Supplementary Table 1. Understanding, mitigating, and managing the impacts of fire will require addressing five challenges to inform how we serve environmental and social justice by sustainably living and interacting with fire in our natural world.

Challenges	Needs	Expected Impacts
1. Integrate across disciplines by promoting coordinated fire science, social science, and ecological research	• Remove siloes between disciplines • Build upon the adaptive, integrated knowledge and "use-inspired" approaches • Include empiricists, modellers, practitioners and domain experts from broad disciplines over research life cycle	• Rethinking collaborations across disciplines and expertise creates scientific advancements and promotes transdisciplinary science • Improved approaches for team science • Better integration of research into decision making
2. Embrace different ways of knowing and knowledge generation to identify resilience pathways	• Use co-production to integrate knowledge from across disciplinary, organization, and community boundaries • Co-define resilience incorporating Traditional Ecological Knowledge (TEK) • Accept fire as a social-ecological phenomenon across space and time • Use the Resist-Accept-Direct (RAD) framework to inform management • Dismantle systemic barriers to fire sciences	• Increased diversity across disciplines, identities, sectors, and communities • Convergence of resilience solutions • Restructuring of dialogue across different groups with fire as a social-ecological phenomenon • More use of adaptation management
3. Use fire as a lens through which to address fundamental science questions	• Use fire to answer fundamental scientific questions within and across physical, biological, and social sciences • Coordinate research supporting basic fire science for applications to cross-scale pyrogeography of fire as a social-ecological phenomenon	• Better understanding of human's role in cross-scale pyrogeography as a basis to address other challenges
4. Capitalize on the "firehose" of data to support community values	• Fund research to study the wealth of data that exists • Develop infrastructure to collect real-time, dynamic observations from flame to fire regime across wildland-urban gradient • Develop technologies for cross-scale observations from microbe to planet • Create usable information across disciplines with standardised metadata • Establish a community of practice for contributions to open science • Use biomimicry and create digital twins for experimentation	• Reduced barriers to search, discover, and access information across disciplines • Accelerated scientific discovery of fire drivers and impacts • More fire-resilient communities
5. Develop coupled models that include human dimensions to better anticipate future fire	• Develop cross-scale nested, coupled models that include human dimensions • Capture differences between managed and unmanaged fires as they relate to preceding conditions, ignitions, fire behavior and effects • Improve representation of fuel heterogeneity, including physiological, dynamic fuel loading, moisture, and flammability • Represent heterogeneous fuels across the wildland-urban gradient • Model metrics of risk and resilience to inform decision-making	• Enhance our understanding of the connections, interactions and feedbacks among fire, humans, and the Earth system • Expanded definition of risk to include social and ecological impacts • Enable resilience planning