Report CA LCC Ecosystem Process Project Input

Date	December 8, 2014
Host	Debra Schlafmann
Participants	36 persons have participated.

Contents

1 Background Information

1.1 Background Information (Presentation)

Presenter
Debra Schlafmann

Background Info
Survey on Ecosystem Processes to CA LCC Science-Management Team

The CA LCC Science-Management Framework calls for implementation of at least two interdisciplinary projects to assess and address climate change impacts to priority ecosystem processes at a landscape scale over the next five years. These projects will build collaborative partnerships, synthesize existing science, conduct research to address uncertainties, and provide decision support to managers.

Through the process of developing the Science-Management Framework and a series of interviews with scientists and managers, the CA LCC has identified effects on ecosystems, community assemblage, and species by changes in the following ecosystem processes as priority for future projects:

- Carbon cycle and sequestration
- Fire regimes
- Hydrologic regimes
- Meteorological changes (e.g. air temperature)
- Sea level rise and changing ocean conditions
- Sediment regimes
- Storm frequency and intensity

The following survey will assist the CA LCC in identifying a topic and rationale for the focus of an ecosystem process project in the next fiscal year. An example ecosystem process project with a focus on sea level rise can be found here: http://www.werc.usgs.gov/project.aspx?projectid=222.

Presentation

· This looks like a great list. (#2 | Diana Craig)
· I'd also add insect outbreak and altered disturbance regimes. (#3 | Carolyn Enquist)

2 CA LCC Ecosystem Process Project Input

2.1 Existing Ecosystem Process Projects (Discussion)

Number of participants: 11

Participant instructions:
What existing ecosystem process projects do you think the CA LCC should know about?
Named, non-anonymous discussion.

Hydrologic Regimes

- I suggest a project to study drought stress in Sierran forests and how it can be measured by spectral imagery. This will require linking physiological indicators with spectral indicators. The ultimate output is a tool that can be used to identify vulnerable areas and track forest stress through time. (#14 | Koren Nydick)
- Sorry, this is not an existing project. However, I've been working to develop such a project focused on giant sequoia groves. I think there is opportunity to combine field measurements with LiDAR and hyperspectral imagery to do this at a larger spatial scale. (#15 | Koren Nydick)
- Ongoing collaboration between US Fish and Wildlife Service (Refuges I&M) and UC Davis Watershed Center using CALVIN hydroeconomic model to predict future water availability for refuges in the Central Valley (#16 | Karen Laing)
- DWR has provided funding to the US Forest Service for a three-year investigation (partly extended into a fourth year) of the hydrologic effects of meadow restoration and how restored meadows can contribute to improved (water) system operation as well as ecosystem functioning. Final report will be available in Spring 2015. (#18 | Erin Chappell)
- I think a central investigation about California's hydrologies and climate change is the frequency/duration/peaks-lows of surface water flow in different basins in California. This would be done above and below water control faciities [dams]. This would get to the issue of changing water regimes across the State, similar to how we look a fire regimes. (#21 | CA LCC Ecosystem Process Project Input)
  - I wrote 21. With apologies. Kevin Shaffer (#24 | CA LCC Ecosystem Process Project Input)
- Jesse Dickenson et al. have been doing work on variability in groundwater regimes and implications for riparian areas funded by the SW CSC. (#28 | Carolyn Enquist)
- Here's a link to Jesse et al's recent work; new work forthcoming: https://www.soils.org/DISCOVER-SOILS/STORY/NEW-TOOL-EASES-TASK-SIMULATING-AQUIFER-REFILL (#29 | Carolyn Enquist)
- Work by Flint, Flint et al. funded by SW CSC (but you likely know about this as it was to help populate the CA commons) (#30 | Carolyn Enquist)
- A proposal titled "An Integrated Assessment of Drought Impacts on Migratory Waterbirds in Key Conservation Regions of the Western US" was just awarded funding by the National Climate Change and Wildlife Science Center (NCCWSC). Head PI is Bruce Dugger from Oregon State (others are from UC Davis, CVJV, IWJV, and USGS). It will look at changing water/wetland availability (using scenarios) and impacts on waterfowl in important Pacific Flyway wintering and staging areas (CV, Klamath Basin, Great Salt Lake). Informed by LCC-funded work of Fleskes et al using their modified WEAP hydrologic model (#34 | Greg Yarris)

Sediment Regimes

- Understanding sediment regimes is critical to support our ability to document current and model future sediment inputs and how these will promote marsh accretion in the face of sea level rise, and to know where to prioritize efforts to improve sedminent inputs through targeted management efforts ("biggest bang for the buck" and most urgent sites as to where to improve instream flows, flooodplain management, remove dams, etc.) to improve hydrological connections within watersheds. (#11 | Anne Morkill)

- sustainability and resilence to sediment supply, storage, and transport are key to several ecological and social processes and few places have even be slightly investigated [such as the Sacramento/San Joaquin Delta marshes]. Invesigating sediment cycling and transport will be key to infrastructure and commuity safety, aquatic productivity, agricultural productivity. (#22 | CA LCC Ecosystem Process Project Input)
- I wrote 22. With apologies. Kevin Shaffer (#25 | CA LCC Ecosystem Process Project Input)

Meteorological Changes (i.e. air Temperature)

- I think the CA state climate assessment looks into this extensively. http://resources.ca.gov/climate/fourth/ (#36 | Karen Thorne)

Fire Regimes

- High importance (#20 | Diana Craig)
- Fire regime in California is probably only second to hydrologic regime. The information we already have about the various regimes and changes occurring would be very useful to regional and local planning that would affect sediment regime [including desertification], storm effects, water conservation, sustainability of wildlife and habitat- Kevin Shaffer (#23 | CA LCC Ecosystem Process Project Input)
- Phil Mantgem et al. are looking at the question of prescribed fire and forest resilience, particularly in the context of forest mortality events; much of this work is being funded by the SW CSC (#26 | Carolyn Enquist)
- Work on adaptation strategies to wildfire by Mark Schwartz funded by the SW CSC (#31 | Carolyn Enquist)

Carbon Cycle and Carbon Sequestration

- There is little good information on carbon sequestration rates for coastal wetlands along the Pacific Coast. There may be opportunities for carbon registry credits, but more information is necessary on potential sequestration rates under a variety of conditions and restoration trajectories (#13 | Eric Stein)
- DWR and USGS have been working on several demonstartion projects for carbon sequestration potential of both wetland (fresh/brackish) restoration and rice farming. They are now expanding that program, with Delta Conservancy, to help inform the possible development of wetland protocol for ARB consideridation under AB 32. The work done to date (starting with the Twitchell Island project in 1997) is providing data on carbon cycle and sequestration potential (#17 | Erin Chappell)
- UC Riverside (Edith Allen and students) has done a fair amount of work on how N deposition iis nfluencing invasive plant spread. (Not C cycling, but related.) (#33 | Doug Johnson)

Storm Frequency and Intensity

- NOAA's Earth System Research Laboratory (ESRL) is installing four coastal Atmospheric River Observatories (AROs) along the central California coast as part of the Hydrometeorology Testbed (HMT) Legacy project. Along with that DWR, NOAA's ESRL, and the Scripps Institute for Oceanography (SIO) are partnering on a project that builds on research conducted under HMT. It will includes soil moisture sensors being placed at 43 sites across the state (using existing infrastructure at interagency Remote Automated Weather Station (RAWS) sites and CalFire facilities. (#19 | Erin Chappell)
- Gershounov and Cayan work funded by the SW CSC (#32 | Carolyn Enquist)
- Patrick Barnard, USGS, Sant Cruz - OCOF and southern CA project (#35 | Karen Thorne)

Sea-level Rise and Changing Ocean Conditions

- Sea level rise and its impacts on major estuarine ecosystems and associated human communities/infrastructure is an urgent issue. More detailed site information is necessary to inform both resource managers as well as local and regional planning efforts to prepare for and adapt to SLR and integrate natural "green" solutions into local responses. (#9 | Anne Morkill)

- ..."More detailed site information" as in specific on-site measurements and ground-truthing of remote sensing data and modeling outputs, coupled with long-term monitoring to detect changes. (#10 | Anne Morkill)

· Sea level rise will be the main driver in ecosystem functions and services over the next several decades. We must understand expected changes in coastal wetland typology and associated processes. Such changes will necessitate adjustment of expectations of what constitutes optimum function for many of these systems (#12 | Eric Stein)

· Glen MacDonald and John Takakawa have been doing work on SLR funded by the SW CSC; I'll forward their final report once received (near-term). (#27 | Carolyn Enquist)

2.2 Rating: Priority Ecosystem Process

2.2.1.T0 Priority Ecosystem Process (rank order) sorted by Mean

25 persons have contributed a rating.
The Host does not participate in the Rating activity.

Participant instructions of Rating 2.2.1
Rank the ecosystem processes listed from highest to lowest priority for an interdisciplinary project in FY 2015. Criteria to consider: 1. Immediate Need 2. Value-Added 3. High Impact 4. Relevance to Management

Priority Ecosystem Process (rank order) sorted by Mean Criterion: "Priority". Highest rank of 7 is given 7 points. Ratings submitted: 25. List of items randomized.				
Nr	**Item**	**Ø**	**SD**	
1	Hydrologic regimes	6.28	0.16	
2	Fire regimes	4.48	0.24	
3	Sea-level Rise and Changing Ocean Conditions	3.84	0.26	
4	Storm frequency and intensity	3.64	0.26	
5	Carbon cycle and sequestration	3.52	0.27	
6	Sediment regimes	3.40	0.27	
7	Meteorological changes (e.g. air temperature)	2.84	0.23	

2.3 Rationale for priority ranking (Brainstorm)

Number of participants: 16

Participant instructions:
State the reasons for your top two ecosystem processes from the ranking exercise
Why are these: 1. Immediate Needs 2. Value-Added 3. High Impact 4. Relevant to Management
Named, non-anonymous discussion.

Not categorized (18)

1. Numerous scientific studies have shown that changing fire regimes - due to the combination of legacy management impacts, expanding urbanization in some areas, and changing climates are the most important and immediate threat to many ecosystems, species, and ecosystem services. This is also an area where management decisions and outreach can have the biggest impact. (Sarah Sawyer)

· In adddition to fire regimes, changes in hydrologic regimes are having the second largest visible impact on our ecosystems. Particularly in California, where reliance on snowpack is heavy, and changes in snowpack are extreme, these effects can be seen statewide. Major issues include: increased vegetation die off, decreased vegetation recruitment, increased

flooding and changes in flood timing leading to sedimentation and infrastructure effects, impacts to fire and moisture regimes, etc. (#2 | Sarah Sawyer)
  - I agree with Sarah. (#7 | Koren Nydick)
- **3. In adddition to fire regimes, changes in hydrologic regimes are having a major and visible impact on our ecosystems. Particularly in California, where reliance on snowpack is heavy, and changes in snowpack are extreme, these effects can be seen statewide. Major issues include: increased vegetation die off, decreased vegetation recruitment, increased flooding and changes in flood timing leading to sedimentation and infrastructure effects, impacts to fire and moisture regimes, etc. (Sarah Sawyer)**
  - I agree. (#8 | Koren Nydick)
- **4. Re: Sea Leve Rise and Sediment - Consensus among resource managers (for example, per soon-to-be-released Baylands Ecosystem Habitat Goals Update) is that planning and adapting to sea level rise in the San Francisco Bay-Delta is an urgent need now. Need relevant information to inform marsh restoration and floodplain management to prepare. There are lots of general SLR modeling tools for the region as a whole, but more detailed on-site work is needed to facilitate planning and implementation of climate-smart adaptation strategies. Conservation community and natural resource agencies needs to stay ahead of the game in order to successfully promote/integrate natural "green" tools into regional planning frameworks and projects to avoid/minimize hard engineered tools like sea walls, flood gates, tall levees, etc. (Anne Morkill)**
- **5. Aquatic and riparian systems are very important contributors of biodiveristy in California landscapes, and are highly threatened by hydrological modifications and changing precipitation regimes. Management actions that can maintain and enhance hydrologic functions in light of these threats are immediate and high impact needs relevant to many land managers. (Michael White)**
- **6. Recent research is demonstrating the importance of microclimate refugia to the potential long-term changes in species distributions due to climate change. Management actions that address anticipated meteorological changes are potentially high impact and very relevant to land managers. (Michael White)**
  - I agree that understanding where climate refugia might occur is important. This could be done for a specific species or ecosystem type and combine modeling with GIS and field data and paleo. (#9 | Koren Nydick)
- **10. Fire and Carbon sequestration: (dan cox)**
  - Fire appears to be an immediate and significant impact on many habitats. More fire studies may help manage for this threat. Carbon Sequestration: with AB 32 and subsequently the emergence of major funding for carbon sequestration from the cap and trade program, more studies on how to sequester carbon would be hugely helpful and impactful right now. Steering these funds in a way that helps sequester carbon in places that need habitat conservation would be a huge benefit to wildlife conservation in the state. (#11 | dan cox)
- **12. Changes in hydrologic regimes due to climate change and human activities are already having a major impact on fish, wildlife and ecosystems in California. In addition to issues listed by Sarah Sawyer here, there is political pressure to move water to particular users, and to increase use of groundwater from an aquifer already in deficit condition. Understanding the hydrological system and being able to model alternate scenarios and management regimes will be very useful to managers and political leaders making decisions about this complex system. (Karen Laing)**
- **13. Sea level rise (and sedimentation) measurement, modeling, vulnerability assessment and adaptation need to occur soon to be most effective. Managers must determine whether and where it is cost-effective to continue coastal restoration versus procurement of future marshes or other actions. In addition, sea level rise affects freshwater hydrologic regimes as**

salinization moves inland, and must be accounted for by managers of these systems. (Karen Laing)

- **14. As stated by Karen and Sarah, changes in hydrologic regimes are already having a major impact on ecosystems in California. Our ability to protect, ehance, and restore those ecosystems relys heavily on the hydrologic conditions. A better understanding of its role in supporting the other ecosystem processes at the watershed level will be key for managers moving forward. (Erin Chappell)**
- **15. Like water, sediment (soil) regimes are fundamental to how our ecosystems function. However, how climate change will impact sediment regimes is not well understood. It is definitely an area that needs attention and will be very relevant to land managers. (Erin Chappell)**
  - I agree. And this issue seems less well-studied relative to others in the list. Sogood value-added. (#22 | Christine Albano)
- **16. Sediment regimes (fluvial, coastal) and hydrological regimes are both already having a large impact on both ecosystems and on human communities, due to a legacy of poor or unrealistic planning and management. Many of the problems have to do with infrastructure or poor siting of development. Decisions about infrastructure that are being made now will have hard-to-reverse consequences for 50 - 80 years into the future. Thus, there is both an immediate need as well as a high impact for a long time into the future if useful tools were to be developed sooner rather than later. This is also true of fire regimes, but these have appear to have had more work done than hydrologic regimes, which have had more work than sediment regimes. Sediment regimes have particular potential value-added because they could be viewed not just as a problem, but as a tool for restoration, particularly of floodplains threatened by changes in hydrology and storm systems, and coastal areas threatened by sea-level rise. There is high impact for both hydrology and sediment regimes due to the rarity of fluvial and coastal habitats, the centrality of runoff (and thus sediment issues) in the state's economy and water budget, and the extreme dynamism of these systems. Management relevance comes from the widespread perception that traditional ways of dealing with fluvial and coastal issues is not working, but the way forward is not necessarily very clear. (David Boughton)**
- **17. Water and fire patterns in California effect each other, all human communities, all terrestrial and freshwater habittat and wildlife, and both immediate [proximate] and long-term [ultiamte] effects on human and wildlife communities. Humans also have an active role and influence on water and fire cycles in California and can affect what happens in the future. Water and fire cycles also have huge effects on sediment, carbon cycling, storm potential impacts/resilence. Kevin Shaffer (CA LCC Ecosystem Process Project Input)**
- **18. Riparian systems support significant biodiversity but are vulnerable to hydrological modifications due to changing climate, water demand and highly variable precipitation. Managers need land use and conservation planning tools to sustain and enhance water supply in these systems to improve resiliency (Kristin Byrd) (Kristin Byrd)**
- **19. Managing carbon sequestration in wildland, oceanic, agricultural, and built settings is the major mitigation action for climate change. (Fire regime management is an aspect of carbon sequestration. Also, substitution of renewable energy for carbon-fuel energy.) Managing hydrologic regimes more efficiently is the critical adaptation strategy to secure resiliency and continued productivity in ecosystems as climate changes. (Jim Weigand)**
- **20. Changing fire regimes are an urgent issue in the coastal sage scrub region of southwest California, where they affect ecosystem processes including type conversion. Need a region-wide project to addrees potentia futures and needed management actions that involves researchers, managers, stakeholders and decision makers. (John Hopkins)**
- **21. Changing hydrologic regimes will have a major impact on riverine, riparian and floodplain ecosystem processes, affecting communities that have been reduced to a very small fraction of their historic extent. (John Hopkins)**

- **23. Hydrologic regimes have primary impact on vegetation communities. There's an immediate need to understand how changes will impact habitat as well as water supply. Carbon storage needs to be a central aspect of management actions, and we need a lot more information quickly to know how to best take C into account in a variety of conservation situations. (Doug Johnson)**
- **24. Re: sediment - There is a general understanding of sediement regimes in coastal areas but usually management decisions are made with large assumptions about habitat persistance and restoration. A better understanding about sediment availability (too little or too much) for accretion for marshes, mudflats, beaches, dunes and other intertidal habitats is needed. This was identified as a key science need at all of my coastal workshops. Hydrology - with changing precip, snow pack levels etc. ecosystems will continue to be impacted in CA. This topic is immediate and timely for many resource managers. (Karen Thorne)**

2.4 Information Gaps (Discussion)

Number of participants: 3

Participant instructions:
Do you have any other comments about the ecosystem processes below?
Named, non-anonymous discussion.

- **Carbon Cycle and Sequestration**
  - We need better understanding of C cycling in a range of CA habitats, and how invasive plants impact sequestration through biomass and soil storage. (#12 | Doug Johnson)
  - I think the USFWS has started a carbon program? (#13 | Karen Thorne)
- **Fire Regimes**
  - Like with hydrologic regimes, it's important to understand how fire will impacts veg communities, including invasive plant impacts, and how invasive plants impact fire regimes. (#11 | Doug Johnson)
- **Hydrologic Regimes**
  - It's important to know how changing hydrologic regimes will impact vegetation communities, including invasive plant impacts. It's also important to understand more about how invasive plants impact hydrologic regimes. (#10 | Doug Johnson)
- **Meteorological Changes (e.g. air temperature)**
- **Sediment Regimes**
- **Storm Frequency and Intensity**
- **Sea-level Rise and Changing Ocean Conditions**