# Initial Evaluation of End-gun Removal

This initial evaluation of the potential reductions in consumptive use by removing pivot end guns provides a framework to be refined with better estimates of the parameters assumed here. It also provides an initial estimate to allow gross categorization as a potentially large or not large component of reduction in consumptive use.

## Assumptions

- Alternative if end guns are removed: Fallow or non-irrigated vegetative cover;
- Water source: No assumptions made;
- Pivot size: Average radius 1,320 feet;
- End-gun reach: 100 feet average;
- Percentage of the pivot circumference where end gun is utilized: 50%;
- Consumptive use on end-gun acres: Equal to pivot consumptive use;
- Percentage of irrigated lands served by pivots: 80%.

## Potential Refinements

The estimates of pivot size, end gun reach, and the percentage of time that pivots are operated and the percentage of irrigate lands served by pivots could be refined greatly with eight to 12 hours of GIS analysis of a statistically-valid sample.

Analysis similar to Rumsey's considering the fraction of applied irrigation water that is stored in the root zone, along with analysis of crop data from NRCS or other published sources, could be used to refine the assumption that end-gun acres have the same net consumptive us as the acres under the pivot itself. Such an analysis should not simply difference published consumptive-use fractions but calculate the required application depths at the specified fraction. For instance, the difference between 60% and 90% is 30 percentage points. However, 1.8 acre feet at 60% requires three feet of application and at 90% only two acre feet are required. The difference, one acre foot, is 33% of the greater volume and 50% of the smaller. Further, the analysis should consider carefully the fate of the fraction not stored in the root zone; interruption of percolation fluxes is not a savings to the aquifer. This fate is application-method and site specific, and strongly influenced by crop and operational decisions.

## Calculations

Area of pivot without end gun:

$$(1{,}320 \text{ ft})^2 \times \pi \times (1 \text{ acre} / 43{,}560 \text{ ft}^2) = 127.5 \text{ acres}$$

Area of pivot with end gun @ 100% utilization

$(1{,}420 \text{ ft})^2 \times \pi \times (1 \text{ acre} / 43{,}560 \text{ ft}^2) = 145.2 \text{ acres}$

Difference attributable to end gun @ 100% utilization

145.2 acres - 127.5 acres = 18.5 acres

Difference assuming 50% utilization of end gun

18.5 acres/2 = 9.25 acres.

Area of pivot with end gun assuming 50% utilization

127.5 acres + 9.25 acres = 136.75 acres

Potential percentage reduction per pivot:

9.25 acres / 126.75 acres = 0.073 = 7.3%

Potential percentage reduction overall with 100% adoption of practice:

100% total acres x 80% pivot fraction x 7.3% reduction = 5.8%

**Imprecision**

A first response to this analysis is that the calculated average acreage of 136.75 exceeds the rule of thumb expectation of 130 acres of pivot, 28 acres of corners (four @ seven acres) and 2 acres of roadsides and field borders per 160-acre quarter section. That points to a minimum imprecision of (6.75 acres / 130 acres) or about five percent. Subjectively it is likely that the true potential savings ranges from perhaps four to ten percent on an individual pivot and perhaps from two to eight percent overall with 100% adoption.