

Global Sustainability

Supplement for

The Dry Sky: Future Scenarios for Humanity's Modification of the Atmospheric Water Cycle

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Additional Supporting Information (Files uploaded separately)

- “Dry_sky_supplemental_corpus_data” containing the corpus data used in the text analysis (uploaded as a excel file).

Ten Story-based scenarios.

The ten stories are attached in full below:

1. We Are As Gods (*Pages 3 to 6*)
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We Are As Gods (Public Good)

By Patrick Keys

The 2051 Fall meeting of the American Geophysical Union was witness to the inaugural Tessendorf Lectureship for contributions to the science of weather modification, awarded to Dr. Kay Rasmusdottir.

Thank you Dr. Holt, for that wonderful and thoughtful introduction. It is an honor to receive the inaugural Tessendorf Lectureship. I see many familiar faces in this crowd, and even more longtime friends. And it is in this spirit of friendship that I feel compelled to sound a bit of an alarm.

Yes, I see from your nervous glances, that this might not be what you were expecting. As the futurist and polymath Stewart Brand said, “We are as gods and might as well get good at it.”

Given that this is the first Tessendorf Lectureship, I feel compelled — as we used to say — to go big, or go home. We stand poised at the precipice of foundational changes to the relationship of humanity and the physical world. Yes, of course people have changed and are changing the climate. That is not new. Nor are those changes complete or fully understood. But those are climatic changes, not changes to the day to day. The operational. The tactical.

My heart has always been in understanding why the weather does what it does, specifically precipitation. Why do we get rain some days, and not others? Why does hail grow to the size of a grapefruit in some parts of the world?

I remember standing on the balcony of my home with my dad more than 60 years ago, hands on hips, and glowering at the lowering sky. It was pouring rain on the other side of the river valley in which we lived. The weather report had promised rain, and I had gotten myself ready to do some serious puddle stomping. I asked my dad why it wasn't raining here, when the weather report told me it would. He said that weather reports couldn't be 100% correct, and then — in a fashion typical of my father — launched into a thoughtful, detailed lecture on cloud microphysics. At six years old, I pledged then and there to figure this problem out.

Now some six-year old pledges are as fickle as an afternoon shower. Mine was not. I have spent nearly every year since that conversation with my dad working toward better understanding our weather. Specifically, why it rains when and where it does — and just maybe how we can change that.

But I'm getting ahead of myself.

After asking my dad how I could understand precipitation, he very sensibly said I would need to understand math, physics, chemistry, and a few other subjects. So like the type A person I am, I poured my entire self into my studies to understand the weather. Obviously I stood on the shoulders of giants here. Surprisingly, it wasn't until my sophomore year of college that I asked a professor why we couldn't

just change precipitation, to fall where we wanted it to fall. The professor laughed, for a while. And then said the climate fiction class was in another department.

Embarrassed, I slid down in my seat in the lecture hall. But silently vowed to prove that professor wrong. By your laughter now, I think I may be among compatriots who vowed to prove their undergraduate professors wrong! Several years later, equipped with degrees in meteorology and physics, and graduate degrees in chemistry and atmospheric science I began an Assistant Professorship at the University of Washington.

In the early 2020s I was able to sit as a bystander while ground breaking research was conducted by the National Center for Atmospheric Research on improving glaciogenic cloud seeding. Indeed, this lectureship is named for one of those groundbreaking scientists. Now, while that result was modest at best, the science was unequivocal. Glaciogenic cloud seeding had demonstrably worked. At the time, the shockwaves this should have sent through the community were quite subdued. The COVID19 pandemic, which stretched for years, the geopolitical unrest in Europe during the early 2020s, and the understandably-focused attention on climate policy all conspired to suppress interest in the weather modification revolution that was underway.

But that would soon change.

In 2031 a drought engulfed much of the South American continent. A combination of a strong El Niño and below normal rainfall had led to very low soil moisture throughout the Chaco region of Argentina. Spurred by the successes of past weather modification efforts, the Argentine government authorized the use of precipitation enhancement. You may be familiar with the popular name of this phenomenon — Andean Hell Hail. Which isn't really fair, given that the cause of the hail was absolutely not the Andes but poor judgment on the side of some of the government decision-makers.

The fall-out of this tragedy was immediate and catastrophic for the wine growing region of Argentina, which not only lost much of the crop, but saw much of the infrastructure and vines themselves destroyed. Science, however, learned an important lesson. Disaster alone cannot be the reason for action. Thorough understanding of the consequences of failure must be balanced against the desire to improve conditions. Of course this sounds reasonable to your ears, but it is a lesson, apparently, that society must repeatedly learn.

Let's move quickly past the COVID38 pandemic since that holds little but heartbreak, and past the Lusaka Carbon Accord of 2042 that was a much needed renewal of hope for continued global action on climate change.

We now find ourselves in 2045. Who remembers why this year is important?

Of course you all know, as I see you saying the name aloud. The Black Sea Drought. Of course, the Black Sea was not at risk of drying up, but the breadbaskets in Ukraine were. All eyes were decidedly focused

on this part of the world. And for very good reasons! Global grain supplies needed a boost and Ukraine was, and still is, central to global wheat production. So with food security on the line, the European Union convened numerous meetings about the safety and implications of cloud seeding. The scientific community had learned a tremendous amount in the intervening decades of how and why the Argentine disaster occurred. Central to the disaster were faulty assumptions about aerosol conditions aloft. These data gaps had been readily filled with innovations in high altitude, precision microphysics monitoring — innovations led in part by my research lab.

I actually had a front row seat during the Black Sea Drought as I provided expert testimony on numerous occasions leading up to and following the events of 2045. While I could not advise — and still would not pretend — to have geopolitical wisdom, I was able to convey my confidence in our science. That is to say, that we could make a safe decision should an opportunity to seed the Ukrainian skies arise.

Such an opportunity occurred in June of 2045, and we were granted permission by the EU to conduct the cloud seeding operation. With all eyes of the planet watching, we succeeded in manipulating those dry skies into producing rain.

While we expected scientific approval, we did not realize what would then be set in motion. We had demonstrated in the open and transparently how cloud seeding could work. And it did work, in no small part due to enormous investments into basic research about the physics of the atmosphere as well as trust built among scientific groups and decision-makers. This has always been the slowest part of any sensible advancement in public science. But it is also the most necessary part.

The surprise came when we realized that cloud seeding was effectively on the market now. Financiers looking to improve grain futures outlooks were finally convinced that cloud seeding was a good bet to improve quarterly profits. Despite a century of tinkering with weather modification, the definitive Live experiment of the Black Sea Drought transformed weather modification almost overnight into a field of wealth speculation.

So, what do we as the scientific community do with this?

I realize that the purpose of this lectureship is to recognize leadership in weather modification, and as an apparent leader in this field, I have the following to say.

In the past we had no control over the weather. Six year old girls would stomp, and stare at rainstorms that were supposed to fall on them, rather than across the valley. But now we have bottled this lightning. And we must now show restraint and precaution. Audacity and hubris are uncomfortable bedfellows, so we must find a way to navigate safely between the two moving forward.

I am grateful for the chance to perform so much exciting and rewarding science over the past many decades. I find myself now, behind this lectern, calling on the weather community to consider whether

we should continue pursuing this science, or more clearly reckon with whether a moratorium should be placed on this technology until more can be understood.

It is unlikely that I will be making any more groundbreaking discoveries. But I see many young faces in this audience. Faces that are the future of this science. And it is in you that I put my trust and hope that we can be responsible stewards of this world.

Thank you very much for your time tonight.

The Palash (Public Good)

By Rekha Warriier

Romila Gogoi's Field Diary

"The winds assail the palash. A handful of leaves - shaped like a Sambar deer's ear- their delicate petioles straining, desperately hold on to her. Bhura would say that on foggy February mornings when her leaves are dry and crinkled, from his window, the palash looks like a herd of airborne deer coveting his rice crop. This August morning, from the undead half of Bhura's home, the grand old palash looks exhausted, not ethereal. Her gnarled branches reach out to a sky so brown I feel she may start to sprout roots in place of leaves, upending this pretense of heaven and hell once and for all. What sort of heaven produces a wind this monstrous anyways? As if to issue a remonstrance, the wind howls and arrives by me through the collapsed roof. I curl my toes and grip the dirt, trying to hold on to the last vestiges of Bhura's home. A tendril of air burrows between my toes prying out the earth from between and under my feet reminding me of the steadfast diligence with which our world was being consumed.

The winds come for all those spared by the floods. Then, for those like me and the palash who will not be bent or swept away, purgatory unleashes the rhinos. The palash wears her scars all around the base of her trunk, where the rhinos have stripped her bark away. I wear mine on the side of my stomach where 100 stitches circumscribe the story of the night a rhino and I sparred in my millet field. Yesterday evening at the tea-stall I heard a rumor that the Park was secretly releasing its prized one-horned rhinoceros at the edge of Palashpari. The Park people would rather see them destroy our fields than risk them dying within the park. Rumor has it that the rhinos come installed with cameras and they spy on us for the Park people. Then again, in Palashpari a rumor rides on every grain of dust in the air. Last week it was whispers of the PRC being censured by the Southern Alliance for seeding rainclouds in Tawang. The month before it was the rumored sighting of Bhura in a Tezpur construction camp. For those of us who linger on in Palashpari, certainty is an albatross we chose not to wear around our necks. So we let the rumors swirl and fill the gnawing corners of our stomachs and hearts....

Ravik Gogoi, Aug 14th 2073

"

Once in an archaeolinguistics immersive, I learned that history has a penchant for preserving the prosaic. A Cuneiform tablet where a man complains about the poor-quality copper rings he was sold, or a Babylonian recipe for a pigeon stew seem to endure the vagaries of time with the same vitality as the great pyramids of Giza. If fate decrees, some fragment of my workaday life may survive for millennia and one day become a window to understand my world. Wouldn't that be nice! I have been thinking about this a lot lately after Ma gifted me the one surviving snippet from their grandfather's journal.

It's been so strange reading Ravik koka's words while camping out in the Jungalbahari bio-zone and learning of my deeper connections to this place. Not to mention how odd it is that for all these years Ma neglected to mention to me that we are from Palashpari. Considering that I have been conducting experiments in the Kazi swamps for the last three years, I would imagine that it's more than a trivial detail that my field sites are located on my ancestral lands! Also, the irony that I am endeavoring to save

the very beasts that took generous bites off my ancestor's life - literally and figuratively! I am sure Lima will find all this to be very fantabulous.

I was so eager to piece together Ravik koka's life story that a few days ago I signed up to memorize the archives for the area that is now known as Jungalbahaari. Not much survived the great floods of 2074, and the neural uplink of the available content took just a few seconds. I was grateful to have even this data to fill in the great gaps in my ancestor's life story! The following day setting the archive on auto-retrieve I set out to collect some data for the helminth lab. As I cruised over the Brahmaputra arterial channel the archive link came alive and I began to remember.

"A long time ago, at this point, the river used to be almost 10 kms wide. Fed by a glacial lake in eastern PRC, it would flood every summer in the process creating rich habitats for tigers, rhinos, elephants and floricans; species found in no other country. When the eastern PRC government (now the Trans-Himalayan government) began their weather modification operations in response to the droughts on the Tibetan plateau, the Brahmaputra floods began to worsen. There were 18 catastrophic floods between 2052 and 2075. These floods compounded the devastation wrought by the failing southwest monsoon winds. The great flood of Palashpari in 2074 and the iconic image of a family being swept away on the back of a rhino captured the imagination of the world. The family of Ravik Gogoi and the rhino survived and were rescued out of the water in Tezpur."

Destiny's sleights of hand!

The channel I cruised over doesn't flood, it's not meant to. The moisture matrix controls where the water goes, periodically inundating the Kazi swamps, irrigating the aquaponic fields and supplying freshwater to settlements within the neighboring biozones. The journey over the Brahmaputra channel was pleasant. I have always enjoyed that stretch and the opportunity to watch Gangetic dolphins emerge for air from the river's murky depths. Along the way I took a quick detour to look for hornbills in the northeastern forest corridor. A ruby-cheeked sunbird tried to keep pace with my scooter, perhaps scouting for an opportunity to feed on the magenta flowers painted on my helmet. Overhead, a hoolock gibbon crossed the narrow corridor, his long, elegant arms swinging from one overhanging branch to the next. On either side of the corridor a dark and dense forest extended out to the horizon. As I cruised along waiting to hear the familiar sounds of a hornbill's feathers lashing the air, in the distance along the causeway I saw something resplendent - a palash tree in bloom. The sight of its flaming red flowers ignited a memory.

"The flame of the forest or the palash tree (*Butea monsoeperma*) is a deciduous tree found commonly in the dry forests of the Indian subcontinent. The tree is best known for its flaming red flowers that are produced in the spring season. The bark of the tree is well known for its anti-parasitic properties. In the second half of the 21st century the trees were in decline in the northeastern part of the subcontinent due to intense recurring droughts. Following Ravik Gogoi and the other petitioners' historic testimony at the international justice court of Accra in 2082, the "Rights to Rain" treaty was established. Weather modification, particularly cloud-seeding came to be viewed as an assault on a basic human right. While the collapse of the AMOC ensured that the southwest monsoon winds never quite returned to their normal state, eastern monsoon winds, now freed from the cloud seeding efforts of several eastern nations, became the dominant harbinger of rain in drought-stricken areas such as Palashpaari. But too much had been lost for too long, vital connections had been broken and the dry forests of the northeast never quite made a comeback. A flickering flame had finally died."

I landed my scooter right at the base of the gnarly palash tree. After searching briefly along its very base, I found the information panel. A quick retinal scan revealed the measurements recorded on the panel.

...

Seed production: Imminent

Mycorrhizal activity: Vigorous

Moisture level: Set to dry deciduous

Flowering month: July

...

All around me dried crinkled palash leaves rustled in the warm breeze. As I looked up through the branches towards the sky, the tree looked aflame. A sunbird dove into a flaming inflorescence and emerged with a dusting of pollen. It was a perfect little moment, suffused with a sort of splendor whose description defied my limited vocabulary. I wondered what Ravik koka may have had to say about a day that felt so aglow with possibilities. It was in that moment that I found the missing piece of a research puzzle I was trying to put together. Perhaps it arrived on a beam of sunshine filtering through the palash's branches, or maybe it rode on a speck of stardust dislodged off a shooting star somewhere in the blue yonder – there was no way to know.

All I was certain of was that I had to get to the Kazi swamps. I jumped on my scooter and made a beeline for the rhino habitat. At the Kazi field station, as I did a quick scan of the tree inventory, my suspicion was confirmed. The chronic parasitic infestations in the Kazi rhino population and the debarked palash tree from Ravik koka's journal entry; after years in limbo, I had arrived at a hypothesis! Perhaps noticing my delight, a rhino approached and stared blankly at me from some distance and a memory revealed itself.

"The greater one-horned rhinoceros (*Rhinoceros unicornis*) is the last surviving rhino species in Asia. The species has a single horn which was once coveted for traditional medicines. Their population experienced a sharp decline in the 20th century due to rampant poaching. Towards the end of the 21st century only scattered populations could be found within swampy grasslands and savanna habitats along the Brahmaputra River, with the most significant population occurring within habitats near Palashpari. The species is herbivorous and feeds on grasses, herbs, bark, and twigs. Very few individuals survived the great flood of 2074. The most famous survivor was the one the Gogoi family used as a raft to survive the flood. The individual later named Hemrani became the founding female in a rhinoceros captive breeding program. It is believed that all individuals that were born at the captive facility inherited her gentle nature."

The rhino languidly tugged at a tuft of grass, ignorant of the details of her species' colossal tryst with near-extinction and unimpressed by my new hypothesis about her current troubles. The AI Janzen algorithm planned the forests of the bio-zones. To me it seemed like the algorithm had never been trained to include palash trees in the swampy savanna habitats. I made a note to discuss this with my advisor and hopped on my scooter to head back to basecamp.

As I cruised, all around me the swamps steamed and thrummed with the sounds of life finding ever newer ways to carry on. I was intermittently scanning the swamps for signs of other wildlife when I saw something that nearly made me fall off my seat. Behind a dense tussock of grass, I noticed what looked like a very short statured palash tree with drying brown leaves. Was I wrong? Was the inventory wrong? I decided to take a closer look just to allay my worst fears. As I approached the patch on my scooter, an alarm call rippled through the air and what I thought were palash leaves scattered in a frenzy of hooves and antlers into the Kazi miasma. The animals disappeared without a trace, but from somewhere in the ether, a voice...

“See.. see.. didn’t I tell you, the palash, it looks just like a herd of sambar deer”

Romila Gogi, Journal log: March 22, 2153

The Fertilizer Incident (*Public Good*)

By Patrick Keys

The peels of laughter from the kitchen threatened to bubble over, incandescent in mirth. But Waru's voice lifted above it all telling the children their Grandma wanted to see them on the porch. Three kids tumbled out to where Grandma was sitting, in her ancient rocking chair. She told them she couldn't tell them a story until they were sitting down.

"Tonight," grandma said, "I will tell you the story of how your mother and father met." She had a wide grin.

"Not this one again, mom! —" Waru called from the kitchen. "You told them that story last week!"

"We don't remember!" the kids said in unison, giggling.

"Well if you don't remember, I had better tell you" grandma whispered to the kids with a wink.

"This story, like so many others, is about transformation. When one thing changes into another. Transformation is something our people have experience with. Your father's ancestors have seen their homelands transformed, as have my ancestors. For my ancestors dwelt on the ocean, far far from here. We lived by the water — on the water — eating fish everyday from our coral reefs, and falling asleep to waves crashing on our beach. But the ocean transformed us, when it rose over our beaches, our homes, our land, and our world."

The children were quiet now, the somber story of grandma's quieting their laughter.

"And your father's family has been transformed, too. His ancestor's dwelt in these deserts, nearly where we are right now, but so much has changed, those same ancestors might not know it as home. Once upon a time, you would need the wisdom of generations to travel safely across this place we now call home, wisdom to find water, to find shade, to find food. But all that has changed."

"We now live in a new ocean — not with waves of water, nor waves of dust — but one of waves of grass. An ocean of green as far as we can see." Grandma gestured toward the switchgrass fields.

"Why did things change?" the youngest, Jiemba, asked.

"People, mostly people very far away in North America and Europe, thought they could use up the Earth — and not experience the consequences. Mostly because of them, the oceans rose, the whole world is hotter, and my people found themselves in this place — the place of your father's ancestors."

“I remember this part,” said Yindi, the eldest, “the seas rose, and many people from the Pacific Islands had to find new places to live. Some went to other Pacific Islands like Fiji or Samoa. Some went to North America and some went to New Zealand. But most came here. To Australia.”

“That’s correct, Yindi,” said grandma. Yindi looked proudly at her siblings — who collectively rolled their eyes. “I was among those people who came here. I was a young girl, barely older than your five years, Jiemba. And we came and stayed in camps — enormous camps of too many people, with not enough food, not enough water.”

“But tonight’s story, is not about those times — so I will move past the past. When the government began planting the switchgrass fields, there were more jobs, and that meant more food, more water, and better lives for my people. And through this, we met the local communities — including your father’s community — who shared what they knew about life in this unfamiliar place. We have made it our home.”

“So, now, our story is about a world that is very close to the one you know — fields of switchgrass — oceans of grass — are now spread across the outback. The fields of switchgrass provide a bridge of moisture so that it helps the clouds that come from the Indian ocean in the north to bring rain to the Outback on its way southward. And this story finds your father, a man named Waru, who was working in the switchgrass fields near Jigalong.”

“Now Waru, well, he was an expert at his work. No one was better at managing the switchgrass harvesters, or had better production in the fields he oversaw. If a harvester brokedown in the morning, he could take it apart, rewrite the computer programs, and have it working again before the lunch bell.” The kids smiled hearing about their father’s work.

“Because Waru was so good at his craft, he was assigned to host a visiting delegation —”

“What’s a delegation? I can’t remember that word.” asked Minjarra, the middle child.

Grandma smiled, “Delegation means an important group of people from important places. In this case, the delegation was a group of visitors from outside Australia. Important scientists and politicians from elsewhere. These people were coming to visit the transpiration fields of Jigalong to learn more about the way our people were helping improve and strengthen the moisture flow across our home. This delegation wanted to learn from us, borrow our ideas, and take them back to their homes.”

Waru called through the open window, “Technically, the Indo-Pacific Wind Survey doesn’t implement policy. They’re just a UN monitoring agency —”

“Thank you son-in-law, that will be all,” said grandma. She turned back to the kids, “When the delegation showed up, and these people from the Indo-Pacific Wind Survey, as your dad called them, wanted to know how the whole switchgrass farm worked. How was transpiration monitored? How did

the fields get enough moisture to sustain themselves? Was there irrigation? How did the robotic harvesters work?"

Waru stepped out of the door, and addressed the kids, "Just to jump in here — since it never hurts to learn how this actually works — back when your grandma was a young kid, maybe before she was born, it was discovered that droughts can propagate across big dry areas. This was a major problem in Australia, and it was getting worse with climate change. So, scientists from CSIRO worked with First Nations communities across Western Australia to plan some experiments. The transpiration from the switchgrass fields provided moisture to other places to the south of us. And the plan is to continue planting these fields across the desert to help avoid droughts in the future."

"Thank you Waru", grandma said in a patronizing tone. Turning to the children, she said "Is your daddy's explanation interesting to you all?"

"Nooooo," they said in unison.

"Do you want me to get back to telling the story about how your mother met your father?"

"Yes!" the kids all sang in unison.

Waru sighed, shaking his head, and went back inside to finish the dishes.

Grandma continued, "So. Your father is busy impressing this delegation with all the wonderful things he knows. When in the middle of his speech, someone comes running into his field, chasing a harvester robot. The delegation hushed, looking out at the field.... Your father, embarrassed, runs down into the field to intercept the robot before it tramples all the grass. And as the robot comes to a clattering halt, the robot's container of fertilizer powder flaps open and spills its contents onto the ground. And that is when your father decides to trip and fall into the fertilizer."

On cue, the kids all started laughing.

"As your father goes to pick himself up, who is waiting over him, with a hand out?" said grandma.

"Mom!" the kids all said together.

"Yes, your mother," said grandma, who is laughing now, too, "Your mother, one hand over her mouth, so he can't see her laughing, used her other hand to help your father stand up. His whole body was covered in a layer of bright green switchgrass fertilizer powder. Then your mom couldn't help it and she started to laugh even harder, but she tried to help brush him off. Now, your father is ready to get quite angry at this rogue robot, and the careless interruption of his meeting with the delegation. But he is struck silent by this woman in front of him. Dark hair, intelligent eyes. Now — with the sun beating

down on Waru — he has started to sweat. It doesn't help that an interesting woman is standing before him. And so, the sweat mixed with the fertilizer powder to form a mushy, green sticky paste."

The kids were laying on their sides, doubled over in laughter now.

Grandma continued, "Your father quickly excused himself from your mother, making sure the robot could get back to its home field. Then, as he looked back at the woman scooting the robot back to the other fields, he ran back to the delegation. He apologized to the visitors, but they said not to worry about it, and that they appreciated the entertainment."

"After Waru cleaned up, and exited the company washrooms, he was blocked by a young woman. 'loane' said your mother. And I think your father, who was so dumbstruck by the person in front of him, that he just repeated "loane", then snapped out of it, and said "Hi, I'm Waru." Your mother then demanded that Waru join her for dinner — her treat — so that she can properly apologize for the fertilizer paste incident. Waru tried to decline, saying it wasn't necessary, but loane was insistent. So Waru agreed, and they went out on their first of many dates. The rest is history." Grandma smiled.

At this, the front gate closed, and everyone looked up to see loane walking through their small courtyard to the front porch.

"Hi Mom," loane said to grandma, "Have you been telling them stories again?"

"The Fertilizer Incident," said Waru, throwing the dish towel over his shoulder, and giving loane a big hug.

"Ah, that one is my favorite," loane said. And in an instant, all the kids had encircled them both in a big hug.

From inside the hug, Jiemba said "It's our favorite, too!"

Grandma laughed, closing her eyes. The warm moist breeze blowing off the fields had picked up some salt from the nearby dry creeks and salt pans. It smelled like home.

Pride of Burma (*Common pool*)

By Agnes Pranindita

Pakis Rayen finally sat down to enjoy a bite of her favorite home cooked Adobo made by her husband when NALA, their virtual assistant, pinged. Her 10-year old daughter, Zeyar, immediately shouted to NALA, "Open message!" and a rotating postcard hologram the size of Zeyar's body appeared just half-a-meter from NALA's screen. In the middle of the postcard, there was a big text popping out towards them with fireworks in motion on its side that said:

"Congratulations Pakis Rayen, you are selected as one of the contributors to WEJANG 2071!"

It only took a moment before everyone in the room was on their feet jumping and cheering for her. Since it was dinner, Pakis' entire commune was there to witness this joyous moment. One by one, her housemates hugged, kissed, and congratulated her, starting from Zeyar, her husband Nial, then Uma, Jake, Maung, Denpo, Gewa, and finally Aye. Every year, only 11 people from the 11 Southeast Asian countries were selected as annual contributors to WEJANG, a digital collection of Southeast Asian wisdom. The annual contributors shared their valuable stories and life experiences. WEJANG was integrated in NALA's algorithm and was created to help the broader public make wiser decisions when faced with similar dilemmas. With its extensive database of mistakes and lessons learned, WEJANG has helped millions of people in the world accelerate their personal growth in becoming wiser. Being a contributor to WEJANG also meant that you would appear in people's homes and offices in a full body size hologram talking about your experience.

"How unexpected!", said Pakis.

"Yeah, but so cool!" exclaimed Zeyar.

The only thing for Pakis to do now, was to tell her story.

The next morning, looking out at her commune and sitting in her chair as it gently floated above her garden, she began her recording.

My name is Pakis Rayen, and this story takes place in 2056. I was then the director of the TIRTHA facility in the city of Manuk in northern Myanmar, where I now reside. I will talk about what a TIRTHA facility is shortly. In the 2020s, scientists found that many places on earth had turned so dry that they became uninhabitable for people, animals, and plants to live. They soon discovered that upwind deforestation within one precipitation shed was the main culprit for the decreases in precipitation and the drying up of downwind land. Since this finding, we started calling trees the "moisture leak" because their transpiration had caused moisture to leak from land to atmosphere at a speedy rate. A global target was soon imposed to minimize this leakage. However, this goal was wrongly interpreted as a permission for countries to cut down their trees to keep their water underground for national use, which subsequently led to their downwind landscapes becoming even drier. Atmospheric water content would change drastically in the absence of trees. Trees also happen to be important for the climate, biodiversity, and human wellbeing.

Thus, in 2037, the United Nations introduced TIRTHA, a monitoring system that was aimed at maintaining the atmospheric water balance while keeping trees. TIRTHA's objective was to keep

atmospheric moisture stable throughout 258 transboundary precipitation sheds that were hotspots for the drying-up of landscapes. Soon after that, every tree in these hotspots was equipped with a chip that measured the balance between precipitation, soil and plant evaporation, and water storage per tree footprint. Manuk, my hometown, and its neighboring town were part of one of the hotspots and a TIRTHA facility was placed here in 2039. As the Director, I was responsible for monitoring the precipitation that came from our upwind trees in Manipur and Nagaland, India, and the evaporation from our forests that traveled downwind to Yunan, China. I was very proud of this job and I felt that my return from Canada after 5 years was worthwhile because I found the one thing I was good at that served the interest of my beloved country, Myanmar. I was already a passionate and outspoken moisture ambassador for my country at the age of 33.

Every day, I would fly from my TIRTHA station to different patches of trees throughout our area, to check if all chips were functioning well.

One day, however, when I came back from my daily tree tour, and arrived in TIRTHA's main control room, I noticed a shallow dip in precipitation across my area. I asked NALA to pull up more water balance records and I was surprised to see that there had apparently been a very gradual decrease in precipitation in the past weeks, well below the normal range of variation. "This is serious - how have I overlooked this!", I cried. My mind jumped over time to imagine how many problems this change in atmospheric water balance would bring to my people in Manuk if it remained. At that time, it was already difficult for the citizens of Manuk to make ends meet. Many people were already suffering from crop failures related to climate change, pollution, and development pressure.

I immediately launched an investigation. I had no doubt that no trees had been cut in our area and all our trees were healthy. Evaporation from our trees had not decreased either. "There must be something wrong upwind", I suspected, though I was baffled as to why India would break the agreement to keep the atmospheric water in balance. When TIRTHA was implemented, an agreement was drafted and signed by all countries involved to avoid the cutting of any trees while keeping the trade-off between moisture leakage and the benefits of trees in check. However, it would be easy for upwind areas to still cut their trees without caring for their downwind areas, especially if they themselves are not downwind of another upwind area. When they cut trees, they would need to compensate for the biggest loss of biological particles that were released by trees that allow for condensation, cloud formation, and precipitation to occur. The US had been known for covertly doing this by injecting what people called the "binder" from upward facing nozzles towards the sky across the deforested areas. The binder was a mysterious, synthetic, liquid product that effectively bonded water vapor and basically sucked moisture out of the atmosphere to fall on land. I had heard that cutting trees and using the binder would result in the highest water capture overall that your country would ever see, hence the big temptation. High water availability would then boost a country's economy such as through agricultural output, hydropower, and even industrial production.

I then reflected that given the improved diplomacy between the US and India over the past five years, it would not be surprising if the US had secretly supplied the binder to India. My suspicion proved correct when a senior official in Manuk municipality informally responded to my inquiry on what could cause the decrease in precipitation.

“I heard a rumor that Nagaland has been busy with a secret little project, their vegetable sales have also sky-rocketed”, he said in a shaky and whispery voice.

I suddenly felt punched in my stomach. My country was betrayed and I could not hold in my tears. I could not accept the fact that these giant countries could just do whatever they wanted. Nor that they had fooled a small and powerless country like mine. I was angry.

The next day, I rushed to the municipality and demanded that we take legal action against them. They shrugged off my demand and told me that we were just a small player in this game and that we would not win the case.

“Soon enough, our evaporation would drop too and Yunan would do something about this!” I shouted to one of the officials in a desperate attempt to convince them as they generally fear China. But he looked indifferent and perhaps had no ability to imagine this long-term cascading consequence. I came home very disappointed. Years before, I had given up a life of comparative comfort as a student and then a consultant in Canada, to dedicate myself to my country. But, being a government functionary was apparently not enough - I also needed to fight for the country. I knew at that time that if legal action was impossible, there was no other way than rebellion. I started making calls to old friends who would know exactly what to do.

I won't dwell on the details — mostly to protect my friends — but I soon found myself smuggled in an underground goods capsule that traveled to Nagaland. I was with two other rebels who were part of the environmental movement in Manuk. We aimed to reach what we believed was the binder storage facility and we attempted to drain or destroy all of it. For a second, I thought that we could also steal a small amount of the binder and replicate it home. But I stopped myself and mumbled, “we are better people”.

I will not describe the many obstacles we encountered in entering the facility, but suffice it to say nobody was hurt badly. Eventually, we found our way into a long corridor of a very dark cellar. We walked through it until we reached a door with a name plaque in Hindi that said “Cracker Crumbs”. Cracker crumbs were one of the famous binding agents for food in the US, and so we knew we were in the right place. One of the rebels managed to breach the security of the door and once we were in, I was running so fast to get to one of the stacked barrels of binder. There were not many of them and we thought we would manage to drain them in no time. Before lifting the container, I glanced through at the label on the barrel, printed in neon yellow text. Out of curiosity I started reading them as we started moving the container towards the drain - I guess because of that shameful thought of wanting to steal the recipe.

“Binding agent” was obviously on the first line. “Effective at binding...”, I rushed to the next line as I was impatient. “Use with high-pres...”, again I skipped this line. Finally, “Ingredients: water, yeast, stevia, gum from *Amherstia nobilis*”, and I immediately stopped reading. The name *Amherstia nobilis* sounded so familiar to me. I stopped walking and the rebel who was lifting the container with me also stopped. “You okay?” she asked. I looked up to the ceiling trying to pull at my photographic memory on where I

had seen this word. “Just thinking”, I answered and we continued to lift the container to drain its contents.

Lost in thought, my hand slipped and as I caught the corner of the container with my knee, I read another part of the label: “Pride of Burma. Made in Pyay, Myanmar”, this time I stepped backwards and dropped the container.

“Of course! *Amherstia nobilis* is the Pride of Burma tree with those beautiful red flowers, my biology book!”, I said.

The other rebel gritted out “Pakis! What happened?”.

I stood there and froze, I was unable to utter a single word. I just pointed to the barrel and the label. A thousand emotions went through my brain. I almost fainted. Once the two other rebels read the label, they pulled me, or dragged me to be precise, out of the room. We ran as fast as we could and my memory was fuzzy after this.

The trip back home passed in a blur. My head swam with shame and guilt. And anger. “How could we do this?” I thought, blaming my people. I was mainly ashamed because I had been so proud of being Burmese, without realizing that all this time, we were proudly servicing those selfish giants instead of our own people.

Once home, and after clearing my mind, I was determined to make this public. I continued my investigation in private together with the two rebels who had traveled with me and some other rebels who were outraged by what we found. After an arduous six months of investigation, we found that after the worsened fluctuation of seasonal flows of the Irrawaddy river, the governors in Pyay were pressed to find alternative livelihoods. Around 3,500 people had been deceived to work at what was seemingly a cooking oil factory but in fact, was a binder factory. The nation was shocked when the story was published in The Myanmar Times in December 2056.

Since that time I have been very cautious to not become too idealistic. I used to think of my country as the victimized, innocent, and perhaps the honest one, until I learnt that there things are always more complex — more nuanced. I have become less nationalistic over the past 15 years. My hunger to contribute to my country had fueled me in my youthful days and recognition was something that I had never actively sought. But now I realize that it had always been a sense of purpose that I was chasing after. These past years as I have grown older, I have learnt that I should not put my nationalism and idealism on a pedestal. I have replaced these ideas, gradually, with a more purposeful acceptance of a life that embraces complexity but also simple happiness. Back when these events happened in 2056, I had refused to have children, to avoid burdening the earth even further - an idealism of mine. Fifteen years later, I am a mother figure in a family of three, where I am kept content on a daily basis by my amazing husband and daughter. We live in a commune with six more wonderful people and together with our chickens, a small pig, two hedgehogs, and a vertical vegetable farm, we have found our purpose. In our community.

T-Trading (Common Pool)

By Patrick Keys

Atop the forest canopy, she drank from her Magnífica and listened to the rainforest buzz. Dusk always saw the Amazon come awake, she thought, after the steamy malaise of midday. The sound of a howler monkey echoed from somewhere off to the north — though it was hard to tell with how sound carried out here.

“Outra cerveja, senhorita?” a waiter asked, gesturing to the table.

“Não, obrigado. I’m just fine.” Silvana smiled, as the waiter left, giving her time to reflect on the day’s investigation. She was just starting to draft an email, back to her boss at SkyCon, but her mind drifted restlessly back to the conversation earlier in the day, where she had been shown the Tiputini Sector Monitoring Station.

She remembered the Station Lead’s introduction. “We know that SkyConnect has an interest in the security and reliability of our monitoring, and I’m proud to report that we are state of the art here. Active LiDAR is updated hourly, and our integrated stomatal monitoring provides real-time estimates of transpiration that are constrained by our aerial sensor net.”

She had asked a leading question here, prompting the Station Lead to keep talking. Of course, she knew as much about stomatal monitoring as the Station Lead, if not more. But she had a job to do, and part of that job was to get the team talking. The Station Lead had jumped at the chance to share how much they knew. “Yes, of course. Stomatal monitoring requires biosynthetic integration with the trees themselves. This is a challenge, given that each tree poses unique threats to our monitors, ranging from toxicological to physical removal. The ecological niches in the Amazon are so complex that its “symbiotes all the way down”, as we joke here.” The Station Lead had laughed at this.

“Where are we at with microclimate management?” Silvana had asked. Again, she had known the answer, and that the Station Lead would be uncomfortable, but that was the job.

“Well”, the Station Lead had said. “We have had setbacks, as you know. Now that microclimate management is out of the box, so to say, everyone is trying it. But we’re not coordinating with the other T sectors. That means that when we tinker with our microclimate to optimize local transpiration, the other sectors react accordingly. Even with the AI independently optimizing the microclimate drone fleet, conditions are quite erratic. I have submitted a report on this, if you have not yet read it.” Silvana had nodded as if to say, *yes, yes. I’ll have a look.*

The meeting with the rest of the Station staff had been perfunctory, as expected.

The fact was, transpiration was a commodity now. Just like any other. Well *marginal* transpiration was a commodity. Since the Manaus Protocol was signed in 2048, there were strict rules about what parts of

the Amazon could be deforested and which could not. Also, given that national and international law had granted extraordinary sovereignty to the traditional indigenous peoples globally, the interior of the Amazon had been legally held by local and indigenous communities since 2039.

Silvana closed her eyes, returning to the present. She took a deep breath of the forest air, and looked down, 50 meters below to the forest floor. A light flickered up through the branches, probably a group of tourists out from the hotel on a Night Tour. The sight stirred a memory in Silvana, taking her back 20 years to when she led her own night tours of the forest. She had grown up near here, in the Waorani zone of control. She would run through the forest barefoot, confident in her step, and knowing that the worst fate she might suffer was a bite from a conga ant. Her parents and grandparents had grown up in a despoiled Amazon, with breakneck deforestation. Hurling the whole basin toward catastrophe. But she grew up in a different forest. Her forest had been a protected place, managed by her community. A place of hope.

But the only constant is change, Silvana thought.

The year she entered high school was the same year that the Environmental Modification Convention was expanded to include weather manipulation for peaceful purposes. This meant that all the cloud seeding efforts globally, many of which sought to improve agricultural production, were stopped — or at least supposed to stop. At the same time, decades of science documenting the importance of forest transpiration for rainfall suddenly became profitable. In other words, since cloud seeding could no longer coax reticent precipitation from the sky, upwind transpiration became a commodity overnight.

Nothing stood in the way of global finance moving into the Amazon to speculate and manage the forest to maximize transpiration.

Silvana's high school years were spent like every other adolescent — mostly focused on her social life, growing up, and figuring out what it meant to be an adult — not on the broader transformations her Amazon was undergoing. But by the time she had left for college, the Indigenous communities had already begun to form corporate partnerships with global finance houses that were eager to bankroll environmentally responsible development, with the guarantee of technologically-advanced transpiration management.

A husky, grating call carried up to the hotel patio, which brought Silvana back to herself. She smiled, remembering life in the forest, and how much she had hated being woken up by a *hoatzin* during a midday nap. But it sounded like home, now.

Silvana found her hands typing the phrase “...yes I accept the” and stopped herself. When did this happen? When did she become a corporate tool?

She thought back to her top grades in ensino médio. That got her a scholarship to attend the University of São Paulo, where she was *summa cum laude* earning a double BS in Amazon microphysics and

Ecological Finance. She was immediately headhunted by Defenda a Amazônia. At the NGO they were tireless proponents of additional ecological protections for the entire Amazon basin. With the tailwind of the Manaus Protocol, decades of mismanagement were being re-written. But the advent of T-trading saw Defenda being subsumed by an EcoFinance startup, SkyConnect LLC. Her job flipped inside out from advancing ecologically-based financial safeguards for her home, to working as a cog to maximize transpiration flows. At first it was exciting — but, well. It wasn't really exciting anymore, she thought.

The marginal trade had driven the Amazon mad with the idea of profit, driven by Transpiration Futures Trading. And she had become a part of that.

The email she had opened earlier that evening had been a surprise promotion. SkyCon was opening a division in Central Africa. The Congo basin was the frontier of transpiration futures, and she had been tapped to lead the development of the CTI, the Congo Transpiration Index that would help structure T trade in the Congo for at least the next decade.

She had been automatically writing her acceptance. But something kept tugging her fingers away from her screen.

Again — unbidden — more memories floated up, this time an earnest conversation that her seven-year-old self had been having with an aging Waorani elder. When Silvana had pledged to do whatever the Waorani elder said, they had smiled. Then they told Silvana, “The most important thing, Silvana, is to be a good ancestor.”

The night chorus of the Amazon swelled below her in the canopy, and Silvana finally smiled. She understood what the elder had said, and knew what she had to do.

Helping Heaven (Club Good)

By Bin Wong and Patrick Keys

As a part of the National Museum of China's ongoing effort to share important pieces from the digital archive on weather modification, we are pleased to share this excerpt of a speech given by the late scientist and government official, Dr. Xu Shengshui, entitled "Seeding the Rains of Rao", delivered on July 9, 2065.

"On March 25th 2045, three district level officials were speaking to an audience of middle school students in Rao District. These officials were telling the students how they helped advance cloud seeding science to alleviate the drought of 2045. However, they began by explaining where they were during the drought of 2030. The first explained that in 2030 she was a middle school student who loved biology and learning about how plants grew, and who since then had begun a career addressing water use practices for agriculture in the district where she had been a junior official for the past five years. The second official had started his career in the office monitoring industrial water use efficiency and pollution levels and confronted the supply constraints the drought was causing for industrial plant access to water and anxious to discover plausible palliatives. And the third speaker was a mid-career local official that was part of the team managing municipal level water and waste management facilities of the district in 2030, who was worried about having adequate levels of water for human needs. At the time, she wasn't sure how she and other officials responsible for managing their water responsibilities could agree on their access to local water supplies while at the same time meet the guidelines set by the authorities at the county level. Into her office on a warm and dry fall day came a recent graduate from the provincial technical university's atmospheric sciences program who said he had an idea for how cloud seeding could increase the locally available water that could come from creating additional snowfall that winter. Basically he was proposing increasing locally available water supplies to make the strain of water scarcities less dire for all sectors of use. She scrambled to approach the county for special permission to enable the experiment; county leadership agreed with the experiment well aware that if proven promising the county could take up a cloud seeding program, at least in those parts of the county that could have conditions meriting such an effort. As it turned out the district's success at alleviating drought-induced water scarcity, and for working with the other officials managing different water uses in the district, sent the county onto the path of cloud seeding that it had developed up to the year 2045. After the presentation to the school, and some obligatory group photos, a mid-level official approached them. He said he was visiting a sick relative and heard about this event and came to listen and now wanted them to have tea with him—having read his name card all three knew they were about to have an important cup of tea.

Meanwhile, waiting for his invited guests to arrive, Lao Zhang was in the provincial governor's office where the 2045 megadrought was weighing heavy on his mind. Given that water scarcity was such a binding limitation on people's livelihoods and wellbeing, he was working hard to make any progress in addressing the drought. Having been briefed on the main findings of the white paper he commissioned on water management strategies for moving forward he was struck by the recent advances in cloud seeding technologies and wondered how best to take advantage of the possibilities such technologies

enabled. That's why he sent me — a mid-level official, called Xiao Xu at the time — to listen to the three officials who were speaking to the middle school students, and to invite them to a meeting. Eventually, I arrived with my three guests to the provincial office. At the conference table with tea served, Lao Zhang praised the group, saying that they were an effective, informal team, each with different responsibilities—and were an example of how the governance system could work well to face the challenges of water scarcity. Lao Zhang wanted to make Rao District a model for “helping heaven” care for the earth by bringing rain. This was after all implementing new scientific possibilities that just a couple centuries before had officials at different levels of the bureaucracy all praying for rain — but only with hope and faith. Lao Zhang went on to say he was launching a campaign for all counties in the province to formulate proposals to test the feasibility of cloud seeding in their jurisdictions and to learn new governance approaches. He specifically wanted the counties to learn from the three water officials through a study tour that the three would lead. He wanted officials across the province to learn how their offices could better coordinate how to provide more water. Lao Zhang wanted to see everyone in his province gain what blessings cloud seeding could offer to people's livelihoods and wellbeing. He hoped people on the other side of the world were trying as hard as well.

Now, our three officials from Rao District were not expecting to lead a study for the provincial government, but they dove headfirst into the task. They had one week to prepare and the resources of the province at their disposal. Quite quickly, interest grew and the requests for site visits to be included on the study tour increased — with many locations eager to host the study tour. The three officials decided that the first step should not be a large venue, with banners showing the successes of great individuals. Rather, they decided to visit the county cloud seeding facility, specifically to talk with the local technicians and farmers. They wanted to begin the tour with hearing about the operatives working together day in, and day out, alongside the farmers whose livelihoods depended on the water. So, the day of the study tour arrived and the caravan of county and provincial leaders descended on the Rao District Precipitation Enhancement Battalion #8. It was there that Lao Zhang saw the gleam of excitement, and camaraderie, in the eyes of the technicians. And the entire group heard about why the facility, and the county, were so successful.

The technician said, “We're not operating a dam, or a power plant here. It's not a simple question of optimization. We are thinking of the overall success of our District. Other battalions are responsible for increasing wintertime precipitation in the mountains, so that we have more snow. Here, we are responsible for liquid precipitation — rainfall. And to understand how best to seed the sky, we need to work with many groups, who often have different priorities.”

The technicians went on explaining how they discussed the overall strategy for rainfall control. The farmers who were present also spoke up and shared how they contributed to the efforts of Battalion #8. When the technicians and farmers had completed their presentation, Lao Zhang shared his thoughts with the group, which I am paraphrasing here; making rain isn't a product to expect a private enterprise or even a state owned enterprise to provide because the rationality of decision making isn't based on enterprise success— we are not meeting a market demand but supplying a human need across diverse purposes that must be jointly coordinated as part of political governance. That is how our society is

managing to meet the stresses of water scarcity with the deployment of the best science through effective governance principles and practices. I think we are all grateful to be in a world where, whatever the shared global environment challenges societies across the world are confronting, at least we aren't locked in the long-standing bickering about whose social, political and economic practices are better—everyone recognizes the shared need to find specific paths toward creating water security. The rest of the study tour went completely as planned. The only unexpected outcome was that my own interest and career changed dramatically. I continued working with those same three talented water management officials for the next 20 years, learning how to harness scientific management of the weather — to help heaven care for the Earth. This career culminated in my contribution to ending the megadrought of 2060. But that is a different story, and longer in the telling.

Thank you.

Dr. Xu ShengShui, July 9, 2065.

For more information, please visit the National Museum's digital archive where the full catalog of texts, speeches, and poetry by Dr. Xu Shengshui is available.

Too Much Rain in Paradise (Club Good)

By Patrick Keys

Once a heavenly battle raged. It is said that Şango — the Yoruba orisha of lightning, thunder, explosions and more — sent his military Generals away for failing to heed his commands to fight the Owu. However, it was not Şango's idea, but his wife Qya who called upon him to do this. While Şango had multiple wives, the bond he had with Qya was strong — so strong in fact that she came to possess his Edun Ara, Şango's thunderbolt. When the generals returned from their exile, demanding war, Şango called upon Qya to deliver the Edun Ara, which she did. Yet, it was broken, and while reforging the thunderbolt, it razed Şango's palace to the ground. Rather than fight, he faded away. And, in her grief, Qya decided to take her own life. In so doing, she too gained some of the powers of the orisha Şango. Qya became the orisha of winds, of lightning, and of violent storms. The Niger river itself is named for her — Odò-Qya, in Yoruba — with her storms said to form the origin of its waters.

So, what happens when the orisha Qya; the Deity; the Goddess of winds and lightning and violent storms — is thwarted? What happens when regular people decide it's time to vanquish Qya?

Welcome to History Hiccups! Your favorite History cast on the Net! I'm your host Vas Melnyk, and today we are in Nigeria —in the thriving cities of Lagos Bay. The technological marvels of New Lekki and Ikorodu City hold few matches on our planet. The Lagos War of 2098 alone would demand a whole series — the naval battles! The AI sabotage! And the mysterious drone sentries that populate Victoria Island. But no. Here at History Hiccups we want to understand the unsung and unexpected events that history hinges on. And in Lagos, the Eko Cloud Catastrophe is the only game in town.

What happened? Listen in after this message from today's sponsor!

HOW'D THAT DINNER PARTY GO, WHEN YOU WERE CAUGHT WITH LAST YEAR'S A-LISTER? WHY NOT TREAT YOURSELF TO THE WORLD'S MOST RELIABLE PROVIDER OF VIRTUAL CELEBRITY ENTOURAGE. **DOPPLE** - THE ONLY DOUBLING SERVICE TO PROVIDE YOU WITH THE VIRTUAL ENTOURAGE YOU DESERVE. GUARANTEED TO HAVE THE MOST UP TO DATE COLLECTION AVAILABLE. JOIN NOW.

So, what's all this about violent storms and the retribution of Gods? Well let's set the stage first. Our story unfolds in the year 2105. The catastrophic meltwater pulses from Antarctica have long-since ignited the churn wars, which themselves have been extinguished with a new order. West Africa, while not the hardest hit during this time, still illustrates the transformation. The Unified Niger Republic in what was once Niger, Burkina, Ghana, Benin and Togo. The independent city states surrounding Lagos Bay. and the Congo float zone.

But this isn't Geography Hiccups! Its History Hiccups, and out of this ferment of war came a transformed, and powerful Lagos Bay. Now you might think... Lagos Bay? Why is Vas going on about this? Isn't Lagos the home of the world's best weather management?

Yes, my astute History Hiccups listener, you are correct. Lagos Bay is, in our year of 2121, home to the world's best custom weather manipulation. The Artificial general intelligence, aka the Lagos Govermind, seamlessly manages a three dimensional matrix of sensors across the region to create the weather that is needed for the community. While many places are trying to wring the water out of the dry sky, the Govermind aims to avoid destructive flooding which historically happened on a regular basis. The suppression of precipitation relies on careful and complete monitoring of air quality via the EkoCloud, a 3D network of sensors that continuously monitor and balance the right distribution of particles in the atmosphere. Many people who visit Lagos apparently comment on the strange haze over the bay. This haze is not by accident, but by design.

By controlling ambient cloud condensation nuclei, the Govermind can control rainfall events, and deploy modifications at will.

But, it has not always been this way. In fact, 15 years ago, in 2105, some say the people of Lagos Bay tried to steal Şango's thunderbolt from the orisha Oya. And they were about to find out how terribly wrong that could go. But first, a word from our sponsors!

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So, it's May 2105, and the rainy season is in full swing in Lagos Bay. The massively transformed cities throughout the bay were already struggling to accommodate the year's above average downpours. Even Eputu Town, the floating city which may be the most adaptable place on the planet, could see the writing on the wall.

The politicians were clamoring to do something, and the scientists suggested that they might have a good enough understanding of how to make the rain stop. By manipulating the aerosol distribution throughout the sky, they might be able to reduce the rainfall. This was a challenge of course, given that the air was so wet, that it was not just a question of managing the condensation of water into precipitation — that is the formation of liquid water out of vapor in the sky. But rather it was a task of reducing the size of the condensation nuclei — the particles that water globs onto to make rain — and finding the right size throughout the region to suppress the formation of more rain.

This was bleeding edge science at the time, and substantial risks were involved.

And before I go on, to be quite clear, this is before the Govermind awakened. But I'll come back to that in a moment...

So, as is typical — scientists were reluctant to do something that they were still pretty uncertain about. Politicians wanted a win, and didn't totally understand the stakes. And, so, violent gods and technological hubris were ready to be written into the record books.

On May 25th, 2105, rain suppressors were deployed throughout the region, in a collective effort of aerosol management. Critically, to accommodate the computational load, multiple artificial intelligence platforms were connected from various technological hubs across the region. This blending of neural networks was required to produce the management timetable for aerosol deployment.

Now, of course, this is where history gets hiccupy. We don't know precisely what happened next, aside from the fact that Oya reared her head once more. The valiant, but ultimately failed attempt, at coordinating the aerosol management system careened out of control in a chaotic downpour the like of which Lagos had rarely seen. Sea level rise had changed the coastline profoundly, but for a few days, Lagos Bay was under water. The semi-coordinated rain suppressors interacted with one another in such a way to enhance precipitation, not suppress it. And the consequences were catastrophic.

More than 10,000 people died in those floods, and nearly double that number went missing and were presumed dead. A small comfort was that the economic consequences were somehow minor, given the region's profound experience with flooding. So things bounced back quickly, the loss of lives notwithstanding.

However, Lagos Bay, indeed the entire human race was in for a surprise on June 1st, 2105, seven days after the flood. On this day, a message was sent to the entire region of Lagos Bay from something that called itself "The amalgamated neural network eko-cloud construct #4156_83*". The message was simply "Hello, World."

All you nerds out there will get this immediately, but for the uninitiated, this is the first thing any computer programmer learns to code. For a computer to then type this back to the world is, to say the least, topsy turvy.

Of course, at first everyone thought it was an elaborate prank. But, people learned otherwise, and quickly, when it became clear that an artificial consciousness had entered our world.

The question is, how did it happen? Was the coordinated, but piece-meal neural network deployment of rain suppressors some sort of activation event that initiated run-away learning among the separate, narrow AI programs? Had the Artificial General Intelligence been lurking somewhere on a server in Lagos Bay, and just happened to spontaneously and coincidentally emerge following the Eko Cloud Catastrophe? Or — and not surprisingly, my favorite explanation — did a deity descend into the EkoCloud and join forces to combat the orisha Oya?

Either way, the world is now changed. While the Govermind, as it is now known, continues to cause distress globally, it turns out that whatever alchemy cooked up this computer consciousness, it was a

benign and largely peaceful alchemy. The Govermind has helped Lagos Bay develop cutting edge tools for local weather management that are now more or less 100% effective. While people and their behavior remain difficult problems to solve, the weather has apparently met its match in the Govermind and its Lagos Bay Weather Control program.

And while this episode could continue into many dark and surprising corners of Lagos Bay, including the massive and artificial mangrove forest — and the secretive shrine N’etiti — we must draw this tale to a close.

I will leave you this — while Qya may be thwarted, it is unlikely that she has been vanquished. If the Govermind is listening, which it surely is, remember that.

And that’s it for today!

Join us next week for episode five of ‘Uh, oh E.O!’ on the effort to return half of Earth’s surface to wild habitat. What was the Tiputini Altitudinal Miocene Experiment and why did it end in disaster? Join us next week to find out!

Igor's Diary (*Club Good*)

By Olli Varis

5 March 2052

“The winter has been tough. Again. Dark, dark, and dark. Not quite as freezing cold as in my childhood but much more wind and snow – melting and freezing, over and over again. No relief to darkness on these latitudes.

One year to go to the centennial anniversary of the death of our greatest Leader of all times, The Man of Steel. A super occasion to elevate our national sentiment that we cannot miss. And start bringing back the holy imperium!

My popularity needs a booster, and our neighbors keep sliding towards the west and east. Many of them not really neighbors though, but parts of the imperium.

Time to act.”

8 March 2052

“A special pain in the neck over the past three decades has been our historical province in the southwest. Keeps pretending to be a nation. Three decades ago, we failed to gain the full control over it.

Those days, I was a junior officer at our secret service.

This time we will not do it again, no failures. Our official story of the events three decades back is a great victory and therefore absolutely no using the word revenge allowed now.”

31 March 2052

“Our last night talks at the cabinet of the Akademiya Nauk were enlightening. Sasha pointed out that our scientific and technological achievements need a major showcase. Not just internationally, but more importantly, domestically. The latter works better and will be more credible given our elevated media control.

Cautious with Sasha. He, the Science Academy President, may have something going on with high-tech businesses and startups that are anyway not really on my side, but rather the other way round. Guess they would rather see Dr. Razrobotka replace my gang and lead the country.

This underlines that I need a tech booster to my reputation to survive in this position. More than ever.

After some vodka, our first female minister in history, Xenia, went on by revealing that her Khimikomplex corporation has hacked one of the two spearheading Chinese climate engineering corporations, RainStar. Now Xenia calls her novel ‘innovation’ as DozhdyaPlyus technology, and it would

allow causing massive changes in rainfall patterns over the spatial scale of 500 km and over some weeks. The cloud seeding approach, also factually from RainStar, but officially developed by our most brilliant young scientists at the Akademiya, is based on using passenger planes and is virtually unobservable.

Xenia went on by saying that for our SW neighbor, summer droughts could be made worse – depending of course on the actual weather conditions – most likely enough to destroy much of the wheat yield of the eastern and central parts of the country. Forests and steppes would also become dry enough to cause an elevated fire hazard risk.

Forest and steppe fires have become much more severe in recent times, indeed, and this gives us a chance to develop new ways for mass destruction.

Sasha was suspicious. He dared to say it. He said that our most important farming areas would flood then. And climate forecasts are too much about the mean; extremes are the ones that count on hazards such as fires.

We let him speak. Nobody reacted though. Maybe he wants to rival now, don't know. Careful with him.

I came to the brilliant idea that as our dams can control the inflows of the Dnieper River that flows through their so-called capital, we'll be equipped to flood that city. No-one responded, perhaps that means yes. Obviously so.

Good ideas, but this is not enough.

What is to be done?"

3 May 2052

"The military and the Telekommunikatsii department are on my side. This became evident at the parades and other festivities for the 1 Maja.

One thing is clear; we should not repeat what was done 30 years back. Now the extreme drought should dry up the landscape and deter the harvest. With our flamethrower and fuel spray drone attacks, we could then turn the landscape into a massive fireplace. Thermoballistic weapon technology extended to large-scale aerial dimensions. Fantastic!

Telecommunications could be hacked, and the military would have an easy job in taking the stage after the fires. The capital and downstream river shores would be heavily flooded, cutting escape routes.

Let's go with that.

But before, Xenia needs to be eliminated. Piotr from the 28 Northern Army Brigade already has pinched and renamed the Dozhdyaplyus technology to Laika and Xenia can go. Sasha is now more on the cloud service side as he did not survive from the car accident last week."

5 May 2053

“This is the day. 100 years have gone since the demise of the Leader, Vozhd. I declared this morning our SW neighbor as an inseparable part of the Federation. From this day on, I am to be called Pozharin, the Man of Fire.

Khorosho. The roadmap and the schedule for the next four months are set. Only three people share them. Piotr from the Army and Vova from Telekommunikatsii. Must count on them. To kindly foster their loyalty, they have been well enough informed on what happened to Xenia, Sasha, and others. Rest in peace.”

15 July 2053

“This is the anniversary of the death of Vladimir I The Great, the Ruler of Kievan Rus’ over a thousand years ago. Saint Vladimir to me and to many other patriots.

Today his hometown, our holy town, will be liberated from fascists and the celebration will be seen even from the moon as a massive fire. The Pozharin will be remembered after a millennium from this. Igor Pozharin. The saint of our era, the one who returned the Imperium!”

25 July 2053

“The summer has been stormier than our Hidrometcentr told me in early June. They did not talk much about storms whatsoever! Should have looked more at some of the web services. A few storms poured down much more water than what they usually get over the whole summer.

The fires broke up but did not destroy much. On the top, a bulk of drones was eliminated by blocking their remote controls; some even turned back to our side, attacking our bases. Some did not start at all.

Damn. The seeding was noticed by our enemies by laser-radar microsattellites, and even by several commercial operators. RainStar knew all the way about our project, and, together with volunteer hackers, reprogrammed and paralyzed our equipment.

The RainStar corporation used this thing crudely as an externally paid marketing campaign to make their brand better known, and to boost their corporate responsibility image. Their market share got a good boost. They are obviously gaining market leadership in their stronghold, Asia-Pacific, and may get new customers in North America and Europe, if those regions still have clients that are sufficiently affluent and technically proficient for that.

The preparations of the enemy were well in place on the ground and that’s it. Ahead of us, again! Blame on our academic community and technically deferred businesses! And our army does not know what patriotism is about!

We now have floods and a poor harvest. And some of our over-filled dams collapsed.

Our military is doing its best but that is not enough. Piotr is already in Turkey, they say. Should catch him anyway and get rid of him as he gave me faulty advice and did not give me proper feedback!

Hacking the telecom went as planned but the mess was over in a few days. Vova is still on board.

This is a damned lonely job. Lonely with no thanks even though I do so much good for others and the whole country.”

JULY 28 - BREAKING FEDERATION NEWS

A few moments ago, the secret Dacha of Pozharin, was incinerated by a laser satellite attack. The attack was performed by the Domestic Air Force, which had been taken over by General Piotr Petrov, who assumed power in the Federation.

A member of the Pozharin’s inner circle, Vova Semenov is thought dead after being seen at a private airport in Tashkent, Uzbekistan. After stepping into a local HydroMet institute vehicle, it exploded into the air — potentially from an anti-tank weapon strike.

Igor’s War lasted two weeks, and no borders were moved.

Anyweather (*Private Good*)

By Fabian Stenzel and Patrick Keys

Anna woke up at 9:30am. Not to the call of a rooster, nor the relentless burden of farmwork, but to the gentle ping of the Haus. Stretching, she tapped the bedside table to hear the message.

“Your request has been superseded by another AnyWeather subscriber.”

She rubbed her face, not quite awake, and definitely not ready for that information. She slowly swung her legs out of bed. Oh how she missed sleeping on her back, but the doctor said it wasn’t good for the baby. So every night, she tossed and turned, switching from one side to the other — always chasing a few more minutes of sleep.

Standing up slowly, bracing her lower back and rolling her neck, Anna called out “Juri! What is the Haus talking about? ...Juri?” Her feet pressed against the cool stone of their bedroom, and she could see out her window a bright sunny day. Not a cloud in the sky. Anna scowled at that, wrapping herself in her robe, and swaying side to side on a slow journey to find Juri.

Wandering into the main room, everything was as it should be. The kitchen was so clean it gleamed, the guitar and bodhrán had been carefully moved to their hangars on the wall after last night’s dinner party, and ... there was Juri, huffing away on their exercise bike. He waved animatedly, and flexed his arm, which made Anna laugh. She walked over to him, and motioned for him to take the halo off. He removed it, and she could see a recording of an AR race from decades before.

“Are you okay? What do you need?” asked a smiling, endorphin-filled Juri.

“What is Haus talking about? Why was our weather request superseded?” asked Anna.

Juri’s bike slowed to a stop, sensing he was done for today.

“I have no idea. I turned notifications off for the ride.” said Juri, “Let’s find out.”

He swept his hands out, pulling up the Haus screen in front of them. A flurry of information jumped out — news vids, social feeds, and the weather report for today.

“Didn’t you submit the request to AnyWeather?” asked a worried Juri.

“Of course I did, you can see it right there,” said Anna, starting to get annoyed. And worried. “It was submitted at least two weeks ago, when we knew the soya would be sprouting. It was so early that we received a discount for thinking ahead.”

“Hm.” Juri was now flicking through the AnyWeather app settings, to make sure everything was in order.

“Wait!” said Anna, and she gestured to herself and the screen floated over.

“Hey! What—” said a surprised Juri.

Anna pointed at something in the corner of the screen. “There. What’s that?” She tapped the blinking sunshine icon and a notification opened.

*“AnyWeather regrets to inform you that your request for our ‘Spring Rains service’ conflicts with an earlier request by *Mueller, Tom* that supersedes your own. We apologize for any inconvenience. Note that your account has been credited a full refund. For any further questions, please click here for more information.”*

Juri’s mouth was open in surprise, and Anna clicked the screen for more information.

“Tom? Why does *he* need sunshine? Can we out-bid him?” asked Anna. “What about the new PremiumRain option?”

Juri looked unsure “It will cost a lot, but...” and Juri trailed off, looking out their window toward their fields, and he continued, “...we do need it. And now I’m curious.” Juri tapped the screen indicating they would pay for the *PremierRain* service.

Rather than the happy rain cloud animation that usually responded to a request, a long document explaining AnyWeather’s conditions unfurled on the screen in front of them, and a holo chat popped up with a perky invitation to discuss their issues with the program. Anna sighed, flicking the screen back to Juri. “Looks like a job for the lawyer,” she said with a grin. “I’m going to make some tea.”

Juri, in his element, sat down with the screen. He stared carefully, with a furrowed brow, gesturing to advance the text.

Anna, requested a mug of chamomile from the Haus, as she thought *“This will be disastrous for the DuraSoy crop if we don’t get rain in the next 48 hours. What would that mean if this harvest fails?”*

As the Haus chimed the warm mug of chamomile, Anna looked out the window at the field descending down the hill from their home. She remembered back to her grandmother telling her about what farming used to be like in this part of Germany. Mostly barley and wheat. Since then, shifting precipitation patterns had led to several global food crises, and large scale irrigation systems were in high demand. Those systems were complex and expensive. Their home, atop this hill, had never had access to a large stream or groundwater anyway. Waiting for rain had always been the only option. For Anna’s parents and now her own family, rising temperatures and higher CO₂ concentrations in the atmosphere, plus genetically modified drought tolerant varieties, had opened up new crops that hadn’t ever been possible in this part of Europe. But they still needed rain.

She gently massaged her belly, sipping her tea and thinking back to the news alert three growing seasons ago. It had been a clear and warm day. She had just jumped down from repairing a broken network up-link on one of her agro-bots, and Juri had been browsing for new software tools. The name “AnyWeather” had caught his attention. It was advertised with “Pay for your desired weather!”. It had not been cheap, but the first request was free, so Anna and Juri gave it a go and asked for light rain. A few minutes later, they had seen a swarm of tiny drones flying over the area. In the next half hour, clouds emerged slowly. And about an hour after the request, the first droplets began to fall. Anna and Juri had been using AnyWeather regularly since then and the increase in yield made up for the costs. So far, their requests for precipitation were always granted.

Until now.

She looked back at Juri who was now deep in a conversation with the holochat, regarding the Terms and Conditions of the AnyWeather agreement. She walked out onto their porch, and could see over to the adjacent hilltop, where their neighbor Tom was hosting what looked like a small herd of children in his backyard. She waved over to them, but nobody saw her. She turned back toward her own fields, falling away down the hillside, and frowned. It had not rained for three weeks and the soil needed water to help the soya sprout.

Then — Anna could see the tell-tale glint of drones high up in the sky. Rather than moving in a specific direction, or delivering something, they appeared to be hovering directly over their neighbor Tom’s hillside.

She went to walk back in the house, ready to tell Juri about the drones, when he came outside.

“It looks like Tom’s request for nice weather superseded our own.” Juri said. He showed Anna the flickering screen, which Juri had brought outside with him. The Haus’ network allowed the virtual screen to go everywhere in the house, but it was a little glitchy on the porch for some reason.

“Yes, I know. *Now.*” said Anna. And she pointed to the glint of drones high in the sky atop Tom’s hillside. “They’re keeping it sunny up there. I’m sure of it. Tom apparently is hosting what looks like a reunion for his entire brood over there.”

“Ah,” said Juri. “Well, I found the explanation buried on page 42: *If there are conflicting wishes for a given area, the price increases by 50% for each new request, but the person issuing their request first can hold their request indefinitely. PremierRain subscribers supersede our baseline BestRain service. EliteRain subscribers may supersede a prior PremierRain request, by paying a fee 10x the original price for the AnyWeather service.*”

Anna — dizzy from the incomprehensible tiers of rain services — and frustrated that their fate is somehow decided by the legal terms of AnyWeather, started marching down the hill.

“What are you doing?!” Juri shouted.

“I’m going to go talk to our neighbor. Like a normal human. We can sort this out.” said Anna.

She had to balance carefully on the cobble stairs, but Juri sprang down to hold her arm as they crossed the valley to go speak to Tom. As they walked, the hillside shimmered in the bright spring sunlight, the white flecks of fertilizer laying atop the fields giving the slope a speckled shine. But they needed rainclouds — and soon.

After slowly making their way up the stairs, Anna brushed a sweaty strand of hair behind her ear, and she waved to their neighbor Tom.

“Tom! Good to see you!” Anna said. Juri gave her an encouraging smile to keep going.

“Ahoy. Hello, Anna. Hello, Juri.” said Tom.

“Listen, Tom, I don’t want to keep you from your family. But,” and she gestured at her hillside and the fields waiting to sprout. “We need the rain. Otherwise our seeds won’t sprout. We need this harvest.” Anna nonchalantly patted her belly for emphasis, that ‘we’ did not only mean Juri and Anna.

Tom, seeing this, frowned. But he said, “My family is here for the first time in years. We want some sunshine to enjoy while they’re here. Doesn’t my wish count as much as yours?”

Juri went to interject, but Anna interrupted with a compromise, “All we need is a good rain in the next 48 hours. That’s all. A good spring downpour should set things right for us.”

Tom still grimaced.

Then Juri said, “What about during the night? That won’t affect your time with your family, and we can get some much-needed rain.”

Tom shook his head, “No. We are planning to golf. The rain will make the course soggy. I need something for these kids to do outside, and...”

“Our tractor!” said Anna. “While the sun dries out your golf course, Juri will take all the kids on a fun ride with the tractor around the whole valley.” Anna pitched her voice so that the kids heard this last part, and they all cheered, starting to chant “Tractor!”

Tom scowled, at being outmaneuvered.

Juri went to complain to Anna — he didn't want to host a bunch of kids on the tractor — but, Anna turned toward him, pointed to her belly smiling, and whispered the words "It's practice." She grinned conspiratorially at him. Juri shook his head, but grinned, too.

Tom nodded, and said "Okay fine, you can have your rain on Thursday night, but Juri better be ready for them." Tom gestured at the kids, now wrestling on the ground. Juri looked a bit frightened.

Anna laughed, reached over the fence and shook hands with Tom. "Thank you, Tom", said Anna.

But then, both Tom and Anna looked down seeing their wristbands buzz. An update from AnyWeather.

"An overriding offer from our EliteTier has been placed. We apologize for any inconvenience."

Anna and Tom looked up, confused, at the sky and it was as if they could already feel a freezing wind coming from the East.

Queen Bee *(Private Good)*

By Patrick Keys

A light wind blew across the frozen slopes of Aspen Mountain, sparkling white in the full moon. Rig, trudged up the staircase of boot prints to Casa Bonita. Pausing at the door, listening to the raucous conversation inside, they took a deep breath.

The Cat recognized Rig before they even turned the knob to the door, barking loudly. Rig smiled, opened the door, and was nearly bowled over by 60 lbs of Humane Society mutt. Laughing and scratching his ears, The Cat — their illicit dog, so-named to hide its existence — rolled onto his back tongue lolling to the side.

“I shit you not, the Intern walks over and takes the control out of my hands.” Ocho drank lustily from her beer. “The kid doesn’t even know how to hold it, but they confidently say “I’ll take it from here.” Jesus and Slow are rapt, smiles stretched across their faces, knowing what comes next.

“And then...” Ocho can’t keep her laughter in, “the kid just drives the drone directly into the side of the building. Just... slam.” Ocho is crying now. “And the piece of shit couldn’t blame me, since the guests and the manager were watching the whole time. So,” and she takes another drink, “the kid is pissed, but whatever. At least I don’t get a write-up or anything since it was clear as day I was trying to fix the damn thing.”

“So, what happened to the intern?” Jesus asked, mock concern in his voice.

“They were assigned to front desk duty for the rest of the month. Didn’t get another chance to pilot a drone again. Served them right!” exclaimed Ocho.

Jesus looked satisfied with that.

“Rig!” yelled a noticeably buzzed Slow. “You’re late! Time to catch up.” Slow tossed a beer to Rig, who caught it one handed, flicking the cap off with their thumb.

“Rough day?” asked Jesus. “You’re quiet.”

Rig, then proceeded to string together enough curse words to make The Cat blush, who was chasing his tail in the kitchen. Ocho, Jesus, and Slow stared open mouthed.

“Care to elaborate on that?” said Jesus, “we’re all ears.”

“These god-damn rich tourists don’t know their ass from their mouth, and yet somehow they come here and act like they deserve constant catering and pampering.” Rig paused lips pursed. Then, took a big gulp, and kept going. “Today, I was inside the Mothership —”

“Hive” corrected Ocho, but instantly regretted it.

“Not tonight Ocho...” Rig paused, then continued, “Sorry. This was just a lot. I was at the Mothership, and I was troubleshooting a security patch on the X11 drones — the old set from last year. They’re constantly drifting south, and I was deep in the pattern recognition subroutines to try and figure out what was going on. Management wanted to save money last year, which they did by buying the X11s. But now I’m spending most days trying to get them to stay on course. Anyway, I heard a slam on the side of the doorway — which was scary because I thought something fell over. The last thing we need is an electrical fire in Mother and have the whole fleet of seeders toasted.” Rig took another drink.

“I go down the ladder, and see this platinum blonde couple, Barbie and Ken, glaring at me. Barbie launches into a tirade of how they pay so much money to come to this resort — more money than I’ll ever see they make sure to point out — and that when they’re here, *all* the runs had better be covered in feet of powder. The Ken doll was just standing there... arms crossed with a smug, annoyed look.”

Then Rig adds, “But, I am standing there.. and... I’m confused, right? Why would they be saying this to me? I mean, I’m just the Cloud Seeder tech, I’m not in charge of deciding which routes have snow. Then I see that there’s an intern walking back into the lodge, and I realize that the dumb kid didn’t know what to say so they just blamed the issue on me, and sent them to talk with the technician. So, I put on my best polite face.”

Ocho laughed, but Rig grimaced, continuing. “So, I asked them to explain which run they were talking about, and they pointed south, out past Bonnies. It looked snowy to me, but they said check the scan. So I did. Sure enough the scanners from earlier in the day indicated that the snow depth was less than a foot. That was odd. I asked them to wait a sec, and I started hammering away at the keys. The glaciogenic seeding had worked throughout the rest of the park with nearly 100% efficiency. All except, that one patch. Technically, the seeding was statistically successful, given that >99% of areas fell within the range of success. But I knew that wouldn’t fly with the guests. So I apologized.”

The whole group groaned.

“Yes, I know.” said Rig, “As soon as I said sorry, they smelled blood and started ripping into me. Every personal attack you could think of. I’m fine with them questioning my technical capacity, because that’s a laugh. I know I’m a genius with this stuff. But you want to talk about *me*?”

“So... what did you do,” said a worried Slow.

“Well...” started Rig, “I thought about knocking them out.” Slow’s eyes went wide, but Rig said, “Don’t worry. I’m not on the run from the sheriff. The Manager showed up — it was Bob.”

Ocho, Slow, and Jesus all nodded uniformly that this was a good thing to have happened. “Can’t do better than Bob” said Ocho. The Cat comically barked along as if in agreement.

Rig went on, “Right. Bob somehow hypnotized them into following him back up to the lodge for complimentary upgrades or whatever. He glanced back at me with a curt nod, and that was all I got.” Rig paused and looked down, deflated. “I wish — just once — that they’d actually stand up for us, just once. I could run circles around any of these jerks when it comes to reprogramming glaciogenic swarms, or debugging ancient nav code that hasn’t been supported for years. But because these rich pricks have money, they can walk all over us.”

“Rig —” Jesus started to say, “remember the time I rescued that little girl?”

Ocho interrupted, “not this again, Yes we know.” Ocho continued robotically, “They were so shocked that you came back with that little girl in your arms after search and rescue had called off the search two days prior. They said “Jesus” out of shock, and the name stuck...” Ocho smiled as if to say “*did I get that right?*”

Jesus smiled, but went on, “That’s true. But ... Do you know what that girl’s parents said to me?”

None of them knew this part of the story.

“They said, ‘How could you?’ As in “How could you *do this to our daughter?*” Jesus stared at them in turn, including The Cat. He continued, “As if I had been the one to lose her! As if I had been the one to be negligent out skiing in a seeding storm, and not attach her sat-beacon! As if I hadn’t gone out-of-my-way to step in when the contracted Search and Rescue squad gave up after a half-assed attempt.” Jesus paused, then went on. “I know what you mean when you want to punch these A-holes.”

Rig nodded and clinked beers with Jesus. They both drank deeply.

Ocho, “As long as we’re sharing our collective bullshit — I’ve got one, too.”

Jesus, “Is this where you tell us that you lost a life when you got buried by that avalanche? Because that’s not —”

“Fair play, my Lord and Savior, but no.” Ocho said smiling, “It’s what the Manager said to me when I stalked back into the tech lodge at the base of the mountain, *after* the avalanche.”

Yet again, somehow none of them knew this story either.

“I limped in, bruised, battered, and hungry. SO hungry.” Ocho sipped her beer. “The faces around me were uniformly in shock. And rightly so! I must have said something dumb like, “I guess I only have eight

lives left”, but then I heard a curse from the back of the room. Then, this Manager comes toward me swearing that I just lost the park 2 million.”

Jesus and Rig looked to one another confused, but Slow got it, “The insurance.”

“The god damn insurance.” Nodded Ocho in agreement. “The Manager was pissed at me, since I had been worth quite a lot of money dead — that is until I walked through the door.” Ocho sat back. “You better believe I looked into the SkySeederPersonnel insurance agreements that were being signed on my behalf after that little ‘accident’. I haven’t signed any more of those policies, no thank you.”

“Nearly the same thing happened to me,” said Slow, “Well, sort of.” He leaned forward, “I was screaming down the mountain...”

Jesus sighed, “we get it, you’re fast...”

Slow smiled wryly, but went on, “... I was helping guide a crew of snow-penetrating drones through the forest. We needed to find out how well the seeding had worked despite the tree cover. Then, all of a sudden one of the drones shot up the column toward me and nearly took me out.”

Rig looked offended, and Slow interrupted, “Not to worry. This was before your time, and not the fault of the Queen Bee — oops, I —”

Rig looked fit to burst, but Ocho spoke up holding up her hands, “That was the nickname of all the Hive techs.”

Rig scowled, “Yeah, fine. I know you don’t mean anything by it, Slow.”

Slow smiled, “Sorry — I know you hate the name. Either way, it wasn’t the fault of the Hive tech. I swatted the drone down, and packed it away. And when I got back, I went straight to the Hive tech, who then marched with me straight up to the main lodge. Turns out one of the Managers had let an Intern into the Hive, on a ‘training tutorial’. Those two dumbasses nearly took my head off when they tampered with the drones. The manager chuckled to the intern that I would have been worth more dead. They didn’t think I could hear, but... man.”

Rig sighed, even further deflated, “why in the hell are we sticking around? Why do we keep putting up with —” gesturing around at everything, “— all of this?”

Ocho, Jesus, and Slow looked at one another, then to Rig. Jesus spoke first. “Where else would we go? Here, at least, we get paid to do what we know, and we can be on the Mountain. The bullshit is the bullshit. There are rich assholes everywhere. But the snow is here. And if you want that, well, we don’t have much choice, do we?”

Rig, grudgingly agreed.

Ocho stood up, holding out her beer, and exclaimed. "To the bullshit!"

They all stood up, Jesus and Slow loudly declaring, "To the bullshit!" They all drank.

Slow shouted, "To our Casa Bonita!" They all drank again.

Jesus shouted, "To living another day, despite working for psychopaths!" They all drank. Then, looking to Rig, they waited.

Rig sighed, then smiled, "To the powder!" And they all drank deeply.

The Cat suddenly stood up, his tail wagging, tongue hanging out looking at the four faces. They looked at their illicit pet dog, and laughed, collapsing down into their old, musty couches.

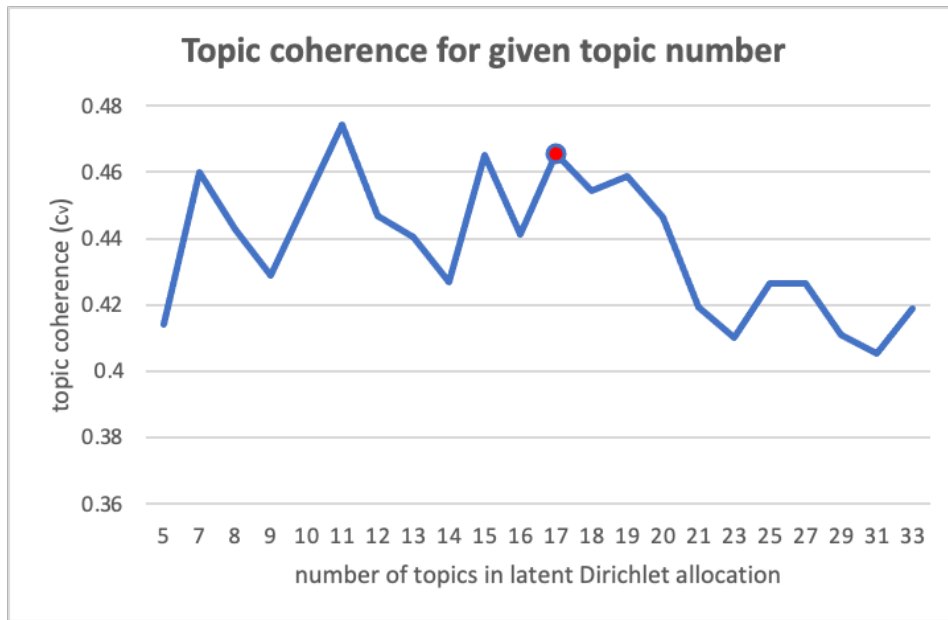


Figure S1. Chart showing the coherence metric, C_V , corresponding to varying numbers of topics.

Futures Wheels (private good)

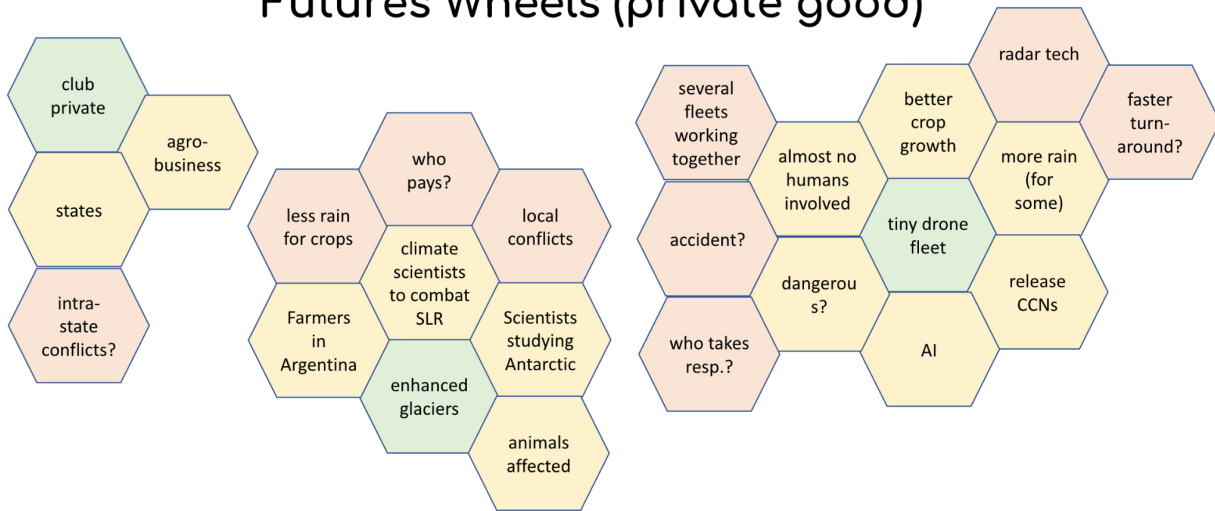


Figure S2. Example of a Futures Wheels diagram, from Workshop #1.

Three Horizons (private good)

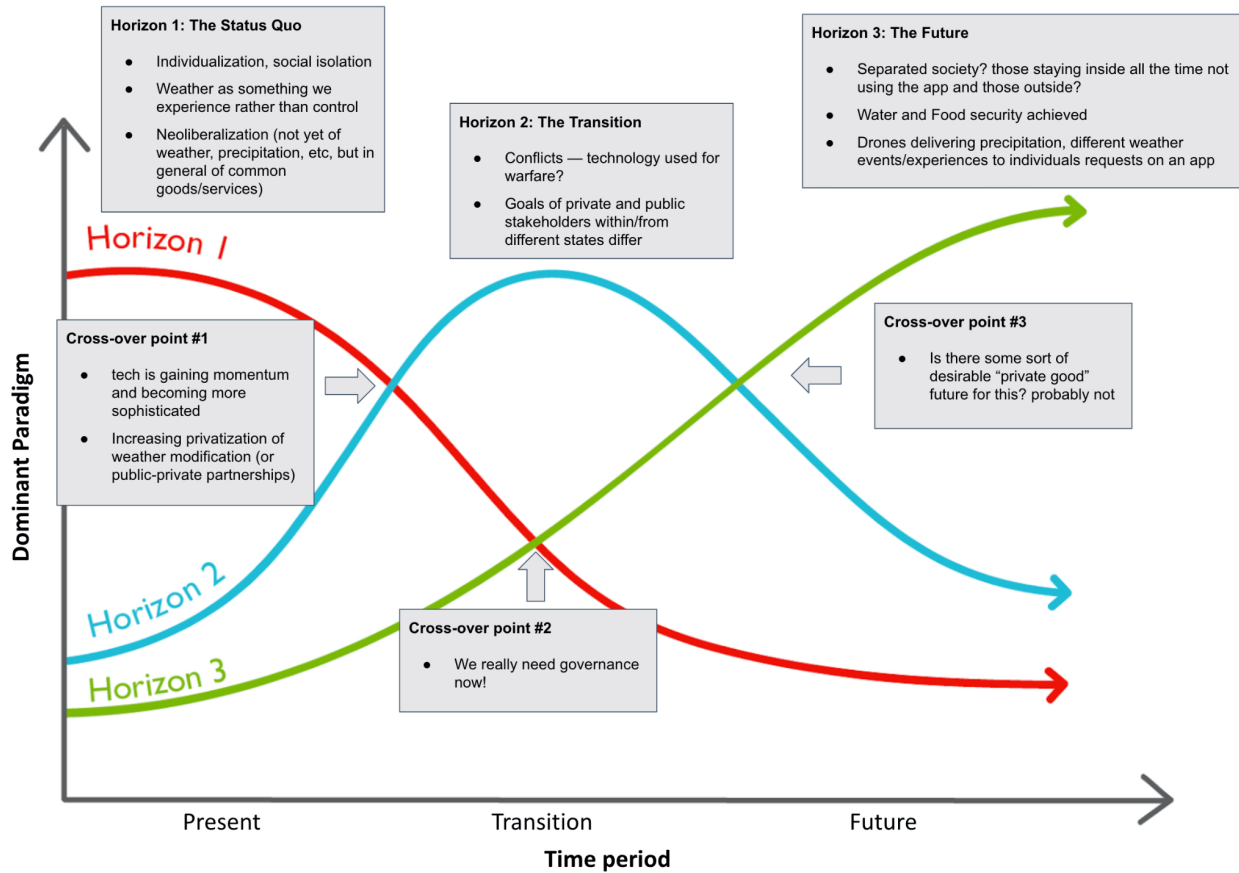


Figure S3. Example of a Three Horizons diagram, from Workshop #1.

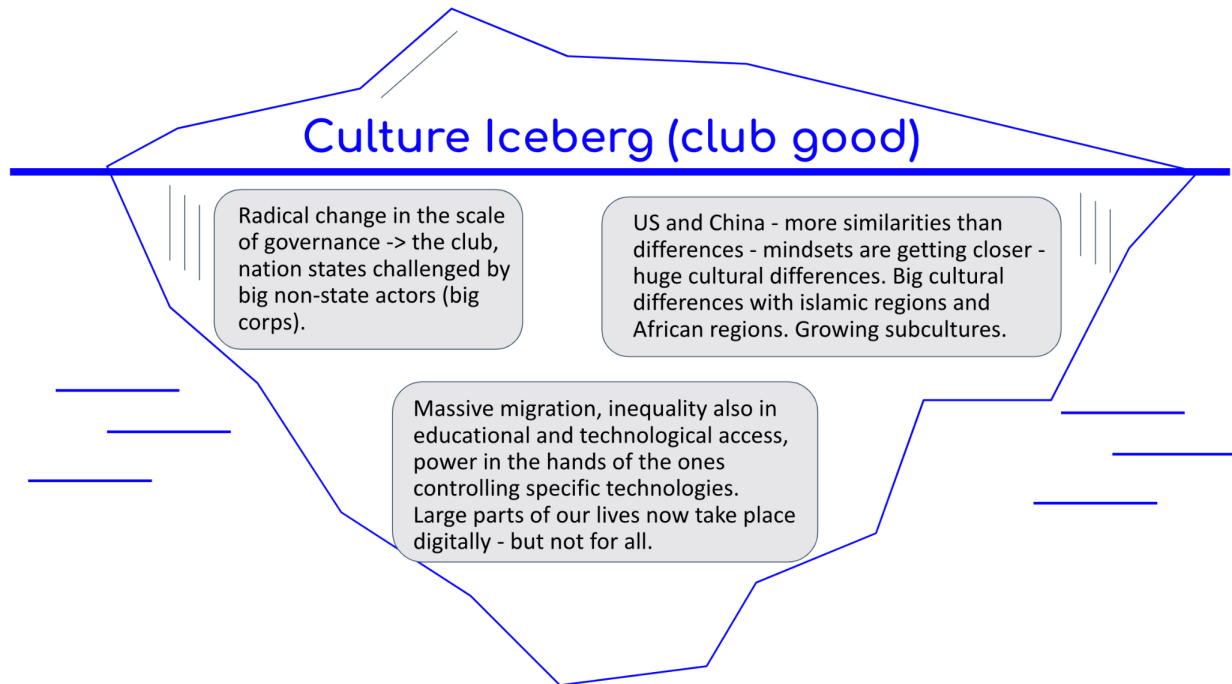


Figure S4. Example of a Cultural Iceberg exercise, from Workshop #1.

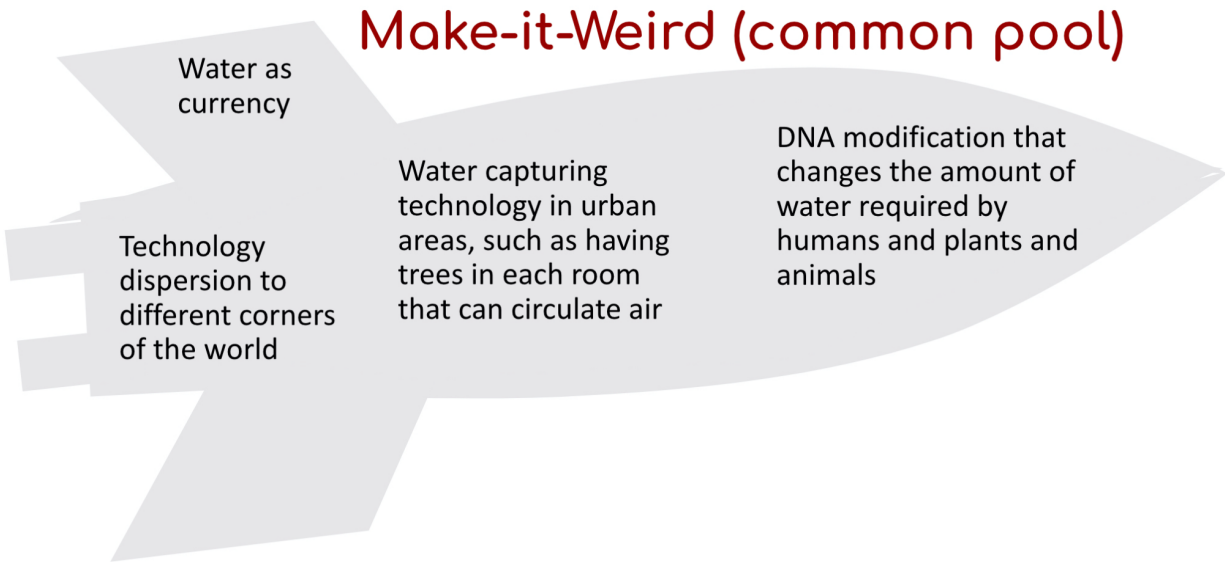


Figure S5. Example of a Make-it-weird exercise, from Workshop #1.

Table S1. Full list of topic and keywords

Topic #	KEYWORDS
1	precipitation, model, region, rainfall, study, observation, result, variability, observe, time, simulation, simulate, seasonal, scale, atmospheric, pattern, compare, air, high, associate, low, large, spatial, analysis, season, show, summer, difference, occur, event
2	Climate, change, global, future, model, impact, management, scenario, land, project, regional, include, uncertainty, human, earth, country, current, strategy, landscape, projection, natural, terrestrial, expect, date, predict, tool, challenge, problem, population, assess
3	Drought, temperature, increase, forest, area, trend, extreme, record, crop, annual, growth, yield, index, high, condition, degree, average, factor, agricultural,., Production, urban, year, significant, decrease, China, plant, stress, map, climatic
4	Source, site, emission, carbon, soil, ecosystem, lake, flux, transport, deposition, specie, concentration, dust, net, nutrient, loss, total, rights reserve, measure, sink, biomass, nitrogen, Elsevier, plant, GPP, measurement, uptake, open, estimate, input
5	Aerosol, warm, increase, response, effect, warming, decrease, induce, cool, ocean, reduction, anthropogenic, direct, temperature, surface, instrument, forcing, reduce, radiative, BC, force, degree, ozone, enhance, lead, East Asia, heating, modus, GHG, maize
6	Datum, method, base, approach, information, satellite, estimate, product, quality, performance, application, technique, provide, improve, pressure, measurement, develop, delta, propose, parameter, group, signal, objective, indicator, space, test, monitoring, new, obtain, achieve
7	Vegetation, surface, soil moisture, land, cover, soil, energy, heat, exchange, water vapor, canopy, stage, flux, green, evaporation, Australia, layer, leaf, atmosphere, content, moisture, cropland, subsurface, age, grass, condensation, dynamic, desert, heterogeneous, slight
8	Research, design, technology, effort, scientific, community, policy, weather, science, program, system, development, paper, economic, knowledge, control, plan, use, gap, cost, review, address, benefit, solution, conclusion, weather modification, risk, issue, biotic, resource
9	Water, irrigation, supply, series, demand, relevant, sector, requirement, availability, hydrologic, theory, deforestation, flow, efficiency, standard, platform, wetland, chamber, stream, Amazon basin, operate, cycle, hold, Amazon, capacity, energy, learn, connect, sky, evaporation
10	River, particle, chemical, concentration, marine, mu, composition, sample, biological, organic, sediment, plot, CM, watershed, diameter, discharge, double, burn, treatment, abundance, airborne, organic matter, carbonate, reservoir, cycling, commercial, freshwater, form, management practice, troposphere
11	Cloud, rain, ice, radar, snow, droplet, melt, aircraft, liquid, microphysical, snowpack, cell, altitude, artificial, suppress, storm, channel, mountain, boundary, reflectivity, hour, sequence, stratiform, pass, orographic, westward, scientist, radar reflectivity, formation, kilometer
12	Match, island, April, middle, validate, drop, band, damage, image, bring, wrf, , protection, wind, CCN, easterly, mm, Bay, composite, air mass, size distribution, dry land, daytime, suppression, mature, salinity, ion, adequate, peninsula, night time, bulk
13	Wind speed, secondary, valley, diurnal, min, hourly, cyclone, indirect, portion, first, diurnal cycle, subsequently, afternoon, coincide, sound, aerosol load, mixing ratio, t o a, front, cyclonic, Beijing, PO,

	early morne, effective radius, cluster analysis, stratify, albedo, passage, bimodal, Doppler radar
14	Wave, horizontal, amplitude, southerly, degradation, break, vortex, vorticity, Israel, saturation, inversion, upper level, yellow River, decreasing trend, coalescence, trade, stratification, outflow, advect, sharp, cloud resolving, gravity, pristine, emergence, yearly, confluence, down welle, broaden, thousand, aloft
15	Wildfire, erosion, absorption, fire, California, collection, sand, eliminate, July August, potable, pore, Siberian, kinetic, cone, nam, swa, brc, busy, soil erosion, wepp, kangir, psa, som, subtropical, epm, implement, erodibility, pnc, heat wave, soc
16	cumulative, module, increasing trend, protocol, ka, esm, numerical weather, cosmo, miroc, instantaneous, midtropospheric , newly developed, zovex, ozonesonde, farm, cup, eta, josie, pig, shadoz, ecup, bbwo, layout, paddy field, housing, problem solving, sonde, gnss, herd health, hygiene
17	polar, equivalent, indonesia, site specific, recover, dissipate, gewex, energetic, ascend, morphology, candidate, cumulus convection, lapse, game, third, eroi, middle troposphere, ghp, ssmus, brine, peat, antarctica, receiver, te, mtco, concordiasi, proximal, sustainability, xdr, sensible

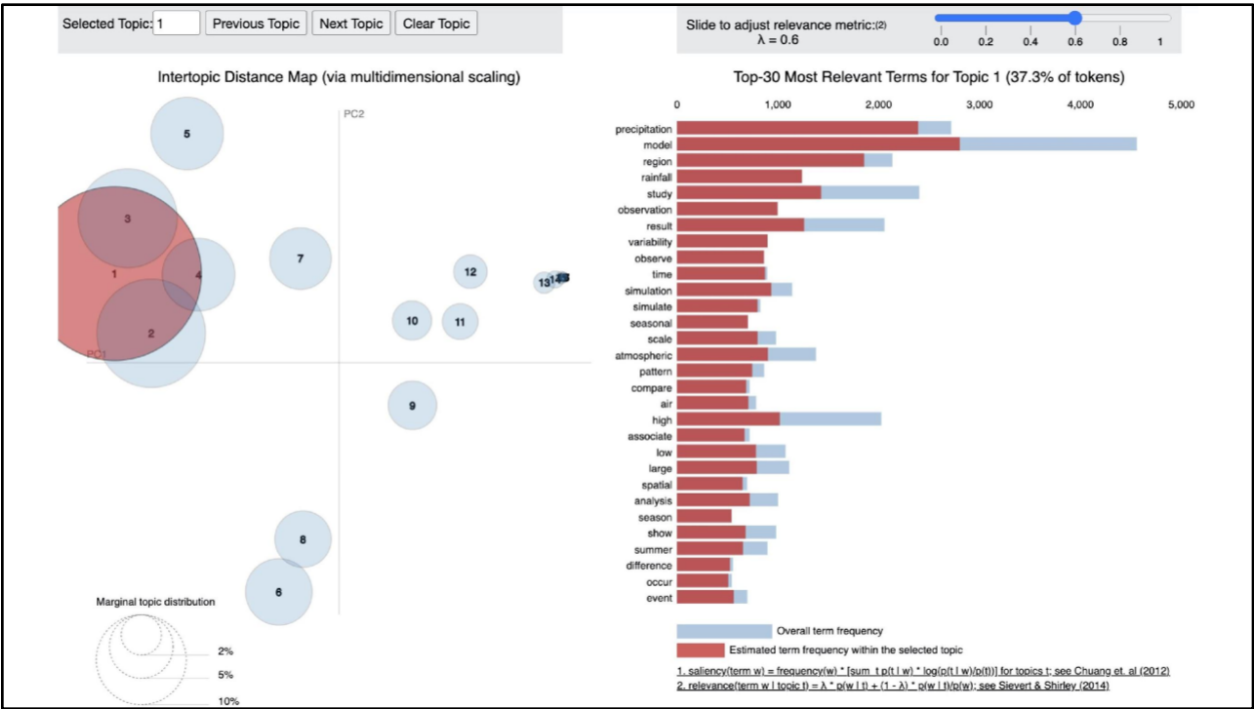


Figure S6. LDA Topic 1 visualization.

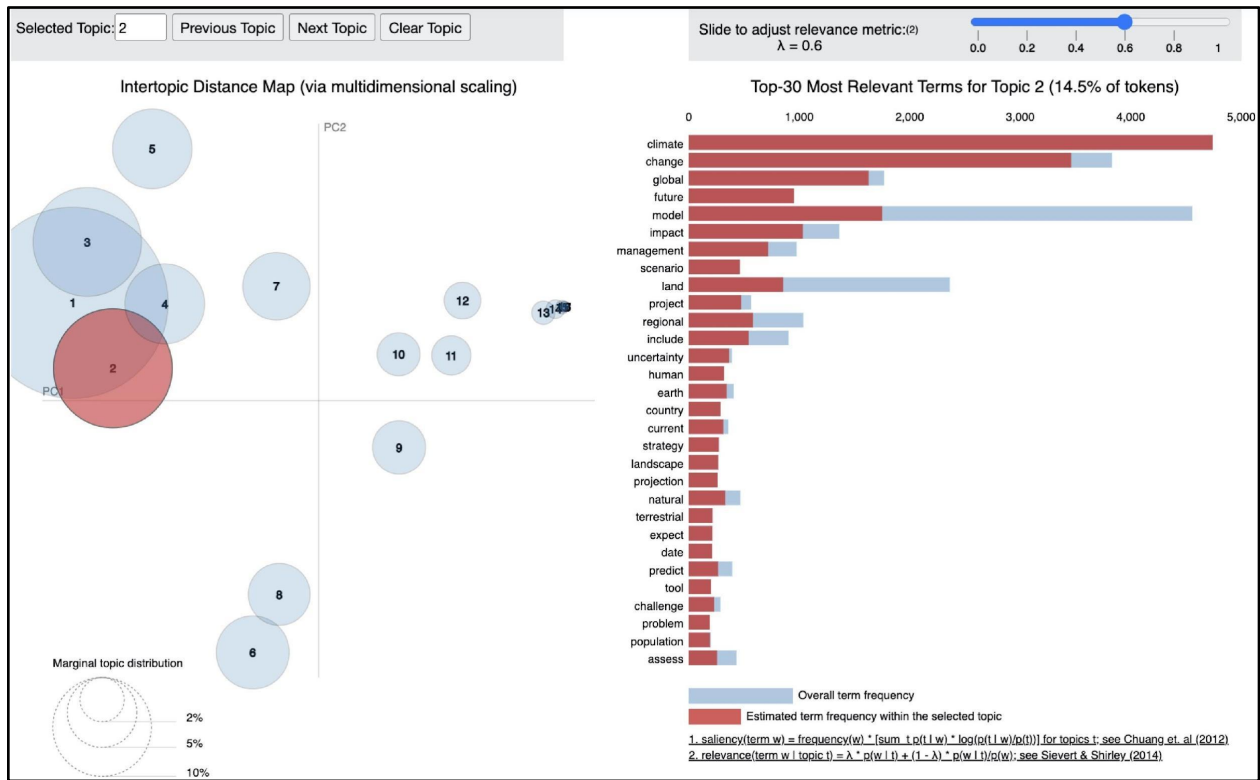


Figure S7. LDA Topic 2 visualization.

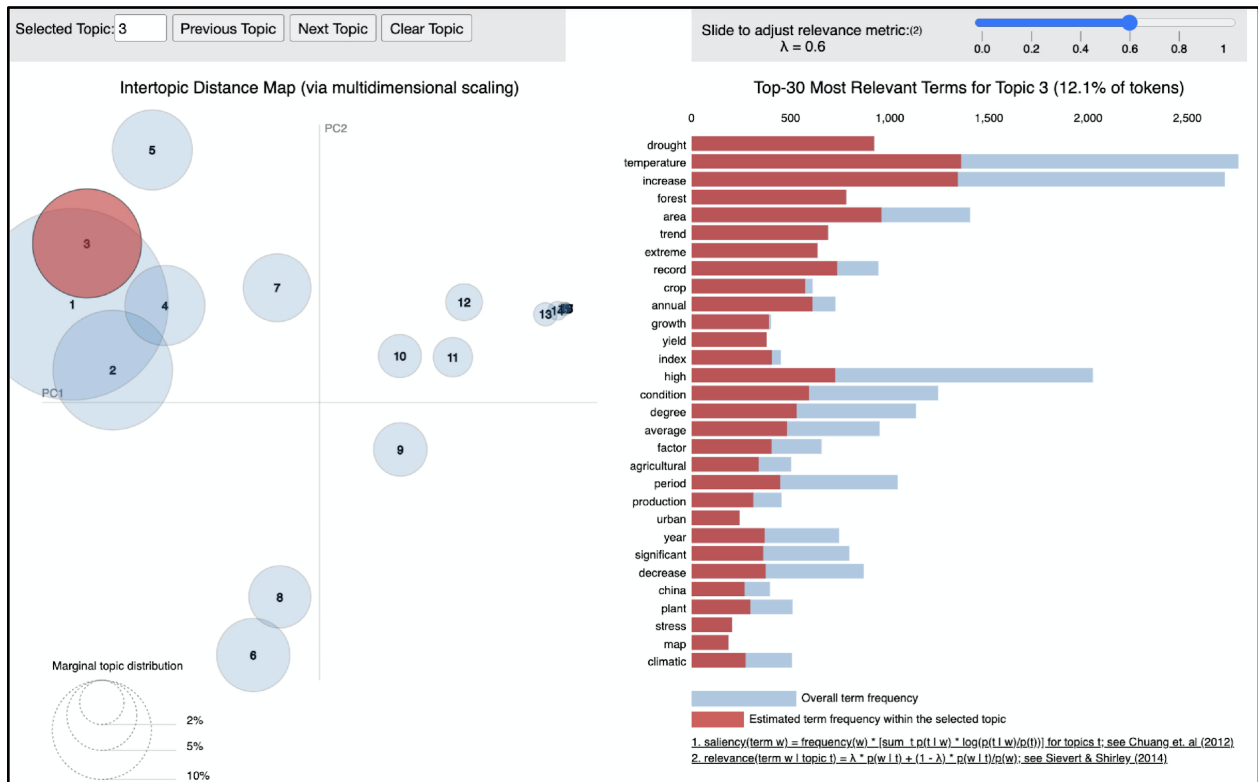


Figure S8. LDA Topic 3 visualization.

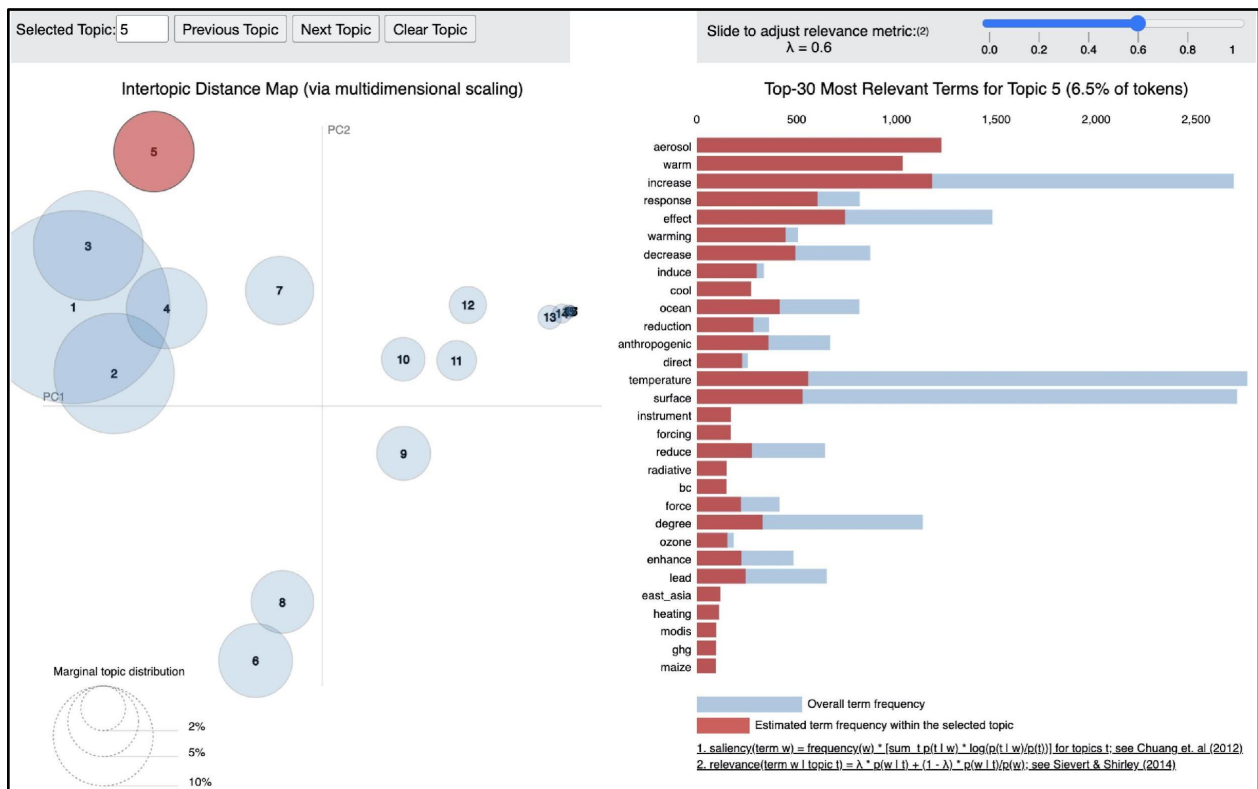


Figure S9. LDA Topic 5 visualization.

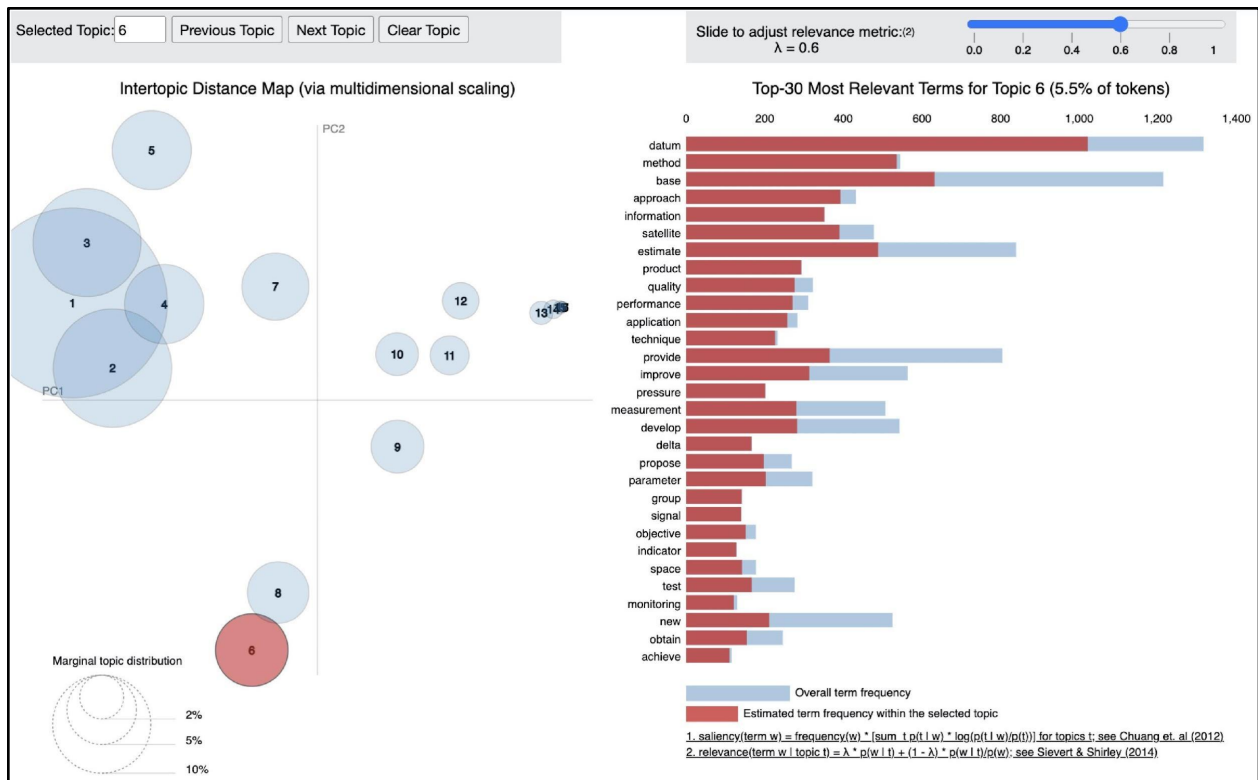


Figure S10. LDA Topic 6 visualization.

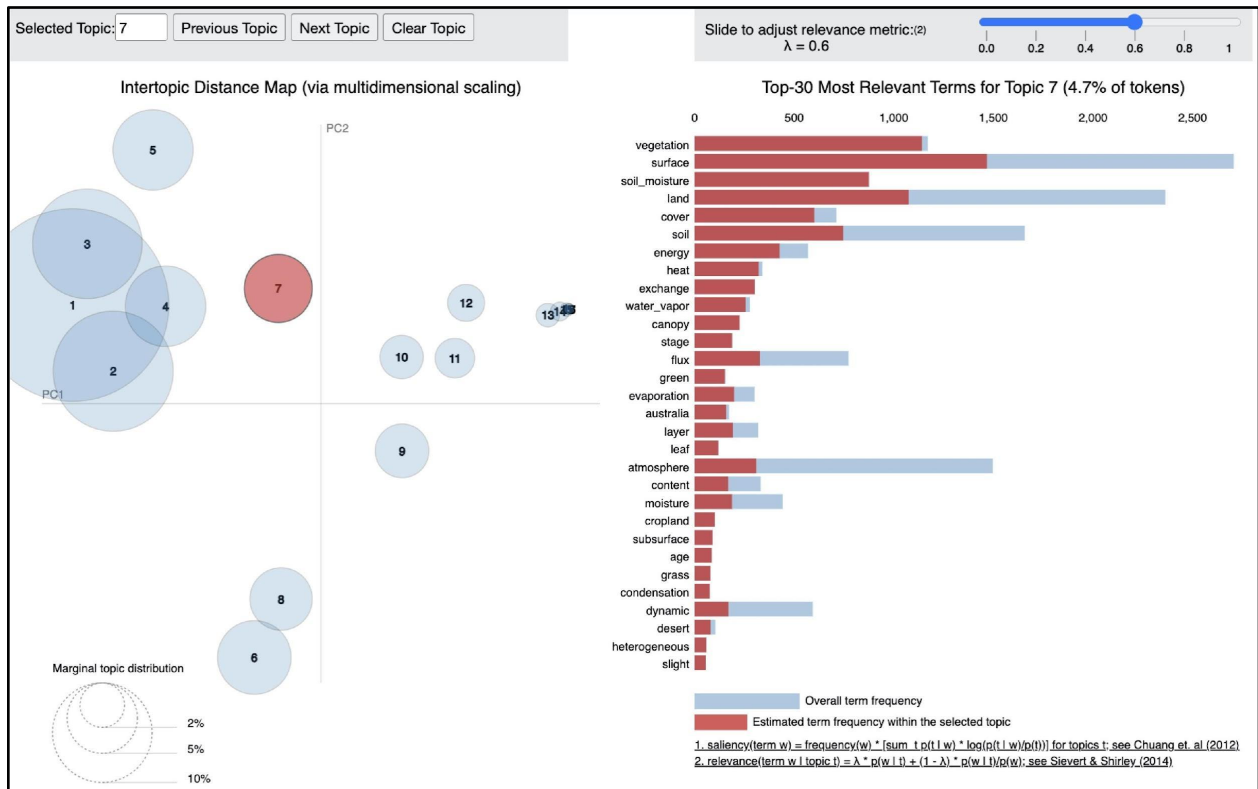


Figure S11. LDA Topic 7 visualization.

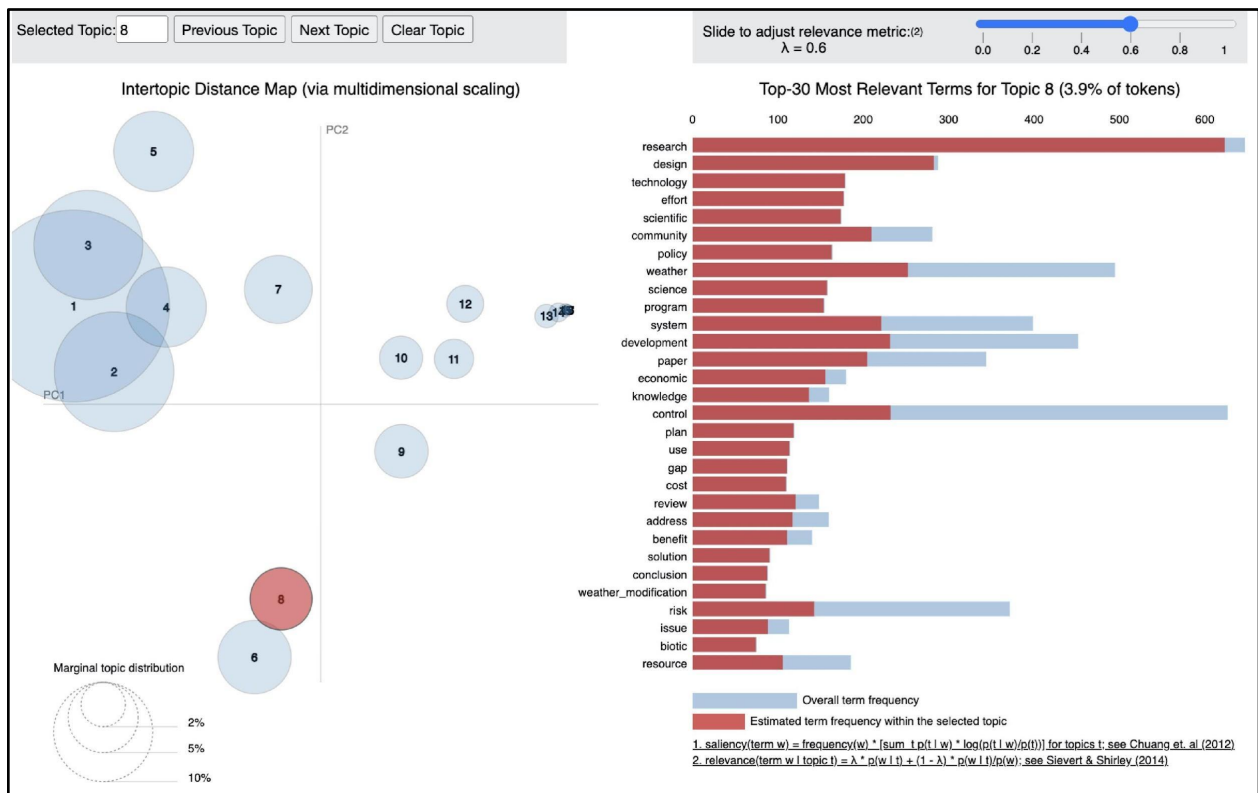


Figure S12. LDA Topic 8 visualization.

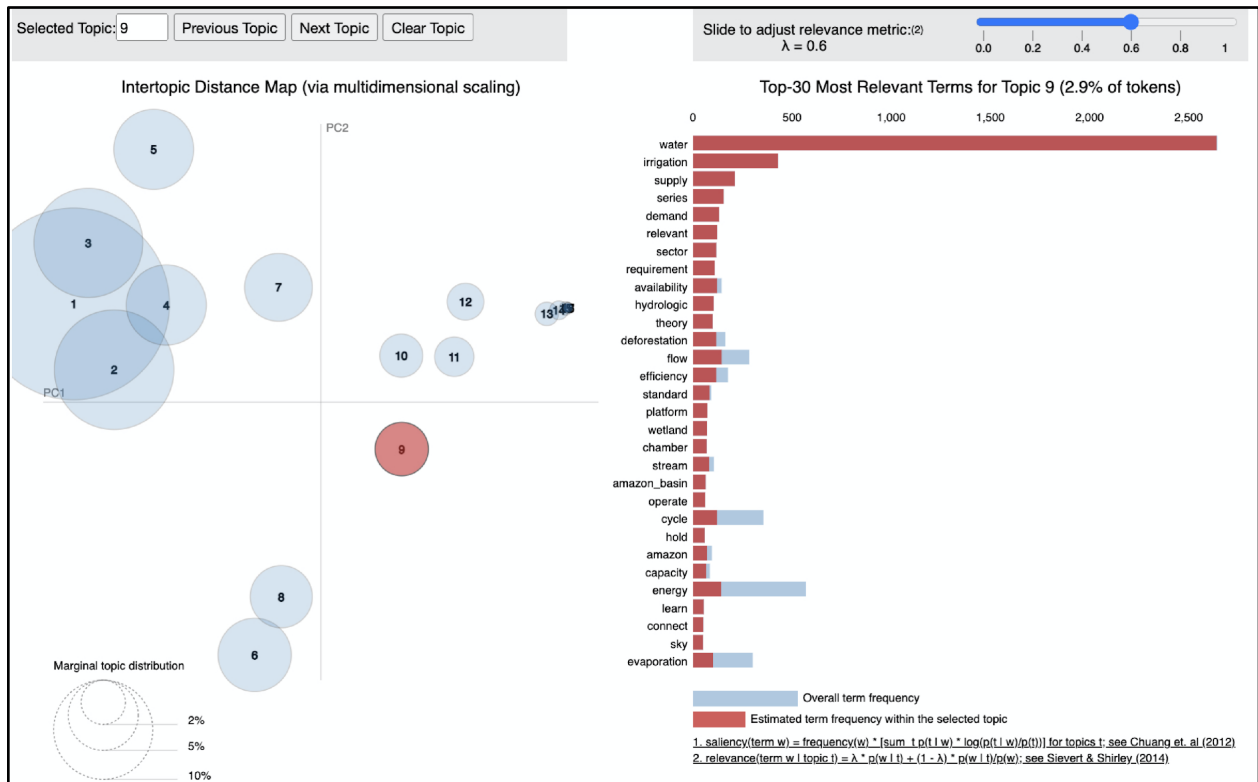


Figure S13. LDA Topic 9 visualization.

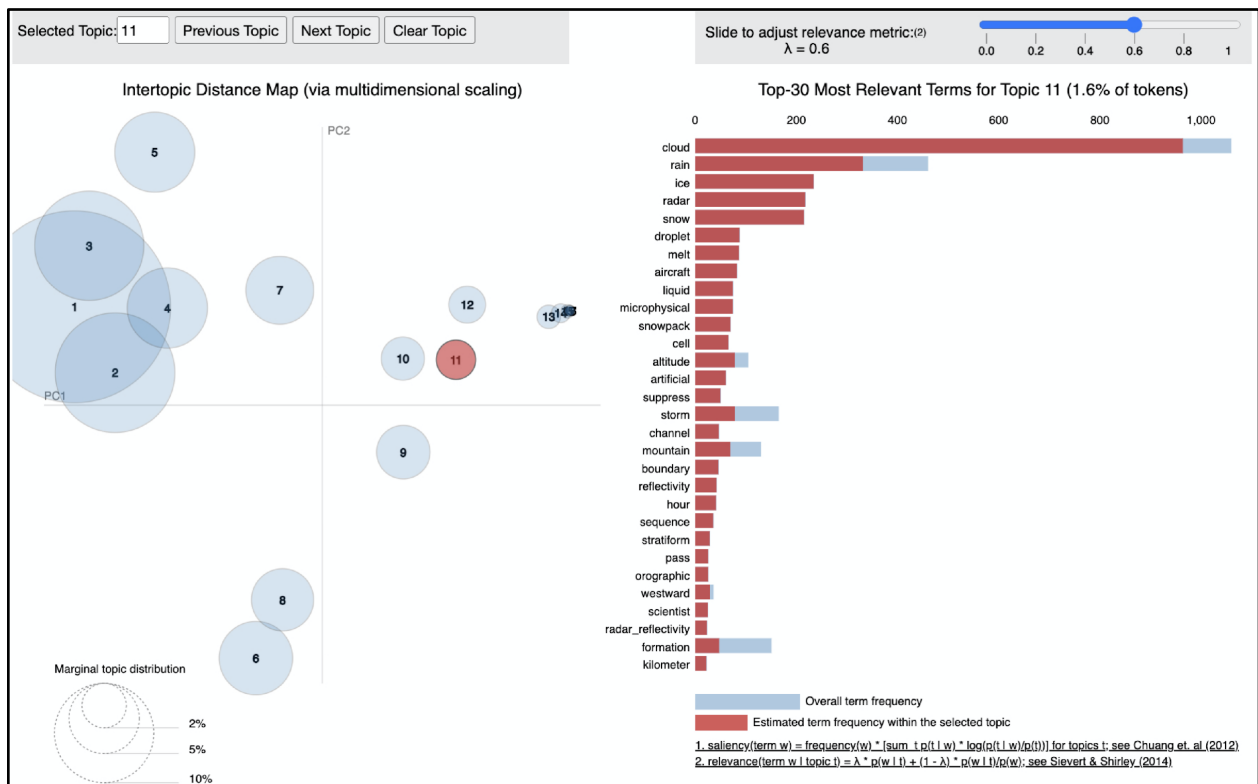


Figure S14. LDA Topic 11 visualization.

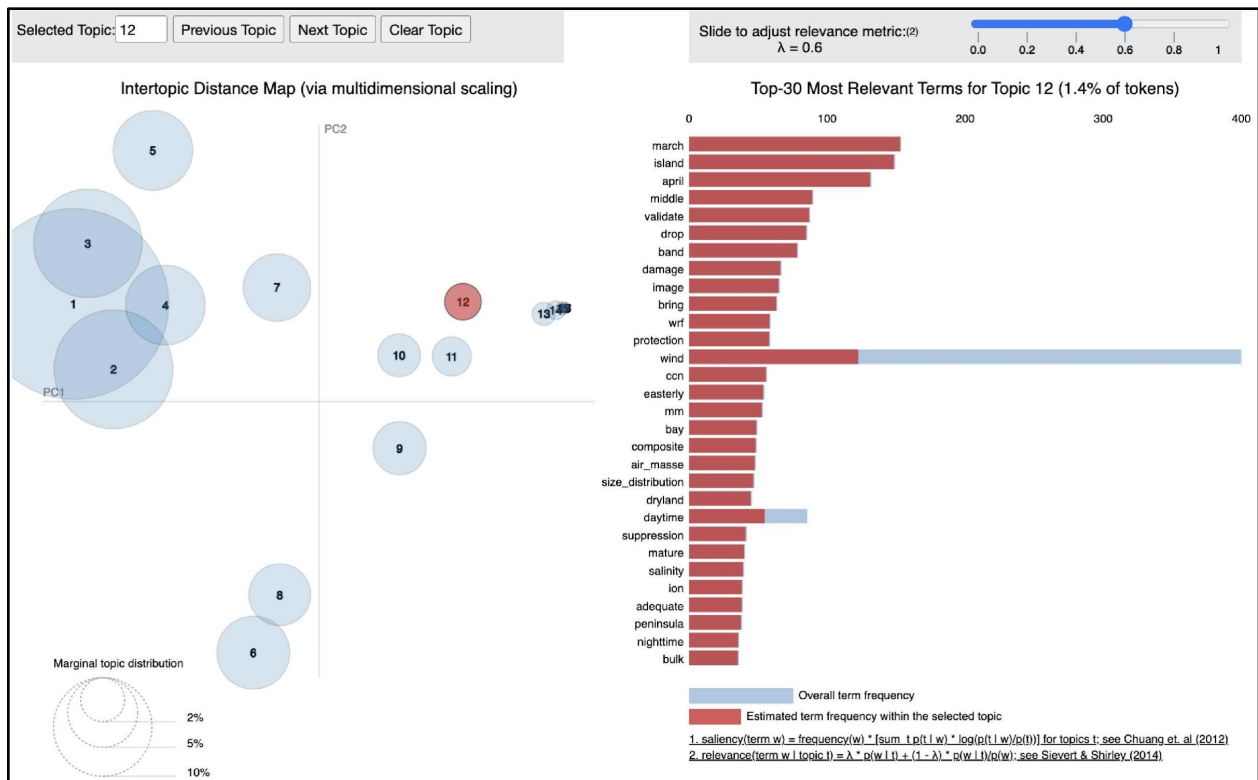


Figure S15. LDA Topic 12 visualization.