KNP Post-Fire Research and Monitoring Questions and Activities

Coordinated partnerships provide a holistic landscape approach to understanding and managing wildfire in these current times. Sequoia and Kings Canyon National Parks created a KNP Complex post-fire research prospectus to create awareness of what research is needed, what is already planned, and what should continue so that individuals, agencies, organizations, and universities can further expand their interdisciplinary work to answer critical questions about how to treat and manage this climatically changed landscape. The research questions and activities are organized by primary and secondary resource categories (e.g., forest ecosystems, water resources…), management links (e.g., restoration, fire management…), priorities (high, medium, and low), and status (e.g., Not started, initiated…). If your research aligns with efforts that are already underway please reach out to Danny Boiano (danny_boiano@nps.gov (mailto:danny_boiano@nps.gov)) and he can connect you with the PI.

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Question or Activity	RSS group	Secondary group	Management	Priority	Status
All	All	All	All	All	All
What are the impacts of the KNP on karst geology, water quantity, water quality, and biological habitat in Lilburn Cave, with specific concerns of altered levels of streamflow, sediment deposition, nutrients, ions, metals, isotopes, and turbidity, and resulting effects to cave biota?	Caves and Karst Systems	Water Resources	Resource Management Planning	High	
Assess initial fire effects in sequoia groves in spring and summer 2022 (census or sample).	Giant Sequoia & their Ecosystems		Fire Management	High	Not started
Evaluate giant sequoia grove condition through metrics such as sequoia mortality, regeneration, and possibly growth as well as subsampling forest structure and fuel loads to assess future fire risk.	Giant Sequoia & their Ecosystems		Fire Management	High	Not started
Identify the drivers of regeneration patterns specific to high severity areas that have not been investigated to date, including differences in scorched vs torched stands and site conditions. Accomplish by surveying high severity fire areas in Redwood Mountain Grove.	Giant Sequoia & their Ecosystems		Individual Species Management	High	Not started
Investigate mortality and survivorship from this event so that these response variables can be correlated with other predictor variables (slope, aspect, management history, fuel loading). Knowledge gained will be used to prioritize other sequoia groves for fuel reduction treatments before they are impacted by high severity fire.	Giant Sequoia & their Ecosystems		Fire Management	High	Partially ongoing
Track changing fire regimes and condition of sequoia groves by mapping fire return interval departure (FRID), fire size, and fire severity.	Giant Sequoia & their Ecosystems	Forest Ecosystems	Fire Management	High	Ongoing

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Monitor fire effects in and adjacent to sequoia groves to evaluate fire program effectiveness and assess conditions following repeated burns over the long term.	Giant Sequoia & their Ecosystems	Forest Ecosystems	Fire Management	High	Ongoing
Analyze historic fuels data across existing network of plots in giant sequoia groves to track change over time and guide change in management actions	Giant Sequoia & their Ecosystems		Fire Management	High	Partially ongoing
Determine if managed fire designed to restore sequoia mixed conifer forests to historic conditions increases resistance to tree mortality during drought.	Giant Sequoia & their Ecosystems	Forest Ecosystems	Fire Management	High	Initiated
Test management strategies for increasing giant sequoia mixed conifer forest resilience by reducing tree densities below historic levels.	Giant Sequoia & their Ecosystems	Forest Ecosystems	Fire Management	High	Not started
Monitor giant sequoias for at least three years to track delayed mortality, including documentation of cedar bark beetle activity. Improve understanding of sequoia-bark beetle-fire interactions.	Giant Sequoia & their Ecosystems		Core Information	High	Partially ongoing
Experiments that inform our knowledge and ability to implement assisted migration of giant sequoias. Includes expanding common garden experiments to establish sequoia seed zones based on climate projections<a0>and planting sequoia seeds from different groves to test seeding success.	Giant Sequoia & their Ecosystems		Restoration	High	Partially ongoing
Assess genetic diversity of giant sequoia within and across groves to determine variability in climate stress tolerance and adaptive capacity.	Giant Sequoia & their Ecosystems		Restoration	High	Initiated
Monitoring in sequoia restoration areas to assess effectiveness of restoration efforts. Need to identify key metrics. Critical to consider species planted and density of planting to ensure success.	Giant Sequoia & their Ecosystems		Restoration	High	Not started
Improve mapping of giant sequoia groves and trees by correcting the Sequoia Tree Inventory.	Giant Sequoia & their Ecosystems		Core Information	Medium	Not started
Improve understanding of water balance in giant sequoia groves (current and under future climate scenarios) to inform restoration, fire operations, and vulnerability assessements. Includes, but not limited to, improved understanding of surface and ground water dynamics in groves, where giant sequoias are getting their water (isotope studies), and effects of smoke on transpiration. Scale from individual strees to watershed.	Giant Sequoia & their Ecosystems	Water Resources	Core Information	High	Initiated

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Map giant sequoia and forest drought vulnerability and monitor across the landscape using remotely sensed data (Leaf to Landscape project).	Giant Sequoia & their Ecosystems	Landscape Integrity & Biodiversity	Core Information	High	Not started
Monitor meteorology in and adjacent to giant sequoia groves to better understand physical conditions over time.	Giant Sequoia & their Ecosystems	Air Resources	Core Information	Medium	Ongoing
Conduct niche modeling including soils information to compare current and potential future distributions of giant sequoia habitat. Identify mircohabit variables that favor giant sequoia persistance.	Giant Sequoia & their Ecosystems		Restoration	High	Not started
Obtain fine scale environmental measurements to determine if giant sequoia groves are climate change refugia.	Giant Sequoia & their Ecosystems			High	Not started
Track current and past research conducted in park sequoia groves to better learn from and communicate this work.	Giant Sequoia & their Ecosystems	Crosscutting Activities	Collaboration and information management	High	Not started
Organize giant sequoia relevant spatial datasets so that they are discoverable, accessible, and well documented.	Giant Sequoia & their Ecosystems		Collaboration and information management	Medium	Not started
Collaborate to integrate data across jurisdictions for a landscape-scale understanding of giant sequoia ecology, status, and trends.	Giant Sequoia & their Ecosystems	Crosscutting Activities	Collaboration and information management	High	Not started
Complete a Giant Sequoia Monitoring and Management Plan, as called for in SEKI's 2016-2021 Strategic Plan.	Giant Sequoia & their Ecosystems		Resource Management Planning	Medium	Not started
Measure fine particulates (PM2.5) as part of an interagency effort to monitor smoke dispersion.	Air Resources		Fire Management	Medium	Ongoing
Improve forecasts of fine particulates (PM2.5) during fires to better inform people about health effects.	Air Resources		Fire Management	High	Ongoing
Determine the ecosystem components most at risk from toxic air contaminants, including higher trophic levels or sensitive species.	Air Resources		fi	High	Not started
Study drought impacts and spatial patterns in oak woodlands (tree mortality, etc.) to inform management actions.	Foothill Terrestrial Ecosystems		Fire Management	High	Not started

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Study foothills nutrient and carbon cycling to inform post-fire recovery and future fire management actions. Recommend monitoring measures and thresholds to support biodiversity and ecosystem function.	Foothill Terrestrial Ecosystems	Aquatic Ecosystems & Species	Core Information	High	Not started
Describe fire's natural range of variability in the foothills, including methods to measure too-frequent as well as less frequent fire. Where does the KNP fire fit in this context and how might management change following the KNP?	Foothill Terrestrial Ecosystems		Fire Management	High	Not started
Monitor fire return interval, fire severity, gap creation, and regeneration/succession across the landscape. Expand fire return interval departure (FRID) to identify areas burning more and less frequently than the historic FRID.	Landscape Integrity & Biodiversity		Fire Management	High	Partially ongoing
Many areas designated as <93>undetected change<94> in the KNP did have an underburn; more extensive surveys are needed to confirm the extent of this pattern.	Landscape Integrity & Biodiversity		Core Information	High	Partially ongoing
Improve understanding of fuels across the landscape. Includes studying fuel accumulation rates, developing fuel models for standing dead in burned area, and incorprating fuels knowledge into vulnerability assessments.	Landscape Integrity & Biodiversity		Fire Management	High	Not started
When climate signals swamp what we know, what are the thresholds where we know we will lose control of fires?<a0>	Landscape Integrity & Biodiversity		Fire Management	High	Not started
Identify intervals for fire re-entry to inform fuels treatment. Consider following approaches: use of historical products to give changes of fuels post disturbance, analysis of possible flame lengths & rate of spread from modeling that uses measured data and incorporating uncertainty analysis through analysis of past wet/dry warmer/cooler years.	Landscape Integrity & Biodiversity		Fire Management	High	Not started
Analyze the patterns of fire spread and wind patterns, to the extent data are available. Did the spread follow projected patterns from flame length and rate-of-spread data?	Landscape Integrity & Biodiversity		Fire Management	High	Not started
Evaluate effectiveness of post-KNP fire treatments on reducing impacts of drought and other stressors to maintain ecosystem services.	Landscape Integrity & Biodiversity	Visitor experience & public perception	Fire Management	High	Partially ongoing
Monitor disturbed areas from fire-suppression (e.g. dozer lines) to assess ecosytem recovering and determine if restoration needed.	Landscape Integrity & Biodiversity	Foothill Terrestrial Ecosystems	Restoration	High	Not started
Post-fire monitoring (ideally long-term) of restoration activities in KNP and other mega and high-severity fires to improve understanding of restoration effectiveness and how it may vary across ecoystems and regions.	Landscape Integrity & Biodiversity		Restoration	High	Not started

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Design an adaptive management experiment following extreme fire, wind, etc. to test erosion controls and planting genotypes/species suitable for future conditions.	Landscape Integrity & Biodiversity		Restoration	High	Not started
Identify data we need to hone in on assisted migration actions.	Landscape Integrity & Biodiversity	Giant Sequoia & their Ecosystems	Collaboration and information management	High	Not started
Does replanting in high severity areas occur at the expense of maintaining or even expanding prescribed fire in areas that didn't burn or were lower severity?	Landscape Integrity & Biodiversity	Forest Ecosystems	Restoration	High	Not started
Assess effectiveness of combining planting with fire and mechanical treatments to create greater landscape heterogeneity	Landscape Integrity & Biodiversity		Restoration	High	Not started
Inventory distribution/abundance of special status plants post-fire, with emphasis on rare plants. Include areas in the inventory where the park is considering fuels treatments . Continue to monitor idenified populations.	Landscape Integrity & Biodiversity		Core Information	High	Not started
Continue and enhance fire effects monitoring, the parks' most comprehensive, plot-based dataset relating specifically to fire.	Landscape Integrity & Biodiversity		Core Information	High	Ongoing
Continue to acquire, analyze, ground truth, and evaluate satellite based fire severity data on large fires to provide coarse scale estimate of fire effects and vegetation response.	Landscape Integrity & Biodiversity		Core Information	High	Ongoing
Understanding of vegetation and ecosystem change and shifts across the landscape: detect landscape-scale changes in vegetation types (remote sensing), document species distribution shifts to understand if species are being lost or are just changing distribution (ecotone studies), improve understanding of where, when, and why certain ecosystems may be impacted and then recover over time vs instances where a tipping point/threshold is surpassed so that there is an ecosysem shift.	Landscape Integrity & Biodiversity		Core Information	High	Not started
Measure and monitor natural sounds in selected areas (e.g., burn severity, pre and post restoration, KNP v surrounding landscape) to measure change in biological activity and diversity.	Landscape Integrity & Biodiversity	Terrestrial Wildlife of Concern	Core Information	Medium	Initiated
What do these larger patch sizes of higher severity that we are observing in the KNP and other mega-fires mean to the ecosystem?	Landscape Integrity & Biodiversity		Core Information	High	Not started
Resurvey sites (e.g. Natural Resource Inventory plots) to detect changes post fire in species distribution and abundance.	Landscape Integrity & Biodiversity	Forest Ecosystems	Core Information	High	Ongoing

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What areas in the KNP are susceptible to undesirable type conversion and therefore high priority for direct or resist response.	Landscape Integrity & Biodiversity		Restoration	High	Not started
Where are the refugia following the fires and what abiotic factors help control their location?	Landscape Integrity & Biodiversity		Restoration	High	Not started
Conduct a meta-analysis of recent fires to help us understand what climate related factors are now over ruling all we used to know about fire behavior.	Landscape Integrity & Biodiversity		Fire Management	High	Not started
Which patterns and impacts are generalizable across western megafires and which are more specific to individual fire/watershed/regional scales. Common monitoring, questions, and data analysis techniques will go along ways towards helping answer these questions.	Landscape Integrity & Biodiversity		Collaboration and information management	High	Not started
Consider impacts of the KNP that go beyond park boundaries, including impacts on ecosystems benefits that people of CA look to Sierra Nevada land managers to provide. Identify and collect data that not only identify problem areas, but also identify and prioritize management responses in order to help partnerships transform from discussion to action, and hopefully transform discussion from focusing on individual self interest to broader community interests. Assess to what extent the Parks and other federal partners can act as champions to bring this about.	Crosscutting Activities	Landscape Integrity & Biodiversity	Collaboration and information management	High	Not started
Develop better methods for cumulative impact assessment and review of significant actions proposed by adjacent landowners/agencies. (actions related to fire management)	Landscape Integrity & Biodiversity		Fire Management	Medium	Not started
What is the role of disturbance (from the KNP) and its effect on biodiversity, especially in the management of natural ecosystems?	Landscape Integrity & Biodiversity		Core Information	High	Not started
Improve our understanding of the interactions between drought, wildfire, and related management actions. Assess drought resilience for terrestrial and aquatic ecosystems, building on landscape responses to the historical multi-year dry periods(1987-92, 2012-15, and 2020-present). Project this resilience into the future. Consider additional data on drought stress that directly links with remotely sensed data and modeling products (e.g. continuous soil moisture at varied depths).	Landscape Integrity & Biodiversity		Fire Management	High	Not started
How will long-term changes to vegetation from wildfire interact with reduced snowpack and drought conditions to affect aquatic resources (water supply, wetlands, aquatic habitat)? Consider in the context of resiliancy of the resources and ability to understand limitations of management actions.	Landscape Integrity & Biodiversity	Aquatic Ecosystems & Species	Core Information	High	Not started

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Downscale climate change scenarios from abstract globally and regionally modeled scenarios to the more experiential, place-specific realities of SEKI.	Landscape Integrity & Biodiversity		Core Information	Medium	Not started
Develop conceptual models that show the linkages between disciplines, along with the analytical techniques to test and demonstrate the linkage. Use to identify pathways that might inform novel post-fire management actions.	Crosscutting Activities		Collaboration and information management	High	Not started
Create landform maps that integrate geology, soils, and topography to help understand vulnerability and manage watersheds, ecosystems, cultural resources, and natural hazards.	Landscape Integrity & Biodiversity		Collaboration and information management	Medium	Not started
Compare and integrate vulnerability assessment products to describe and map vulnerability to fire effects in the context of other stressors of concern at parkwide and larger regional scales.	Landscape Integrity & Biodiversity		Collaboration and information management	High	Not started
Generate mechanistic hypotheses to explain fire, drought, and beetle interactions and continue to test pre-burn treatments to eliminate physiological damage that results in vulnerability to beetle attack.	Forest Ecosystems	Giant Sequoia & their Ecosystems	Core Information	High	Not started
Rapid assessment needed to see if low elevation forests and habitats still exist across the landscape	Forest Ecosystems		Core Information	High	Not started
Identify areas where conversion of forests to another vegetation type is acceptable due to past conditions, management activities, etc.	Forest Ecosystems		Restoration	High	Not started
Determine if prescribed and other fire management activites designed to restore forests to historic conditions increases resistance to tree mortality during drought.	Forest Ecosystems	Giant Sequoia & their Ecosystems	Fire Management	High	Not started
Test management strategies for increasing forest resilience by reducing tree densities below historic levels using prescribed fire.	Forest Ecosystems	Giant Sequoia & their Ecosystems	Fire Management	High	Not started
Continue USGS and I&M forest monitoring and remeasure Natural Resources Inventory plots to understand long term forest structure change and assess stressor exposure on forest health, demographics, and structure.	Forest Ecosystems		Core Information	High	Ongoing
Continue to support and apply findings from USGS forest demography monitoring and improve application of findings from the USFS Forest Health Program	Forest Ecosystems		Core Information	Medium	Ongoing
Map forest vulnerability to moisture stress to help prioritize fire and fuels management and other treatments (Leaf to Landscape project).	Forest Ecosystems	Landscape Integrity & Biodiversity	Fire Management	High	Initiated
Identify metrics to define "resilient forests and landscapes" and revise management prescriptions as needed.	Forest Ecosystems		Core Information	High	Not started

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Create a species-level map of an area of SEKI that was recently burned in the Castle fire and for which we have prefire fine-scale LiDAR and hyperspectral imagery from 2015, 2016 and 2017	Forest Ecosystems		Core Information	High	Initiated
Understand the new trajectories of post-fire forests, understand the spatial distribution of remaining trees, and decide when and where active reforestation may be needed and is likely to persist under a Resist, Accept, Direct (RAD) framework. Need for immediate inventory of key tree species in high and moderate severity burned areas to support these questions.	Forest Ecosystems	Landscape Integrity & Biodiversity	Resource Management Planning	High	Not started
Understand impacts of fire retardant gel to trees, understory vegetation, and other organisms and test for gel presence in soil and water.	Forest Ecosystems	Water Resources	Fire Management	High	Not started
How has climate-fueled, high-severity fire changed historical regeneration dynamics and adult tree mortality risk?	Forest Ecosystems		Fire Management	High	
Develop a strategy with partners for characterizing and communicating <93>good<94> fire versus <93>bad<94> fire, especially with respect to giant sequoias.	Visitor experience & public perception	Forest Ecosystems	Collaboration and information management	High	Not started
Document why fuel treatments are not taking place when we know such treatments can work for improving resilience.<a0> Identify the limitations/barriers (cost, staffing, compliance, etc) to help develop a systems approach to overcome these barriers.	Visitor experience & public perception	Crosscutting Activities	Fire Management	High	Not started
Survey stakeholder values about giant sequoia to inform goal-setting, monitoring indicators, and implementation decisions.	Visitor experience & public perception	Giant Sequoia & their Ecosystems	Collaboration and information management	High	Not started
Improve understanding of post-fire rockfall hazards and methods to evaluate and mitigate hazard.	Visitor experience & public perception		Visitor Use and Interpretation	High	Not started
Use visual imagery to gain public perceptions and expectations regarding management treatments now necessary to mitigate ecological and visual effects of large-scale high- severity fire.	Visitor experience & public perception		Fire Management	High	Not started
Revisit 1990s visual assessment of sequoia groves, comparing change while also considering change in visitation management and climate driven changes to sequoia grove resilience; all in the context of visitor perceptions and expectations.	Visitor experience & public perception	Giant Sequoia & their Ecosystems	Visitor Use and Interpretation	High	Not started

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Correlate trail use levels, seasonal visitation patterns, and social trailing with post-fire ecological impact.	Visitor experience & public perception		Visitor Use and Interpretation	High	Not started
Study whether and how aesthetic perceptions of forest resiliency can be used to promote climate change adaptation management actions on the ground<a0>	Visitor experience & public perception	Forest Ecosystems		Medium	
Routine monitoring of the effectiveness of social and other online media to convey wildfire information and the story of fire should be completed bi-annually. Routine monitoring of on-site visitor communication effectiveness should be monitored every 3-5 years	Visitor experience & public perception		Collaboration and information management	High	Not started
Survey all park employees on understanding of fire and effectiveness of communications	Visitor experience & public perception		Collaboration and information management	High	Not started
We have areas surveyed for cultural resources prior to KNP. Need to determine accuracy of surveys and if more sites are now visible.<a0> What is the impact on sites of different types?	Cultural Resources		Core Information	High	Not started
Reintroduce traditional ecological knowledge and cultural practices (such as Native American burning, thinning, and non-native plant removal), into ethnographic landscapes where appropriate.	Cultural Resources		Collaboration and information management	High	Not started
Identify high probability areas for presence of cultural resources. Overlay with vulnerability to erosion, fire, vandalism, etc. to inform management prioritization.	Cultural Resources		Resource Management Planning	High	Not started
Develop and implement a mixed conifer wildlife monitoring program for fishers, mid-level carnivores, and common herbivores as an indicator of ecosystem health.	Terrestrial Wildlife of Concern	Landscape Integrity & Biodiversity	Individual Species Management	Medium	Not started
Map and monitor wildlife movement corridors, including using remote cameras and volunteers, to enable the protection of these corridors.	Terrestrial Wildlife of Concern	Landscape Integrity & Biodiversity	Individual Species Management	High	Not started
Map habitat suitability for California spotted owl and Pacific fisher and apply results to avoid or mitigate impacts to these species.	Terrestrial Wildlife of Concern		Individual Species Management	High	Not started

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Complete a comprehensive inventory in and near the burned area to determine the effect of the fire on CA spotted owl numbers, habitat and barred owl invasions.	Terrestrial Wildlife of Concern		Core Information	High	Not started
It is critical to learn what areas of the burned landscape are being used by Fisher versus what areas are being avoided to inform fuel treatment and restoration priorities.	Terrestrial Wildlife of Concern	Landscape Integrity & Biodiversity	Fire Management	High	Not started
Monitor water temperature continuously (high-frequency time interval) in rivers and streams to understand synergistic effects of climate change and KNP-fire. Identify potential refugia.	Water Resources		Resource Management Planning	High	Partially ongoing
Develop an extreme hydrologic events assessment program to further inform park management and visitors of hydrologic conditions.	Water Resources		Visitor Use and Interpretation	Medium	Not started
Understand historic stream dynamics in the foothills as a baseline to assess whether changes that may occur are caused by climate change, fire, administrative actions, visitor use, etc.	Water Resources	Aquatic Ecosystems & Species	Core Information	Medium	Not started
Assess degree of impact of erosion and sedimentiation on water quality. Determine if level of concern with reqard to aquatic organisms or drinking water quality.	Water Resources	Aquatic Ecosystems & Species	Core Information	Medium	Not started
Develop long-term monitoring protocol for hydrology and soil indicators within and adjacent to sequoia groves.	Water Resources	Giant Sequoia & their Ecosystems	Core Information	High	Not started
Track post-fire hydrologic changes at small and large watershed scales as a tool to understand watershed level changes in vegetation, recovery trajectory, and associated impacts. Use to inform decisions on upland or riparian restoration.	Water Resources	Landscape Integrity & Biodiversity	Core Information	High	Partially ongoing

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All	All	All	All	All	All
How will fire effects impact algal growth? Consider riparain vegetation changes and effects on light, water temperature and flow, nutrient fluxes, and watershesd level canopy cover changes on snow melt.	Aquatic Ecosystems & Species	Water Resources	Visitor Use and Interpretation	High	Initiated
What extent of the riparian areas burned at high severity, what is the recovery trajectory, and what are the thresholds that would trigger riparian restoration?	Aquatic Ecosystems & Species	Water Resources	Restoration	High	Not started
What level of fuels treatments are needed to protect riparian zones and stream corridors from severe fire?	Aquatic Ecosystems & Species	Water Resources	Fire Management	High	Not started
Evaluate fire severity and riparian condition (shading, habitat features/large woody debris, water temp) and relate these effects to aquatic organisms by species of concern (e.g., turtles, newts, fish, inverts). Use to determine need and approaches for riparian restoration or individual species management.	Aquatic Ecosystems & Species		Individual Species Management	High	Initiated
Evaluate fire severity and effects along riparian corridors and tie into effects on terrestrial species that utlize riparian corriders (e.g. fisher).	Terrestrial Wildlife of Concern	Aquatic Ecosystems & Species	Individual Species Management	High	Not started
How have post-fire hydrologic and sediment regimes altered the geomorpholog and aquatic habitat in stream communities? Relate these effects to aquatic organisms by species of concern (e.g., turtles, newts, fish, benthic macroinvertabrates). Use to determine need and approaches for riparian restoration or individual species management.	Aquatic Ecosystems & Species	Water Resources	Individual Species Management	High	Not started

Question or Activity	RSS group	Secondary group	Management	Priority	Status
Identify key breeding habitats for low-elevation aquatic species persistence and relate these location to fire severity and effects assessments.	Aquatic Ecosystems & Species		Individual Species Management	Medium	Initiated
Develop and use new monitoring techniques (eDNA, acoustic monitoring, etc.) to improve detection of species or communities of conservation interest in aquatic habitats. Apply to post-fire aquatic assessments and monitoring of management actions.	Aquatic Ecosystems & Species		Individual Species Management	High	Initiated
Apply monitoring and research to develop climate change adaptation strategies, potentially including new types of intervention activities, for conservation of lower-elevation aquatic species and habitats in areas of concern affect by the KNP-fire.	Aquatic Ecosystems & Species		Individual Species Management	Medium	Not started
Study foothills hydrology to recommend monitoring indicators and improve understanding of climate-water-vegetation interactions.	Aquatic Ecosystems & Species	Foothill Terrestrial Ecosystems	Core Information	Medium	Not started
Water balance - climate modeling in giant sequoia groves: How much water will sequoias need to use in future years under increased temperature and ET rate scenarios?	Giant Sequoia & their Ecosystems	Water Resources	Individual Species Management	High	
Leaf to Landscape project - improve linkages between landscape and individual sequoia tree analysis to inform vulnerability maps.	Giant Sequoia & their Ecosystems		Individual Species Management	High	Initiated
Survey for weed infestations and monitor post-treatment	Landscape Integrity & Biodiversity		Restoration	High	Ongoing
Develop a post-fire restoration framework	Crosscutting Activities	Landscape Integrity & Biodiversity	Restoration	High	Initiated
Develop a framework for assessing vulnerability - a standardized format on how to determine what will be vulnerable from climate driven wildfire to inform prioritizing treatments and developing the capacity for treatments.	Crosscutting Activities	Landscape Integrity & Biodiversity	Fire Management	High	Not started
Establish landscape monitoring partnerships to understand species adapting to changing conditions versus those in danger of being lost from the ecoregion.	Crosscutting Activities	Landscape Integrity & Biodiversity	Collaboration and information management	High	Initiated
Develop a vision for what a managed wildfire regime would look like, and what steps need to be put in place to get there. Parks well poised to lead in this.	Crosscutting Activities		Fire Management	High	Not started

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Adopt a multi-benefit ecosystem-services framework to help balance competing and potentially conflicting objectives. Recognize how wildfire-protection actions carry over to also benefit other ecosystem services.	Crosscutting Activities		Collaboration and information management	High	Not started

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