DEVELOPING CAPACITY AMONG NATIVE AMERICANS/TRIBAL/INDIGENOUS COMMUNITIES TO LEAD CLIMATE ADAPTATION AND RESILIENCE PROJECTS

By

Elizabeth Tanzi
Katharine Poole
John Quinn

CAPSTONE PROJECT REPORT

Submitted in partial fulfillment of the
requirements for the degree of
M.A. in Climate and Society

COLUMBIA UNIVERSITY

2020

***Client*: Institute for Tribal Environmental Professionals (ITEP)**
***Instructor:* Aisha Owusu**

Abstract

Integrating climate change into hazard mitigation planning is essential, especially for Native American/Tribal/Indigenous communities. These communities must develop the capacity to lead in climate adaptation and resilience projects, to protect themselves and cultural resources from the threats of climate change. To aid in capacity development among Tribes to lead climate adaptation and resilience projects, our team of Columbia University candidates in M.A. in Climate and Society worked with the Institute for Tribal Environmental Professionals (ITEP) for our Capstone project. We assisted in curriculum development for ITEP's Introduction to Climate Change Adaptation Planning course (CC 101) and Hazard Mitigation Planning Cohorts (CC 202). We worked to provide general frameworks for climate adaptation and hazard mitigation, support for preparation and implementation of plans, and a range of examples from Native/Tribal/Indigenous lands across the United States. Our team analyzed and summarized 35 Tribal Hazard Mitigation Plans from FEMA Regions VI, IX, and X. Through our research, we found that many Tribes are currently preparing for and discussing climate change within their communities. However, there are no formal guidelines or checklists to aid in the holistic integration of climate change into hazard mitigation planning. This hinders accessibility to adapt, consistency, and overall capacity levels.

This paper summarizes our methodology and findings of our Capstone project, as well as includes documents and deliverables created by our team that serve as curriculum development. Additionally, this paper analyses literature on climate change, Tribes, and hazard mitigation planning.

Table of Contents

Introduction

The Vulnerability and exposure of Native Americans/Tribal/Indigenous communities to climate change impacts has been widely recognized by the U.S. National Climate Assessments, Intergovernmental Panel on Climate Change (IPCC) reports as well as other sources, yet the population of tribal professionals who can plan or implement climate adaptation and hazard mitigation activities remains limited. Structural obstacles to climate change education among these groups remain a challenge. To properly prepare for and adapt to the impacts of climate change, there is a need for culturally sensitive adaptation and hazard mitigation methods for Tribes.

Over recent decades, disasters in the United States have become more frequent and increasingly costly. Climate change will exacerbate disaster risk, especially among vulnerable and underserved populations. To properly prepare for changes in climate, and to protect cultural resources, Tribes must integrate climate change into their Federal Emergency Management Agency (FEMA) hazard mitigation plans.

To aid in competency development among Tribes to lead climate adaptation and resilience projects, our team of Columbia University candidates in M.A. in Climate and Society worked with the Institute for Tribal Environmental Professionals (ITEP) for our Capstone project. Our general task overview included assisting in curriculum development, including, for example, the development of worksheets and case studies, for ITEP's Introduction to Climate Change Adaptation Planning course (CC 101) and Hazard Mitigation Planning Cohorts (CC 202). We worked to provide general frameworks for climate adaptation and hazard mitigation, support for preparation and implementation of plans, and a range of examples from Native/Tribal/Indigenous lands across the United States. Background information on U.S. disaster legislation and history, as well as FEMA guidance, was read by our team and depended upon throughout the remainder of our research.

Our team analyzed and summarized 35 Tribal Hazard Mitigation Plans from FEMA Regions VI, IX, and X. Through our research, we found that many Tribes are currently preparing for and discussing climate change within their communities. However, there are no formal guidelines or checklists to aid in the integration of climate change into hazard mitigation planning. This ultimately hinders accessibility, consistency, and capacity building. We isolated Risk Assessments and Asset Inventories from each Tribal plan and then assessed and summarized each plan. Throughout the summaries, we documented any mentions of the following categories: Climate change considerations, cultural considerations, Tribal/Indigenous knowledge, community engagement and outreach, proposed actions for implementation, and public health concerns, disease, and pandemics. A comprehensive spreadsheet of Tribes, plans, and assessment of the above categories was completed.

Additionally, we assembled worksheets, or infographics, pertaining to the intersection of climate change and hazards in Tribal Hazard Mitigation Plans, as well as on community outreach and engagement, and goal setting. These were a mixture of both long and short-form worksheets that aimed to create a more accessible dialogue. These worksheets were developed to be updated continuously and serve to help consider climate change in the context of mitigating specific hazards and hazard mitigation planning more generally.

This project provided insight into how Tribes can increase resilience and ensure climate change is considered in preparing for hazards. Our findings and developed worksheets below are the product of our research. This paper explores the connection between climate change, Tribes, and hazard mitigation planning.

Methodology

This project consisted of four tasks, each meant to provide general frameworks for climate adaptation and hazard mitigation from a range of concrete examples from Native/Tribal/Indigenous lands around the U.S.
Our original project plan, represented by a Gantt chart was not what our final project plan turned out to be in actuality. Our team had to adjust our project schedule accordingly. A copy of our Gantt chart can be found in Annex I.

I. Task 1

The first of these tasks was to familiarize ourselves with the current policies and legislation surrounding tribal hazard mitigation plans and the U.S. disaster legislation and history. Approximately one week was spent familiarizing ourselves with this background material to gain the conceptual foundations required for the following tasks.

To begin the project, our team analyzed relevant literature and background information from a variety of sources. These documents were provided by the Client and were intended to be used as a reference and guide for our research and objectives.

A list of documents used for Task 1 follow below:

- Code of Federal Regulations (44 CFR Part 201), Tribal Mitigation Plans
- Robert T. Stafford Disaster Relief and Emergency Assistance Act
- FEMA Fact Sheet Hazard Mitigation Planning for Indian Tribal Governments
- FEMA Fact Sheet Tribal Mitigation Plan Review Guide

- FEMA Tribal Mitigation Plan Review Guide Policy
- FEMA Tribal Mitigation Plan Review Guide
- FEMA Tribal Mitigation Planning Handbook
- Planning Process Workshops
- Pre-Disaster Recovery Planning Guide for Tribal Governments
- FEMA Mitigation Ideas, a resource for reducing risk to natural hazards
- Examples of Tribal Hazard Mitigation Plans
    - Quileute Nation 2015

This portion of the project was crucial as it laid the framework for how both Tribal and non-Tribal hazard mitigation plans are designed, and what must be included in each. Tribal Hazard Mitigation Plans are essential to Native American/ Tribal and Indigenous communities as they help these groups receive federal funding and resources, as well as help with disaster assistance.

II. Task 2

Task two was centered on summarizing existing Tribal Hazard Mitigation Plans (THMPs) into more succinct and readable content. Each THMP varied in length and detail, some just barely meeting HMP requirements and others going far beyond. ITEP specified that FEMA regions of interest to them were Regions VI, IX, and X. Within each region, a list of all federally recognized Tribes was compiled, and summaries were made for those Tribes with accessible or public THMPs. Each summary included a cover page outlining each report's contents, as well as the extracted hazard profiles. The information for each Region was compiled into a master spreadsheet for record-keeping and analysis. An overarching summary was written for each Region, identifying trends noticed within the available plans and area. We documented any mentions of the following categories: Climate change considerations, cultural considerations, Tribal/Indigenous knowledge, community engagement and outreach, proposed actions for implementation, and public health concerns, disease, and pandemics, and uniqueness of the plan itself. As only a small fraction of these plans were available, these trends cannot be used as a representative sample. Our work was set up in a template that makes the continuation of this project for another potential group manageable.

We found that a favorable way of going about this task was to read the plan, and then perform a keyword search of relevant climate-related terms. This helped us to fully analyze the documents and ensure that all climate-related information was compiled. We would simultaneously write our summaries for each plan while reading them.

When a Tribe itself did not have a hazard mitigation plan, we did try to find the mitigation plan for its county or state. If we could not find a plan for the county nor community, we removed the tribe from our list. This task was initially estimated to take two weeks but instead spanned over one month.

III. Task 3

Task three used the summaries previously mentioned as resources in the development of worksheets and curriculum materials. Worksheets were created for two hazards: flooding and pandemics, as they were prioritized by ITEP. For each hazard, we developed a worksheet of how to consider climate change in the context of mitigating the specific hazard, including case studies, available hazard mitigation, and risk assessment tools and approaches, resources, and agency expertise for the specific hazard. Our team worked with the client to come to a consensus on design style and content. Throughout this step, our clients emphasized that they would like our deliverable documents to be editable. Task three was combined with task four, as worksheets detailing community engagement and goal setting strategies were also made at this time. Task three was completed within fourteen days. We used Google Docs and Microsoft Word to create these documents.

IV. Task 4

For task four our team developed worksheets for hazard mitigation planning topics. The topics we focused on were community outreach and engagement, and goal setting. These two worksheets depended upon content from Tasks 1 and 2.

The findings of these tasks were presented on August 12 in a presentation with both Client and Instructor.

Literature Review

Tribes, Climate Change, and Hazard Mitigation Planning

Disasters are impacted by climate change. There can be an increase in intensity, frequency, and duration of many hazards as a result of these changes.[1] There is currently a call for climate to be integrated into hazard mitigation planning.[2] Birkmann and Teichman indicate that the increase in disasters due to natural hazards has increased, for the most part, as a result of

[1] Field, C. B., Barros, V., Stocker, T. F., & Dahe, Q. (Eds.). (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation: special report of the intergovernmental panel on climate change*. Cambridge University Press.

[2] Birkmann, J., & von Teichman, K. (2010). Integrating disaster risk reduction and climate change adaptation: key challenges—scales, knowledge, and norms. *Sustainability Science*, *5*(2), 171-184.

climate change.[3] It is crucial to note, however, that attribution of a single event to climate change is still very difficult. The authors discuss best practices to integrate climate change adaptation into the disaster cycle.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act is the authority that governs federal assistance for emergency management and disasters, and regulates how FEMA operates.[4] It sets the foundation for disaster recovery programs, such as Hazard Mitigation Grant Programs and Pre-Disaster Mitigation program. Research indicates that communities undertaking hazard mitigation planning struggle to meet minimum requirements set by FEMA, overlooking critical issues such as climate change.[5]

Federally-recognized tribes must adapt to many ecological challenges that result from climate change.[6] Tribes face a myriad of challenges and hazards, such as sea level rise, reduction in glaciers, drought, and public health threats. In his research, Whyte includes the alteration of habitats of culturally significant species and community relocation as additional problems for tribal adaptation planning. It is noted that governmental and societal institutions supporting tribes in adapting to climate change are often constrained by political obstructions, leading to justice issues such as rights violations.[7] Whyte advocates for a justice framework to guide how leaders, scientists, and tribal professionals understand what actions are morally essential for supporting tribes' adaptation efforts.[8] He situates this framework within systems of responsibility that matter to tribes, such as inter-species relationships and government-to-government partnerships.

It is important to note that climate change is only one of the drivers of change, and cannot be separated from social, political, economic, and environmental changes confronting indigenous and tribal communities.[9] According to Wildcat, awareness of climate change is high among indigenous peoples of the USA comparatively to most citizens of the USA.[10] Heightened awareness of climate changes can be a result of collective life experience and risk perception. Federally-recognized tribes can be found in every environment type in the United States, creating a wealth of potential regarding potential adaptation strategies. Native knowledge of climate changes seem to not be fully incorporated into traditional climate change research.

Despite this, there is a need for climate services in tribal communities. Research indicates that collaborations between tribes and climate science organizations have potential to provide

---

[3] Birkmann, J., & von Teichman, K. (2010).

[4] Stults, M. (2017). Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. *Climate Risk Management*, *17*, 21-34.

[5] Frazier, T. G., Walker, M. H., Kumari, A., & Thompson, C. M. (2013). Opportunities and constraints to hazard mitigation planning. *Applied Geography*, *40*, 52-60.

[6] Whyte, K. P. (2013). Justice forward: Tribes, climate adaptation and responsibility. In *Climate change and indigenous peoples in the United States* (pp. 9-22). Springer, Cham.

[7] Whyte, K. P. (2013). Justice forward: Tribes, climate adaptation and responsibility.

[8] Whyte, K. P. (2013). Justice forward: Tribes, climate adaptation and responsibility.

[9] Wildcat, D. R. (2013). Introduction: climate change and indigenous peoples of the USA. In *Climate Change and Indigenous Peoples in the United States* (pp. 1-7). Springer, Cham.

[10] Wildcat, D. R. (2013). Introduction: climate change and indigenous peoples of the USA.

support for climate change planning. A study found that the benefits of collaborations between these stakeholders outweighed the potential harms for both groups.[11] Potential harms were much more important to Tribes. While collaboration could be very beneficial, there is a history of climate service organizations failing to honor tribal agreements on confidentiality of information shared or sampled by indigenous peoples. Developing stronger relationships and trust in the collaborations as a product of sharing systems of responsibilities can aid in overall adaptation capacity for climate change.[12]

When it comes to integrating climate change into hazard mitigation planning, there is little literature on the intersectionality of that topic and tribes. However, even general hazard mitigation planning and climate change integration literature can provide frameworks for planning. Stults notes in her study on 30 U.S. local community hazard mitigation plans that a majority of communities she analyzed are openly discussing how climate change impacts or could affect hazards.[13] They are analyzed against a conceptual framework for how climate change could be integrated into requirements specific by FEMA Plan Review Crosswalk, a checklist used to approve local hazard mitigation plans.[14] Over half the plans surveyed included hazard mitigation actions designed for a climate change future. These are usually focused on researching, planning, and capacity building. Stults finds that there is little consistency in how communities are integrating climate change into hazard planning.[15]

Literature regarding integration of climate change into hazard planning tends to focus on the theoretical and not on mechanisms by which the two topics could be integrated. There are many ways that tribal communities can plan for climate change, including integrating climate change into multi hazard mitigation plans.[16] Integrating climate change into hazard mitigation planning is not yet incentives or required, besides for State Hazard Mitigation Plans. Stults finds 21 general and specific ways to integrate climate change throughout hazard mitigation planning. [17] This report additionally indicates the valuable information that can be gathered through analyzing mitigation plans with a scale of integration of climate change. This may also be easily transferable to tribes and their planning efforts.

---

[11] Kalafatis, S. E., Whyte, K. P., Libarkin, J. C., & Caldwell, C. (2019). Ensuring climate services serve society: examining tribes' collaborations with climate scientists using a capability approach. *Climatic Change*, *157*(1), 115-131.
[12] Kalafatis, S. E., Whyte, K. P., Libarkin, J. C., & Caldwell, C. (2019).
[13] Stults, M. (2017). Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. *Climate Risk Management*, *17*, 21-34.
[14] Stults, M. (2017). Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. *Climate Risk Management*, *17*, 21-34.
[15] Stults, M. (2017). Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. *Climate Risk Management*, *17*, 21-34.
[16] Joyner, T. A., & Orgera, R. (2013). Climate change hazard mitigation and disaster policy in south Louisiana: Planning and preparing for a "slow disaster". *Risk, Hazards & Crisis in Public Policy*, *4*(3), 198-214.
[17] Stults, M. (2017). Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. *Climate Risk Management*, *17*, 21-34.

Summarizing and Analyzing Tribal Hazard Mitigation Plans

For Task 2, our team focused on three FEMA Regions. Region 6, involving the States, Texas, New Mexico, Oklahoma, Arkansas, and Louisiana. Region 9, involving the States, California, Arizona, Nevada, and Hawaii, and Region 10, involving the States Washington, Oregon, Idaho, and Alaska.

Although only a few plans overall were summarized, we tried to note patterns and trends within regions. However, because this is a small sample size, any trends indicated in this report are not statistically meaningful. We found that in Region 6, there was little mention of climate change. Only one plan summarized included changes to the climate. Many of the plans in this region were also confidential and can only be obtained by contacting the tribes directly. Some of the plans did, however, discuss things relevant to climate change, but did not use the terminology of climate change. Rather, changes to the environment or environmental degradation was the framing chosen. This may stem from political landscapes within the region as a whole or States individually.

Region 9 plans did not include climate change either. This could be due to several or States individually. reasons, one explanation we had for this is that the years in which these plans were published could play a role. Plans that were published more recently, after 2016, are more likely to have climate change included. Public health was emphasized throughout the region as well, albeit the specific mention of a pandemic was only found in two of the tribal hazard mitigation plans. That said, a growing concern for cyber threats and terrorism seems to be a trend throughout the region. Both of these threats were either listed as a hazard or had resources designated to identify the potential hazard they present.

FEMA Region 10 encompasses the Cascadia subduction zone. This fault produces some of the largest and most damaging earthquakes in the world. Because of the Cascadia subduction zone, this region is prone to earthquakes, which was found to be one of the more prominent hazards within all of the hazard mitigation plans summarized. Along with earthquakes themselves, the secondary hazards that arise from the earthquakes are just as dangerous to the tribes of this region. Such secondary hazards include but are not limited too, landslides, tsunamis, and liquefaction. For example, the Sauk Suiattle Indian Tribe of Skagit County, Washington states that the secondary effects of earthquakes can cause around $441,000 on damages within their reservation. Another trend noticed throughout the plans summarized was the risk of flooding. Most of the tribes that were looked at in this region reside on the Pacific coast, thus extremely vulnerable to flooding and the exacerbated effects of flooding due to climate change. Because of such, many of these tribes are a part of the National Flood Insurance Program (NFIP) through FEMA. Even tribes that reside more inland are subject to flooding, but

the type that will affect them is riverine and inland flooding. This can be compounded by increased rapid snowmelt.

It is important to note that because of how small our sample size was, regarding the number of tribal hazard mitigation plans summarized, we can not draw concrete conclusions about trends. These are our observed opinions. Out of the 35 plans looked at, 15 of them had no inclusion or mention of climate change, and 20 addressed climate change. The plans that integrated climate change were varied in the sense that some simply mentioned climate and others delved deep to fully assess the topic in the context of hazard mitigation. Region 10 had the greatest total of tribes that discussed climate change in their plans. For each region, we documented any mentions of the following categories: *Climate change considerations, cultural considerations, Tribal/Indigenous knowledge, community engagement and outreach, proposed actions for implementation, and public health concerns, disease, and pandemics.*

As we know, climate change stands to exacerbate the risks faced by some of the world's most vulnerable populations. For many of these communities, a history of oppression and alienation has resulted in resource challenges that are directly affecting their resilience. The population of tribal professionals who plan and implement climate adaptation and hazard mitigation activities remains small. Overall, there is little consistency as to how Tribes integrate climate change into their hazard plans.

We created a Google Sheets spreadsheet with all of our findings relating to hazard mitigation plans by Tribe. We created folders for each Tribe we analyzed and wrote summaries, as well as pulled out relevant information asked for by ITEP.

Integrating Climate into Hazards and Mitigation Strategy

When researching methods to integrate climate into hazards and mitigation strategy during Task 3, we found that there are a variety of approaches to consider. Common themes of hazard mitigation plans that address climate change fully include climate related stakeholders in the planning process, climate change discussed at public meetings, and that goals and objectives have climate change in mind. Other themes are discussion of how climate change could impact each hazard, factoring in probability calculations for future hazards, or considering climate change as a stand alone hazard.[18] Things that seemed to aid in integration was robust community participation, accessible and available data, or having a recent disaster. What made integration more difficult seemed to be lack of funding for climate change integration, lack of data available, and low issue salience for climate change in comparison to preparing for more immediate-seeming projects. Our research seems to indicate that, even if tribes do include climate change in their plans, it is difficult to assess climate related mitigation strategies versus

[18] Stults, M. (2017). Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. *Climate Risk Management*, *17*, 21-34.

general hazard mitigation strategies.

When focusing on our two hazard topics, flooding and pandemics, we searched for the most up to date research on the topics and their relation to climate change. When looking at plans that integrated climate change and flooding, we found that they have included mitigation structures for a future, changed floodplain, as well as made plans based on 100 year floodplain or greater projections.[19] Tribal communities would benefit from engaging with stakeholders such as climate scientists or local mitigation and adaptation organizations to enhance adaptive capacity.

To develop both a long form and short form worksheet and infographic for flooding, we detailed the connections between climate and flooding, the risks, common integration and adaptation methods, and sources for information and funding.

We did not find a wide variety of information regarding pandemics in the plans for the development of the pandemic worksheet. However, we documented how climate change threatens to increase the spread and rate of disease transmission. Additionally, we included how tribes were impacted by the COVID-19 pandemic and effective strategies used to combat the infection rate within tribal areas.

Because community engagement and outreach, as well as goal setting, seemed to be so influential in climate change hazard planning integration, we also developed worksheets on those topics. We used the information gathered throughout the project to inform this work. ITEP additionally had interest in the development of these two worksheets.

Outputs and Worksheets

Examples of deliverables can be found in Annex II.

Future Considerations

In the future, it may be helpful to perform an analysis using tiers, jurisdiction, and date. By setting tiers such as “Mentions climate change”, “No mention of climate change”, and “Fully integrates climate change” could aid in analysis and capacity building. Analyzing these plans by year developed could be helpful in seeing if more recent plans are actually incorporating climate change more robustly than in the past. Finally, separating this by jurisdiction could be interesting. This could be done in order to see what jurisdiction type is more likely to include climate change in planning.

We found that there is no formal guidance to integrating climate change into hazard mitigation planning at the Tribal or local level. This added to the complexity of summarizing plans and creating a cohesive database. Many of the plans are confidential and lack public accessibility which led to difficulty in properly assessing trends. It would be helpful to reach out to Tribal liaisons at the beginning of the project to gather more Tribal Hazard Mitigation Plans that are confidential in order to get a bigger sample and more meaningful analysis.

[19] Stults, M. (2017). Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. *Climate Risk Management*, *17*, 21-34.

Finally, because of the length of time it took us to perform Task 2, we didn't have ample time to finish Task 3 and 4 as intended in the original task description given at the beginning of the project. Task 3 and 4 listed many more hazards and topics to develop worksheets for than we actually had time to do. While this is regrettable, we think it is helpful information in the future regarding proper time management and the estimated length of each task.

Conclusion

Our project shows the need for capacity development for Tribal/Native/Indigenous groups in preparing for climate change hazards. Our team worked to analyze relevant plans, assess observable trends, and develop open and accessible documents with information to increase understanding and resilience. To prepare for disaster and climate change properly, Tribes must fully integrate climate change into their hazard mitigation plans. This is made difficult due to structural barriers, educational barriers, and lack of formal guidance for integration. Developing a formal integration framework would be very beneficial to creating comprehensive guidance for Tribes.

Our findings show that many tribes are having discussions about climate change and how to incorporate it into planning. However, there is still enormous opportunity for planning practitioners from tribal communities all over the United States to improve or begin developing their climate change adaptation capacity. We hope that the results and deliverables of our project can aid in assisting capacity development for tribes nationwide.

Bibliography

Birkmann, J., & von Teichman, K. (2010). Integrating disaster risk reduction and climate change adaptation: key challenges—scales, knowledge, and norms. Sustainability Science, 5(2), 171-184.

Field, C. B., Barros, V., Stocker, T. F., & Dahe, Q. (Eds.). (2012). Managing the risks of extreme events and disasters to advance climate change adaptation: special report of the intergovernmental panel on climate change. Cambridge University Press.

Frazier, T. G., Walker, M. H., Kumari, A., & Thompson, C. M. (2013). Opportunities and constraints to hazard mitigation planning. Applied Geography, 40, 52-60.

Joyner, T. A., & Orgera, R. (2013). Climate change hazard mitigation and disaster policy in south Louisiana: Planning and preparing for a "slow disaster". Risk, Hazards & Crisis in Public Policy, 4(3), 198-214.

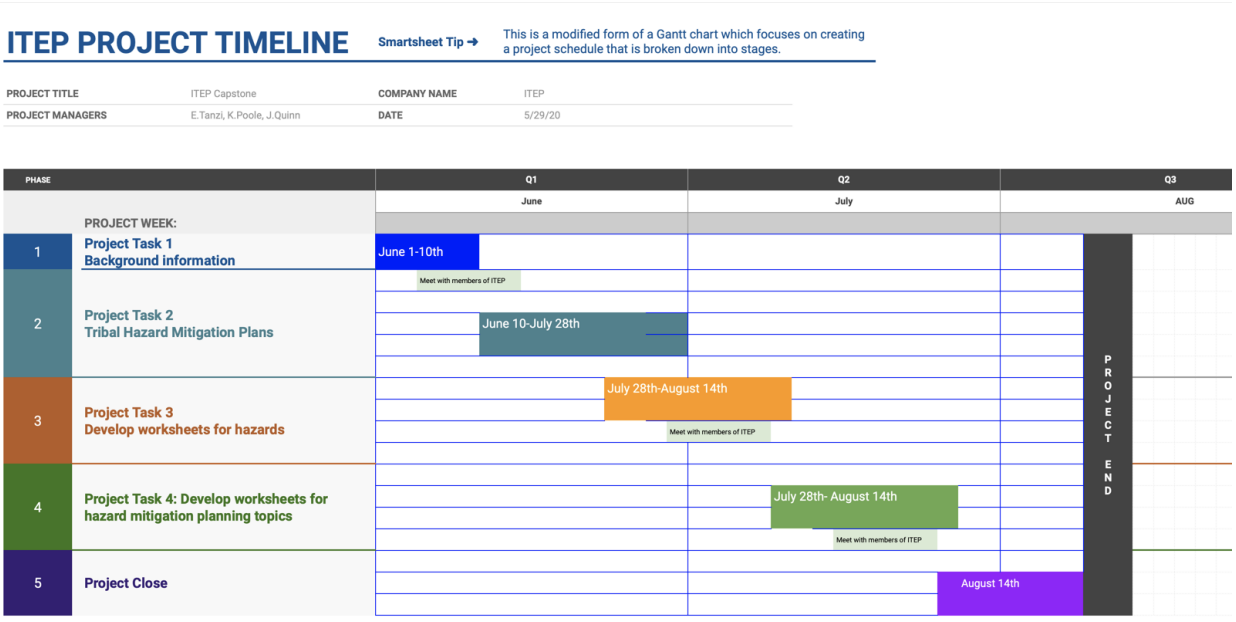
Kalafatis, S. E., Whyte, K. P., Libarkin, J. C., & Caldwell, C. (2019). Ensuring climate services serve society: examining tribes' collaborations with climate scientists using a capability approach. Climatic Change, 157(1), 115-131.

Stults, M. (2017). Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. Climate Risk Management, 17, 21-34.

Whyte, K. P. (2013). Justice forward: Tribes, climate adaptation and responsibility. In Climate change and indigenous peoples in the United States (pp. 9-22). Springer, Cham.

Wildcat, D. R. (2013). Introduction: climate change and indigenous peoples of the USA. In Climate Change and Indigenous Peoples in the United States (pp. 1-7). Springer, Cham.

ANNEX I



Updated project work plan Gantt chart

ANNEX II - Example of Flooding Info-Grapahic

FLOODING

AND CLIMATE CHANGE IN TRIBAL HAZARD MITIGATION PLANS

DEFINITION OF FLOOD

A flood is a general and temporary condition of partial or complete inundation of normally dry land area. Flooding can stem from:

- Unusual and rapid accumulation or runoff of surface waters from any source; or
- Overflow of inland or tidal waters; or
- Mudslides (i.e., mudflows) which are proximately caused by flooding and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.; or
- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Floods typically fall into three major categories:

Floods typically fall into three major categories:	Riverine flooding
	Coastal flooding
	Shallow flooding

Alluvial fan flooding is another type of flooding found primarily in the mountainous western states.

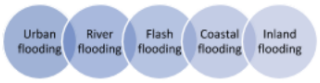
FLOODS CAN OCCUR QUICKLY

Flash floods are responsible for the greatest number of flood-related fatalities. Sudden heavy or intense rainfall can cause floods to occur in minutes to hours.

FLOODS CAN OCCUR SLOWLY

Rainfall can build up over hours, days, or weeks. Runoff from rainfall may create substantial flooding

Flooding can result from a river, or any water source, overflowing its banks, snowmelt, heavy rain, and breaches of levees and dams.



Flooding can be caused or amplified by weather and human related conditions

WEATHER FACTORS:
- Heavy, intense precipitation
- Snowmelt
- Severe Storms
- Storm Surges

HUMAN FACTORS:
- Poor or altered drainage
- Structural failures
- Land cover alterations
- Development in floodplains
- Anthropogenic climate change

Areas damaged by wildfires are at risk for flash flood and debris flow during rainstorms.

CLIMATE CHANGE AND FLOODING

The Intergovernmental Panel on Climate Change (IPCC) noted in their Special Report on Global Warming of 1.5°C that while climate change may not create flooding directly, it exacerbates weather conditions that cause flooding, such as changes to rainfall or snowmelt. The IPCC AR5 did not attribute changes in flooding to anthropogenic influence, nor reported detectable changes in flooding magnitude, duration, or frequency. However, there has been an increase in flood frequency detected by stream gauge stations. This can be consistent with the increasing trends in extreme precipitation events as a result of climate change. Precipitation increases have a significant impact on flood statistics.

Impacts of climate change on flooding can be demonstrated by stronger storms, intensifying hurricanes, and an increase in heavy precipitation events. These factors lead to a risk of flooding and storm surge, which can be amplified by sea level rise.

HEAVY PRECIPITATION HURRICANES SEA LEVEL RISE

HEAVY PRECIPITATION	• Heavy rainfall events projected to increase • Rare events occurring at higher frequency • Climate change increases number and intensity of precipitation events because a warmer atmosphere can hold more water • Climate change alters weather patterns and precipitation characteristic • Can degrade water quality, overwhelm capacity • Scientists predict increases in extreme precipitation to

	continue across much of the United States
Hurricanes	• Hurricanes are one of the biggest contributors to flooding. Climate change can increase the strength and danger of hurricanes • Category 4 and 5 storms are increasing, along with hurricane wind speeds • expected to bring more rainfall, produce greater storm surge, have higher wind speed, and move slower • Rapid intensification of storms
Sea level Rise	• Loss of ice increases the volume of the world's oceans, causing sea levels to rise globally • Averaged globally, sea level is expected to rise by 2-7 feet over the course of the 21st century • Changes in sea level will impact regions differently based on their geography and elevation • Amplifies near term vulnerability to storm surge and increase long term flood risk

Cascading, Secondary Hazards

Flood risk can be increased when it is included in a compound event. A compound event can be described as two or more extreme events occurring successively or at the same time, or combinations of events that are not extreme events yet lead to an extreme event or impact when compounded. For example, a high sea level at the same time as hurricane landfall.

Primary	Secondary	Other Long Term Impacts
• Physical damage • Casualties	• Water supplies • Transportation routes, power, gas • Diseases • Crops, commercial and food supplies • Trees downage • Landslides and mudslides can occur	• Decline in tourism • Economic hardship • Rebuilding costs • Food shortages • Erosion

Changes to Land Use

Flooding is also influenced due to changes in land use and cannot be explained by changing precipitation patterns and climate change alone. Construction within floodplains, the use of impermeable surfaces, the degradation of natural areas, and the design of dams and levees can reduce the ability of land to withstand weather events. Changes in land use are leaving more people more vulnerable to flooding.

Flooding and Climate Impact on Agriculture and Wildlife

Floods and changes in streamflow can have impacts on both agriculture and wildlife that depend on stable water sources. Flooding can stir up sediments, increase erosion, negatively impact fisheries, and create an environment for disease transmission. Climate change threatens to disrupt seasonal streamflow, which will create consequences on fish migration. Culturally significant plants or crops may be vulnerable to flooding or secondary consequences of flooding in a changing climate.

TOOLS AND APPROACHES TRIBES HAVE USED TO CONSIDER CLIMATE CHANGE AND FLOODING

METHODS:

Plan for Climate Change

Develop coastal restoration plans
- Restoration plans should consider impacts of sea level rise and development
- May protect water infrastructure from storm surge by increasing protective ecosystems

Identify and protect most vulnerable facilities
- Prioritized based on likelihood of flood damage and subsequent service disruptions

Integrate climate risk into capital improvement plans (CIPs)
- Any plans to expand infrastructure should consider risk of proposed locations to flooding and climate change
- Additionally, capital improvement programs (CIPs) can help with directing development away from hazard areas, through directing funding to critical infrastructure and facilities located outside hazards areas.
    - Develop relocation plans

Modify Land Use

Mange ecosystems
- Natural ecosystems can regulate runoff, streamflow, and create a buffer against flooding
- Creating self-sustaining, natural ecosystems can reduce damage and flood risk, and be beneficial to the environment. They can also mitigate erosion.
- Nature based solutions can not only have a positive effect on ecosystem conservation and hazard reduction, but also contribute positively to tourism, employment, and sense of community

Green infrastructure
- Can help to reduce runoff and stormwater flows that may otherwise exceed system capacity
- Rain gardens, green roofs, water capture methods, replacements for impervious surfaces

Integrate flood management and modeling into land use planning
- Future water utility infrastructure should be planned and constructed based on consideration of future flood risks.

Study response of nearby wetlands to storm surge events
- Understanding the ability of existing wetlands to provide protection is important considering climate change effects to sea level rise and storms

Model Climate Risk

Conduct extreme precipitation events analyses
- Extreme event modeling can help to understand risks and consequences of events

Develop models to understand water quality changes
- The quality of water sources may be compromised by extreme events and can be addressed in watershed management plans

Model and evaluate groundwater conditions
- Climate change may lead to diminish groundwater because of reduced precipitation and runoff
- Can detect saltwater intrusion as a result of coastal flooding or sea level rise

Model inflow/infiltration in sewer system
- Sewer models can gauge the impact of increased wet weather flows on wastewater collection systems

Ensure floodplain data is up to date and accurate

Repair and Retrofit Facilities

Implement policy and procedure for post-flood repairs
- Improve pumps that can cause wastewater backflow

Increase capacity for wastewater and stormwater collection

Increase treatment capabilities
- Existing systems may not be sufficient to process water of reduced quality as climate change impacts source or receiving water quality

Implement saltwater intrusion barriers and aquifer recharge

Construct new infrastructure

Build flood barrier to protect infrastructure
- Levees, dikes, seawalls, floodproofing

Relocate facilities to higher elevations
- Relocating utility infrastructure can reduce risk from climate change, coastal flooding

Monitoring events
- Monitoring current weather
- Monitoring flood events and root causes
- Monitoring data for precipitation, temperature, runoff, and sea level rise can be incorporated into flood models

Early warning and evacuation systems

Community driven initiatives and improved public engagement
- Improving flood forecasting and warning systems
- Public awareness of flood risks
- Creating plans for households who live in flood-risk areas
- Understanding the way individuals perceive and respond to flood risk

TOOLS:

- **Stormwater Calculator with Climate Assessment Tool**
- **Storm Water Management Model (SWMM) | US EPA**
- **Storm Surge Inundation and Hurricane Strike Frequency Map**
- **Scenario-Based Projected Changes Map**
- **RAINE, Resilience and Adaptation In New England**
- **ICLUS - Integrated Climate and Land Use Scenarios**
- **Environmental Justice Screening and Mapping Tool**
- **CREAT, -** Climate Resilience Evaluation and Awareness Tool
- **Climate Ready Estuaries (CRE)**
- **US Climate Resilience Toolkit | US Climate Resilience Toolkit**
- **Tribal Resilience Program** Bureau of Indian Affairs Climate Change Program
- **Tribal Resilience Resource Guide** Tribal Resilience Resource Guide - Bureau of Indian Affairs Climate Change Program
- **Fourth National Climate Assessment** (Chapter 15 - Tribes and Indigenous People and Chapter 24 - Northwest)
- **USGS Coastal Change Hazards Portal**
- **Tribal Climate Tool**
- **Tribal Vulnerability Assessment Resources**
- **Guidelines for Considering Traditional Knowledges in Climate Change Initiatives**
- **Surging Seas: Sea level rise analysis by Climate Central**
- **NOAA Coastal Flood Exposure Mapper**
- **NOAA Sea Level Rise Viewer**
- **Extreme Water Levels - NOAA Tides & Currents**
- **United States Interagency Elevation Inventory**
- **Adapting Stormwater Management for Coastal Floods**
- **Managed Retreat Toolkit » Introduction**
- **Climate Vulnerability Experiences and Priorities Survey** - Tribal Health Climate Project https://docs.google.com/forms/d/17NVn6Pv-xp7px5nZyd76IKBE2bB1dyJYlaIJJRfFeHg/viewform?edit_requested=true
- **BIA Regions | Tribal Resilience**
- **Climate Change Adaptation Certification Tool: IDENTIFY EVALUATE DETERMINE** - EcoAdapt, Foresight Partners Consulting
- **Climate Action Resource Center** NCAI Climate Action Resource Center (CARC - National Congress of American Indians)
- **River Forecasts - National Weather Service NOAA**
- Climate Prediction Center - National Weather Service **Global Monsoons: North American Precipitation**
- **Tribal Green Building Toolkit (June 2020 Link Updates)** Tribal Green Building Toolkit - EPA
- **Federal Emergency Management Agency (FEMA) Floodplain Management Requirements** – Information and model ordinances for the National Flood Insurance Program. www.fema.gov/floodplain-management-requirements
- **FEMA Floodplain Management Tools** – Strategies and tools to maintain or restore floodplain resources. www.fema.gov/floodplain-managers
- **No Adverse Impact Floodplain Management** No Adverse Impact Floodplain Management Tool, Association of State Floodplain Managers
  Toolkit: NAI Toolkit8
- **Digital Coast - NOAA Digital Coast Home**
- **Strategies for Climate Change Adaptation | Climate Change Adaptation Resource Center (ARC-X)**

COMMON FLOODING AND CLIMATE CHANGE MITIGATION STRATEGIES

Using natural flood protection	Implement vegetation	Expand restoration projects	Flood elevate homes and buildings	Team up with other agencies to provide flood mitigation and protection around critical infrastructure
Improve stormwater drainage	Installing floodgate	Improving floodwalls	Participate in Community Assistance Programs	Restore badly eroded streams at coastal outfalls
Improve Hatchery and Fishery Management	Maintain and update flood contingency and emergency response actions plans	Monitor changes in design standards	Prohibit road and utility construction in areas subject to excessive erosion	Change permitting process to include sea level rise and other climate change factors
Relocation/Retreat Plans	Protect and maintain historical and archival Tribal records	Acquire properties in low hazard areas	Locate structures and equipment at higher elevations	Minimize paved surfaces

FUNDING MITIGATION PROJECTS

Below are listed potential sources of funding that may be able to assist with flood mitigation and integrating climate change into flood preparedness:

FEDERAL:

- **FEMA Pre-Disaster Mitigation Program**
  - Provide funds to develop mitigation plans and project
- **Department of Homeland Security FEMA Cooperating Technical Partners**
  - Allows proactive matching for Risk MAP digital flood plan and coastal mapping
  - Flood studies
- **USDA development grants**
- **FEMA Hazard Mitigation Grant Program**
  - Provides post disaster funds for hazard reduction projects
- **Flood Control Assistance Account Program**
  - Provides funds for developing flood hazard management plans, flood damage reduction projects and studies, and for emergency flood projects
- **Flood Mitigation Assistance Program**
  - Provides funds for flood mitigation on buildings that carry flood insurance and have been damaged by floods
  - Available on an annual basis
- **Historic preservation grants**
- **U.S. Army Corps of Engineers**
  - Provides funding for coastal and waterway projects
  - Flood prevention analysis, plans, and options
  - GIS and modeling, floodplain
- **Community Assistance Program (for NFIP)**
  - Supports state floodplain management program
- **Severe Repetitive Loss (SRL)**
  - Annual appropriation
- **Repetitive Flood Claims (RFC)**

STATE/LOCAL:

In some cases, funding may be available from state or local sources, especially for mitigation actions that overlap jurisdictions such as flooding.

PRIVATE:

Donations, volunteers from the community.

REGARDING UPDATING A PLAN:

Indian Tribal governments are required to review and revise plans to reflect any changes in development, progress in mitigation efforts, and changes in priorities and submit for approval within 5 years in order to maintain eligibility for FEMA assistance.

A risk assessment update must address any newly defined or identified hazards determined to pose a threat to the tribal planning area. It can also include improved descriptions of hazards.