

Watersheds

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- **FRAMING:** Adopt a Watershed construct that includes human interactions on landscape. Not just engineering operations.
 - *Could put a social component under each topic, or could break out social component separately.
- *Synthesis of mgmnt question associated with needs.
 - With info on progress. Need goal for each topic. Basic research. Applied research. Implementation.
- *NEED: map of subregions of list of important parameters
 - * For the whole list – have each region map these priorities for research.
 - Drag and drop map vs. table. Crowd sourcing.
- **NEW GROUP 5: SOCIETAL**
 - Adaptation for policy and regulation
 - Adaptation for Land Management
 - Adapataion for Water Demand/Management
 - Outreach, Interpretation, Translation
 - Adaptation/quantification of water for environments.
- *NEED to consider multiple dimensions (incl. socio-economic as well as ecological) –
 - **drought adaptation and resilience.**
 - Drought is defined by where you are – not simply a hydrologic parameters. Includes socioeconomic.

- ***SECTION 4: * Snow missing from list** - *snow albedo, different processes, e.g., dust, vegetation changes, sublimation, fire
- * NEED: Underdeveloped outreach to ecosystem community.
 - LTDOC has High level of detail in physical processes but lump ecosystems
- NEED: * Guidance to modelers on biological ecosystem effects, not just physical.
 - * understand where ecosystems cross a transition threshold. Focus on resilience theory to structure discussion on ecosystems.
- **4.01 Guidance on Models to support planning**
- *Priority: Move from Low to Medium*
- * OPPORTUNITIES: Sharing/transferring our products. We are making progress on planning. But we are not transparent on our progress. But not socializing those strategies for other communities.
- NEEDS: To make info actionable, regardless of uncertainty, must march people thru a decision framework.
 - Notion of rolling risk assessment but regulated community concern about flexibility to cope
 - Are our policies flexible and adaptable enough to deal with a changing climate?
- **NEED: Guidance: which hydrology model to use - was rated low in 2011 but a lot of work went into it. Enough work as been done to see how sensitive the models are.
- * OPPORTUNITY: discuss which models are sensitive to what metrics and what we can trust. E.g. VIC good with flood but not summer flows
 - Guidance on how to interpret results against uncertainty. describe fit-for-use of techniques. Synthesis of different models.
 - ID attributes we care about

- **4.02 PET: NEED: Change Potential ET: * Change to ACTUAL ET. Priority: High**
 - *Progress on ET: Minimal. CSC and LUC remote sensing programs in corps working with others agencies on ET.
- ****NEED: Potential and actual Evaporation and Transpiration**
 - IPCC5 – area of global need.
- **** Need: energy balance – radiation, wind speed, humidity, p and t. Need to ensure internally consistent between the climate the climate model and the hydrologic model -**
 - e.g. * Reevaluate use of penman montief – start from scratch
 - What equations do we need to get the energy balance right?
- **** Needs: Biologically based ET should be incorporated into watershed model to improve calculation of water balance at the surface.**
- **** Need: simple ways to tell people if the model over or underestimates the risk**

- **4.03 Extreme Events**
- *** Separate High flow from Low flow (drought)**
- *** Need: How to define indicators of hydrologic drought**
 - Reservoir level driven by stream flow and demand.
- ***Need: Streamflow and GW interaction; how snowpack translates to streamflow – High**
 - It is not just about soil moisture

- **4.04 Weather Data**

- **** OPPORTUNITY:** Atlas 14: ***NEED:** integrate climate projections into IDF calculations
- ***Need:** get data not easily getable. Facilitate data sharing between cities, states, feds. Citizen science.

- **4.05 GROUNDWATER/SURFACE WATER INTERACTION**

- **NEED: 4.05: HIGH. Groundwater Recharge:** Drought mitigation process using GW. how well do we understand recharge of deep aquifers? How old is the discharge water? Pumping and cc interaction: reduced recharge.
 - ***management guidance for drought**
- *** Temperature:** Need data to prove hypothesis: warmer soils = warmer groundwater recharge = warmer discharge warms surface water = WQ issues.
 - ***management need: utility specific:** if system is classified as gw then.....Many cities have public utilities with wells on the bank. When temp goes up in wells, water source becomes warmer and is a water treatment issue (water quality)

FISHERIES & FISH ECOLOGY

- **REFRAME 4.06, 4.07, 4.08:**
 - Riparian Ecosystems
 - Fisheries, benthic, non-native riparian, other species and habitats
 - Groundwater dependent ecosystems (GDE)
 - Upland Ecosystems
- Progress: some not enough.
- Priority: Should be Medium or High (not Low)

- *Need: Integrating quantitative fish models in community oriented system models. Need to build those niche models.
- NEED: coupled physical niche modeling
 - *Needs: baseline assessment of watershed needs
- * Need: ID Threshold-like behaviors and standards (tipping points). Coupling of impact with biological needs. Recognize resilience mechanisms of populations.
- NEEDS: what are the most important physical response connected to the biology?
 - *Concept of biological response is hidden in natural system response. Too much focus on hydrological modeling (bias of people here makes it a low priority but it should be HIGH)
- OPPTY: think of future climate when establishing riparian species. Floodplain species dependent on GW vs upland conifers – develop science to anticipate species shift vs. where less of a concern.

- **4.12 Sediment – progress is sparse mostly related to fire.**
- NEED: climate change and sediment still needs work.
- **4.09.4.11 CO2 – didn't discuss**
- **4.13 River and Reservoir Ice – didn't discuss**