

**COLORADO RIVER BASIN SALINITY CONTROL ADVISORY COUNCIL  
MEETING MINUTES**

Wallace F. Bennett Federal Building  
125 South State Street, Room 5102  
Salt Lake City, Utah

**Advisory Council Beginning Time:** **Wednesday, May 20, 2015, 1:00 p.m.**

**Designated Federal Officer:** Kib Jacobson

**Presiding:** Chairman David Robbins

**I. Welcome and Introductions** **Robbins**

Advisory Council (Council) Chairman David Robbins called the meeting to order. He asked the Council to introduce themselves. Alternates for Council members included Steve Miller for James Eklund from Colorado, Andrew Burns for John Entsminger from Nevada, Chuck Cullom for Marie Pearthree from Arizona, and Paul Harms from New Mexico. A copy of the attendance roster is attached to these minutes as Appendix A.

**II. Opening Comments, Acceptance of letters appointing substitute members** **Jacobson**

Kib Jacobson welcomed the group to Utah and expressed appreciation to the Utah delegation for their efforts in arranging for the meetings, the lunch, and the tour.

**III. Review and Approval of proposed Agenda** **Robbins**

Chairman Robbins asked for any changes to the proposed agenda. As there were none, the agenda was approved as proposed. A copy of the agenda is attached as Appendix B.

**IV. Draft Minutes of 2014 Fall Council Mtg. in Santa Fe, NM** **Jacobson/Robbins**

The draft minutes of the October 29-30, 2014, meeting in Santa Fe, New Mexico, were reviewed. There were no changes or edits suggested, and the minutes were approved.

**V. Report on the responses to the Advisory Council Report** **Robbins**

Chairman Robbins invited representatives from each of the federal agencies to report on their responses to the Advisory Council Report.

**Reclamation** – Kib Jacobson shared Reclamation’s response. As Paradox issues had been discussed in detail earlier in the day, he felt it unnecessary to revisit that subject. Regarding the Federal Accomplishments Report, Reclamation will make an effort to make their contribution to the report more concise and focused. Regarding concerns about the Economic Damages Model, Jacobson reported that Jim Prairie had made quite a few improvements in the spreadsheets that would tie them together better and make the process more efficient. The improved information will be made available to the subcommittee that was formed to review the model. Jacobson reported that funding for the Basinwide Program for the current year was \$6.4 million and the President’s budget for FY 2016 shows \$8.4 million. Recommendations from the Advisory Council were \$11.2 million for FY 2017 and \$12.1 million for FY

2018. Jacobson noted that the FY 2017 budget is in process and Reclamation will be working on a budget for FY 2018 in the summer. They will make every effort to get as much funding as possible. He also reported that they have been able to get adequate funding to do O&M for the original units of Paradox, Grand Valley and McElmo Creek. Regarding Paradox they have included in the FY 2016 and FY 2017 budget funds to complete the EIS process. He mentioned that they have been pleased to be able to acquire additional year-end funding for the Basinwide Program in the last few years and hope that will be the case again this year.

**USDA-NRCS** – Travis James indicated that NRCS received their EQIP salinity funding late in November in the amount of \$12 million of financial assistance (FA) which was distributed between the three states. The states are in various stages of getting those funds obligated. The amount that headquarters allocated was less than what the state conservationists requested in their three-year plan. They have been pretty much flat for the last three years at about \$12 million of FA. The states will be preparing a three-year plan for the next cycle and will confer with their partners to project what those amounts should be. The Farm Bill has given NRCS new authority to conduct the Regional Conservation Partnership Program (RCPP), and the Colorado River Basin has qualified as a “critical conservation area” under that program. There were two RCPP projects selected by NRCS, one on the Verde River in Arizona and the other on the Lower Gunnison in Colorado. James noted that there are some additional challenges in working with this program. James reported that NRCS is currently well staffed with most positions filled.

**BLM** – Though a formal response had not yet been received from BLM, Cole Green Rossi addressed the suggestions specific to BLM from the Advisory Council Report. Regarding funding she explained that funds for salinity do not come solely from the Soil, Water and Air Program, but that there has been an effort to acquire additional funds from other programs that have not been able to utilize the funds available to them. She explained that there have been a lot of personnel changes in Washington, making it hard to follow through on funding issues. With respect to the suggestion that BLM pursue a line item for salinity control, Green Rossi noted that BLM’s idea of a line item is very different than other agencies and that she would have to defer to Washington for a decision on that subject.

The second item had to do with BLM’s efforts to identify and implement salinity specific activities in the Colorado River Basin and to quantify past and present salinity control. Green Rossi explained that many of BLM’s programs contribute heavily to salinity and they are evaluating those programs to determine which ones produce the most salt. She is working on collecting the data and acquiring the right equipment to do the job. All of these efforts are in process.

The Advisory Council stated in its report that BLM’s salinity coordinator is critical to implementing a comprehensive BLM salinity control program and has a vital role in assisting other agencies in implementing the program. Green Rossi was not sure which agencies she was supposed to assist, but was willing to do what she could if they would contact her. She explained that she is assisting BLM field offices in their efforts to get salinity numbers and make sense of the data collected. They are drafting a five-year plan which should be completed by the end of the summer. In response to the suggestion that the salinity coordinator allocate sufficient time to accomplish her role, she responded that she already spends 50-60 hours on salinity and didn’t know how she could squeeze in any more time, given her other responsibilities. Regarding the Paradox Valley Unit EIS, Green Rossi stated that BLM’s field office will continue to support the effort. She noted that other than that, she is not involved with the PVU and contact should be made with the field office. Regarding the funding request to BLM, Green Rossi noted that the \$800,000 which has been set aside through a manager’s discretion was a holdover which BLM has chosen to use for the salinity program and which they hope to be able to increase. She reported that the past year they were able to put in over \$1.3 million and they hope to increase that amount for the coming year. She indicated that she cannot foretell what funding might be allocated to salinity, but they will continue to do their best. Overall she felt that they have come a long way in recent years. She noted that she now has two different

equations to help determine tons of salt coming from different situations, such as irrigated and non-irrigated lands. She suggested that if this model could be of use to others, she would be willing to assist in that effort.

**USGS** – Pat Lambert explained that he has a new assignment as a federal liaison with the Western States Water Council and that David Susong has taken his place as the Director of the Utah Water Science Center. They have determined that they can work together as co-representatives to the Forum and Advisory Council to make sure that USGS will be represented at the key meetings, and they will continue to assist the Work Group, the TAG and the Science Team by providing sound and timely scientific support. Lambert noted that the Advisory Council Report addressed participation by USGS in science support to the Paradox issue and also the work being done at Pah Tempe Springs. He reported that Pah Tempe discharges about the same amount of salinity load as is being diverted at Paradox. They are looking at the feasibility of diverting that load from the Virgin River, which is tributary to the Colorado River. Lambert stated that the work they have been doing at Pah Tempe Springs is wrapping up and they are prepared to assist with any future efforts pertaining to Pah Tempe. He suggested that at an upcoming meeting USGS might be allowed to summarize their work to date as it wraps up so that the Forum and Advisory Council might be aware of where they are and where they might go in the future.

**FWS** – Barb Osmundson responded on two main comments from the Advisory Council Report. She responded that FWS will continue to work with Reclamation and NRCS in terms of wildlife replacement habitat. She is trying to visit more sites and reported that wonderful things have been happening with the Grand Valley wildlife replacement project. She was able to watch as they removed a large amount of Tamarisk, and the improvement was very impressive. She noted that the Olathe Pond project had been stalled, but NRCS will pursue getting that project past the hurdles and on its way. With respect to the Paradox effort, she reported that FWS continues to participate as a partner agency and is concerned about salinity control. She stated that she continues to have concerns about migratory birds, but is watching as the NEPA process plays out.

**EPA** – Jim Luey had a brief response to the Advisory Council’s comments. He stated that EPA will continue to support the water quality standards review process, as well as the states’ subsequent adoption. They will also continue to support the important efforts at Paradox as a cooperating agency. He noted that both their NEPA and underground injection control folks are participating in that process on an active basis. Finally, he reported that EPA has agreed to maintain EPA’s salinity coordination responsibilities within the Region 8 office in Denver.

## **VI. Items from the Forum**

**Tanya Trujillo**

Tanya Trujillo reported that the Forum would like the Advisory Council to send a letter to the Regional Directors from the Upper and Lower Basins of the Bureau of Reclamation regarding recommendations for how to address some short-term management questions associated with the Lower Colorado River Basin Development Fund. She explained that these recommendations are similar to those made the previous year in terms of asking them to allocate funding appropriately to ensure meeting the cost-share requirements from the Lower Basin Fund for the continued operation of salinity control program projects. A motion was made to approve sending the letter over Chairman Robbins’ signature. The motion passed.

## **VII. Basinwide Program**

**Jacobson/Brad Parry**

Brad Parry shared a spreadsheet showing the funding status of all the open agreements in the Basinwide Program (see Appendix C). He reported that they are finishing up most everything selected in the 2012 FOA and are looking ahead to getting some very good projects through the next FOA. He cautioned that in this FOA, an entity can maintain a maximum of \$8 million at any one time of unliquidated obligations.

This will allow Reclamation to fund as many projects as they can without tying up too much money with one entity.

Parry introduced Janice Richardson, the lead grants officer in the Financial Assistance Office, and Melanie Russell, the contracting officer. He commended them for their excellent work in getting the projects taken care of in a quick and efficient manner. Richardson and Russell mentioned that they were in attendance representing James Durrant from the Acquisition Office. They explained that following some shortfalls in their acquisition processes in previous years, they implemented some new initiatives and have seen some improvement. They were interested in feedback from the group. Chairman Robbins responded by thanking them for their successful efforts in expediting the work. He noted that there will be a number of contracts in connection with the Paradox Valley that will need to be pushed through in order to keep the environmental and geotechnical work on schedule. He asked for their assistance in expediting those efforts. He added that everyone has been very pleased with their team's willingness to listen to input from representatives of the states and with the improvements that have been made to move the process forward. Jacobson added that with the new FOA, they will be selecting new projects around August with the goal of having all those agreements executed by the end of February.

### **VIII. Update from Reclamation's LC Region**

**Rich Eastland/Rick Leavitt**

Rick Leavitt, Chief of the Financial Management Office of the Lower Colorado Region, expressed appreciation for the opportunity to attend the meeting and was happy to publicly acknowledge the cooperation between the Upper and Lower Colorado Regions in managing the salinity control program. He turned the time over to Rich Eastland to give an update of hydrology from the Basin.

Eastland commented on current reservoir conditions, emphasizing the bad drought that is currently being experienced. He reported that Lake Powell is at 45 percent of capacity and Lake Mead is at 38 percent. Total basin-wide in the Colorado River system is 48 percent of capacity. As of May 4<sup>th</sup>, the inflow forecast for water year 2015 is 59 percent of average. He noted that 2000 through 2015 is the driest sixteen-year period on record. Based on a 24-month study in May, Lake Powell is projected to release 9 million acre-feet in 2015 and Lake Mead is projected to operate under normal conditions. Projections for 2016 show a drop in the release volume from at Lake Powell to 7.48 million acre-feet and Mead continuing to operate under normal conditions. Due to hydrologic uncertainty in 2015, there is a 33 percent chance of a Lower Basin shortage in 2016.

Moving on to salinity operations, Eastland reported that the annual salinity differential for calendar year 2014 was 129 ppm. It was explained that in accordance with the 1944 treaty with Mexico, the United States is required to deliver Colorado River water to the Northernly International Boundary of Mexico with a water quality differential of  $115 \pm 30$  ppm from its measurement at Imperial Dam. Eastland noted that current projections for 2015 are at 133-141 ppm. The Yuma Desalting Plant (YDP) in Arizona is used to help meet that differential. Reclamation continues to maintain the YDP in the most efficient manner possible with the funding under Title I of the Salinity Control Act. Approximately \$10 million of funding is used each year for this activity, which runs the testing laboratory, the Minute 242 well field and the bypass drain. Future operation of the YDP is under consideration as part of the drought contingency planning process.

### **IX. Rangeland Study by USDA-ARS**

**Jack Barnett/Pat Lambert/Cole Green Rossi/  
Mark Wertz/Kossi Nouwakpo**

Jack Barnett shared a little bit of history on the subject of salinity control in relation to rangeland. He explained that in the Salinity Control Program, they have come to learn how to control salt when it has to do with agricultural water being delivered in canals and pipes and applied to the land. It has become apparent that in the future they will run out of areas in which to do that agricultural improvement and hence,

run out of an opportunity for salinity control in irrigated agriculture, at least to the scale that it has been done in the past. There was a concern about where to go next. It is recognized that a large amount of salt enters the Colorado River system from the vast areas of rangeland, many of which are managed by the BLM. Some time ago, the Science Team advised the Work Group that some funds should be spent to try to better understand what's occurring "across the fence," meaning out of the fields and over into the rangeland. A few years ago, a bold decision was made to actually step "over the fence" when the Utah Department of Agriculture proposed performing some experiments on Mancos Shale lands in Emery County that might give insight as to how salt moves off the Mancos Shale and into the river system. That study was authorized, which began additional investigations in this area. Barnett referred to Forum Memo 2015-30 which gives further information and details the funding path for studies of this nature (see Appendix D).

Barnett explained that the Agricultural Research Service (ARS) with the help of BLM did a worldwide search of all literature that described mobilization of salts on these kinds of lands. This was a massive effort resulting in a 364-page bibliographic publication summarizing 981 reports that were deemed to have merit. A second publication resulted from this effort which explained the research and what might be learned from it. These studies were funded by ARS and BLM without any contribution from Basin States funds. The expected and disturbing results of these efforts were that we just don't know how to control salinity off of rangelands.

A six-phase study effort by USGS was recommended using Basin States funds. Those studies have been finalized and reports are being prepared. In addition, Basin States funds were used on field investigations of artificial rain events on small tracts of Mancos Shale done by ARS. Barnett indicated that the Advisory Council will be asked to consider a request for an additional \$79,173 for this effort, bringing the total Basin States funds contribution for rangeland efforts to \$914,400.

Pat Lambert explained that the first two phases of the six-phase study referred to by Barnett were actually the literature search and the summation done by ARS. Information from these studies was incorporated into several other tasks done by the USGS. One was to take the characteristics and the drivers that influence loading from rangeland identified in the literature search and see if they could be quantified in the Geographic Information System (GIS). On top of that would be to test those characteristics and drivers in the existing SPARROW Model to see if that type of an assessment would tease out the statistical significance, or the importance of what the literature said was critical to the transport and fate of load from rangelands. An additional phase was to take a look at the concept underlying a lot of that literature indicating that erosion equals salinity load. USGS would look at actual data that correlated suspended load to dissolved load. Lambert indicated that there was not time to present the details of these efforts, but they were wrapping up.

Lambert also noted the gaps that were identified in the literature research and summary. He suggested that the rainfall simulation studies being done by ARS might fill those data gaps. The reason why they haven't paid much attention to rangeland in the past was because it is much harder to collect data over a vast area where you have to depend on rainfall rather than a small focused irrigated area where you can control the elements and easily measure loads. So the idea is to begin to fill those gaps and determine if you can incorporate the data collected into usable tools that you could pose questions to. The strategy is to take experimental data that is coming out of the tests and look at ways to scale it up into sub-watershed models to begin to answer questions such as: What is the connectivity between locations that are being rained on and salts being dissolved and mobilized? What does that mean to the eventual fate of that load? Does it reach a stream? When does it reach a stream? How does it reach a stream? The hope is to eventually have enough reliable information to allow for modifications in land use that would contribute to salinity control on rangelands.

The Advisory Council then took a short break.

Cole Green Rossi began by explaining how the rainfall simulation team was organized and their efforts to get accurate and reliable data from their experiments. Dr. Mark Weltz shared a PowerPoint regarding their work on estimating water quality from saline rangelands (see Appendix E). He noted that about 55 percent of salts come from rangelands and their research program is being conducted to try and quantify that and see if they can actually provide corrective measures to reduce that load. They are using a rainfall simulator in ground-based experiments to measure the amount of salt that is transported out in surface water. That data is being provided to USGS which is working together with ARS in an effort to build a model that could be used within the Basin. They could then use the model to answer questions about the effect of different practices on salt levels and the costs associated with those measures. He explained how the rainfall simulator worked and how it could mimic any rainfall pattern that occurs in the Basin. They have conducted experiments at two sites in Utah, one near Price and one near Ferron. They simulate different intensities of storms and determine how much salt comes off from each type of rainstorm. They measure many things such as volume, intensity, flow paths and formations, and for the first time, they are measuring sediment deposition. Weltz credited Dr. Kossi Nouwakpo with developing several new devices that allow for more detailed and accurate measurements. The information is now computerized, so it is very fast and efficient. He showed some of the results from their experiments of the previous year in these two areas. He explained that the secret of what they have found to date is that sediment concentration from these two unique geologic formations is highly related to total dissolved solids. Weltz emphasized that they couldn't depend on the information collected from these two sites to be standard for the entire Basin. He proposed that they study additional sites with different types of soil chemistry to improve the information and be more comfortable in moving ahead with a model. Weltz turned the time to Nouwakpo to explain his state-of-the-art instrumentality which has been very valuable in their studies.

Nouwakpo explained that he had done laboratory work on a technology called "structure from motion" which essentially involved taking pictures and reconstructing a 3D surface. When he was asked by Weltz to participate in these rainstorm simulation experiments, he was interested in how this instrument could be used out of the laboratory to come to understand sediment transport processes. They fitted the simulator with a camera and took a series of pictures which showed in high resolution the surface condition before the event and the surface condition after the event. They can then use image methodologies on those data to begin to answer some of the sediment transport questions. The idea is if we can tie sediments to salt, we can then better understand these surface processes and develop mitigation strategies to reduce salinity.

Weltz explained that from the two sites they ran the previous year, they could estimate hydrology pretty well, but with the additional work they plan to do over the summer, they should be able to come to understand erosion relationships better and how the amount and spatial location of vegetation alters salt loading. They expect that when they are done, their model will be able to determine how much salt is coming off a certain site and the amount of salt reduction that will result from certain practices they might implement on that land. Weltz reported that this summer they will do additional work in the Ferron, Moab, and Huntington areas and an additional area. In 2016 they will work in two areas in Colorado, one north of Grand Junction and another by Montrose. Weltz reviewed the funding for their work from several different sources. He noted that the University of Nevada has graciously agreed to work with the money from the Basin States funds at zero overhead. He also explained that the work being done has attracted the interest of many in the United States and around the world.

**X. Public Comment** – As there was no public comment, the Advisory Council recessed their meeting until the following day.

**Reconvene Meeting:**

**Thursday, May 21, 2015, 8:35 a.m.**

**XI. Basin States Program**

**XI.a. Update on Grand Valley Wildlife Project**

**Jim Currier**

Jim Currier reported that a couple of years earlier, the Basin States Program agreed to fund a wildlife project that NRCS Colorado was not able to fund through EQIP in the amount of \$804,000. This project is on Colorado Parks and Wildlife land and consists of about 490 acres. It was especially important as it provided replacement acres of wildlife habitat needed for the Grand Valley salinity control project. Currier reported that the funding was in place and about 80 percent of the project had been completed. The project consisted mainly of Tamarisk and Russian Olive control on the Colorado River front at five different locations. The plant removal has been completed and they are currently trying to determine exactly how much was treated for a final calculation. All that is remaining is some noxious weed control and policing of the area to make sure there is no regrowth of the offensive plants. They expect to be able to make a payment on that soon which would total \$770,000. There was a question about whether there has been an estimate of the impact of water in the river as a result of the project. It was suggested that this may be difficult and expensive to determine. Chairman Robbins mentioned that you could probably use what is known about the consumptive use of these types of plants on an annual basis and come up with a pretty good estimate. He asked Currier to look at doing this.

**XI.b. Program Status**

**Marcie Bainson**

Marcie Bainson reported that contracting has improved. They have been able to get a new agreement in place with NRCS Colorado and NRCS Wyoming in the past year. She commended Mark Quilter and Jim Currier for being ahead of schedule with their projects in Utah and Colorado. They have obligated almost all of the funding on the Colorado agreement. As they will basically be done with all their projects, the FOA timing is crucial in providing new projects for the states. Bainson noted that she had all the packages in for the SIR projects and they are ready to go. She also has all the PR packages in for the first quarter of FY2016 which will allow the states and NRCS to have their funding the first quarter and keep things moving along.

**XI.c. Basin Funds Status and Accounting**

**Parry/Eastland**

Brad Parry shared a spreadsheet showing the cash balance for the Lower Colorado River Basin Development Fund (LCRBDF) as of April 2015 (see Appendix F). The LCRBDF had a cash balance at the end of the year of \$11.4 million. So far in FY 2015, \$9.2 million has been transferred to the UC Region, and, at this time, does not anticipate much more being transferred, if any. Parry noted that included in that transferred figure is the anticipated additional appropriations of 15 percent for Paradox and the Basinwide Program. From the numbers he is getting, it appears that the cash balance at the end of FY 2015 will be very similar to the previous year.

**XI.d. Contracts with Federal and State Agencies**

**Parry**

Parry noted that Bainson had reported that she is working with Currier to expedite Colorado's agreement. Agreements are current with all states, except Wyoming, and that should be finalized within the month. This is the first time since 2008 that the NRCS in all three states is under agreement. They have done very good work and are moving things right along. Parry explained that things are going well with the FOA and they are encouraging those who are submitting applications to review them with the contact person in their particular state so that things can run smoothly and they will have a better chance of being approved.

**XI.e. Accounting of Past Studies, Investigations and Research (SIR)**

**Parry**

Parry noted that the master spreadsheet for SIR projects is available on the Forum’s website. He reported that every SIR project up through 2013 is complete. As reports come in, links to the reports will be added to the spreadsheet on the website. He noted that they will be adding the Lower Gunnison and Uinta Basin studies into the SIR spreadsheet so they can be accessed. He wondered if we should add the salinity coordinators for those basins to the SIR items as they are on two-year contracts that can be renewed. This idea was agreed upon by the Council.

**XI.f. Technical Advisory Group (TAG) BSP Funding Recommendations**

**Patrick Dent/Lambert**

Patrick Dent spoke about cost share dollars that are earned for NRCS technical assistance (TA) which go into the Basin States Program. He noted that there has been kind of a breakdown over the years on how those dollars have been allocated out within the Program for funding. He stated that they intend to continue to follow those breakdowns for implementation, which are 40-50 percent for SIR projects and the remainder at 50-60 percent, depending on whether or not wildlife is included for implementation. As was discussed the previous day in connection with short-term recommendations for management of the LCRBDF, this is the part that gets affected a little bit, so the percentages actually used for funding have been reduced somewhat. He proposed that we continue to use the cost share earned on the NRCS TA and continue funding projects in that manner.

Dent reported that the Science Team met in January with proposals from the coordinators to look at implementation of science studies for the coming year. Those recommendations were reviewed by the TAG, and they came up with a list of seven projects that they would recommend for funding. Lambert reviewed those projects briefly. Some of these proposals would leverage funds from other work and dovetail with projects coming out of other programs. Patrick followed up by recommending funding all of these projects at a total cost of \$661,000.

**XI.g. Recommendations of the AC**

**Robbins**

Chairman Robbins suggested that the Advisory Council authorize the preparation of a memorandum to Reclamation recommending funding of these SIR projects in the amount of \$661,000. A motion was made to that effect and the motion was approved by the Advisory Council.

**XI.h. Lower Gunnison Basin Coordinator**

**Jacobson/Currier**

Jacobson reviewed the events leading up to studies that were done in the Lower Gunnison and Uinta Basins. One of the main recommendations that resulted from these studies was that they felt a salinity coordinator would be helpful in each one of these basins. The coordinators would be familiar with the federal agencies and the programs available, and they could work with the irrigation companies and others in taking advantage of programs that would improve their practices and reduce salinity.

Jim Currier reported that they had hired Beth Karberg to act as the salinity coordinator in the Lower Gunnison area in Colorado. He noted that Karberg is well qualified to fill this role. She has a Master’s Degree in Civil Engineering Water Resources and previously served as the District Manager for the Delta Conservation District. Karberg is a local person who is very familiar with the area. She understands irrigation systems and has had experience with the federal programs. Currier noted that they are very happy to have her on board and that she has already made contact with numerous irrigation groups and is moving ahead in her new role.

## **XI.i. Uinta Basin Coordinator**

**Quilter**

Mark Quilter indicated that they are very pleased with Brett Prevedel who was chosen to be the salinity coordinator in the Uinta Basin in Utah. Prevedel previously worked with NRCS and was the District Conservationist in that area. Prevedel has been involved with the studies from the beginning and is already doing amazing things as coordinator. He has visited many canal companies and reports that several of them are submitting FOA requests, possibly including some of the tribes. Quilter noted that Prevedel was instrumental in getting two canal companies, which have long been in competition with each other, to recognize that they need to work together in order to move forward. They have joined together on one proposal for the FOA. The work is going well under his direction.

## **XII. Funding Reclamation's Salinity Control Program**

**Brent Rhees**

Chairman Robbins noted that Brent Rhees was not available to report at this time, so he finished up the rest of the agenda items for the Advisory Council and recessed until Rhees was able to join the group during the Forum meeting, at which time the Council was reconvened for his report, which is included here.

Brent Rhees reported that he had been selected as the new Regional Director for the Upper Colorado Region, taking the place of Larry Walkoviak who had retired. He noted that Daniel Picard had been selected as a Deputy Regional Director and they are working on filling the position of the second deputy. Rhees explained that he had long been a supporter and advocate of the salinity program and intends to continue that support. He mentioned that there was a bump-up in the President's budget that was submitted, which was a step in the right direction. They would like to see that number increased in the future. He noted the competition that exists within the federal government and within Reclamation for funding dollars for many programs, but stated that they have placed a priority on the salinity program. Regarding Paradox, Rhees commented that since the operations have changed, the pressures have been better and have not experienced the spikes they previously had, but he recognized that the problems are not solved. They are interested in continuing on with the EIS, and he expressed that they were committed to stay on schedule. He also noted their interest in continuing to analyze the evaporation pond alternative. Chairman Robbins expressed his appreciation to Rhees for his leadership and his willingness to support this very important effort and keep things moving on time.

Rhees mentioned the trip to Washington, D.C. where Barnett and Trujillo had met with Reclamation folks and noted that he had received an action item out of that visit. He was assigned to get together with the appropriate people from FWS and talk things out so they would have a clearer understanding of what the needs and issues are with regard to ponds. He did appreciate the feedback he received from that meeting wherein appreciation was expressed for the efforts of Reclamation in support of the program, and particularly regarding the efforts they have made to improve the acquisition process. He is hopeful that the difficulties they experienced three years earlier are behind them.

Chairman Robbins informed Rhees of the discussion held the previous day with members from the acquisition department wherein he emphasized the importance of getting the contracts connected to the Paradox Valley pushed through in a timely manner in order to keep the environmental and geotechnical work on schedule. Rhees agreed that he would support that request.

**XIII. Items for the Forum**

**Robbins**

There were no items that the Advisory Council needed to take to the Forum at this time. Also, there were no additional items to be discussed or any public comment.

The Council was then recessed until they could receive their report from Brent Rhees, and then adjourned following his report.

**XIV. Additional Items**

**Robbins**

There were no additional items.

**XV. Public Comment**

**Robbins**

There was no public comment.

**XVI. Other Business/Actions**

**Robbins**

There were no other business or actions.

Chairman Robbins adjourned the meeting.

## Advisory Council Meeting

Utah State Capitol Building  
Senate Room 210, 350 North State Street  
Salt Lake City, Utah  
May 20-21, 2015

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20	Dave Kanar	CRW	970 945 8522	dkanar@crwd.org
21	Donna Keeler	Forum	801-292-4663	dkeeler@barnettwater.com
22	Abigail Baudewyns	WY AG	307-777-3442	abigail.baudewyns@wyo.gov
23	Brenna Mefford	WY SEO	307-777-6151	brenna.mefford@wyo.gov
24	Lindia Liu	CRB CA	818 500 1625	lliu@crb.ca.gov
25	Jim Currier	CSCB CO	9702424511	jim.currier@state.co.us
26	Barb Osmundson	USFWS	970628-7189	Barb-Osmundson@FWS.gov
27	WARREN TRUKETT	NV	702 994 6068	wtrukett@crs.nv.gov
28	Harry Ruzgerian	MWDSC	213 217 6082	hruzgerian@MWDH20.com
29	RICH EASTLAND	USBR	702 293 8457	REASTLAND@USBR.GOV
30	Rick LEAVITT	USBR	702 293 8457	RLEAVITT@USBR.GOV
31	Ed WHICKER	NRCS	435-722-4621	ed.whicker@ut.usda.gov
32	Mary Schwader	NRCS	307-233-6757	mary.schwader@usda.gov
33	Travis James	NRCS	801-524-3831	tjames@usbr.gov
34	Patricia Lambert	USGS <sup>801 755 4105</sup>	<del>801 524 7254</del>	plambert@usgs.gov
35	Dave Brown	NRCS	801-524-4551	on file
36	Jim Luey	EPA	303-312-6791	luey.jim@epa.gov
37	DAVID SUSOWG	USGS UT	801-908-5062	dol.susowg@usgs.gov

Appendix A

	Name	Entity	Phone Number	E-mail Address
38	Deanna Ikaya	ADWR	602-771-8531	dkikaya@azwater.gov
39	Cissy Collins	SNWA	702-862-3798	Cissy.Collins@snwa.com
40	Lindsay Patterson	WDEQ	307-777-7079	Lindsay.Patterson@wyo.gov
41	MICHAEL THOMAS	WDEQ	(910) 964-3142	Michael.Thomas@wyo.gov
42	Keenan Hendon	WVDO	307-777-7626	Keenan.Hendon@wyo.gov
43	MARIE BAINSON	BOR	801-524-3747	mbainson@usbr.gov
44	Cole Green	BLM	801-538-4028	ccrossi@blm.gov
45	Ben Radcliffe	BOR	801-379-1213	bradcliffe@usbr.gov
46	Mark Quilter	UDAF	801-538-9905	mquilter@utah.gov
47	Robert Hougaard	UDAF	801-538-7180	rhougaard@utah.gov
48	John Barnett	FORUM	801-292-4662	jbarnett@barnettwater.com
49	Jim Hensley	WVREGIONS	602-679-0004	jhensley1@com.net
50	DON BARNETT	FORUM	801-292-4663	dbarnett@barnettwater.com
51	BRAD PARRY	BOR	801-524-3723	bjparry@usbr.gov
52	Steve Miller	CWRB	303-866-3441	Steve.Miller@state.co.us
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**AGENDA**  
**COLORADO RIVER BASIN SALINITY CONTROL ADVISORY COUNCIL**

Wallace F. Bennett Federal Building  
Room 5102  
125 South State Street  
Salt Lake City, Utah

**Advisory Council beginning time:** **Wednesday, May 20, 2015, 1:00 p.m.**

**Designated Federal Officer:** Kib Jacobson

**Presiding:** Chairman Dave Robbins

- |       |   |   |
|-------|---|---|
| I.    | Welcome and Introductions   | Robbins                                   |
| II.   | Opening Comments, Acceptance of letters appointing substitute members | Jacobson                                  |
| III.  | Review and approval of proposed Agenda                                | Robbins                                   |
| IV.   | Draft Minutes of 2014 Fall Council Meeting – Santa Fe NM              |   |
|       | a. Review   | Jacobson                                  |
|       | b. Action   | Robbins                                   |
| V.    | Report on the responses to the Advisory Council report                | Robbins                                   |
|       | a. USDA-NRCS  |   |
|       | b. Reclamation  |   |
|       | c. BLM  |   |
|       | d. USGS   |   |
|       | e. FWS  |   |
|       | f. EPA  |   |
| VI.   | Items from the Forum  | Tanya Trujillo                            |
| VII.  | Basinwide Program   | Jacobson/Brad Parry/James Durrant         |
|       | a. Agreements status  |   |
| VIII. | Update from Reclamation’s LC Region                                   | Rich Eastland/Rick Leavitt                |
| IX.   | Rangeland Study by USDA-ARS   |   |
|       | a. Science Team Perspective   | Jack Barnett/Pat Lambert/Cole Green Rossi |
|       | b. Update on Study  | Mark Weltz                                |
| X.    | Public Comment  | Robbins                                   |

**Recess Meeting:** **Approximately 4:30 p.m.**

Agenda Continued on Next Page

**Reconvene Meeting:**

**Thursday, May 21, 2015, 8:30 a.m.**

- XI. Basin States Program (BSP)
  - a. Update on Grand Valley Wildlife Project Jim Currier
  - b. Program status Jacobson/Parry
  - c. Basin Funds status and accounting Parry/Eastland
  - d. Contracts w/ Federal and State agencies Parry
  - e. Accounting of past Studies, Investigations, and Research (SIR) Parry
  
  - f. Technical Advisory Group (TAG) BSP Funding Recommendations
    - i. Continuing Recommendations Patrick Dent
    - ii. Studies, Investigations, and Research (SIR) Lambert/Dent
  
  - g. Recommendations of the AC
    - i. On items i and ii above Robbins
  
  - h. Lower Gunnison Basin Coordinator Jacobson/Currier
  - i. Uinta Basin Coordinator Jacobson/Quilter
- XII. Funding Reclamation's Salinity Control Program Brent Rhees
- XIII. Items for Forum Robbins
- XIV. Additional Items Robbins
- XV. Public Comment Robbins
- XVI. Other Business/Actions Robbins

**Adjourn Meeting:**

**Approximately 10:30 a.m.**

Date as of 10/9/2015

Basinwide Program		Date as of		10/9/2015		FY 2015		FY 2016		FY 2017	
Contract Name	End Date	Contract Amount	Obligated to Date	Balance To Obligate	Expended to Date	Balance to Expend	Appropriations & Cost Share + 15% End of year	Appropriations & Cost Share + 15% End of year			
Farson/Eden Pipeline Pjct	12/31/2015	\$ 6,453,072	\$ 6,219,417	\$ 233,655	\$ 5,969,189	\$ 250,228	\$ 300,000	\$ -			
Grand Valley - Canal Improvement (A) 2010	9/30/2015	\$ 2,819,228	\$ 2,420,000	\$ 399,228	\$ 2,419,545	\$ 455	\$ -	\$ 399,228			
UVWUA East Side Laterals Project Phase 8	5/30/2017	\$ 3,542,157	\$ 1,795,000	\$ 1,747,157	\$ 422,666	\$ 1,372,334	\$ 1,200,000	\$ 1,747,157			
Minnesota Canal Piping Project Phase II	9/30/2015	\$ 3,028,762	\$ 3,028,762	\$ -	\$ 2,895,660	\$ 133,102	\$ 928,762				
Slack/Patterson Laterals Piping Project - R-Mesa	1/22/1900	\$ 3,324,849	\$ 3,324,849	\$ -	\$ 2,950,123	\$ 374,726	\$ 1,296,516				
Cattelman's - Cedar Canyon, Iron Springs	9/30/2016	\$ 2,007,225	\$ 1,272,644	\$ 734,581	\$ 130,993	\$ 1,141,651	\$ 1,000,000	\$ 734,581			
GVIC Canal Improvement 2012	9/30/2017	\$ 4,581,825	\$ 1,570,000	\$ 3,011,825	\$ 191,270	\$ 523,549	\$ 1,170,000	\$ 1,880,000	\$ 1,131,825		
Austin/Wall Off-Farm Irrigation Project	12/31/2015	\$ 1,350,000	\$ 1,350,000	\$ -	\$ 156,151	\$ 1,193,849	\$ 300,000				
Blue Cut/ Mammoth Unit	9/30/2016	\$ 5,500,000	\$ 3,016,667	\$ 2,483,333	\$ 2,736,783	\$ 279,884	\$ 1,528,735	\$ 2,121,265			
South Valley Lateral Salinity Project - Sheep Creek	9/30/2016	\$ 4,026,265	\$ 3,071,667	\$ 954,598	\$ 3,071,667	\$ -	\$ 2,021,265				
Huntington Cleveland Project Continuation	3/31/2015	\$ 1,109,913	\$ 216,293	\$ 893,620	\$ 56,655	\$ 159,638	\$ 216,293	\$ -			
		\$ 37,743,296	\$ 27,285,299	\$ 10,457,997	\$ 21,000,702	\$ 5,429,415	\$ 9,961,571	\$ 6,882,231	\$ 1,131,825		
Uncompahgre Eastside Lateral Phase 7 - BASIN STATES PROGRAM	12/31/2015	\$ 3,183,983	\$ 3,183,983	\$ -	\$ 2,156,088	\$ 1,027,895	\$ 1,383,983				
<b>Projects that are fully obligated</b>											
Huntington Cleveland Irrig Co.	12/31/2015	\$ 22,006,423	\$ 22,006,423	\$ -	\$ 22,006,423	\$ -					
Minnesota Ditch Project 1	9/30/2015	\$ 3,943,272	\$ 3,943,272	\$ -	\$ 3,943,272	\$ -					
Cottonwood Creek Project 1	12/31/2015	\$ 6,509,548	\$ 6,509,548	\$ -	\$ 6,509,548	\$ -					
Uncompahgre Eastside Lateral Phase 5	12/31/2015	\$ 4,318,122	\$ 4,318,122	\$ -	\$ 4,318,122	\$ -					
Lower Stewart Pipeline Project	9/30/2015	\$ 6,000,000	\$ 6,000,000	\$ -	\$ 5,779,927	\$ 220,073					
"C" Ditch/Needle Rock Project	9/30/2015	\$ 1,434,885	\$ 1,434,885	\$ -	\$ 1,430,074	\$ 4,811					
Crawford Clipper Irrigation Project	9/30/2015	\$ 1,214,140	\$ 1,214,140	\$ -	\$ 1,133,764	\$ 80,376					
<b>CONTRACT COSTS</b>							\$ 9,961,571	\$ 6,882,231			
<b>NON-CONTRACT COSTS</b>							\$ 480,000	\$ 600,000			
<b>TOTAL OPEN AGREEMENTS</b>		\$ 86,353,669	\$ 75,895,672	\$ 10,457,997	\$ 68,277,920	\$ 6,762,570	\$ 10,441,571	\$ 7,482,231			
Appropriations S10							\$ 6,360,000	\$ 8,162,000			
Cost Share X10							\$ 2,725,714	\$ 3,498,000			
Recoveries S10											
Recoveries X10											
Additional Appropriations S10							\$ 954,000	\$ 1,224,300			
Additional Cost Share X10							\$ 408,857	\$ 541,479			
<b>TOTAL</b>							\$ 10,448,571	\$ 13,425,779			
<b>Appropriations/Cost Share Totals</b>							\$ 10,448,571	\$ 13,425,779	\$ -		
<b>Contract/Non Contract Totals</b>							\$ 10,441,571	\$ 7,482,231	\$ -		
<b>Carry Over</b>							\$ 7,000	\$ 5,943,548	\$ -		



# Colorado River Basin SALINITY CONTROL FORUM

## GOVERNORS

Doug Ducey, AZ  
Jerry Brown, CA  
John Hickenlooper, CO  
Brian Sandoval, NV  
Susana Martinez, NM  
Gary R. Herbert, UT  
Matthew H. Mead, WY

## MEMORANDUM 2015-30

**TO: Forum Members**

**FROM: Jack A. Barnett**

**SUBJECT: Investigations Relative to Salt Mobilization and Transport on Rangelands**

**DATE: May 8, 2015**

## FORUM MEMBERS

### Arizona

Thomas Buschatzke  
Larry R. Dozier  
Linda Taunt

### California

Bill Hasencamp  
Thomas Howard  
Tanya Trujillo

### Colorado

James Eklund  
Pat Pfaltzgraff  
David W. Robbins

### Nevada

Leo M. Drozdoff  
John J. Entsminger  
Jayne Harkins

### New Mexico

Scott A. Verhines

### Utah

Leah Ann Lamb  
Eric Millis  
Gawain Snow

### Wyoming

Dan S. Budd  
Patrick T. Tyrrell  
David Waterstreet

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At the upcoming Salt Lake City meetings efforts to better understand how salt moves to the Colorado River from rangeland will be discussed. More funding by the Basin States Program will be proposed. Hence, it was felt that a review of past efforts and funding, accomplishments and proposed future efforts would be helpful. This effort has a long and sometimes confusing history. Now there is some real progress to be reported.

The 1971 EPA report identified that more than 60 percent of the salt load of the Colorado River comes from natural sources. Most of these natural sources are located on federally administered lands. Therefore, the 1974 Salinity Control Act identified that because most of the salt load of the Colorado River came from federally administered lands, initially 75 percent (subsequently amended to 70 percent) of the cost of the Salinity Control Program would be borne by the federal government. Congress directed the Secretary of the Interior in the 1984 amendments to the Act to develop a comprehensive program for reducing the salt load to the Colorado River from BLM administered lands.

The focus of the Colorado River salinity program over the years has been to reduce the salt load from irrigated lands. This is due in large part to the more concentrated nature of the salts on the irrigated lands and the fact that we knew how to implement corrective actions. However, we have long known that there will be a time when we will begin to run out of irrigated lands to treat. The program may then move to the vast rangelands within the Colorado River Basin. We have sometimes referred to this as our need to “move beyond the fence and out into the rangelands.”

## EXECUTIVE DIRECTOR

Don A. Barnett

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Bountiful, UT 84010  
(801) 292-4663  
dbarnett@barnettwater.com  
www.coloradoriversalinity.org

Determining how salt moves from rangelands to the Colorado River and how that salt loading can be reduced is a difficult task. With the support of the Science Team and the Work Group, the Forum and the Advisory Council first took the bold step “over the fence” and urged Reclamation to enter into a contract with the Utah Department of Ag and Foods (UDAF) to do on-site experiments on the Mancos Shale in Emery County Utah.

Brad, Marcie and Travis have been most helpful in advising me so that I could prepare this somewhat historic account of the rangeland efforts to date. Attached you will find a spreadsheet that lists all the commitments for this over-the-fence look using Basin funds. At the top of the spreadsheet you will find UDAF efforts. They quickly learned that understanding how the Mancos Shale responded with respect to runoff caused by precipitation was a very complex issue. After some field attempts to gain some understanding, UDAF recommended that its contract be terminated and that Basin States funds could be better spent on a different approach. This explains the line item which shows \$502,619 authorized, \$161,390 expended and \$341,229 de-obligated.

A half dozen years ago the Work Group and the Science Team began to talk more seriously about the need to better understand the processes of salt mobilization on rangelands. This led to somewhat of an informal committee of Kib, Heidi, Travis and myself looking at the issues. This ultimately led to NRCS facilitating a meeting of experts in Salt Lake City. Going into the meeting, some felt that the assembled experts would be able to point to past efforts that had addressed rangeland salt loading and identify gaps where more research or study may be helpful. A thought was that at the close of this meeting a concise work plan could be agreed upon and then an effort would go forward to employ a consultant with expertise in this area to study the subject and prepare a meaningful report.

This was not the outcome. All agreed that very little was known and more fact finding was needed. It was agreed that ARS and the USGS were best suited to advance this effort. The ARS effort was to 1) undertake a massive literature search, 2) report the findings of the literature search, and 3) move some of its rain simulation efforts to the Colorado River drainage.

ARS efforts 1 and 2 referred to in the preceding paragraph all involved non-field studies. These two efforts received no Basin States funding, although they were linked to the funding and work effort for efforts 3-6 as shown on the spreadsheet. Effort 1 was a massive literature search. Many contributed, but staff at ARS took the lead. A leader for ARS was Mark Weltz. Cole Rossi was heavily involved and BLM contributed funding to this effort. Much credit must go to the National Agricultural Library staff that USDA employs in Beltsville, Maryland. Members of the Work Group also contributed time in reviewing documents and writing summaries.

Reports concerning hundreds of studies were reviewed. The product of this effort is a 364-page document in which 981 studies and the associated reports were reviewed and a summary was prepared. This report is titled *Salinity Mobilization and Transport: Hydrologic and Aeolian Processes and Remediation Techniques for Rangelands, A Selected Bibliography*. The publication of this huge annotated bibliography is a major accomplishment and was most important as the salinity control investigators look “over the fence.” The Forum has a copy of this report which will be brought to the upcoming Forum meeting and discussed.

Effort 2 of the ARS study effort was to look at the bibliography and report what might be learned from it and also to report what has not been investigated. The report for Phase II has been published. It is titled *Salinity Mobilization and Transport from Rangelands: Assessment, Recommendations, and Knowledge Gaps*. It is a joint publication by ARS and BLM, and Mark Weltz and Colleen Rossi are among the authors. The Forum has a copy of this 61-page report and it will be brought to the Forum meetings and discussed. Weltz and Rossi will be at the Forum meetings and they will be helpful in our understanding of Efforts 1 and 2. I have reached the conclusion that a major finding of these efforts is that when we move over the fence and onto landscapes, the likes of those carved into Mancos Shale, we need to be prepared to do pioneer work.

The second entry on the attached spreadsheet concerns a six-phase study effort to be accomplished by the USGS. The contract was signed by David Anning whom some will remember as the lead investigator of the effort that led to the creation of the original Southwest Sparrow Model. You will note from the attachment that all \$231,397 of the Basin States funds authorized have been expended. Studies are being finalized, draft reports prepared and some reports printed. Time will not allow for the USGS to report on the results of these six phases of the study at this Forum meeting. Pat Lambert will be in attendance to give some general comments and answer questions that Forum members may have.

With the recommendation of the Advisory Council, Reclamation did step “over the fence” and contributed Basin States funds to field investigations on the Mancos Shale. This authorized field work, identified as ARS Effort 3, focuses on the creation of artificial rain events on small tracts of Mancos Shale and observing the inducted runoff. This effort is led by Mark Weltz. Mark will make a presentation to the Forum describing his efforts. The Advisory Council recommended to Reclamation initially that \$300,000 of Basin States funds be used to further this field investigation effort in the Colorado River Basin. At the Santa Fe meeting the Advisory Council recommended that an additional \$142,440 be added to this ARS effort. After further consultation with Weltz and Rossi, the Science Team has recommended that the Work Group, the Forum and the Advisory Council consider supporting an additional \$79,173 of Basin States funding for this ARS effort. This last funding would allow ARS to simulate rain on selected sites where vegetation cover will in part deflect the energy from the dropping water before it impacts the ground.

In summary, thus far the Forum and the Advisory Council boldly recommended original research “over the fence” by UDAF and \$161,390 were expended. The Forum and the Advisory Council recommended that \$231,397 be expended by the USGS to “look over the fence” using information gained by the ARS literature search. The Forum and the Council also recommended a major step “over the fence” to support rain simulation studies in the amount of \$442,440 and will be considering a request to add \$79,173. This would bring the total Basin States funds rangeland investigative efforts to \$914,400.

Attachment

cc: Work Group, Federal Salinity Coordinators, Larisa Ford, Mark Weltz

Agreement	Recieipient	Amount from Basin States Fund	Expended	Deobligated	Year Approved	Deliverable
UDAF - R09AP40021 Carbon County Rangeland Salinity Redution Project	UDAF	\$ 502,619	\$ 161,390.00	\$ 341,229.00	FY 2009	None - Agreement Canceled
Effects of Rangeland Conditions on Salinity Loading - R13PG40047 Six Phase Study, ARS/USGS	USGS/ARS			N/A	FY 2012	Phase 1 - Literature Search Phase 2 - Bibliography Phase 3 - GIS reconnaissance Phase 4 - Sparrow Model Review Phase 5 - Díssolved solids/suspended sediment relation analysis Phase 6 - Documentation of Results
		\$ 3,597	\$ 3,597			
		\$ 38,500	\$ 38,500			
		\$ 46,400	\$ 46,400			
		\$ 40,400	\$ 40,400			
		\$ 102,500	\$ 102,500			
	total	\$ 231,397	\$ 231,397			
Rangeland Salinity Mobilization and Transport R13PG40038	ARS	\$ 300,000	\$ 119,339	N/A	FY 2013	Eight interim products resulting in final analysis and report
Modification 1		\$ 142,440	\$ -	N/A	FY 2015	Two additional Field Sites and testing
Modification 2		\$ 79,173	\$ -	N/A	FY 2015	Additional data from vegetated sites
	total	\$ 521,613				
Rangeland Projects Current Under Contract		\$ 753,010				



# Estimating Water Quality from Saline Rangelands



# Salinity Research Team

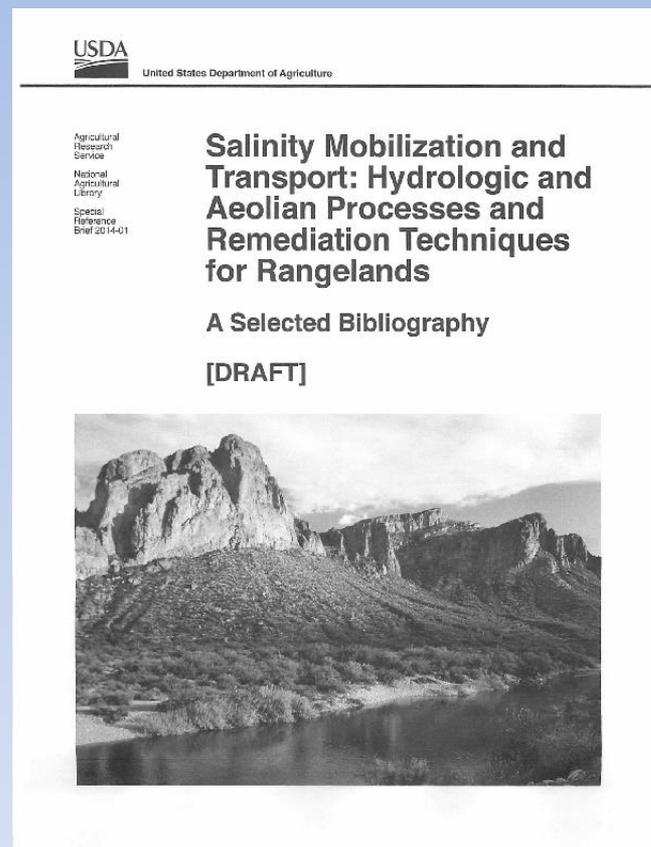
- Dr. Mark Weltz            USDA ARS, Rangeland Hydrologist
- Dr. Kossi Nouwakpo    Univ. Nevada Reno, Soil Scientist
- Dr. Ken McGwire        Desert Research Institute, Physical Scientist
- Dr. Colleen Rossi        DOI BLM, Soil Chemist





# Background

- ***Worldwide Literature review and synthesis of knowledge.*** The primary objective of this phase was to compile a body of easily accessible knowledge learned from past studies on the sources and transport of dissolved solids to streams in rangelands around the world.



Limited number of hard copies are now available from ARS.

<http://wqic.nal.usda.gov/draft-salinity-mobilization-and-transport-hydrologic-and-aeolian-processes-and-remediation>

# Knowledge gap

- Rainfall-driven process of salt mobilization and transport from saline rangeland
- Nature of Salinity / Sodicity – Erodibility relationships
- Effect of vegetation on transport processes
- Effect of vegetation on deposition processes
- Process-based erosion equations for sediment and salt transport

# Project Goal

Develop technology to assess rangeland ecological sites potential to deliver total dissolved solids (salts) to the Upper Colorado River Basin.

Ferron, Utah experimental site



# Objectives

- Quantify rainfall-driven transport of soil and dissolved solids from saline rangelands
- Develop salinity-dependent erosion equations for use in process-based models (e.g., RHEM)
- Improve understanding of sediment/salt transport processes (e.g., deposition, concentrated flow erosion) as they are affected by biotic and abiotic factors

# Approach

- Use rainfall simulation techniques to quantify salt transport processes on upland rangeland hillslopes in Upper Colorado River Basin

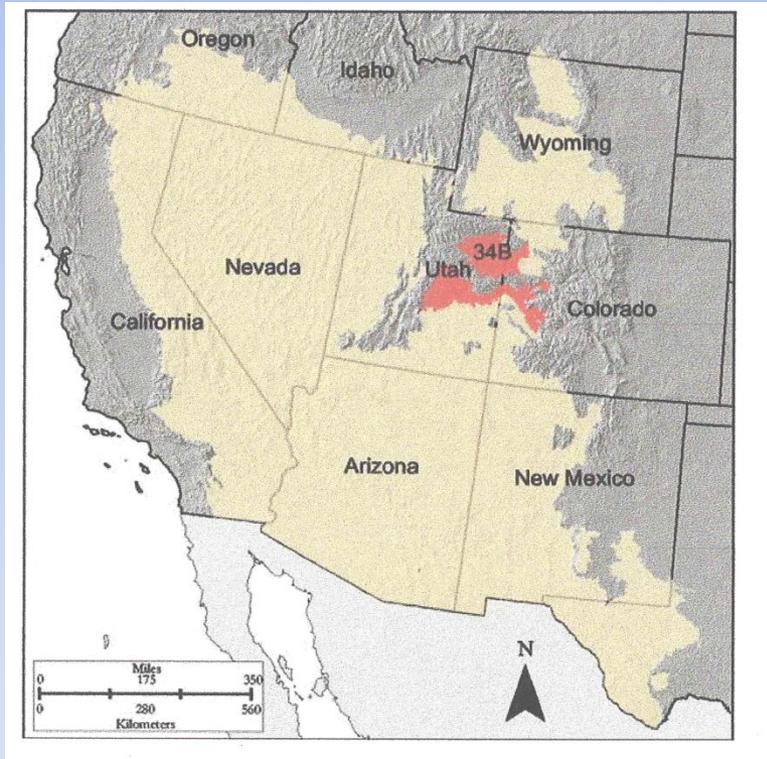
Price, Utah experimental site



# Location of Sampled Sites

## Major Land Resource Area 34B

Warm Central Desertic Basins; Mountains; and Plateaus



# Experimental Design I:

## Quantify salt mobility and transport process on Colorado and Utah rangelands

- 6 Ecological Sites for evaluation of salinity transport processes:
  - 4 sites in Utah and 2 sites in Colorado
- 4 rainfall intensities / return periods evaluated
  - 2 year (50 mm/hr)
  - 10 year (90 mm/hr)
  - 25 year (114 mm/hr)
  - 50 year (140 mm/hr)
- 3 replicates per rainfall intensity
- 12 plots per site evaluated (Plot 2 m by 6 m)

# Physical Classification of Sites

- Price site:
  - soil is classified as Persayo loam
  - Vegetation is classified as: Desert loamy clay (shadscale) (R034BY109UT) Ecological site
- Ferron site:
  - soil is classified as Chipeta-Badland complex
  - Vegetation is classified as: Desert shallow clay (mat saltbush) (R034XY117UT or R034XY117UT\_1) Ecological site

# Experimental Measurements

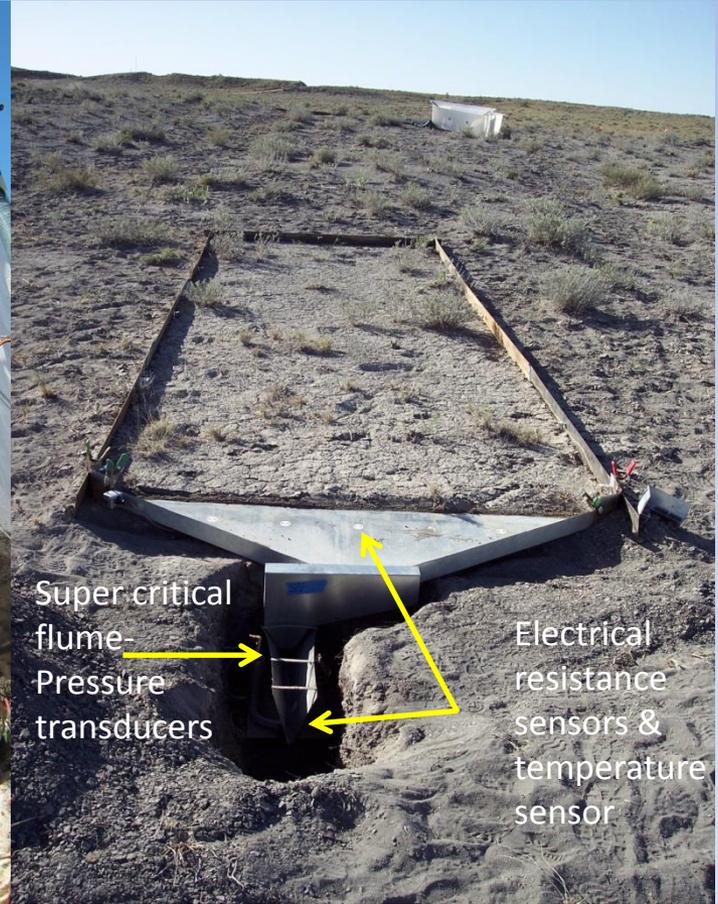
- Hydrologic measurements
  - Rainfall volume and intensity
  - Runoff
  - Concentrated flow path evolution
  - Rill formation and evolution
  - Sediment deposition
- Water Quality
  - Anions ( $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ )
  - Cations ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ )
  - Electrical Conductivity
  - Cation Exchange Capacity
  - pH
  - Sodium Absorption Ratio
  - Total Dissolved Solids
  - Sediment load

# Experimental Measurements

- Soil sampled at 0-5 mm, 6 to 50 mm, 51 to 100 mm before rainfall event and after rainfall event. Sampled undershrub canopy and bare interspace locations for:
  - Texture
  - Bulk Density
  - Electrical Conductivity
  - Cation Exchange Capacity
  - pH
  - Anions
  - Cations
  - Soil water content
  - Sodium Absorption Ratio

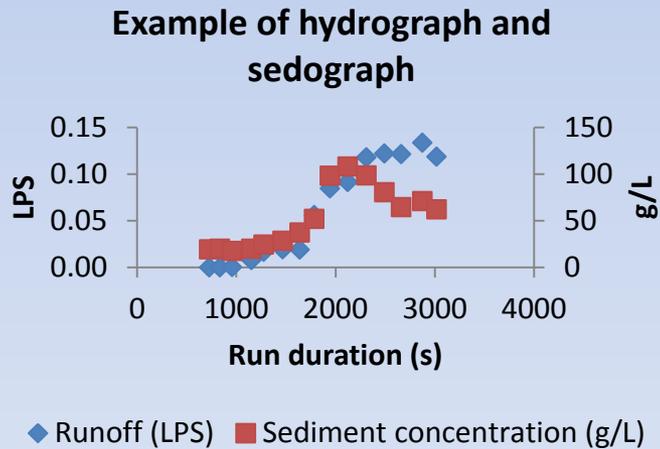
# Rainfall Simulator at Ferron & Price, Utah

Walnut Gulch  
Rainfall Simulator  
capable of  
producing rainfall  
intensities from 25  
to 200 mm/hr.



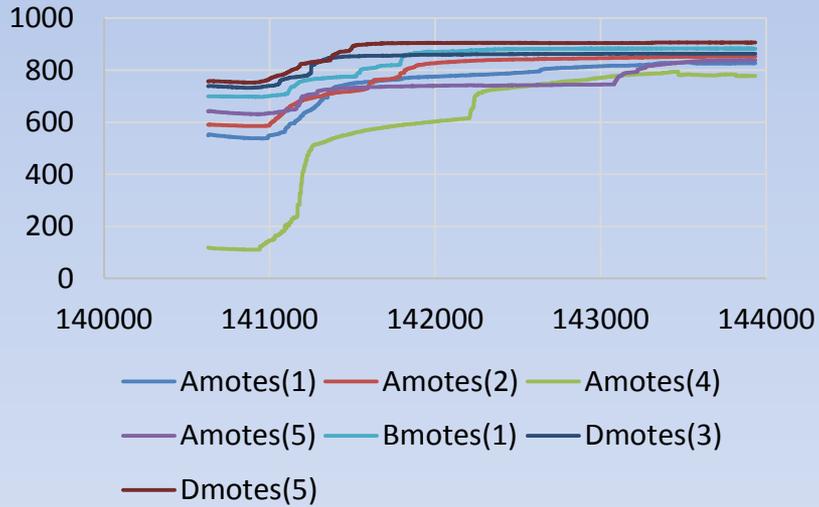
# Rainfall simulation

Runoff discharge, sediment concentration and water quality sampled at regular intervals



# Salt load monitoring

## Electrical resistance monitoring

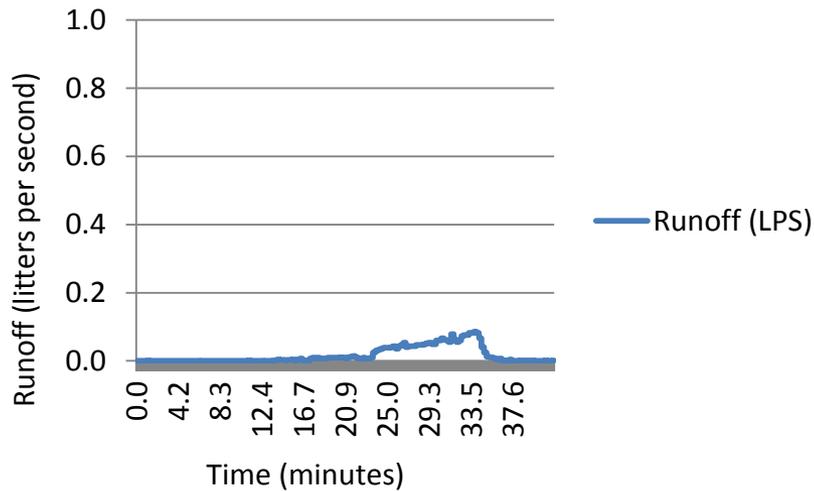


# Hydrology

## Price, Utah

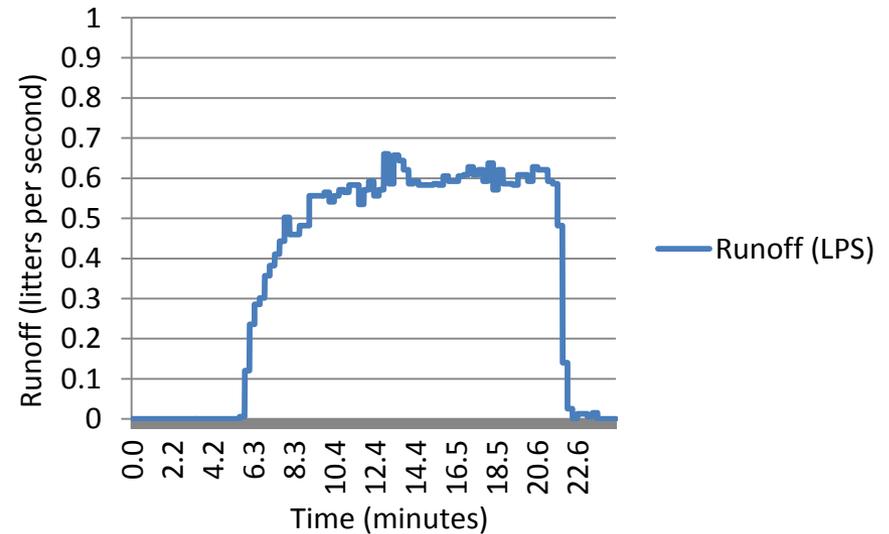
Plot 6

2 year precipitation event  
50 mm per hour intensity

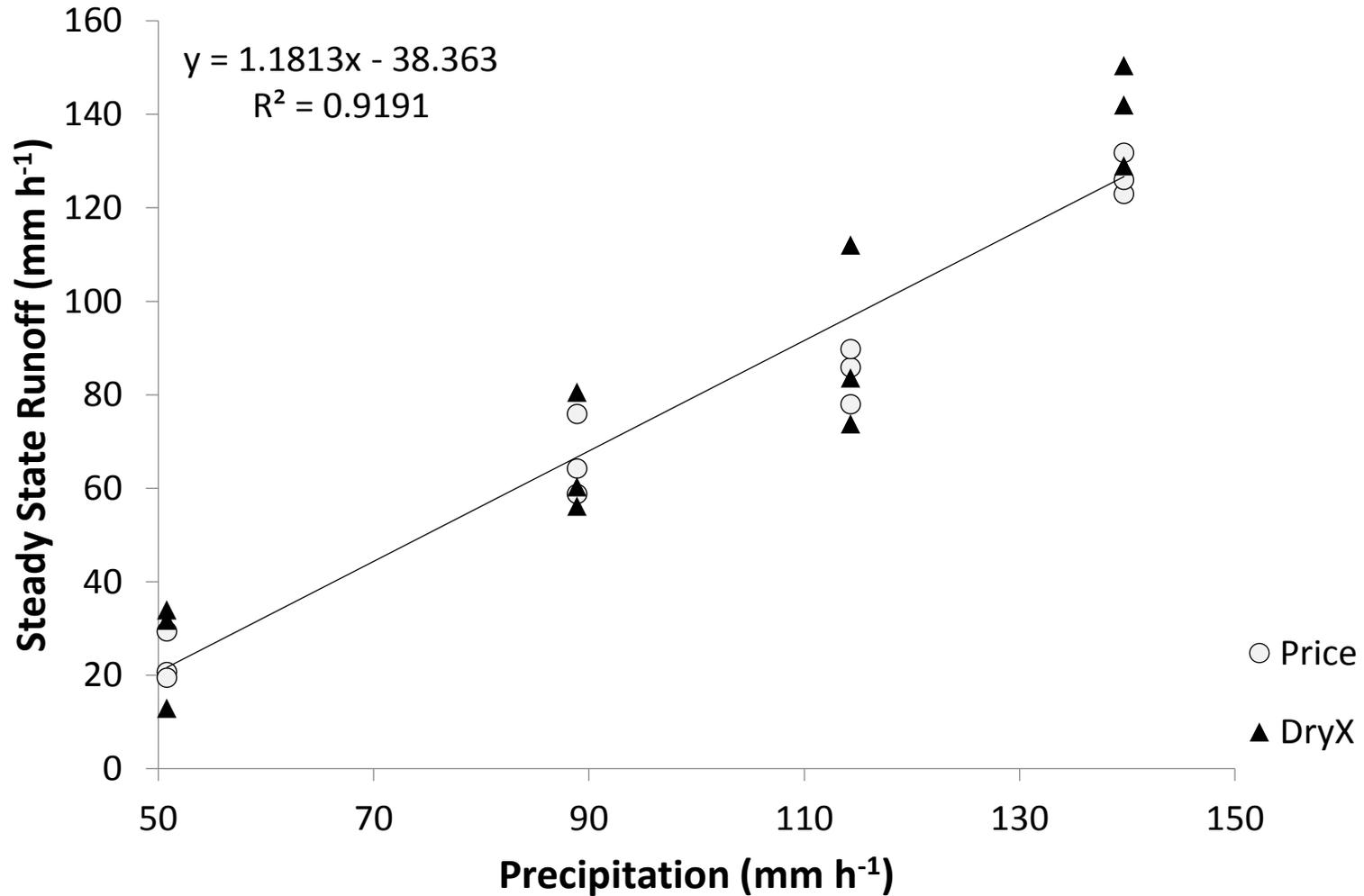


Plot 6

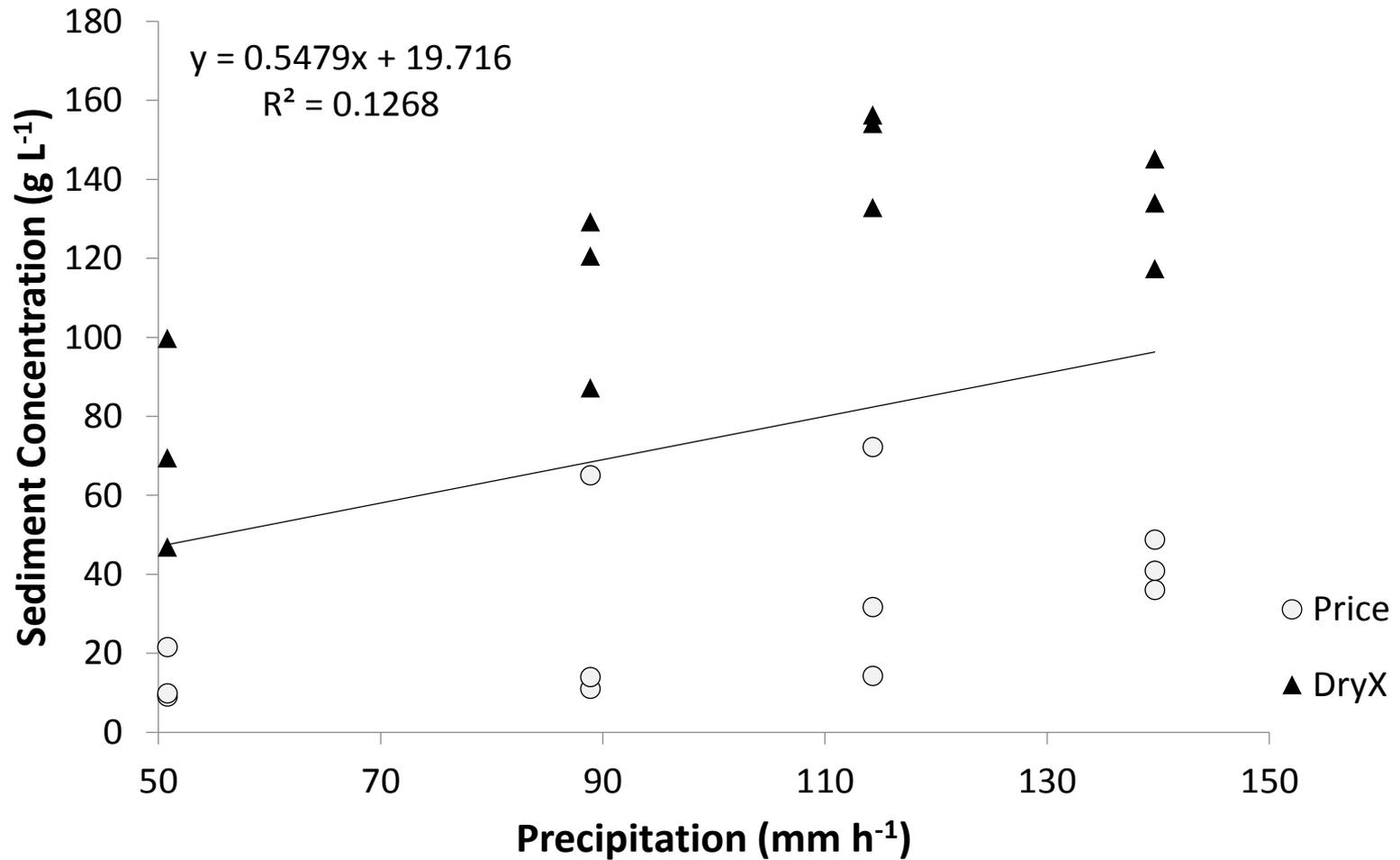
50 year precipitation event  
140 mm per hour intensity



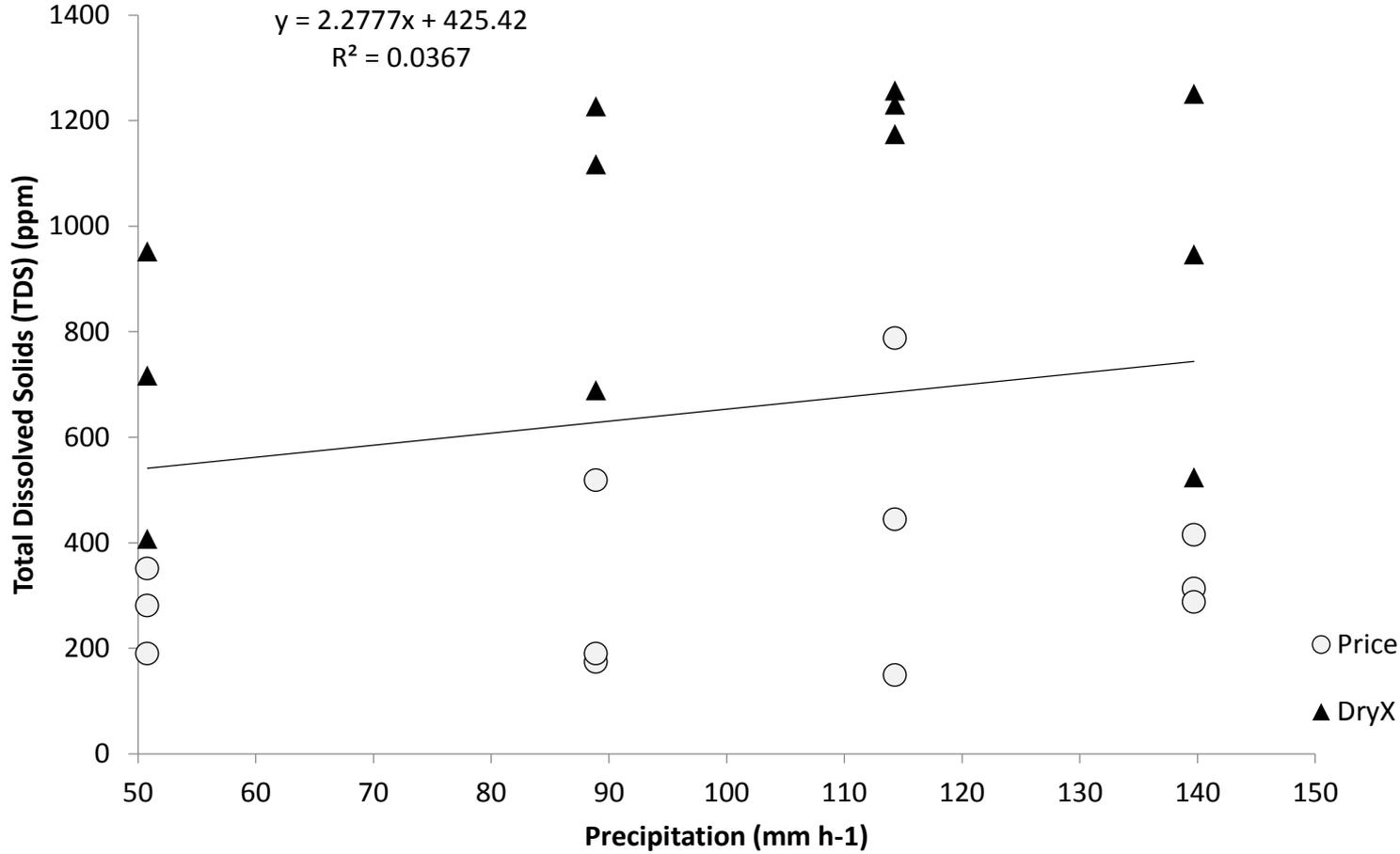
# Precipitation and Runoff



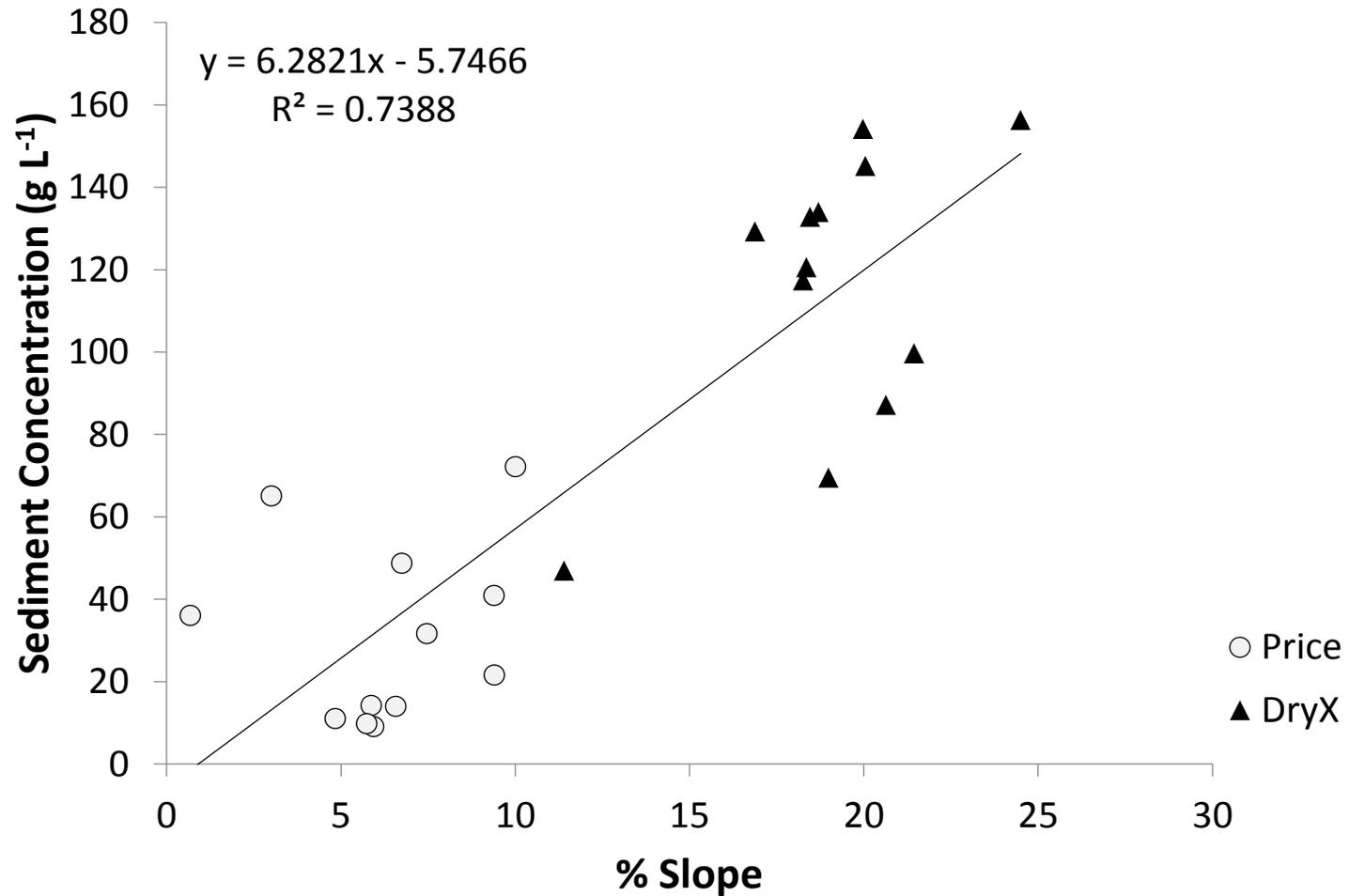
# Precipitation and Sediment



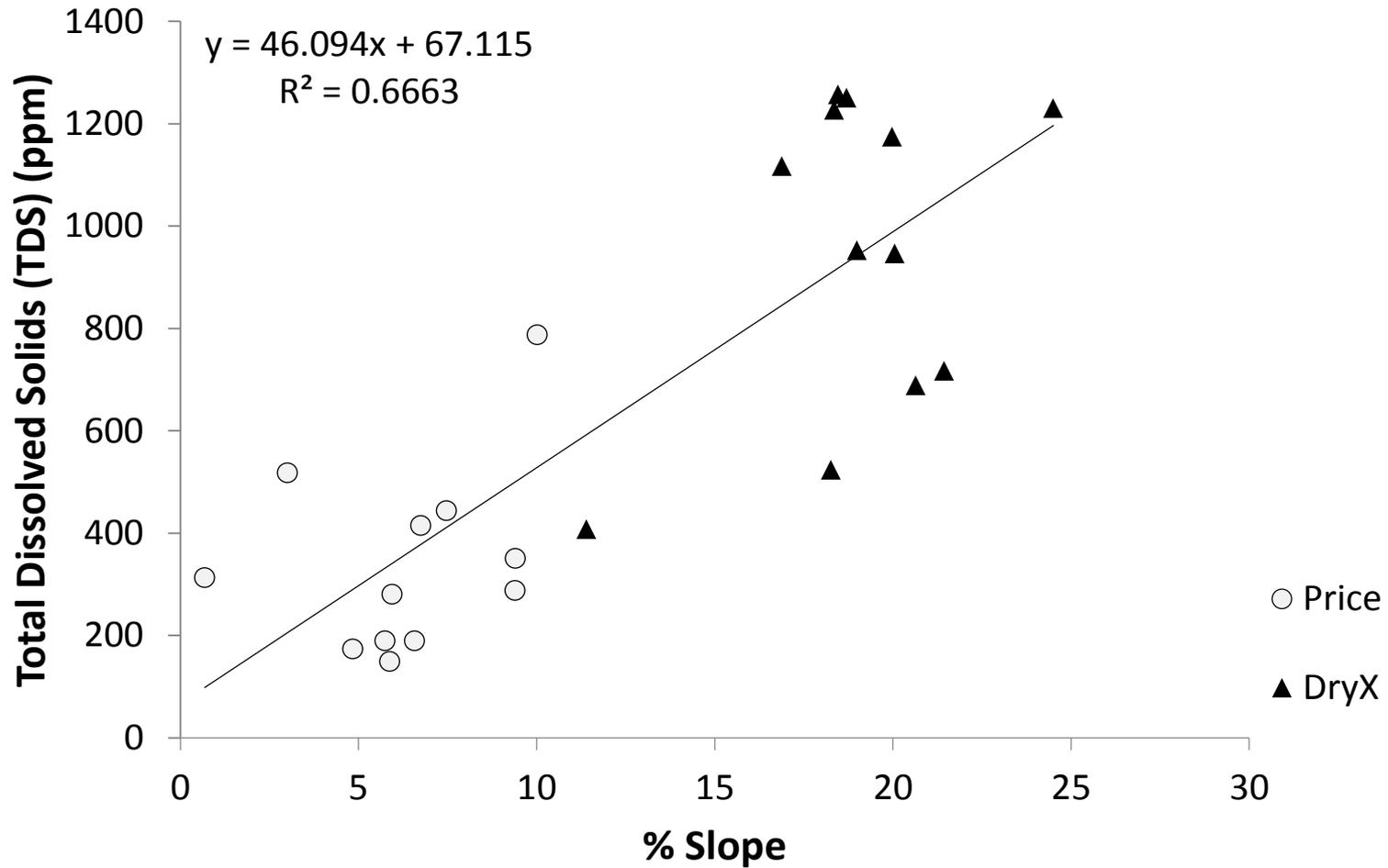
# Precipitation and Total Dissolved Solids



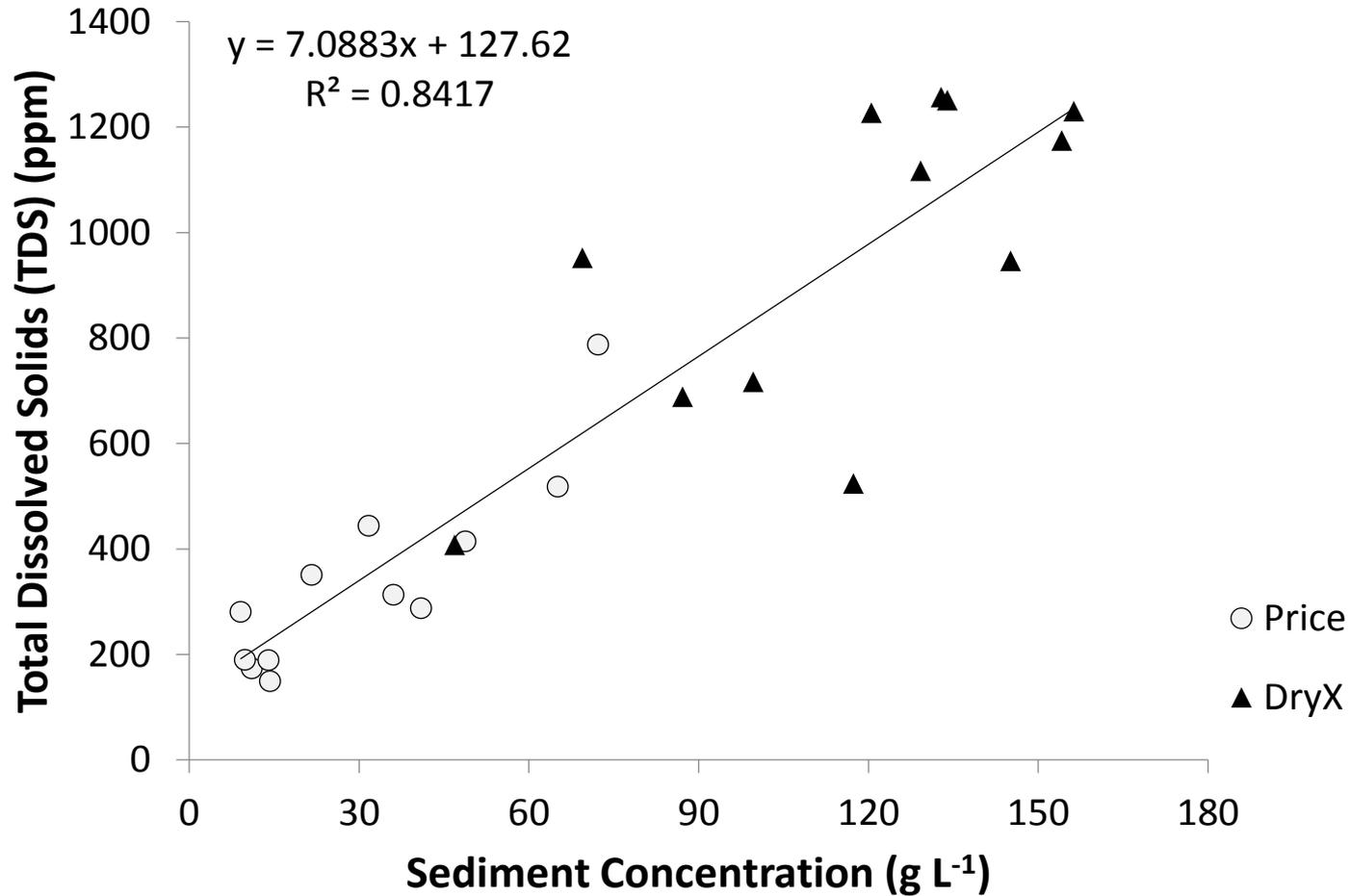
# Slope and Sediment Concentration



# Slope and Total Dissolved Solids



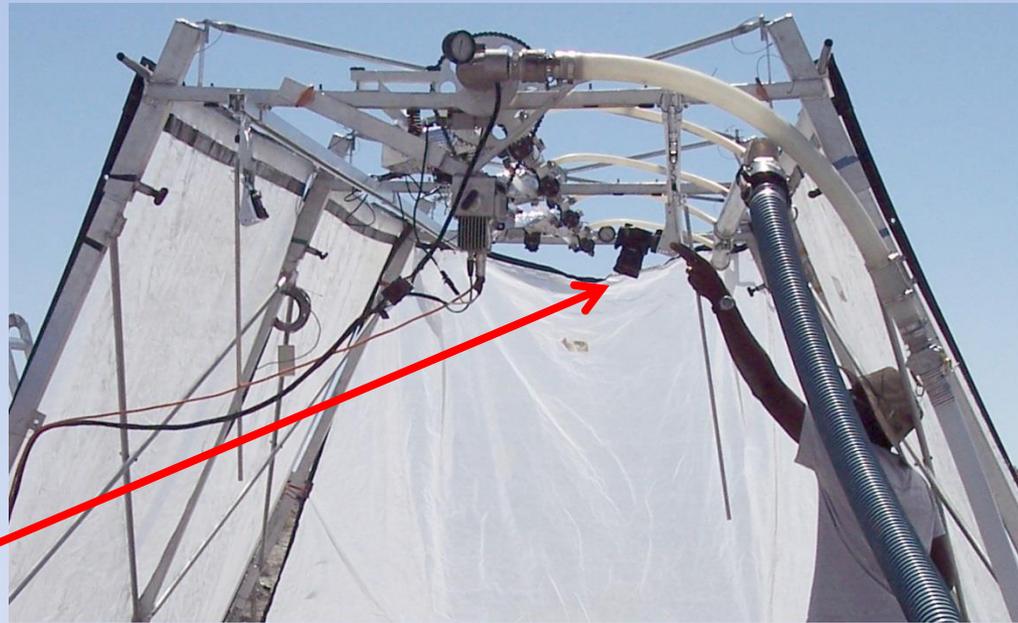
# Sediment Concentration and Total Dissolved Solids



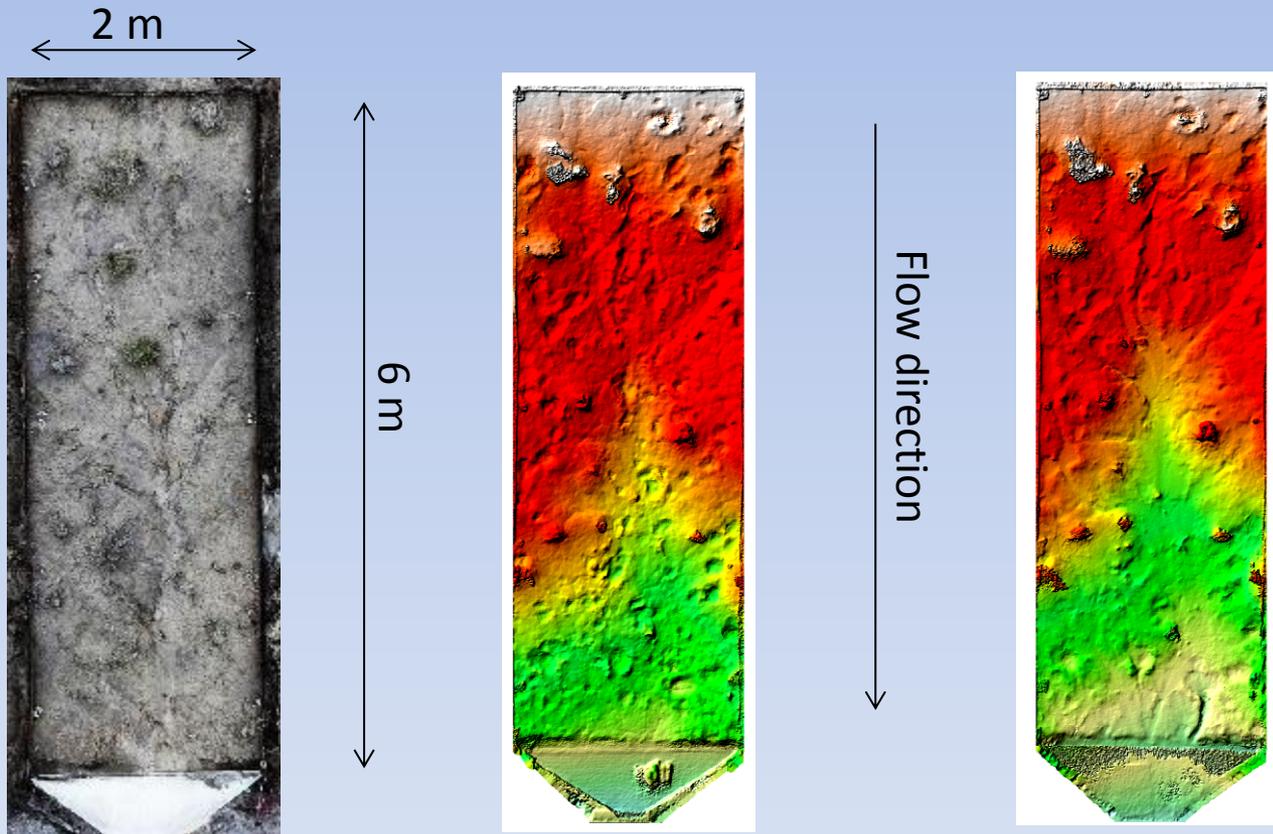
# Structure From Motion for erosion & deposition assessment

- Erosion / Deposition patterns tracked with Structure from Motion (SFM)
- SFM images taken before and after events

Camera on rail



# Spatial erosion / deposition assessment



Synoptic view of erosion plot

Before

After 25-Yr storm



# Erosion process partitioning

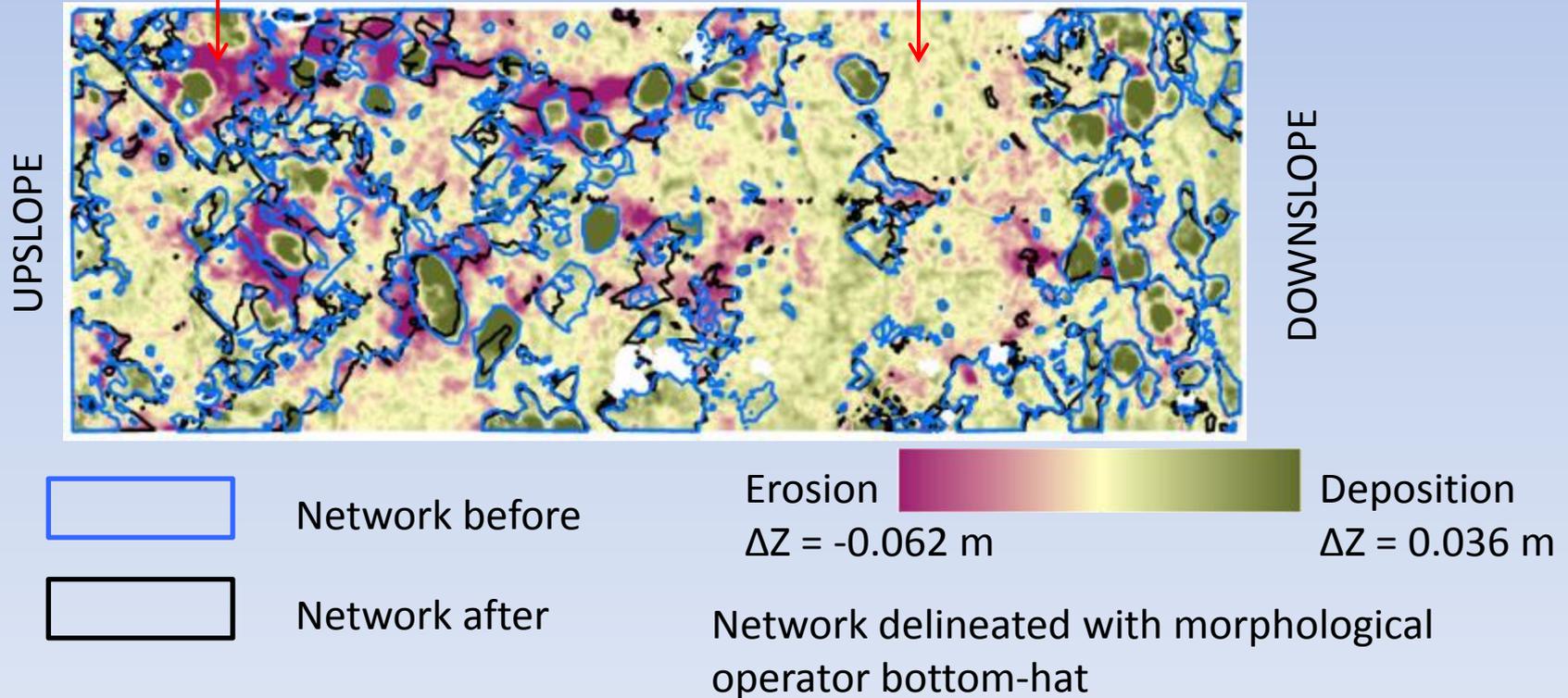
Concentrated flow

$$D_c = K_\omega(\omega)$$

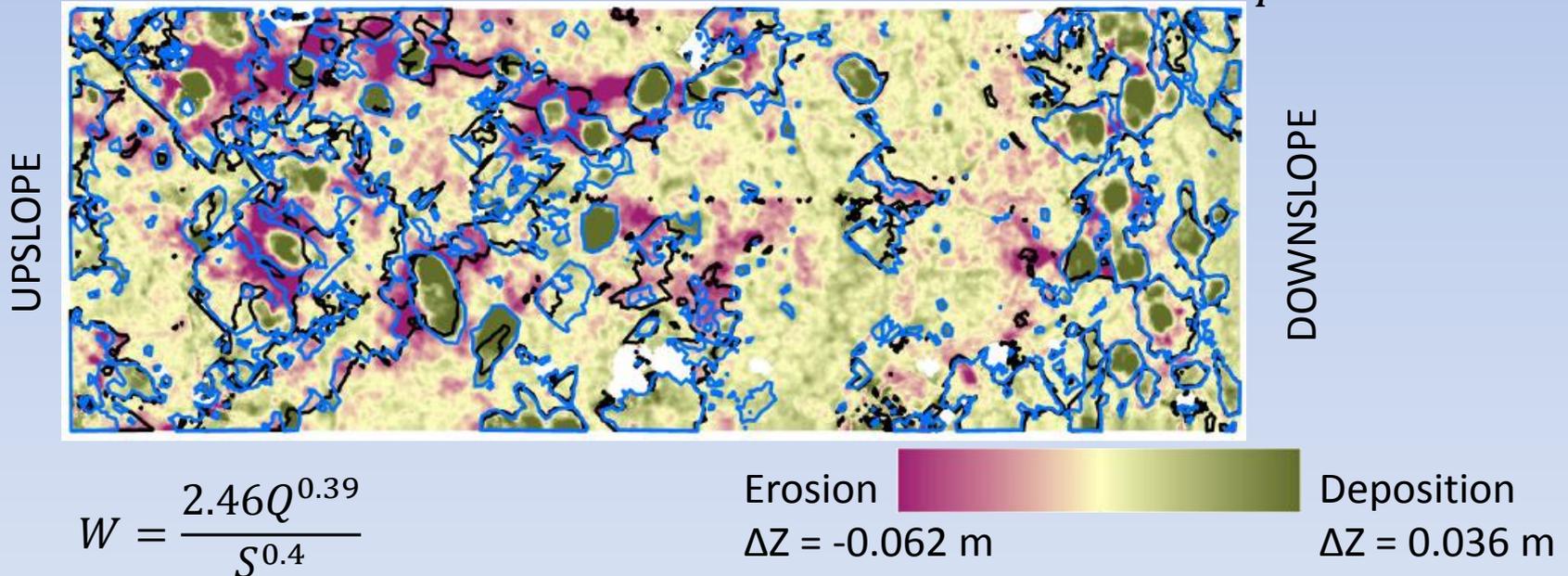
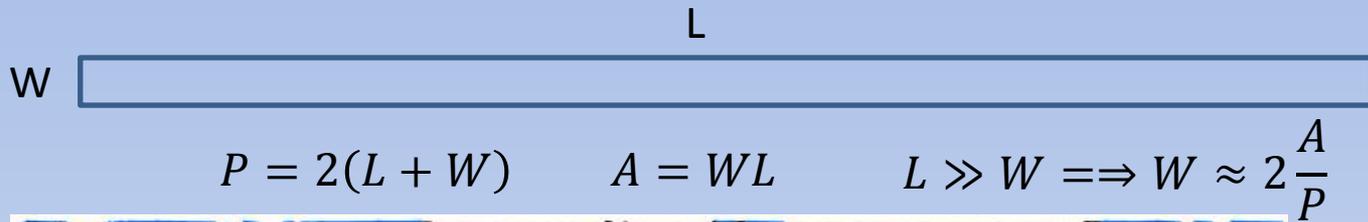
$$D_c = K_{\omega(Max)adj} \exp(\beta q_c) \omega$$

Sheet and splash

$$D_{SS} = K_{SS} r^{1.052} q^{0.592}$$



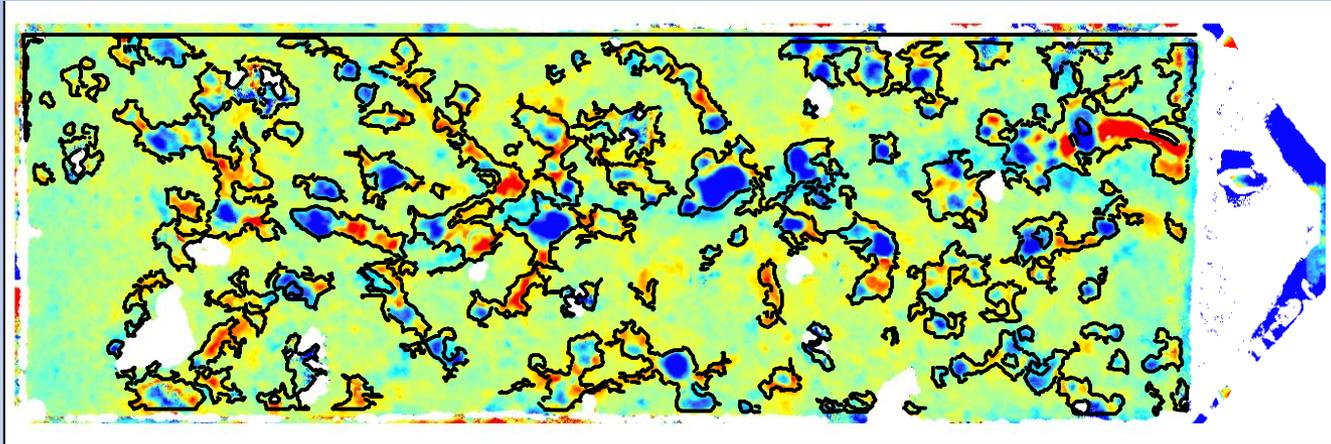
# Channel geometry estimation



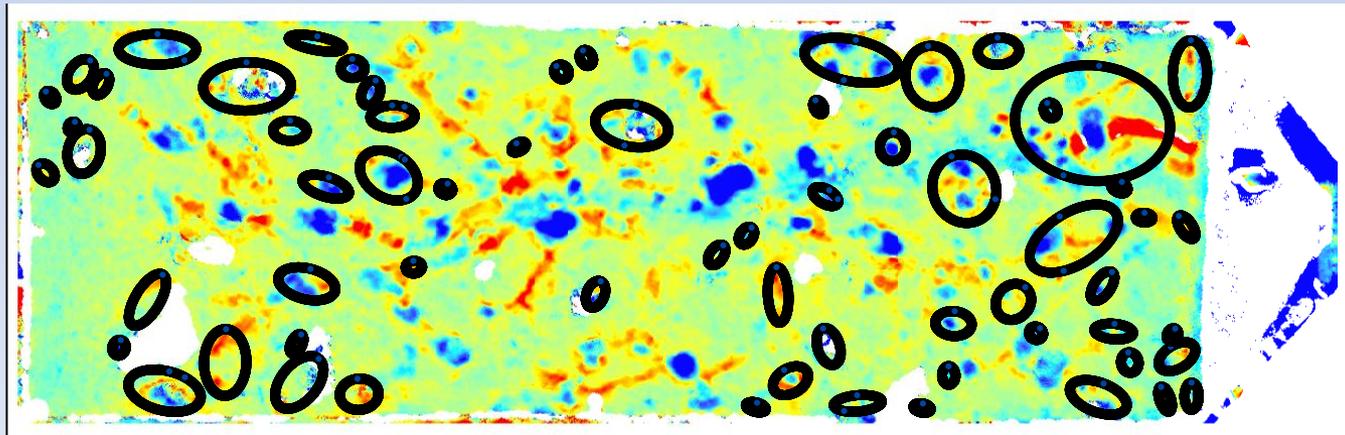
Total area of delineated channel network and total perimeter would provide  $W$ , to be compared with Al-Hamdan et al., 2012

# Channel geometry estimation

Edge detection

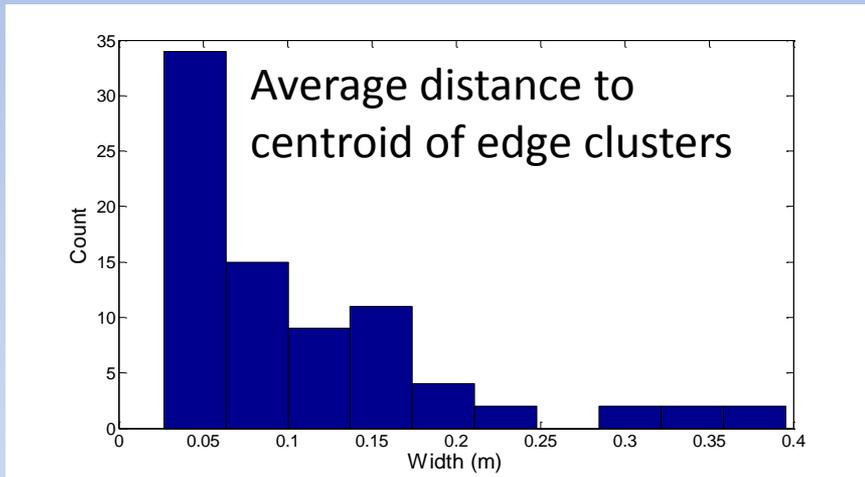


Ellipse fitting



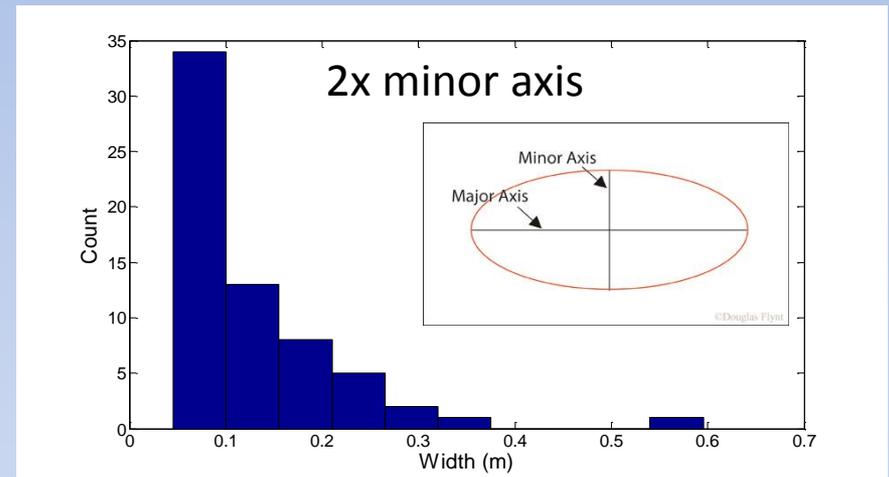
# Mean rill width estimation

Irregular shape



mean rill width =  $0.108 \pm 0.086$  m

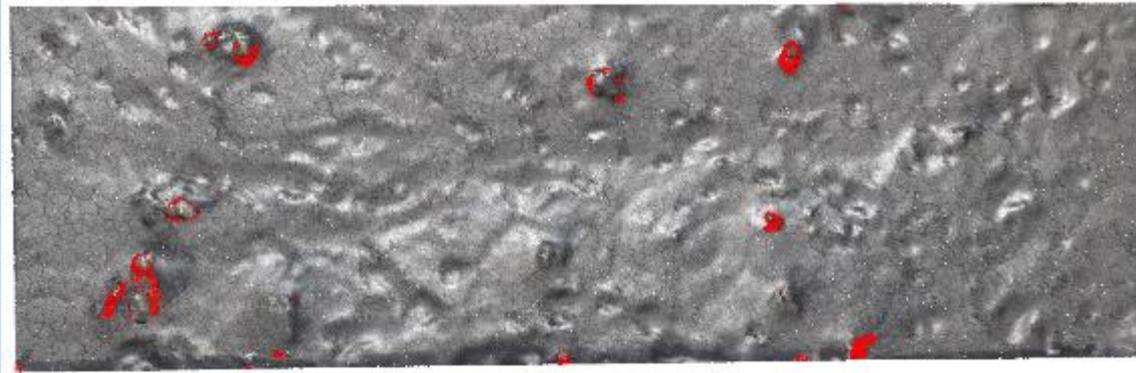
Ellipse fitting



mean rill width =  $0.122 \pm 0.089$  m

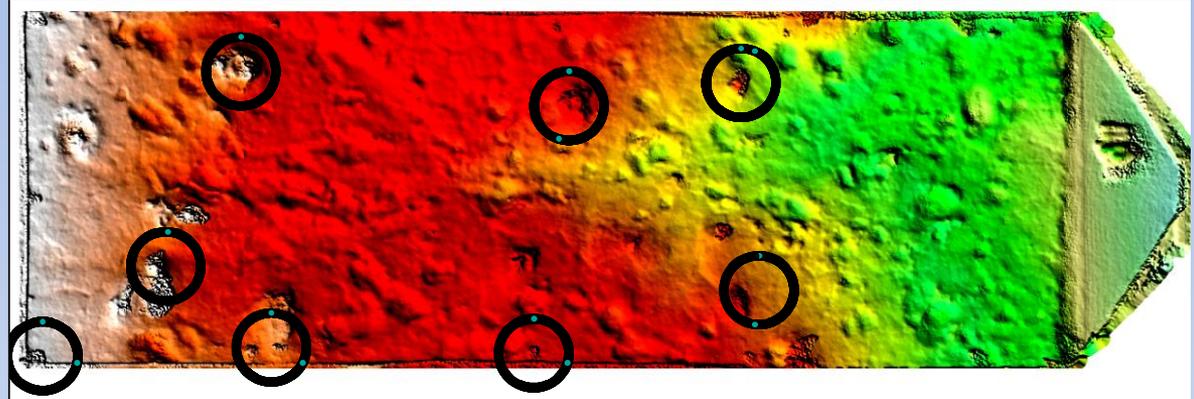
# Relating vegetation to sediment redistribution

Automated vegetation detection with difference of normal segmentation



# Relating vegetation to sediment redistribution

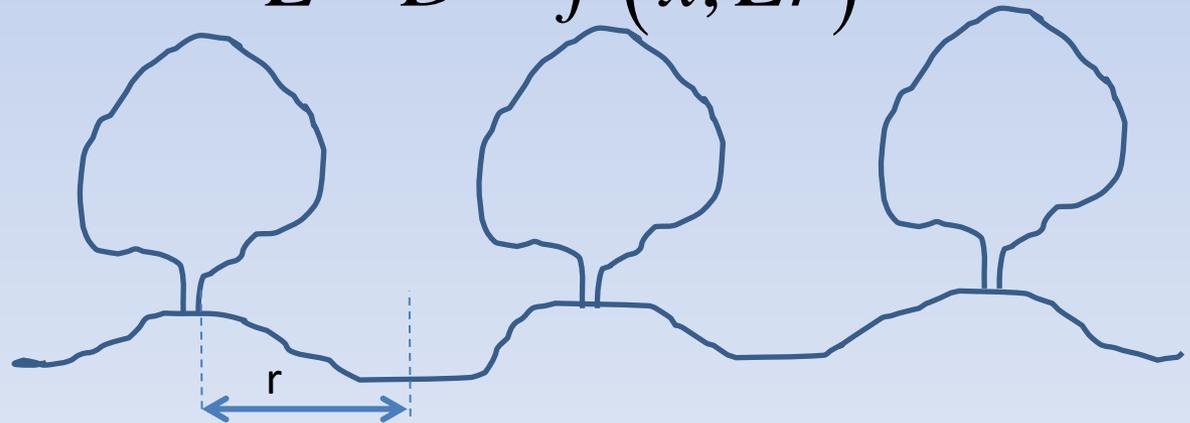
- Sediment budget at increasing distance  $x$  around shrub centroid: Relevant to management strategy



$$E - D = f(x, Er)$$

$E$  = Erosion,  $D$  = Deposition,  
 $Er$  = Erosivity

If  $E - D > 0$  at  $x < r$  →  
Degradation  
Else: Aggradation



$Z = 0$  m



$Z = 0.66$  m

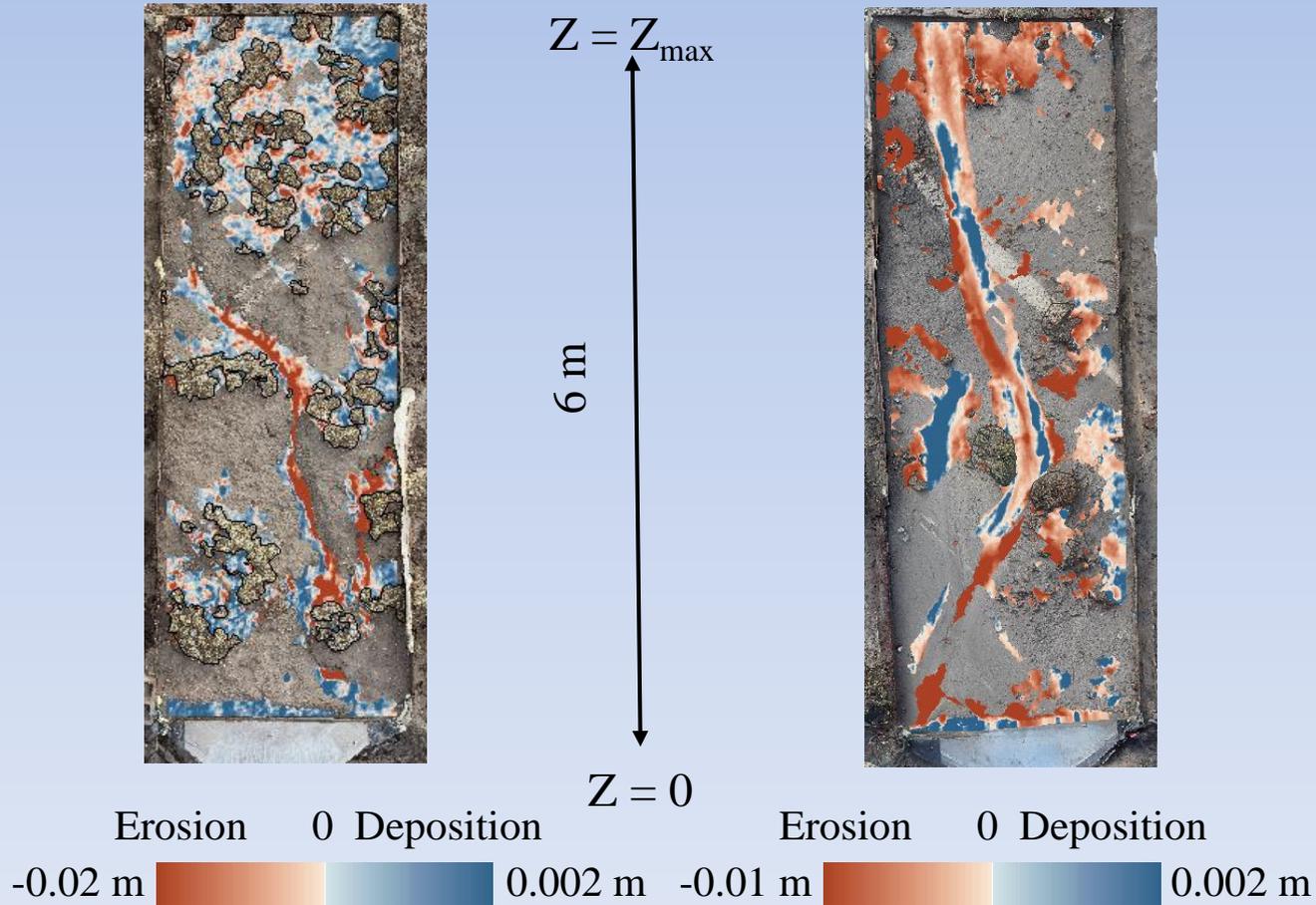
# Vegetation and deposition

Slope = 18.9%, Cover = 20.2%

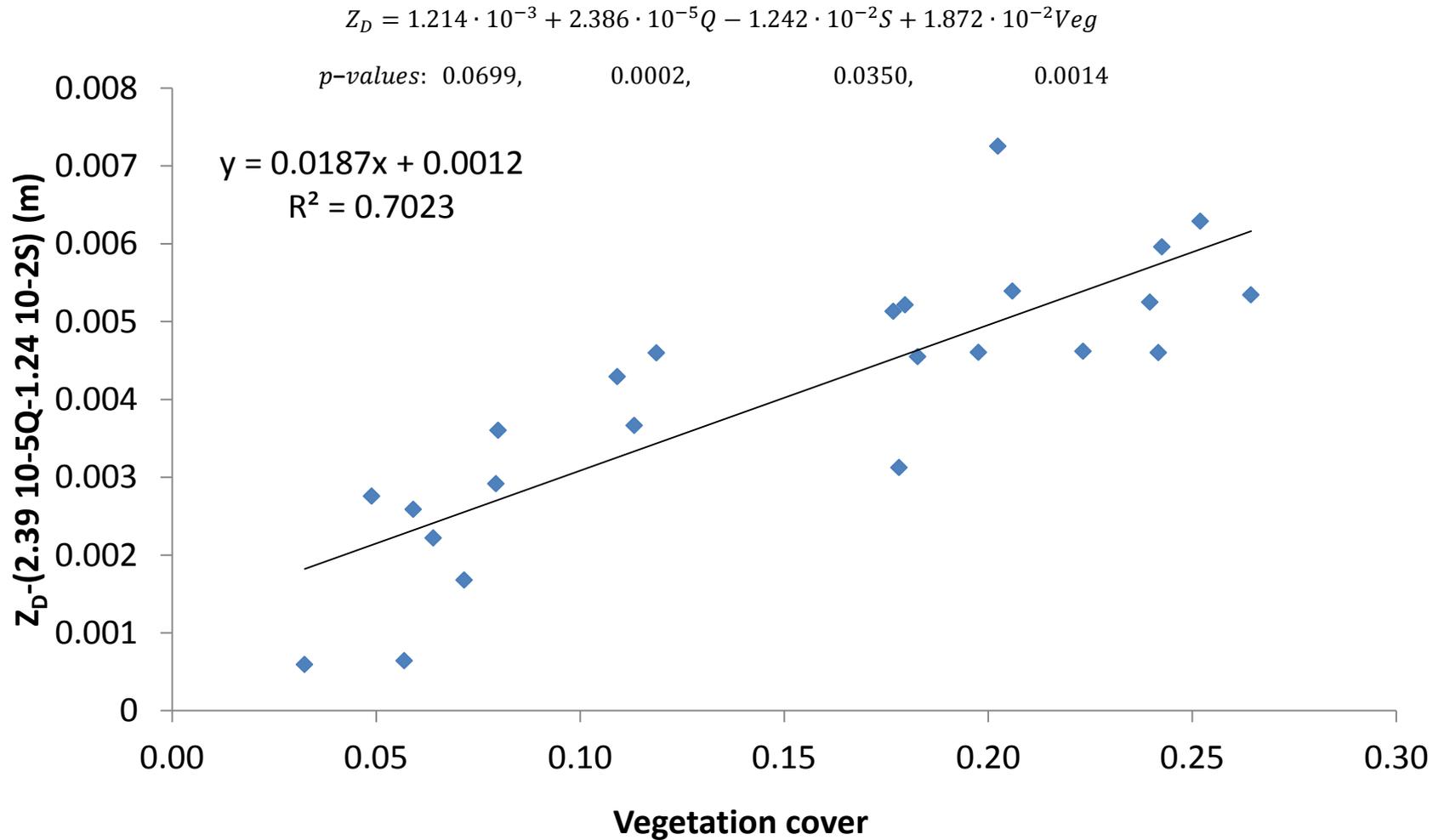
Rainfall intensity: 88.9 mm/hr

Slope = 9.4%, Cover = 3.3%

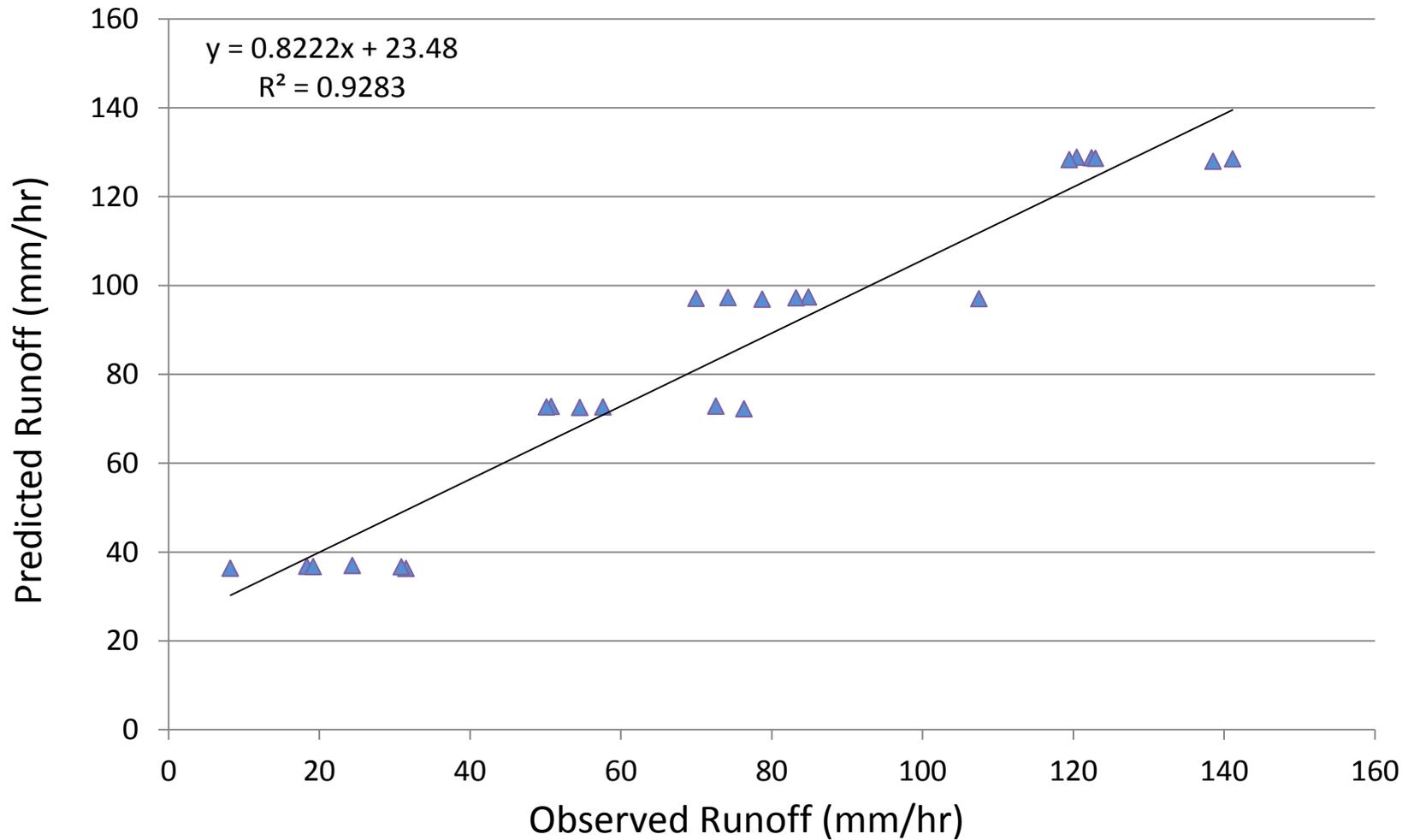
Rainfall intensity: 139.7 mm/hr



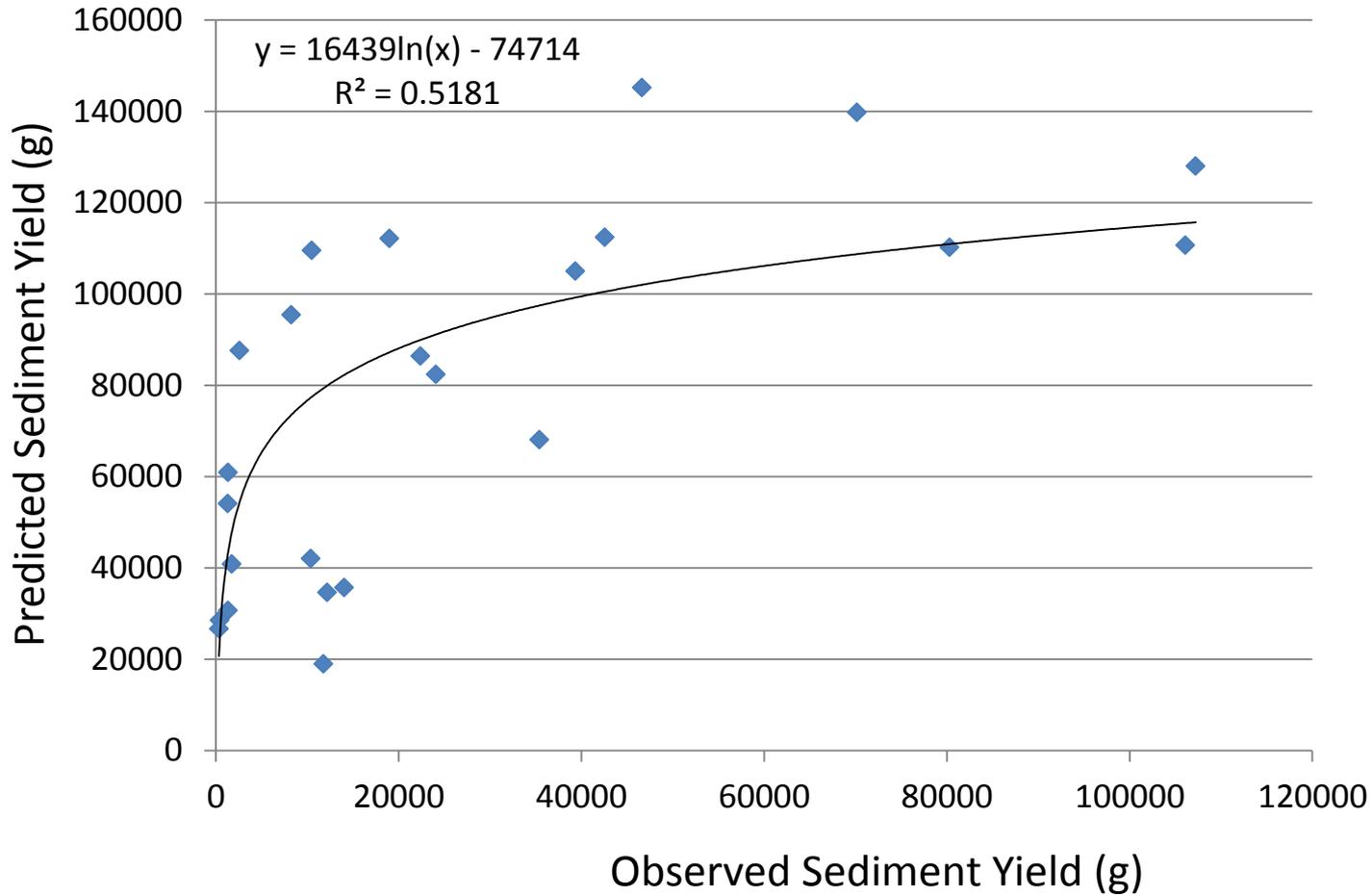
# Vegetation and deposition



# Rangeland Hydrology and Erosion Model



# Rangeland Hydrology and Erosion Model



# Experimental Design II:

## Quantify role of vegetation in salt mobility and transport processes on Utah rangelands

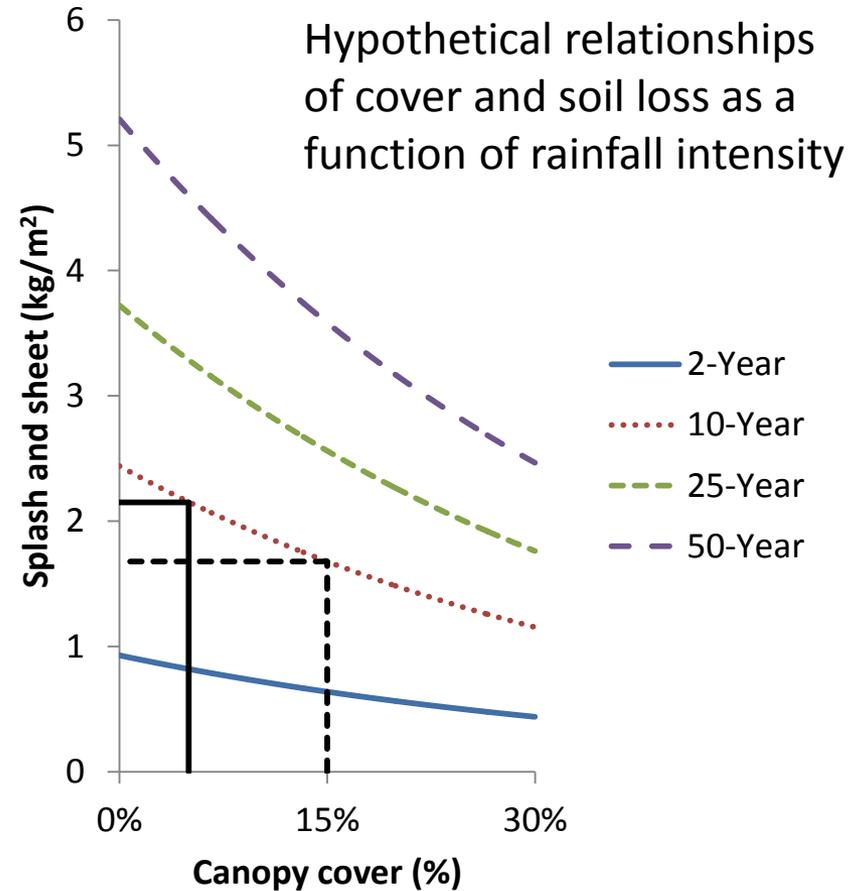
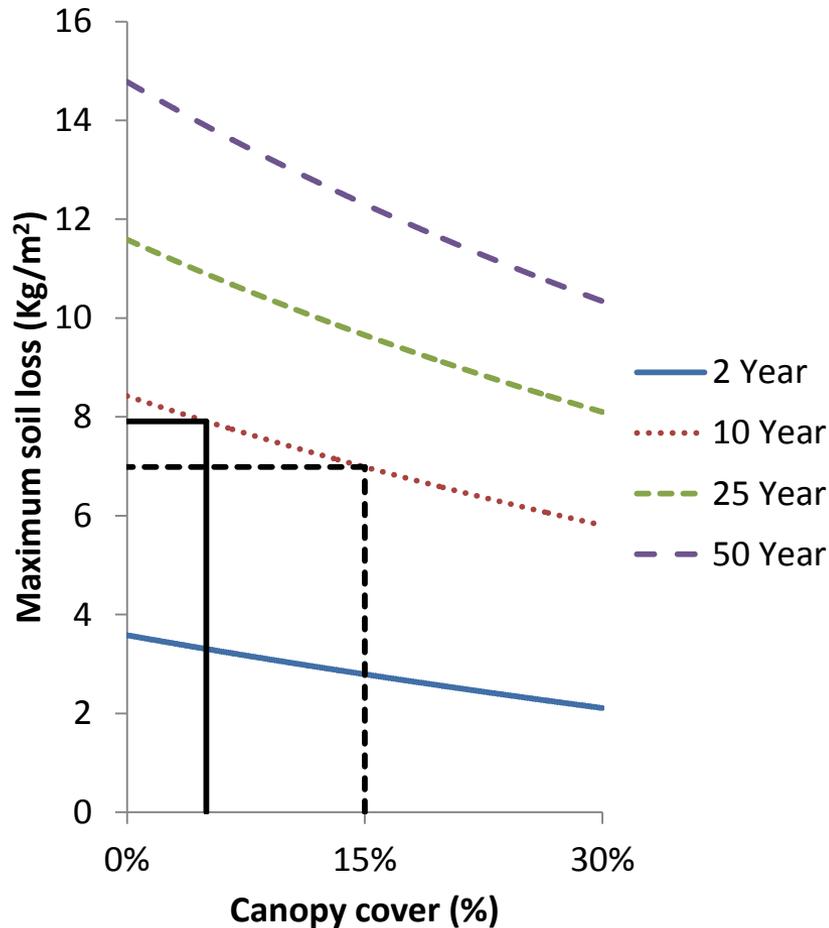
- Use Ferron, Utah Ecological Site for evaluation of canopy cover and vegetation distribution on salinity transport processes:
- 1 rainfall intensity at 1 return period
  - 25 year (114 mm/hr)
- 3 replicates per cover class
- Vary cover by percentage classes:
  - 0-10, 11-20, 21-30, 31-40, 41-50%
- 15 plots per site evaluated (Plot 2 m by 6 m)

# Location of Proposed Sample Sites

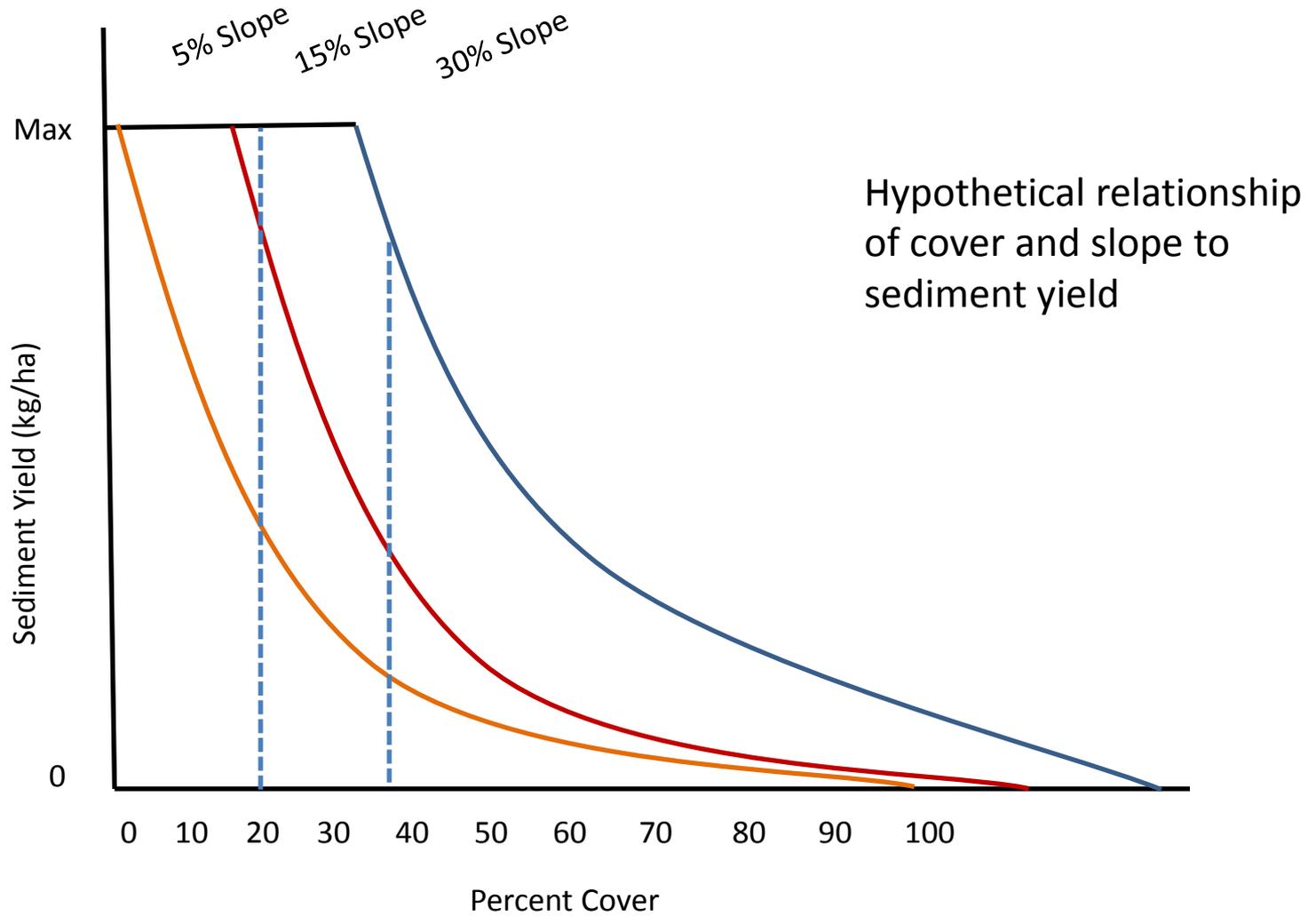
- Rainfall intensity study to quantify salt mobility and transport processes
- Study to quantify role of vegetation in altering salt mobility and transport processes



# Rangeland Hydrology and Erosion Model



# Rangeland Hydrology and Erosion Model



# Timeline of Project

- First Year (2014): Quantify salt mobility and transport process on Utah rangelands
  - Identify ecological sites and get clearance to implement the research (Price and Ferron, UT)
  - Conduct rainfall simulation
  - Process data
  - Conduct RHEM model runs
- Second Year (2015): Quantify salt mobility and transport process on Utah rangelands
  - Identify ecological sites and get clearance to implement the research (Hanksville or Fillmore, UT)
  - Conduct rainfall simulation
  - Process data
  - Conduct RHEM model runs
- Second Year (2015): Quantify role of vegetation in salt mobility and transport processes on Utah rangelands
  - Identify ecological site get clearance to implement the research (Ferron, UT)
  - Conduct rainfall simulation
  - Process data
  - Conduct RHEM model runs

# Timeline of Project

Third Year (2016): Quantify salt mobility and transport process on Utah rangelands  
Identify ecological sites and get clearance to implement the research (Hanksville or Fillmore, UT)  
Conduct rainfall simulation  
Process data  
Conduct RHEM model runs

Third Year (2016): Quantify salt mobility and transport process on Colorado rangelands  
Identify ecological sites and get clearance to implement the research (Grand Junction and Montrose, CO.)  
Conduct rainfall simulation  
Process data  
Conduct RHEM model runs

# Timeline of Project

Forth Year (2017): Quantify salt mobility and transport process on Colorado and Utah rangelands

Develop new parameters to estimate infiltration and runoff on saline soils

Develop techniques to determine role of vegetation cover and the spatial distribution of cover on controlling salt transport

Develop technique to estimate salt mobility and transport from saline soils

Develop rangeland rainfall/runoff/soil erosion/salt transport database

Modify RHEM to estimate Total Dissolved Solids

Fifth Year (2018): Quantify salt mobility and transport process on Colorado and Utah rangelands

Develop new parameters to estimate infiltration and runoff on saline soils

Develop techniques to determine role of vegetation cover and the spatial distribution of cover on controlling salt transport processes

Develop technique to estimate concentrated flow erosion

Develop technique to estimate deposition of sediment

Develop technique to estimate salt mobility and transport from saline soils

Modify RHEM to estimate Total Dissolved Solids

Deliver final reports

# Projected Funding for Project over 5 year

Agricultural Research Service	Approximately	\$2,000,000
Bureau of Land Management	Approximately	\$ 880,0000
Bureau of Reclamation	Approximately	\$ 520,000
University of Nevada Reno	Approximately	\$ 100,000
Desert Research Institute	Approximately	\$ 50,000
France	Approximately	\$ 75,000

## Potential Sources of funding: FY 2015-2018

National Science Foundation	Approximately	\$ 500,000
National Institute for Food and Agriculture	Approximately	\$ 500,000
U.S. State Department	Approximately	\$ 10,000
Jordan	Approximately	\$ 10,000

# Products to Date

## Presentations:

Third International Salinity Forum 2014, Riverside CA., June 2014

- Rossi et al. An evaluation of the effects of selected rangeland conditions on the sources and transport of dissolved solids to streams in the Upper Colorado River Basin.
- Rossi et al. BLM and its future: Quantifying relative contributions of the salt mobilization and transport as a function of State within selected rangeland ecological sites in CO, ID, NM, MV, and UT.

Society for Range Management 68<sup>th</sup> Annual conference, Sacramento, CA., February 2015.

- Weltz et al. 2015. Estimating water quality from saline rangelands
- Nouwakpo et al. 2015. Estimating soil loss from saline rangelands
- Li et al. 2015. Low-cost wireless salinity sensors for runoff characterization and water quality monitoring.

Fifth Interagency Conference On Research In The Watersheds, North Charleston, SC. March 2015.

- Rossi et al. 2015. Soil and Salinity Mobilization and Transport in the Colorado River Basin

# Products to Date

## Presentations:

3<sup>rd</sup> Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, Reno, NV., April 2015.

- Nouwakpo et al. 2015. Estimating flow concentration and sediment redistribution on saline rangeland communities
- Cadaret et al. 2015. Vegetation canopy cover effects on sediment and salt loading in the upper Colorado River Basin Mancos shale, Price and Ferron, Utah.

# Products to Date

## Publications:

- Gagnon et al. 2014. Salinity Mobilization and Transport: Hydrologic and Aeolian Processes and Remediation Techniques for Rangelands: a selected bibliography. Special reference briefs; 364 pgs. NAL-SRB. 2014-01. USDA, Agricultural Research Service, National Agricultural Library, Beltsville, Maryland.
- Weltz et al. 2014. Salinity Mobilization and Transport from Rangelands: Assessment, Recommendations, and Knowledge Gaps. 62 pages. United States Department of Agriculture, Agricultural Research Service, Great Basin Rangelands Research, Reno, Nevada. General Technical Report 1.
- Nouwakpo et al. 2015. Estimating flow concentration and sediment redistribution on saline rangeland communities. Pg: 809-819. 3<sup>rd</sup>. In *Proceedings of the 3rd Joint Federal Interagency Conference (10th Federal Interagency Sedimentation Conference and 5th Federal Interagency Hydrologic Modeling Conference), April 19 – 23, 2015, Reno, Nevada.*
- Cadaret et al. 2015. Vegetation canopy cover effects on sediment and salt loading in the upper Colorado river basin Mancos shale, Price and Ferron, Utah. Pg. 1621-1630. 3<sup>rd</sup>. In *Proceedings of the 3rd Joint Federal Interagency Conference (10th Federal Interagency Sedimentation Conference and 5th Federal Interagency Hydrologic Modeling Conference), April 19 – 23, 2015, Reno, Nevada.*

# Products to Date

## Publications:

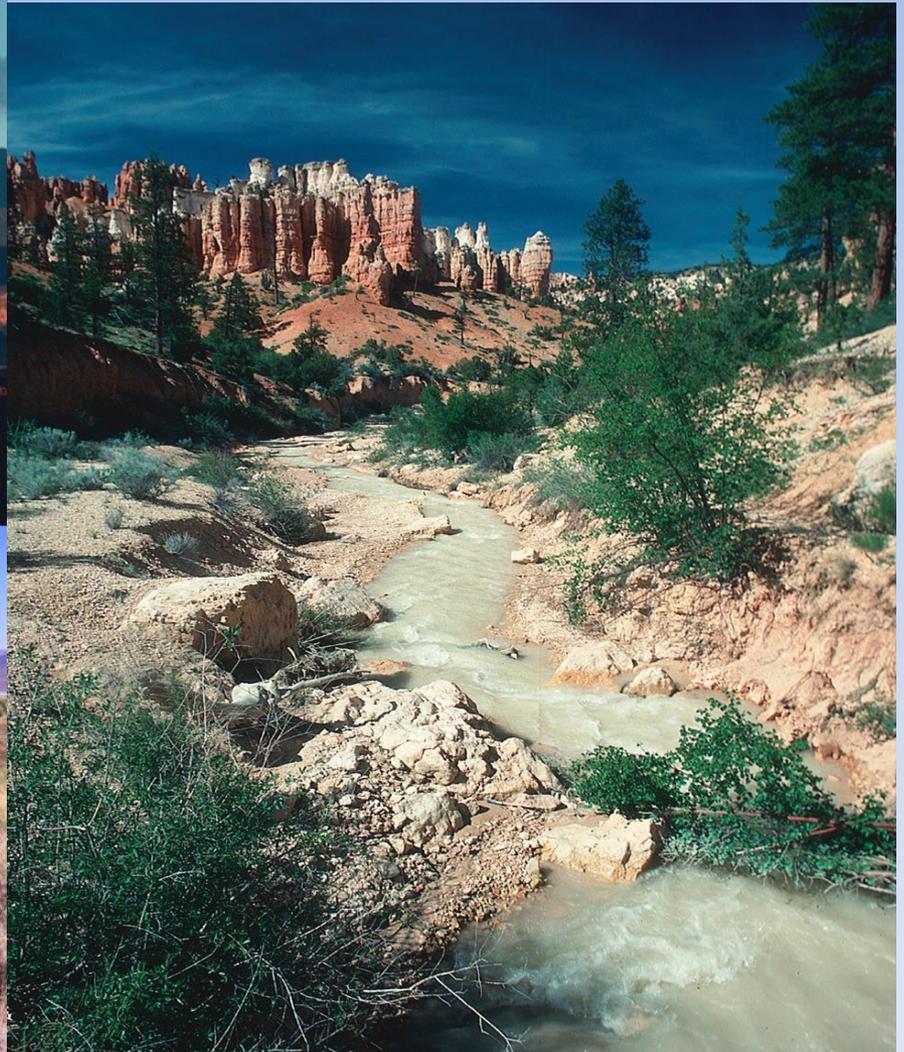
- Rossi et al. 2015. Chemical speciation in semiarid environments. CRC..... In Press.
- Rossi et al. 2015. Second book Chapter. In Press.....

# Conclusion

Data from rainfall simulation studies on saline rangelands offer unique opportunity to quantify:

- Infiltration and runoff rates on saline soils
- Soil erosion and deposition rates
- Sediment concentration and yield
- Salt transport processes
- Role of vegetation in controlling transport processes of soil and salts
- Water quality as expressed as total dissolved solids in runoff derived from rangelands
- Develop GIS techniques to characterize channel network and estimate rill geometry
- Develop predictive models for estimating runoff and transport of soil and salts off-site

# Thank You



SALINITY FUND BALANCE  
FISCAL YEAR 2015

Month	Hoover	Parker-Davis	Total Deposits	Transferred	Cash Balance
Prior Year Balance					11,438,175.34
October	521,267.50	83,447.28	604,714.78		12,042,890.12
November	592.50	110,460.69	111,053.19		12,153,943.31
December	500,635.00	102,162.22	602,797.22	(1,000,000.00)	11,756,740.53
January	906,057.50	114,899.47	1,020,956.97		12,777,697.50
February	373,935.00	93,552.50	467,487.50		13,245,185.00
March	710,077.50	86,900.24	796,977.74	(3,802,400.00)	10,239,762.74
April	521,482.50	164,475.45	685,957.95	(4,400,075.00)	6,525,645.69
May			-		6,525,645.69
June			-		6,525,645.69
July			-		6,525,645.69
August			-		6,525,645.69
September			-		6,525,645.69
	3,534,047.50	755,897.85	4,289,945.35	(9,202,475.00)	6,525,645.69

Deposits represent 2.5 Mills Collected.