Draft Notes

TRINITY RIVER RESTORATION PROGRAM

Decision Support System Workshop

March 29, 30, and 31, 2016

Trinity Alps Preforming Arts Center, Weaverville, CA

Tuesday March 29, 2016; 8:30 AM

Presenters	Affiliation
Robert Franklin	Hoopa Valley Tribe, Fisheries
Joe Polos	Fish and Wildlife Service, Arcata
Jim Peterson	SAB, US Geological Survey and Oregon State University
John Buffington	SAB, US Forest Service, Boise
Chad Smith	Platte River, Headwaters Corp
Greg Pohll	Walker River, Desert Research Institute, University of Nevada, Reno
Tyrell DeWebber	DSS, Oregon State University
Dave Gaeuman	Trinity River Restoration Program, Bureau of Reclamation
Aaron Martin	Yurok Tribe, Fisheries
Russell Perry	US Geological Survey, Fisheries
James Lee	Trinity River Restoration Program, Hoopa Valley Tribe
John Plumb	US Geological Survey, Fisheries
Sarah Rockwell	Klamath Bird Observatory
Andreas Krause	Yurok Tribe
Donna Darm	NOAA Fisheries, Seattle; facilitator

Other Attendees: Elton Baldy, Bruce Bingham, Josh Boyce, Todd Buxton, Damion Ciotti, Billy Colegrove, Nick Davids, Caryn Huntt DeCarlo, Kyle DeJulio, Gil Falcone, Vina Frye, Michele Gallagher, Damon Goodman, Steve Gough, Brandt Gutermuth, Elizabeth Hadley, Paul Hauser, Dave Hillemeier, Paul Hauser, Nick Hetrick, Roy Jones, Jr., Chris Jordan, George Kautsky, Mary Clair Kier, Tony LaBanca, Seth Lawrence, Justin Ly, Mike Merigliano, Jeanne McSloy, Trevor Morgan, Seth Naman, Andrew Paul, James Patterson, Eric Peterson, Bill Pinnix, Shane Quinn, Derek Rupert, Donna Rupp, Hank Seemann, Jake Shannon, Terri Simon-Jackson, Mark Smelser, Nick Som, Jamie Stephens, Wade Sinnen, Wes Smith, Claire Stalnaker, Jaimie Stevens, Robert Stewart, Tom Stokely, Paul Zedonis,

Notes: Kim Mattson

Workshop Goal

The goal of the Trinity River Basin Decision Support System Workshop was to advance the development and use of a decision support system for the Trinity River Restoration Program

(TRRP). The workshop consisted of oral presentations and panel discussions related to four key elements: 1) providing background on DSS and example applications, 2) communicating the status of DSS development for the TRRP and how it can be used in the near term to support decision making, 3) identifying and initiating an approach to resolve key organization and administrative challenges to DSS development and 4) initiating next steps recommended by the Science Advisory Board for implementation of a DSS such as a work plan, schedule, and identifying task leaders.

Meeting Summary by Agenda Item

Donna Darm, NOAA Fisheries and facilitator, opened the session and touched on some of the ground rules of no interruptions, keeping open minds, avoid assumptions, and keep the goal of the meeting in mind. She introduced speakers at the beginning of their presentations.

1. Opening Remarks

Robert Franklin, Hoopa Valley Tribe, touched on some basic concepts as a start to the workshop. He noted that the Decision Support System (DSS) will not make any decisions for you but it would help make the most crucial decisions. It would be based on ideas and would decouple institutional momentum. He reviewed the basic concepts of the Trinity River Restoration Program (TRRP or Program) based on the Flow Evaluation: removing the constraints to a healthy river attributes to free the river to respond.

2. Trinity River Restoration Program Goals and Objectives

Joe Polos, Fish and Wildlife Service, gave a review of the goals and objectives of the TRRP. He cited the foundation documents—the Flow Evaluation Study, the Trinity River Federal Environmental Impact Statement, and the Record of Decision (ROD). The original strategy of the TRRP was to use mechanical alterations and managed, high-flow releases to promote fluvial processes leading to better aquatic habitat. He listed flow, sediment, channel, and watershed work as some of the tasks being under taken. He showed the Adaptive Management Process as a cycle of learning through experimentation and continuously adjusting the management options. He cited Appendix O as important as it described the process of developing hypotheses and embracing uncertainties. He said he regretted that this relevant information was put into an appendix and he recommended they review these as the Program went forward.

Polos related how the goals and objectives of the Program were developed over time and refined by the Integrated Assessment Project (IAP) 2013. The overarching goal is to restore and sustain natural production of anadromous salmonids to pre-dam levels and facilitate dependent tribal commercial and sport fisheries. He went on to cite the means objectives including creating and maintaining complex channel, fish habitat, thermal conditions, wildlife habitat riparian vegetation, and to minimize hatchery effects. He noted the more recently formalized set of Big Questions.

Polos described how the Phase I Review recommended the Program to become better organized around objectives and hypotheses about the dynamic nature of the river and that they adopt the DSS.

Questions

Chad Smith asked whose questions will the DSS support? Polos said the TMC are the management deciders but they have not yet formally adopted the DSS.

Paul Hauser asked about the fish return numbers and noted that the Program has fallen short of these goals. Polos agreed and noted that some of the other programs such as harvest managers do not manage to the TRRP goals. He also said the Program does not know exactly how the numeric goals were established and they will need to address that.

3. **Background on Adaptive Management and Decision Support Systems**

Jim Peterson, USGS and Oregon State University, explained what a decision support system is and gave examples of its use. He cautioned that it is difficult to understand the DSS without actually performing it. He called DSS a tool to evaluate trade-offs. DSS is most effective when decisions are revisited frequently. The decision makers must take ownership of the decisions.

Peterson described some problems with general decision support processes. He noted that there is often confusion over fundamental objectives (what needs to get done) and means objectives (steps towards the fundamental objectives). There is a failure to recognize sources of uncertainty and a tendency to "fall in love" with the model. There is a failure to incorporate monitoring. DSS guides decisions but is not a replacement for intuition and subjectivity.

Peterson described the steps of DSS—identify the problem, develop the alternatives, build the model, and to identify the uncertainties. He noted the importance to recognize and to focus on that type of uncertainty that you can reduce. An example of reducible uncertainty is rate of population increase as a function of habitat area. We may not know the precise relationship but DSS can offer alternative models.

Peterson gave an examples of how the DSS could be used to reduce uncertainty and how the value of information was presented to a city seeking increased water withdrawal from the Apalachicola Chattahoochee Flint basin in Alabama and Georgia. He also explained how DSS may be repeatedly run and the results can contribute to learning using an example of two experts that predicted different outcomes. The two experts' predictions can be iteratively re-run through the model and using Bayes rule or other methods one can narrow down uncertainties. Peterson closed his presentations by describing a double-loop system of learning first about the system followed by re-evaluating the models.

Questions

Seth Naman asked, regarding the example of the Apalachicola, how the DSS worked there and if the outcomes of the model supported the decisions? Peterson said yes, three models were integrated (flow, habitat, and fish). They worked on individual ways to reduce errors. The linked models went all the way down to fish production.

4. **Recommendations from the Science Advisory Board**

John Buffington, US Forest Service, gave a review of the Science Advisory Board (SAB) and how they came to the recommendation of using the DSS. He cited the Phase I Review and noted that the SAB saw the Program as good as creating fish habitat, but was not addressing the fundamental objectives.

The SAB thought the DSS would support the adaptive management approach by using linked models of dynamic response. They thought DSS would predict site and system response to alternative actions faster than monitoring could. The models would also help to focus monitoring, develop tests of hypotheses, and to structure the Program. It would also help to develop transparency for the Program.

Recommended applications include: critical assessment of actions, test hypothesis that a dynamic river will restore fish, and test the efficacy of the change in design strategy toward more intensive mechanical intervention.

5. Example of a DSS from the Platte and Walker River Basins

Chad Smith of Headwaters Corporation reviewed an example of using structured decision making on a recovery program on the Platte River in Nebraska. He said his presentation was aimed at the members of the Trinity Management Council (TMC) as they are the decision makers. He distinguished the TRRP as not a science program but a restoration of resource program that needs to deliver back to the taxpayers. He emphasized two main points. First the governance is important and that second, the program is to inform decision. That is, the program is more than an accumulation of science but is a means to synthesize science for the decision-makers.

Smith described the Platte program in Nebraska whose goals are to restore target species and prevent ESA listings. Objectives include land acquisition and securing water flows. He noted several elements of the Platte program: shared decision-making that includes stakeholders, the 10-years of negotiation, the independent Executive Director, and the use of consensus. He said the program is not advisory but is able to execute actions. The independent Executive Director was hired and he formed a consulting company to run the program as an independent or non-vested partner. The Governance Committee has been able to make all decisions by consensus. They meet in the afternoon and socialize afterwards and this has been helpful in resolving issues. He gave his definition of adaptive management and noted that this definition is important. He noted they have Big Questions with uncertainties. They manage sediment by pushing it into the river and build islands. They utilize pulsed flows. They produce an annual State of the Platte Report and synthesis documents. He acknowledged that synthesis is poorly done. In the case of plovers and flow, they concluded their current actions were not working. They needed to adjust according to adaptive management. He noted most programs will not take the adjustment step. He said they are nearing the end of a structured decision process to arrive at the adjustment steps. He showed a matrix of alternatives with a variety of predicted outcomes. He noted that the Governance Committee will use the output of their DSS as part of their decision that will be analogous to "horse trading." Smith thinks this is the first large-scale program to complete one full loop of adaptive management.

Questions

Seth Naman asked about the spreadsheet that showed the alternatives versus staying the course. Smith explained how the alternatives were displayed and that the table listed predicted outcomes. The various models produced the outcomes that are summarized in the table. The positive and negative outcomes were color coded for ease of review. He noted that the numbers are robust and give a quantitative sense of the alternatives.

Wade Sinnen asked about the genesis of the program. Smith said it was ESA and FERC relicensing. The Platte is more oriented towards birds than fish. The Platte does not have a Record of Decision nor are any tribes involved.

Paul Hauser asked if Smith could be as candid when they report to Congress about wasting money for misdirected efforts (e.g., plovers and islands). Smith said they could defend the program but they would avoid saying they need large chunks of water in the summer to protect island habitat as this is now recognized as not as important. The program gives them ESA coverage for water use.

Dave Hillemeier asked about other synthesis chapters addressing Big Questions. Smith said that they are working on several chapters.

Wes Smith noted the black and white picture of success of island building. Smith said they are a species-recovery program and not an ecosystem-recovery program. He said they are focused on these target species and this gives them the ability to look at things as black and white. He said they do want habitat and that this is good for other things.

The presentation continued as Greg Pohll from Desert Research Institute, gave his presentation on the Walker River basin and use of decision support there. The Walker River is on the border of California and Nevada and flows eastward into Walker Lake. The issues are declining lake levels in the lake. In 1920's, the Walker River was diverted starting a long-term, 150-foot decline in water levels in Walker Laker that, in turn, caused an increase in dissolved solids. Congress passed a law to allocate $300 million to protect Walker Lake but also to protect the economy of the basin. The funds route through the Bureau of Reclamation and the National Fish and Wildlife Foundation (NFWF). Participants include the Desert Research Institute (DRI), USGS, University of Nevada, two tribes, Walker River Irrigation District.

Once the program began purchasing water rights, a contention developed that led to negotiations among the stakeholders. The transfer of water rights was denied by the State court and is now being appealed. Pohll wanted to describe this process as a way to show that different interest groups have used the model to promote their particular positions. He noted that the attacks on the model have not been successful as it had been peer-reviewed.

Pohll explained their model of water flow using PRMS, MODSIM, and MODFLOW that feeds into a lake model and predicts lake stage and solids concentration. An economics model helps to decide the costs and guides spending.

He showed a simulated 3-D fly over of the basin and the different components of the hydrology. He showed data on ground water pumping being related to depletion in the river. They have four ground water models for each geographic area. The decision makers need to know if they purchase water rights what are the effects on Walker Lake levels and dissolved solid concentrations. The economics model says that the $300 million is enough to buy the needed water rights except for the uncertainty of climate change in the future. Pohll said they have not had a lot of feedback between data collection and the model. They need mostly hydrologic data which is readily available. They identified one important assumption that has driven extra monitoring.

Questions

Tom Stokely asked about long- or short-term purchases of water. Smith said they are interested in both.

Wade Sinnen asked about instream water rights. He asked about the biological constraints driving the issues and he asked about TDS levels. Pohll said that one downstream tribe has a senior water right that acts like an instream water right. He said species in the lake are important. Huntt noted these would be Lahotan cutthroat trout. Pohll noted that Walker Lake is a terminal lake and decreasing hydrology caused increased TDS.

Jim Peterson asked about the dynamics of the group. Pohll said they presented results to stakeholders. Now the team is meeting with NFWF and it is more difficult to get the information out to the broader stakeholder. He hopes this will be resolved once the appeal process is finished.

6. **Fitting Healthy River Objectives with the DSS**

Robert Franklin again referred to the fundamental objectives: restored river health and restored fish populations. He said that the tribal communities see the false notion of the separate objectives of a restored river and restored fish. They see it as connected. He noted that healthy river is one of many outputs of DSS. He asked are we recovering river health? River health is the capacity of the river to restore itself. Lacking a plan to communicate to the stakeholders how the program is working demonstrates a need for DSS. The public thinks the Program makes decisions that they cannot explain. Franklin thinks the DSS will help describe the plan.

Questions

John Buffington said he appreciates Franklin's points and agrees the healthy river is a fundamental objective. He said if the Program does a management action, they need to ask if it is going to produce a healthy river or increase in fish production and not be satisfied with increases in measures of habitat.

Chris Smith asked how does the Program handle the question of gravel filling in my fishing hole? Franklin said not too well. They often say future studies that can provide data, but have not pointed to a plan. Franklin thinks this failed the test of some individuals on the river.

Lunch

7. **How DSS Pieces Work Together: Overview of Models**

Tyrell DeWebber, Oregon State University, hosted this afternoon session. He reviewed the flow chart of the DSS showing actions feeding into models, and eventually producing a response.

Questions

Bruce Bingham asked if all the models on his chart are already developed. DeWebber said that mostly yes, they are developed enough so that the Program can use them. Andreas Krause pointed out that in the larger flow chart, not all the models are ready to go.

Hydrology Model used to Predict Flows

Robert Franklin explained the hydrology model as a simple summation of flows that adds Lewiston releases and the various tributary additions.

Questions

Nick Som clarified this is not a hydraulics model.

Hydraulic Model

Dave Gaeuman of the TRRP explained the hydraulics model and said they are using SRH-2D, a two-dimensional model that predicts flows horizontally but not vertically. The inputs are bed morphology, flow releases, tributary inflows, hydraulic roughness, and downstream water surface elevation (WSE). The model predicts flow, depth, depth-averaged flow velocity, direction, and shear stress. These results feed into habitat, temperature, and geomorphic applications. He showed equations that conserve mass and momentum. Most hydraulic models use these same equations but differ in the numeric solutions that cause some models to crash. He showed the mesh of rectangles and triangles on which the model does it calculations. The mesh element sizes are important and he said most are about 10 feet long and most are less than 4-feet wide. They run the model on a set of increasing flows from Lewiston and tributary accretions. The model can generally predict water surface elevations to within 0.5 feet. Velocity is generally predicted within 0.5 feet per second. These become inputs to the fish habitat model.

Questions

What is the spatial extent? The spatial extent is the 40 miles. It takes about a week of run time to get the model to stabilize.

John Buffington asked if the errors propagated down the system, and how the errors may affect the fish habitat model. Would this mean you need finer mesh? Gaeuman said he did not know, but they do not have the topographic data for a finer mesh yet.

Claire Stalnaker asked how it the model was calibrated. Gaeuman said it was calibrated with water surface data and velocity data was used as way to see its accuracy. Stalnaker pointed out that some models use Manning's n to calibrate the velocity in each cell. Gaeuman said their model has over a million cells.

Tyrell DeWebber asked if a final report was ready. Gaeuman said he had not seen a final report. Aaron Martin said a draft report was available.

Habitat

Aaron Martin described the modeling of juvenile Chinook habitat. He noted that coho will use the same habitat and it will also be useful for steelhead. They focus on velocity, depth, and distance to cover as variable for fish habitat. He noted the time fish rear is a critical period for their survival. They take outputs from the hydraulic model to model the fish habitat in each cell over the 40 miles of river. He noted the multiple years of snorkeling helped to develop an equation to describe habitat. They calculate a weighted usable area (WUA) for a specific flow with values ranging from zero to one (highest). He showed a flow-to-habitat curve where habitat decreased at increasing flow up to 2,000 cfs and then increased at higher flows. The model outputs compared well to actual mapping of habitat. The habitat model is built into the S3 fish production model. It can be updated based on new terrain acquired by the Program.

Questions

Mike Merigliano asked about how the model integrates cells of varying habitat. Do fish see the difference between small areas of differing quality? Martin said they have always seen high fish densities in the best habitat and he thought fish can distinguish fine scale in habitat.

Andrew Paul asked about measures of fish habitat. Martin said they do perform measures of fish and habitat quality. What they have mapped in the field is comparable to the model.

Jim Peterson asked about comparing the model to the monitoring. Are you monitoring the same grid sizes? Martin said they do not monitor based on the mesh. They monitoring over the whole range observed in the river. They derived relationships between density and habitat independent of the model. The average area they snorkeled was 4 m^2.

Claire Stalnaker said the next step was to calibrate the model and do verification. They are not there yet, but are on the right track.

Wade Sinnen asked about the relationship of decreasing WUA with increasing flow to 2,000 cfs and increasing with higher flows. Does it mean that high flows all the time would produce more fish? Martin said more fish habitat with higher flow means that the river begins to enter the floodplain and the model recognizes more habitat cover there.

Water Temperature Model

Russell Perry explained the water temperature model called the RBM-10. He noted that temperature is a means to an end but is important as every biological process is driven by temperature. The model structure is one dimensional based on heat-budget formulation. It was first used in the Klamath River in 2011. It was used on the Trinity River from Lewiston to the Klamath River. The Trinity River has 7 field calibration points.

They used a HEC-RAS model along with a daily meteorological inputs and boundary conditions (Lewiston Dam and the 14 tributaries). To calibrate, they used evaporation coefficients and rate of heat flux. They estimated these parameters by fitting it to the observed and work in a downstream fashion. They compared the modeled water temperatures to observed temperatures and found it had a mean error of 0.2 to 0.9 C. The model is useful for effects of management actions. It is now linked with Klamath River model. A report is being completed. A graphic user interface is being developed for users.

Questions

Dave Gaeuman asked about the hydraulic model. Perry uses a more simple hydraulic model that is one dimension. It also uses a more simple tributary input.

Andreas Krause asked how he got the upstream boundary conditions for the water coming out of Lewiston Dam. Perry said they use observed temperatures coming out of Lewiston. There was discussion about water temperature coming into Lewiston.

Fish Production

Russell Perry described the fish production model S3. He noted that a fish production model can be a good way to understand the mechanisms of responses, can compare alternate hypotheses, and can aid in decision making. The model works on habitat units. It produces available habitat as functions of river discharge for various life stages. The model describes juvenile abundance as a function of depth velocity and distance to cover. They used the upper

bounds of a series of predictions of density based on flows as a way to estimate highest possible density or what he called capacity.

Habitat lengths were an average of 100 m and there were 356 units between Lewiston Dam and Pear Tree. The model operates on a daily time step. The model is somewhere between a life stage matrix model and an individual model. They track total fish number by life stage, but model on habitat units and on a daily basis. The model predicts survival of spawners and eggs and then transitions to predict both survival and growth of juvenile and smolts. They also allow fish to move between units.

Perry said that the model is built and is running, and they are now just starting model calibration. They ran the model for the year 2012. They matched what actually happened for flows and temperatures and match these as good as they can. They then compared the outputs from the fish model to the weekly abundance of juveniles passing the Pear Tree smolt trap. They also ran the model using two different flow scenarios (natural versus ROD hydrograph) and will show the results tomorrow.

Biological inputs to the model for 2012 were 4,649 spawners (based on redd surveys). They also added in the juveniles released from hatchery. They did not include juveniles from tributaries as they did not think it was large for the upper 40 miles. They estimated survival based on published natural rates and temperature effects. Emergence was estimated based on accumulated thermal days. They estimated growth based on bioenergetics. Three parameters were estimated: a single survival rate and two movement rates. They fit the model to data and adjusted the parameters using an optimization routine for the best parameters to fit the data.

They developed a constant daily mortality rate and an upper thermal tolerance (but there were no mortalities due to high temperature). They developed a "mover-stayer" model based on probabilities that were density dependent, with an exponentially distributed movement distance. Perry showed that the predicted smolt abundance agreed well with the observed values at Pear Tree. Fork lengths agreed well also. They estimated daily survival of 0.982. Mean movement distance of 11.1 km/day. Probability of movement was low at low density but increased rapidly with increasing density.

Questions

Wade Sinnen asked about average smolt size and size of hatch and if smolt size shouldn't decrease with density. Perry said they estimate average size. They separate fall from spring Chinook juvenile based on the dates the adults spawn.

John Buffington asked how soon they can start gaming with the model. Perry said soon and they will show results tomorrow.

Jim Peterson asked about how they go from the meshes to the habitats. Perry said they have the SRH-2D model and they assign cells into habitats. He said Aaron Martin did the work of assigning cells to habitats. Martin said each cell is unique. Peterson asked if survival is different in each type of habitat. Perry said no, they are not using habitats to drive the model. Perry said they could do summaries by habitat and they did see that the riffles had less capacity. This meant that more fish were moving out of them. Peterson asked if they could eventually use the spatial arrangement of the habitats and model that. Perry said they could swap the best habitats and move them.

Andrew Paul asked if capacity is based on values from habitats. Perry said the model is based on the field data in that the habitat is based on the cells and then it is summed over all cells in a habitat.

Riparian and Yellow-legged Frog

James Lee presented on frog production and black cottonwood initiation. Both species require specific flow conditions along the river edges. Survival and occurrence of both species are indicators that the riparian and riverine processes are occurring and this supports Program objectives. Black cottonwood does better in wetter years while frogs do better in drier years.

Lee explained how black cottonwood recruitment can be explained by a simplified recruitment box model using the river water levels and levels of water table in the floodplain. Recruitment occurs in a specific level of the river stage during the descending limb. Descent of the water table must be lower than the rate of root growth rate. The TRRP has two models of vegetation. For now the Program is using TARGETS model which runs on Excel software. The model works on a daily time step over the growing season. It uses physical, hydrological, and biologic variables to predict where target species recruited. It predicts where recruitment will occur.

To run the model, HEC-RAS is used to get a rating table. Next users input seedling and capillary fringe characteristics such as seed dispersal dates, rooting depths, and drought tolerance in number of days they can withstand drought. Finally, the hydrograph is entered. The model predicts the number of places on the floodplain where recruitment is expected to occur.

Foothill Yellow-legged Frog use habitats similar to steelhead. Warming water temperatures and receding flows trigger breeding. Egg masses are susceptible to scour and dropping river levels too fast can result in egg dessication. The model predicts the probability of dessication using Excel software. The model allows users to place egg masses at a specified depth and the river stages are then used to decide if eggs hatch to tadpoles or are lost over approximately 30-day incubation periods.

Questions

Nick Som asked how to set the capillary fringe depth. Lee said it doesn't vary along the cross section but can be changed between cross sections.

Mike Merigliano asked how the cross sections are chosen. Lee said it would be most appropriate to look over the entire river and find those floodplains that may respond similarly. Alternatively they could look at the floodplains they just constructed. They are not choosing the locations for cross sections systematically yet.

Jaimie Stevens asked if they have determined a desirable number of nodes for black cottonwood annually. Lee said no, nodes are not the same as length. You could get recruitment between nodes but maybe not. In general, the more nodes, the better.

8. Future DSS Development

DSS Next Steps

Tyrell DeWebber reviewed the utility of what they currently have in DSS. He noted they can now link flow to fish production, riparian, and wildlife. This can support annual flow decisions. The responses can be focused on fundamental objectives. This would be a repeatable process. Model output can also be used to compare predictions to observed results. Alternate models can be run side by side.

The next steps will require clearly defined objectives and performance metrics. Should DSS be expanded to include other metrics or other types of management actions? One option is to develop influence diagrams to show what things influence a specific response (e.g., fish production). They will need to think about what format to show output (tables, or figures). Sensitivity analysis will be also be useful to develop alternative ideas.

Bird Monitoring and Compliance

Sarah Rockwell from the Klamath Bird Observatory in Ashland presented on the bird monitoring. She described their Northwest Avian Knowledge data base. Birds are excellent ecological indicators as they are high on the food chain, sensitive to disturbance, and are easy to monitor. One of the Program objectives is to incur no net loss of birds. Five riparian species have been chosen for focal species for monitoring over the past 12 years. Three of the species are increasing over time, one is stable, and one is declining. Bird density increases with canopy density and alder density. Nest success increases with shrub richness.

Questions

Aaron Martin asked about the impending die-off of older alders. Rockwell agreed that it could be important for future trends.

James Lee asked about the patch size for measures of canopy cover or alder tree density. Rockwell said they use a standard plot of 11.3 m^2.

Todd Buxton asked if they are looking at the effects of invasive plants. Rockwell said they are interested in this question and so far, there does not seem to be any deleterious effect of nesting in Himalayan blackberry.

Big Questions and Future Developments

Andreas Krause of the Yurok Tribe posed some questions for DSS. What is the appropriate extent and does DSS inform major management questions? Querying the crowd, about one-third thought the DSS would answer major management questions, one-third did not think it would, and one-third did not know. Krause chose selected Big Questions to see if the DSS may be answering them. One question was whether or not program actions on track to produce spawning and rearing habitat. He thought for the mainstem, the DSS may be answering this question; for watershed habitat, only partially. A related question being asked by the TAMWG is whether watershed restoration is better than mainstem restoration. Krause said in the fish model, the watershed component is a fixed value, so he thought no. But he added that a watershed production component could be added. A third question was whether DSS could provide answers about climate change. He noted the hydrologic model is not

predictive of the future, but there are existing models that could be incorporated into their DSS. He cited reservoir water temperature models and down-scaled hydrologic models.

He thought the bounds may be appropriate for DSS depending on the questions being asked. He noted the need that DSS be relevant to the Program management.

Questions

John Buffington thought the questions should come from the foundation documents. He recommended they tackle those questions first. Krause agreed that the Program needs to prioritize the top questions that need to be answered.

Tyrell DeWebber asked if they need a DSS to answer some of the questions such as, "Is flow creating habitat?" Krause said they can said they can monitor habitat but the point of DSS is to be proactive not reactive. It depends on the questions.

Chad Smith said the big questions on the Platte are the uncertainties related to the foundational document goals. They are working toward these questions regarding target species. He asked, "What does the ROD say the Program is supposed to be doing and are they getting there?"

Wade Sinnen noted the fundamental question is to get toward harvestable goals and they are not there yet. Krause agreed but noted that the fish production model can be working on all life stages.

9. Open Question and Comments on the Day

Donna Darm opened the session up to questions.

Chris Jordan asked about timing of individual pieces as being ready to answer questions on an annual basis. How complicated can you make the DSS and still have answers be available on an annual basis?

Robert Franklin said they should follow the recommendations of the SAB and appoint a leader of the DSS to help organize it. The model should be as simple as possible and there are only a few crucial decisions such as gravel additions and flow releases.

Tyrell DeWebber said the Program does have a schedule to support certain decisions. So they would know when certain fish data such as spawning would be needed to feed into the model. He asked would they be able to do this?

Wes Smith noted the Program now looks at five hydrographs and they generally know what type of year it will be ahead of time. So they are able to respond with an answer for flow releases right after the water year is announced. There is already a process and he doesn't want to lose track of that.

John Buffington noted that the channel restoration portion has a fixed end date and that may be one component they will want to do sooner than later.

Claire Stalnaker noted that in this Program they already had the water allocated to the Program. The original question was could they release the constraints to the river mechanically and then manage the smaller river via flow and gravel inputs that would lead to fish production similar to original levels. They now have the pieces to model the river. He said they need to do some "cartooning" to play with the system flow regime or temperature to maximize fish production. They may need to make the case that varying flows are needed to

maximize salmon in the upper 40 miles. But will this have an effect for those fish that go to the ocean? You can game with the system to show whether you can increase the probability of increased returning adults. That is better than waiting for the actual data. You can bring this to Congress as an argument for continued funding. This program is different in that they had they flows already and did not have to prove they needed the flows.

Aaron Martin thought they are not very far away from being able to do that. He thought they can estimate the capacity of the river and can develop ways to move the river towards that. He thought they can readily incorporate large woody debris and fiddle with that.

Chad Smith asked would the DSS be managed by the technical staff with output that would be given to the decision makers. The answer was yes, that was the idea.

Jaimie Stevens thought there are fundamentals questions being asked. It may not be simple versus complex but instead simple and comprehensive.

Donna Darm asked if the group agreed about what the management questions are that the DSS would ask. She noted an eye-roll and asked if this is an inappropriate question. Andreas Krause said they have formalized these questions but they have not been formally approved by the TMC.

Aaron Martin thought the best things DSS can help with is construction, flow and temperature, but perhaps not gravel augmentation as that is not a 40-mile issue.

Russell Perry noted they now have a bunch of separate models but they are not necessarily linked. He still thinks there needs to be a system and who is going to bring the models together and support that system. How will it be housed and who will manage it?

Tyrell DeWebber said that is one of their questions for tomorrow.

Break for Day 1

Day 2, Wednesday March 30, 8:30 am

10. **The Trinity River DSS Exercise**

Tyrell DeWebber introduced the next set of presentations and explained the presenters would be presenting modelled output under three difference hydrograph scenarios. These would then be presented to decision makers in an exercise in decision-making.

Model Outputs Alternative Hydrographs

Joe Polos explained the three hydrographs that were used by the modelers for this modelling exercise. The hydrographs were the ROD hydrograph, the modified ROD hydrograph used in 2012, and a natural hydrograph developed for the Trinity based on the hydrograph of the nearby Salmon River. The ROD hydrograph had a peak of 6,000 cfs with a descending limb that contained a bench at 2,000 cfs then descending to low summer flow. The 2012 modified ROD hydrograph was very similar to the ROD hydrograph, but with more small benches on the descending limb and pulsed releases of over 1,000 cfs in the fall. The natural hydrograph had multiple, narrow peak flows during the winter of between 3000 and 8500 cfs with an earlier descending limb.

Questions

Ed Duggan asked why we don't use a natural hydrograph. Polos explained they have a huge constraint in that they cannot release more than 11,000 cfs at Lewiston because of the infrastructure in the existing floodplain. Because of this, they have instituted the mechanical channel construction projects to create the geomorphology that the high flows would have done.

Model Outputs Bed Scour and Mobility

Robert Franklin showed the Trinity River Flow Evaluation recommended objectives for bed scour. These were for flows to mobilize cobbles (D84) during Normal and wetter years; mobilize cobbles (> 1 D84) during Wet and Extremely Wet years. Mobilize cobbles (> 2 D84) during Extremely Wet years.

He showed measured cross sections where they used marked rocks and re-measured following high flows. From this data they constructed a deterministic model called the Bed Scour and Mobility Mode that was able to show predicted bedload movement during a high flow event. The model predicted bed mobility objectives were partially met during Normal year release 6,000 cfs and shallow bed scour objectives not met for Wet year 8,500 release.

Model Outputs Black Cottonwood and Yellow-Legged Frog

James Lee presented the TARGETS model to predict black cottonwood recruitment. For this model he assumed three cross sections, three hydrographs, and no capillary fringe. At the Normal ROD hydrograph, they had one initiation node at Dark Gulch, none at Ed's Bar and nine at Reading Creek (total of 10). Salmon River hydrograph had none at Dark Gulch or Ed's Bar and nine at Reading (total 9). 2012 hydrograph had more initiation nodes at all three sites (total of 23).

Questions

Nick Som asked why set the capillary fringe to zero. Lee said when TARGETS was set up that is what "fell out." John Bair said that is the most conservative setting to show the greatest contrast between hydrographs.

Russell Perry asked were the three hydrographs enough to represent the range of flows? Lee said more is better. Andreas Krause pointed out they will be using a new model. How might that be different? Lee said they have received the first output of SRV-2D but its output was in a different format and will take some translation work.

Wes Smith asked about the poor results of the natural hydrograph and whether it was a function of see dispersal. Lee said they are attempting to track that. He noted that day length or degree day accumulation may be important factor. John Bair noted that if they had had 500 cfs more flow in the natural that recruitment would have increased.

Lee continued his model results for the Foothill Yellow-legged Frog. The ROD hydrograph using 11.1 C water temp as a breeding start did not produce breeding until July 7. Lee noted that this was not typical and showed that the model needs more work. Never-the-less, 22 out of 28 breeding days could have successfully hatched eggs. 2012 ROD simulations were similar to the normal ROD. The natural hydrograph had 6 of 28 successful breeding days but since these were earlier in the year, Lese considered these more successful.

Questions

One question was how would results change if they did not have the cold water releases from Lewiston? Lee said warmer water starts breeding earlier. He thought there may be faster growth during the summer.

Terri Simon-Jackson asked where the frogs are over-wintering. Lee thought the tributaries. They may also breed there, especially once they experience the cold water in the mainstem.

Russell Perry asked if the frogs would actually breed in July. Lee said he was not sure and he had not seen egg masses that late; he thought it would not be very successful.

Model Outputs Temperature

Joe Polos presented temperature outputs for out-migrating smolts at Weitchpec. The modeled output showed temperatures ranged from 45 F in April to 75 F by August. 2012 and ROD were virtually the same. The natural trended higher by several degrees during the interval from May to late July. These higher temperatures began just entering the unsuitable range in early June and again in late July.

Model Outputs Fish Production

Russell Perry ran the fish model for fry and parr through the three hydrographs and found the ROD and 2012 to be nearly identical. Total available habitat varied as a function of season. The natural hydrograph produced more habitat area earlier in the year. The same was true for capacity. Weekly abundance passing Pear Tree showed a difference in timing between the hydrographs. The median value for the ROD passed earlier than natural by about 9 days. Natural had higher temperatures and this produced longer fork lengths. There was no difference in total fish. The natural produced fewer fry but more parr and this translated into a 50 % greater mass of fish. The natural had higher capacity and fish stayed longer and grew faster.

Questions

Seth Naman asked about the greater habitat area under natural that was predicted during June and July and the cause. Perry did not know. Naman thought base flow produces more fry habitat and that may be something we have missed. Perry noted that the capacity was not very different during that time.

Chad Smith asked which metrics the Program should use to judge success. Perry said that is what this exercise is about. Numbers of fish are important but so is quality as larger fish are more successful. Mass may be one way to boil it down. Seth Naman said they do not have a decided metric for juvenile. They do have adult numeric metrics.

Aaron Martin noted that for juveniles, the increase in habitat area in the natural hydrograph are important in March and April as 80 % of the fish leave in May and June.

Chris Jordan said it is important to identify what key points are really important to identify bottlenecks. This type of graphing helps to extract this.

Seth Naman noted it would be good to overlay a graph to show the life stage periodicity to show things like when the fry are there. This is better than using just WUA.

Jim Peterson asked about the life history stage. Russell said at 55 mm all their fish transition from fry to parr. Peterson said the Central Valley has moved away from life stages and use length.

Chris Jordan asked if they can use a growth potential metric. Russell said that is a good idea.

George Kautsky noted that regarding the fish passing Pear Tree, the two hydrographs had 80 % of fish passing by about the same time.

Wade Sinnen asked about natural versus hatchery fish. Russell said these are natural fish. Sinnen asked about the high values (50 fish per m^2) generated for capacity. Russell acknowledged that these were for a single day and therefore were high if translated to a week or month.

11. Decision Based on Output

Tyrell DeWebber summarized the key numbers from the model outputs for the three hydrographs. The total fish numbers were the same. The natural hydrograph produced more parr. The predicted area of bars that were mobilized was 48 % under both ROD hydrographs and 60 % under the natural hydrograph. There were differences in black cottonwood initiation and frog success days among the hydrographs. The 2012 ROD produced 23 cottonwood initiation sites while the natural produced 9 and the traditional ROD produced 10. Both ROD hydrographs produced more successful frog breeding days, but these were thought to be less beneficial since they were later in the year and left less time for the frogs to mature during the summer.

12. Panel Discussion among the TMC regarding the Model Output

Tyrell DeWebber explained that the TMC members attending were going to discuss the results as an exercise by decision makers. TMC members participating were Terri Simon-Jackson, Bruce Bingham, Seth Naman, Mike Orcutt, Dave Hillemeier, Paul Zedonis, and Tony LaBanca.

Bruce Bingham said the TMC members may have some concerns or misconceptions about DSS. He reiterated that DSS is an aid to answering questions. He read from the SAB report, which clarified that the DSS is to make predictions regarding Program actions, help monitoring, and help to structure the Program. Bingham said this session has been helpful. He noted that DSS does not have to be a Cadillac but is one of many tools to be used.

Tony LaBanca agreed and asked if they need to clarify the Big Questions. Seth Naman thanked those that produced the model output and noted that this is essentially the DSS.

Terri Simon-Jackson said, in her job as decision-maker for the Forest Service, if she was handed the table, she would say, "Now go back and make a recommendation and explain the uncertainties about the predictions." She noted in Joe Polos' handout and the presentations that communication is very important. Polos emphasized the need to tell the story of the Trinity River and she asked if that was being done. As a decision maker, she needs to know the risks. What happens if there is a wildfire that takes out the roads in the tributaries, or what are the effects of marijuana grows? She emphasized telling the story: being able to say where we've been, where we are, and where we are going. She asked that Polos' questions in his handout be more simply worded. She thought the model output is only half done and the TMC would need recommendation on actions to be taken.

Dave Hillemeier said he was really impressed by the models. There are still critical steps but there does seem to be support to reach these steps. He commented on whether or not the TMC have accepted the Big Questions, and did not think they have formally accepted them, but this could be addressed and the questions could be reviewed on a regular basis. He said he would like to see monitoring tests of some of the predictions. Naman suggested they could add columns to the summary table of the hydrographs showing tests and results.

Mike Orcutt said he is "behind the curve" as he could not attend yesterday but he has observed they do need to communicate better. He said he has been plagued by the fact that he is not convinced that DSS is the way to go. The Hoopa Valley has concerns over the whole river—how smolts will survive in the Klamath and ocean fisheries management. He noted that he has been involved with the Program since day one and he is glad for the progress that has been made. He noted Congress said to restore to pre-dam levels. We are now getting the numbers on various species.

Tom Stokely noted the need to take a step back and look at the fish prediction Mega-table. He pointed out that 2012 was the second worst year of Chinook returns to the Klamath. In a $15 million budget only $250 K was spend in watersheds. We are not seeing the response in fish. Maybe hindcasting with the models may help to answer the question of why are we not producing the fish. We need to take a step back and ask what is going on. Maybe we don't need to continue the mainstem projects. The Program has many detractors. We need to figure out how to restore the fish and not study fish. He said he was discouraged with the progress.

The group moved to the exercise of making a recommendation on a hydrograph. Tony LaBanca said from the perspective of fish production the recommendation would be the natural hydrograph. Tyrell DeWebber noted that they have not weighted the various metrics and that is something they can do. Bruce Bingham said that we all understand that mangers are faced with making decision based on more than just the science—they also consider social, political, economics.

Dave Hillemeier said the natural hydrograph looks better and this may help to address Stokely's concerns of lack of progress. If cottonwood were a major concern, he would ask if they might put small benches onto that hydrograph. Regarding thermal conditions in the Lower Klamath, he is not sure they are not that much different from historic. Disease is a whole different issue.

Paul Zedonis thought that conceptually where the DSS is at was great, but he agreed with Bingham's and Simon-Jackson's comments on decision-making. He thought the DSS would help to structure and prioritize future studies. Mike Orcutt said a big issues that may be overlooked is spring Chinook management, an important species to the Hoopa Valley Tribe. Russell Perry said the fish production model will produce spring Chinook results.

Ed Duggan said the main goal of the ROD is to restore fisheries to pre-dam levels. Fisheries involved coho and steelhead and Chinook. The TAMWG represents the stakeholder and only recently has communications with the TMC improved. Communication needs to still be improved both with the public and with other partners in the Program. He thought the natural hydrograph was best. He would like to know the eventually effects on the adult returns, however.

Tyrell DeWebber asked if anyone wouldn't go with the natural hydrograph. Orcutt said they may actually add further modifications. Naman said the natural already has some modifications by adding low flow to meet holding conditions for adults. He further said he

like the natural as this may be better timed to tributary output, the geomorphic benefits look better, he would want to hear some of the nuances on cottonwood and frog production.

Stokely asked if the natural hydrograph worked with the existing channel. The answer was yes. He asked about scour of redds and increased stranding. Perry said they have a way to asses scour of redds but they did not use it for this output.

Zedonis said they need to take the model outputs cautiously that some outputs may be very sensitive to assumptions. But he still called it a noble effort. Orcutt noted that one area of difficulty is the wildlife as there are no pre-dam estimates making it difficult to assess what is a healthy river. Naman said he is not too worried about redd scour or stranding until you get above 6,000 and early in the year. If you walk along the Smith River you find normal stranding. Bingham emphasized the need for learning as opposed to simply monitoring. They would eventually learn what the best metrics for monitoring are. Aaron Martin agreed the management of the DSS is now the biggest challenge. Simon-Jackson restated her desire for more integration by the staff experts with assessment of risks. Bingham the decision-makers job is not to tell the experts what is the most important metrics, but to tell the experts what the decision-makers need to know to help them make decisions.

13. Assessing Uncertainty in the S3 Fish Production Model

John Plumb of the USGS presented on the uncertainty in the fish estimates. He said he would talk about three types of uncertainty: statistical, input, and model or structural uncertainty. A fourth type is latent uncertainty or that which is hidden in their assumptions.

Statistical uncertainty was assessed using statistical techniques such as bootstrapping, input uncertainty was assessed by changing inputs by doubling or halving, and model uncertainty was assessed using Akaike's Information Criterion (AIC).

He found low variation (uncertainty) in survival, distance moved, or probability of staying. The weekly abundance in fish passing Pear Tree was also low given the parameter values they chose. Annual abundance estimates were precise enough to say with confidence there were differences in fry and parr numbers between hydrographs. Biomass was different. Particularly when they compared the one-to-one difference between the bootstrapped model runs. Regarding structural or model uncertainty the AIC values suggested low uncertainty between the model structures.

He summarized that parameter uncertainty appear to be tight. Input uncertainty produced differences in biomass but not abundance. Model uncertainty suggested that the null model was best model fit to 1 year. Density dependent movement was the best mechanistic model.

Questions

Seth Naman asked if they tripled or increased spawner might there be an asymptote in the increases? Plumb said they have a super-imposition function but it was not used.

Aaron Martin also asked about the nearly same doubling and halving of juvenile abundance when Perry doubled or halved the adults.

Wade Sinnen asked about egg survival and the changes from year to year. Plumb said the nice thing about models is it shows things we don't know and that egg to fry survival is a critical number to nail down.

Todd Buxton asked about the egg to fry survival and if they could back calculate this rate from the Pear Tree abundance numbers. Plumb said there are methods to get at it. To back calculate to eggs, he would need to make estimates for fry survival which would be difficult. Russell Perry said the literature has a wide range for egg-to-fry survival. If we raise the egg survival, the fry survival would go down.

Tom Stokely said the Flow study assumed that increases in adults would not make a difference in smolts but Perry's modeled data here seems to contradict that. Plumb said they could not assess that at this time.

Ed Duggan asked about prospects for putting more data together for survival between the two downstream traps. Plumb said, yes, he cannot wait to do that.

Bill Pinnix pointed out that there are issues between the two traps such as inputs from tributaries that may be important to consider. Plumb said the available survey data suggested low spawning in tributaries, but this is not well known.

Sean Ledwin noted the differences in biomass and asked about temporal aspects and fish passing 9 days earlier and would still be growing and would suffer more mortality. Plumb agreed that these were important issues.

Wade Sinnen asked if the model is more sensitive to habitat or temperature. Plumb said temperature has a greater effect on growth and habitat has a greater effect on movement and survival.

Kyle DeJulio asked about density-dependent thresholds for triggering movements for fry and smolt. Plumb said it is just a function of density and is size independent. Perry said there are indirect linkages in the model. He said that parr have lower capacity than fry and this should cause parr to move sooner.

Lunch

14. Learning through Monitoring

Chad Smith added some observations and comments on the TRRP as it moves forward based on some of his experiences on the Platte River. He mentioned that he really liked the previous TMC session exercise. He projected his table of alternatives and said it took nine years to get to the table to get to what metrics they needed and how to measure. The TRRP has a much more decentralized method of getting projects going on the ground. The Platte has a centralized group in charge. Most of their field work in the Platte is done by contractors they hire via a competitive process. He noted the importance of a strong leader that can motivate and nurture staff and get information up to the TMC. The TRRP needs to spend time thinking about how to manage and who will manage DSS. He noted challenges regarding how to build DSS and challenges in how to use it. He opined you only need a model that will answer your question and do not necessarily need a Cadillac. Smith's assumption is that DSS would be used to game out options that could be used in Phase 2 of the adaptive management process. It would be good to get everyone to agree on this plan and figure out what metrics should be in the model. In the Platte they have a number of constraints and do not try to game out every possibility. The TRRP may want to consider if they want to constrain themselves to avoid wasting time doing scenarios that will never be implemented. He asked again about the goal and noted it still was not clear to him. He appreciated Andreas Krause's presentation on the Big Questions.

Greg Pohll talked about some of the benefits and challenges they had experienced on the Walker. He noted the need for leadership and it was extremely important to have a leader in the Walker. Their leader originally approached their DSS as his personal science project and that did not work well. It is now a tool of the program and they can now do analyses "on the fly." Adding groundwater to the process added an order of complexity and it now takes their model 12 hours to run. He strongly believes in the concept of parsimony and it is important to use the simplest model that will do the job. He said they have relatively good buy-in among the stakeholders, but not all the stakeholders. Anything to get better communication and get buy-in on the complexity of the model is extremely important. He commented about how to add new elements to the model. He related how the State wanted to use the model to assess new rules for ground-water pumping and that turned out to be a lot of work. Another challenge is how to present the information output at the appropriate level of complexity for the audience. Sometimes recommendations are not clear and you need to present as much information as you can and the decision makers will have to make the hard choice. He noted that simple models are better suited to optimization routines in using data. You may have to choose whether the model could be used in litigation and who would have to be the expert witness.

Question

Ed Duggan asked if adding components to the model is not adaptive management. Chad Smith said that is not adaptive management as he defines it. He asked that his slide be shown again. He cited the need for communication and executive director with a shoulder to the task to keep the process going and walk the path between partners, science, and economics.

Robert Franklin asked if it is a goal of the Walker program is to support Lahotan cutthroat.

Chris Jordan asked their observations in the mock exercise. He also asked about the Walker output and whether it was given as recommendations or plus and minus and how they convey the risks. Pohll said he found you need to present the results in a very precise manner but they cannot always make a recommendation. He found it sometimes difficult to assess risk as their model is rather large and they do not have the computational resources. Smith said they convinced their Governance Committee to try DSS for the plover habitat. They started the Governance in at the start of the process. The contractors they hired interviewed all the Governance Committee members and the Committee was led along the way as the DSS was developed. He noted the Committee needed to read the report and ask questions before the meeting. He thought the TRRP will need to spend even more time given their complexity.

Chad Smith asked if the TRRP still pays attention to Marmorex's assessment plan. Franklin said yes. Smith said that and other documents are still very good documents to "mine."

Tyrell DeWebber said that the DSS is a lot of work but asked what is the alternative? Smith said, "Failure." He noted they have an awesome science pile but so what?

15. Question and Answer Session

Damion Ciotti asked selected members to address questions that had been written on the cards.

Aaron Martin: How is DSS going to inform us about channel rehabilitation?

Martin said thought they would not be using it for specific design questions but instead to focus on the 40-mile scale, or to look at reach-sizes scales. For example, they can address the

effects of increasing habitat over 40-mile scale. DSS could be used to show the difference between where we are and from where we have come. They can run scenarios of alternatives such as adding wood. He thought, realistically they can use DSS to determine where we can get with the 40 miles and the water we have.

Questions

John Buffington asked why not assess on a case-by-case basis what the effects of individual projects are since they have a fine mesh on which to model. Buffington said he did not know how much work it would be to re-format the model with new topographic data, but the Program may be asked by a Congressman, "What benefit did this structure have?"

Ed Duggan asked what type of wood are they talking about and what about the safety. Martin said he would like to see whole trees added to the banks and keyed in. They don't know the longevity of such projects. Hazards will have to be managed. The alders will be coming into the river naturally. He acknowledged that safety is a priority.

Kyle DeJulio asked if DSS leads to an altered hydrograph would this lead to new designs? Martin said yes.

Eric Peterson: How would DSS used prior year's hydrographs?

Peterson said the 2013 flow was higher—about 7500 cfs. They had wondered if they should increase the peak to accomplish more geomorphic work since such high flows had not occurred recently. However, that year had a lot of juveniles and they released for these juveniles instead of a geomorphic peak. However, the next year they did increased the peak to get more geomorphic work since they had not had a high flow in recent years. Tyrell DeWebber said James Lee noted that they do not have to have a good frog year every year but it may be needed occasionally. Russell Perry said they could run multiyear decision support to evaluate year to year uncertainties.

Questions

Todd Buxton said that they bumped the water up in a dry year to get more geomorphic work, isn't this moving away from reality? Kyle DeJulio said that even in a dry year, they could still get high flow events from storm events.

Joe Polos: Of all the normal years on the Salmon what criteria were used to pick the hydrograph?

Polos said they picked 2012 and this year was a good contrast to the ROD hydrograph for demonstration purposes.

Questions

Todd Buxton asked if the Program could implement the natural hydrograph. Polos said the operations folks would need to be brought in and they have been pretty good at doing this sort of thing.

Seth Naman asked if Polos could give background on the scoping for the EIS and alternatives for flows. Polos said the EIS considered all the flow down the river and they considered 40 % down the river on a weekly time step. This alternative worked out well but it did not rank out as well as it did not have the peak flows and did not meet the temperature criteria later in the summer. Naman commented that it would be easier to avoid banking of water.

Dave Hillemeier: What is the TMC's role in implementing the DSS?

Hillemeier said the primary role is to make sure the resources are available for models. and efforts be prioritized in an efficient manner. Also the TMC needs to make sure they have the adequate person power to take on the DSS. He now believes that the DSS and adaptive management are very important. The TMC could help be being really clear about what is needed by the DSS. DSS would help in synthesis reporting on an annual basis and in layman's terms.

Questions

Bruce Bingham said he agreed with Hillemeier that resources need to be committed. He thought they know the goal and the Big Questions. Management needs to tell the technical folks what they need to make their decisions. That means they need to understand the questions and what they need to do. The TMC needs to have a similar level of clarity on the DSS.

Aaron Martin asked if this is a TMC job. They need to test hypotheses such as the effects of flow but there is not funds set up for this. Bingham sees this as taking a different tact on their monitoring program. Seth Naman said DSS will help the TMC to prioritize funding and monitoring. He said it is important that the TMC embrace DSS and provide support. The TMC also needs to dig into it and understand.

Mike Orcutt said he has a real strong opinion on this matter. The first order of business is to make a more efficient adaptive management program but federal agencies are slow to change. He said we need an unbiased review of the existing program. The TMC as described in Appendix C maybe has worn out its role. The concept we have put together is co-managers. The hatchery is co-managed with the Tribes. There are many broader and comprehensive management issues such as flow in the Lower Klamath which need to be addressed in a new approach.

Robert Franklin noted that Chad Smith has come here three times and still expressed uncertainty over the goal. Mary Claire stated it is to restore fish to pre dam levels. Franklin said Smith is smart but he gets cross messages. Orcutt said the goal was clarified in the IAP and that is now the goal of the program. Seth Naman said he is not confused and he cited that the SAB recommended the Program to do a DSS, and that is what they are doing here.

Sarah Rockwell asked about complexity of the program and how to move toward adding birds to the DSS. Tyrell DeWebber said the decision-makers need to decide that this is important. Bruce Bingham said they cannot do everything even though it is important. They need to do the things that allow them to complete their Program. Jaimie Stevens noted that DeWebber said DSS needs to relate to flow, she asked about the goal of a healthy river. Andreas Krause said his understanding is a healthy river is a fundamental goal. They tried to come up with indicators that they could also evaluate he concluded it would still be a bit of work to do.

16. Panel Discussion with Science Advisory Board and Outside Managers

The Science Advisory Board assembled as a panel to give their observations.

Chris Jordan said he saw an amazing amount of progress in integrating fish and habitat data along with the riparian model into the DSS. There is still more work to do. They should think about how to develop the scenarios. There are an infinite number of scenarios but not all options are on the table. Second they need to think about communication and how to boil

down their information for the decision makers. They should spend extra effort how to communicate technical information to the non-technical consumer. Perhaps those that wrote the model should not be the one that explains it.

John Buffington echoed Jordan's comments on the progress. He said to use the DSS to find where the system is most sensitive and where you can get the biggest bang for the buck. There are differences in opinions of what a healthy river means. He viewed the fundamental objective as "fish restoration" and the means objective was "to work in a scaled down river."

Jim Peterson thought the staff can address the technical issues. But the "technical cart is before the decision maker horse." The technical could get so far ahead the decision makers could get overwhelmed and decide it isn't worth it. Sometimes it can take three meetings to come up with a single sentence of what the purpose is. He is also concerned over the notion that this needs extra resources to add DSS on. He thinks this is something they already have and they just need to organize it. They need an organizer to do the job. But they need to focus on the business process of getting the DSS going.

Mike Merigliano said he was worried that the model could end up being "the world." But he is not as worried once he saw the questions brought up over the fish production model. On another topic he wanted to bring up the healthy river concept. For much of the public, consistency is more positively viewed and floods and change is not their view of healthy. He recommends not using the term healthy river as there will be a question of how to measure it and roll into DSS. Health is often thought of how sustainable and how much it doesn't need to be messed with. But the Trinity will need to be messed with. Another measure of health may be salmon. Black cottonwood or birds could be another metric. A question is whether a healthy river is a means in itself or a means to get to fish restoration? We may never get to that. He cautions that trying to quantify healthy river is troublesome. John Buffington said metrics they choose for a healthy river should also relate to fish as a hedged bet.

Andrew Paul said he has been impressed with the work and enthusiasm of the group. He echoed the comment over the need to focus on the process. He commented on Chad Smith's results table and he noted that each row was something of importance to at least one of the decision makers.

17. Group Discussion and Wrap Up

Donna Darm opened it up for discussion and questions for the SAB.

She summarized the SAB comments and that these could be breakout group subjects for tomorrow's meeting:

1. Carefully consider scenario development and consider binning.
2. Consider communication in non-technical terms.
3. What management actions are driving outcomes.
4. The need to address the metrics of a healthy river.
5. Decision maker engagement.
6. Options for a coordinator and business process.
7. Healthy river concept.
8. Process of DSS and determine interest in the rows.
9. Restoration strategy and critical evaluation.

Russell Perry said he is really supportive of narrowing or limiting the scenarios.

Claire Stalnaker said he is really impressed with the current SAB board. He said the Program needs to have the right people to bridge between the technical people and the decision-makers. He thought it should be the Science Coordinator and the Executive Director, and if not, they should hire a consultant. Maybe the choice of these people should get SAB input on this.

Tom Stokely cited the SAB's comments that the Program had changed the designs process without going through an adaptive management. John Buffington said they did not say the change was without an adaptive management but it was "ad hoc." He said the current change in projects could be examined in a DSS exercise (e.g., before versus after project). They could also game to see what types of projects are best to meet the objectives of the Program. Stokely asked should they? Buffington said, personally, he thought they should try to account for the effects of the Program.

Claire Stalnaker said it may be important to compare the concept of a minimum constant flow versus a dynamic flow. They may be able to show dynamic flow is much better in a fixed channel and it would be a good defense to those that want a minimum, constant flow.

Seth Naman asked Perry for his honest assessment whether the S3 fish model could be used to assess the difference in fish production regarding the effects of restoration at a single site? Perry said they could run the model and they could evaluate capacity. They shouldn't expect a big response from changing a small section of the river. Naman said that is mentioned in the SAB's recommendations. John Buffington clarified that the intention was not to evaluate response at one location but it was a system-wide response. But you may find specific areas that really "rang the bell" with lots of response. You may find that channel work is flattening out and they are not getting as much response. It is good to look for the long-term response of all the projects. Perry said it may be good to look at effects of one site to see process such as reduced fish movement.

Jim Peterson asked the group whether the concept of the fundamental objective of a dynamic river has been tested. None raised their hands. Todd Buxton said maybe they now think the river is not as alluvial as thought. John Buffington said it is important to report that. But there are sections that are alluvial and they can test the effects there. Buxton said he agreed, but they don't have those decisions to do that work. Donna Darm asked how to incorporate this concept into DSS. John Buffington said that it could be posed as a question: "Is the means objective of a healthy alluvial river leading to restored fish?" Chris Jordan said they may need to re-scope the expectation that only certain sections of the river are alluvial. Joe Polos said in his limited participation in the Flow Evaluation Study they never expected the upper 40 miles to be totally alluvial. This is where the Program needs to get on the same page here. Buffington said this needs to be addressed in their communication. Robert Franklin said they understood the entire river was not alluvial. Regarding communication, there have been many areas of miscommunication and a disconnect with the decision-makers.

Tom Stokely noted the poor Chinook run last year, and asked if DSS could be used to look at what happened in 2012 to smolts. Russell Perry said their next step is to use DSS over the data set of 10 years that they have and this is one way they can get at hindcasting. Chris Jordan said their best demonstration that their model can predict the future is whether it can describe the past. Brandt Gutermuth said they need to consider the non-basin factors that also control adult returns. Maybe they will show that fat, young fish have better survival and they can manage for that. Jordan said they can't rely on adult returns to see on whether the model is doing well as this is what they have the least leverage on. There are too many ways to

make the patterns match. They need to see if they can match the life growth stage process to match.

Claire Stalnaker added to Jordan's comments. He related that when the Flow Study was put together, the Bureau said they did not care what happened to the fish once they left the system and entered the ocean. But this thinking is now gone. And they can consider these processes today.

Aaron Martin wanted to echo what Stalnaker had said earlier that it is important for DSS to show what the overall actions of flow and channel design has done. This needs to be shown to the public and other critics of the Program.

Break for Day 2

Day 3, Thursday March 31, 8:30 am

Donna Darm opened the session for Day 3 in the lobby. She went over the nine points developed during the discussion yesterday. The idea was to form breakout groups and address the points and possibly make recommendations or commitments. One concept that generated some discussion was the fundamental objectives and whether the TMC has explicitly adopted these. Three breakout groups were formed a Metrics group, Scenarios group, and a Process group.

18. Breakout Technical and Management Sessions

Notes from the Process Group: Andrew Paul, Andreas Krause, Eric Peterson, Justin Ly, Teresa Connor, Claire Stalnaker, George Kautsky, Caryn Huntt DeCarlo, and Paul Zedonis.

This group was assigned to cover communications, information flow, and the process of carrying out the DSS. Andrew Paul offered to explain his experience in a DSS and observations of process in Alberta regarding water withdrawals in the Wapiti River. He listed the process steps they took on the Wapiti: 1) develop decision context or rules (what they are doing, goals, stakeholders), 2) define fundamental objectives, 3) develop performance measures (metrics), 4) develop alternatives, 5) evaluate using metrics or performance measures, 6) choose alternative, 7) implement, 8) monitor.

Following this, the discussion ranged over a number of topics including the process steps of the DSS, fundamental objectives and the need to get buy-in, about long-term and short-term experiments and the need to organize the TRRP budget around annual and multi-year experiments.

Regarding the process steps, Stalnaker pressed that a schedule of transfer of information needs to be established and it needs to be delivered on an annual basis. Krause agreed and said they need to be able to identify the responsible groups and who it is to be delivered on a schedule. Paul described how the Wapiti technical groups developed detailed work plans. Krause said the metrics need to be measurable, predictable, and have a defined desired range in order to assess success or failure. He also advocated for a portfolio of management experiments and they need more flexibility in how work plans are developed. They currently have only one year work-planning process, there are budget constraints, and there are no program objectives that lend themselves to adaptive management. Stalnaker noted the need for a budget for long-term management in addition to the annual budget.

Regarding testing of metrics and the fundamental objectives, the group discussed the value of bold testing to see if very different outcomes can be produced as a way to prove their hypotheses or assumptions work. Eric Peterson commented on the value of controlled experiments and since these cannot be done on the Trinity, they can do contrasting experiments. Krause said they need to acknowledge the healthy river as a fundamental objective, establish metrics, and then develop tests. Krause advocated for more specific metrics including frequency and timing that would allow discretion to choose one objective over another (e.g., frogs over fish). Stalnaker recommended they come up with two alternative hydrographs every year, both being scientifically valid. Connor said they ought to include a metric of recreational days available on the river or days available for construction. They noted that development of metrics would not just be a science exercise.

Regarding the two fundamental objectives, Claire Stalnaker pointed out that it is okay to have two fundamental objectives but they need to be linked to each other and this can be readily done. Krause said they need to formally accept the two fundamental objectives. Connor said the TMC may not have formally adopted it but they were looking for more information on it. Stalnaker said they need to have budgets for both objectives—some for fish and some for healthy river. He said the two objectives are the in the ROD but the healthy river has not been defined. Peterson asked if the grand experiment would be to show that a healthy river would result in more fish. Stalnaker said yes, that is the grand experiment. That is why they need metrics to define it. Peterson said it is important for the TMC for to accept the healthy river, and he suspects there is evidence of increased health. Connor pointed out, if that is true, the relationship with fish does not exist. Krause said he did not know of the data that supports a healthy river. Stalnaker said because it is not defined. Discussion of achieving healthy river is one success even if fish not responding (due maybe to ocean conditions).

Regarding costs as a metric, Krause asked if the next step may be to consider channel rehabilitation improvements versus costs in DSS. DSS may be able to show what the potential for fish production may be with maximized habitat over the entire the river as a way to help define boundaries of channel rehabilitation. Stalnaker read Big Question 1 whether channel rehabilitation is creating a healthy river. He said currently, channel habitat is building habitat and that is not a natural process; the Program was originally envisioned to remove berms and do management to allow the river to build its own habitat. This could be step 1 to settle this argument. Krause countered that they are building things to allow fluvial processes. Stalnaker responded that they are not supposed to be building things but instead taking things out. Krause said natural processes could take millennia and asked if we were willing to wait that long. Can we instead overcome some obstacles to accelerate the process? Peterson observed they have seen how lowering floodplains have prevented hydraulic change.

Krause suggested they get back to the decision context—what is in and what is out. He noted you cannot manage what you do not measure. The annual reports are good, but they also need an annual report on how well they do on adaptive management. Kautsky said they need a workshop on adaptive management. Zedonis said adaptive management is used to evaluate the metrics and inadvertently it is factored in.

Peterson recommended they document what they have already learned

Connor recommended the TMC decide what they minimally need to monitor every year and avoid doing the same thing year after year.

Justin Ly suggested they develop a fact sheet for new TMC members. Stalnaker said you need to read every word of the fundamental documents

19. Report Back to Group and Closing

The three groups gave reports from breakout sessions. The goal was to come up with next steps to implement DSS.

Group Metrics

Tyrell DeWebber offered a definition of healthy river as self-renewing (HERO is an acronym for Healthy River Objective). He summarized the result of their group but showing a table of metrics they had developed with major metrics of a healthy river, riparian wildlife, and riparian vegetation.

Questions

Andreas Krause suggested macroinvertebrate species abundance and distribution is a biological integrator.

Wes Smith asked how this may tie back to DSS. DeWebber said they would first list the things that are important. But they did not establish direct links to DSS management actions.

Scenarios Group

Chris Jordan presented on the scenarios they envisioned. He listed the major scenarios as "dials" on the model: flow, physical habitat, temperature, escapement, aquatic/terrestrial productivity, where each dial had a series of "settings." The Flow dial would have ROD, Natural, Flat line. These would be the choices and then the user would push the "Run" button. Temperature would have three settings. Escapement would have three: pre-dam, current and a low. Aquatic/terrestrial would have three settings low medium and high. All possible combinations could conceivably have 400 possible settings.

Outputs should include adult equivalents from juveniles passing the North Fork and adult equivalents per spawner or freshwater productivity. He emphasized they look at the consequences of food, habitat or flow on adults coming back.

They posed some questions for the fish model development: 1) size specific and flow specific movements, 2) density dependent growth and survival, 3) changes in habitat quality, 4) can you run the model backwards to explore to a 200% goal, 5) address steelhead and coho, 6) what about river morphodynamics, changing boundary conditions, test whether a dynamic river is better for fish.

Questions

Andreas Krause suggested hatchery influences. Jordan said that would be a huge input.

Jim Peterson suggested within acre feet of what you have, run optimization on it.

Tyrell DeWebber asked if they would include some estimate for harvest. Jordan said they could estimate harvest once they pass density increases in adults. Mike Orcutt said the management regulations would come into play and these would need to be overlaid. Krause asked putting a variable harvest opportunity may be a way to integrate. The Hoopa Valley has

a recommendation for harvest goals and future opportunities that they could send around if anyone is interested.

Process Group

Group summary of key next steps:

- Administrative
  - Decision context needs to be reviewed (rules of operation).
    - "decision context" is a term from Alberta. It includes variety of things like: what are we doing, side boards, operating rules for DSS, and associated workplan, establish rules for consensus and non-consensus and define and is not up for debate (e.g. two fundamental objectives). Consider inclusion of a decision log (different than action tracker) to understand what has already been decided and no longer needs to be debated.
  - TMC to formally accept 2 fundamental objectives acknowledge the grand experiment (restoring river process to increase production) ties them together.
  - Develop an annual DSS workplan that defines who does what, when, why, and how to share data.
    - Work plan include labor and budget for syntheses and science exchange.
  - Budgets
    - Establish two separate budgets for funding
      - long term trend monitoring
      - Annual adaptive management experiments. This new type of budget line item allows for budget flexibility needed to conduct adaptive management.
    - Both fundamental objectives (production and healthy river) are co-equal. Budget should reflect equal funding for evaluating both fundamental objectives.
    - Plan for labor and budget on cyclical basis to:
      - develop synthesis reports that reduce "science pile" into a form consumable by stakeholders and managers
      - communicating the results of adaptive management to public, stakeholders, and managers. This includes biannual conferences (see below).
  - Offer orientation for new members and staff about adaptive management.
- Adaptive management
  - Develop synthesis reports that document what learning we have done and associated management implications.
  - Establish a portfolio of adaptive management experiments
    - identify management action to be taken, learning objectives, study plan (monitoring and analysis), and budget.
    - Portfolio to include range of experiments from small scale to the grand experiment.
    - real experiments periodically stress the system to get contrast
    - proposed adaptive management experiments (production, healthy river, annual management actions) should be informed by broader DSS

scenario exercise and sensitivity analysis that helps define critical information needs.

- Produce an annual report assessing adaptive management
  - consider all aspects of adaptive management (e.g. communicating results to stakeholders)
  - document annual learning
  - identifying needed improvements to shore up adaptive management
- Host biannual conferences to facilitate two way communication between science, stakeholder, and managers on the state of the science and get feedback on next steps.

- DSS
  - Develop performance measures for both fundamental objectives
    - performance measures need to be measurable, predictable, have a target value or range, are testable, and relevant.
    - performance measures need to be developed iteratively in partnership with stakeholders and managers to ensure they are relevant
      - Consider other performance measures beyond just science.
    - performance measures should include frequency, timing, and duration to help inform annual management action tradeoffs (because you should not always optimize for a single parameter like production). For example, cottonwood equipment is needed only once every ten years.
    - performance measures table (like that on the Platte) should also include values from past year and be paired with separate report that fully describes the performance measure and how it is calculated.
  - Management action recommendations should identify
    - risk and uncertainty
    - tradeoffs
    - learning objectives
  - DSS should include consideration of channel rehabilitation for healthy river and fish production.

<u>End Day 3 12:00 PM</u>