Runoff Farming

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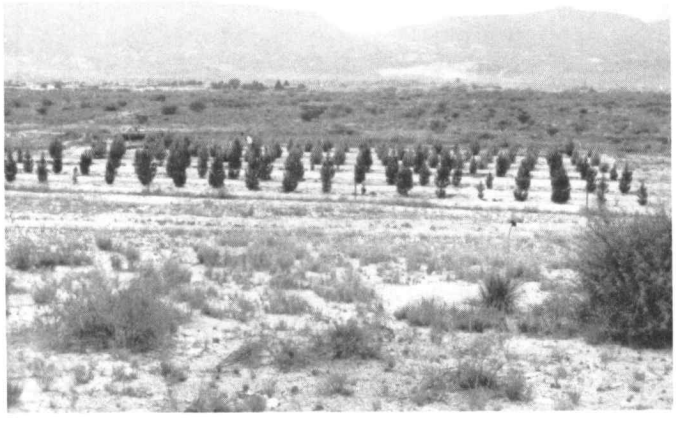
Runoff farming is simply the use of water harvesting to grow a "crop." A portion of the land (catchment) is sacrificed for the water it yields to produce a crop on the runon area. The collected water normally is all stored in the soil profile of the cropping area, but any surplus may be stored in small onsite reservoirs to be used for subsequent irrigation.

We have been evaluating runoff farming as a management tool to try to improve the productivity and profitability of marginal land in the Southwest. In our studies, runoff farming was used to grow conifer trees on extremely marginal land. Two sites on Forest Service land near Camp Verde, Arizona, were converted from assorted cactus, creosote bush, catclaw and weeds to stands of Arizona cypress and Eldarica pine. This area has an average annual precipitation of 12 inches, but a potential evaporation of five times that amount.

Parallel-contour terraces were constructed to grow the trees on. The upper terrace portions were the water-collecting catchment area with the runon-cropping area at the lower edge. The catchment-runoff areas were treated to increase precipitation runoff. One site with a loamy-sand soil was treated with a paraffin wax at 0.9 pounds per square yard. The other site, with a silty loam soil, was treated by mixing common stock salt at 5 tons per acre into the surface layers.

The tree seedlings were planted in a row, 5 feet apart, in the middle of each runon area. They were hand watered every two weeks from planting in March until the summer rainy season began in August.



Conversion of desert scrub to conifers using runoff farming.

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The site for the runoff farming study described in this report was provided under a memorandum of understanding with the U.S. Forest Service, Prescott National Forest.

The Arizona cypress got off to a fast start, nearly doubling their height the first year. After only three years, the trees on the sandy soil averaged over 7 feet tall. On the clay soil, the growth of the cypress slowed after the first year with visible indications of drought stress. Apparently, there was poor water infiltration on the finer soil type. Nevertheless, the trees continued to slowly grow with only a 3% mortality.

The Eldarica pine trees got off to a slow start at both sites. It was not until the third year that the trees exhibited good growth. Pines on the salt-treated clay site averaged over 6 feet tall after three years, and less than a half percent died. There was no apparent water infiltration problem at this site for this species. Unfortunately, the Eldarica pine had trouble rooting at the sandy site. Nearly 50% of these trees died from drought stress while the deeper rooted cypress on the same site were thriving. Those pines thrived that developed root systems which could exploit the deep-stored soil water.

Arizona cypress after three growing seasons on wax-treated sandy soil.

The water requirement of these trees as they reach maturity is still unknown, but certainly they can not survive at locations such as our study site without extra water. Our catchment sizes were designed so as to double, triple, or quadruple the amount of water supplied by the precipitation. Those trees with the smallest catchments showed more stress than those on the larger catchments. About 24 inches of water per year may be about the minimal amount required.

We are currently evaluating a drip irrigation system to substitute for handwatering during plant establishment. Very little irrigation water is involved just for starting the trees, and it would be expected that the lines can be moved after establishment to accommodate new plantings. We are also looking at deep tillage techniques to improve rooting and speed early growth of the pine, and are evaluating soil treatments to improve water infiltration on the salt treated soil.

Other Uses of Runoff Farming

In our studies the conifers were designated for Christmas trees, but they could have been used for other purposes, and we could have used other "crops." Following are other possibilities of potential runoff farming applications.

Livestock Applications: Runoff farming could be used to grow trees for summer shade and shelterbelts for winter storm protection. The runoff farming systems could also be designed to channel some of the harvested water into a storage reservoir for drinking water supplies. Runoff farming is already being used in some parts of the world to supply emergency livestock feed during severe droughts. Opuntia and saltbush have been used, but many other drought tolerant evergreen browse plants such as jojoba, kochia and winterfat could be likely candidates.

Conservation and Wildlife Applications: Runoff farming can be used to improve wildlife habitats. Plants could be chosen for the particular food, cover and/or nesting requirements of specific wildlife species. The system also could be used to supplement the animal drinking water supplies.

Desertification is an ever present danger of fragile, abused lands. Once the desertification process is initiated, it is difficult to stop, and is nearly irreversable. Runoff farming techniques can be used to revegetate such areas. There are many parts of the world where fuelwood is used for practically all the household energy needs. Even in the United States, there is a renewed interest in firewood for home heating. Runoff farming could be used to grow the necessary trees.

Runoff farming could be used to support wind-, snow-, sand-, and even firescreens. Snow-screens would concentrate the snow to reduce sublimation losses and would slow the spring melt. Sand-screens could reduce the nuisance and hazard of blowing sand.

Aesthetic Applications: Runoff farming can be used to improve landscaping around ranches, and to revegetate abandoned irrigated crop land and mine spoils in some arid-semiarid areas. Combined with mosaics of small woods, this should also be ideal for wildlife.

Improving Productivity: Our studies were with evergreen conifer trees but there are a number of potential uses for runoff farming to improve the productivity of some of our semiarid lands where water is a limiting factor. Runoff farming could be used in some areas for commercial or food crops where irrigation is not an option. High value crops either tried or suggested for runoff farming include grapes, berries, various fruit and nut species, Indian corn, and asparagus.

Runoff farming is a centuries-old agricultural system designed specifically to increase the productivity of arid-semiarid lands. The use of runoff farming is expanding throughout the world, but has been slow to catch on in the United States. Generally, the system has languished in the shadow of irrigated agriculture, but this may change as irrigation waters dry up or become prohibitively expensive, and as population pressures around the world force additional demands on marginal lands.

References

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