Improved Foothill Rangelands—An Economic Analysis

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The Role of Seasonal Ranges.
Livestock producers in the Intermountain area rely on seasonal ranges to meet livestock nutritional requirements. Timing of use depends on factors such as precipitation and vegetation quality and quantity. Low elevation desert ranges are used in the winter, middle elevation foothill ranges in the spring and fall, and mountain ranges during the summer and early fall (Call and Malechek 1989).

Foothill ranges, while offering the most potential for seasonal range improvement, have been the most abused. Overgrazing and farming during the late 1800’s and early 1900’s, combined with fire suppression, resulted in a loss of perennial grasses and forbs and an increase in big sagebrush and other undesirable woody species (Call and Malechek 1989). Natural recovery of disturbed range ecosystems is uncertain (West et al. 1984, Westoby et al. 1989). Even if natural recovery is possible, ranchers cannot afford to protect an area from grazing for several decades in the hope that the area will regain its productivity. Once a range site deteriorates beyond a particular threshold, significant management interventions (e.g., burning, plowing, revegetation) may be required to restore the site (Friedel 1991). Under these conditions, it may be economically feasible to use artificial revegetation to restore productivity.

Overcoming The Spring Forage Bottleneck
Limited availability of spring forage (the “spring forage bottleneck”) is a production constraint on the typical Utah ranch (Call and Malechek 1989). In response to ranchers’ needs for an inexpensive spring forage, the Agricultural Research Service (ARS) has recently developed several improved forages including Hycrest, a cultivar of crested wheatgrass (Agropyron cristatum (L.) Gaertn., A desertorum (Fisch. ex Link) Schult.), Vinall, a cultivar of Russian wildrye (Psathyrostachys juncea (Fisch.) Nevski), and Syn A, a synthetic hybrid of Russian wildrye.

The Crucial Question
From the rancher’s perspective, a paramount concern is whether revegetation will “pay for itself.” Only then will a rancher worry about which species or cultivar to use. In this economic analysis, we compared Hycrest crested wheatgrass, Vinall Russian wildrye, and Syn A Russian wildrye with Nordan crested wheatgrass and with each other. Each improved forage species was also compared with unimproved native range and “old” (20 years or more) crested wheatgrass stands left as is. The forage yields were measured on upland loam range sites. We used net present value (NPV) analysis which makes it possible to compare projects of different size and duration (Workman 1986).

The following are among the factors that have biologic and economic impacts on the establishment and use of improved forage species on Intermountain rangelands: (1) sagebrush overstory kill; (2) size of treatment; (3) stocking rate; (4) retreatment schedule (Workman and Tanaka 1991). Variability in abiotic factors, input costs, and management strategies mean no two ranchers will deal with the same combination of costs and returns.

We analyzed three combinations of costs and returns to represent the range of possible revegetation outcomes: 1) the USU Tintic research area represented high costs and low returns; 2) ARS research plots represented average costs and high returns; and 3) the “realistic” combination complied from Bureau of Land Management (BLM) and Soil Conservation (SCS) data represented average costs and average returns.

Preparing The Economic Analysis
Economic analysis of range revegetation projects requires the following information: (1) project costs, (2) project benefits, (3) value of benefits, (4) interest rate, (5) project risk, (6) expected project life, and (7) the range site selected for revegetation (Workman and Tanaka 1991). Project costs include seed, seedbed preparation, seeding, alternate forage, and labor. Project benefits are valued by multiplying the forage portion of the private lease rate ($8.51 * 0.70 forage value = $5.96/AUM) by the increase in annual forage production (AUM/ac). This stream of annual future benefits is then converted to present dollars by discounting, using a 4% real (inflation free) interest rate as recommended by Row et al. (1981). This present value is then further discounted by one year, to recognize the need to defer grazing. Project risk (expected failure rate) is expressed as a percentage of initial project costs. An expected failure rate of 15%, for example, increases project costs by 15%. The expected project life was set at a conservative 20 years.

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The following is an example of the economic analysis described above. The cost of seed, seedbed preparation, and seeding of $33.53/ac was added to $1.71/ac deferment cost (alternate forage), and a 15% risk cost for a total cost of $40.53/ac. Hycrest crested wheatgrass produces 1,151 lb/ac/yr under favorable conditions on an upland loam range site (Mason 1971). An estimated 90% of the herbage is forage, of which 65% can be utilized. This yielded 673 lb/ac/yr of usable forage (1,151 lb/ac/yr herbage * 90% forage * 65% utilization), or 1.02 AUM/ac (673 lb/ac/yr divided by 660 lb/AUM). Native range, under the same conditions, produced .30 AUM/ac. The annual value of the increased production (1.02 - 0.30 = 0.72 AUM/ac) was $4.29/ac (0.72 AUM/ac * $5.96/AUM). Present value of the increased production, taking into account one year deferment, was $56.08/ac ($4.29 * 13.59020 yrs., 4% * 0.9611 yr., 4%). Net present value (NPV) was the present value less total costs, or $15.55/ac.

Analysis of the data from Tintic indicated that revegetation with any of the improved forage species was not economically feasible at the high seed costs and drought that existed at the time of seeding and establishment (Figs. 1 and 2). In a situation where revegetation is necessary to meet unquantifiable but important noneconomic goals (e.g. erosion control), Hycrest was the least cost improved forage species.

Analysis of the data from ARS, collected under ideal conditions (small plot sizes, clean and firm seedbeds, and favorable years) indicated that it was economically feasible to revegetate native range with Nordan, Hycrest, or Syn A but not with Vinall (Figs. 1 and 2). It was economically feasible to revegetate "old" crested wheatgrass with Nordan or Hycrest, but not with Vinall or Syn A. Hycrest was the economically efficient choice for revegetation with a net present value of $49.27 per acre on native range sites and $40.38 per acre on "old" crested wheatgrass sites. Analysis of "realistic" forage yield data indicated that revegetation with Nordan was economically feasible on native sites but not on "old" crested wheatgrass (Figs. 1 and 2). Revegetation with Vinall or Syn A was not economically feasible on either native range or "old" crested wheatgrass sites. Hycrest was the economically efficient choice for revegetation on both native range sites and "old" crested wheatgrass sites, with net present values of $15.55 and $6.66 per acre, respectively.

Which Alternative Will Provide The Greatest Net Return?

Analysis of the data from Tintic indicated that revegetation with Nordan, Hycrest, Vinall, or Syn A compared to native range left as is. Data were collected on upland loam range sites in central Utah.

**Fig. 1** Increased net present value (NPV) of revegetating with Nordan, Hycrest, Vinall, or Syn A compared to native range left as is. Data were collected on upland loam range sites in central Utah.
feasible solution to this problem. We compared the economic returns of seeding Nordan, Hycrest, Vinall, and Syn A to "old" crested wheatgrass seedings and native range. Economic performance was evaluated under three combinations of costs and returns producers might expect.

Hycrest was the economically efficient choice for revegetating upland loam range sites currently supporting native range or "old" crested wheatgrass. Revegetation may not be economically feasible if seedbed preparation costs are unusually high. Due to high risks of establishment, it is not economically feasible to revegetate with Vinall and Syn A.

Most range managers know that factors beyond their control can profoundly affect the biological and economic outcomes of revegetation projects. For example, the cost of seed following an unfavorable seed production year is substantially higher than after a favorable year. If possible, range managers should postpone purchasing seed for a revegetation project until the fall following a good seed crop. Programs such as the Conservation Reserve Program (CRP) may increase demand for seed and drive up price. Economic feasibility of a project depends more on near future events than on those that occur in the distant future. Thus required grazing deferment is more important in economic success than is project life (Workman and Tanaka 1991). Drought during the establishment period that postpones establishment and flow of project benefits (i.e., increased production) is very costly to the economic feasibility of a project. Uncontrolled herbivory by insects can also decrease the NPV of revegetation projects (Asay et al. 1985).

This study raises some important questions regarding research on improved forage species. While ARS needs a clean seedbed and precision seeding to evaluate forage species from biological and ecological perspectives, this type of research does not simulate conditions of practical revegetation projects on large areas of rangeland. On-ranch studies would permit researchers to evaluate improved forage species under "real life" conditions.

Finally, whether improved forage species are evaluated on research plots or on large rangeland areas, costs associated with revegetation projects must be carefully recorded to facilitate an accurate economic analysis. An accurate record of the costs and the seedbed preparation techniques on a particular revegetation project are essential if range managers are to gauge the expected economic outcome of revegetation.

Literature Cited


Fig. 2. Increased net present value (NPV) of revegetating with Nordan, Hycrest, Vinall, or Syn A compared to "old" (greater than 20 years) crested wheatgrass left as is. Data were collected on upland loam range sites in central Utah.


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