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**Analysis of worldviews and construction of scenarios based on presentations at the Water Quality Workshop, Sacramento, CA September 2012**

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**Worldviews**

During a three-day workshop that focused on mechanisms to improve water quality in Upper Klamath Lake, a range of authentic worldviews was evident in the discussion. Briefly, worldviews are self-consistent and self-reinforcing descriptions of how the world works. Each worldview tends to use cognitive tools (such as analysis approaches and particular theoretical constructs) that they are comfortable with and which provide internally consistent answers.

The value of recognizing these worldviews is that it helps identify the underlying assumptions that the proponents are relying on. These assumptions might be generally accepted in their community or discipline and not explicitly stated. By identifying those assumptions and cognitive frameworks, we can then compare the strengths, limitations and liabilities of each approach. An over simplified example is: if you and all your contacts think assume that the Earth is flat, then even considering sailing to the edge of it would be unimaginable and you would never discover global (i.e. spherical) trading routes.

There are four worldviews that have been identified from work on culture theory and applied to many problems of decision and risk. There are variations on these general categories. Below are two different formulations of essentially the same for three worldviews: Individualist=Cornucopian, Hierarchist=Industrial Ecologist, Egalitarian = Committed Ecologist. Fatalists and Deep Ecologists from these two approaches are not equivalent.

Table 1. Worldviews as described by van Asselt and Rotmans 1996.

|  |  |  |
| --- | --- | --- |
| Worldview | Key points | MEA Scenario |
| Individualist | Free market mechanisms are bestContinual economic growthTechnical innovation will solve most problems | Techno-Garden |
| Hierachist | Well crafted regulations are bestRules will level the playing field for all | Global Orchestration |
| Egalitarian | Cooperation Promoting a diverse set of approaches | Adapting Mosaic |
| Fatalist | Prepare for the worst caseProtect governmental sovereignty  | Order from Strength |

Table 2. Worldviews as described by Cunningham and Saigo 2001.

|  |  |
| --- | --- |
| EnvironmentalWorldview | Basic Assumptions |
| Cornucopian | Technology will always provide an answerGrowth will solve the problemLet private capital seek high returnStrong individual property rights |
| Industrial Ecologist | Efficiency is keyIf humans made the problem they can correct itUse cost/benefit ratio |
| Committed Ecologist | Conservation and limited consumption are keyUse the precautionary principle |
| Deep Ecologist | Severely limit consumptionEconomic tools don’t capture the valuesStrong rights to non-human entities (species or land) |

**Statements during the expert panel discussion**

A range or worldviews were expressed in the discussion and in the expert panel. Here are a few examples for illustration purposes (not to critique the speaker).

Pat Higgins represented the views of the Resighini Rancheria. His statements were very close to “Deep Ecologist” world view, i.e. that restoring the system to a natural state more like pre-European influence levels would lead to a system that was self-regulating and health.

John Day presented ideas for restoring ecosystem functioning and “ecological engineering” that are similar to the “Committed Ecologist” worldview. In particular the idea that low energy scenarios should be considered and avoid those strategies that will require a high allocation of energy. This is the precautionary principle and is characteristic of this worldview.

Stuart Rounds’ remarks were close to the “Industrial Ecologist” view, especially when he suggested that we identify the cause and work to eliminate the effect. Assuming that there is an identifiable cause and that industrial scale efforts are the most efficient approach is a characteristic of the Industrial Ecologist worldview.

David Ferguson was the closest to stating a “Cornucopian” worldview. He said that the ranchers have faced problems and always been able to solve them. He stated that respecting individual property rights is crucial to get any project to be successful.

**Scenarios and comparison**

The point of this exercise is to create general scenarios that are based on the assumptions for each worldview and then test that against the other worldview’s assumed future conditions. If the scenario behaves poorly or crashes under other future condition sets, this is called a “dystopia”.

All scenarios are stated in an internally consistent way and I have tried to state each case as a proponent would argue for it as their choice for the “best” solution.

***Scenario 1: “Economic Renaissance”***

* Major features
	+ The upper basin will increase economic vitality because of a well-managed lake that provides clean water, recreation/tourism, and jobs.
	+ Modern, innovative technology will be used to clean up the lake and simultaneously produce power from biomass and a commercially viable fertilizer source.
	+ Private property owners will see increased land values because of water availability for irrigation.
	+ Farm production will increase due to stable and non-intrusive regulations that allow local innovation and entrepreneurship to flourish.
	+ State, national and global markets will reward the efficiency and quality of exported produce, meat, and other agricultural commodities.
* Set of key assumptions for future economy and ecology of the region
	+ Based on “Individualist” or “Cornucopian” worldviews.
	+ Global climate change will not have a detrimental effect on agriculture, infrastructure or economy. The economy will be able adapt to any climate shifts or oscillations.
	+ Private enterprise will provide the most cost-effective and efficient solution to the water distribution issues and will lead to a highly competitive local economy (if let to run on these principles).
	+ Population growth and demographic shifts will enrich the available human capital, especially if that population is mobile and can change to meet the increasing demand for certain types of labor.
	+ Strong private enterprise will enrich the tax base and assets of the basin.
* Impact on the lake, specifically
	+ Big technological fixes are probably warranted and useful.
	+ Current technology and expected innovation will be able to fill any technical gaps in implementation.
	+ Improving the lake will provide an increased utility that will benefit the region and a well-managed lake restoration plan can optimize that benefit if it is not too severely constrained by regulations.
	+ Increased recreation and involvement with the lake directly will be one part of the economic recovery.

***Scenario 2: “Expert Lake Management”***

* Major features
	+ The Upper Klamath Lake Basin will be managed to reduce P input to the lake and the lake itself will be intensively manipulated to remove P. The result will be a productive (i.e. still green) but healthier ecosystem.
	+ Strict regulations will be created to control related processes in the basin and lake. These will create a level playing field for all participants from farmer to rancher to down-stream fishermen.
	+ Targeted engineered solutions will be employed to sequester or remove P and these have no unintended consequences or side effects.
	+ A vibrant and healthy Upper Klamath & Agency Lake system will provide local economic benefits through fisheries, natural resource based tourism and a new area of water recreation tourism. Fishing boats, jet skis, windsurfers, and water ski boats will all be towed into the region with tons of people.
	+ The stabilized lake will provide adequate water for strong agriculture however, the more water-efficient agricultural practices may have to be implemented though incentive programs.
* Set of key assumptions for future economy and ecology of the region
	+ This scenario is based on a “Industrial Ecologist” or “Hierarchist” world views that would employ environmental engineering approaches along with strict regulations. Regulations are a regarded as sophisticated form of social technology not a government intrusion.
	+ We have the knowledge to manage this large ecosystem. It’s essentially a scale-up of previously successful techniques.
	+ If humans caused the problem (through land use or water use) then humans can engineer a solution. Modern technology is much more advanced and powerful that the problems that caused the problem in the first place.
	+ Conservation and creation of a wide range of wetland types will actually increase habitat for birds and fish while cleaning the water.
* Impact on the lake, specifically
	+ The lake-level approach will include a portfolio of large engineering “hard” projects with pumps, concrete and energy use along side restoration of wetlands and land management practices.
	+ Large structures could be built to filter AFA out of the lake. Alum or dredging might be used in targeted areas.
	+ Constructed treatment wetlands will be a favored approach because we can manage the hydraulic residence time and species composition for optimal nutrient removal.
	+ The value of the lake for all forms of recreation is increased.

***Scenario 3: “Collaborative Mosaic”***

* Major features
	+ A wide range of small to medium scale manipulations and restoration efforts will transform the landscape and lead to a weakly linked mosaic of wetlands and riparian zones.
	+ Wetlands will include restored or rehabilitated larger tracts in the Upper Klamath and Agency Lake area, construction of treatment wetlands, and establishment of small wetlands on ranches and farms throughout the basin.
	+ Stream, river and riparian zones will be revitalized.
	+ A local and expert workforce will be established to continue this work over a long term. These jobs will be designed to be desirable (and not denigrated by assigning these jobs to convicts, for example).
	+ Natural areas will be enhanced by the wide variety of landscapes that have high agricultural utility, such as in-field marsh.
	+ Most of the smaller scale features will be created due to incentives that are offered for pollution reduction or water conservation (rather than broad and top-down enforcement of regulations).
	+ A basin-wide collaborative community of landowners and land managers (from agencies) will emerge that has common goals.
* Set of key assumptions for future economy and ecology of the region
	+ This scenario is based on the “Committed Environmentalist” and “Egalitarian” worldviews.
	+ Funding for incentives will come from government directly and nutrient reduction programs.
	+ Trusts for particular land management practices (riparian zones or wetlands) can be partially funded from property tax relief.
	+ Small to medium projects can be monitored in a cost effective manner because the participants are willing participants and have little incentive to cheat, i.e. reports from the land owners themselves can be trusted.
	+ “Natural” marshes and near-natural marshes will be resilient to climate change because they can continually adapt to shifting weather and hydro-year patterns.
* Impact on the lake, specifically
	+ The creation of more intra-lake and peri-lake marshes will change the water quality and water storage characteristics for the better.
	+ Multiple uses of the lake for fishing, hunting, eco-tourism and water recreation should have broad economic and social benefits.

***Scenario 4: “Return to nature”***

* Major features
	+ Wetland restoration and rehabilitation would be combined with severely reduced human license to degrade natural systems to return as much of the basin to a previous, healthier condition.
	+ Habitat for birds and fishes would be a main priority.
	+ Native American rights for water and fish or plant harvest would be respected.
	+ Urban areas (population and industrial) would be isolated from the lake as much as possible.
* Set of key assumptions for future economy and ecology of the region
	+ This scenario is based on the “Deep Ecologist” world view.
	+ The aesthetic and spiritual aspects of the lake ecosystem and the rights of animals and plants to survive in these systems cannot be part of a cost-benefit analysis. The rights of nature must be established as a first set of conditions before economic tradeoffs are made.
	+ Natural systems, with less human influence, are inherently better at a wide range of ecosystem functions than man-made structures and processes.
* Impact on the lake, specifically
	+ There would be more natural intra- and peri-lake wetlands.
	+ Barriers would be established to separate human activities from natural areas and processes to restrict human impact.
	+ Lower impact activities (such as canoeing, bird watching, and cultural appreciation) would be encouraged for tourism.

***Scenario 5: “You’re all crazy, this will never work!”***

* Major features
	+ The Upper Klamath Basin is enormous and has several physical and biological factors that doom any attempt to clean up the lake, such as high natural phosphorus loading and required economic activity of farming and ranching.
	+ The technologies suggested have never been successful at this scale and even at smaller scales, analysis suggests that some of the positive results at lake restoration were highly questionable.
	+ It may be better to concentrate our economic activity (farming and ranching) in this basin and manage the consequences rather than displace it across other landscapes.
	+ The current condition of the lake is a known condition and accepted deficit to the region’s total value.
* Set of key assumptions for future economy and ecology of the region
	+ This scenario is based on a “technology skeptic” and “fatalist” worldviews.
	+ Large human projects have both expected side-effects and unintended consequences that can be very damaging. Because of these, most projects end up with damages to the ecosystem and economy that are much higher than predicted.
	+ All projects cost more than engineers estimate.
	+ We don’t believe in the approach taken by environmentalists with their ecological “precautionary principle” and always wanting more studies, but we feel the risk of unintended consequences of large-scale manipulation to local landowners is unacceptable. How would we benefit from a cleaner lake? There’s nothing in it for us.
	+ A large bloom of non-toxic AFA maybe better than a small bloom of toxic Microcystis that could replace AFA under clearer water conditions.
	+ Any manipulation of the lake that results in increased clarity would set off a massive bloom of invasive macrophytes.
* Impact on the lake, specifically
	+ The lake would continue to be managed with low-budget mechanisms.
	+ Algae, phosphorus and other pollutants would be constant at today’s levels.
	+ New wetlands might be constructed for fish or bird habitat, based on the mission of the agencies holding that land, but none would be constructed with the goal of significantly improving the water quality.

**Cross-Analysis of the five scenarios**

Each scenario has specific assumptions about the future and is tuned to those assumptions. For example, if we accept the assumptions about the future from the “Economic Renaissance” scenario then it is not surprising that scenario does well. But to examine the uncertainty in the future, we can ask ourselves “how well does the “Economic Renaissance” scenario do if the future turns out to be more like one of the other scenario’s assumption set?” By comparing all scenarios against all assumption sets, we can determine if any scenarios do well or are particularly sensitive to particular assumptions.

A typical way to present this is to show whether a particular scenario does well, no effect, or poorly under a range of assumptions. This approach doesn’t require any pre-weighting of the effects or calculation of probability of those aspects of the future coming to pass. The approach here is to list a set of important values and conditions that could change over the next 20 years and then compare that to the sensitivity of each scenario to each major factor.

Values and Conditions

1. Values of the public – will they change significantly?
	1. Trust individuals vs. control with rules
	2. Rights: property-animal-“nature” continuum
	3. Economics: financial methods can capture all important values
	4. Job preference: people will seek environmental jobs
	5. People support the government’s projects
2. Ecosystem function
	1. The system is currently resilient and will take great effort to change
		1. There are thresholds vs. the system will respond incrementally
	2. Rehabilitated or restored ecosystems (marshes) will provide benefits to the public beyond just the marsh
3. Demographics
	1. The population will grow significantly
	2. Employment opportunities in other segments (outside of ecosystem restoration or the lake) will increase employment rates overall
4. Energy and Global Warming
	1. Strong global warming impact
	2. Restricted/expensive energy costs
5. Institutions
	1. Government is effective enough to lead change
	2. Government has sufficient money
	3. Government mission is stable over a long enough period to finish projects
	4. NGOs and Trust are effective
	5. Private enterprise, such as socially responsible corporations, can contribute to accomplishing goals
	6. There is continued innovation in institutions to meet new needs
6. Knowledge base, provides the ability to successfully manage
	1. technical projects are feasible at these scales
	2. wetlands will provide desired water quality outcomes
	3. direct innovation will help meet mission goals
	4. Scientific adaptive management can be employed and supported to grow the knowledge base and reduce uncertainty

**Sensitivity of scenarios to these factors**

Each scenario implicitly contains a set of predictions for these factors. The justification for the scenario is that, in the eyes of its proponents, fits with how they think the world works and their predictions for the future. For example proponents of the “Economic Renaissance” scenario would expect that:

* Any shift in values would favor a strong economy. People working toward their own betterment, with little regulation, will result in benefits to society.
* The ecosystem can be managed incrementally, there aren’t any surprise thresholds.
* Population will grow and there will be jobs (because those are connected).
* Energy technology will increase the availability of reasonably priced power and that technology will be able to mitigate for global climate impacts.
* Our institutions, in particular a strong free market system, will thrive in the future.
* We have the knowledge and can manage innovation to meet the needs of our society, as we have always done.

But if you play these expected parameters against some of the other scenarios, those scenarios do poorly. For example, the intensive lake management approach might be highly dependent on central regulations for pollution control. If the economy and society are all driven by a free market paradigm, it might be difficult for the large-scale coordination needed for success.

Instead of having to be able to predict the future to complete our analysis, we can compare which scenarios and assumptions sets give positive, null or negative outcomes, and in particular which scenarios might be very dangerous to pursue given possible sets of future conditions. For example, the “Expert Lake Management” scenario relies heavily on the knowledge set to be able to manage large ecosystem projects, if it turns out that the assumption made by the “Collaborative Mosaic” scenario that we just don’t have that level of expertise comes to pass, then the “Expert Lake Management” scenario approach would fail. A complete cross-comparison is presented in Table 3 (see appendix). The six conditions and values that are identified above have been converted into categories with sub-categories. Each of the five scenarios is scored by whether that scenario agrees with that statement (Positive), would dispute it (NEG), or that assumption statement is neutral or not applicable with respect to that scenario. This scoring is another way to illustrate the clusters of beliefs and assumptions that the world-view approach builds into the scenarios.

Another way to look at the alignment of the scenarios with the assumption sets is to compare “radar” graphs. For example, it is not surprising that the “Economic Renassaince” scenario has a high score on valuing individualistic statements of public values but low scores on relying on ecosystem function and services (Figure 1a.). In general, you can see how the “Collaborative Mosaic” has more agreement with statements about the importance of energy conservation and ecosystem values and lower on individualistic statements. The scenario that is fatalistic has negative agreement with statements on the competency and role of government and other institutions in their ability to effect change.

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| Figure 1a. A radar plot comparing \*\*\*\*\*. Each dimension of the plot represents the normalized score for that scenario, where POS =1, NEG = -1 and NA = 0. | Figure 1b A radar plot comparing \*\* \*\* .  |

**What can we learn from comparing these scenarios**

Scenarios contain complicated sets of assumptions as would be expected for any predictions of the future. Without being able to prove which are right, we can perform internal comparison to look for particular assumptions about the future that are necessary for one scenario that might contradict what is necessary for another scenario. For example a typical comparision between hierarchist and egalitarian world-views (such as the Lake Expert Management and the Collaborative Mosaic) shows that the hierarchists don’t think people will behave well just left on their own without rules, where as the egalitarians depend on civic pride and trust. If the egalitarian future depends too much on everyone getting along, but it turns out that humans really need strict rules to guide their activities, then the egalitarian forecast would likely fail (or turn into a “dystopia”). Analysis of the scenarios shows several cases that are a little more nuanced than the Hobbes-Rousseau debate. Several comparisons that stick out are:

* Econ Res compared to Lake Management shows that it is much more dependent on independent rights and very sensitive to increased energy costs or climate change. Expert Lake Management would fail if overwhelming individual property rights prevailed.
* Lake Management compared to Collaborative Mosaic shows that these sets of assumptions differ over the severity of the role of energy and climate change and the importance of ecosystem functions. The Expert Lake Management would fail if the energy costs and available were restricted.
* The Collaborative Mosaic compared to a return-to-nature approach have disagreements over the importance of institutions and innovation/knowledge. The collaborative mosaic would fail in the case that new innovations weren’t available or if the institutions couldn’t actually mediate the social construction of new cooperative agreements.
* The Return to Nature scenario ranks ecosystem higher than the other scenarios, and if restored ecosystems weren’t able to produce the level of functioning assumed, this scenario would pose a very challenging future.
* The “nothing works”, fatalistic scenario would not fail in the same way as the others, because it predicts failure to start with, instead this fatalist vision would fail to benefit from increased innovative knowledge or effective institutions. This type of failure is a lost opportunity rather than a dystopia.

The exercise of collecting participant value and knowledge claims and extending those into scenarios can also help us address uncertainty and surprise. Although Ursula LeGuin claims that “The only thing that makes life possible is permanent, intolerable uncertainty, not knowing what comes next.”, many of us are working hard to reduce, or at least, manage uncertainty and avoid surprises. Norton claims (2005) that one of the purposes of scientific adaptive management is to be able to choose actions that will reduce uncertainty for subsequent rounds of management. Gunderson and Holling (2002) explain how creating resilience systems will help avoid surprises. However, Gross (2010) takes a different view of surprises and argues that we should construct our ecosystem restoration activities (and other scientific adaptive management plans) to seek surprises. He explains that, if we are prepared, we will learn the most from surprises and increase our working knowledge. Scenarios exercises force us to consider multiple perspectives and world-views and this helps prepare for surprises in two ways. First, bringing multiple voices and views to the table with embedded values provides us with a larger repertoire of approaches and a broader language with which to describe the problem. Second, authentic and public statements of science “facts” and values helps build trust within the public. Trust is a crucial asset for communities to deal with surprises (Gross 2010), because stakeholder groups have to be able to work together \*\*

\*\* dealing with surprises

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Another value of scenarios is that they can be set up to support “back-casting” exercises. Concrete proposals for the future can be evaluated financially, socially and ecologically. This provides the opportunity to vet details and look for barriers that might crop up. A particularly useful portion of this is to identify responsibilities of different stakeholders and agencies to carry out the specifics. The information gained in back-casting can be used to modify or create new scenarios as part of a discussion. Although theoretical in nature the discussion surrounding the serious consideration of alternative futures can also create a sense of community for a shared future and the responsibilities that go with that.

A democratic process is necessary for sustainability. There is currently an experiment in consensus democracy that is addressing the issues in the basin that includes many individuals and stakeholder groups. However the plan will require the use of Scientific Adaptive Management (SAM) and part of the effort will be to move from scenarios to SAM involves moving from low control that results in not being able to specify any particular future path toward higher control of the system that is required to make scientific manipulations (Williams et al. 2009). Although democratic deliberative process and SAM share basic goals, we need to be aware that there are potential conflicts between the basic tenets of democracy and SAM (Table 4).

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| **CONFLICT BETWEEN DEMOCRACY AND SAM ON COMPLEX ENVIRONMENTAL ISSUES** |
| Complexity of environmental problems that lack definitive cause and effect are difficult to manage. |
| The public has a difficult time voting on uncertain thresholds rather than cause and effect relationships.  |
| Difficult problems may confuse the public and many citizens may disengage. |
| Technical aspects may lead to over-reliance on experts. |
| Large projects require significant and effect infrastructure, which has a life of its own and may set up a “double state” (Zolo \*\*\*\*). |
| Public opinion can be manipulated (Schumpeter \*\* find this reference \*\*) |
| The good will that “lubricates” democracy can evaporate under the conditions of scarcity (Benjamin Friedman \*\*\*) |

Given these potential conflicts, the two processes need to be coordinated to manage and avoid. \*\*\*\*

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**Summary**

The presentations at a recent workshop that addressed water quality in Upper Klamath and Agency Lakes contained many statements that

 Discussion of water issues – analyzed for world views

 Scenarios constructed

 Compared for robustness in face of other assumption sets

 Identified several particular obstacles

 Very useful in reaching a sustainable solutions incorporating best of SAM and democratic principles

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Table (insert Excel Sheet)