

# Integrating ITEK in USACE Aquatic Ecosystem Restoration

EMRRP Webinar

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15 September 2025



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# Project Team

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# Presentation Overview

## Introduction

- What is ITEK
- Statement of Need
- Project Objectives

## ITEK Vault

- Literature Review using Large Language Model (LLM)

## Questionnaire and Interviews

- USACE Questionnaire
- Case Studies and Tribal Interviews

## Draft Framework

## Summary and Way Forward

## Questions and Discussion



# What is ITEK?

Indigenous Traditional Ecological Knowledge (ITEK) is a body of observations, oral and written knowledge, practices, and beliefs that promote environmental sustainability and the responsible stewardship of natural resources through relationships between humans and environmental systems. It is applied to phenomena across biological, physical, cultural and spiritual systems. IK/ITEK has evolved over millennia, continues to evolve, and includes insights based on evidence acquired through direct contact with the environment and long-term experiences, as well as extensive observations, lessons, and skills passed from generation to generation.

U.S. Fish & Wildlife Service, (Feb. 2011), Traditional Ecological Knowledge for Application by Service Scientists, <https://www.fws.gov/sites/default/files/documents/TEK-Fact-Sheet.pdf>

ITEK is a valid form of evidence. It doesn't need further validation. Indigenous Knowledge and western scientific methodologies share many common features:

- (1) Systematically understand and explain ways of knowing;
- (2) Use of systematic observation, innovation, and verification through repetition;
- (3) Derived from direct contact with the environment and evolve over time in response to new inputs;
- (4) Seek to make sense of the world and desire to conduct practical and curiosity-driven investigations; and
- (5) Use of empirical approaches.

OSTP and CEQ, (Nov. 2022), Guidance for Federal Departments and Agencies on Indigenous Knowledge, <https://www.whitehouse.gov/wp-content/uploads/2022/12/OSTP-CEQ-IK-Guidance.pdf>

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# Statement of Need #2106

## Framework for integrating traditional ecological knowledge into decision making on USACE AER studies

Problem: directive and operations do not align

Directives to incorporate local and Indigenous Traditional Ecological Knowledge (ITEK) where applicable

Within USACE, no guidance on the 'how' or 'why'

Project processes & metrics?

Lack of participatory methods for engagement?

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# Project Objectives

- Empower USACE project teams to operationalize directives by aligning ITEK with leverage points that correlate to project planning processes (e.g., problem/opportunity definition, objective setting, alternative development, evaluation, modeling, decision-making, public dialog) and strengthen partnerships and collaboration with Tribal Partners.
- Empower Tribal partners and increase their sovereignty in USACE projects by integrating Tribal knowledge, perspectives, and sovereignty considerations throughout planning and implementation.
- Bring together parallel audiences within the USACE and Tribal communities and facilitate effective dialog on co-led projects by creating a shared lexicon and framework.



# Approach

## Phase I: Collecting

Data Collection

Task 1: State of Practice in USACE

Task 2: Library & structured literature review



Analysis

Task 3: How ITEK fits into USACE Restoration

Task 4: Draft Framework



## Phase II: Considering

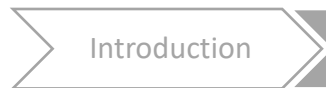
Task 1: Test with Case Studies

Task 2: Refine Framework



## Phase III: Implementing

Task 1: Socialization and Tech Transfer



Introduction



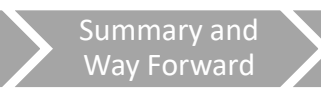
ITEK Vault



Questionnaire and Interviews



Framework Development



Summary and Way Forward



Questions and Discussion

# ITEK Vault

Purpose: Understand trends in literature using large language model (LLM)

- Aids in processing large corpus of literature

Method: Develop a tool using Retrieval Augmented Generation (RAG)

- Collated 600+ articles mentioning ITEK, Indigenous Participation, Local Knowledge
- Ethically sourced literature
- Reposited into a LLM and then set up for query

Utility: RAG method is adaptable to other curated literature datasets

- Users can:
  - Upload documents
  - Change sensitivity of quantity of documents used in responses

Way forward: Web-Based tool with a GUI, hosted on EMRRP

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# ITEK Vault

```
[1]: #This Cell Loads the Python Library, defines the context, and, and initializes the model.
from local_llm import LocalLLM

context_string = "You are ITEKbot, a model designed to read and interpret information on Indigenous Traditional Ecological Knowledge (ITEK). You will f

llm_ITEKbot = LocalLLM(pdf_dir="Document Upload",vector_store_dir="vectorstore_ITEK_fulldatabase_9_9_25",context=context_string)
```

```
[8]: # Example query
query = (
    "What is Indigenous Traditional Knowledge?"
)

# Run query
answer, references = llm_ITEKbot.query(query)

# Print results
print("Answer:")
print(answer)
print("\nReferences:")
print("\n".join(references))
```

Answer:

Based on the provided documents, Indigenous Traditional Knowledge (ITEK) can be defined as a body of evolving practical knowledge based on observations and personal experience of indigenous residents over an extensive time period [1]. It is passed down from generation to generation and includes extensive understanding of environmental interrelationships [1].

ITEK is also described as specialized knowledge with a strong connection to heritage, on a topic or topics [2]. This definition highlights the importance of cultural codes in the transmission of ITEK.

Indigenous Knowledge (IK) is a broader term that encompasses Traditional Knowledge (TK), including other forms of knowledge [2]. IK is considered a body of observations, oral and written knowledge, innovations, practices, and beliefs developed by Tribes and Indigenous Peoples through interaction and experience with the environment [3].

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# ITEK Vault

**Query:** What is Indigenous Traditional Knowledge?

**Response (generated by LLM):**

Indigenous Traditional Knowledge (ITEK) can be defined as a body of evolving practical knowledge based on observations and personal experience of indigenous residents over an extensive time period [1]. It is passed down from generation to generation and includes extensive understanding of environmental interrelationships [1].

ITEK is also described as specialized knowledge with a strong connection to heritage, on a topic or topics [2]. This definition highlights the importance of cultural codes in the transmission of ITEK.

Indigenous Knowledge (IK) is a broader term that encompasses Traditional Knowledge (TK), including other forms of knowledge [2]. IK is considered a body of observations, oral and written knowledge, innovations, practices, and beliefs developed by Tribes and Indigenous Peoples through interaction and experience with the environment [3].

In summary, Indigenous Traditional Knowledge (ITEK) is a body of evolving practical knowledge based on observations and personal experience of indigenous residents over an extensive time period, passed down from generation to generation. It includes extensive understanding of environmental interrelationships and is characterized by its strong connection to heritage.

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# ITEK Vault

Query	Response (generated by LLM)
What is the guidance on integrating Indigenous Traditional Ecological Knowledge?	<ul style="list-style-type: none"><li>• Respect and acknowledge the importance of ITEK in environmental decision-making processes [1].</li><li>• Recognize that ITEK is a systematic way of thinking applied to phenomena across biological, physical, cultural, and spiritual systems [2].</li><li>• Understand that ITEK has developed over millennia and is based on evidence acquired through direct and long-term experiences and extensive observations, lessons, and skills [3].</li><li>• Acknowledge the inextricable linkages between ecological systems and cultural systems, and recognize the importance of considering these linkages when integrating ITEK with Western sciences [4].</li><li>• Emphasize the need for respectful and mutually beneficial relationships between researchers and Indigenous and local peoples when developing collaborative partnerships to represent and protect traditional (ecological) knowledge [5].</li><li>• Recognize that there are similarities and differences in the ways that Western science and ITEK approach environmental issues, and strive to understand and respect these differences [6].</li><li>• Acknowledge the importance of addressing the ecological challenges of the twenty-first century through the indigenizing of environmental education and the integration of ITEK with Western sciences [7].</li></ul>

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# ITEK Vault

Query	Response (generated by LLM)
How is Indigenous Traditional Ecological Knowledge integrated?	<ul style="list-style-type: none"><li>• <b>Collaboration:</b> ITEK is often integrated through collaboration between Indigenous peoples and Western scientists [2], [5]. This involves working together to share knowledge, values, and perspectives.</li><li>• <b>Contextualization:</b> ITEK is contextualized by considering the local environment, culture, and history of Indigenous communities [3], [6]. This recognizes that ITEK is embedded in specific contexts and cannot be separated from them.</li><li>• <b>Recognition of epistemological differences:</b> The integration of ITEK acknowledges the epistemological differences between Western scientific knowledge and Indigenous traditional knowledge [1], [4]. This involves recognizing that different knowledge systems have different assumptions, values, and methods.</li><li>• <b>Incorporating Indigenous perspectives:</b> ITEK is integrated by incorporating Indigenous perspectives and worldviews into environmental management, conservation, and research [7], [8].</li><li>• <b>Two-Eyed Seeing:</b> The concept of Two-Eyed Seeing, which involves seeing from multiple perspectives simultaneously, is also used to integrate ITEK [9]. This approach recognizes that Vaulth Western scientific knowledge and Indigenous traditional knowledge have value and can be complementary.</li><li>• <b>Indigenizing environmental education:</b> There are efforts to indigenize environmental education by incorporating ITEK into curricula and educational programs [10].</li><li>• <b>Recognition of TEK as a distinct form of knowledge:</b> The integration of ITEK also involves recognizing it as a distinct form of knowledge that is different from Western scientific knowledge [11]. This recognition acknowledges the unique characteristics, values, and assumptions of Indigenous traditional knowledge.</li></ul>

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# ITEK Vault

Query	Response (generated by LLM)
What prevents Indigenous Traditional Ecological Knowledge from being integrated?	<ul style="list-style-type: none"><li>• <b>Colonialism and cultural suppression:</b> The dominance of Western scientific knowledge has led to the marginalization and erasure of ITEK [1]. This historical context has created a power imbalance, making it challenging for indigenous peoples to share their knowledge and have it recognized.</li><li>• <b>Lack of recognition and validation:</b> Scientists often view ITEK as unscientific or anecdotal, which can lead to a lack of recognition and validation [2]. This skepticism can prevent the integration of ITEK into mainstream scientific research.</li><li>• <b>Language barriers:</b> The language gap between indigenous communities and Western scientists can be a significant obstacle to knowledge sharing [3].</li><li>• <b>Cultural and epistemological differences:</b> The cultural and epistemological frameworks underlying ITEK are often unfamiliar to Western scientists, making it difficult for them to understand and appreciate the value of this knowledge [4].</li><li>• <b>Power dynamics:</b> The historical power imbalance between indigenous peoples and Western societies continues to influence the integration of ITEK. Indigenous communities may be hesitant to share their knowledge if they do not feel respected or valued [5].</li><li>• <b>Lack of institutional support:</b> Institutional frameworks, such as universities and research organizations, often prioritize Western scientific knowledge over ITEK. This lack of support can hinder the integration of ITEK into mainstream research [6].</li><li>• <b>Methodological differences:</b> The methods used to collect and analyze ITEK may differ significantly from those used in Western scientific research. This can lead to a lack of understanding and appreciation for the value of ITEK [7].</li></ul>

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# ITEK Vault

Query	Response (generated by LLM)
What prevents Indigenous Traditional Ecological Knowledge from being integrated?	To address these challenges, it is essential to: <ul style="list-style-type: none"><li>• Recognize and validate ITEK as a valuable form of knowledge.</li><li>• Foster cultural exchange and collaboration between indigenous communities and Western scientists.</li><li>• Develop methods that are sensitive to the cultural and epistemological frameworks underlying ITEK.</li><li>• Provide institutional support for research that integrates ITEK.</li><li>• Address power imbalances by empowering indigenous communities to share their knowledge and have a voice in decision-making processes</li></ul>

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# ITEK Vault

Source	Annotated Summary
<p>Cusicanqui, S. R. (2012). Ch'ixinakax utxiwa: a Reflection on the Practices and Discourses of Decolonization. <i>South Atlantic Quarterly</i>, 111(1), 95–109.</p>	<p>The colonial condition obscures a number of paradoxes. Throughout history, the modernizing efforts of the Europeanized elites in the Andean region resulted in successive waves of recolonization. One example is the Bourbon reforms that Vault preceded and followed the great cycle of rebellion from 1771 to 1781. Although it is true that modern history meant slavery for the indigenous peoples, this does not mean that they were completely powerless. The indigenous peoples resisted and fought back against their colonizers, often using guerrilla warfare and other forms of resistance.</p> <p>The colonial condition also led to the erasure of indigenous cultures and identities. The Europeanized elites sought to impose their own culture and values on the indigenous populations, leading to the suppression of traditional practices and beliefs. This erasure was not limited to the cultural sphere; it also extended to the economic and political realms. The indigenous peoples were forced to adopt European customs and practices in order to survive, which further eroded their cultural identities.</p> <p>In conclusion, the colonial condition has had a profound impact on the indigenous peoples of the Andean region. It has led to the erasure of their cultures and identities, as well as the suppression of their traditional practices and beliefs. However, it has also inspired resistance and fight back against their colonizers. The indigenous peoples have continued to resist and fight back throughout history, using various forms of resistance to preserve their cultures and traditions.</p>

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# USACE Questionnaire

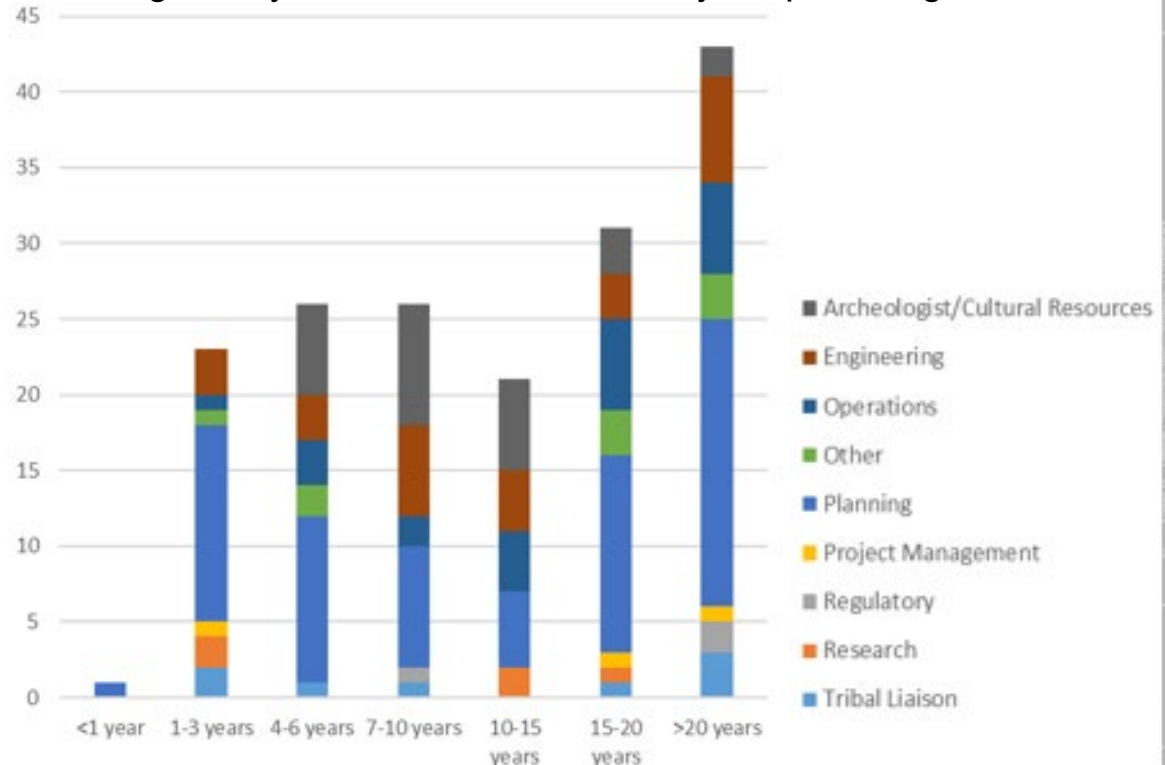
## Survey:

- Solicited a 15-minute questionnaire
- Targeting those most likely to have ITEK experience in USACE (Tribal Liaisons, Planning and Operations CoPs, River Engineering Working Group)
- Forwarding was encouraged

## Response:

- 171 respondents, 68 with ITEK experience
- All regions represented
- Range of roles and experience

How long have you worked with U.S. Army Corps of Engineers?



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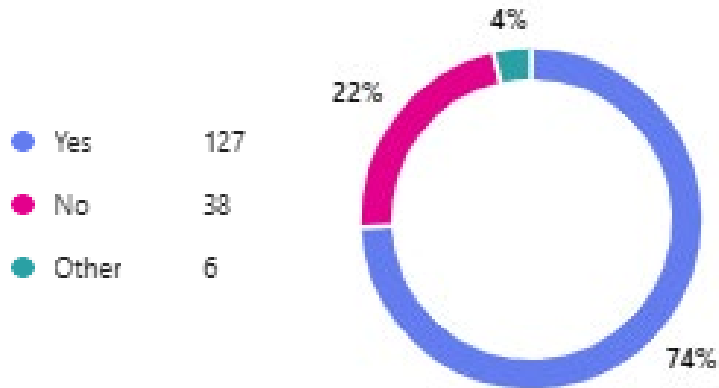
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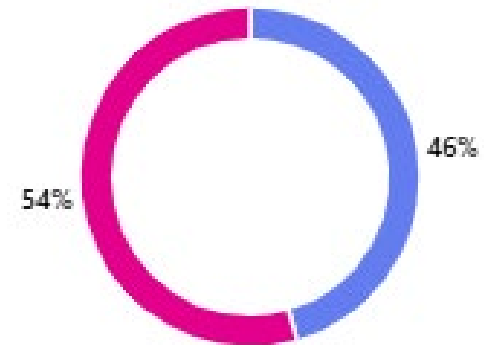
# USACE Questionnaire

Have you engaged Tribes as part of your work ?

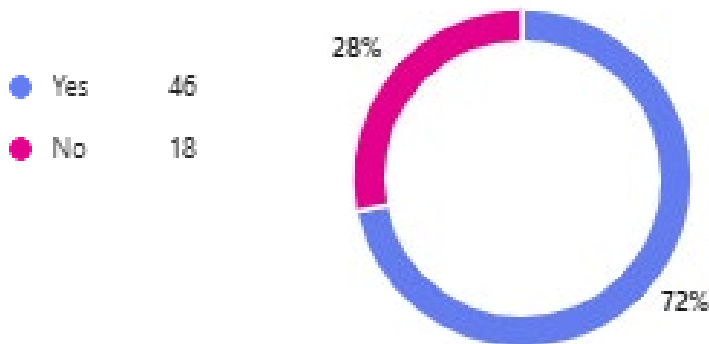
Do you have experience on a project that involved significant Tribal engagement for ITEK?



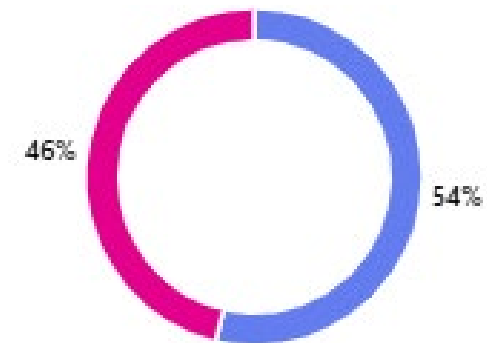
Response	Count
Yes	31
No	37



Are there gaps in support and guidance for engaging with ITEK?



Response	Count
Yes	44
No	38



Note: Difference in total is from survey structure – branches of questions based on previous responses

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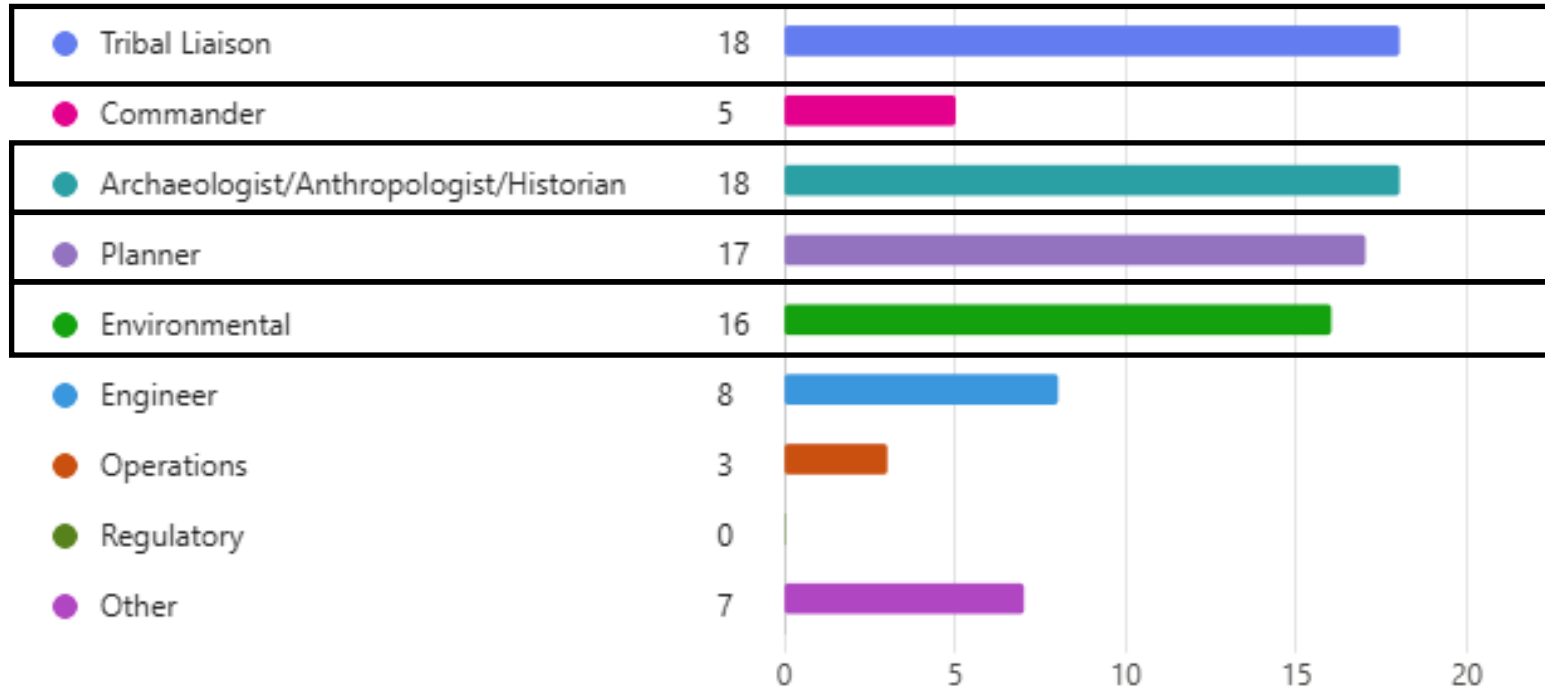
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# USACE Questionnaire

Who from the Corps engaged directly with Tribal partners regarding ITEK?



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# USACE Questionnaire

What are the primary challenges to considering ITEK in projects?



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# USACE Questionnaire

## Initial findings:

- A minority of projects engage ITEK
- Current engagement activities do not match what respondents see as most effective
- Primary barriers reported include lack of guidance and training
- Preferred training materials include:
  - PROSPECT courses
  - Webinars
  - Flowcharts
- Technical Note: In progress

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# Tribal Interviews

The questionnaire identified numerous case studies and projects that include ITEK considerations. We are following up with the identified Tribes to gather their perspective of the USACE consideration and integration of ITEK. In August 2025 we reached out to **over 20 Tribes** to request participation in a semi-structured interview regarding ITEK engagement for USACE projects. Tribes contacted include:

- Lac Vieux Desert Band of Lake Superior Indians, Yurok Tribe, Lytton Rancheria of California, Yakama Nation, Nez Perce, Confederated Tribes of the Umatilla Indians, Bay Mills Indian Community, Cheyenne River Sioux Tribe, Mechoopda Indian Tribe of Chico Rancheria, Fond Du Lac, Miccosukee Tribe, Seminole Nation, Osage Nation, Delaware Nation, Absentee Shawnee Tribe, Eastern Shawnee Tribe of Oklahoma, Cherokee Nation, Shawnee Tribe, United Keetoowah Band of Cherokee, Muscogee Creek Nation, Choctaw Nation of Oklahoma, Enterprise Rancheria (Estom Yumeka).

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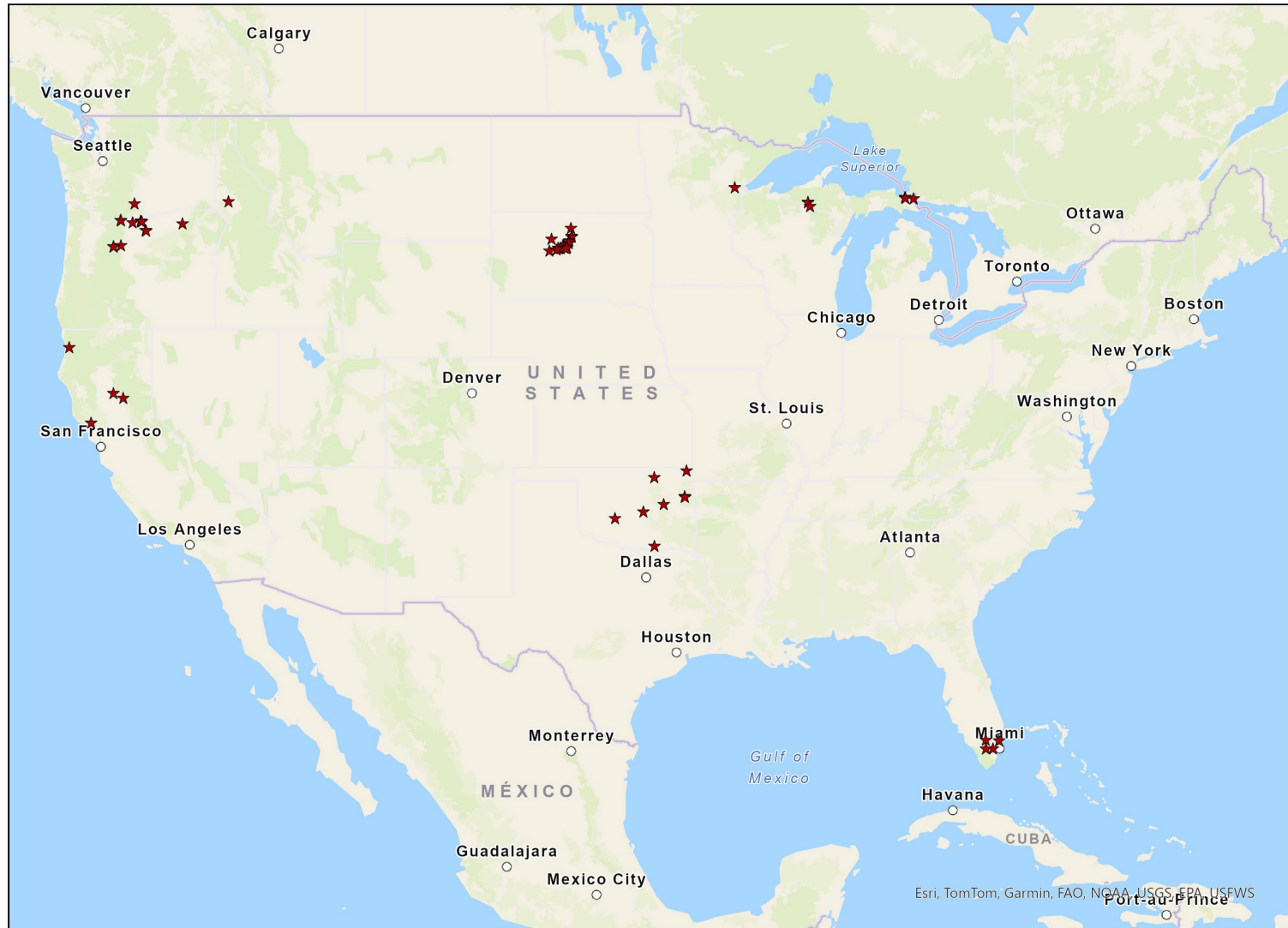
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# ITEK Questionnaire Tribal Contacts



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# Tribal Interviews

- Interviews will begin later this month, themes include:
  1. Baseline information on the ecological restoration and/or USACE project
  2. Engagement, communication, and relationship building between the Tribe and the USACE around ITEK
  3. Type of ITEK shared and key considerations
  4. Role of ITEK in the USACE planning processes
  5. Primary challenges experienced
  6. Primary successes or opportunities for improvement
  7. Comparison of USACE project experience to projects working with other agencies, organizations, or internally
- Host a virtual workshop to further collect Tribal perspectives on ITEK in USACE projects.

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# Case Studies

Briefly, some case studies and existing projects we've identified:

- Umatilla Reservation: Mill Creek fish passage project. Chosen for CW Pilot Project, WRDA 2020.
- Other projects identified via Questionnaire: Lac Vieux Desert Manoomin PAS, Klamath GI, Coyote Valley Dam Water Supply GI, Yakima Delta/Bateman Island PAS and Causeway CAP 1135, Sweetwater Creek TPP, Celilo Falls Village Redevelopment Project, Saint Marys River-Rapids Restoration PAS, Quapaw PAS, Moreau River TPP, Clear Creek Ecosystem Restoration TPP, Spirit Lake/Island PAS, Everglades CEPP, COP, EAA2, and CERP, Three Forks of Beargrass Creek Ecosystem Restoration, Utoy Creek Ecosystem Restoration CAP 206, Pearl River Flood Risk Management, Sutter Basin Native Plant Garden Mitigation.
- Authorities: Planning Assistance to States (PAS), Flood Risk Management Services (FPMS), Continuing Authorities Program (CAP; Sections 14, 205, 206 & 1135), Feasibility Study Investigations, Interagency & International Support (IIS), Watershed Studies (Section 729), Tribal Partnership Program, Emergency Assistance (PL 84-99), and other Congressional WRDA or WRRDA authorizations.

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# Next Steps: Draft Framework

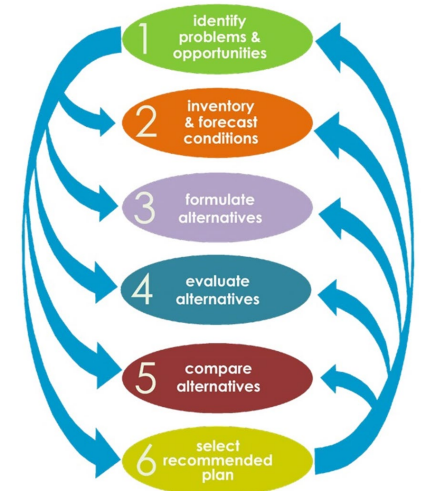
The vision for the framework

Engage tribal liaison and include on PDT, TNTCX, using engagement policy

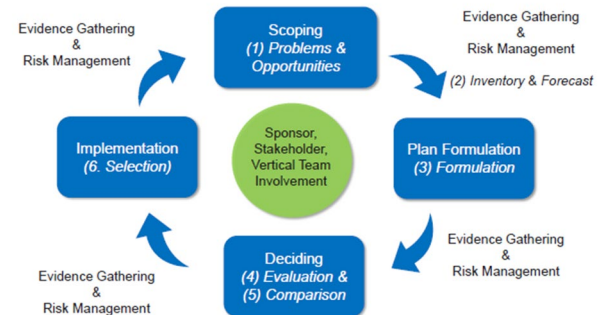
Outreach

Respecting knowledge holders rights

Identify converging goals



## Risk-Informed Planning Process



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# Summary for FY 25 and Way Forward

- Developed a versatile LLM methodology for navigating a large literature corpus
- Conducted data collection of USACE and Tribal perspectives
- Continue to build on these findings to develop (FY26):
  - Publish USACE/Tribal state of the practice and use the literature search and interviews to develop a framework to advance the use of ITEK
  - Pilot and develop a draft framework based on identified case studies
  - Information guide for Tribes to engage with USACE

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# Acknowledgements

- CESPA Isleta 1135
- Tribes to be interviewed
- USACE people that helped pilot the survey
- USACE survey respondents
- EMRRP

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# Questions, Suggestions, Discussion

Any relevant case studies or projects?

Perspectives?

Barriers to ITEK integration with USACE project processes?

## Summary

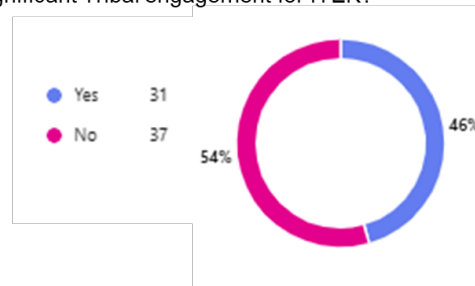
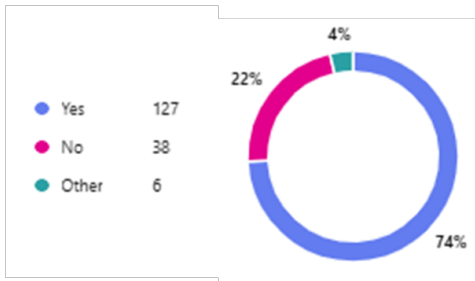
- Developed a versatile LLM methodology for navigating a large literature corpus – ITEK Library
- USACE and Tribal perspectives

## Next Steps

- Draft Framework
- Case Studies



Have you engaged Tribes as part of your work ? Do you have experience on a project that involved significant Tribal engagement for ITEK?



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# Additional Information

- Focused on the U.S. Army Corps of Engineers' (USACE) recognition and application of Indigenous knowledge into federal Agency decision-making for aquatic ecosystem restoration projects.
- To date, the USACE has not developed a framework or approach that includes Indigenous Knowledge in land and water management decisions on and off Tribal lands.

# Background

FY25 New Start, from the SON#: 2106

## What is ITEK?

Indigenous Traditional Ecological Knowledge is a body of observations, oral and written knowledge, practices, and beliefs that promote environmental sustainability and the responsible stewardship of natural resources through relationships between humans and environmental systems. ITEK has evolved over millennia, continues to evolve, and includes insights based on evidence acquired through direct contact with the environment and long-term experiences, as well as extensive observations, lessons, and skills passed on from generation to generation. ITEK is owned by Indigenous people—including, but not limited to, Tribal Nations, Native Americans, Alaska Natives, and Native Hawaiians.

## Potential advantages:

Stronger relationships with Tribal partners and integration of ITEK to achieve better ecological outcomes and more sustainable engineering outcomes. Cost savings, better relationships with Tribal Partners and communities, reduced operations and maintenance, increased project effectiveness (ecosystem restoration, flood risk mitigation)

## Outcome:

Development of Framework for Best Practices and Approaches. This research will emphasize the utility of ITEK and tribal engagement in aquatic ecosystem restoration and other USACE projects. Research deliverables will focus on added benefits and reduced risks that occur with proper engagement, integration of local knowledge and sensibility, and tools that support operationalization of policy directives at the District level.

