

NWAL 2019 Tribal Summit – Plenary Workshop responses

October 23, 2019

Survey 1: Family Experiences in the Recent Past

Did the events impact you or your family? If they did, what aspects of the events impacted you or your family?

- A lack of a drought management policy for water use for Tribes, communities, agriculturists.
- Mid 1940s and late 1980s are remembered as droughts of record for the Navajo Nation. These events impact ranchers and farmers as well as families/individuals who collect medicinal plants.
- Pyramid Continually watching the river Also, flood and washout area, tumble weed accumulation Roads that wash out, have to travel long distances around Fire then blocks off roads and areas So common, they are just dealing with it Fires have taken out vegetation and then cheat grass comes in Restoration is expensive and takes time, phases get mixed etc. Walker Lowering of the river Worms eating up the leaves of the trees Trees aren't blooming as needed More violent extreme weather, snow rain, heat, windy
- Gila River has been dry about 100 years - great grandparents might be the last generation that saw it flow; when they did have water all of the families farmed, but when it was dammed - completely changed the lifestyles = increase in diabetes and other health problems; past few years = got water rights and getting back into farming = not traditional farming, but cash crops - alfalfa, etc. Northern NV - 1997 flood = didn't directly impact the communities, but it was really good for Walker Lake The drought that followed = the biggest impact was the loss of the fisheries - no more trout; Walker River Paiute are the Agai Dicutta (trout eaters); haven't had trout in over 10 years; Another impact of the drought - loss of birds, and other wildlife species (regular migratory route = they know they've lost birds, but they can't quantify) Cattle range dried up: used to run 2500 herd, but had to reduce down to 500 because cows were dying; Even with the recent wet years, they aren't increasing herds to let the range come back; Ranching = not enough water for irrigation = lots of families left ranches fallow Similar issues in Pyramid Lake = cut range herd down 50% 1970s/80s flood = remembers in Pyramid Lake - lost land due to erosion
- 1995-96, it was dry for several years, then large monsoonal rain event took bridge out in Chinle - years to repair. On Navajo, live in flood ares and many small towns were flooded. Navajo Nation declared state of emergency due to stranding, food and hay deliveries made to rural areas for cattle, sheep. Late 60's early 70's huge snowstorms resulted in air dropped supplies to people, huge state of emergency. snow up to roofs, could make a tunnel in the snow on Navajo Nation teacher told stories about family coming to California during the dustbowl. early 2000's drought did planting and monsoon never came. scattered showers here and there. research project had no plant growth but were able to see which plants were most resilient to drought. introduced species came out. Tried to come up with seeding regimen to get something to hold soil. family had to cut back livestock during drought, sold off. had to haul water. during drought. Last year, horses and other livestock due to lack of water 2017-2018 in Tuba City area. Horses were starved and/or got stuck in mud trying to get to water. This year, monsoon was odd - didn't get rain they usually get. Used to floods during monsoon. 2 years ago, road between Gallup and Shiprock was destroyed due to flooding after fire. Tuba-page road also watched out. Navajo Nation Navajo Technical College. Flood effects are patchy. Three years ago north rim of Canyon de Chelly - flash flood killed a grandmother doing planting. No flood warning system - no electricity or cell service.

- Heavy spring runoff created flood warnings, which led to emergency community planning. had to move people who lived in low lying areas.
- Yes, drought impacted crop & livestock production The "big dig" in Churchill county to drain water impacting Fallon tribal producers. Only 1 crop per irrigation was allowed in 2015
- Yes the floods fires, and droughts which caused major roads washing out, deciding when to irrigate, and speeded up the rotation of the crops (alfalfa).
- Flash flooding can wash out areas such as roads that keep people from traveling to different areas, while the droughts can cause brush fires that burns vegetation and creates more washouts. Pests begin to invade vegetation that can compromise them, allowing more invasive species to take over land. The extremes of the climate affects the ecosystem slowly, but is making droughts more common in desert areas. These extremes will make non-invasive species leave due to their habitat not being habitable and allow invasive species invade the left habitat.
- WATER costs have increased dramatically. Drought this summer monsoon brought just .56 inches of rain Crop reductions of more than 15%. Favorite campground in the chiricahua mountains burned and left desolate
- A lack of a drought management policy for water use for Tribes, communities, agriculturists.
- Yes, drought impacted crop & livestock production The "big dig" in Churchill county to drain water impacting Fallon tribal producers.
- Heavy spring runoff created flood warnings, which led to emergency community planning. had to move people who lived in low lying areas.
- Drought of 2015-2016 caused limited crop season & low production included limited revenue.
- Of course. Floods. Too much water can damage crops wash away top soil especially when soil has been dry for few years
- Receding quantity of herbal traditional medicines and overall lost of vegetation
- Weather: Drought & Wildfires

Were there droughts that were more impactful for you or your family than the ones shown in these data?

What made those droughts problematic?

- 1940s and 1980s for Navajo Nation. Lakes are going dry and landscapes are changing over time. Some lakes are completely gone and no longer exist. In the mountains, the trees are dying (piñon pine and juniper) because of overall lack of precipitation. Some of the animal populations are changing over time too. It is a cyclical process of change.
- 2016 river came very high and close to homes, washed out roads
- 1950s drought = no irrigation water in Pyramid Lake - remembers going down and blocking the whole river off to irrigate the lands;
- Fires floods drought conditions
- Yes, in year 2015 tribal producers were only allowed one watering to their crop
- Walker Lake lost their entire fish population--Lahonton trout. Now a "dead lake." TDS (total dissolved solids) levels went way up. Nothing for cattle to eat--died. Herds cut back 60%. Affected incomes. Cattle got into the river system, ate everything, caused river erosion. Extreme fire dangers. irrigation

system could only support two cuttings of alfalfa. More upstream users of ground water, which reduces surface water flows to our lakes. Upstream ag. producers moving to more water-intensive crops.

- The most impactful droughts occurring in our area were after the data set presented
- Those droughts in 2012 and 2015
- See previous
- The most impactful droughts occurring in our area were after the data set presented
- Yes. After drought came the flood in Churchill County.

How has knowledge of the events been passed down within your family?

- The worldwide abuse of natural world can be felt locally. We are starting to reach or have already reached a climate tipping point. The industrial revolution on Navajo Nation (coal and other mining) of the 1940s and 1950s etc. was not thought to have a big enough effect to cause climate change, but it was contributing and we see that now.
- Pyramid Lake = flood years - farm lands eroded, and tore down fences = moved houses; Gila River = when the river dried up, the knowledge about how they used to farm quit being passed down;
- These events in our area were in last few yrs. Historical data in
- Oral history Prior to the 1930's families had to travel distances to hills to find a water source to grow gardens for subsistence.
- Pyramid Lake = flood years - farm lands eroded, and tore down fences = moved houses; Gila River = when the river dried up, the knowledge about how they used to farm quit being passed down;
- orally, news accounts, pictures
- Oral tradition of how certain plants react to upcoming weather, similar to animals migrating to other areas, but the changing extreme climates ruin this aspect, and each specie change to the weather. This aspect of knowledge is not something that can be relied on if the climate continues to change erratically.
- It has not until my generation and I have shared the information with my family to raise consciousness of the issue.
- Pyramid Lake = flood years - farm lands eroded, and tore down fences = moved houses; Gila River = when the river dried up, the knowledge about how they used to farm quit being passed down;
- It has not until my generation and I have shared the information with my family to raise consciousness of the issue.
- Parents provided experience of flooding in Churchill & fears.
- By talking about it within the family and friends

What examples of adaptation and resilience to drought events can be taken from your family's experience?

- In Shiprock, NM, having to haul water for livestock due to a lack of precipitation. Rely more on irrigation. In Montana, crop prices go up when rain is not falling. Increased fires results in air quality

issues, trees dying, increase of insect such as grasshoppers. Decrease in rangeland quality. Overgrazing results in invasion of undesirable species, increases in grassland fires. Dropping groundwater levels results in drinking water quality issues. Fisheries impacted. Warm water affects native fish populations. More wildlife come down into communities from their habitats foraging for food out of their habitat. In CA, we had neighborhood irrigation restrictions (1980s- and 90s). Even and odd address watering restrictions. Local temperature increases result in more AC use. Changes in snow pack levels results in melt off, and affects reservoir water storage. This impacts local irrigation districts Changing an irrigation method (from flood to center pivot, for example) to deal with water loss from evaporation. An increase

- From Indigenous view, seems like we talk about the surface or superficial aspects of climate change. We don't get down to the root core. Indigenous people have a basic understanding of these realities and can share the truth if the conference organizers want to hear it. As human beings we have forgotten to live in a respectful manner with the earth so the threshold or pivotal point is being exceeded and throwing everything out of balance.
- Gila - depended on government subsistence foods when the river dried up; community never left - made it work there in their homelands; Schurz - drought FSA emergency money compensation = proved the cattle were dead by just walking around taking pictures = huge die off; many ranchers sold the rest of their herds off; Pyramid Lake = cattleman sold theirs 50% (required by BIA); 2000 herd down to 800; ranchers are moving to different professions;
- Song that is sung during mens sweatlodge captured all of the things that were being taught during class about water quality, macroinvertebrates, etc...those songs were created a very long time ago. song talks about how flow, diversity, water quality are part of human wellbeing. Being in tune with surroundings to accommodate the unexpected. have rules about being alongside a small stream when it rains. little kids hear thunder elsewhere and know they need to leave. this is what resiliency is.
- Orally picture data news
- Switching to winter annual crops or low water use crops during drought In 2018 after the drought the flooding impacted the crop lands by the water tables increasing causing sink holes.
- Thinking about changing crops, but that is hard to consider. Thinking about water rights and how best to use it. Always want to use your water allocation--for ag, fisheries, ecosystem improvement. Looked at alternative drinking water sources. drilling more wells for livestock, using solar power-- been a good project. renewable energy, as an alternative for farming revenue. geothermal too.
- repaired and redesigned drainage systems replanted and releveled fields and crops activities are in the planning process to repair infrastructure and existing facilities
- Consider alternative crops.
- Have a secondary income & be prepared. Yes

Does the climate information we presented (time series of PMDI, stream flow data) capture the aspects of the drought event that actually impacted you? What about those data seem useful or not useful in describing the drought?

- Does the information provided include annual precipitation or is it growing-season data?
- Lots of times we come to these kinds of conferences but we only talk about the issues and not the solutions. If there is any really effort to fix these problems science and technology won't be the answer because physical aspects of problem just half of it. For Indigenous the answer is totality of

spiritual and physical -- that is the truth. Science is handicapped. Some scientists understand the limitations and are recognizing the Indigenous perspective. For the Indigenous this is absolute and has to be this way.... otherwise we are spinning our wheels in obscurity and the great demise.

- No all the events are morer eventa
- In 2015-17 drought affected us & floods in 2018
- Yeah = their memories are in line with the results reported here; USDA monthly reports of water availability were helpful for cattelman (Pyramid Lake) = don't get these mail outs anymore
- We use it all the time. Helps keep track of water quality data. Affects aquatic life. Longterm is lower water supply, higher TDS, more danger for aquatic life. also affects spawning success--manage the spawning events if water too low.
- The more impactful events occurred after the data presented
- We are dependent on the gila river which has poor hydrology. While not in one of the graphs the gila is likely similar to the pattern we see on these graphs.
- Does the information provided include annual precipitation or is it growing-season data?
- Yes

Are these kinds of information you are using now? Why/why not? If you are using different information to understand drought, what is that and why are you using that information?

- The empirical data is just one piece. We need to discuss what is causing these trends. It is scary but we need to talk about the causes. Indigenous people need to say what they need to say and everybody needs to listen to deal realistically with root causes of climate change. Scientists are depressed because we know we are at a superficial. Navajo say to remember first where you come from.
- Need each person to be able to enter their own info, too much geographical diversity
- Slow internet - difficult to access climate information online; Pyramid Lake = Through tribal meetings = cattelman's meetings - USDA monthly reports of water availability were helpful for cattelman (Pyramid Lake) = don't get these mail outs anymore Walker River = BIA range assessment done a few years ago = this was really helpful to help plan for range; don't have the funding for better data; Gila = own telecommunications/internet services = publish on the internet where they get all of their information
- Yes but more recent data for recent yrs.
- Yes
- Water quality data. look at fish populations, native minnows. Based on minnow pop, we plant quantity of trout USGS flow monitoring along the watershed to terminal lakes.
- The information now used is the more current data as most of the impactful events occurred after the timeline resented
- We are using bor s Colorado River simulation system to model local impacts.
- USGS & info. from other resources.

Session #2: Community Experiences in the Deep Past

We've presented information about past streamflow and drought that is based on tree rings. Do these data tell a story that is consistent with your community history—how often drought occurs, how long they last, and which were the worst droughts?

- Drought interpreted so differently based on where you are from - it is relative. Pyramid Lake water is greater than historically due to changes in water management - Lake near Gerlach (Winneemucca Lake?) dried up. parents stories of snow suggest more snow than is currently experienced memories of snow cover during all of winter, doesn't happen often. Last year was first time. Stories about how difficult it is to manage livestock in snow but young people haven't experienced it so last year take advantage of teaching kids how to do it because it was the one time there was snow.
- Absolutely. The gila river was dammed on the late 1920s. The reservoir has been filled only 3 times 1941, 1978 to 1983, and 1993 -1994. The point is the hydrology of the gila parallels the general stream recreations shown. The gila was wet much of the 18th and 19th centuries until the latter part of the 19th century. The 1940s appear to be wetter but the fifties forward (except the late 1970s and early 1980s and 1993) have been dry. The impacts on Downstream growers was further impacted by Upstream diversions.
- We feel these questions are repetitious and we have already said our answers .
- Never really heard stories about drought in the past; Pyramid Lake = used to have forests in the North end of Pyramid Lake = used to have pinenut trees there (ancient = petrified); still had a handful (maybe 3), but they died in the fire two years ago; Evidence of sheep = old bones and skulls; Schurz = petroglyphs located up higher = communities used to live up higher in the mountains when the water level of the lake was higher; Gila River = wild plants drying out; used to be abundance of berries (remembers picking them with her grandma and mom); used to pick every year, but haven't been able to recently; wild spinach, cactus fruit being affected by times when it's too cold at night, and too hot in the day; Climate change affecting their plants;
- At Pyramid Lake the Little Nixon Bridge and water flume washed out in the early 1950's and was never replaced this shows on the graph Snowfalls were greater in the late 1950's according to memory of those present at the table and also corresponds to the graph
- Yes somewhat. Been 2 to 4 years of wet then floods come after 7 to 9 years of drought
- Every 7-9 yrs. drought occurs followed by 2-3 years of flood years, this does coincide with the Northwest NV drought graph.
- In more desert-based areas, there is no current application for using tree rings in such communities. When water is diverted from the rivers for irrigation or farming to other outside communities, the accuracy of this data would be compromised, as far as applying to the benefits of one's community down river from the diverting communities.

Are there drought events that have affected your community that you don't see represented in these data?

- The drought is an abstraction but the effects of drought affected real people and communities. Drought likely led to the collapse of some "prehistoric communities" in the latter 16th century

- We feel these questions are repetitious and we have already said our answers . But in making sense of how science arrives at evidence of these drought patterns of 1580s. Immediate concern is how relevant of centuries ago climate relate to our current dilemma. Our concentration should be on our current dilemma and how do we move forward. Because of this horse blinder perspective that scientists have they analyze things to death. What is the benefit of this information for us and what do we walk away with from this? Our situation is so urgent, we can't really give the topic dry discussion.
- Gila river located south - different climate than the upper Colorado River Basin = drier conditions;
- Reflects some historical events but not actual
- The construction of dam's on major rivers stopped natural spring flow & the migration of salmon & other fish species. Animals such horses & cattle damage springs during drought years in search for water below the surface, the mining industry in NV doesn't help with their dewatering efforts in the numerous operations throughout NV. Water wars & the human effects on social economic. Tribes on the tail end of the water deliver system suffer from the lack of water as opposed to upstream users.
- In the mid-1930s, 1938 Pyramid Lake lost its fish population. Winnemucca Lake dried up. Pryamid lake became a terminal lake. i
- Yes. There are Juniper and Cottonwood trees on the Truckee River that will assist in better representing more communities. Irrigation diversion upstream will misrepresent the data as well.

What are some other differences between what your community knows about drought events and what these data show? (Seasonality? Length? Timing? Relative severity?)

- Seem to be longer
- We feel these questions are repetitious and we have already said our answers . We are all speaking English here but to move forward we have to ask the right questions. We have to have that conversation whether we want it or not. Native culture, traditions and thought processes sometimes don't want to be heard -- so one side and another side of the problem. Spiritual and traditional vs. science is one issue but then the other is ongoing communication.
- Precipitation falls in the mountains; Phoenix area - used to get more rain, but it doesn't come down as much; Increase in extreme wind events (Walker River area) = roads being closed down; A decrease in dust storms in the Gila River area this year = two years ago, they had a really thick dust storms;
- Do not see any major differences
- Less snow less rain. More wind hotter temperatures in the past 30 years.
- It's pretty close of what we've gone through in our lives, but the graph shows the drought & wet years are become more extreme & frequent. Currently with farming, out of 10 years 2 years you'll make money 3 years & 5 years you break even.
- In the 1500 drought event, all N. Nevada lakes dried up except Pyramid Lake.
- Bank erosion from the rivers; more flow takes more river banks away if bends are more prominent.

What lessons about drought resilience have been passed down through generations?

- Plant indicators of overgrazing during drought if species are missing, that can tell you something as well Things will be different now, perennial streams might be lost - water harvesting, permaculture, building up water table, hydromulching rather than use of pesticides
- We feel these questions are repetitious and we have already said our answers . I grew up a certain way but now I live a certain way and you have to have balance. Is climate change actually cyclical -- that is, is it something that the earth does cyclically? We have cycles throughout the year (seasons), moon cycles, for example, so are these climate events cyclical. Such a complicated lesson for humanity that it requires input and respectful discussion which means that we are all equals, regardless of higher degrees and expertise. Scientists cannot feel/think that they are more important than the grandmother sitting at the sheep camp who isn't formally educated. Formal science degrees and research cannot replace this kind of real knowledge. Some profound questions cannot be answered by science. "Record of Change: Science and Elder Observations on the Navajo Nation" documentary on Navajo Nation (<https://youtu.be/47ufPa9hPE>) explains this and everybody may want to watch this. The capacity-building intended by this project is happening in opposite way. The data scientists are looking for lives inside the people.
- The fact that when reservations were established as ranch and farming communities all is impacted
- Did Tribes move from geographic regions as a result of local climate conditions? Is there a record of stories shared between generations of how families adapted? Non-native populations attempting to homestead lands during dust-bowl era are forced to move and relocate for economic reasons. Prior to reservations, tribes were mobile and moved to hunt and gather food. Drought may have affected availability of food forcing tribes to follow the paths to track wildlife and where water was flowing. Hunters and gatherers roamed vast areas of geographic regions. Tribal clan systems of the Navajo were located near water sources. Moved from lands by Spaniards and European settlers. Early tribes in Southwest were impacted by interaction with Spaniards.
- In good years when you can make money on crops you still must watch the market trends since over abundance of crops can drive the prices down.
- You can't depend on anyone else.
- During drier years, pinyon pine trees bear smaller pinyons than wetter seasons.

How did your community recover from droughts in the past? How long did that recovery take?

- The recent drought and Upstream diversions (past 120 years) has not been overcome despite a water settlement. Effects on the environment have severe in addition to health impacts on the people.
- We feel these questions are repetitious and we have already said our answers. When you speak to scientists they get uncomfortable and they change the subject, kind of like car salesmen. The salesman has one track mind-- to make that sale. The scientist has one track mind -- to have his/her conclusions validated. What is driving the scientists? So bottom line is to come back to who you are and where you come from... there is always a way forward from this place. Coming from a place of who you are allows to work with science more effectively.
- Gila = they didn't have any water (dammed and diverted), so droughts didn't really impact them = put all action into recovering water rights; several decade battle;

- Repair, rebuild, replant, and some entities have never recovered
- Still in recovery
- Changing irrigation method technologies. Moving from "flood" method to sprinkler and drip-application. to minimize water loss from evaporation, and
- Still recovering. Not sure it's possible with climate change. Fought, and still fighting, for water rights.
- Working with National Fish and Wildlife to create more sufficient stream flows specifically for the trout and recovering from the damaged lake.

Session 3: Regional Experiences in the Future

How will families and communities in your region achieve food and resource security and sovereignty over the next century under each of these scenarios?

- Become more self-sufficient growing gardens and orchards on a family scale. Hoophouses/greenhouses for growing produce helps with becoming self-sustaining. If sovereignty means control of some sort it is only controlling within the family or community it is a smaller scale in the big world
- Coming up with new ways of using water = instead of flood irrigation consider alternatives; look to alternative sources such as pumping water (groundwater); using water more efficiently - make it stretch further; -aquaponics = greenhouses, efficient water uses = longer growing season; -food preservation (canning); -getting permits to use groundwater = obtain more water rights; -defensible space for fire protection; -fire protection for outside areas that need to be protected = e.g. grazing; turn out during noxious weeds = almost 50% of pyramid lake reservation burned;
- Growing your own produce, e.g., hoop houses gardens. Hunting, fishing, gathering traditional food sources. Issues tribes face is getting more people interested in working to achieve this goal, they find it so much more convenient to purchase food from the store.
- large scale watershed planning need to recognize interconnections between social ecological cultural how to change policy around land use and building ecological resiliency what are the political and systematic barriers
- Change what foods we eat, to more drought-resistant crops. Switching from ag-based economy to renewable energy (e.g., geothermal). How do we humans adapt physiologically to higher temps? Our children? More restrictive fishing regulations to protect fish populations when water temps are high. Build new homes with central A/C, build more shades for kids. Evaporative cooling doesn't work anymore, due to smoke. Building more hoop and greenhouses. More gardening. Family-based. Investing in more solar tech.
- If we are going to talk solutions, scientists must hear the Indigenous perspectives. Otherwise, if science can make it rain, let's see it. Perhaps we can make it rain. Right here and now, if you want to hear possible solutions you need to hear us. We talk about food security on the Navajo Nation, but still if we cannot address the bigger issue -- global climate change impacts. On a global spectrum let's cut to the chase. Science and technology have horse blinder perspectives on the world due to training. If science and people of academia are not able to provide the opportunity for us to say what we need to say, then they are part of the problem.

- For food sovereignty and security, the community needs to encourage personal farming vegetables and fruits for personal consumption at first. Once the people become secure with their ability to grow, create farmer's markets in the communities to circulate currency into the community rather than outside of the community. Eventually expand into having massive farmer's markets that will have multiple reservations attending. The produce could even be traded for other types of produce as well, having families specify into growing one or two crops.
- large scale watershed planning need to recognize interconnections between social ecological cultural how to change policy around land use and building ecological resiliency what are the political and systematic barriers
- Farming Design more efficient irrigation systems Develop alternative cropping systems Communities Develop sustainable food sources (individual and community gardens) Develop infrastructure that will handle the floods that may occur. Range management systems need to be modified to best handle the weather variations (fire , flood ,and droughts)
- Consider drip irrigation (or other technologies) or crop selection and match crop to the region . Consider technological advances. Adapt crops to the climate. Water conservation through converting open canals to pipeline and water education.

What advice would you give to your grandchildren about how to flourish under each of the scenarios?

- To pay attention to all that is around you. You see someone litter you pick it up instead of throwing debris on the earth. Respect earth we walk upon water we need and air we breathe. Love life
- -never give up; -teaching each other about some of those older ways = hunting, gardening, livestock, preserving food for droughts (canning, drying foods, etc.); everyone used to always have their own gardens no matter what;
- Targeting our youth to understand the value of hard work & change their attitudes to reflect a better quality for a better future. This allows our younger generation to understand the situation regarding food sovereignty today will fall on their shoulders sooner than they think. To keep our cultures & traditions by eating wild game & foods.
- RESIST! build new institutions of environmental governance and restore traditional agricultural and migratory practices verifying oral traditions with data -- helps to recognize the value of these oral stories leaders are carrying out an adaptation plan that protects them at the cost of everyone else. We need something better. This is not working for us. The Global Youth Movement is going in this direction but it hasn't trickled down to local level. Youth needs a voice - get involved in local politics, judges, magistrates, county commissioners that can affect change more immediately
- Can't be lazy (starve or survive) Become as self sufficient as possible
- Return agriculture education to schools.

What other kinds of information would be useful for planning for your household / community / region?

- Information is useful. More solutions to be stressed on how we need to conserve our resources as a nation. Slow down development and destruction of land and water. We need to continue with our culture and traditions as Indigenous people caretakers of the world we live in today.

- Food banks = difficult situation, but already realistic for most families in rural areas; -information on home gardens, and hoop houses (home, school, communities);
- Models based on historical data that are more reliable, trustworthy.
- Outreach from this project has been more effective than the summits -- outreach such as going into the communities, engaging the community and have hands-on learning and communication.
- Develop weather forecasting models, awareness and education . Always have plan B