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Commentary

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Performance of Irrigation Systems

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Description

The primary consumption of water within an irrigation system is by the process of evaporation from open water surfaces, evaporation from moist soil and transpiration from vegetation. The combination of this evaporation and transpiration is termed ET. The transpiration of water is a necessary and inevitable part of vegetative growth and agricultural production. In addition to ET, water that is returned to a saline water body or that is severely degraded in quality is essentially lost as a freshwater resource. All other water diverted by an irrigation system remains in liquid form and will ultimately return to a freshwater system. The return of diverted water to the system is a natural, diffusive process that is nearly impossible to control, because remaining liquid water must obey the law of gravity and the law of conservation of mass. Gravity brings no evaporated water back to a stream, ocean or aquifer system. A consequence of reducing water diversions is almost always a reduction in return flow back to the resource. Therefore, the quantity of net consumption by an irrigation system may be largely unchanged by a conservation program. To effectively create "new" water in a regional context, unless directly upstream of a salt sink, a conservation program must in some way reduce evaporation or ET or improve return flow quality, and not simply reduce diversions. Reductions in the direct consumption of water are usually in the form of reducing areas of phreatophytes or wetlands along canals, collection ditches, or in areas of shallow, ground-water seepage to the soil surface. Wetlands and phreatophytes created by irrigation are often considered to be of value for wildlife habitat and may be lost when water conservation practices are implemented. It is important that irrigation improvement procedures be evaluated to show when and how water is actually saved by the conservation program. Guidelines for preparation of conservation plans must include procedures for describing hydrologic components and interactions within and beyond irrigation system boundaries, with descriptions and examples of how to assess whether evaporation or ET can be reduced within the system or "return" flows into saline systems can be reduced, thereby achieving real conservation of water and the creation of an enhanced water supply. Unfortunately, it is common to draw "lines" around system boundaries and to neglect the real interconnections between in-system "losses" and existing river system gains. In evaluating the performance of irrigation systems, one has to be careful to establish appropriate physical boundaries and time frames, since water is often in transit or in temporary storage. One can only evaluate the performance of an irrigated area by examining the irrigation water when it leaves the defined boundaries of interest. The applied irrigation water can be placed into several categories. Water consumed by the crop within the area for beneficial purposes. Water consumed within the area under consideration but not beneficially. Water that leaves the boundaries of the area under consideration but is recovered and reused by the same party or by a “downstream” party. Water that leaves the boundaries of the area under consideration but is either not recovered or not reusable. Water that is in storage within the boundaries. Categorization can help to identify improvements that may truly conserve water. Water consumption are physically unreasonable, since buried drip systems can generally only reduce evaporation by about one-half and consequently can create savings of only 5 to 10% of total consumptions and likely only 2 to 5% of total water diverted. .

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