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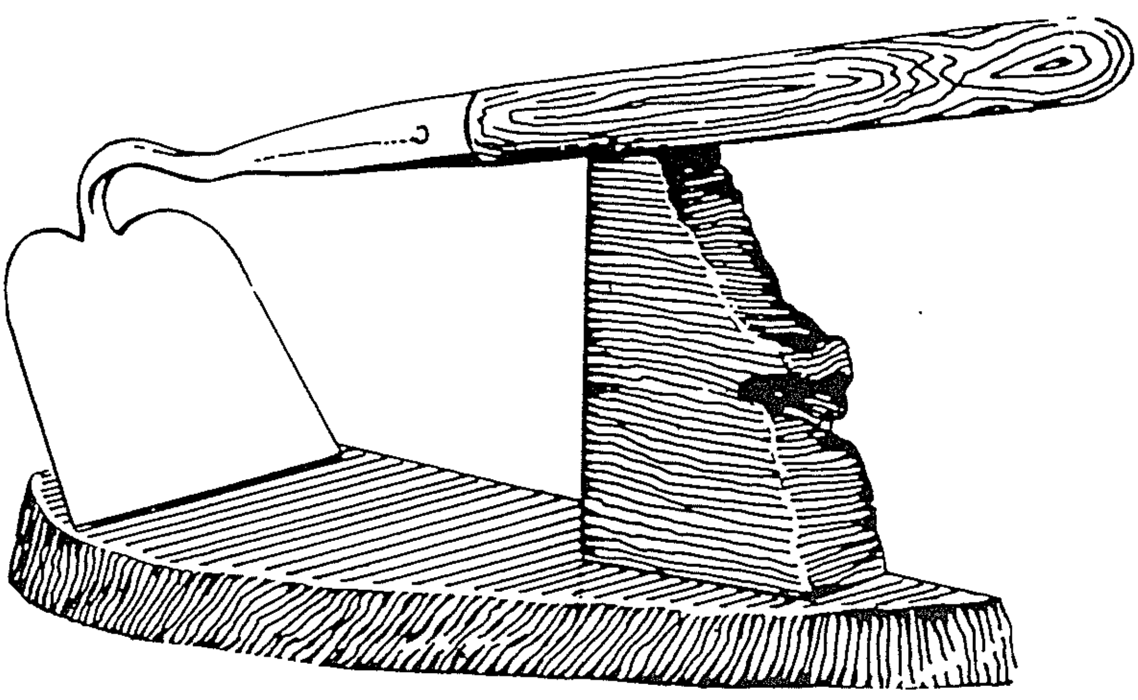

REVEGETATING RETIRED FARMLAND FOR WEED AND DUST CONTROL

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URBAN WATER DEMANDS ARE DRIVING THE RETIREMENT OF FARMLAND IN ARIZONA.

In many areas of Arizona, the water beneath farmland is more valuable than the crops that can be grown on the surface. Cities, developers, and speculators have purchased "water farms" to secure municipal water supplies (6). In Pima County, the City of Tucson has purchased and retired about one-half of the farmland.

Arizona's 1980 Groundwater Management Act (GMA) will probably cause more farmland to be retired. The GMA dictates that by the year 2025, the Tucson, Phoenix, and Prescott Active Management Areas will reach "Safe Yield." Safe Yield means that no more water can be pumped from the aquifer than is recharged into it. In order to meet Safe Yield, the State of Arizona will buy and retire farmland. A pump tax is now accumulating funds for farmland purchases.

If farmland is retired without a vegetative cover, blowing dust and tumbleweeds will characterize the land for five to ten years.

A messy process called secondary succession will eventually revegetate the land (3). Rural residents will endure the blowing dust and tumbleweeds until the land begins to stabilize. Where the annual rainfall is below 8-inches and the soils are clay to clay loams, natural revegetation will take 30 or more years.

In Pinal and Cochise Counties, dust storms from abandoned farms have caused fatal accidents on Interstate 10. There have been no such accidents in Pima County, and the City of Tucson is mowing tumbleweeds to keep them from blowing off the property.

A PERMANENT VEGETATIVE COVER WILL PREVENT THE PROBLEMS.

If a permanent vegetative cover is established before retirement, there will be less blowing dust and tumbleweeds. Hence, there will be fewer highway hazards from blowing dust, better wildlife habitat, and a maintenance-free site.

Over the last four years, we have developed successful revegetation techniques that provide a permanent vegetative cover in <u>one</u> year. We believe that vegetative cover should be established <u>before</u> retirement. The cost is about $100. per acre. This is not unreasonable for a city which would otherwise have to mow tumbleweeds and can be held liable for the environmental problems of retiring the land.

WE HAVE IDENTIFIED THREE FUNDAMENTALS OF ESTABLISHING A PERMANENT VEGETATIVE COVER:

1. Work with the farmer while he is still on the land.

Working with the farmer makes the job simpler. He knows how to efficiently run the irrigation system, weed problems, and soil types. The new landowner may wish to pay the farmer to do the job.

2. Plant adapted species.

The choice of plant species varies with climate and soils. At our test site in the Avra Valley west of Tucson, we have planted a range grass species study in each of the last four years. We are presenting the data of the oldest experiment (planted July 1986) in this section.

We prepared a flat-disked seed bed and planted just before the summer rains began. The species are buffelgrass (Cenchrus ciliaris), kleingrass (Panicum coloratum), "Catalina" Boer lovegrass (Erogrostis curvula), "Cochise" lovegrass (E. lehmanniana Nees x E. trichophora Coss and Dur.), bottlebrush (Anthephora pubescens), and sideoats grama (Bouteloua curtipendula). Only sideoats grama is native to Arizona; the others all originated in Africa.

We applied three irrigation treatments to each species. They were no irrigation, two irrigations on 7-day intervals, and four irrigations on 7-day intervals. Each species x irrigation combination is a separate plot in three replications of randomized complete blocks. Each plot is 6.1 x 91.5 meters.

In 1987 we started another series of experiments to study the effects of establishment irrigations and waterharvesting. Those results are in the next section, and only the results of the species plots irrigated four times are presented here.

Every year since planting, we have measured the standing forage of the grass species by randomly dropping a quadrat and clipping the grass within. The oven dry forage yields are presented in Figure 1. Buffel and Catalina have steadily increased in their presence, despite lower than average (the average is 30 cm) rainfall in 1987 and 1989 (Figure 2). The stands of klein and Cochise thinned in 1989, possibly because of the lower than normal rainfall. The stands of sideoats and bottlebrush were never significantly better than zero.

The upward trends of buffel and Catalina are very promising. The summer of 1989 was extremely hot and dry, and we expected the grasses to decline until conditions improved. Time will tell whether klein and Cochise will rebound.

However, our use of non-native grasses has been somewhat controversial. Native grasses are difficult to establish. We have never been able to establish a stand of sideoats that is significantly better than nothing at all.

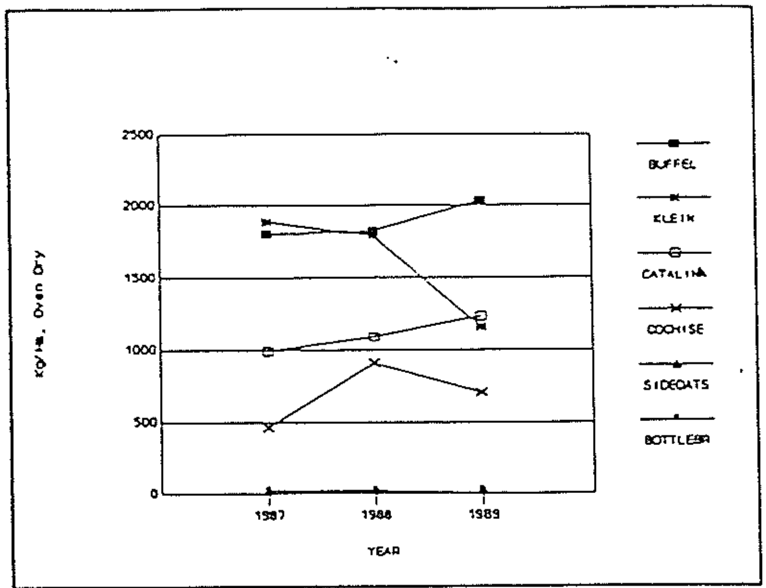

Figure 1: Standing forage in the 1986 species study.

We believe that sideoats grama is adapted to soils with an "A" horizon high in organic matter. This horizon does not exist where the soils have been plowed and irrigated.

In contrast, African grasses evolved on poorer soils than those in Arizona. They think they have died and gone to heaven when we plant them here. In our view, it is not a question of whether we can have introduced grasses or native grasses. It's a question of having introduced grass or no grass, plus wind and water erosion.

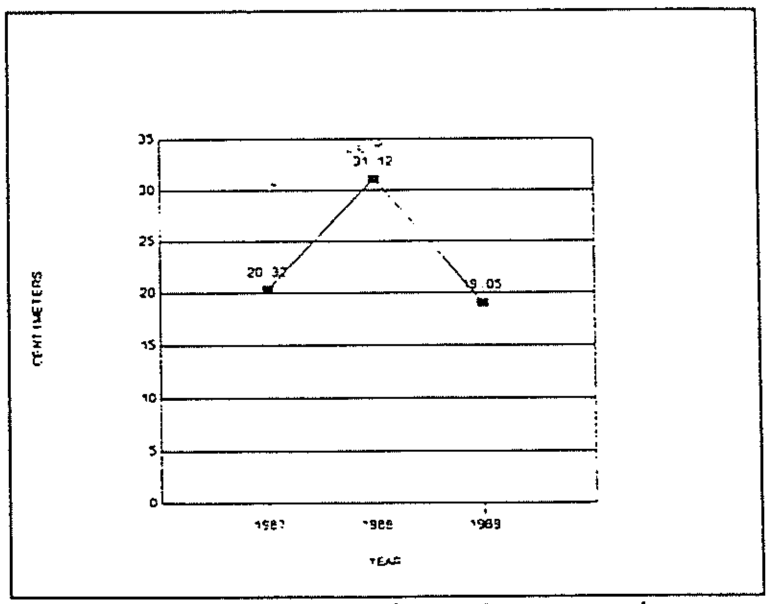

Figure 2. Annual rainfall at raingauge #1, Three Points Test Area.

We do not, however, advocate planting monocultures of grasses. In other experiments, we have identified adapted trees and shrubs (saltbush, mesquites, and acacias); and would recommend a diverse mixture of plants.

3. Apply establishment irrigations.

The conventional wisdom of range seeding in Arizona is that it will work in only one year out of ten. The reason is that the rainfall is erratic and unreliable. Usually, the weather turns out to be too dry; or it does rain, the timing is all wrong (1,2).

In 1987, we began a series of experiments to evaluate the effects of establishment irrigations and waterharvesting on range grasses. Other researchers found that waterharvesting improves the survival and productivity of perennial plants in the desert range (4,5). The three land treatments are flat-disked ground, 40-inch furrows, and 80-inch wide waterharvesting microcatchments. We formed the furrows with an ordinary lister, and we made the waterharvesting microcatchments with road grader blades welded together in a "V" form. The microcatchments are about 4-inches deep in the middle of the "V".

We tested each land treatment with and without establishment irrigations, with each land x irrigation combination as a separate plot. The plots are 6.1 x 45.8 meters, in three replications of randomized complete blocks.

Just before the summer rains, we seeded equal amounts (pure live seed) of buffel, klein, and sideoats grama over the entire experiment. We began the establishment irrigations right after seeding.

As in the species study, we clipped the standing forage. Though we weighed each grass species separately, we are presenting the combined totals for each treatment in Figure 3. When analyzed as separate treatments, the irrigated plots yielded significantly more forage than the unirrigated plots. We could not detect any significant differences due to the land treatments alone.

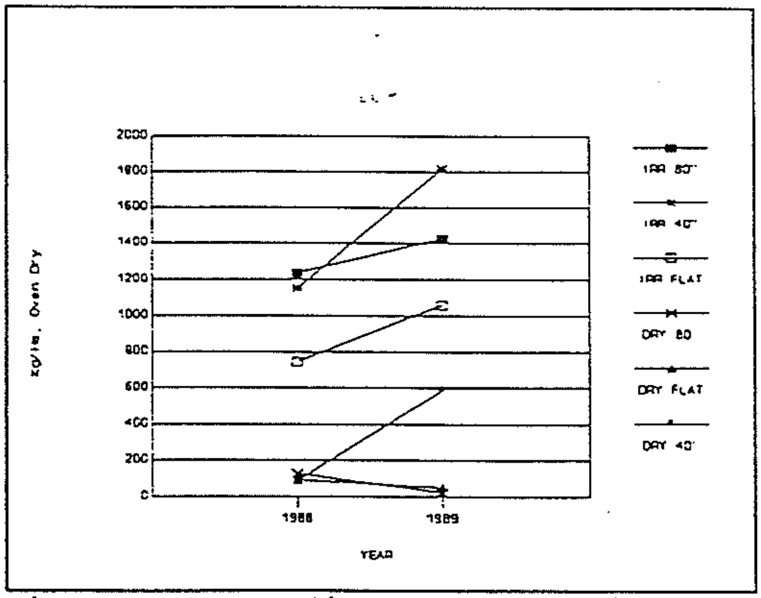

Figure 3. Standing forage in the waterharvesting and irrigation study.

Based on these results and that farmland can be easily and efficiently irrigated in furrows, we recommend listing the land (or using the furrows from the last crop) and applying establishment irrigations. The amount of irrigation needed will vary with the rainfall; we recommend irrigating often enough to keep the top centimeter of soil wet until the seedlings are established. In a large-scale demonstration, we established a cover with about 15 centimeters (6-inches) of irrigation water.

IF PLANTED AS THE LAST CROP IN THE LAND, A VEGETATIVE COVER IS EASY TO ESTABLISH.

Based on the experience and data we have, we have identified three fundamentals of establishing a vegetative cover:

1. Work with the farmer while he is still on the land.

2. Plant adapted species, which in the Avra Valley include buffelgrass, Catalina lovegrass, saltbush, mesquites, and acacias.

3. Irrigate until the seedlings are established. How much and how often will depend on the rain; the important thing is to keep the top centimeter of soil wet until the seedlings root in. Once established, an adapted cover will persist without supplemental water.

ACKNOWLEDGEMENTS

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LITERATURE CITATIONS

1. Fraiser, G.W., D.A. Woolhiser, and J.R. Cox. 1984. Emergence and Seedling Survival of Two Warm-season Grasses as Influenced by the Timing of Precipitation: A Greenhouse Study. J. Range Manage. 37:7-11.

2. Fraiser, G.W., J.R. Cox, and D.A Woolhiser. 1987. Wet-dry Cycle Effects on Warm-season Grass Seedling Establishment. J Range Manage. 40:2-6.

3. Karpiscak, M.M. 1980. Secondary Succession of Abandoned Farmland Field Vegetation in Southern Arizona. Doctoral Dissertation, University of Arizona Department of General Biology, Tucson, AZ 85721.

4. Shanan, L., N.H. Tadmor, M. Evenari, and P. Reiniger. 1970. Runoff Farming in the Desert. III. Microcatchments for Improvement of Desert Range. Agron J. 62:445-9.

5. Tadmor, N.H., M. Evenari, and L. Shanan. 1970. Runoff Farming in the Desert. IV. Survival and Yields of Perennial Range Plants. Agron J. 62:659-9.

6. Woodard, G.C., Elizabeth Checchio, G.W. Thacker, and B.G. Colby. 1988. The Water Transfer Process in Arizona: Analysis of Impacts and Legislative Options. Division of Economic and Business Research, College of Business and Public Administration, University of Arizona, Tucson, AZ 85721.