Research Title : **ECONOMIC ANALYSIS OF GRAZING PRACTICES ALONG MAGAT WATERSHED IN NORTHERN PHILIPPINES**

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ABSTRACT

The current economic analysis, long term cost and external cost of grazing systems in the three provinces of Northern Luzon, Philippines were updated. Economic analysis using simple economic analysis, net present value (NPV, and payback period (PP) showed that continuous-silvipastoral grazing system is more economically viable than continuous-conventional system. All things being equal, the study shows that continuous-silvipastoral system seems to be the better of the two grazing systems in this region of study.

Universal Soil loss Equation (USLE) was used to determine the long term cost. Analysis showed that continuous-silvipastoral system resulted to a higher soil erosion rate with 128.73t/ha/yr as compared with lower erosion rate of 40.68t/ha/yr of the continuous conventional system. Several factors have contributed to this, among others: the slope, stocking rate and area covered by the grazing systems.

External cost is largely contributed by the continuous-silvipastoral system with a larger (48.61m^3/ha/yr) amount of sediments compounded to the lower (9.97m^3/ha/yr) amount from the continuous-conventional grazing system. Based from NIPPON KOI Co., Ltd study (2004) and NPC (2003), continuous-conventional grazing system can reduce the life span of the Magat dam by 0.88 years per year of grazing. Likewise, continuous-silvicultural system can potentially reduce the life span by 4.29 years for a period of one year grazing practice.

Combined the total effect of sediment discharge brought about by the different grazing systems existing within the watershed shortens the service life of the Magat Dam by 5.17 years per year of grazing period.

Keywords: *Grazing System, external cost (social & environmental) along Magat watershed, economic returns in terms of Net Present Value (NPV) and Payback Period (PP), universal soil loss equation model (USLE), and Geographical Information System (GIS).*

INTRODUCTION

The Philippines has a total land area of 30 million hectares (M ha.). The Forestry statistics released by Forest Management Bureau (FMB, 1988) showed that the Philippine grassland is approximately 6.68 M ha. However, other writers reported a wide range from 1.8 M ha. to 11.9 M ha. (Macandog and Magcalle, 1999; Moog and Castillo, 1995). Using the available figures as reported by the different sources, such as DENR (1990), FMB (1997), Borlagdan (1996) and Concepcion and Samar (1995); by computational analysis, Rosacia (1999) reconciled that the extent of Philippine grasslands is 6.5 M hectares, which is approximately twenty two percent (22%) of the country's total land area.

There is no proof to say that there is such a thing as natural grasslands under Philippine condition. The area that we consider as grasslands now, started as intact forest reduced to small patches which, probably, are a result of pest and disease intervention or due to localized microclimatic changes. The existence may also have started from virgin forest to forest denudation via human interference through unscrupulous logging, followed by kaingin, and finally, abandoned open area. Whatever was the source of forest destruction, the common denominator is that, the area becomes exposed to sunlight, rainfall, and wind: hence, continuously subjected to soil erosion. The rich top soil runs down slope, to the streams and to the lowlands. During heavy rains, surface runoff is so intense that it would create ex situ landslides and flashfloods. Drought is experienced due to unavailability of water in the affected watersheds, most especially during the dry season.

The Philippine grassland is basically marginal and shallow soil; not suitable for agricultural cropping unless remedial measures are taken i.e., soil amelioration/amendment. Together with the presence of physical limitations such as rough topography, poor drainage and cold temperature, grasslands are said to be of low productivity which is indicative of the forage scarcity (low quantity) and nutritional deficiencies (low quality) observed in the grassland areas. As such, it takes more than one-and-a-half years to produce marketable size of cow. It is an accepted fact that the stocking rate of Philippine grassland is dismally low at 0.25 animal units (a.u).

Grassland resource is being utilized as hunting grounds for wildlife, mining operation, animal grazing, silvopastoral system or agroforestry area. Seemingly, the grassland areas are presently underutilized or improperly managed, most of which are seemingly owned by influential people and politicians under pasture lease agreement (PLA).

Objectives

The study aimed to assess the environmental effect and economic contributions of the grazing management systems in the Northern Luzon, Philippines by investigating the long term cost and external costs and analyzing the cash flows of adopting continuous-conventional grazing and continuous-silvipastoral grazing systems. Proper environmental and economic assessment may identify possible recommendations to the policy makers that may reduce environmental costs affecting river streams and agriculture productivity and increase income derived for adopting proper grazing system. The ultimate objective of this study is to enable the selection of a grazing system that gives the highest economic returns with the lowest possible externalities (social and environmental).

Background

The Philippines is composed of thirty million hectares classified into eight different land uses (PFS, 2004). Grassland area is found mainly under the A&D Land and some portions of National Park or game refuge and bird sanctuary (GRBS) and Unclassified land, comprising 6.5 million hectares or 21.67 % of the total land area. The land use distribution is presented as follows.

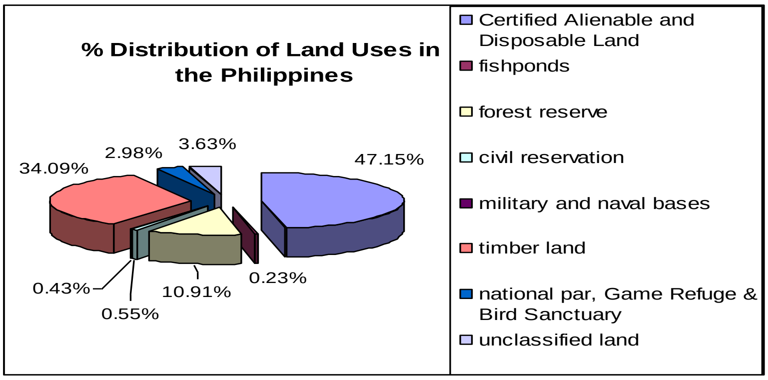

Figure 1: Land use distribution (Source: PFS, 2004)

In Northern Luzon, Philippines, continuous grazing system has been a long time practice by the community as a form of livelihood. Records showed that a land area of 252,000 hectares is granted to a total of 713 private individuals and corporations under PLA issued by the DENR (Malvas, 1995). Region 02 and the Cordillera Administrative Region (CAR) are the leading number with a total of 215 existing pasture leases. This distribution was also shown in Figure 2 which shows that 30% of the total pasture leases are found in my study areas.

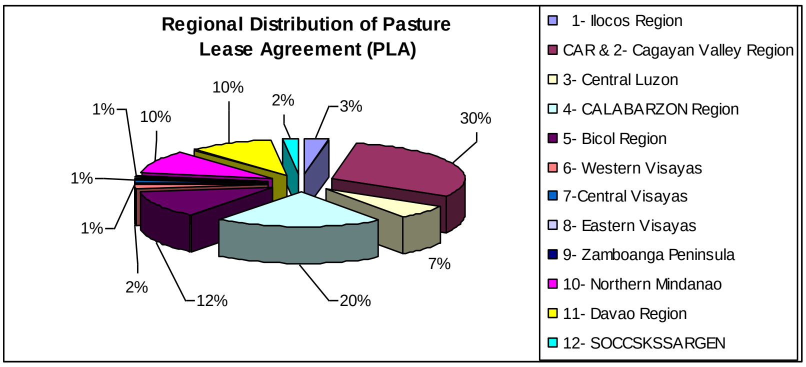

Figure 2: Regional Distribution of Pasture Leases
Data Source: Malvas, Jr., 1995

Given a large extent of the entire Cordillera and Cagayan Valley Region, only the areas of Magat Watershed covering three provinces particularly (a) Ifugao, (b) Isabela, and (c) Nueva Vizcaya were selected. These provinces represent the watershed and ecological boundaries of the Magat watershed. The river systems drain into the Magat Reservoir which supports an existing hydro-electric dam located and established in Ramon, Isabela.

Concept of the Study

Balance integration of grazing components like animals, feeds, trees, and other inputs (Ohlenbusch and Watson, 1994), coupled with monitoring and controlling the pasture plants and the grazing animals (Society of Range Management, 1989), and correct grazing system, would lead to improved grazing management and reduced offsite costs like soil erosion and sedimentation (Hudson 1981; Foster, 1964), which is beneficial to watershed protection.

The choice of grazing system as shown in Figure 3, directly affects the increase or decrease of cash flows, soil erosion and sedimentation of the grazing system. If a chosen grazing system would increase cash flows while increasing soil erosion and sedimentation, then chosen grazing system is required to be modified because the desire is to keep soil erosion and sedimentation to the barest minimum or holding it at a constant with the highest cash flows or return. The challenge is for the ranchers and government policy makers to manipulate the variables to achieve this constant.

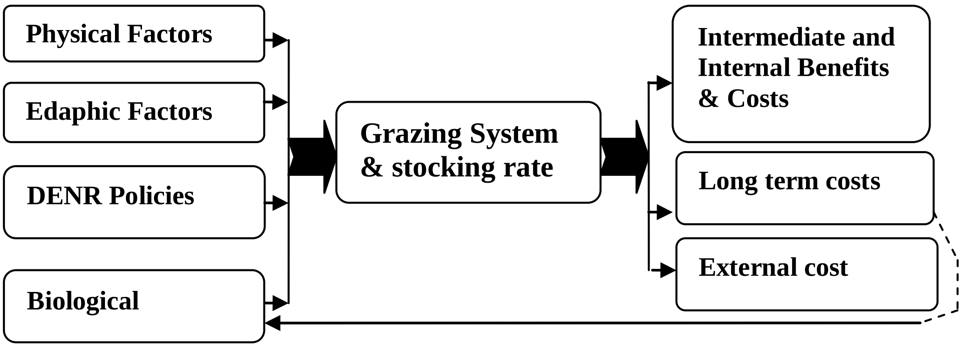

Figure 3: Framework of the study

METHODOLOGY

Research Question 1

The methods used to gather information about the different grazing systems were: (a) Case Study, (a) Using key informants interview, (c) Records and literature searching, and (d) Direct observation of the grazing systems in the grazing lands.

A total of forty five (45) pasture lease owners were selected as respondents for this study.

Research Question 2

A stratified purposive sampling was used to select a number of grazing farms per grazing system as the unit of analysis of this study. Each of the selected pasture owners was interviewed to draw information on the benefits and costs of their grazing systems. Cash flows were calculated using: (a) net present value (NPV) discounted for a period of twenty five years (25) at eight (8) percent discount rate. The 8% discount rate is the average over six year's interest rates of the Central bank, Philippines from 1994-2004 (PIN, 2004); and (b) payback period (PP).

Research Question 3

The method used to determine the long term cost of this study was through the use of Universal Soil Loss Equation (USLE) model (Wischmeier and Smith, 1969, 1978 and 1996).

Location of the Study Areas

Given a large extent of the entire Cordillera and Cagayan Valley Region, only the areas of Magat watershed covering three provinces particularly (a) Ifugao, (b) Isabela, and (c) Nueva Vizcaya were selected. The sampling sites covered 12 municipalities and 21 barangays. Two towns and 7 barangays are found in Ifugao, 4 towns and 5 barangays were in Isabela and 6 towns with 8 Barangays are in Nueva Vizcaya. These provinces represented the watershed and ecological boundaries of the Magat watershed. The river systems drain into the Magat reservoir. It supports an existing hydro-electric dam located and established in Ramon, Isabela. Thus the watershed is classified as critical watershed which focused to soil and water conservation. Figure 4 shows the 3 study sites.

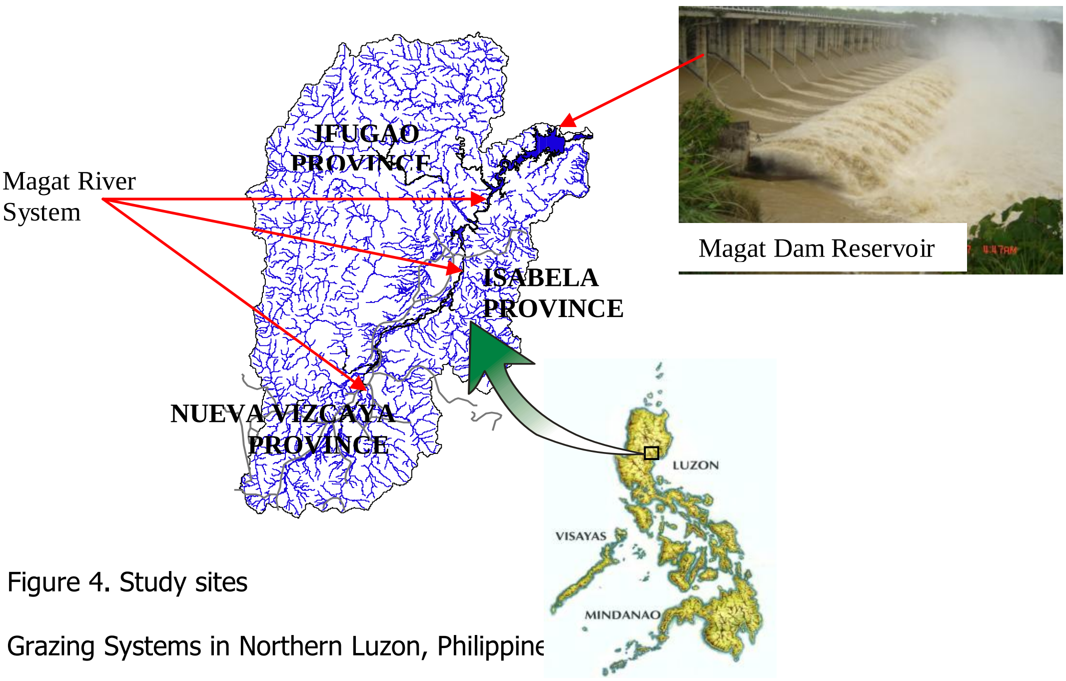

Figure 4. Study sites

Grazing Systems in Northern Luzon, Philippine

A survey study was conducted in Northern Luzon regarding the existing grazing systems. Continuous grazing system is a long time practice by the community as a form of livelihood. In the course of the study, two existing grazing systems were identified as shown in Figure 5. The continuous grazing system located in the slopes of 18 to 49% and below (green color) and silvopastoral system located in slopes of above 49% (blue color). Both were enclosed with perimeter fence.

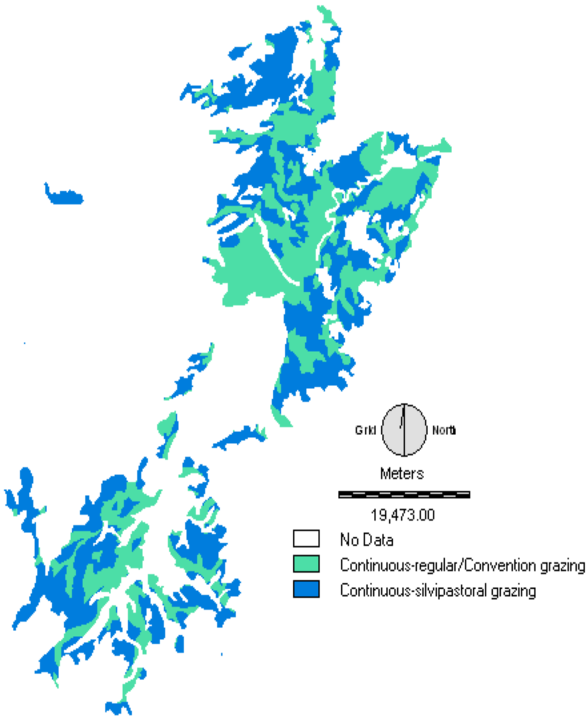

Figure 5: Grazing Systems

Land Acquisition

All grazing lands were operated under pasture lease agreement (PLA), (PD 705, 1975). The Department of Environment and Natural Resources (DENR) is the authorized department to issue PLA. The term of lease contact of PLA is 25 years renewable for another 25 years. The minimum area is 50 hectares; the maximum area is 2000 hectares, allowed for grazing lease application. In this study, there were only two associations (4%) that benefited from this grazing instrument while the remaining 90% were private individuals awarded with PLA.

The two associations/cooperatives were only awarded with 200 hectares each due to unavailability of large tracts of grazing land. Five lessees were able to get areas ranging from 301-750 hectares, each. The latter were absentee lessees; they belong to elite families.

Agro-Silvo-Climatic Condition and Elevation

Climate and Rainfall

The watershed area is under Climatic Type 3 of the Corona Classification, which is characterized by not so pronounced rainfall pattern. It is relatively wet from May to October and rainfall gradually decreases during the months of November to February. The rest of the months are dry. The study area receives about 1868 mm of rainfall in low altitude and about 2034 mm in high altitude.

Elevation and Slope Category

Large areas of the Cordillera Mountains ranging from 1,200 m to 2,900 m in elevation have been converted into agricultural and grazing lands. On the other hand, the Sierra Madre Mountain with elevation ranging from 1,100 m to 1,400 m holds relatively large areas of natural forest.

The topography of the study sites was generally sloping having a large portion of the area with slopes greater than 30%. The grazing systems were classified by the DENR based on slopes. Out of the 123,300 hectares covered by the study; the continuous grazing area covered 18,000 hectares (15%) with a slope range from 18-30%, while the silvipastoral area covered more than twice that of the former at 36,000 hectares (30%) with a slope range from30-50% (Figure 6)

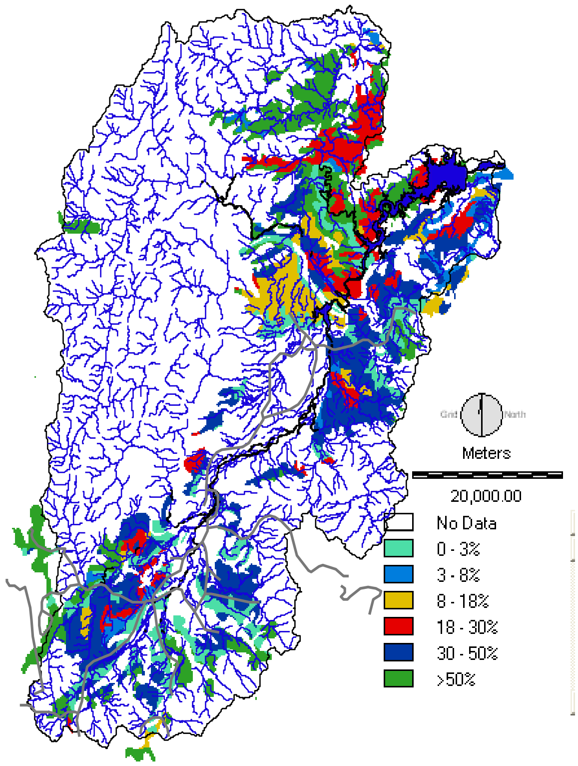

Figure 6: Slope Map of the 3 Study Areas

Cash flows:

The trends of profit for the two grazing systems are depicted in Tables 1 and 2. The tables show that for continuous-regular/conventional grazing system, a negative profit was observed at year one. This has been attributed to the high investment cost like establishment and livestock improvement cost that has been used in order to commence the grazing enterprise. Profit turned positive at year two. This profit trend could have attributed to the sales of cattle after the establishment. Further investment after the first year was minimal. Though there was profits made these were not huge as one would have expected given the fact that investment was low. The cost of labor for peripheral fencing and cost for water system was not much during the succeeding years starting from year two; thus, contributed to profit increase. For both systems, there are no profits in the first year and even with continuous-silvipastoral, there are no profits up to the second year. This loss was a result of investments made in the earlier years. The establishment cost was high for both systems but much higher for continuous-silvipastoral system. That is the reason why the financial losses for continuous-silvipastoral system were much also higher than that of the continuous-regular/conventional system. The trend changes however and starts to yield profits even though marginal. But it shows that the farmers are beginning not only break-even but also make profits over and above their investment cost. However, we noticed a difference in the profit margin of both systems this could be due to a number of reasons; among others management style, silvi-products, forest and non-forest products all contributes to the profit. This conforms to expectations that the profit margin differs as the years pass. It can be seen with continuous-silvipastoral system that there was a gradual increase in profit that continued to rise. This was said to be the results of increasing profits from non-forest products and sales from mango fruits. Not withstanding the high investment costs, these farms illustrate the benefits of choosing grazing systems. This illustrates further that continuous-silvipastoral system has several source of income/sales. It has a kind of sort of insurance that if one product line fails, they still have the other products. The land is therefore more efficiently used. In the short term, the sales might not be that big, but in the long term, it is bond to have higher yields.

The low profit of the two grazing systems based on this scenario has been contributed by low investment on livestock improvement.

The two grazing systems vary in terms of size (area). Continuous-regular/ conventional appeared to be wider in terms of area; in this case, profit was also computed per hectare basis. When the profit and expenses are taken in per hectare basis, there is a higher initial investment for continuous-silvipastoral grazing system. The average yearly profit in per hectare basis also shows to be higher by 34% starting at year three onwards. From this particular study one is tempted to say that continuous-silvipastoral grazing system is more economically viable than continuous-conventional system based on this study. On the basis of the annual excess income that farmers using continuous-silvipastoral grazing do earn 34% extra income over and above their colleagues using continuous-regular/conventional grazing system.

With the help of NPV results one could determine the economic viability of the farms in the present day terms. Whiles with the use of payback determinants one could tell the cash flow differences between the two grazing systems. It can be deduced from comparing Tables 7 and 8 that Continuous-silvipastoral system gives better chances for sustainability. This can be illustrated with the following results. Continuous-silvipastoral system shown to have NPV of Php911,580 or Php 6,905 per hectare as compared to continuous-regular/conventional having Php 286,540 or Php 1,767 per hectare. This means that continuous-silvipastoral is three times higher than continuous-regular/conventional system. It is a clear indication of being more productive. Similarly payback period enables one to see the returns on his investment. For continuous-regular/conventional, the payback period is ten (10) years as compared to seven (7) years in the case of continuous-silvipastoral system. This again demonstrates the viability of continuous-silvipastoral system. All things being equal, this results proofs that continuous-silvipastoral system seems to be better of the two grazing system in this region of study. The summary of NPV and PP values for both grazing systems is shown in Table 3.

Table 1: Average Cash Flows for Continuous-regular/conventional Grazing System

Capital, Operating and Maintenance Expenses and Sales	Operating & Maintenance Expenses & Sales in Pesos (Php) discounted for 25 years		
	Time in Years		
I. Establishment Cost	Year 1	Year 2	Year 3-25
1. Land			
(a) Annual Land Rental	6600	6600	6600
(b) Oath fee	36		
2. Peripheral Fencing			
(a) Barbed wire	19978	1435	765
(b) Post (wood or cement)	116197	13698	3940
(c) labor, fence maintenance	30271	3641	1292

3. Water System			
(a) Drinking trough/tub	10538	769	0
(b) Electricity bills	3498	3498	3960
4. Choral & cattle shed	52692	0	0
5. Silage house	29231	0	0
II. Feeds/ Feeding and Veterinary Medicines			
1. Drugs/ medicine	8811	8811	8811
2. Veterinary treatment/ Fee	923	923	923
3. Forage Improvement			
i. control of poisonous shrubs			6932
ii. introduction of leguminous species		11008	7123
4. salt	5779	5779	9167
5. additional ration		4808	6711
III. Livestock Improvement Cost			
1. change of breeder bull		0	3231
2. purchase of yearling stocks	827538	0	0
IV. Marketing Cost	1692	4769	15154
V. Labor cost of hiring cowboy and other maintenance cost			
1. herding / cowboy	45738	46231	47231
2. fire line construction		11228	12698
VI. Losses (death, others)		9846	19769
VII. Expenses (Total Cost)	**1159522**	**133044**	**154307**
VIII. Sales of Products			
1. cow and or yearlings	0	235615	297391
IX. Sales (Total)	0	235615	297391
X. CASH FLOWS	**-1159522**	**102571**	**143084**

Table 2: Average Cash flows for Continuous-Silvipastoral Grazing System

Capital, Operating and Maintenance cost, and Sales	Operating & Maintenance Expenses & Sales for a period of 25 years		
	Time in Years		
I. Establishment Cost	Year 1	Year 2	Year 3-25
1. Land			
(a) Annual rental	5280	5280	5280
(b) Oath fee	36		
2. Peripheral Fencing			
(a) Barbed wire	16180	2373	693
(b) Post (wood or cement)	89325	11690	3736
(c) labor (fence)	24599	3127	1415
3. Water System			
(a) Drinking trough/tub	25571	0	0
(b) Electricity (energy)	9223	5557	5557
4. Choral & cattle shed	58214	3214	0

5. Silage house	25571	0	0
II. Feeds/Feeding and Veterinary Medicines			
1. Drugs/ medicine	8253	8253	8253
2.Veterinary treatment/Fee	864	864	926
3. Forage Improvement			
i. control, poisonous shrub		8235	6008
ii. leguminous species		6964	7179
4. salt	8493	8493	9064
5. additional ration		5552	5913
III. Livestock Improvement Cost			
1. change of breeder bull		0	0
2. purchase of yearlings	734571	0	0
IV. Plantation Establishment			
A. Tree Farm			
1. Cost of Seedling/nursery			
2. labor			
- planting	3148		
- maintenance	3776	1511	75
B. Orchard/Fruit Tree Farm			
1. cost of seedling	1070		
- planting	3000		
- maintenance	9017	842	300
V. Cost of Marketing	15357	4286	16786
VI. Labor cost of hiring cowboy and other maintenance cost			
1. herding / cowboy	49779	49779	49779
2. fire line construction		7882	9666
VII. Losses (death, others)		8214	10000
VIII. Expenses (Total Cost)	**1091327**	**141896**	**140633**
IX. Sales of Products			
1. cow and or yearlings	0	83400	259354
2. Silvi-products			
- timber (lumber)	0	26071	75000
- non-forest products	2000	2050	2600
- mango fruits	0	0	19290
(TOTAL Sales)	2000	111521	356244
X. CASH FLOWS	**-1089327**	**-30375**	**215611**

Table 3: Summary of NPV and PP values of the two grazing systems		
	Grazing Systems	
	Continuous/conventional	Continuous-Silvipastoral
1. Net Present Value in Pesos		
(a) average per farm	286,540	911,580
(b) average per hectare	1,767	6,905
2. Payback Period in years	10	7

Current Soil Erosion in the study area

The values of soil erosion in this study were estimated based on USLE model (research question 3, Wischmeier and Smith, 1969, 1978, and 1996).

The analysis showed that continuous-silvipastoral system resulted had an average of 128.73t/ha/yr erosion rate as compared to 40.68t/ha/yr for continuous-regular/conventional grazing farms. Thus the erosion value for continuous-silvipastoral system was higher than that of the continuous-regular/conventional system. Several factors could have contributed to this difference among others; the slope, stocking rate and area covered by the grazing systems. As will be recalled from previous section 4.6 grazing fields, continuous-silvipastoral grazing farms were located on steeper slopes than that of the continuous-regular/conventional systems. The stocking rates were also higher. This result does give an indication on what is to be expected on grazing plots whereby the area available is steep, small and has a high stocking rate. Incidentally the grazing area covered by farmers practicing silvipastoral management happened to be those permitted to graze their animals in the sloppy mountainous area. The higher erosion rates determined using the USLE model thus reaffirm the assumptions of erosion mechanics. All things being equal, the steeper the slope, the greater the soil erosion, soil erosion is more severe on long slopes than on short ones as the velocity of the water increases on long, unobstructed downhill stretches (Kelley, 1990).

USLE Factors (K, R, C, P, LS)

The values for USLE factors obtained appear in Table 4 below. K-factor for example, this was derived by combining the effects of soil texture (sand, silt and clay percentages) to that of the constant values of the K-factor equation. K-factor here refers to the OM content in the soil in combination with texture factors. So that if the soil has more OM you would expect to be of finer particular type like loamy soil as against sandy. Of course other factors come into play such as; porosity, soil moisture, bulk density. But the most important those all is the ability of texture type to contain more OM.

As a result, the means of K-factor for both grazing systems where calculated. The table shows that the K-factor for continuous-regular/conventional systems was 0.23 a little bit higher than the mean K-factor of continuous-silvipastoral system. Though relatively small, it shows the varying degree to which texture of the soils in both grazing systems has contributed to K-value. Sandy loam to clay loam was observed along the continuous-regular/conventional system and most heavy clay to silty clay for continuous-silvipastoral system. This type of soil was also revealed by Combalicer (1997) along the lower slopes of Lower Magat watershed area with computed mean K-value of 0.22.

Table 4: Mean values of USLE Parameters for both grazing systems

Grazing system	K	R	C	P	LS	A
Continuous–regular/conventional system						
means	0.25	198	0.32	1	2.72	40.68
Sd	0.073	76.1			1.90	
Continuous-silvipastoral system						
means	0.23	171.6	0.38	0.8	11.80	128.73
Sd	0.076	68.0			5.01	

The R-factor was also a result of means of several years' rainfall data provided by the three weather stations in the study area. The R-factor was not a result of specific rainfall data in specific slope category and soil class but rather, a regionalized rainfall as provided by the weather stations. The study should have use a 10-year back rainfall data for all the study areas. But due to recording problems among the three weather stations, this plan was not fulfilled. However, this study used a 10-year rainfall data for Isabela (1988-1998) and Nueva

Vizcaya (1995 to 2005). Ifugao rainfall data was only for a period of 4 years back (1999 to 2002). R-factors were therefore a result of the average 10-year rainfall data for Isabela and Nueva Vizcaya, while 4-year data for Ifugao. R-factors were computed as: 167, 127 and 300 for Isabela, Nueva Vizcaya and Ifugao. Ifugao lies on mountainous region and more frequent rainfall therefore the R-factor was also higher. In a study of Combalicer (1997), R-values were 167 and 146 for his two study areas along the Lower Magat watershed in Nueva Vizcaya. This therefore shows that, the R-values used in this study were within the range to the previous study conducted not exactly on the same site but it is within and around the Magat Watershed areas of Northern Luzon.

The topographic (LS) factor as cited on the methodology was derived from the equation of slope length factor (L) with a given constant values. The slope length (λ) was first derived considering the length and width of the watershed. The product of this value was then used to calculate L-value. Using IDRISI in a Geographical Information System (GIS), these values were simulated to come up with LS value. Idrisi is not an Acronym. It is a program called after a name of a person, Idrisi that was a useful program in combination with GIS. Idrisi program provides an extensive suite of tools for image processing, geographic and statistical analysis, spatial decision support, time series analysis, data display, and import/export and conversion. Idrisi was therefore use in the present study to help generate LS factors that subsequently used in the final calculations of erosion rates for the two grazing systems of this study. As a result, the computed mean LS-values shows to be, 2.72 and 11.80 with higher LS-value for continuous-conventional grazing system. Examples of LS-values used earlier studies were cited. It varies from 0.1 to 5 in the most frequent farming contexts, and may reach 20 in mountainous areas, Wischmeier and Smith (1996). LS-values used by Combalicer (1997) along the Lower Magat watershed were within the range of 4.16 to 11.29.

Long term and offsite cost

Erosion can have number of effects downstream from the grazing farms from which soil loss occurs. The impact can be positive as well as negative, but almost all of the effects of soil erosion for this study are negative. Reduction of the Magat reservoir directly affects: water supply for irrigation, reduced the capacity of the reservoir to generate hydro-electricity and lessened the fishing ground for fishing as livelihood among the people of Cagayan Valley Region. This happens because of reduction in reservoirs storage capacity and dead storage capacity. Several similar studies on dams in Java, Indonesia and El Salvador, South America have indicated that for all of the reservoirs, sedimentation results in an average 0.5% loss in total reservoir storage capacity per annum and a 2.3% loss in dead storage capacity per annum, Magrath and Arens (1989) and Wiggins and Palma (1980). From this study, it has also been realized that the Magat dam was no exception. This confirms earlier studies on the Magat dam already cited in the introductory part of this study.

CONCLUSIONS

What is evident is that some existing policies and regulations for pastures and herd management need modifications for the rational development of the pasture industry in northern Luzon, Philippines. Results of the study indicate that revisions should cover the administration and disposition of pasture lands and the implementation of lease agreement. New policies should address complementation and coordination among government organizations, providing financial and institutional support and adopting innovative schemes and pasture systems.

That soil erosion in the grazing farm is as a result of several factors among which are stocking rates, slopes and the grazing system.

That this leads to sedimentation, which eventually shortens the service life of the Magat dam and reservoir.

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