

Interactive comment on “Assessing water resources adaptive capacity to climate change impacts in the Pacific Northwest Region of North America” by A. F. Hamlet

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This is an important paper and a timely one as various institutions in the PNW and the US struggle to understand what climate change adaptation means to their own systems and business operations. This author brings together an intimate familiarity with the potential hydrologic impacts of climate change in the PNW and an understanding of the major institutions that make up the larger Columbia basin water management system. The paper identifies the significant and persistent obstacles to climate change adaptation that confront water managers in the PNW at both the process level and the

C1676

institutional level. As a result of these obstacles, many water managers are effective caretakers of the systems they manage, but they may not be prepared to be innovators who can respond quickly to changing needs associated with climate change.

Among the generalized conclusions are that the adaptive capacity of large, institutionally complex systems is inherently low in comparison with smaller, less institutionally complex systems, and that sub-basin planning may be a more workable approach than an integrated Columbia Basin adaptation approach. The paper could offer even more if it explored two issues more deeply in order to frame additional analysis and research: the underlying reason(s) for the failure of the current complex management system to generate change in response to ecosystem impacts on the Columbia Basin as it relates to the large, complex institutional barriers; and the larger geographical and longer-term value of sub-basin planning.

A survey of temperature and precipitation climate change scenarios in the PNW leads to the conclusion that we should expect more potential "surprises" in the effects on precipitation than temperature. The paper then identifies numerous primary obstacles to adaptive capacity such as assumptions of stationarity, use of historic records for planning, short time scale for planning, and rigid operating rules for water resources. In addition, there is an exploration of additional institutional barriers, such as loss of technical capacity after the dam-building era, jurisdictional fragmentation, and bureaucratic resistance to change. This is a good list and individual obstacles are put in context throughout the paper.

From an institutional level, it must appear that specific water issues will have varying degrees of centralized planning and coordination, and policy objectives and priorities. Thus, flood control, hydropower production, drought, and water allocation inspire different levels of effective response capability. Where the centralized response to floods is quite responsive, fragmented treatment of drought impacts is less so. Somewhat ironically, the author argues that, in general, however, there is growing evidence of smaller system autonomous adaptation capacity in the PNW, while the prospects for adaptation

C1677

in large, complex systems is less bright. Where climate change results in modest changes in variability and presumably where there is less complexity in a smaller system, the evidence of autonomous adaptation capacity is an outgrowth of the application of existing mature water planning techniques to current drought impacts and conservation objectives. How this will play out in a future that holds "more potential 'surprises'" related to precipitation is not yet clear.

The author sees a more difficult time ahead for larger, institutionally complex systems. The paper identifies the numerous stakeholder values inherent in the Columbia River water management system, including hydropower production, flood control, irrigation, navigation, recreation, cultural aspects, ecosystem issues (endangered salmon). In describing the complexities of the existing Columbia Basin system, the author's discussion of the system's failed attempts to make progress on the endangered salmon issue is not satisfying. The author correctly says that this issue may be beyond this paper, but there are lessons to be learned here and further explored within the rubric of adaptive capacity to climate change. A further discussion of the attributes that make this particular issue so intractable will shed light on the reason large, complex systems are at risk of not keeping up with necessary adaptive capacity. There is room here for a short exploration of sub-elements of the endangered salmon issue: that it may suffer from a lack of a clear, universally-accepted priority objective (like, arguably, emergency flood control measures), that stakeholders are arguably largely set in entrenched positions, that much of the discourse is combative rather than cooperative, and the range of stakeholders and geography is quite extensive; there are attributes here that explain much of a complex system's inertia and potential lower adaptive capacity compared to smaller, less complex systems.

Last, the conclusion that, given the lower adaptive capacity of larger and more complex systems, sub-basin and local-scale adaptation is a workable alternative, should be further explored. What is it about sub-basin planning that allows it to be more effective at breaking the gridlock? Is it realistic to think that regional adaptation can be accom-

C1678

plished at the sub-basin and local levels? Are there not regional scale issues that must be tackled at the regional level, or at least with the participation of region-wide institutions? Perhaps this argues for a short description of the various roles and kinds of issues to be tackled by sub-basin and regional levels.

Thoughtful and well-written paper on a very important and timely issue. This study offers genuine insight and is an important contribution.

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C1679