

Instream Flow

Clearing the Air on Water

PART
FIVE

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Instream Flow and Return Flow

Listen closely to folks talking about irrigation and there's a good chance you'll hear the comment that one of the best ways to get more instream flow is to increase irrigation. The logic is reasonable enough: Flood irrigation saturates the ground next to the stream, then the water that soaked into this natural "sponge" in early summer gradually returns to the stream, replenishing late summer flows with cool, clean water that's good for fish. It sounds like a fine deal for everyone and for sure, some of the water diverted from some streams does return. That's why it's called return flow. However, this particular process of providing instream flow isn't quite as efficient or reliable as it might sound.

Sure, there are some places in the state where irrigation return flows are pretty obvious. By some estimates water diverted from the Shoshone River near Cody may be reused as many as four times before reaching Yellowtail Reservoir. There's also an indication that return flows from diversions along the Gros Ventre River near Jackson supplement flows in a complex of spring creeks that maintain habitat for native Snake River cutthroat trout.

Many water managers assume that about half of the water diverted from a stream may return over some period of time. There have been a few scientifically defensible studies of return flow rates on which to base this assumption (such as one on the New Fork River near Pinedale) but not many. These studies show that return flows may range from 60 percent of the diverted flow to zero (no return). The state doesn't document the return flow for each stream or stream segment, but in over 23 years of studying streams in all parts of Wyoming, I can name more streams where return flows don't add much flow to the stream than I can streams where return flows are providing good fisheries.

Streams like the Laramie River, the Middle Fork of the Popo Agie in Lander, Clear Creek in Buffalo, Big Goose Creek in Sheridan, Shell Creek and Deer Creek near Glenrock all could use more water, but if current irrigation patterns are providing the little

flow that's present now, it seems unlikely that enough new irrigation could be done to change things very much.

If you think about it, there are lots of reasons why return flows aren't a reliable source of water for instream flow. First, every stream and the land through which it flows is different. The hydrologic and geomorphic characteristics of streams change continuously along their length. Given this natural diversity, it's unrealistic to assume that return flow processes will be the same everywhere. Return flow is a function of when water is diverted, how much water is diverted and where water is diverted from the stream. Precipitation patterns affect return flow, too. If the soil is saturated by melting snow or if the lack of rain has depleted subsoil moisture, it'll make a difference in how much water gets back to the stream.

Soil type makes a difference as to how tightly water is held, and crop type affects how much water is removed. All these factors, and many others, can affect whether return flow comes back quickly or slowly. Sometimes it takes five months for return flows to show up.

One of the biggest factors affecting return flow is where the water is used in relation to the stream. If the water is applied on alluvial soils in the riparian zone right next to the stream, like along the New Fork, more of it may wind up back in the stream. But sometimes, water is applied to fields that are several miles from the stream or even in a different drainage, which is what happens on the Middle Fork of the Popo Agie. In those situations,



Below the diversion and irrigated meadows, Boxelder Creek flows at just a trickle. Return flows from irrigation are not enough to maintain or improve the stream fishery.

it's unlikely any of the diverted water finds its way back to the parent stream.

Sometimes when diverted flows return to the stream, the water isn't in better shape than when it was taken out. That's the case on the Bighorn and Shoshone rivers, which progress from Blue Ribbon trout fisheries below Boysen and Buffalo Bill dams to warm, silt-laden streams.

Much of the return flow in those streams comes back as surface water at the end of irrigation ditches. Certainly, part of the downstream water quality change is due to natural processes, but irrigation return flows to both rivers generally contribute warmer, dirtier water than is flowing in the stream.

None of this is a knock on irrigation or agriculture. Irrigation is an important part of Wyoming's heritage and is essential to maintain this part of our economy. What's more, the Wyoming Game and Fish Commission owns over 650 water rights and irrigates a lot of land for wildlife.

In some settings such as along Bear Creek near Dubois, we even irrigate meadows partly for fisheries — flooding riparian fields in early summer but then ceasing irrigation in late summer so return flows can supplement natural stream flows.

Irrigation does one thing well: It takes water out of streams. However, the process of putting water back in is a much less certain one. Because of the variability associated with the process, it's an oversimplification to imply that irrigating more will generate enough instream flow to support or improve fisheries in all or most situations. Surface and groundwater interactions are always unique and complex.

Detailed studies are the only way to really understand just what that relationship is on each stream. One thing's for sure, though. If irrigation return flows were a significant and reliable way to improve flows and stream fisheries, Game and Fish fishery biologists would be at the head of the line asking for more. But the reality is, there just aren't many places where that's the case.

So the next time you hear that one of the best ways to get more instream flow is to irrigate more, just remember — it's not quite that simple. 🐾



Flood irrigation from diversions on streams like Boxelder Creek near Glenrock is used to grow many crops in Wyoming.

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