River Restoration and Economic Development through Grassland Management: A Case Study of the James River, South Dakota, U.S.A.

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Introduction Efforts are currently underway to develop a Watershed Management Plan (WAM) for the James River , South Dakota .The purpose of the WAM is to determine potential actions for flood damage reduction and ecosystem restoration . Agricultural uses predominate in the watershed with the river and its tributaries critically important to the region for drainage , irrigation , recreation , and wildlife habitats . Current economic pressure for corn production has resulted in a 14 million acre increase in corn planted in the U .S . This pressure has caused corn production to shift to marginal lands with high erosion potential .A newly proposed policy by the U .S .Department of Agriculture would allow harvesting of conservation grasslands for the production of biofuels . The purpose of this study was to determine if an economically viable compromise could exist that would allow row-crop agriculture to continue on prime agricultural land and grassland to exist on marginal lands .

Materials and methods The study area is the James River Watershed , which encompasses 36 ,260 square kilometers of South Dakota . To determine the current extent and potential expansion of grassland , marginal land and land use information were analyzed . Marginal land was delineated in a Geographic Information System (GIS) using SSURGO soil survey data . Marginal land was over-laid with 2006 land use data to determine existing and potential grass resources on marginal land . The potential decrease in stormwater runoff , through conversion of cropland to grasslands , was determined using the Soil Conservation Service (SCS) Curve Number (CN) method as described in Chapter 2 of TR-55 (SCS 1986) . The curve number is taken from a table in TR-55 based on the soil type (Hydrologic soil group) and vegetative cover . TR-55 has equations to calculate the runoff depth for a given parcel based on the CN and rainfall depth . Corn and hay prices were calculated by the South Dakota State University Extension Economics+ (SDSUEE) as the average price per bushel or ton during the month of November , 2007 .

Results A total of 10 ,603 square kilometers (25%) of the James River Watershed is marginal land . In 2006 , 6 ,242 square kilometers (59%) of the marginal land was being utilized as grassland while 2 ,642 square kilometers (25%) was cultivated for row crops . Conversion of the cultivated marginal agricultural land to grassland would result in a 10% decrease in stormwater runoff for each converted square kilometer during a typical 10-year storm event . A runoff reduction of 40% , per converted square kilometer , could be realized for a 1-inch rainfall event . In addition to profits from traditional grassland management , potential profit from grass-to-energy production may provide additional economic incentive to convert marginal land to grassland uses . For example , four million tons of grass could be produced on marginal land in the James River Watershed per year . Early estimates for cellulosic ethanol production from native grasses project 80-100 gallons of ethanol can be produced from one ton of grass . Thus , approximately 400 million gallons of ethanol could be produced per year from the 8 ,000 square kilometers of marginal lands . In addition , the 2006 NET rate of return for nonirrigated cropland and grassland in South Dakota was comparable at 4 .2 and 4 .0 percent , respectively (SDSUEE 2007) . Therefore , grassland production of energy crops would become economically viable with a modification of government programs that would allow harvesting of grasses for energy crops and provide a modest subsidy .

Conclusions The conversion of 8 ,000 square kilometers to managed grasslands could provide significant attenuation of flood flows and provide additional economic benefits for producers while providing benefits to water quality , wildlife , and carbon sequestration . These grasslands could provide an important , cost-effective , energy crop alternative that provides greater ecosystem benefits than corn . Changing typical row-crop land practices to those of perpetual grasslands provides a long term , sustainable solution to both reduce flood damages and enhance the environmental and economic opportunities of this important region .

References

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