Illustration by: Tyaseta • Siloy

URBAN FORESTRY
Taming Precipita
Van Stan • Friesen

Since the beginning of human settlement, people have observed water in its many forms.

Over centuries, they have recorded the ways that water supports and sustains life... like a cunning and capricious witch.

These ‘ecohydrologists’ have dedicated generations to understanding the ways of the water witches.

Since 4.6 billion years ago, they have cast their spells of drought and flood across the globe...

...until all the Earth's ecosystems adapted to their generosity or their greed.
As cities grew, most ignored the water witches.

They even seemed to forget the forests who sheltered humanity from their whims.

As the cities grew and the forests shrunk, they became greyer and impervious...

...like impervious, obstinate rocks who cared little whether rivers submerged or exposed them.

This, the impervious grey landscapes, from the roofs to the rocks, all just watched...

While storms, drought, and erosion took the health and lives of their human inhabitants.

The hydrologists watched too, collecting and analyzing data in search of compromises between cities and water.
AROUND 400 AD, PEOPLE BEGAN TO CUT A CITY INTO THE LINDEN FORESTS OF CENTRAL JERMANY.

FOR 1,000 YEARS, THEY CLEARED TREES, HARDENED THE EARTH, AND BENT THE STREAMS.

MEANWHILE, PRECITA, THE WATERNUTCH WHO DWELL THERE, WATCHED FROM THE LINDEN CANOPIES.

SHE CAST HER STIRPS OVER THE STREAMS AS USUAL.

BUT HER FRIENDS, THE LINDEN, NO LONGER INTERCEPTED THE STORMWATER OR DRANK IT FROM THE SOIL.

THE SOILS NO LONGER RECEIVED HER STORMWATER.

AND THE BENT STREAMS BEGAN TO SWELL AND OVERFLOW THEIR BANKS WITH INCREASING FREQUENCY.
NOW IN THE WATCHTOWER OF THE LEIPZIG RATHSHEUS,
THE DEPUTY MAYOR ADDRESSES FRIENDS OF THE CITY.

THANK YOU FOR COMING. WE ALL KNOW WHY WE'RE HERE.

PEPCOTA, SHE'S OUT OF CONTROL.

ACTUALLY SIR, SHE'S ALWAYS BEEN IN CONTROL. WE STUDY HER. HER SPELLS HAVE A PATTERN AND WE MUST ADAPT TO IT.

YES. WE HAVE LIVED ALONGSIDE PEPCOTA AND KNOW HER WAYS, HER PATTERNS.

OUR FELLOW LINEN THROUGHOUT THE CITY HAVE ALWAYS FOUND SOME COMPROMISE WITH HER.

I SEE... I WOULD CERTAINLY PREFER COMPROMISE, BUT...
...SURELY YOU'VE SEEN THE REPERCUSSIONS OF PRECIPITA'S STORM RUINOR?

HERE RAINWATER DOWNS FROM ROOFS.

ACROSS THE SIDEWALKS.

AND OVER OUR STREETS.

THEN THROUGH STORM SEWERS SO RAPIDLY THAT THE SIDEWALK FLOODS IN A FLASH!

ALL THE WHILE, PRECIPITA'S STORMWATER CURRENTS TEAR APART OUR SOIL-DIPPING DIRT FROM THEIR HABITATE/HOMES AND THE NUTRIENTS WITHIN THEM.

SPEAK TRULY-CAN THE FURRIEST FIND COMPROMISE WITH ONE WHO WOULD DO THINGS LIKE THIS?
Yes, Mayor. Our observations indicate there are ways that forests could protect the city from these hazards.

In forests, before the rain can become runoff or floodwaters, it must first pass through leaves and branches.

There can be hundreds of liters of rain stored on a single canopy.

And liters more per hour can evaporate away.

Not all trees are great rain interceptors, but trees that are have... lots of leaves.

Particularly needle leaves... really thick bark with spongy pore space....

Very flat, broad branches.

And it helps if there are lichens, or mosses, or other epiphytes.
This interception may reduce rainfall available for runoff, but what about the water that makes it to the surface?

Our energy production has strengthened precipitation, increasing the intensity and frequency of severe storms.

Surely, the water that reaches the ground is as intense?

With our climate warming, she can evaporate more water and cast more rainfall onto our city.

These increased rain intensities may still drain the soils, overflow our streets, and overrun streambanks.

Even if we can work with the trees to reduce total rainfall—Is it possible to reduce its intensity?
OUR CANOPIES HAVE LONG MEDITED BETWEEN PRECIPITATION'S INTENSITY ABOVE AND THE SENSITIVE ROOTS BELOW.

WHEN DROPLETS HIT OUR CANOPIES, THEY SPILL AWAY OR MUST FLOW ALONG BRANCHES WITHIN OUR CANOPIES TO REACH THE GROUND.

THOSE PATHWAYS SMOOTH PRECIPITATION'S INTENSITY, DELAYING HER DROPLETS BY ALMOST AN HOUR!

THE "SPLASH" DROPLETS ALSO REDUCE INTENSITY BY EVAPORATING AWAY, RETURNING TO THE ATMOSPHERE.

BY DELAYING WATER DRAINAGE AND EVAPORATING SPLASH DROPLETS, WE REDUCE INTENSITIES BY 20-30%.
EXCELLENT! SO, URBAN FORESTS CAN HELP WHEN PRECIPITA CASTS SPELLS OF PLENTY.

BUT, SHE ALSO CASTS SPELLS OF SCARCITY.

THE TIMES BETWEEN STORMS CAN BE LENGTHY, WHERE SHE PASSES WEARING IN A STATE OF UNMERCIFUL GREED.

SHE BUOYS HIMSELF BY PUSHING THE AIR CURRENTS THAT TRANSPORT MOISTURE AWAY FROM OUR CITY.

IN THOSE TIMES AND IN THOSE AREAS, THERE IS NO OPPORTUNITY TO RECHARGE GROUNDWATER SOURCES.

THIS BECOMES A SERIOUS PROBLEM AT THE SURFACE, TOO, AS THESE GROUNDWATERS FEED OUR STREAMS.

SHOULD PRECIPITA'S MOOD SHIFT TO LONG DRY PERIODS, COULD TREES HELP UNDER THESE CONDITIONS?
Ah! The trees have a way to capture rainfall and rather than evaporate it...
...drain it deep into the soils!

Some trees' canopies can act as a "funnel" capturing rainwater on their surfaces as stemflow.

These droplets hold tight to the branches and trunk as they drain, supplying enormous volumes of water to the soils.

Stemflow water volumes can be so high that they push deeper into soils, recharging groundwater.

And we can increase stemflow infiltration by planting trees in soils that drain more easily!
WE HAVE NO TIME TO WASTE, GENTLEMEN. LET'S PUT THEIR STRATEGIES INTO ACTION AND HOPEFULLY THIS WILL IMPROVE OUR SITUATION.

WE CAN PRUNE ISOLATED TREE CANOPIES TO IMPROVE STEAMFLOW PRODUCTION.

MORE ROWS OF LINDEN TREES CAN BE PLANTED TO MAXIMIZE INTERCEPTION OF RAINFALL.

LET'S "SOFTEN" THE EDGES BETWEEN OUR CITY AND OUR FORESTS BY TERRACING THE VEGETATION.
BACK AT THE LEIPZIG WATCHTOWER, PERCORTA, PLEASED WITH THE CITY'S FORESTRY EFFORTS, JOINS THE DEPUTY MAYOR AND THE FRIENDS OF LEIPZIG.

JOHN VAN STAN

IS AN ECODYNOLOGIST IN CANNON, OK, USA STUDYING HOW LEAVES, BARK & STEMS RESPOND TO PRECIPITATION RATES AND WHAT THESE RESPONSES MEAN FOR WATER RESOURCE MANAGEMENT.

JAN FRIESEN

IS AN ECODYNOLOGIST IN LEIPZIG, GERMANY WHO STUDIES HOW PRECIPITATION DYNAMICS INTERACT WITH FOREST SCALES AND WHAT IMPACT FORESTs HAVE ON WATER AVAILABILITY.

TYASSETA

A FATHER, A COMIC ARTIST FROM INDONESIA, OBSESSED WITH GAMES, MOVIES AND AN ACTION JUNKIE.

HE IS @TYFATE

SILAY

A GAME DEVELOPER AT NOON & COLOUR ARTIST AT NIGHT. CURRENTLY PASSIONATELY DEVELOPING FUN DISPLAY A CHANEL GAME FOR KIDS.

WWW.KAMSTUDIO.COM
**Heiko Rosenthal**

Is the Deputy Mayor of Environment for the city of Leipzig, Germany that is constantly facing Precipita's moods.

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**Precipita**

Brings water from the sky to the ground, and is very sensitive about what we put into her sky. Let us not provoke her wrath!

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**Linden**

Is a hardy tree that is native to Leipzig and friend to Precipita, but it is also friends to Waterwitches in many forested cities across Europe.

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**Ecohydrologists**

Work hard every day to seek sustainable solutions to balance the water needs of society and nature.
HELLO READER! IT'S MY PLEASURE TO INTRODUCE YOU TO TWO CHARACTERS IMPORTANT TO OUR CITY'S WATER MANAGEMENT: PRECITTA, THE WATERWITCH, AND HER LONG-TIME PAL, THE LINDEN TREE! LINDEN, PLEASE TELL US A LITTLE ABOUT WHERE YOU TWO ARE FROM.

WELL, DEPUTY MAYOR ROSENTHAL, WE'RE FROM LEIPZIG, GERMANY! LEIPZIG...JUST LIKE MANY CITIES AROUND THE WORLD, IS ESSENTIALLY AN URBAN FOREST. MOST CITIES MANAGE THEIR FORESTS TO KEEP THEM HEALTHY AND IMPROVE THEIR COMMUNITY SERVICES. THIS IS CALLED URBAN FORESTING.

DOES ANY OF THE COMMUNITY SERVICES PERFORMED BY URBAN FORESTS INVOLVE PARTNERING WITH THIS STUNNING LADY? PRECITTA?

I HAVE BEEN FRIENDS WITH THE FOREST SINCE THE FIRST TREE, OVER 350 MILLION YEARS AGO. THEY ARE THE LAND-DWELLING LIFEFORMS THAT RESIDES CLOSEST TO MY ATMOSPHERIC HOME IN THE CLOUDS. THIS MAKES THEM EASY TO INTERACT WITH, BY PROXIMITY--

--BO, I THINK WHAT PRECITTA IS GETTING AT IS THAT OUR CANOPIES ARE THE FIRST OBJECTS HERE RAIN, SNOW AND RIME CONTACT ON THEIR WAY TO THE SURFACE. BECAUSE OF THIS, URBAN FORESTS SIGNIFICANTLY AFFECT STORMWATER.

WHAT DO YOU MEAN? HOW DOES THE WAY THAT PRECITTA INTERACTS WITH YOUR CANOPIES AFFECT STORMWATER?

WHEN I CAST MY DROPLETS FROM THE SKY, LINDEN AND HIS URBAN FOREST STOP MANY OF THEM FROM REACHING THE SURFACE--

--WE STOP THEM FROM BECOMING RUNOFF.

EXACTLY, THEY ALSO AFFECT MY DROPLETS' SIZE AND THEIR CHEMISTRY AND THE MICROBES THEY CARRY AND...

OH, OK...WE GET IT! THE LIST GOES ON AND WE'D LOVE TO HEAR THE WHOLE THING, BUT WE'RE OUT OF SPACE ON THE BACK COVER! IF YOU WANT TO KNOW MORE, PLEASE OPEN THIS COMIC.