Reduced Rio Grande Flows and Bosque Management - Cliff Crawford - Department of Biology, University of New Mexico

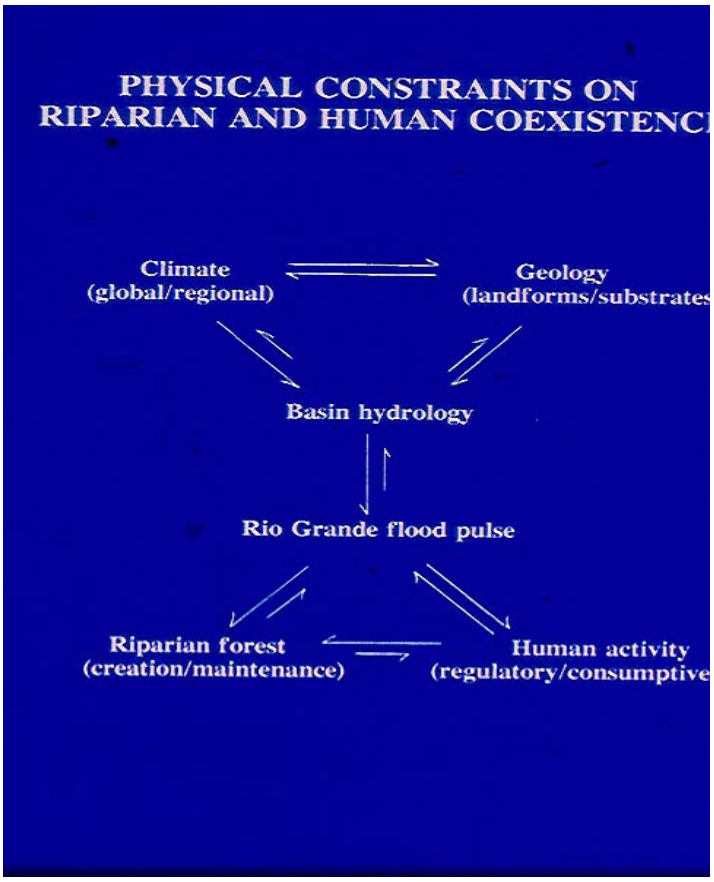
The University of New Mexico

Cliff is a Professor Emeritus in Biology at UNM. He's been involved for nearly two decades in bosque research and is the Director of the Bosque Ecosystem Monitoring Program. BEMP is a partnership between UNM and the Bosque School that combines science and outreach to monitor long term environmental change in the middle Rio Grande bosque. There are currently nineteen BEMP sites located between San Juan Pueblo and Lemitar, with nine sites in the Albuquerque reach. They monitor key variables (groundwater depth, precipitation, litterfall quality, and biomass) at each site every month. There have been about 6,000 K-12 students who have participated in this project in the past six years. They and their teachers do the monitoring, working with UNM interns and BEMP staff. The data is analyzed and summarized in reports that are made available to water resource managers, researchers, and to the public as well.

I know the bosque, but at the same time, there's an awful lot I don't know about the bosque. I was asked to talk about Reduced Rio Grande Flows and Bosque Management, and after I got to thinking about it, especially sitting here listening to the others, if we reduce Rio Grande flows, I could give you a quick response as to what is going to happen to the bosque if we reduce those flows down to a point. I can do that in a sentence actually, but instead I'm going to talk around the issue instead of dealing with the nuts and bolts right offhand.

An Update

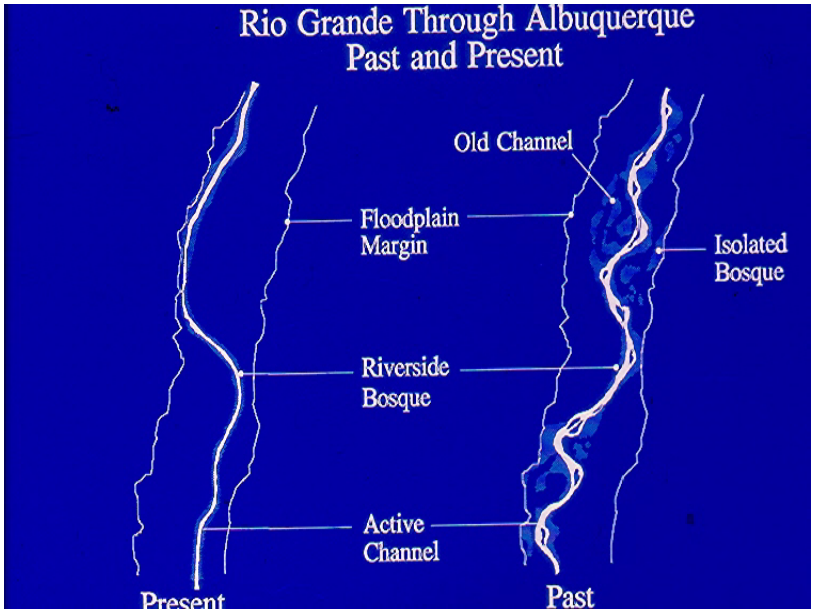
Let me start with an update on how the bosque got to be the way it is. I think it's useful to understand something about the past in order to begin to understand the present, and begin to think about how to deal with the future. I'll say a few words about the outlook for management and finally end up with some suggestions for management. (No one asked me for suggestions about management, but why not?)



Why does geology control the whole show in the bosque and the river? At least it did, for a long, long time. Until regulation began, basin hydrology was a function of climate and geology interacting. In the short term, which is what interests me particularly, the timing, duration, and intensity of flood pulses caused the river to have a flow regime that started the bosque, maintained the bosque, and redistributed the bosque. The flood pulse is the basis of basin hydrology, water coming down in pulses. The concept of a flood pulse is really pretty important: otherwise, you think of high or low flows, but not something with a surge that would bring about a critical response, such as the planting of new trees. The flood pulse directly influences the establishment, physiological and ecological maintenance, and distribution of trees in the riparian forest or bosque. It also has influenced--usually detrimentally--the people living along the river. This caused people in the late 1800s and early 1900s to do something about it, and we ended up with the kind of regulation we've been talking about.

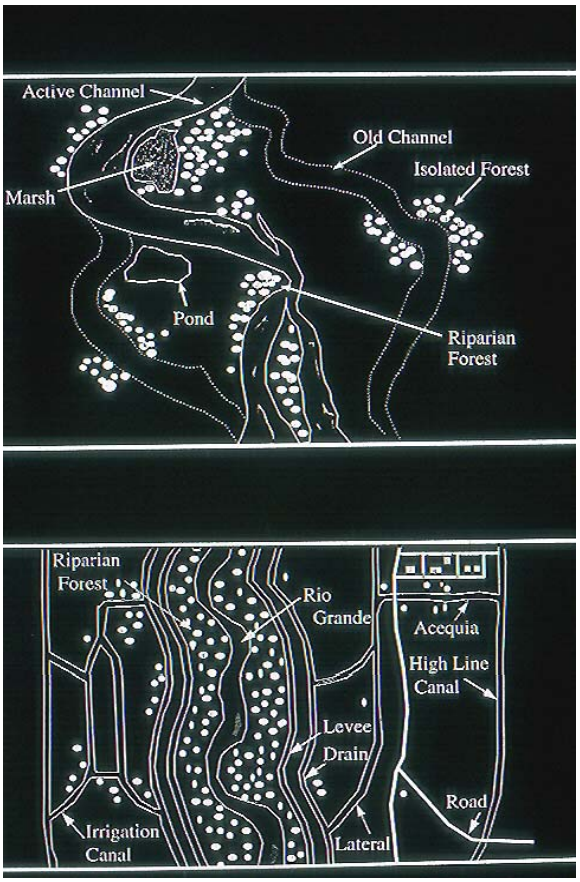
The flow regime itself historically controlled the establishment and distribution of the native forest, and it did so as the diagram on the right indicates. Compare that with the diagram on the left. The figures outline the floodplain boundaries in the Albuquerque reach. On the left you see the river and the gallery forest lining the river and that's a fixed entity that is continuous. The one in the past is an imaginative look at the river and the bosque--the bosques, plural--at any point in time over the past several million years probably, but definitely over the past ten thousand years. The river moved across its flood plain, plugged itself up, and by avulsion, bounced off into a new channel. With the flood pulses coming down, particularly at this time of year as snowmelt, new bosques were planted, and new bosques were destroyed, creating a hodge-podge, a mosaic, of trees in different

places with open space in between. The trees were not all of the same age, as they pretty much are in the bosque we have here now. The dynamics of the whole system were very different.



To continue this history, today we regulate the flow regime, together with stream morphology and sediment distribution. The upshot is that we are responsible for the way the bosque works, for its present day establishment, and for its present day maintenance and distribution.

The next slide shows the same thing on a slightly different scale. The meander channel wiggles a bit there and you can see along it a patchwork of trees. There is also a patch of isolated cottonwood forest around what was a town at one time, with water-ways and wet meadows. This is not too unlike what the case was back in the thirties. Someone earlier alluded to the fact that the valley had a much higher water table then. One reason, certainly, that the [middle Rio Grande] water table was higher at that time was that there was an awful lot of runoff coming down as a result of logging, beaver damn removal, and grazing in the upper watershed. This aggraded the river, and it bled off to the sides, raising the water table in the valley.



Coping with the Urgent Shortfall Reality

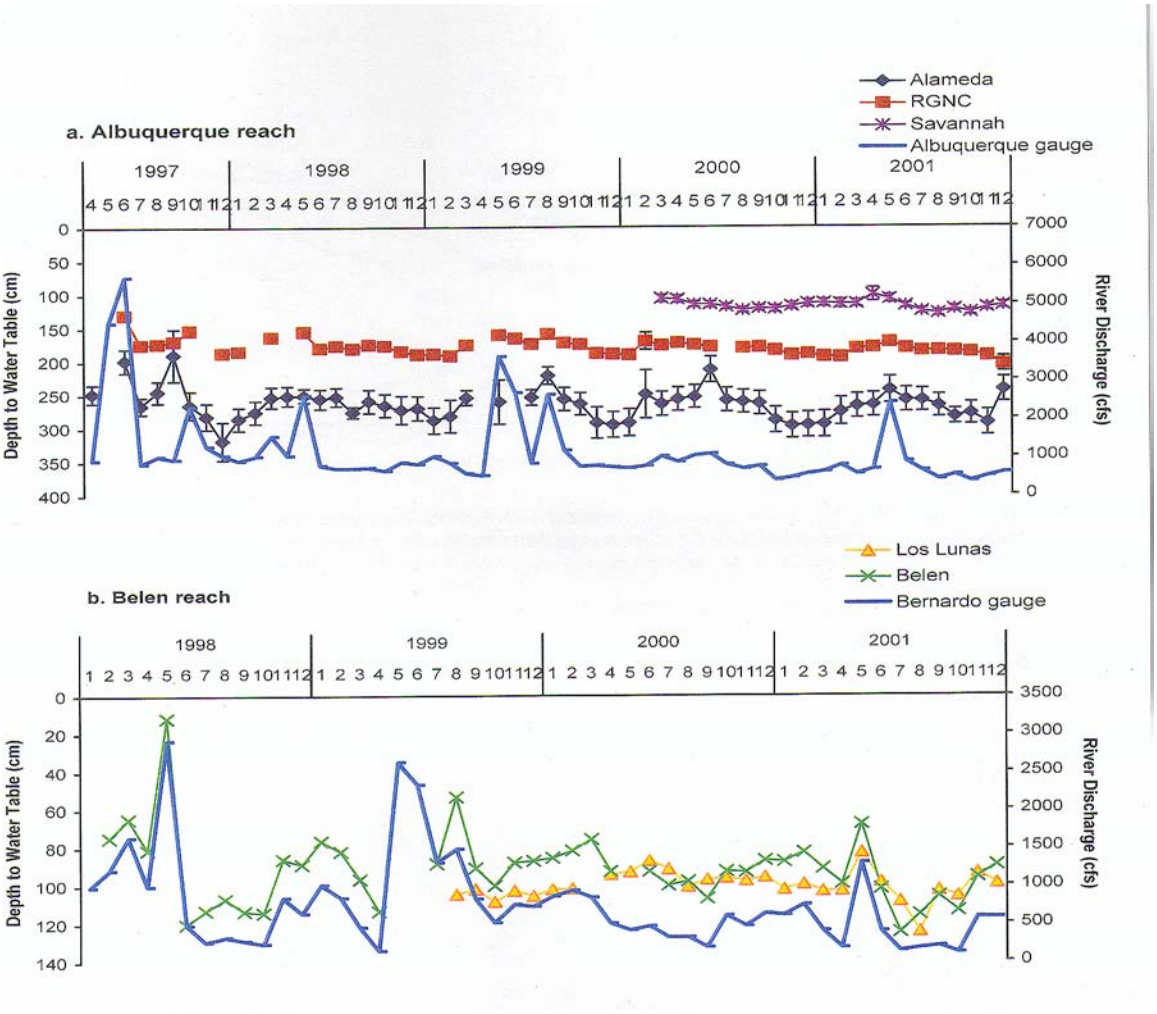
Seldom do we see this anymore: new cottonwoods, planted the year before by overbank flooding. These are new cottonwoods, and new willows, but look across the river and that's a picture of the real bosque right now. For the most part it's non-native vegetation, Russian olive, saltcedar, and a few big old cottonwoods behind. Invasive trees are here to stay. They really contribute to the bosque, complicating the whole picture, and greatly adding to the density, to evapotranspiration and the wildfire potential of the whole gallery forest. In the past, the driving force behind how the bosque was organized was the flood pulse. At present, the new driving force is largely fire--at least that's what all of us think.

This next slide shows maybe a quarter of mile of bosque with three main kinds of trees--cottonwood, Russian olive and saltcedar. If you took any place along this quarter mile and tried to establish how well it was connected to the river, how much the river influenced it at any one time, you'd probably come up with three rather different [?]. The degree of connectivity of the river to any of those places would not necessarily be the same, which would have consequences over the long run. In other words, the connectivity varies, and we know from ongoing studies in other parts of the west that it's not [water levels dropping below] twenty-five feet that will kill cottonwoods: it's more like ten feet, about three meters. Then you get canopy die back, which ultimately reduces photosynthesis and the trees begin to die. This is happening in certain places along the bosque right now.

Meeting Rio Grande Compact Obligations in the Years to Come

Next slide. The dots with arrow bars on them represent the Alameda BEMP site over a five year period. The blue line is the river flow in cubic feet per second. The line at Alameda goes down to below 300 centimeters, which is where things get really tight for cottonwoods, and it has hit that point a number of times. It wiggles a lot over this five year period. These are monthly collections and Alameda is quite different from the other two sites. The two lines above are the Rio Grande Nature Center, which is not far south from Alameda, and the purple one is the Savanna site, across the river from the Nature Center. The point I want to make is that there is a lot of variability in connectivity with the river.

You can see the same thing below, where the Bernardo site is represented with a blue line over a four-year period. The yellow line is an old forest at Los Lunas, and the green line, which tracks very closely with the river, is a young forest, about thirty years old, at Belen. The latter is very tightly connect to and gets flooded periodically by the river. Variation is what I'm after here: there's no one place in the bosque that's quite like another with respect to the influence of the river.



The Outlook for Management

How does management cope with all this? Not easily. Right now there's an awful lot of clearing going on in the bosque--clearing for fuel load reduction. The benefits are undoubtedly a reduction in the prospect of wildfires, and a saving in water, but the question I have is, if these cleared areas are

replanted with cottonwoods (pole planted, not naturally re-seeded,) might not this whole thing come back again in a period of maybe ten years? We would have saved people's lives and property by reducing the fuel load, and we may have saved water too, but eventually we will come back to this if we merely go in and replant where we've cleared. The subtlety resides in understanding the locations where you can plant cottonwoods and have them in contact with saturated soil in the root zone. If you don't have that information, there's going to be a lot of wasted time and effort planting trees in some sort of regular pattern just to get what appears to be a pretty bosque. Saltcedar is going to come in because it doesn't obey the three-meter rule at all. It has roots that go well beyond that and saltcedar is therefore very, very hard to extract and get rid of.

It's been evident to me from what the previous panelists have been saying, that flows will continue to be reduced and in places the riverbed will continue to be increasingly incised. You get incision below dams in particular, and the gouged-out sediment keeps moving downstream and gets deposited in other places to the point where it becomes a sediment problem. There's no one way of dealing with this very happily unless you understand how the sediment is going to be moved. There are those who advocate increasing sediment in sediment-starved reaches in order to create new floodplain within the levee system that would support new colonies [of trees] but you can't do that everywhere. The need for flexibility arises and I should add that if the three-meter rule is disobeyed by taking the river down, incising it to a point where it is below where it is at Alameda for example, you're going to get some real problems with the bosque.

Suggestions for Management

So I've got some simple, general steps to prevent this. First, be flexible. Emphasize adaptive management that takes advantage of these reductions. Revitalize the ecosystem itself by creating a mosaic similar in structure and appearance to those of the past, but now confining them to within the levee system. [A mosaic] of mostly native, uneven- aged tree stands interspersed with grasslands and shrublands ought to reduce evapotranspiration--save water--and very definitely cut back on the sweeping effect of wildfires in the system.

I think it's evident that in the last ten years or so, management has become a bit more cohesive. There's more collaborative effort going on, and more integration going on. Ultimately, the landscape is going to be changed to the point where it somewhat resembles the past, where it can adapt to water flow reductions, and where there's still some bosque that's attractive and interesting and biologically diverse. The resource agencies need to continue working with each other to develop location-specific plans and a much more integrated management than has taken place in the past.