Indigenous Agroforestry

Technology & Tools Needs Survey Report

INDIGENOUS
AGROFORESTRY
NETWORK

Table of Contents

Cover: Collecting native nettle plants at Tryon Creek in Portland, OR. **Kari Rowe Photography**

Indigenous Agroforestry Survey Report

Report written by:
Sara Loreno, Yankuic Galvan-Miyoshi, and Alexi Lovechio
Ecotrust Forests and Ecosystem Services Team

Designed by:
Heldáy de la Cruz

In collaboration with:
The Indigenous Agroforestry Network

September 2025

Funding provided by:
The Indigenous Agroforestry Network is funded through the USDA NIFA American Rescue Plan Technical Assistance Investment to Benefit Underserved Farmers, Ranchers and Forest Landowners.

Use of mobile technology for plant identification. **Kari Rowe Photography**

Introduction

This report presents the findings from the 2025 Technology and Tools Needs Survey, designed to assess current technological capacities, data needs, and training priorities of tribal natural resource programs across the Pacific Northwest and beyond. The survey was developed in close collaboration with members of the Indigenous Agroforestry Network, a regional initiative focused on fostering knowledge-sharing and collaboration among tribal agroforestry practitioners and allied organizations.

The motivation for the survey stemmed from calls from partners to better understand and address the persistent barriers Tribes face in accessing decision-support tools, forest data, and training opportunities. Despite their role in stewarding over 18 million acres of forestland nationwide, Tribes continue to face disproportionate funding and limited access to critical tools for forest management. This survey aims to ground future capacity-building efforts in the expressed needs of tribal staff.

The Indigenous Agroforestry Network played a key role in organizing and promoting the survey. Through their support and outreach, the survey captured diverse perspectives from tribal natural resource staff working across the region. Their contributions help ensure that the recommendations and resources developed from this work are community-informed and culturally relevant.

Context

Indigenous Agroforestry Network

The Indigenous Agroforestry Network is intended to improve mutual understanding and cooperation between Indigenous agroforestry practitioners, Tribes, and allied partners. The Indigenous Agroforestry Network is Northwest-based, but welcomes support, collaboration, and opportunities for connection beyond this region.

With guidance and leadership from its participants, the Indigenous Agroforestry Network will provide opportunities for:

- Build trust and relationships among the emerging network of Indigenous agroforestry practitioners and partners;
- Develop and curate events, programs, and workspaces for knowledge-sharing and learning;
- Co-create and implement research priorities at the intersections of Indigenous land stewardship and agroforestry; and
- Support educational programs, with an emphasis on experiential learning and mentorship for Indigenous youth.

The Indigenous Agroforestry Network is supported through a project called "Building a Community of Practice for Tribal Agroforestry Producers and Youth in the Pacific Northwest" aimed at supporting improved understanding of and equitable participation and inclusion of Tribes and Indigenous agroforestry producers in USDA programs and services related to agroforestry, including new and existing programs, services, and technologies. The project is led by Ecotrust in collaboration with the USDA National Agroforestry Center, Intertribal Nursery Council, USFS Pacific Southwest Research Station, USFS Research & Development, USFS Forest Management Service Center, Heritage University, Hoopa Valley Tribal Forestry, California Polytechnic State University, Cal Poly Humboldt, Oregon State University, and Washington State University Extension.

Many project partners are also organizers of the Indigenous Agroforestry Network. The Indigenous Agroforestry Network organizers include:

Stephanie Gutierrez, Forests and Community Program Director, Ecotrust:
The lead organizer for the Indigenous Agroforestry Network, Stephanie, San Carlos Apache, works at the nexus of Indigenous foods, fibers, medicines, and forest stewardship. She co-leads the Forests and Ecosystem Services team at Ecotrust and is based in Portland, Oregon.

Amanda Squiemphen-Yazzie, Community Outreach Coordinator, Ecotrust: Amanda, Wasco, Navajo, Yakama, and Citizen of Warm Springs Nation, supports project and partnership coordination and outreach for the Indigenous Agroforestry Network.

Alexi Lovechio, Forests & Ecosystem Services Program Manager, Ecotrust: Alexi coordinates the planning and implementation for projects that support tribal forestry, agroforestry, and climate-smart forestry at Ecotrust.

Kara Briggs, Vice President for Tribal Lands and Waters Stewardship, Ecotrust: Kara, Sauk-Suiattle/Yakama, leads the Forest & Ecosystem Services teams work with Tribes from California to Alaska.

Daniel Lipe, Ph.D., Associate Professor, Environmental Science Management, Cal Poly Humboldt: Dr. Lipe is a registered Western Band Cherokee tribal member and an Associate Professor at Cal Poly Humboldt in the environmental science management department.

Frank Lake, Ph.D., Research Ecologist, USFS PSW Research Station: Dr. Lake is a researcher of restoration ecology and incorporation of Indigenous knowledge into landscape management at the USDA Forest Service Pacific Southwest Research Station.

Don Motanic, Tribal Forestry Consultant (retired): Don, Confederated Tribes of Umatilla Indian Reservation, is self-employed after retiring from a 44-year tribal forestry career with the Bureau of Indian Affairs and the Intertribal Timber Council.

Jessica Black, Heritage University: Dr. Black is the Director of the Center for Indigenous Health, Culture & the Environment, an Associate Professor of Environmental Science and Studies, and the Chair of the Science Department at Heritage University.

Jeremiah Pinto, Research Plant Physiologist/Tribal Nursery Specialist, Intertribal Nursery Council: Jeremy works for the USFS-managed Intertribal Nursery Council to support and improve native plant nursery cultural practices.

Kate MacFarland, USDA National Agroforestry Center: Kate is an agroforester for the USDA National Agroforestry Center.

Badege Bishaw, Courtesy Faculty, Forest Ecosystems & Society, College of Forestry, Oregon State University: Dr. Bishaw focuses in the areas of agroforestry, international forestry, and sustainable natural resources at Oregon State University.

Patrick Shults, Extension Forester, Washington State University Extension: Patrick develops agroforestry pilot projects to benefit land managers in Washington State.

Tribal forest management

Tribal natural resource departments are structured in many different ways, depending on each Tribe's size, priorities, and available resources. Often, these departments function as umbrella organizations that include a range of programs such as forestry, fisheries, wildlife, water, environmental protection, and cultural resources. Within this structure, forestry programs typically focus on forest health, timber management, and fire or fuel reduction. The survey responses reflected this diversity. Some participants came from standalone forestry programs, while others worked within larger departments responsible for a wide variety of land and resource management efforts.

This variation in organizational structure reflects the broad scope and importance of tribal stewardship. The 2023 Assessment of Indian Forests and Forest Management (IFMAT IV), commissioned by the Intertribal Timber Council, underscores the essential role Tribes play in managing more than 18 million acres of forestlands across the United States. These lands are ecologically valuable, culturally significant, and support local economies. Despite their leadership, many tribal forestry programs face persistent challenges that limit their ability to fully achieve their goals. These include underfunding, limited access to current data, outdated equipment, and a lack of practical decision-support tools.

Despite tribal forests often being managed with higher ecological integrity than other ownerships, the report highlights consistent funding shortfalls. Per-acre funding for tribal forests is consistently lower than that for federally managed lands, limiting the capacity for workforce development, forest health treatments, and long-term planning (IFMAT IV Executive Summary, 2023). In addition, many tribal forestry programs face outdated or incomplete forest inventories and struggle to adopt new technologies due to high costs, limited training opportunities, and insufficient information technology infrastructure (IFMAT IV full report, Task Findings, 2023).

Why this matters: Tribes are uniquely positioned to lead in climate-adaptive forest management, guided by generations of Indigenous knowledge and a deep relationship to the land. However, this leadership cannot thrive without equitable access to resources and tools that support proactive, science-informed management.

Access to accurate data and effective planning are essential to forest management. These tools allow managers to anticipate change, assess risk, prioritize treatments, and ensure long-term ecological and economic sustainability. Without robust planning frameworks and access to timely data, forest stewardship goals are difficult to realize.

Key Findings

Existing tools and approaches

- **Use of GIS and mapping tools:** 88% of respondents reported using GIS to support natural resource management, particularly for mapping timber stands, tracking restoration projects, and visualizing land use patterns. For many departments, GIS has become a core management tool.

- **Integration of traditional ecological knowledge:** Many respondents noted that their resource decisions are guided by tribal knowledge systems. While not always captured in digital tools, tribal science is being actively incorporated into natural resource design and planning.

- **Data systems in development:** Multiple Tribes reported efforts to build or improve internal data management systems. This includes custom databases for permitting, environmental monitoring, or integrating spatial data. These efforts are often staff-led and driven by specific program needs.

Barriers identified

- **Limited funding:** 71% of respondents cited budget constraints as a barrier to technology acquisition or upgrades.

- **Access to training:** 79% of respondents cited inadequate technical skills or training opportunities as a significant barrier to their ability to fulfill their mission. The majority preferred field-based learning or mentorship over classroom-style or virtual training sessions.

- **Data access:** While Tribes actively engage in data collection efforts, 45% of respondents reported lacking data on soil, wildfires, and wildlife. 29% cited lacking a comprehensive forest inventory for their Tribe's forest lands.

- **Inadequate infrastructure:** 44% report difficulties with data management, 27% reported unreliable internet, and 24% cited insufficient computing resources. Only 3% reported using cloud computing services.

- **Fragmented data systems:** Less than half of the responding Tribes reported having structured systems to manage forestry or cultural resource data, limiting long-term planning and reporting capacity.

Processing native seed at the Tsemeta Forest Nursery owned and operated by the Hoopa Valley Tribe. Daisy Autumn Photography

Opportunities

- **Invest in long-term workforce development:** Provide sustained support for hiring, training, and retaining tribal natural resource professionals.
- **Develop culturally aligned, intuitive tools:** Build systems that incorporate tribal science and are designed for ease of use. 97% of respondents stated they are likely or very likely to adopt new technologies if they become more accessible and suited to their needs.
- **Support peer-to-peer networks:** Facilitate mentorship and shared learning among Tribal programs to strengthen capacity across communities.
- **Advance Tribal data sovereignty:** Ensure Tribes retain control over how their data are collected, stored, and applied in decision-making.
- **Bundle support resources:** Combine software, training, and technical assistance into integrated packages to increase adoption and impact.

Survey approach

This survey was developed in response to a clear and ongoing need identified by organizers based on direct feedback from tribal natural resource professionals, Indigenous agroforestry producers, and prior assessments such as the *Indian Forest Management Assessment Team (IFMAT)* reports. These sources consistently highlight the demand for improved access to tools, training, and technical support tailored to tribal contexts. The survey also builds on prior work led by Ecotrust and its partners through USDA-funded initiatives, including the *Pacific Northwest Tribal Agroforestry Working Group and Building a Tribal Forestry Workforce in the Pacific Northwest and Beyond.*

The Technology and Tools Needs Survey was created to identify gaps in the technological infrastructure and skills needed to support tribal forest planning and management. It aims to guide future investments in capacity-building including workshops, technical assistance, and tailored training that directly support tribal priorities.

Survey questions were informed by input from project partners. Topics ranged from organizational structure to detailed inquiries about data collection practices, tools and technologies used, and specific software applications for forest management. The survey also explored challenges related to technology access and data management, the integration of tribal science, and identified training needs and preferred formats for technical skill development.

The survey team and project partners conducted outreach to participants using a variety of methods, including direct emails, Instagram posts, the Indigenous Agroforestry Network newsletter, and in-person engagement through tabling and presentations at conferences. The survey remained open for two and a half months, from mid-February 2025 through the end of April 2025, and received 38 responses from natural resource professionals working for a Tribe. These professionals came from departments structured in different ways. Some worked within dedicated forestry programs, while others were part of broader natural resource departments that also managed fisheries, wildlife, water resources, cultural sites, or environmental protection. This variation reflects how Tribes structure their stewardship programs based on governance models, land base, available funding, and local priorities.

Methodology

This survey was designed to collect both quantitative and qualitative information. Responses were analyzed in adherence to data governance practices to protect participant privacy and support meaningful interpretation across different tribal contexts.

Before analysis began, all survey responses were de-identified and normalized to ensure participant anonymity and data consistency. Any personally identifiable information was removed. Where responses involved text input (e.g., “Other” fields), answers were reviewed and cleaned for consistency in terminology and structure.

Each survey question was analyzed at two levels. First, responses were examined at the individual level to summarize the specific selections made by each participant. Second, responses were aggregated at the tribal level by combining input from all individuals representing the same tribe. This approach ensured that Tribes with multiple respondents did not disproportionately influence the results, allowing for a more balanced view across communities.

In the narrative that follows, results are reported either by individual respondents or by tribe. The reporting level is noted for each finding. Only valid responses were included in the analysis. Missing or incomplete answers were excluded to ensure that the findings accurately reflect the input provided.

Survey data and takeaways

Descriptive statistics

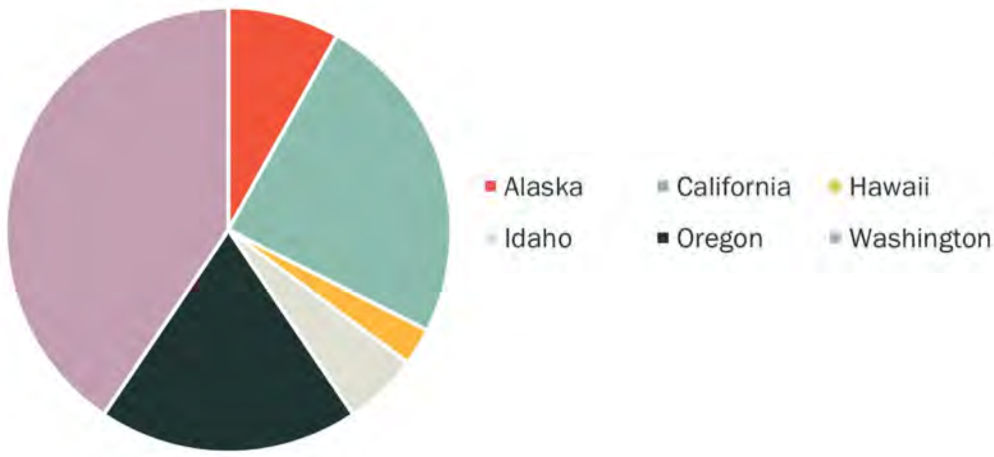
The survey responses reflected a broad and diverse group of natural resource professionals working for Tribes, representing many regions and ecosystems across the Northwest and beyond.

EXPERIENCE AND LOCATION

More than half of respondents (53%) had 12 or more years of experience in natural resource management, demonstrating a high level of expertise across the respondent pool. At the same time, nearly 29% reported having 0-3 years of experience, suggesting a growing number of newer professionals entering the field, many of whom may benefit from mentorship and capacity-building support.

The majority (76%) of the respondents were tribal citizens. Respondents came from a variety of Tribes and organizations and primarily resided in Washington (41%), California (24%), and Oregon (19%), which aligns with the regional Northwest focus of this assessment.

Chart 1: Respondent Location



STAFFING AND STRUCTURE

Departments varied significantly in size and structure. Among those who reported full-time staffing levels:

- 52% had 16 or more staff
- 11% had 11-15 staff
- 32% had 5-10 staff
- 5% had less than 5 staff

> *"The department and staff are funded completely through grants, which make management actions very specific."*

> *"The tribe is one of the largest employers in the region due to season work in the natural resources division."*

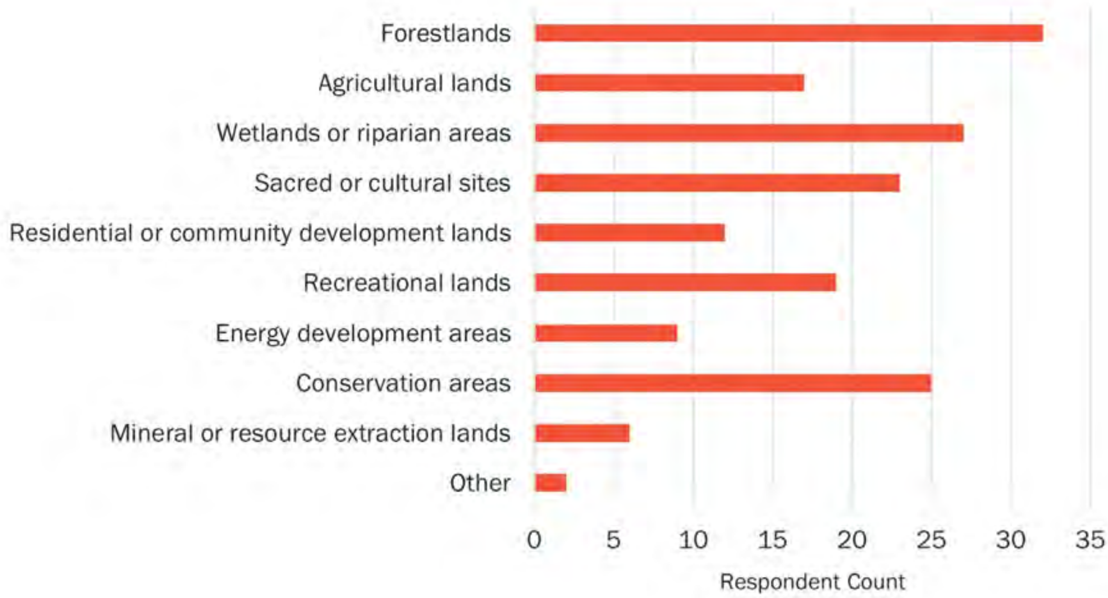
Several respondents noted that their programs were fully funded by grants, which often dictated the scope of their activities and created year-to-year uncertainty. Other respondents described tightknit, interdisciplinary teams where staff wear multiple hats, from forest restoration to native plant nursery work and youth programming. Open-ended responses further illustrated the variability in departmental structures. Some of the respondents' departments operated within larger tribal governments or corporations, while others functioned as independent districts or subunits.

MANAGEMENT SCOPE

Tribal departments are responsible for a wide range of land types. Most (91%) managed forestlands, 77% engaged with wetlands or riparian areas, and 66% oversaw sacred or cultural sites. Other areas included conservation lands (71%), agricultural lands (49%), and recreational areas (54%). This diverse portfolio highlighted the complexity of tribal stewardship and the need for tools that work across ecological, cultural, and regulatory contexts.

To better understand the management challenges and opportunities tribal departments face, future research should explore the types of land tenure and governance structures involved. Knowing whether lands are tribally owned, co-managed, held in fee status, or managed under federal trust can provide essential context for resource planning, tool adoption, and funding strategies. These distinctions are particularly relevant in light of overlapping jurisdictions, varied access to data, and structural barriers to long-term stewardship.

Chart 2: Management Scope



When asked to rank the priority level of various natural resource activities, the top areas identified as "high priority" were:

- Fisheries or aquatic management (58%)
- Wildlife management (53%)
- Land conservation and restoration (53%)
- Timber management (50%)
- Management of cultural species (47%)
- Fire and fuel management (47%)

These priorities reflected a balance between ecological health, cultural values, and economic goals and underscored the interconnectedness of forest, water, and community well-being in tribal management frameworks. The relatively even distribution of "high priority" responses across activities like fisheries, wildlife, fire, timber, and cultural species suggests that many tribal programs are managing multiple, equally important responsibilities. This makes it difficult to rank one area above another, especially when ecological, cultural, and economic goals are closely linked. Future analysis could examine whether these rankings shift when adjusted for the respondent's program area. For example, a higher number of fisheries staff might influence the prominence of aquatic management. Additional research could also explore how priorities vary across regions or disciplines.

Activities that got the most responses as being a "low priority" were:

- Agroforestry (42%)
- Recreational or ecotourism development (37%)
- Renewable energy products (34%)

It's important to interpret these rankings with nuance. In particular, the relatively low ranking for agroforestry may not mean these practices are not a priority. Instead, the term "agroforestry" may be unfamiliar or not commonly used by respondents, even if they are engaging in practices that align with it. For example, activities like interplanting, gathering forest foods and medicines, or managing culturally important understory species may already be taking place. These practices are often embedded in broader forest management or cultural stewardship work and may be described using different language. Future outreach and training efforts may benefit from framing agroforestry in ways that are more aligned with local terminology and traditional practices.

Overview of results

DATA COLLECTION PRACTICES

Despite resource constraints, many tribal natural resource departments are actively collecting a wide range of environmental and cultural data to inform land stewardship. The survey shows that a majority of respondents are tracking core ecological indicators, often combining western scientific methods with Indigenous knowledge systems.

- 89% of respondents reported collecting data on Indigenous knowledge and cultural resources, making it the most commonly selected category. This reflected a deep integration of cultural values into natural resource management and highlighted the importance of supporting tools that can accommodate both scientific and cultural data.
- 80% were conducting forest inventories, suggesting that timber-related data collection remained a priority, even when formal systems or technical tools may be limited.

- 77% collected water resource data, underscoring the central role of water in both ecosystem health and community well-being.
- Other commonly collected data included:
    - Remote sensing (69%)
    - Vegetation and habitat (67%)
    - Weather and climate (66%)
    - Fire and fuel (60%)
    - Wildlife (60%)
    - Soil and geological data (57%)

Only 9% of respondents selected "Other," indicating that most needs were captured in the listed categories. This breadth of data collection shows that Tribes are already engaged in sophisticated, multi-dimensional monitoring. The opportunity lies in providing better tools, training, and data systems to support, organize, and act on this knowledge more effectively.

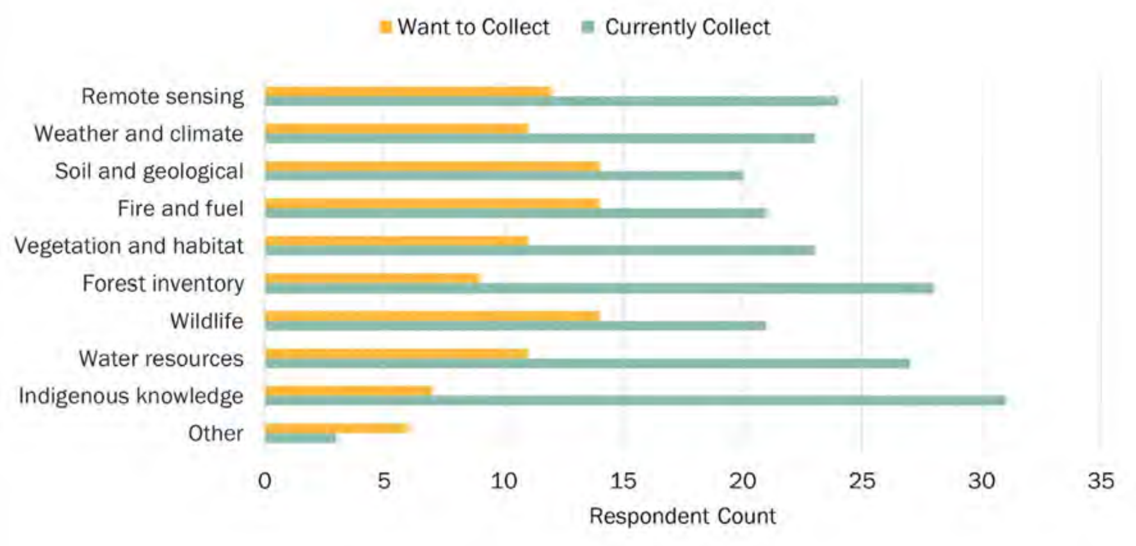
GAPS IN DATA ACCESS

While many tribal departments are actively collecting environmental and cultural data, the survey revealed significant gaps in access to key datasets needed for effective land stewardship. Among the 31 valid responses to this question, several areas emerged where support is most needed.

- 45% of respondents indicated they lack access to soil and geological data, fire and fuel data, and wildlife data. These gaps are particularly concerning given the increasing urgency of wildfire risk, habitat fragmentation, and land stability across the region.
- 39% reported limited access to remote sensing data, which includes aerial or satellite imagery often used for monitoring forest change, disturbance, or vegetation health.
- A similar percentage (36%) noted a need for better weather and climate data, vegetation and habitat data, and water resource data. These information types are essential for climate adaptation planning and ecosystem resilience.
- Notably, 29% of respondents reported lacking access to forest inventory data, despite 80% reporting that they collected some form of inventory. This suggests a potential mismatch between local data collection efforts and access to more comprehensive or up-to-date inventory datasets, such as LiDAR or regional inventory tools.
- 19% selected "Other," indicating additional unmet data needs that may be context-specific.

These findings highlight a need not just for data access, but also for support systems that make these datasets usable. Support systems in this context are the structures, tools, and services that help people actually use the data they have access to. For example, a support system might include a regional hub or cooperative that offers free or subsidized access to fire modeling tools, paired with ongoing mentorship and technical assistance from trained GIS or fire ecology professionals. Barriers to data access may include lack of subscriptions, technical infrastructure, training, or time to interpret and apply data to local decisions. Targeted investments in these areas, particularly in fire, wildlife, and geospatial data, could significantly strengthen tribal capacity for proactive and climate-smart resource management.

Chart 3: Data Access



TECHNOLOGY BARRIERS

Technology limitations remained a significant barrier for many tribal natural resource departments. Of the 34 respondents who answered this question, a majority reported that gaps in funding, training, and digital infrastructure were holding back their teams from fulfilling their missions.

The most widely cited barrier was budget constraints for technology acquisition or upgrades, reported by 71% of respondents. This challenge reflects broader resource limitations faced by many departments, where aging equipment and lack of financial flexibility restrict access to modern tools and platforms.

65% of participants reported inadequate technical skills or lack of training opportunities as a key barrier. Even when tools or systems were available, many teams lacked consistent opportunities for capacity building. This result aligns with subsequent findings from this survey, where respondents emphasized the need for hands-on, accessible, and culturally grounded training.

Nearly half of respondents (44%) identified data management and storage challenges. These include difficulties organizing datasets, maintaining long-term records, and accessing data across programs. Without robust data systems, departments struggle to track change over time or meet reporting and planning requirements.

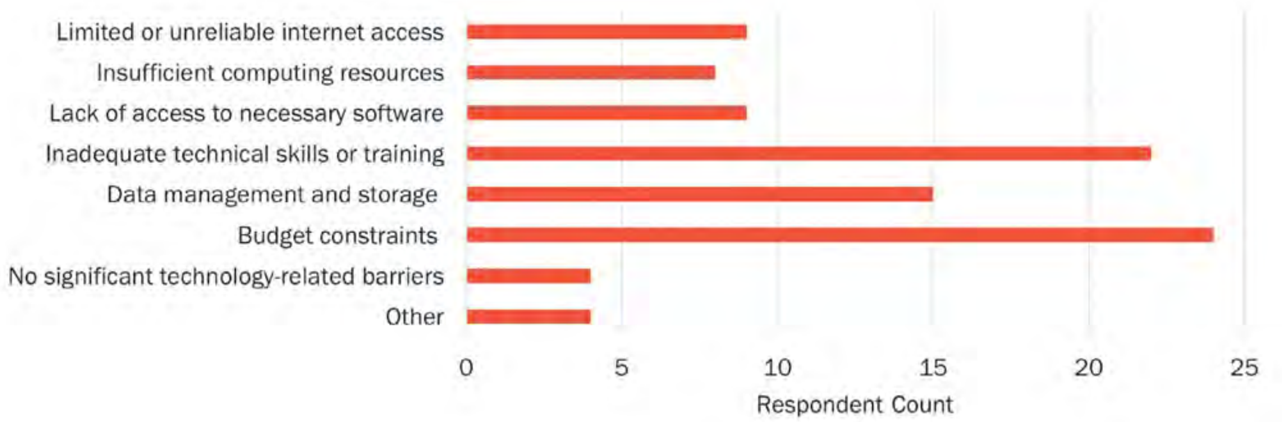
Other barriers included:

- Limited or unreliable internet access (27%)
- Lack of access to necessary software (27%)
- Insufficient computing resources (24%)

A small number of respondents (12%) reported no significant technology-related barriers, suggesting that some departments have been able to secure stable digital infrastructure or work around limitations through creative adaptation.

These results point to a clear opportunity: supporting Tribes with bundled technology solutions that include software access, digital tools, infrastructure upgrades, and dedicated training. When technology support is consistent, flexible, and tailored to the needs of each department, it can dramatically increase capacity for effective, community-led stewardship.

Chart 4: Technology Challenges



> *"We need more funding to attract and hire the best people."*

DATA MANAGEMENT

When asked where critical information is stored, survey responses revealed that most tribal departments relied on local or decentralized systems to manage their data. Of the 35 valid responses to this question, nearly half (49%) reported using computers on premises or local servers as their primary storage method. This approach offers direct control over information but may also limit accessibility, sharing, and long-term data security if not properly maintained.

A smaller number of respondents (14%) used external hard drives or portable storage devices, which can serve as short-term or stopgap solutions, but often present challenges related to data redundancy, loss, and collaboration.

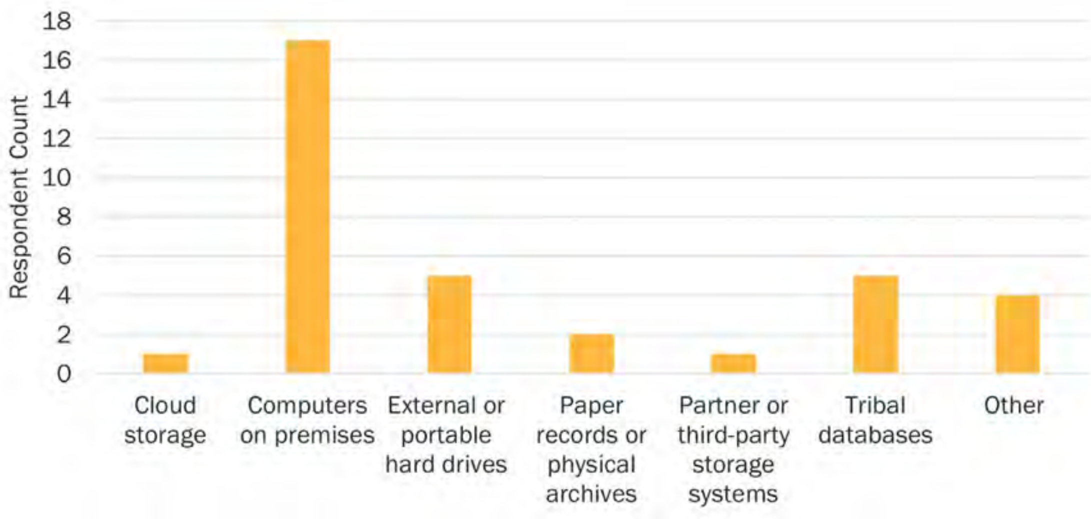
Another 14% reported using tribal data repositories or databases, signaling that some departments were developing or accessing more formalized systems for data management. These systems offer a foundation for improved consistency and sovereignty over data, though further investment may be needed to expand their use.

Native pine trees grown at the Tsemeta Forest Nursery. Daisy Autumn Photography

Only 3% of respondents indicated that they use cloud-based storage services such as Google Drive, AWS, or Microsoft Azure. Low adoption of cloud solutions may be related to concerns over data control, internet access, cost, or unfamiliarity with these platforms. Similarly, only one respondent reported using partner or third-party storage systems, and 6% relied on paper records or physical archives.
11% selected "Other," with written comments suggesting a mix of ad hoc solutions, including individual staff devices or shared drives not formally managed by the department.

These findings point to an important opportunity: improving access to secure, centralized, and culturally appropriate data management systems. Whether cloud-based or locally hosted, systems must protect tribal sovereignty and governance while enabling staff to organize, access, and protect the data needed for effective resource management.

Chart 5: Data Changes



> *"A big challenge is access to work devices for data collection. Most of the time, we are using our personal devices."*

GEOGRAPHIC INFORMATION SYSTEMS

Geographic Information Systems (GIS) play a central role in how many tribal departments manage, monitor, and plan for their lands and resources. The survey showed that GIS is widely used and viewed as highly effective, though the tools in use are primarily proprietary and may not be fully accessible or customizable for all teams.

An overwhelming majority (89%) of respondents reported that they currently use GIS software for natural resource management and land stewardship. This widespread adoption signaled that GIS has become a foundational tool for tribal environmental and forestry programs.

When asked which types of GIS platforms are in use, 100% of users reported using the ArcGIS suite, a proprietary software package. This suggests that Esri products dominate the landscape of tribal GIS, likely due to long-standing partnerships, training access, or familiarity among staff. However, no respondents indicated the use of open-source GIS tools such as QGIS or GRASS, and only a few (10%) reported using web-based GIS platforms or custom/in-house applications. This lack of diversity in tools may point to unmet needs for flexible, cost-effective alternatives, especially for smaller departments or those with limited technical capacity.

Open-ended responses for "Other" GIS tools included ArcGIS Online (AGOL), Avenza Maps, and onX, showing that some departments were supplementing desktop GIS with mobile-friendly or field-use applications, even if they were not fully integrated into broader systems.

Among respondents who use GIS, the applications were wide-ranging:

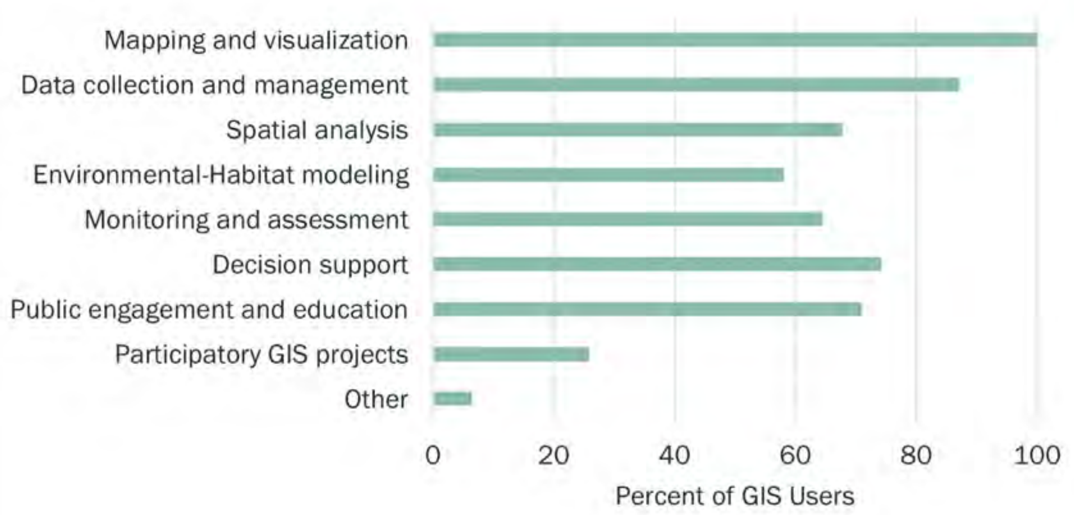
- For mapping and visualization (100%)
- For data collection and management (87%)
- For decision support (74%)
- For public engagement and education (71%)

These results demonstrated that tribal departments were using GIS not just as a mapping tool, but as a core system for planning, communication, and analysis.

When asked to evaluate the effectiveness of GIS in their work, 71% of users described it as very effective, and another 23% found it somewhat effective. Only one respondent found it ineffective. This overwhelming endorsement suggested that GIS is not only widely used, but well-integrated into daily operations and decision-making.

However, the reliance on proprietary tools, the absence of open-source options, and the limited use of custom or web-based platforms point to opportunities for growth. Tribes may benefit from training in alternative GIS systems, expanded access to mobile and cloud-based platforms, and support in building or adapting tools that better reflect Indigenous values and workflows.

Chart 6: GIS Functionality



Processing acorns at the 2024 Indigenous Agroforestry Network Gathering in Humboldt county, CA. Daisy Autumn Photography

GROWTH AND YIELD MODELS

Growth and yield models, such as the Forest Vegetation Simulator, are powerful tools used in forestry to project forest conditions under different management scenarios. However, survey results showed that these tools were not yet widely adopted or accessible across tribal natural resource programs.

Only 37% of respondents indicated that they currently use growth and yield models in their work. A significant portion (34%) reported that they were not familiar with these tools, and another 29% stated that they did not use them. These numbers suggested both an awareness gap and a possible training or resource barrier preventing broader adoption.

Among those who did use modeling tools, the most common platforms were the Forest Projection and Planning System (50%) and the Forest Vegetation Simulator (46%). A notable number (42%) selected “Other,” indicating that some Tribes may have been using customized tools or external contractor-led models. However, follow-up comments suggested that even among users, confidence and familiarity vary. Several participants noted that growth and yield modeling was not their area of expertise or that reliance on a single staff member to run the software created vulnerabilities due to turnover or limited institutional knowledge.

In terms of application, those using growth and yield models employed them for a variety of tasks:

- Treatment scenario planning (68%)
- Fuels and fire management (41%)
- Economic forecasting (41%)
- Carbon accounting (27%)
- Tradeoff analysis (14%) — Although few respondents reported this use, this represents a promising area for future expansion, particularly in balancing ecological and economic outcomes.

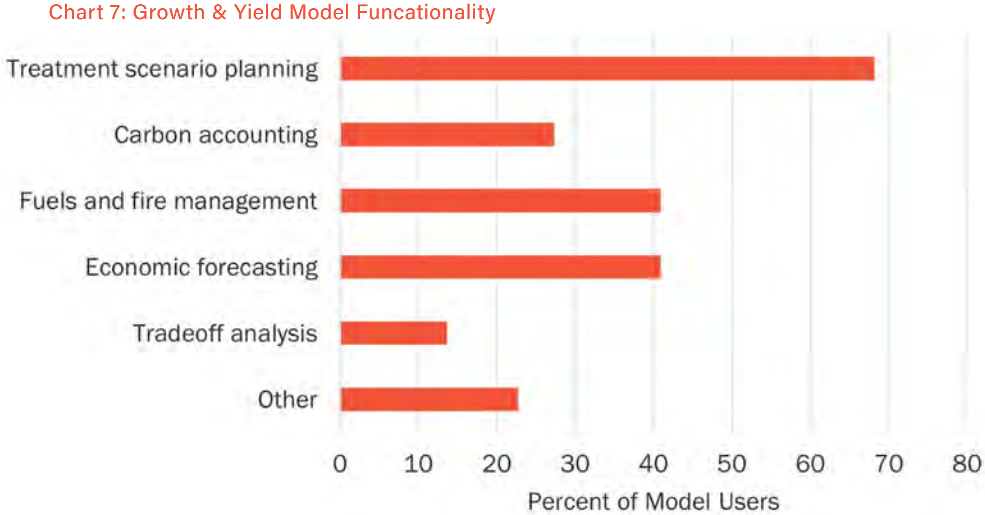
Despite the range of applications, confidence in the tools appeared mixed. Only 13% of respondents rated these tools as very effective. Half of respondents (50%) selected neutral, and 38% rated them as somewhat effective. Open-ended feedback provided context: Some teams were still in the process of implementing these tools, while others lacked the training, staffing stability, or technical support to use them effectively.

These findings point to several key opportunities:

- Training and onboarding support is needed to build broader familiarity with growth and yield modeling among tribal staff. Many respondents expressed interest but lacked access or expertise.
- Reducing reliance on a single expert within departments is critical. Staff turnover has disrupted modeling efforts, indicating a need for shared knowledge, written protocols, and cross-training.
- Simplified interfaces and localized support could increase use and confidence. Tribal programs are more likely to adopt these tools when they are paired with scenario templates, built-in decision support, or direct assistance from regional partners.

Ultimately, while growth and yield models are in use among some Tribes, the results suggest that without more accessible training, sustained staffing, and tailored support, these tools will remain underutilized despite their potential to inform long-term, climate-smart forest planning.

Chart 7: Growth & Yield Model Funcationality



> *“We have encountered difficulties with staff turnover and being reliant on a single staff member to use this technology.”*

FIRE MANAGEMENT SOFTWARE

Fire is a growing concern across tribal lands in the Northwest, yet the survey indicated that fire management software was not widely adopted by most tribal natural resource departments. This gap reflects a broader need for accessible tools, knowledge sharing on available tools, targeted training, and ongoing support in fire planning and risk mitigation.

Only 31% of respondents reported using any kind of fire management software in their work. A significant majority (69%) indicated that they do not currently use these tools, suggesting limited exposure or barriers to entry. This was especially notable given the increasing importance of wildfire resilience across the region.

Among those who did use fire management tools, the most commonly used systems included:

- Wildland Fire Decision Support System (WFDSS; 70%)
- LANDFIRE datasets (60%)
- Interagency Fuel Treatment Decision Support System (30%)
- Fire behavior/spread models such as FSPro, FlamMap, or FARSITE (10%)
- Other systems (30%) — This indicated the use of alternative or locally adapted tools.

In terms of application, fire management software was being used for:

- Prescribed burning (90%)
- Fuel treatment projects (80%)
- Wildfire risk assessment (60%)

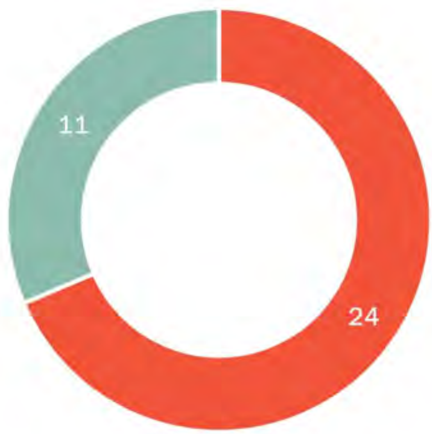
These results showed that where tools were in use, they were focused on proactive treatments and prescribed fire, which are key areas for building landscape resilience and reducing hazardous fuels.

These findings point to an important opportunity. As fire risk increases across the region, Tribal departments need greater support in accessing and applying fire modeling tools. This includes:

- Training staff on existing systems like WFDSS or LANDFIRE;
- Reducing the complexity of inputs and interfaces;
- Supporting localized data integration; and
- Providing guidance on interpreting outputs for decision-making.

Increased investment in fire modeling tools, coupled with mentorship and ongoing technical support, could significantly improve the capacity of tribal departments to plan for and manage fire in culturally appropriate and climate-resilient ways.

Chart 8: Use of Fire Management Software



> *"We are behind in knowing how to use [Fire Management Software], and keeping up with necessary data input."*

INTEGRATION OF TRADITIONAL ECOLOGICAL KNOWLEDGE

Tribal natural resource professionals emphasized that traditional ecological knowledge is central to forest and land stewardship, though the degree to which it is formally integrated into planning and decision-making varied across communities. One respondent noted that "everything with forest management revolves around TEK," reinforcing that Indigenous knowledge is not a separate component, but rather a foundational perspective shaping how stewardship is practiced.

Several Tribes incorporated traditional ecological knowledge through direct engagement with elders, cultural departments, and tribal councils. Proposed management activities were often reviewed by cultural practitioners and tribal leaders, ensuring that traditional knowledge informs restoration, fire, and forestry work. In some cases, forest and fire planning was guided by oral teachings, cultural site mapping, and first foods knowledge, reflecting long-standing relationships with the land and the species it sustains.

However, some respondents described barriers to deeper integration of tribal ecological knowledge. These included:

- Limited documentation of traditional practices, especially related to cultural burning;
- Loss of intergenerational knowledge, particularly for Tribes whose scientific and cultural practices were disrupted by forced removal from ancestral lands or relocation policies;
- Separation between natural resource and cultural departments, which can slow communication and create silos;
- Reliance on one individual to communicate with leadership, limiting broader staff engagement with the tribal council;
- Lack of training for non-tribal staff or younger professionals on how to respectfully and effectively engage with traditional ecological knowledge; and
- Time constraints and extended planning timelines, especially when culturally meaningful consultation is required but not always feasible.

Despite these challenges, teams are actively working to rebuild or strengthen tribal science pathways. Strategies include:

- Interviewing elders;
- Participating in cultural monitoring and archaeological trainings;
- Engaging cultural departments early in project planning; and
- Hosting educational programs to support internal staff learning.

One respondent also noted that traditional ecological knowledge is evolving, and that part of stewardship today includes learning how to be better stewards in both traditional and contemporary contexts. This dynamic approach reflects an ongoing commitment to honoring ancestral knowledge while adapting to the realities of climate change, ecological disruption, and shifting governance systems.

Overall, the responses highlighted a strong desire to make traditional ecological knowledge more visible, respected, and operational in natural resource work. Tribes are leading this integration in many ways, but need more support, flexibility, and internal coordination to fully realize its potential.

> *"Everything with forest management revolves around TEK."*

TECHNOLOGY NEEDS

Seventy percent of respondents said they wished they had access to tools or technologies that they currently lack. The open-ended responses reflected both practical field needs and broader aspirations for innovation. Common themes included:

- Advanced geospatial tools like LiDAR, drones, and Drone2Map to support vegetation mapping, erosion control, and forest inventory;
- More user-friendly growth models for regionally specific forests, especially in east-side conditions;
- Electronic field equipment, such as tablets, data collectors, and rugged laptops, to support mobile data collection and real-time GIS access;
- Training in emerging technologies, including artificial intelligence and cloud-based data processing, to prepare staff for the future of natural resource management;
- Enterprise data sharing systems and infrastructure for GIS data storage and processing, particularly for use in the field; and
- Community science tools that would allow tribal members to participate in monitoring through photo collection or observation (e.g., a culturally adapted version of iNaturalist).

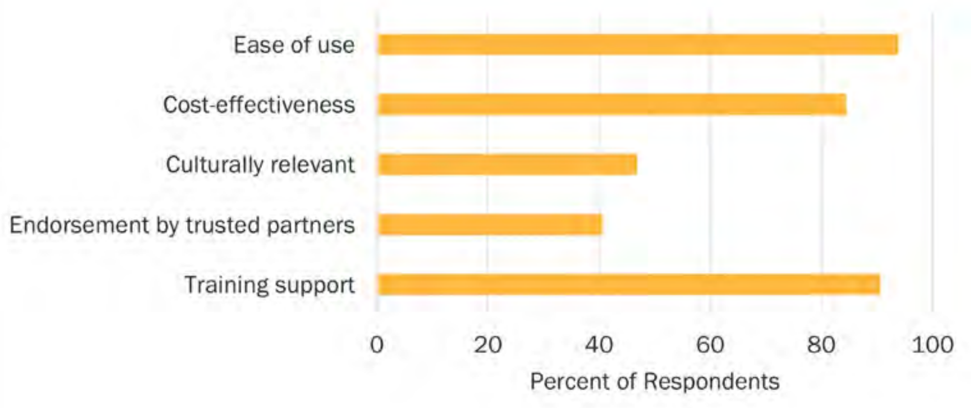
The survey also indicated a high degree of openness to new tools, provided they are accessible and relevant. Nearly all respondents (97%) said they would be likely or very likely to adopt new technologies if those tools were better suited to their community's needs.

The conditions for adoption were clear. Respondents emphasized:

- Ease of use (94%)
- Training and workforce development (91%)
- Cost-effectiveness (84%)
- Cultural relevance (47%)
- Endorsement by trusted partners (41%)

These results indicated that Tribes are eager to innovate, but adoption depended on whether tools are designed to align with local capacity, values, and goals. The focus should not be on introducing more technology for its own sake, but on supporting systems that are intuitive, affordable, culturally grounded, and accompanied by sustained training.

Chart 9: Criteria for Tool Adoption



TRAINING AND CAPACITY BUILDING

The survey results revealed a clear preference for hands-on, relationship-based training formats when it came to learning new tools and technologies. Tribal natural resource professionals overwhelmingly valued training opportunities that are experiential, accessible, and grounded in community relationships.

94% of respondents identified hands-on field training as the most effective learning format. This was followed by:

- In-person workshops or demonstrations (84%)
- Virtual webinars or tutorials (66%)
- One-on-one mentorship or coaching (63%)
- Peer-to-peer learning within the community (38%)
- Printed or digital manuals and guides (34%)

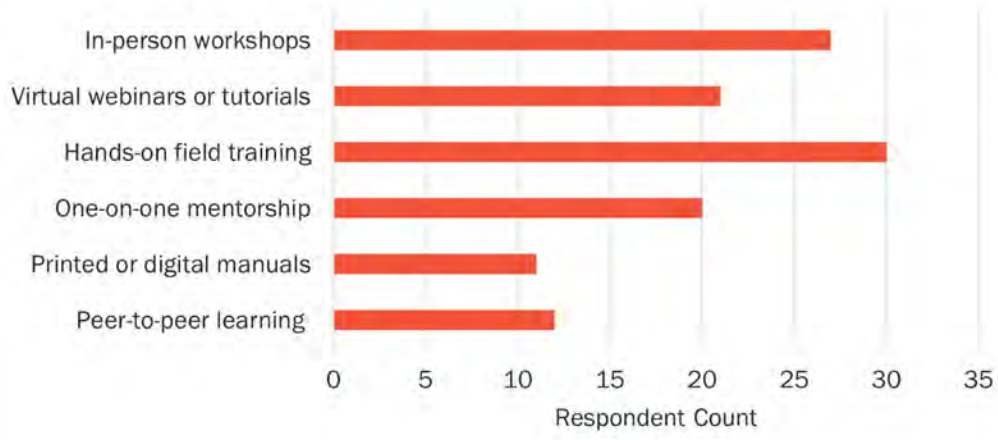
These results confirmed that many tribal professionals learn best by doing and that learning is most effective when rooted in place-based practice and relationship-building. While online formats and self-guided materials played a supporting role, they were not seen as substitutes for the depth and connection offered by in-person learning.

When asked where they typically seek out training, tribal-led organizations and community-based programs emerged as the most trusted and relied-upon sources (78%). Other common sources included:

- Local or regional government agencies (56%)
- Universities and academic institutions (44%)
- Online platforms or learning portals (41%)
- Nonprofit or environmental groups (25%)
- USDA or the National Agroforestry Center (22%)

Overall, these findings point to a strong appetite for capacity-building, especially when it is community-led, field-based, and integrated with real-world projects. There is a clear opportunity for funders and partners to invest in peer-led, regional training networks, support mentorship opportunities, and co-create learning experiences that honor the knowledge systems and relationships that define tribal land stewardship.

Chart 10: Preferred Training Format



Conclusion

The Technology and Tools Needs Survey underscores the strong dedication of tribal natural resource departments to caring for their lands and waters. Across the Pacific Northwest, tribal programs are gathering important environmental and cultural data, applying traditional ecological knowledge, and using geospatial tools to guide their work. At the same time, many face serious challenges. Limited budgets, outdated equipment, gaps in training, and scattered data systems make it hard to build and sustain the tools they need.

Despite these barriers, the survey points to promising paths forward. Tribal professionals are ready to adopt new technologies when those tools are designed with their communities in mind and come with the right kind of support. Growth and yield models, fire management tools, and geospatial platforms hold particular promise, but many programs lack the staff capacity or training to use them fully. Respondents stress the need for more peer learning, hands-on training, and long-term workforce development to build lasting capacity.

This survey offers a clear call to action. Funders, partners, and technical experts can help by investing in tools that are easy to use, grounded in cultural relevance, and backed by strong training and mentorship. Supporting Indigenous data sovereignty and co-developing systems that reflect the needs and values of tribal communities will be key. With the right support, Tribes can continue to lead the way in climate-smart and culturally rooted land management for the future.

Indigenous Agroforestry Network Gathering at Tryon Creek in Portland, OR. **Kari Rowe Photography**

References Cited

1. Intertribal Timber Council. (2023). *The 2023 assessment of Indian forests and forest management.* Intertribal Timber Council. https://www.itcnet.org/file_download/inline/1e6f3774-b3c2-476f-a7c0-04ab3d7b3a7d

2. U.S. Department of Agriculture. (2022). Equity action plan. U.S. Department of Agriculture. https://www.usda.gov/sites/default/files/documents/usda-equity-action-plan.pdf