

plots of mature northern hardwood forests in two national forests of the western Great Lakes (U. S. A.). Using relationships between earthworm presence, habitat characteristics, and likely earthworm introduction points, we created a predictive model of invasive earthworm presence to map the extent of earthworm invasion and identify likely uninvaded areas. Earthworm presence is significantly related to soil texture and pH, tree basal area, and distance to roads, trails, cabins, lakeshores, and streams, but relationships and extent of invasion vary by earthworm species and national forest. *Lumbricus* species had a significantly negative effect on native plant species diversity. The abundance of over half of all plant species was negatively correlated with *Lumbricus* invasion. While invasion is extensive, our results identify earthworm-free areas where prevention of introductions should be focused and earthworm-sensitive herbs whose conservation status should be monitored closely.

**406. BEYOND RESERVE SELECTION: INTEGRATING SYSTEMATIC CONSERVATION PLANNING PRINCIPLES INTO THE SPATIAL MANAGEMENT OF NATIONAL PARKS IN SOUTH AFRICA.** HOLNESS, STEPHEN. South African National Parks, Arid Ecosystems Research Unit, PO Box 20419, Humewood, 6013, Port Elizabeth, South Africa.

Systematic conservation planning exercises often end with the selection of parcels of land for incorporation into protected areas. Once areas are incorporated within reserves they are considered to be conserved. However, within our current conservation paradigm protected areas are required to pay their way, which implies tourist and management access and infrastructure. The identification of use zones provides a powerful tool for spatially controlling development and management activity both strategically (e. g. new facilities) and operationally (e. g. vehicle access). This paper presents an overview of the landscape analysis process that SANParks is implementing within National Parks. The SANParks zoning is underpinned by examination of the landscapes' underlying biodiversity, heritage and aesthetic characteristics. "Sensitivity-value analysis" integrates systematic conservation planning with traditional site analysis. The approach attempts to bridge the divide between science and management. The suitability of an area for a particular type of development is seen to be a combination of its value (i. e. contribution to the national conservation estate) and its sensitivity (i. e. the vulnerability to disturbance). The paper outlines how we have attempted to combine biodiversity value, biodiversity sensitivity, aesthetics and heritage attributes at a landscape scale into an analysis useful for appropriate park management.

**407. DYNAMICS OF THE OCCUPATION OF AMAZON FLOODPLAINS.** HOMMA, ALFREDO KINGO OYAMA. Embrapa Amazônia Oriental, Tavessa Eneás Pinheiro, s/n, Bairro Marco, CEP 66095-100 Belém, Pará, Brasil, homma@cpatu.embrapa.br.

The pre-Colombian population that inhabited the floodplains, estimated in 950 thousand natives, was sustainable. The European occupation, starting with the foundation of Belém (1616), promoted the use and the destruction of the natural resources, forming cycles: cocoa, rubber, rosewood, jute, wood, fishes, livestock, açai fruit. The rivers allowed the penetration and the consolidation of the Brazilian nationality, the improvement of the navigation and, more recently, the interconnection with the upland and serving as drainage for ores and soy, industrialized products from the Man-

aus, generation of energy, hydro ways. In spite of the relativity of the "floodplain civilization" in relation to the "upland civilization", the growth of cities as Iquitos, Manaus, Belém, Santarém, of the tourist flow, the deforestation in the headwaters and margins, in the neighboring countries and in the savannas, the release of the urban and industrial dejects, gold fields, extraction of petroleum, fishing pressure, public insecurity, they constitute future risks, as source of water and of biodiversity. Even the management activities can represent risks if spread in wide scale in the floodplains. The problems of the floodplain are not independent, being connected with national problems, justifying the formation of a condominium of the countries of the Amazon basin.

**408. COST-BENEFIT ANALYSIS OF ECOLOGICAL (DISK PLOWING) TILLING VS. THE TRADITIONAL METHOD FOR CREATION OF NEW PASTURE-LAND IN THE TROPICS.** Hoogesteijn, Almira L.; MONTEIRO, JOSE LEMOS. Wildlife Conservation Society, Jaguar Conservation Program, Ranchers Outreach Program, Rua Cayova 353, Barrio Chacara Vendas, Campo Grande, Mato Grosso do Sul 79003-150, ahoogesteyn@wcs.org (AH) Fazenda Bandeirantes, Aquidauana, MS, Brazil (JLM).

The costs and benefits associated with traditional and ecological tilling in the tropics was compared in one Brazilian ranch in Pantanal. Production data of the same ranch, before and after introduction of disk plowing that conserves original flora, allowed the gathering of data on pastureland formation costs, flora conservation, livestock production and cattle predation. Traditional tillage resulted in: 1) 29% additional tractor hours/hectare (ha) of soil preparation, 2) additional half hour/ha for planting, 2) increase of 1.75 - 2.5 kg/ha of seeds needed, 3) loss of soil nutrients, and 4) non-significant (5%) increased in cattle carrying capacity (kg/ha). Ecological practices resulted in: 1) 25% increased parturition, 2) over 3-fold increased number of finished heads sent to the slaughter house, 3) conservation of the original flora and fauna, and 5) absence of cattle mortality due to predators. Ecological tilling is compatible with flora and fauna conservation as well as increased economic livestock benefits.

**409. ADVANTAGES OF WATER BUFFALOES OVER CATTLE WHEN AFFECTED BY LARGE FELINE PREDATION, A SOLUTION FOR RANCHERS IN FLOODED SAVANNAS IN SOUTH AMERICA.** Hoogesteijn, Rafael J.; HOOGESTEIJN, ALMIRA L. Wildlife Conservation Society, Jaguar Conservation Program, Ranchers Outreach Program, Rua Cayova 353, Barrio Chacara Vendas, Campo Grande Mato Grosso do Sul 79003-150, Brazil, ahoogesteyn@wcs.org (ALH) Productora Hernandez S.A. Hato Merecure, Apure Venezuela (RJH).

Jaguar conservation in South America depends mainly on two factors, habitat destruction and ranchers tolerance to the felines. Water Buffalo (*Bubalus bubalis*) and bovine mortality associated with wild predators (*Panthera onca* and *Puma concolor*) were evaluated in three Venezuelan ranches with a cross-sectional and observational study. The number of killed cows (as percentage of all animals at risk) was significantly lower than that of buffaloes in all ranches ( $P \leq 0.03$ ,  $X^2$  test). Defensive behaviors, observed in buffaloes but not in bovines, supported these findings. It is suggested that cattle mortality due to large feline predators may be reduced when the species being raised is buffalo. We suggest that higher productivity and defensive behavior should make buffaloes, the livestock of choice in areas with severe jaguar and puma predation problems and flooded savanna conditions.