Prospectus Sierra Nevada Recreation and Infrastructure Vulnerability Assessment and Adaptation Strategy Partnership [updated 8/24/2018]

Purpose and Need

In partnership with the Washington Office (WO) Office of Sustainability and Climate and Pacific Southwest and Northwest Research Stations (PSW/PNW), the Region plans to proceed with a Recreation and Infrastructure Climate Change Vulnerability Assessment and Adaptation Strategy for the Sierra Nevada. This Assessment/Strategy is initially intended to be a resource for the agency and its partners; later, it may help inform Planning efforts.

The goal is to produce a vulnerability assessment with a geospatial component to complement existing products (such as that developed for the Region's Science Synthesis) and to build on previous vulnerability assessments/adaptation strategies developed in partnership with EcoAdapt that focused solely on species and habitats, not the built environment. In addition to asset-related impacts, we aim to assess the socio-economic dimension of changes in the climate regime. We also aim to establish criteria to help a location determine if it is vulnerable to climate change impacts.

While this is envisioned to be a Forest Service-focused exercise, key agency partners will be invited to participate and provide expert input throughout the process. In this way, we can ensure the final product reflects a range of priorities and includes datasets/tools managed by our partners.

Objectives

- **Synthesize the best available science to assess climate change vulnerability** and develop adaptation strategies for recreation and infrastructure resources on National Forests in the Sierra Nevada Mountain Range to understand and mitigate potentially adverse effects of climate change.
- **Develop a framework and tools for managers to incorporate the best available science plus existing/complementary assessments** into USFS recreation and engineering program assessments.
- **Define priority regional- and forest-level climate change vulnerabilities** so that such factors may be integrated in a cohesive and strategic manner throughout the land management planning process.
- **Produce a spatially explicit, peer-reviewed vulnerability assessment** (with specific adaptation strategies noted) written to support the needs of Forest Service resource managers.
- **Identify priority areas for cross-boundary partnerships and/or third-party investments** to best leverage agency appropriations and to maximize our opportunities for shared stewardship.

Approach

1. **Review existing R5 vulnerability assessments and resources to extract and organize pertinent outputs and information to priority program resources within the recreation and infrastructure programs.** Existing resources include:
    - EcoAdapt Climate Adaptation Project for the Sierra Nevada
        - http://www.ecoadapt.org/programs/adaptation-consultations/calcc
        - See also unpublished Recreation Chapter
    - Sierra Nevada Bioregional Assessment
        - https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5444839.pdf
    - Science synthesis to support socioecological resilience in the Sierra Nevada and southern Cascade Range.

- https://www.fs.fed.us/psw/publications/documents/psw_gtr247/
- Draft U.S. Forest Service Climate Change and Transportation Resiliency Guidebook (developed in partnership with the VOLPE Center)
  - See R5 Engineering, Leslie Boak, for latest draft
- California Climate Vulnerability Assessment of Macrogroup Vegetation
  - https://lccnetwork.org/sites/default/files/Resources/California%20Climate%20Vulnerability%20Assessment%20of%20Macrogroup%20Vegetation_01.31.2016_FINAL.pdf
- Climate Change Vulnerability and Adaptation in the Intermountain Region
  - http://www.adaptationpartners.org/iap/docs/Halofsky_etal_2018_inpressreader7.pdf

2. **Consult with R5 Recreation and Engineering Staff and key partners in the Sierra Nevada to:**
   - Present projected climate change effects and their connections to the recreation and infrastructure programs
   - Understand the key resources within their programs that will be affected by climate change
   - Elaborate the important questions that will need to be addressed to help them assess climate change vulnerability
   - Identify the most effective management and program processes for integrating climate change analyses into:
     - Forest plan assessments (Phase 1 of the Adaptive Planning Framework); and plan revision components (Phase 2 of the Adaptive Planning Framework)
     - Recreation Site Analysis process (new)
     - Capital Investment Program (CIP) process
     - Climate change and transportation resiliency analyses
     - Cost-benefit or risk analysis based on transportation asset life-cycle cost (values analysis)
   - Brainstorm the tools and applications that will best help them apply and plan for adaptation actions and analyses.
3. **Compose a vulnerability assessment, including adaptation strategies, for Recreation and Infrastructure Program resources in the Sierra Nevada that answers key questions for the appropriate management and program processes**
   - See proposed outline below
   - The assessment and adaptation strategies will be peer reviewed and published, ***providing the scientific foundation for operationalizing climate change*** in planning and project management.
4. **Develop vulnerability maps for Forest Service priority recreation and infrastructure resources**
   - To assist program managers to evaluate vulnerability, plan adaptation, and prioritize investments. Pending consultations in step 2, example maps include:

- 100-year flood event relative vulnerability maps by watershed for:[1]
  - Roads and culverts
  - Developed recreation sites
  - Trails
- Weather-based access vulnerability maps to inform
  - Road opening and closures
  - Developed recreation site management
  - Special use permit provisions
- Recreation activity setting vulnerability maps
  - Key activities cross referenced with geographic or elevation based climate change effects to prioritize adaptation strategy implementation
- Others or alternatives as outputs from field consultations

5. **Conduct a workshop(s)** with scientists, land managers, and other stakeholders to review the vulnerability assessment.
   - Downscale information from the assessment to identify the most significant vulnerabilities to climate change for priority resources in each management unit.
   - Identify adaptation strategies and tactics to reduce resource vulnerabilities. Adaptation strategies and tactics will be linked to corresponding management operation levels at different spatial and temporal scales.

Potential Partners

- **U.S. Forest Service –** Region 5 Regional Office, Pacific Southwest and Northwest Research Stations, Sequoia NF, Sierra NF, Stanislaus NF, Inyo NF, Eldorado NF, Tahoe NF, Lake Tahoe Management Unit, Plumas NF, Lassen NF, and Modoc NF.
- **National Park Service –** Yosemite NP, Sequoia NP
- **Bureau of Land Management**
- **California State Agencies –** Dept Parks & Recreation, Sierra Nevada Conservancy, Tahoe Conservancy, CalTrans, CA Natural Resources Agency
- **County Governments and Other Connected Municipalities**
- **Tribal Governments**
- **Industries –** Outdoor retailers, ski resorts/permit holders, river outfitters, etc
- **Bureau of Indian Affairs**
- **Non-Government and Non-Profits –** Recreation/ski associations, etc
- **Universities –** UC Davis, UC Berkeley, UC Merced, UN Reno

Possible Products

- **3-5 field consultations**
- **Vulnerability maps**
- **Climate change vulnerability General Technical Report**
- **Public webinar/workshop as close-out**

[1] Current 100-year flood models do not adjust well to large, landscape changes such as those brought about by massive fires or extensive bug kill/tree mortality. This is a known limitation to the data available for mapping.

Potential Resource Needs

- ***GIS support for maps***
- ***Core R5 Staff on monthly phone calls***
- ***Forest staff available for consultation meetings (1/2 day)***
- ***Forest climate change coordinators involvement***
- ***Core R5 Staff to review final products***

Timeline

- **April 2018:** Establish a science-management partnership; determine partners and team members, and resource areas to be covered by the vulnerability assessment
- **Spring/Summer 2018:** Review, organize and crosswalk existing resources
- **Summer/Fall 2018:** Field consultations
- **Fall/Winter 2018:** Vulnerability assessment and GIS product development
- **Early Spring 2019:** Adaptation strategies and tactics development, with potential (virtual) expert elicitation workshop to gather input from field-based subject matter experts.
- **Late Spring 2019:** Finalize the vulnerability assessment and adaptation strategy report, plus conduct internal and external peer-review of the interim product.
- **Summer 2019:** Final product presentation
- **Fall 2019:** Submit report to the Pacific Southwest Research Station to be published as a General Technical Report (GTR)

Sample General Technical Report Outline

Chapter 1 – Introduction & Context (Biogeographic, Demographic, Cultural, and Historical Setting)

Chapter 2 – Climate and Biophysical Effects of Climate Change

- Hydrologic dynamics – changes already in progress
- Snowpack and streamflow (winter peak flows, summer low flows)
- Temperature trends
- Seasonal trends

Chapter 3 – Climate Change and Infrastructure[2]

- Hydrology and infrastructure interactions
- Extreme events
  - Flooding, landslides, debris flows, fire, drought
  - Effects on infrastructure (roads, trails, bridges, campgrounds, facilities)
- Facilities – adaptation, loss of water systems due to changes in the water table, consideration of climate change vulnerabilities in decommissioning, considerations impacting property purchases/leases/lease renewals, structural mitigation options

[2] Refer to 36CFR 219.6 Assessment to review the 15 topics to be assessed. Infrastructure is Topic 11; Climate Change is Topic 2 – Systems Drivers.

Chapter 4 – Climate Change and Recreation[3]

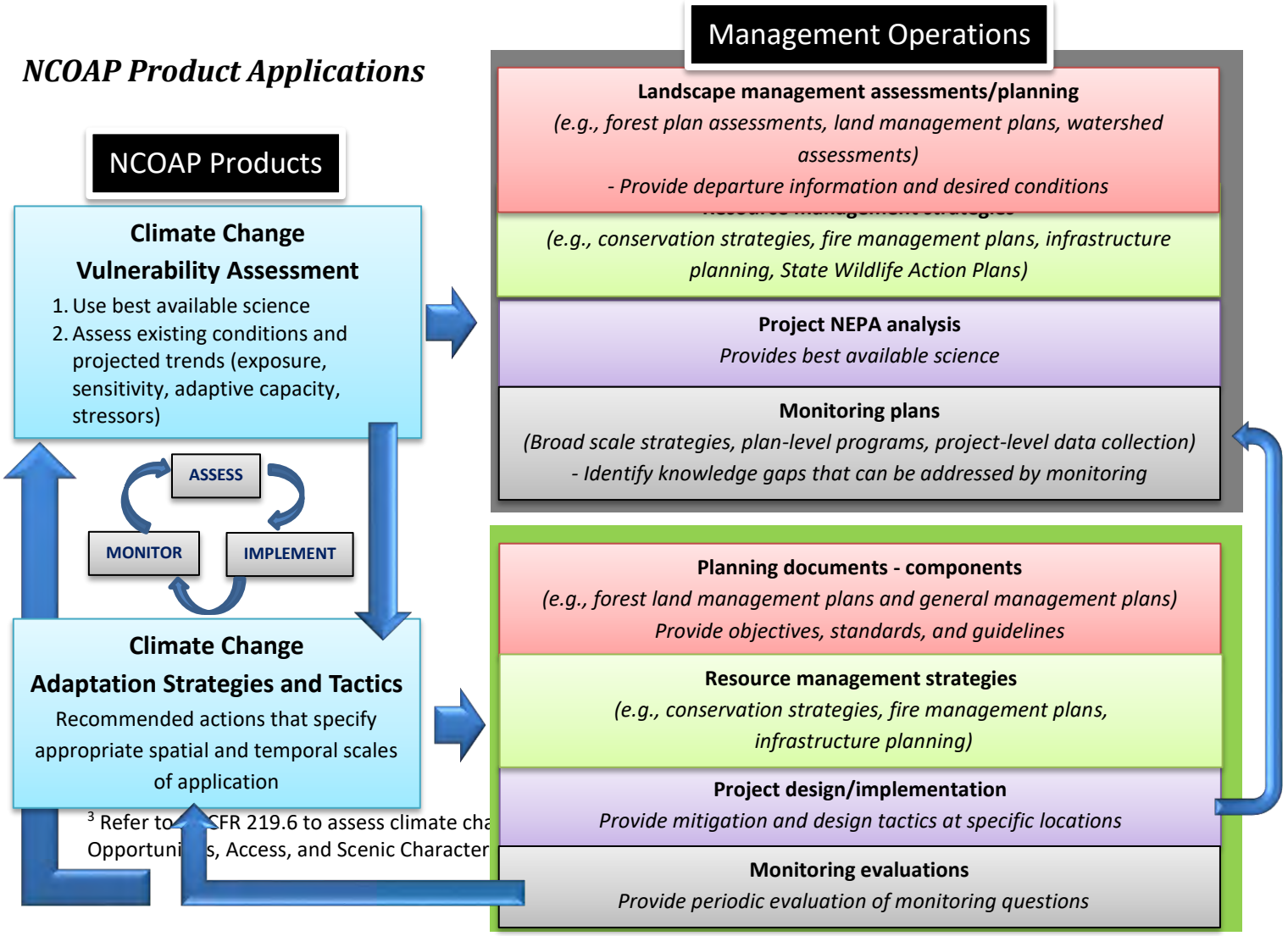
- Current recreational activities, values, and economic impact
- Effects of climate change on recreational activities (summer, winter, water, etc):
  - Access (Trails, Roads, etc)
  - Opportunity (developed sites, dispersed sites)
  - Setting (tree mortality, river access at sites, etc)
  - Scenic character (larger heterogeneous landscapes)
- Climate change effects on recreation based economics (local communities, guides, etc.)
- Connection to other resource areas

Chapter 5 – Adapting Recreation and Infrastructure Resource Management and Design Considerations to Climate Change

- Tie to R5 Public Services' Strategic Initiative involving recreation facilities.
- Inform Forests' Facilities Master Plan efforts

Chapter 6 – Conclusions and Management Applications

- Link to annual, regional program of work ("One Region, One Program of Work")



[3] Refer to CFR 219.6 to assess climate cha
Opportuni s, Access, and Scenic Character