# Eastern Innovation Landscape Network

Progress Report

March 2023 – May 2024

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## *Table of Contents*

## *Executive Summary*

The Eastern Innovation Landscape Network (EILN), conceived in March 2023, is an interagency collaborative created to evaluate and refine emerging wildland fire tools and technology. In its first year, EILN has evolved into a fully functioning network of fire scientists and practitioners co-producing wildland fire research and technology to provide fire managers with the tools they need to meet their fire and land management objectives safely and effectively. Through thorough initial strategic planning, relationship building to recruit partners and willing fire practitioners, formation of a Leadership Team and Working Group, a series of virtual and in-person workshops, and initial outreach, EILN has established a solid foundation and has become a viable pathway for fostering deliberate accelerated wildland fire innovation. Within the first year as a network, EILN identified six emerging tools and technologies for evaluation and innovation, assisted in delivering three terrestrial LiDAR training events, hosted three innovation co-production workshops, developed a website, and delivered at least four presentations at various agency and national conferences and workshops among other successes outlined in this report.

This report outlines the activities, outcomes, and impacts of co-production for the first year of EILN. This includes the early strategic planning phase, EILN vision and goals development, Innovation Nodes selection, priority tools and models currently under evaluation, workshops, trainings, and outreach. Appendix A provides a timeline documenting key events in the first year of the EILN for reference. Hyperlinks are embedded throughout the report for websites or documents archived within a USFS Pinyon Box folder (Eastern Innovation Landscape Network Box Folder). Those unable to access the Pinyon Box folder may reach out directly to the EILN Working Group Lead, Brett Williams, at Brett.Williams@usda.gov, to access any of the documents referenced within this report.

## *Strategic Planning Phase*

### SERDP & ESTCP WFSI Workshop (March 9-10, 2023)

EILN was born out of a Department of Defense (DoD) Strategic Environmental Research and Development Program (SERDP) & Environmental Security Technology Certification Program (ESTCP) Wildland Fire Science Initiative (WFSI) workshop held at Eglin Air Force Base (AFB), FL March 9-10, 2023 (Final Workshop Report). Representatives from DoD SERDP & ESTCP, DoD Office of the Deputy Assistant Secretary of Defense (ODASD), US Forest Service (USFS) Regions 8 and 9, USFS Southern Research Station, US Fish and Wildlife Service (USFWS) Region 4, the Southeastern Wildland Fire Cohesive Strategy, and other key partners recognized the need to both increase the relevance and pace of adoption of emerging tools for prescribed fire, conservation, and land management and to reduce the chances of technologies failing to be adopted by wildland fire end users. This resulted in a proposed interagency collaboration based on a similar fledgling USGS Innovation Landscape effort in Southwestern Arizona and was initially titled the "Eastern Innovation Landscape Pilot" which was subsequently changed to the Eastern Innovation Landscape Network. In addition to evaluating and refining emerging technology, the intent of EILN—and what truly makes the concept revolutionary—is that it leverages existing partnerships and deliberately facilitates and accelerates innovation through more intentional co-production of wildland fire research between fire researchers and fire practitioners.

The initial leaders of the Eastern Innovation Landscape Network identified the following opportunities:

- Offer an interagency landscape-scale partnership opportunity that aligns with the National Cohesive Wildland Fire Strategy and interagency shared commitment to confront the nation's wildfire crisis while recognizing climate change
- Advance innovative data sets and technology transfer to support science and modeling at a landscape level
- Provide proof of concept potential and scalability across federal agency land ownership boundaries and jurisdictions to support collective landscape stewardship opportunities
- Provide transparent and deliberate interagency efforts to generate new solutions while optimizing efficiencies by leveraging the collective assets and capacities of each agency committed to the EILN
- Provide products that will benefit practitioners in prescribed fire planning and implementation, wildfire suppression, risk management, and various land management techniques, while providing integrated support for decision makers

Following review and subsequent conversations among the initial leaders, or principals, partnering organizations agreed to support the Eastern Innovation Landscape Network either through direct funding or through in-kind support, such as personnel time and effort. USFS Region 8 provided immediate support by offering up their newly hired Technology Transfer Specialist, Brett Williams, to lead the EILN Working Group. Initial objectives for the pilot included:

- Continue integrating interagency tool development
- Validate models/tools in partnership with pilot sites (DoD Installations, National Forests, DOI Refuges)
- Distribute and apply tools and technologies to wildland fire end users in the field
- Ensure two-way information flow between managers on the ground and researchers

Through discussions during the workshop, the principals and partners decided that the initial tools and technologies the Eastern Innovation Landscape Pilot would evaluate would include the following:

- Three-Dimensional Fuels Characterization and Monitoring
    - FastFuels
    - Terrestrial LiDAR
    - Airborne LiDAR
- Next Generation Coupled Fire-Atmospheric Behavior Models
    - QUIC-Fire
    - BurnPro3D
    - Wildland Urban Interface Fire Dynamics Simulator (WFDS)

Prescribed fire practitioners in the Southeast have deemed the current suite of tools for monitoring fuels and modeling fire spread and behavior insufficient in meeting their planning needs. The currently available models are unable to account for fire's interactions with the atmosphere and model complex ignition patterns typical of prescribed fire. This has spurred innovations in the development of "Next Generation" fire behavior models that are physics-based, allow for complex ignitions, and able to capture fire-atmospheric interactions and feedbacks. These Next Generation tools and models initially chosen for EILN (listed above) were already being evaluated and funded for development through DoD SERDP & ESTCP WFSI to fill this gap, so additional EILN evaluation of, and innovations around, these tools and models through direct co-production with managers was the next logical step towards operationalizing these models.

The management units which would serve as initial primary demonstration sites for tool evaluation and refinement were termed "Innovation Nodes." The 9 innovation nodes were initially comprised of three National Forests within USFS Region 8, three DoD installations in the Eastern U.S., and three Refuges within USFWS Region 4. As tools and models matured and were ready for operational use, the technology will then be transferred to "Technology Transfer Sites" within each agency as well as other across federal, state, and private partners.

It was decided that the structure of EILN would consist of a Leadership Team (comprised of principal leads from each agency and key partners) and a Working Group (of agency and partner representatives appointed by the Leadership Team). The Working Group was tasked with the planning and implementation of EILN.

**Initial Strategic Planning Meetings and USFS Briefing Paper Development (March – April 2023)**

Throughout March and April 2023, those involved held strategic meetings that would make EILN a success. USGS became a key partner in the initial planning stages of the EILN, and both USFS Southern Research Station and Northern Research Stations signed on to support the effort. Noblis, a non-profit federal consulting firm contracted to support SERDP & ESTCP, joined the team to support both the EILN and establish the Innovation Landscape Network (ILN), a network of networks that also includes other Innovation Landscape networks in Alaska and the Southwest.

In March 2023, Working Group Lead Williams composed a Southeast Interagency Landscape Pilot Briefing Paper for USFS Region 8 Fire and Aviation Management (FAM) leadership. This was the first official briefing paper to describe and introduce what would become known as EILN, and its circulation garnered USFS Region 8 leadership support for the EILN concept.

**Innovation Node Recruitment (May – August 2023)**

Innovation Nodes became the core demonstration sites for evaluating, refining, and providing feedback on the emerging tools and technology considered by EILN. Fire science co-production has traditionally occurred between fire researchers and fire practitioners at the local level and within small groups. While co-production can occur at any scale or forum, from informal conversations on the fire line to formal workshops, engagement between researchers and fire managers at innovation nodes is intended to increase the pace and scale of more intentional co-production at a landscape-level. The following criteria was used to assess whether sites are appropriate to be suitable innovation nodes:

- Sites with proactive, progressive, and successful prescribed fire programs
- Sites with fire managers and firefighters who value and embrace fire research and/or technology
- Sites within the Coastal Plain and Piedmont physiographic regions (initial geographic focus)
- Sites who are willing participants and have time to engage with EILN

The EILN leadership chose to focus on sites within the Coastal Plain or Piedmont initially because their relatively flat ground and homogenous fuels were an ideal first spot for testing and evaluating the newly developed fire behavior models before testing in more complex terrain.

The Leadership team and Working Group selected the following nine initial Innovation Nodes, grouped by federal organization:

- USFWS Innovation Nodes: St. Mark's National Wildlife Refuge (NWR), Piedmont NWR, Merritt Island NWR
- DoD Innovation Nodes: Ft. Stewart, Ft. Liberty, Joint-Base McGuire-Dix-Lakehurst
- USFS Innovation Nodes: Chattahoochee-Oconee National Forest (NF), Francis Marion-Sumter NF, Savannah River Site

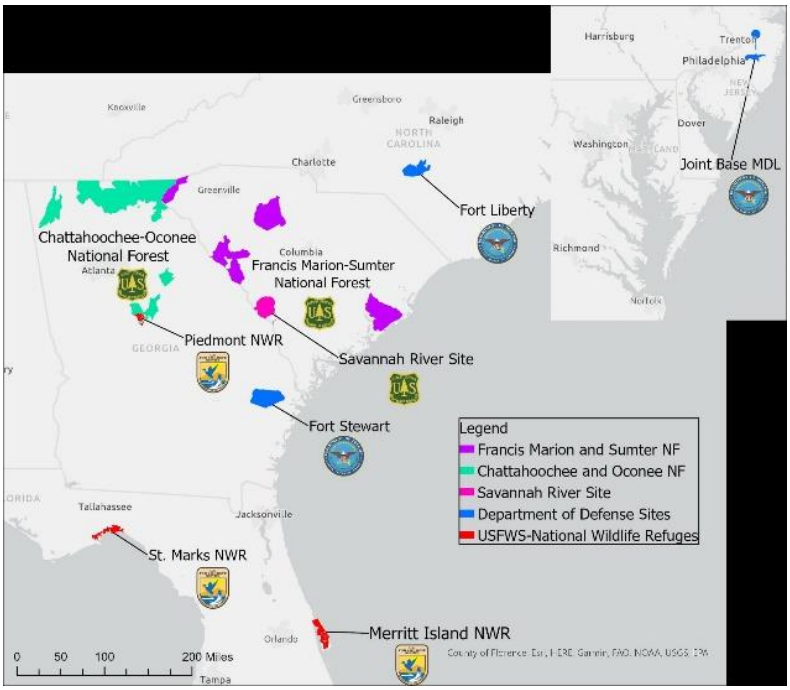


*Figure 1. Eastern Innovation Landscape Network Innovation Nodes map*

From May – August 2023, EILN Working Group Lead Williams, and USFS DoD Liaison, James Furman, worked with DoD and USFWS liaisons on the EILN Working Group to brief the Innovation Nodes on the EILN concept. They introduced them to the initial technologies and tools they proposed to be evaluated and refine, answered questions and concerns, and gained formal commitments of their participation in EILN as Innovation Nodes. A link to the standard initial Innovation Node briefing can be found here. All nine nodes agreed to become Innovation Nodes within EILN; however, there has still been little participation to date by one of the nodes.

EILN is currently considering adding initial Technology Transfer Sites to the network for the EILN TLS tools and applications specifically. TLS technology has matured and is already in operational use primarily within USFWS, USGS, and USFS, so it is ripe for technology transfer. TLS requires ample field training data for model development, so the more scans that can be collected across natural community types of the Eastern U.S., the faster the underlying models can be built to analyze fire effects and fuels metrics. To increase the scale of TLS scanning and operational use, EILN Tech Transfer Sites will tier from the Innovation Nodes as additional USFS, USFWS, and DoD sites in the Eastern U.S. acquire LiDAR scanners and are ready for TLS training. TLS transfer to Tech Transfer Sites will also provide additional opportunities for TLS technology evaluation and innovations.

**EILN Vision Statement and Goals (July – September 2023)**

Through an EILN White Paper, the Nodes, Leadership Team, and Working Group all came to a better understanding of their roles, the goals of the program, and the organizational structure.

***EILN Vision Statement:*** Networked interagency co-production fostering deliberate accelerated wildland fire innovation.

***EILN Goals:***

1. Accelerate fire science and technological innovation via wildland fire scientist/practitioner co-production in the Eastern U.S.
2. Utilizing a combination of field data collection and fire managers' experiential knowledge, develop a process for testing, evaluating, and refining:
    - 3D fuels characterization/monitoring,
    - Next generation fire behavior and smoke models, and
    - Fire planning tools for managers.
3. Relying upon a user-centered approach, develop and implement a process to transfer advanced fire management technologies and tools to wildland fire practitioners, planners, and managers for training, education, and/or operational use.
4. Accelerate the process for identifying future wildland fire research and technology needs in the context of a rapidly changing and novel environment.
5. Formalize and document communication feedback loops amongst the Leadership Team, the Innovation Working Group, and wildland fire practitioners.
6. Define and communicate management-relevant wildland fire science and technological innovation funding priorities.

The team developed an EILN white paper to compile the above with the need, purpose, and organizational structure of the EILN. They soon after created an EILN factsheet as an abridged version of the White Paper, to reach a broader audience. This fact sheet was disseminated at workshops, conferences, and meetings and has been a valuable communication tool for educating partners, co-workers, leadership, and new participants in the EILN.

**EILN Leadership Team and Working Group**

On July 6, 2023, the EILN Leadership Team convened for the first time through a virtual meeting (meeting recording). Leadership Team representatives for this initial meeting included:

Kevin Hiers – DoD SERDP & ESTCP
Tracy Mallard – Noblis
James Furman – USFS DoD Liaison
Anne Jewell – DoD OSD
Jon Wallace – USFWS Region 4
Steve Parrish – USFS Region 8
Brett Williams* – USFS Region 8
Jenn Fawcett – Southeast Regional Partnership for Planning and Sustainability (SERPPAS)
Elliot Nauert – SERPPAS/Southern Fire Exchange

Gary Wood – SE Wildland Fire Cohesive Strategy
Nick Skowronski – USFS Northern Research Station

*Working Group Lead

This first meeting was primarily a report out from Brett Williams and James Furman on progress made since the initial meeting at Eglin AFB in March 2023. The Leadership Team members emphasized the need to ensure that the tools and technology evaluated by the EILN are management-relevant and help fire managers and practitioners streamline their burn planning and fire effects monitoring programs. The group also discussed who else to invite into the Leadership Team, and decided the Leadership team would meet monthly.

On August 16, 2023, the EILN Working Group met for the first time virtually (meeting recording and meeting summary).

Attendees at the initial Working Group meeting included representatives from USFS Region 8, USFS Region 9, DoD OSD, Air Force Wildland Fire Branch, USFWS Region 4, Noblis, USFS Southern Research Station, USFS Northern Research Station, Los Alamos National Lab, ESTCP Integrated Research Management Team (IRMT), SERPPAS, New Mexico Consortium, and Southern Fire Exchange.

Similar to the initial Leadership Team meeting, the first Working Group meeting was spent briefing the Working Group on the EILN concept and progress-to-date. During this meeting, the Working Group discussed Innovation Node site locations, potential additional EILN partners and members, the EILN White Paper, effective co-production methods, and initial planned EILN activities for Fall 2023. The EILN Working Group also decided to meet once per month.

**Innovation Nodes Needs Assessment – Aug 2023**

In August 2023, the EILN Working Group Lead developed and distributed a questionnaire to the Innovation Nodes to acquire baseline data on current methods for fire behavior effects monitoring, perceived needs, and knowledge of emerging LiDAR technology and next generation fire behavior modeling. Links to the needs assessment survey and responses are below.

- Innovation Nodes Initial Needs Assessment
- Responses to Initial Needs Assessment

There were eight responses, representing five Innovation Nodes, to the needs assessment. Some key findings from the needs assessment include:

- Only one of the Nodes responded that their management unit did not conduct fire effects monitoring.
- Most Nodes collect data on paper datasheets.
- When asked how their fire programs use monitoring data, most sites used monitoring data to determine whether burn objectives have been met post-burn, to evaluate fuel treatment effectiveness, or as a communication tool with leadership, partners, and the public.
- In terms of fuel metrics, all Nodes responded that fuel reduction and consumption were the primary metrics of interest followed by fuel bed depth and groundcover abundance.

- Most Nodes had a basic understanding of LiDAR and its applications, but only two Nodes had actually either used a TLS scanner or analyzed the data.
- In terms of TLS benefits, faster data collection and increased sample size were seen as the largest benefits.
- The primary concerns with TLS technology were data management/analysis and agency IT security challenges.
- The most commonly used fire behavior model in use currently was BehavePlus.
- For Next Gen Fire Behavior Models, the Nodes ranked developing burn prescriptions, pre-burn planning, and predicting holding concerns as the most beneficial potential uses and spatial distribution of fire potential, general escape potential, and flame lengths as the highest fire behavior output metrics of interest.

### *Presentations and Briefings*

*DoD Climate Resilience Workshop: St. Louis, MO - July 12, 2023*
EILN Working Group Lead Williams delivered a lightning talk introducing the basic EILN concept, outlining why Innovation Landscapes are a useful new paradigm for fire science co-production, and describing the tools and models EILN plans to evaluate.

*DoD Innovation Symposium: Washington, D.C. – November 29, 2023*
USFS DoD Liaison Furman and EILN Working Group Lead Williams co-delivered a presentation tracing the history of and key research players within the DoD WFSI, introducing the basic EILN concept, outlining why Innovation Landscapes are a useful new paradigm for fire science co-production, describing the tools and models EILN is planning to evaluate, and sharing the Innovation Node sites chosen and their activities to date. A poster was also presented describing the IRMT and its role supporting the EILN.

*Association of Fire Ecology Conference: Monterey, CA. December 7, 2023*
Kevin Hiers, SERDP & ESTCP Resource Conservation and Resilience Program Manager, presented an overview of the EILN and progress to date. Paul Steblein, Chad Hoffman, Carolyn Enquist, and Seth Munson, all with USGS, were co-authors of the presentation.

*National Military Fish and Wildlife Association Conference: Grand Rapids, MI – March 28, 2024*
USFS DoD Liaison Furman delivered a lightning talk which provided EILN context within the larger DoD SERDP & ESTCP WFSI and large research burn campaigns, an overview of tools and models currently under EILN evaluation, the Innovation Node co-production concept, a timeline of significant events and accomplishments since inception, and next steps.

The EILN concept was also mentioned in other presentations throughout the year including at two SERPPAS Steering Committee Meetings in March and September 2023, Rx-510 Advanced Fire Effects at the National Advanced Fire & Resource Institute in Tucson, AZ in January 2024 and at the USFS Region 8 RT-300 virtual refresher in January 2024.

### *EILN Co-Production Activities – Workshops and Trainings*

Over the past year, EILN convened fire scientists and practitioners at strategic workshops and focused technology trainings to accelerate the development and adoption of next-generation fire tools. These co-production events resulted in the following key insights and achievements:

- Built trust and fostered new co-production relationships and opportunities among fire managers from the nine Innovation Nodes and EILN wildland fire researchers
- Developed a new QUIC-Fire roadshow workshop series launched in 2024 to be held at each of the nine Innovation Nodes to provide more in-depth practitioner feedback for QUIC-Fire model
- Assisted in delivery of two terrestrial LiDAR trainings at St. Mark's NWR and Eglin AFB with 30 total fire managers in attendance
- Four Innovation Nodes initiated terrestrial LiDAR fire effects monitoring programs and began data collection as a result of these trainings

**Workshops**

EILN organized and facilitated multiple workshops over the past year to maximize end-user feedback for the tools and models under evaluation and to scale co-production efforts across key federal agencies within the Eastern U.S. Workshops were delivered in virtual, in-person, and hybrid formats. Working Group Lead Williams was the lead organizer for each workshop with support from USFS DoD Liaison Furman, USFS Southern Research Station, USFS Rocky Mountain Research Station, USFS Northern Research Station, Los Alamos National Lab, New Mexico Consortium, and the USFWS Regional Fire Ecologist.

*EILN Virtual Kickoff Workshop*

The kickoff meeting for the larger EILN included the Innovation Nodes land managers to connect them with EILN members and researchers. Researchers delivered briefings on the various tools and models the EILN had agreed to focus on for testing and evaluation: FastFuels, terrestrial laser scanning (TLS)/IntELiMon, QUIC-Fire, and BurnPro3D. The meeting concluded with a summary of next steps and planned events.

The meeting was successful and well-received, but post-presentation discussions were brief due to the virtual format. Network members were able to get to know one another, begin forming relationships and the EILN goals and vision, and Innovation Node land managers became familiar with the researchers and the emerging tools to be evaluated. The TLS and Next Generation Fire Behavior Model SMEs portrayed confidence and expertise in the tools and models the EILN chose to evaluate which helped build trust in the EILN concept amongst fire managers. Overall, the virtual meeting format for an initial kick-off meeting was a viable tactic for ILN formation, but the lack of in-person contact limited opportunities for trust and relationship building and discouraged deeper discussions.

The agenda of the virtual kickoff meeting is here and the recording of the virtual meeting is here.

*Ft Stewart In-Person Co-production Workshop*

The first in-person workshop of the EILN took place on October 19-20, 2023 at Ft. Stewart, GA. EILN fire researchers (from SRS, NRS, and Los Alamos National Lab (LANL)), representatives from most of the

Innovation Nodes (Ft Stewart, Ft Liberty, St Marks NWR, Piedmont NWR, Chattahoochee-Oconee NF, Savannah River Site, and Francis Marion-Sumter NF), EILN Working Group, and Leadership Team were all in attendance. The workshop agenda included a presentation of results from the 2022 Ft Stewart WFSI Burn Campaign, an overview of Innovation Node fire programs, a session on terrestrial LiDAR new developments with Q&A, and introductions to QUIC-Fire and BurnPro3D. The LANL modelers and developers guided the Innovation Node fire managers through hands-on model runs in QUIC-Fire and BurnPro3D, while the fire managers provided feedback on qualitative model accuracy and graphical user interface (GUI) functionality and ease-of-use. This active co-production allowed modelers to better understand fire managers needs and implement their requests directly into technology updates.

Based on post-workshop surveys and feedback (summarized here), the first co-production workshop was a huge success. Based on post-workshop survey feedback, the Innovation Node managers gained a better understanding of the co-production concept, became more familiar with QUIC-Fire, BurnPro3D, and TLS and potential management-relevant applications, and began to better comprehend their end-user roles within the EILN. Participants commented that they wished the workshop was longer, and that smaller groups may be more effective for future co-production to occur. Discussions at the workshop catalyzed the concept of the "QUIC-Fire Roadshow," a series of workshops starting in Spring 2024 focused on more intimate QUIC-Fire feedback and evaluation sessions at each of the separate Innovation Nodes.

Based on specific feedback from managers at the workshop that using TLS to estimate fuel loading and consumption would be a high priority, the USFS SRS TLS SMEs immediately began working on a method to estimate relative biomass change from paired pre- and post-burn TLS scans.

Click hyperlinks to access the workshop agenda, recordings, and meeting AAR and questionnaire summary.

*Field Tour of Silas Little Experimental Forest and Joint Base McGuire-Dix-Lakehurst*

On September 22, 2023, the Northern Research Station hosted a field tour for USFS and DoD senior leadership. Tour stops included the Silas Little Experimental Forest and Joint Base McGuire-Dix-Lakehurst, one of the EILN DoD Innovation Nodes. The field tour showcased NRS fire research across the New Jersey Pine Barrens, explored ideas for growing existing partnerships for fire research innovation, and highlighted ways to leverage prescribed fire for wildfire mitigation. The EILN was highlighted as a current strategy for accelerating wildland fire research innovation through collaborative partnership.

*Terrestrial LiDAR Monitoring Plan Development Virtual Workshop*

To meet an emerging need and in response to frequent questions from the EILN Innovation Nodes concerning the design of terrestrial LiDAR monitoring programs, the EILN invited the terrestrial LiDAR research subject matter experts (SMEs) and interested Innovation Nodes to convene virtually to discuss terrestrial LiDAR monitoring program development and to provide a Q&A forum on December 5, 2023. Topics included the function of EILN as a test bed for these new technologies and applications, technical discussions concerning collecting first order vs. second order fire effects with TLS, sample size, Tier 1 vs. Tier 2 sampling, plot stratification considerations, seasonality of monitoring, and organizational capacity. This workshop was a successful example of EILN co-production in action as researchers responded to an emerging need from Innovation Node fire managers. Following this workshop, at least four of the

Innovation Nodes began developing a monitoring strategy and generated an array of TLS plots for their forest, refuge, or installation. The recording of this meeting can be found here.

*DoD WFSI Ft Stewart Research Burn Campaign EILN Workshops*

The EILN hosted two workshops in conjunction with the DoD SERDP & ESTCP WFSI prescribed fire research campaign at Ft Stewart, GA on February 6-11, 2024. The first workshop on February 7 was focused around two presentations concerning the progress of EILN tools and models to generate discussion on potential applications. First, Joe O'Brien, USFS SRS Research Ecologist, provided an update on QUIC-Fire and presented various prescribed fire scenarios his lab has been working on. Then Louise Loudermilk presented updates on TLS innovations including biomass and consumption estimation as well as an analysis of the effect of time-since-burn on a variety of metrics derived from TLS.

The second workshop on February 9th was a beta test for the QUIC-Fire Roadshow concept with the Ft. Stewart wildland fire staff, led by QUIC-Fire modelers and developers from LANL and SRS Athens Rx Fire Lab. All participants in the QUIC-Fire Road show workshop agreed that it was a productive workshop worth repeating at other EILN Innovation Nodes.

Both workshops, and the WFSI research burn campaign itself, brought together and stimulated discussion amongst a wide array of fire researchers and fire managers from a diversity of agencies and organizations including DoD, USFS, USGS, LANDFIRE, NASA, New Mexico Consortium, LANL, and a number of universities. The Ft. Stewart fire staff were excited and encouraged by QUIC-Fire model performance as they developed prescribed burn scenarios, and the modelers and developers gathered valuable feedback for improvements to the graphical-user interface.

*Oconee NF / Piedmont NWR QUIC-Fire Roadshow Workshop*

After a successful beta test at Ft. Stewart, EILN held the second QUIC-Fire Roadshow workshop at Oconee NF and Piedmont NWR on May 15-16, 2024. With planning and logistic support from the DoD ESTCP Integrated Research Management Team (IRMT), EILN Working Group Lead Williams led seven fire and natural resource managers from the Oconee NF and Piedmont NWR, three fire modelers from LANL and the SRS Athens Fire Lab, and three other participants through a series of presentations, hands-on exercises, and facilitated discussions designed to elicit feedback on QUIC-Fire model fidelity, the QUIC-Fire GUI, and BurnPro3D. Fire managers from the Oconee NF and Piedmont NWR shared fire management program overviews, and EILN Working Group Lead Williams facilitated discussions among managers and modelers concerning local prescribed fire plans, burn objectives, and burn prescription parameters. Participants visited recent prescribed burns on both the Oconee NF and Piedmont NWR and discussed pre-burn planning processes and considerations, firing strategies and tactics, and resulting fire effects to provide tangible field examples and real-world context for the fire modelers. The Oconee NF and Piedmont NWR managers and fire modelers spent most of the workshop running QUIC-Fire and BurnPro3D models on local burn units. This stimulated fruitful discussion in which managers and staff provided feedback and discussed ideas for continual tool refinement. Following the workshop, the Piedmont NWR requested a BurnPro3D user account and were provided access for additional testing and evaluation over time. Approximately half of the Oconee NF and Piedmont NWR fire managers had previously worked with the same LANL and SRS fire modelers at the Ft. Stewart Co-Production workshop in October 2023, so this follow-up workshop further solidified manager and modeler relationships and

trust. All participants agreed that the smaller, more intimate setting of the QUIC-Fire Roadshow was ideal for maximizing co-production.

Based on the workshop after action review and questionnaires, all participants found the workshop successful and productive. The fire managers and practitioners gained familiarity with QUIC-Fire and BurnPro3D user interfaces, functionality, and output metrics; and through interactive modeling sessions, provided the fire modelers with a wealth of useful suggestions to improve the user interface and model outputs. The Oconee NF and Piedmont NWR fire managers and practitioners generally agreed that the QUIC-Fire GUI had improved significantly from their first exposure to it at the Ft. Stewart Co-production workshop in October 2023, but that there remained potential to improve the user experience. In general, participants preferred the BurnPro3D user interface to the QUIC-Fire GUI in terms of ease-of-use and perceived benefits to fire planning, and the fire managers felt strongly that fire behavior output metrics for both models could be made more relevant to managers. The modelers responded positively and agreed to continue developing and refining output metrics over time based on the feedback they received. All participants agreed that the training applications for QUIC-Fire model runs and visualizations are endless. One specific training application idea from the workshop is a narrated ignition pattern and scenario video for less experienced firefighters that would use QUIC-Fire visualizations to illustrate simple to complex ignition patterns and the phenomenology of unique firing scenarios. LANL also shared a QUIC-Fire virtual reality experience that would provide a realistic, virtual training environment once fully developed. This workshop strengthened the co-production relationships between fire modelers and practitioners, elicited feedback that will improve the QUIC-Fire and BurnPro3D models, and spurred ideas for potential innovative applications and approaches.

**Trainings**

The EILN supported several TLS training events in its first year, spurring TLS innovation while building the capacity of EILN Innovation Nodes to develop and implement a TLS fire effects monitoring program. EILN chose to focus on supporting TLS training over the past year due to TLS being more closely ready for operational use when compared to the other technologies under EILN evaluation. The trainings were led by TLS SMEs from the USFWS Region 4 (Emily Link and Leta Douglas) and the New Mexico Consortium (Scott Pokswinski). EILN Working Group Lead (Brett Williams) and Southern Research Station Forester (MC Murphy) assisted with the trainings.

*St. Marks National Wildlife Refuge TLS Training – August 8-10, 2023*

On August 8-10, 2024, St Marks NWR hosted TLS training along two separate tracks: “Data Collector” and “Data Manager.” Both tracks learned the basics of TLS and data collection sampling protocols, but the Data Collector track focused more on TLS data collection, Tier 2 sampling protocols, and off-loading and converting point clouds into a usable format. The Data Manager track was focused on generating TLS plot locations in GIS, making plot maps available in ArcGIS FieldMaps, and developing a Survey123 data entry form.

Two of the three USFS Innovation Nodes were represented at the training (Chattahoochee-Oconee NF and Savannah River Site). The remaining attendees came from other National Forests in Region 8, Florida International University, USGS, and USFWS. Following the St. Mark’s TLS training event, two of the Region 8 National Forests within the EILN developed a TLS fire effects monitoring and began scanning.

*Eglin AFB TLS Training – November 7-9, 2023*

The EILN supported a second TLS training hosted by Eglin AFB in Northwest Florida. This training was primarily focused on data collector training, but also briefly touched on data management. Emily Link (USFWS), MC Murphy (USFS SRS) and Scott Pokswinski (NMC) led the training. The EILN Innovation Nodes present at the training included representatives from Joint Base McGuire-Dix-Lakehurst, Chattahoochee-Oconee NF, and Francis Marion-Sumter NF. Students from the Air Force, Army, and Colorado State University also attended. Following the TLS training event at Eglin AFB, students from JBMDL and Francis Marion-Sumter NF began designing and implementing a TLS fire effects monitoring program.

*Savannah River Site TLS Refresher Training and ESTCP Project Kickoff – March 20-21, 2024*

The Fire Staff at Savannah River Site are planning to begin implementing a TLS fire effects monitoring program in Summer 2024 and have hired two University of Georgia (UGA) students to assist over the coming summer starting in May 2024. Two of their permanent staff had previously completed interagency IntELiMon TLS training in 2023, but to ensure consistent and quality data collection, they requested refresher training ahead of on boarding the summer interns to ensure they were following the sampling protocol and data offload and conversion processes correctly.

Louise Loudermilk and Mike Gallagher, Research Ecologists with Southern Research Station and Northern Research Station, respectively, received DoD ESTCP funding to assess the performance and usability of IntELiMon TLS monitoring with that offered by CruzAssist, a tablet-based TLS scanning product, at Savannah River Site and Fort Stewart. The request for Savannah River Site TLS refresher training coincided with a need for Southern Research Station to make an initial site visit for scouting and planning for the ESTCP project.

EILN Working Group Lead Williams met with Louise Loudermilk and MC Murphy (Southern Research Station Forester) and a few of the Savannah River Site Fire Staff on site on March 20-21, 2024, to provide the TLS refresher training and discuss early coordination and data needs for the ESTCP research grant. The Savannah River Site Fire Staff felt more comfortable with teaching TLS data collection and upload to GLOBUS, a USGS EROS interface for TLS point cloud upload and storage, to the incoming UGA students after the refresher.

## *Outreach*

### **EILN Website**

In early strategic planning discussions, the need for an EILN website arose. The Leadership Team preferred that a non-DoD partner host the EILN website to foster commitment from non-DoD partners. EILN Working Group Lead Williams worked with Jenni Moore-Myers, Southern Research Station Communications Team Leader, to create the website. The SRS EILN Website went live on January 24, 2024 and contains the following sections: overview, approach, priorities, Innovation Nodes, partners, contact info, and resources. Currently, the SRS Communications Team Leader still manages the website content, while EILN Working Group Lead Williams receives USFS website management training, so that the EILN can have direct control over their website content. The EILN has also been working to ensure

alignment between the NILN SERDP & ESTCP website and the SRS EILN website, so that they complement one another. The EILN website immediately expanded EILN visibility and outreach and is an extremely useful resource for informing new and interested partners of the EILN concept and priorities.

**Publications and Articles**

A few articles published in 2023 highlighted EILN's efforts to innovate through co-production between fire managers and researchers. The first article titled, "DoD's Wildland Fire Science Initiative Delivers Proven Fire Science Tools to Natural Resource Managers," was published in the DoD's Natural Selections in Summer 2023. It highlighted the collaborative interagency efforts of EILN that will accelerate refinement and transfer of innovative wildland fire tools and technology within the context of the WFSI Eglin AFB research burn campaign in March 2023.

An article entitled "Eastern Innovation Landscape Network Highlights Power of Wildland Fire Research Collaboration" was published on the DoD SERDP & ESTCP website in March 2024. This article explores the purpose and goals of EILN, its structured, the Innovation Nodes, and the emerging wildland fire tools and technologies EILN is evaluating using fire practitioner feedback and input.

### *Impact & Future Events and Opportunities*

**Technology transfer across Innovation Landscapes Network.** The QUIC-Fire modeling roadshow spear-headed by EILN is being facilitated for the Colorado Front Range, demonstrating technology and knowledge transfer across the Innovation Landscapes Network. The EILN QUIC-Fire Roadshow will continue with the next workshop planned for May 15-16$^{th}$ at Oconee NF and Piedmont NWR with a longer-term goal of conducting workshops at all Innovation Node locations.

**Natural Resource Management Partnerships**. Northern Research Station and the Environmental Chief at JBMDL are in discussions to designate a dedicated wildland fire research area at JBMDL due in part to EILN co-production efforts over the past year, the inclusion of JBMDL as an Innovation Node, and USFS Northern Research Station's close relationship with the JBMDL fire management program.

**Policy engagement.** EILN will be highlighted at the Seventh National Cohesive Wildland Fire Management Strategy Meeting through a pre-meeting workshop in September 2024 and may demonstrate technologies/workshops for the Wildland Fire Leadership Council. EILN Working Group Lead Williams will be presenting on the EILN concept and accomplishments at a Southern Group of State Foresters meeting in June 2024.

**Training.** EILN will be sponsoring a TLS training for Innovation Nodes and partners at the Southern Research Station Athens Prescribed Fire Lab in October 2024.

### *SWOT Analysis*

The following Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis is meant to assess EILN progress and status with regard to these categories for strategic planning and communication to the EILN Leadership Team, Working Group, Innovation Nodes, and other partners across the network. This is simply a snapshot in time and is meant to be updated periodically into the future.

| EILN SWOT Analysis – May 2024 | |
|---|---|
| ***Strengths*** | ***Weaknesses*** |
| • Existing relationships and new relationships across the network have built trust rapidly<br>• Dedicated Leadership Team, Working Group, and agency/partner representation exists<br>• Integrated Research Management Team and Ember Alliance support in place for planning, logistics, and outreach<br>• Early proof of concept has been successful<br>• Southern Research Station EILN website is live and public-facing | • Innovation Node time and staff capacity to remain engaged with EILN and to conduct fire effects monitoring and fire behavior modeling<br>• Slow pace of GUI development and tech transfer of next generation fire behavior models<br>• Lack of sufficient fuel metric modeling for site-specific TLS outputs<br>• Delays in, and funding for, airborne laser scanning (ALS) of Innovation Nodes<br>• Lack of effective interagency EILN file sharing options<br>• Lack of EILN funding / staffing to support program coordination and outreach |
| ***Opportunities*** | ***Threats*** |
| • Proposal submitted for National Fish and Wildlife Foundation Longleaf Stewardship Fund grant, and pre-proposal submitted to NFWF America the Beautiful, to support TLS scanning support, training, and outreach.<br>• SERDP & ESTCP funding for ALS scanning across DoD Innovation Nodes<br>• Considering addition of new EILN Tech Transfer Sites for TLS<br>• Identify and leverage early adopters and champions to promote emerging innovations across the Innovation Nodes and Tech Transfer Sites | • Institutional inertia within federal agencies for adoption of new technology and tools like TLS for fire effects monitoring and next gen fire behavior models<br>• Sustainable, long-term funding for development and tech transfer of next gen fire behavior models<br>• Agency IT and cybersecurity hurdles to adopting and integrating new technology |

## APPENDIX A. 2023-2024 EILN MILESTONE TIMELINE