Rangeland and Marginal Cereal Cropland in Central Tunisia

D.E. Johnson, M.N. Ben Ali and M.M. Borman

In Central Tunisia, as well as throughout North Africa and in many other arid countries, there is a trend toward conversion of rangeland and forests to cereal cropland (World Resources Institute 1986, Bedoian 1978). This conversion is a result of expanding human populations with increasing food requirements, sedentarization of nomadic or seminomadic people, and decreasing farm size. Tilling the land also provides a basic claim of ownership in areas where property boundaries are not well defined. However, many of these converted rangelands cannot be cultivated on a regular basis. In Central Tunisia, much of the cereal cropland is intermittently tilled. A farmer may till a parcel of land one year out of four. This causes a degradation and reduction of the permanent cover.

We have tried to view this practice from the perspective of the farmer/stockman to better understand the reasons for the practice, to determine its effects, and to determine what can be done to increase the long-term productivity and stability of the agricultural system. This was done as part of a larger program of rangeland development which began in 1982 and was jointly sponsored by the Tunisian Ministry of Agriculture and the United States Agency for International Development. Technical assistance was provided by Oregon State University.

Johnson and Borman are asst. professor and graduate research associate, Dept. of Rangeland Resources, Oregon State University, Corvallis 97331; Ben Ali is consultant, United Nations Development Programme, Mogadishu, Somalia, C/O UNDP #1 UN Plaza, New York, NY 10017.

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Cereal Production

Most of the farms in this region raise a variety of crops and animals with cereals, olives, and sheep being the principal products from the family farms (Johnson et al. in press). The climatic pattern of Tunisia is Mediterranean with cool, relatively wet winters followed by hot, dry summers with a corresponding variability in plant productivity (Floret et al. 1983). In this fluctuating environment, farmers traditionally attempt to diversify production among several agricultural enterprises to reduce risk of failure of the total crop. Wheat yields are typically about 3.5 quintal/ha (350 kg grain/ha) on dryland sites without irrigation or precipitation run-on. Cereal cultivation predominates and is well adapted to this mixed farming system because: (1) cereals are well adapted to the Mediterranean climate, (2) cereals are easy to plant because seeds are large and can sprout from a variable depth, (3) the cost of cereal seeds is low, and (4) although labor intensive, the techniques of seeding and harvest are inexpensive (have a small capital investment).

Cereal production requires that the soil be tilled and seeded with approximately 80 kg of seed per hectare. On a typical farm in Central Tunisia tillage and seeding is accomplished in a single operation by broadcasting in front of a tractor-drawn disk or a plow drawn by animal traction. The cost to the farmer is approximately 10 Tunisian Dinars/ha ($12.50 US/ha) for the disking operation, which represents the tractor rental price, and 10 Tunisian Dinars/ha ($12.50 US/ha) for seed. In most cases there are no capital outlays for fertilizers, herbicides or harvest. Hand weeding of the crop is done by family members and the weeds are fed to livestock. Family members usually harvest the crop by hand. A portion of the grain, as well as the straw and stubble, is used to feed the animals. Very little standing dead vegetation remains in place following grazing of the stubble in July and August. Almost all the non-grain vegetal material produced is utilized as animal forage and the soil is left bare.

Assuming no cost for labor and the availability of sufficient family labor for each operation, annual return on cereal production need only amount to 20 Tunisian Dinars/ha ($25.00 US/ha) in order to break even. Grain prices are stable, being controlled by the state, so a break even yield can be estimated with some degree of precision. If the price of cereals as grain is 12.5 Tunisian Dinars

per quintal ($15.63 US/100 kg) the break-even yield would be 1.60 quintals/ha (160 kg/ha). Straw prices are quite variable but a reasonable base price in the local markets is 0.050 Tunisian Dinar/kg as fed ($0.06 US/kg). Other combinations of grain straw and hay are given in Table 1. Cereals represent a low cost (at least in the short-run), low risk option for farmers who have ample labor supply.

Cereals also provide flexibility in management options. The farmers have developed a management strategy that reduces the risk of failure in dry years and increases the potential for gain in good rainfall years. In dry years the cereals may be used for either direct grazing or hay. The farm sizes are small and the farmers can rapidly adjust to changing climatic conditions. The flexibility of the management strategy is illustrated in Table 2. By adjusting the amount of land sown to cereal crops, dependent on the fall weather conditions, farmers are able either to avoid losing seed and reduce the risk of capital loss or to maximize the land in cereal grain production. Because they wait for rains and have relatively little land they can make management decisions at several critical times and quickly implement them. For example, if it doesn't rain in the fall a farmer doesn't plant so there is no loss of seed. If abnormally heavy rains come, he can expand the planted area within a few days. After planting, if moisture is scarce because of a dry winter and spring, he can graze the crop directly or collect some of it for hay to reduce the loss. However, in all these cases he must have ample family labor.

Cereals, therefore, provide a high degree of flexibility in the production sequence. Unfortunately, the possibility of a high short-term return in a wet year encourages farmers to plow and seed lands which are marginal as croplands. In subsequent dry years, this land produces weedy forage of limited value. Annual mustards such as *Moricandia arvensis* and *Eruca vesicaria,* the poppies *Glaucium corniculatum* and *Papaver rhoeas,* and other weeds dominate the site.

Weedy vegetation is not limited to intermittently tilled lands. Many of the overgrazed rangelands in the region are also dominated with plants of limited

(top) A marginal wheat crop in April. It is apparent that this stand will not produce grain and flocks are beginning to graze its margins.

(middle) A relatively good stand of cereal in Central Tunisia. The density of the plants is typically low as are grain yields.

(bottom) A central Tunisian farmer collecting cereals to be used as forage for his livestock. If the stand had been better he would have harvested the crop for grain in a similar fashion.

Table 1. Break-even yields of traditional cereal culture in the region of Sidi Bouzid, Tunisia with no labor opportunity cost.

Product	Yield
Grain Only	1.60 Quintal/ha (160 kg/ha) (at 12.500 TD/qu)
Straw Only	400 kg as fed/ha (at 0.050 TD/kg)
Hay Only	222 Kg as fed/ha (at 0.090 TD/kg)
1/2 Grain and 1/2 Straw	0.8 qu grain/ha & 200 kg straw/ha (at 12.500 TD/qu and 0.050 TD/kg straw)
Reseeded Medic Pasture	140 KgDM/ha of increased consumable forage over that available in unseeded pasture (assuming a 5 year life of the seeding and grazing begins year one)

Table 2. A diagram of the management strategy followed by farmers in Central Tunisia.

Month	Action
September	Seed Best Lands—Wait for Rains
October	If Rains are Good—Seed More Land If Insufficient Rain—Wait
November	If Rains are Good—Seed Marginal Land If Insufficient Rain—Wait
December	If Rains are Good and Weather is Warm—Seed Marginal Land If Insufficient Rain—No Action
January	No Action
February	No Action
March	No Action
April	If Insufficient Rain and Crop is Poor—Graze Poorest Stands If Rains are Good—Wait
May	If Insufficient Rain and Crop is Poor—Graze the Crop or Collect for Hay If Stands are Good—Wait
June	If Stand is Good—Harvest and Store the Straw If Stands are Poor—Graze the Crop
July	Graze the Crop Residue

value. The yield of usable vegetation from these ranges is generally low because of continuous intensive use (Wagner 1978, Floret et al. 1978). Abused ranges that have good soil depth (15cm or more) are often converted to cropland because cereals increase the usable forage production even though total vegetal production is less.

Rangeland conversion also results from social considerations. For a farmer, protection and management of rangeland is more difficult than that of cropland because, from the perspective of his neighbors, ranges have traditionally been open. Crops, in contrast, are more likely to be recognized as belonging to an individual or family. Trespass animals are more frequent on rangelands than on croplands.

There are major deleterious aspects to this type of farming. Intermittent tilling results in destruction of perennial and beneficial annual plant populations, especially shrubs. The loss of these plants and the cover they provide increases wind and water erosion and contributes to siltation and flooding problems that are in evidence throughout the region. When contrasted with a well-managed rangeland, this system of land use increases the variation in forage from year to year and accentuates fluctuations in sheep production. The loss of genetic reserves in native plant populations is also accelerated. Most of the farmers in Central Tunisia, however, are more concerned with survival in the near future than with long term stability.

A Program for Reversing the Trend

The responsiveness of this production system to climatic variation and the social benefits associated with tilled land should be emulated in a land restoration program. Range seeding techniques that can be implemented rapidly, with a minimum of expensive equipment and in response to weather conditions, need to be developed. This includes administrative and budgetary flexibility in governmental or assistance programs. Plant species that are amenable to seeding by broadcast are also desirable. A critical characteristic of such a plant species would be large, inexpensive seeds that can emerge from a relatively deep planting and are easily thrown by hand. Since precipitation patterns from year to year are so variable, it is also important that the seeded species have a hard seed content so that there is carry-over, even when there are several dry years in succession. Ample supplies of seeds of adapted range plants and storage facilities where they can be maintained from year to year is prerequisite to a successful program. Seed development to date has concentrated on legumes such as annual medics (*Medicago* spp.) (Chatterton and Chatterton 1984, Gintzburger 1986) and sweetvetches (*Hedysarum* spp.) (Hess 1984, Borman 1986). These plants have shown mixed results in the 200 to 300 mm precipitation zone both across years and sites. Medics and sweetvetch show a high degree of soil specificity, with medics tending to do better on sandy soils. Plant materials development will need to be aggressively pursued in order to isolate and expand seed supplies of locally adapted strains and to define site and environmental requirements.

If the farmer/stockman can learn to manage these plants as self-seeding forages and recognize and respect their value as crops, there is a good potential for revegetation of ranges. Since these plants need only be seeded once and can be grazed the first year (given there is adequate precipitation), only a moderate amount of increased usable production is necessary to give positive return on investment (Table 1). Cooperative range improvement programs with small landowners hold promise since many private farmers, each working his own land, can rapidly improve large surface areas. Management objectives, however, need to be straightforward and expectations of farmers must be realistic in order to insure coop-

eration and success.

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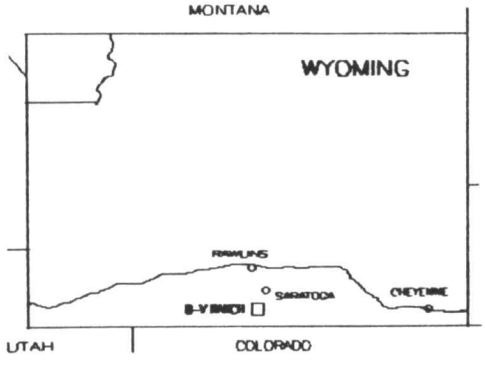
Bath-Vyvey Ranch—Saratoga, Wyoming

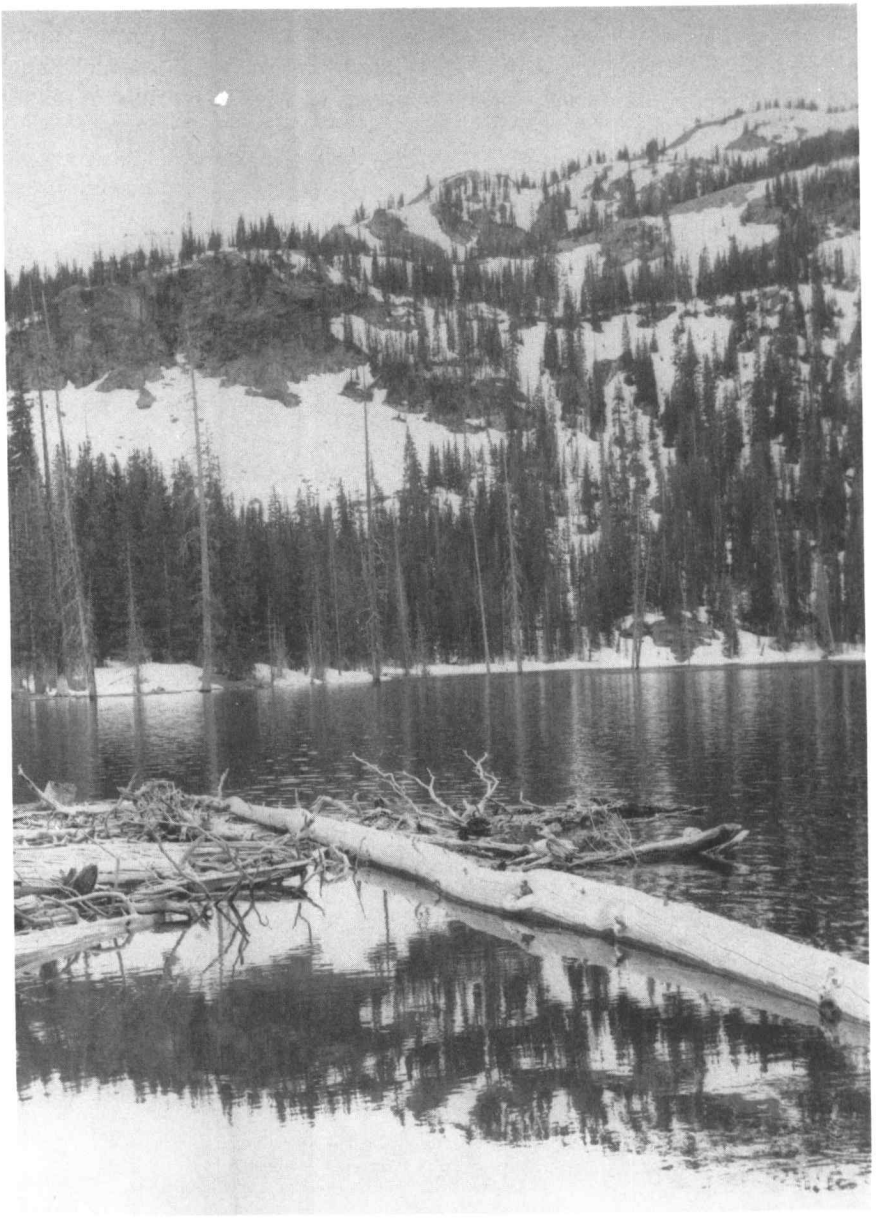
D. Morris Blaylock

The foundation for today's Bath-Vyvey Ranch near Saratoga, Wyoming, was started by Mr. and Mrs. James Heather in 1886. The Heathers' land consisted of two 640-acre homestead allotments, and a 160-acre improvement claim. Mr. Clinton and Charlotte Brown bought the Heather land about 1910, which they combined with their two 640-acre allotments.



The Browns developed the 160-acre Forest Service improvement claim and it became the South Spring Creek Reservoir about 1912. The reservoir is located

The author is a retired range conservationist and now a rancher-farmer and has visited the Vyveys occasionally since 1950.



Spring Creek Reservoir. (Photo by Jennifer Vyvey)