RESUMEN

En el sur de la región semiárida Argentina el sobrepastoreo, el desmonte y las labranzas han modificado la vegetación natural y las propiedades superficiales del suelo, en consecuencia se han acelerado los procesos de erosión. Bajo las condiciones mencionadas el objetivo del presente trabajo fue: evaluar el escurrimiento, la pérdida de suelo y nutrientes por erosión hídrica laminar en sitios con distinto grado de disturbio mediante el empleo de parcelas de escurrimiento y lluvias simuladas. Los tratamientos respondieron a diferentes estados del pastizal: Pastizal pastoreado sin pisoteo (P); Pastizal pastoreado y pisoteado (PP); Pastizal fuertemente pastoreado y pisoteado (PP+); Corta fuego pastoreado y pisoteado (CPP); Corta fuego recién arado (CA). Para evaluar el escurrimiento y la pérdida de suelo se utilizó un simulador portátil de lluvia con parcelas de escurrimiento de 1 m^2. Se aplicaron dos lluvias consecutivas en 24 horas de 30 minutos de duración, con una intensidad media de 56 mm h^{-1}. En cada parcela se evaluó biomasa aérea, residuos vegetales, cobertura superficial, humedad antecedente del suelo, Carbono orgánico del suelo (COS), Nitrógeno total (NT), Fósforo total (PT) y disponible (PD), textura y estabilidad estructural, densidad aparente (DA), porosidad total (Ps) y distribución del espacio poroso. En cada lluvia se midió: la lámina aplicada, el escurrimiento y la cantidad de sedimentos perdidos a intervalos de 5 minutos. Se calcularon los siguientes parámetros: Infiltración acumulada (I_a), Tasa de Infiltración final (TIF), Escurrimiento total (Et); Tasa de escurrimiento final (TEF), pérdida de suelo (PS) y Tasa de Pérdida de suelo (TPS). Se analizó el agua de escurrimiento (Nitrógeno y Fósforo soluble) y los sedimentos (textura, COS, NT, PT y PD).

Al aumentar la presión de pastoreo se redujo la biomasa y la cobertura (vegetal) del suelo. En los sectores desmontados, la cobertura del suelo dependió de la proximidad temporal de la última labranza. Cuánto más desprotegido estuvo el suelo más se degradó. En este sentido, se observó que a medida que aumentó la presión de uso se produjo una disminución progresiva de los contenidos de arcilla, limo, COS, NT, PT y PD en el suelo superficial. Conjuntamente, los efectos negativos del manejo quedaron evidenciados a través de la degradación de la estructura, el aumento de la DA, la disminución de la Ps con pérdida de macroporos. Estos cambios en las propiedades superficiales del terreno modificaron la dinámica hidrológica, provocando que el ecosistema se vuelva más susceptible a la erosión. En este sentido, los ensayos de simulación de lluvia indicaron que, a medida que aumentó el disturbio disminuyó la capacidad de infiltración del suelo. La I_a y la TIF se redujeron un 54 y 70 % en el sitio más intensamente pastoreado (PP+) y en alrededor del 20 y 41 % en el desmonte respecto de los sitios poco disturbados (P y PP). Por su parte, el escurrimiento total aumentó en el siguiente orden P, PP, CPP, CA, PP+; los incrementos más significativos se dieron en los tratamientos con mayor sobrepastoreo y labranza. Las pérdidas de suelo aumentaron en el orden P, PP; PP+, CPP; CA. Estas fueron mínimas en P y PP, incrementándose significativamente en PP+, CPP y CA. El suelo arado sufrió la mayor erosión. El efecto de la lluvia y la condición de humedad antecedente del suelo tuvieron una influencia pronunciada en el escurrimiento y en la erosión. Ambos parámetros aumentaron en condiciones de capacidad de campo. En todos los tratamientos, los sedimentos fueron más ricos en partículas finas (< 50 µm) y nutrientes que el suelo de origen. Esto refleja la selectividad del proceso de erosión, principalmente respecto a Carbono orgánico

(CO) y NT. La concentración de nutrientes fue siempre más alta en los sitios poco disturbados que en los muy disturbados. Sin embargo, la pérdida total de nutrientes mostró una fuerte relación lineal positiva con la pérdida de suelo por erosión. Esta relación explica que altos niveles de pérdida de suelo conducen a elevados niveles de pérdida de nutrientes. La fragilidad del ambiente se manifiesta por la magnitud de los cambios ocurridos. En el pastizal, las altas tasas de escurrimiento y pérdida de nutrientes en los parches sobrepastoreados puede limitar la recuperación de los mismos favoreciendo a la desertificación de la región.

Palabras clave: pastizales semiáridos; sobrepastoreo; simulación de lluvia; escurrimiento superficial; infiltración; erosión; pérdida de nutrientes.

ABSTRACT

In the south of the semi-arid region of Argentina, overgrazing, deforestation and tillage have altered natural vegetation and soil surface properties, thus accelerating erosion processes. Under these conditions, the aim of this study was to assess runoff and soil and nutrient loss due to sheet erosion by water in sites with different degrees of disturbance using runoff plots and simulated rainfall. Treatments responded to different grassland conditions: grassland grazed but not trampled (P), grazed and trampled grassland (PP), heavily grazed and trampled grassland (PP+), grazed and trampled firebreak (CPP) and recently plowed firebreak (CA). In order to assess runoff and soil loss, a portable rainfall simulator was used in 1-m^2 runoff plots. Two consecutive 30-minute rains, with a mean intensity of 56 mm h^{-1}, were applied in 24 hours. Above-ground biomass, residual vegetation, vegetation cover, previous soil moisture, soil organic carbon (SOC), total nitrogen (TN), total phosphorus (TP) and available phosphorus (AP), texture and structural stability, bulk density (BD), total porosity (Ps) and porous space distribution were assessed in each plot. The amount of rainfall applied, the runoff and the amount of sediment lost at 5-minute intervals were measured for each rain. The following parameters were calculated: accumulated infiltration (I_a), final infiltration rate (FIR), total runoff (Rt), final runoff rate (FRR), soil loss (SL) and soil loss rate (SLR). Runoff water (soluble nitrogen and phosphorus) and sediments (texture, SOC, TN, TP and AP) were analyzed. When grazing pressure increased, biomass and vegetation cover decreased. In deforested areas, soil cover depended on the temporal proximity of the last tillage. The less the soil was protected, the more it degraded. Also, it was observed that, as land use pressure increased, a progressive reduction of the contents of clay, silt, SOC, TN, TP and

AP in surface soil occurred. In addition, negative effects of management were demonstrated by soil structure degradation, BD increase and Ps decrease with loss of macropores. These changes of the soil surface properties altered the hydrological dynamics, making the ecosystem more susceptible to erosion. In this regard, rainfall simulation trials indicated that, as disturbance increased, soil infiltration capacity decreased. I_a and FIR decreased by 54 and 70 % in the most heavily-grazed site (PP+) and approximately by 20 and 41 % in the deforested area compared with slightly disturbed sites (P and PP). Moreover, Rt increased in the following order: P, PP, CPP, CA and PP+; the most significant increases occurred in treatments with the heaviest grazing and tillage. Soil loss increased in the following order: P, PP, PP+, CPP and CA; it was slight in P and PP, but it increased significantly in PP+, CPP and CA. Plowed soil was the most severely eroded. The effect of rainfall and the previous soil moisture condition had a strong influence on runoff and erosion. Both parameters increased under field capacity conditions. In all the treatments, sediments were richer in fine particles (< 50 µm) and nutrients than the soil of origin. This reflects the selectivity of the erosion process, mainly regarding organic carbon (OC) and TN. Nutrient concentration was always higher in slightly disturbed sites than in highly disturbed ones. However, total nutrient loss showed a strong positive linear relationship with soil loss through erosion. This relationship explains that high soil loss leads to high nutrient loss. The fragility of the environment is evidenced by the extent of the changes that took place. In grasslands, high runoff rates and nutrient loss rates in overgrazed patches may limit their recovery, favoring desertification of the region.

Keywords: semi-arid grasslands; overgrazing; rainfall simulation; surface runoff; infiltration; erosion; nutrient loss.

CAPITULO 5

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