gradually become hotter and drier. Since 1920, the average high temperature has increased by almost 2 degrees C [4], and is predicted to climb by 4-10 degrees C in the next century in Florida.[5] This combination of hotter and drier summer months has led to an increased potential for southern pine beetle infestations in Florida pine forests. These infestations are highly detrimental and can cause the deaths of thousands of acres of pine forest in a matter of weeks, making large expanses of forest look like they have been bleached from the sky, a discoloration that spreads rapidly like a disease. The southern pine beetle will attack longleaf pines by tearing through the bark to get to the phloem of the tree. Typically, pines can enact a defense mechanism by producing resin that helps keep away the beetles and heal the tree, but if conditions are dry enough (conditions that will be brought about by climate change in Florida), the tree cannot put out resin as its defense system,[6] leading to the death of the pines.

In addition to the growth of southern pine beetle infestations due to climate change, Florida longleaf pine trees are already experiencing the wrath of another slightly less destructive insect whose range is also expanding due to climate change— the redheaded pine sawfly. This small bug with a rust red body and wings like a black cape attacks a variety of pine trees, including the longleaf pine, by laying its eggs in the needles of

the pine trees, effectively defoliating the trees.[7] This defoliation can lead to death in small trees and stunted growth in larger pines.[8] As Florida climate warms, the range of the sawfly is likely to expand well into Florida, posing a threat to longleaf pine forests, especially young forests where the trees are in the beginning stages of growth.

Besides increased vulnerability to insect pests, longleaf pine forests have already begun to move northward and be displaced by white sandy scrub lands and golden savannahs.[9] The longleaf pines' lack of ability to adapt to a warmer climate drives spans of pines northward and, where the pines are unable to migrate northward, their ranges are contracting, disappearing and evaporating like water in the summer sun. This movement and disappearance of longleaf pine forests as well as other hardwood trees such as southern red oak and American beech will affect different animals' abilities to nest and forage[9] and will lead to a rapid decline in biodiversity. You would no longer be able to spot the gopher tortoise, a slow—moving gentle giant that digs large burrows up to 65 feet long and 26 feet deep into the ground below pine forests. These burrows are important not only for gopher tortoises but also for up to 350 other species such as insects, snakes, mice and frogs that share a home with the tortoises.[10] The red cockaded woodpecker, an endangered black and white and red specked bird that relies on longleaf pines for their survival would fade from sight. The indigo snake, a snake black in the shade and iridescent indigo in the sunlight, lives in the understory of the longleaf pine habitat and relies on the burrows of gopher tortoises to survive.[10] The longleaf pine forest, like many other ecosystems is home to an astounding number of organism that all support a larger web or life, and its destruction, either by insects or shifting climactic bands would be detrimental.

II. Mirage on the Horizon

Colors ripple sideways on the horizon— a mirage of light and people and cars dance above black asphalt. Humid hot days and silent sidewalks. Even the birds are quiet in this urban sauna. Relief comes when night falls, but only slightly. This is summer in Florida. According to a recent study, Miami, one of Florida's largest cities, ranks number one for having the largest increase in days over 90 degrees Fahrenheit (a 46 day increase to be exact[11]) and ranks third for the greatest increase in days where the heat index is above 104 degrees Fahrenheit.[11] This increase in hot weather, driven by climate change, poses a variety of severe health issues for Floridians especially for those living in large cities such as Miami where the urban heat island effect exacerbates warming temperatures. An urban heat island is like a giant bubble that surrounds a city full of concrete, asphalt, glass, metal and few trees in which all the manmade building materials absorb the sun's UV rays. This traps heat in during the day and throughout the night, effectively making cities a few degrees warmer than surrounding lands covered with natural materials and plants.

There are populations that are more vulnerable to the effects of this dripping sticky heat including children, the elderly (especially those over 65 and 75 years of age), pregnant women, those of low socioeconomic status, outdoor workers, and those with preexisting mental health issues.[12] The vulnerability of the elderly is especially important to note as 21% of the Florida population consists of residents over 65 years of age.[13] Higher temperatures can worsen medical conditions such as cardiovascular diseases, diabetes related illnesses, and respiratory diseases, and prolonged exposure to high temperatures can hinder the body's ability to regulate its internal temperature leading to hyperthermia. Hyperthermia is a concern for anyone who engages in rigorous physical exercise in the peak summer months such as children or adults that play outdoor sports and construction workers. More serious medical conditions can arise from heat exposure

including mental health issues and preterm births.[12] Dealing with heat is a serious issue and is important to consider when thinking about planning for the future.

The heat itself is not the only thing to worry about as temperatures rise. Imagine the sky is an azure blue as you sit down on your patio to enjoy the beautiful spring weather. The birds chirp and the ground hums with life—moths and spiders and butterflies. And mosquitoes. They arrive on the scene like devils in disguise, long legged black bodied vampires, business as usual except this time their food is you. Not only does the heat craft mercury into skyscrapers inside thermometers, but increased temperatures expand the range of some insects, creating new havens for disease carrying vectors such as mosquitoes.

Mosquitoes are one of the most common carriers of vector borne diseases such as Zika viruses, dengue, and chikungunya and as the number of cold winter days in Florida decreases, the range of mosquitoes will begin to extend farther north.[14] Currently mosquitoes are only active in July through September in the more northern parts of Florida, but it is expected that soon transmission will become year-round.[14] This extended active season poses a greater threat to Florida populations and puts people, especially those that live in cities (cities have more stagnant water sources than rural areas)[14], at risk for these types of dangerous diseases.

III. The Tipping Point of Human Life

If our planet continues to warm, and all scientific research that has been done on this topic says it will, then we might eventually reach a point in time in which is it simply too hot for human survival without the aid of a breakthrough technology. Research has been done that concluded that 35 degrees Celsius is the wet bulb temperature at which, if exposed to for a long enough period of time, the human body will cease to regulate body

temperatures properly, therefore inducing heat related problems and eventually, death.[2] This is a look at the future of humankind if we do not take action.

35 degrees C
Is an ugly place to be
It is the tipping point
Where the body becomes disjoint
Hotter nights and hotter days
Mirages on asphalt that trap your gaze
Every second spent inside
Sitting where cool airs glide
A step outside and away you go
Skin burning while dreaming of snow
Insides so hot you can't sweat
About hyperthermia you should fret
Insides of cars are boiling saunas
And drooping are the flora and faunas
A child in a stroller— oh my
Of the heat the baby does cry
A kid walks down the block
While the mother watches like a hawk
For more than a ten minute stroll
The death bell will toll
The concept of playing outside
Had shriveled up and died
So much for parks and playgrounds and preserves
For the heat will fry your nerves
35 degrees C
Is the end of our invitation to be
On our adaptability I wouldn't bet
For humans haven't survived this hot yet.







Part II. The Time Riptide

As atmospheric temperatures warm in seemingly small increments, ice at the poles will continue to melt at increasingly rapid rates causing sea level rise around the world. Coastal ecosystems such as marsh and mangrove systems will be forced on a death march landward, and coastal communities will be captured by the salty fingers of the sea. By the year 2100, Florida is predicted to experience anywhere between 1.0 and 4.3 feet of sea level rise with some predictions estimating as much as 8 feet of sea level rise.[14] One foot of sea level rise will make life on the coast uncomfortable, 4.3 feet will be detrimental to coastal ecosystems and coastal infrastructure, and 8 feet will be catastrophic to both coastal and inland communities.[16] Humanity as we know it is living on minutes that are being drowned in salty water and living on vibrant lands that will soon become still waters.

I. The Slow (and Hindered) March Landward

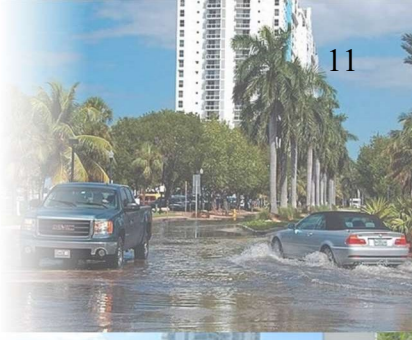
Tangled roots cluster along the shore— a red mangrove tree on stilts braving the landward licking tide. Green reedy grasses stretch far and wide, filling in empty spaces while sunlight filters in between the lime green waxy leaves of the black mangroves and crabs scurry along woody branches. This is the beauty of the salt marsh and mangrove ecosystems that cover most of the Florida coast. These ecosystems are an important part of the Florida coastline in terms of housing biodiversity and providing storm protection and other ecosystem services.

Tidal salt marsh wetlands are expanses of green and yellow tinged cordgrass and rush grasses teeming with life both big and small. There is lively activity that covers every part of this ecosystem— there are tiny insects and crabs that cover the mud in between the reedy stems, spiders and sap sucking insects on blades of grass, and rosette spoonbills, willets,

and blue herons that soar over the marsh or stand with feet in the mud, silently waiting for a meal.[16]

While the salt marsh system is sunny, flowing, and lively, to enter the mangrove systems is to enter a hushed and hidden world where life is present but stealthy. Fish glide silently under the still, brackish waters that cover the bottoms of the mangroves with silent indifference, the tide sliding higher and higher along the finger—like roots of black mangroves that push out from the dark brown organic rich soil and end in a mass of brown and green that is framed against bright blue sky. Great egrets land effortlessly in the tangle of mangrove branches and sit quietly while brown speckled mangrove tree crabs blend in with ease on the pockmarked branches that arch over water channels. It is clear that both the marsh and the mangrove ecosystems are essential components in maintaining Florida biodiversity. They are also important in maintaining processes that are less easily identified with the eye. Being coastal wetlands, and because the soil is constantly inundated, leaving no room for decomposition of carbon—based materials, both of these ecosystems are able to trap large amounts of carbon in the soil.[16] This is especially important in the face of climate change as we continue to emit carbon dioxide into the atmosphere. Marsh and mangrove wetlands also help filter water, removing chemicals and wastes from the system.

These ecosystem functions are very important to life in Florida, but the functionality of these processes is being threatened as salt marsh and mangrove systems are being held hostage by both rising sea waters and human development. Salt marshes and mangroves are being pushed inland by a process known as coastal squeeze.[16] Normally, the salt marshes and mangroves can keep pace with sea level rise by trapping sediments in their roots and reeds causing them to move upwards and inland but their migration inland in many places will be hindered by the glittering glass windows and concrete walls of beachfront resorts and houses. Furthermore,

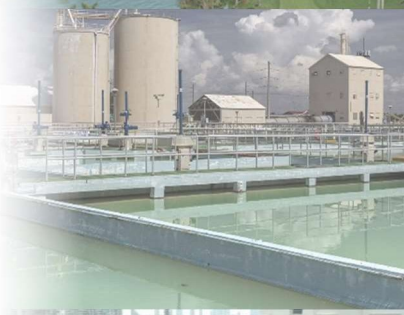


if ice in Antarctica and Greenland melts more quickly than anticipated, sea levels will rise very rapidly, possibly at a pace where salt marshes and mangroves cannot keep up.[16] If this occurs, salt marshes and mangroves will rapidly disappear, swallowed up by the ocean.

II. Invasion

Water covers the streets in sheets of blue glass interrupted by cars that slosh slowly through a foot of water. A big rainfall on a cloudy day? No. The day is sunny and cloudless and the water is salty. These are king tides in Miami Beach, Florida. Water licks at shops along the street and people wade around in brightly colored rainboots. Today Miami experiences about 18 days of severe flooding due to tides, but this number is predicted to increase to at least 30 days by the year 2050.[14] This threatens the infrastructure and health of coastal Florida residents, and as 80 percent of Florida residents live on the coast [17] this is a mounting problem. One of the greatest concerns currently when dealing with sea level rise and human development is the flooding of stormwater systems. When the sun, moon and the earth align in the solar system, the Florida coastline experiences instances of very high tides called spring tides or more casually known as king tides. As the stormwater pipes run directly out to the ocean, large tidal surges cause blue salty ocean waters to flow up the stormwater pipes and eventually spill out onto asphalt streets and green turf yards, resulting in inches or even feet of ocean water flooding.[15]

Additional problems arise from the fact that many Floridians along the coast have septic systems which is a way to dispose of wastewater from your property without being connected to the wastewater system. When sea levels rise, the water table rises with it, causing water to infiltrate low lying septic tanks leading to sewage spilling out into backyards and streets. These waters that glide across pavement and sparkle in the sun may look harmless but are filled with viruses and human feces.[15] During the king tides in Miami, fecal bacteria in the streets have been measured up to 630



times the legal limit.[15] If this fecal bacteria comes in contact with cuts or open wounds while one walking down flooded sidewalks or in backyards or is ingested while swimming in the bay, it can lead to serious health consequences like infections such as norovirus, and a variety of diarrheal illnesses.[18]

Beyond the fact that human feces is overflowing into Miami streets and spreading like wildfire on a windy day onto sidewalks and into the bay, rising sea levels will cause salt water intrusion of groundwater supplies,[15] limiting the amount of pristine freshwater available for drinking. Floridians depend on aquafers for drinking water and when you combine thousands of gallons of fresh water with a hundred gallons of salt water what you have is diluted salt water but salt water none the less. Salt water takes far more energy and time to process for drinking then does freshwater, so salt water intrusion of wells and aquafers could lead to severe water shortages.

In addition to water related infrastructure, transportation infrastructure is already being compromised. Roads are often flooded both during king tides and during instances of large rainfall events. Massive flooding events occur after rainfall because sea water is backing up the stormwater pipes, acting like a stopper in a gutter and preventing the rainwater from draining out into the ocean. This poses risks to drivers and pedestrians and creates a challenge for those with disabilities, those that rely on public transportation, and those in need of emergency services.

Furthermore, many coastal communities rely on the coast for tourism and food, both of which will be impacted by sea level rise and directly affected by both city flooding and fecal contamination. As is evidenced by tourism numbers from 2017 that revealed that Miami got a whopping 15.8 million visitors who in total spent 29.5 billion dollars,[19] tourism makes up a large percentage of the economy of Miami and other Florida coastal cities. As the sea encroaches on city structures and boardwalks and beachfront resorts, it will also encroach on profits from tourism. If the bay waters

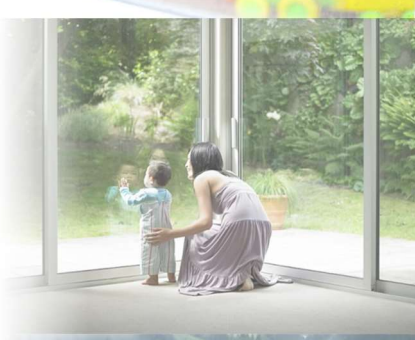
smell of fecal matter and sulfur no one is going to choose to vacation on the beaches of Miami[15] and as a result Mami and other Florida cities will take a huge monetary punch in the gut. Furthermore, flooded roads will cause hassle for travelers and will make navigating the city more difficult which will turn away tourists. Beyond the tourism industry, salt water fishing is a 4 billion dollar a year business in Florida[20] and is thus an important component of the Florida economy. Nearly 80 percent of fish and other seafood caught in Florida rely on estuaries for part of their life cycle and these estuary ecosystems will be swallowed up by sea level rise, causing fish nurseries to disappear, leading to a decline in fish populations, on top of already declining populations due to warming oceans and overfishing.[21] This poses great risks to local fishermen and fisherwomen who rely on their catches for income as well as for the larger Florida economy in general.

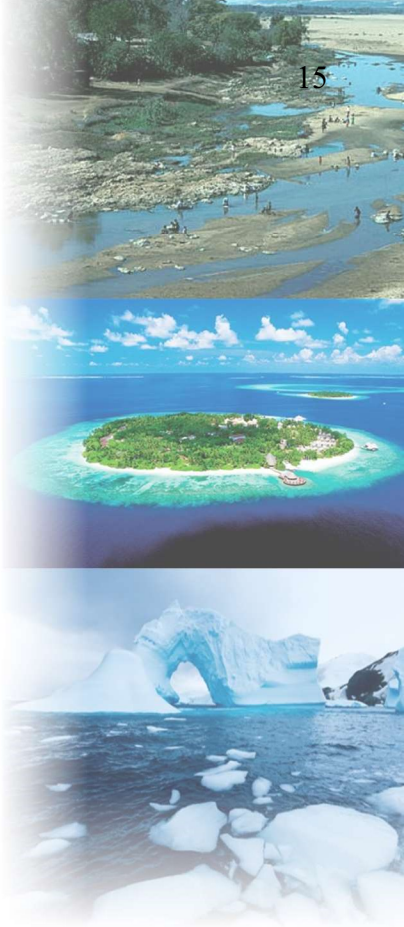
III. Childhood Drowning

Sea levels are rising steadily and as glaciers and the polar ice caps continue to melt, low lying coastal land will continue to be consumed by sea water. Eventually salt water flooding will become so severe that it will cause people to leave their coastal properties in search of housing elsewhere. This in turn will create many climate change refugees, people who have been driven out of their homes because of rising seas. However, for those who cannot afford to move out immediately or who have a hard time leaving their cultural ties to their city, these individuals and families will be subject to daily flooding, hindering their ability to enjoy their lives as well as the outdoors.

Oh what a life I now live
With a five-year-old kid
“Can I go outside and play mommy?”

He asks because the weather is balmy
"No honey there's water in our yard"
I reply playing the climate change card
"But it's like swimming in the ocean!"
He says and I can't bear the notion
"It's not safe out there for you Luke"
I say as I think of water filled with poop
"I don't care I just want to play outside!"
He screams accusingly and cries
"I know sweetie how about a board game instead"
I say as I think about the past potential of sunny days in my head
"I guess that's fine."
He pouts with a forehead line
And I cry inside for this drowning world
Into which he has been hurled
This world of impassable salt water roads
Of backyard wetlands and constant wet toes
This world where the oceans creep
And accords and agreements we cannot seem to meet
I wish I could give him the days
Of green lawns and sports playing craze
I wish he could run around on the grass
And watch squirrels and birds and rabbits pass
But we are stuck inside
All the time except at low tide
365 days a year
I live in fear
That my little boy
Will grow up without the joy
Of the outdoors to call his toy.





Part III. Hope for the Future

When it comes to global issues such as climate change, staying positive in the face of daunting issues that will bring different challenges and hardships to differ geographic locations and cultures is difficult. While Florida may experience increased temperatures and sea level rise, other parts of the world may experience more severe storms, decreased rainfall amounts, and food shortages, making climate change a multi-faceted problem. The scientific and social research being conducted today tells us that we are rapidly altering our planet and begs us to recognize the fact that humans are the center of the tornado of destruction that has begun ripping through our earth over the last century. Reading about cities drowning and people starving and battles with storms being lost may make us feel hopeless and depressed. But I do not write these things to make the future seem hopeless, I write about these things so that our eyes will open to the destruction we are causing and so that we can learn from our mistakes. We must go into the future with the heavy knowledge that we brought harm to the planet but with the hope that we can learn from our mistakes and become more conscious of our actions as a species. We should look at the future as an opportunity to make positive change rather than seeing the future as leading to the demise of humanity. We need to think of the future as the end of a *way* of human life, not the end of humanity altogether. When we adopt a positive mindset about the future, and look at it as an opportunity to modify the ways in which we live and the things that we value, we have the opportunity to collaborate with others, to learn how to live more in tune with nature and to better understand cultures around the world. We can choose to look at the future as a dark tunnel of doom and gloom or we can choose to believe that the earth is giving the human species another chance to do things right.

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