Spatial GIS database for adaptive grassland management in Dudhwa National Park, India

Neha Midha [A] *and Pradeep K.Mathur* [B]

[A] WWF-India, Secretariat, 172 B, Lodi Road, New Delhi, - 110 003, India
[B] Wildlife Institute of India, P Box # 18, Chandrabani, Dehra Dun – 248 001 (Uttarakhand), India
Contact email: n_midha@rediffmail.com

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Introduction

Ecologically important tall grasslands of Dudhwa National Park (DNP) in Northern India are being threatened by various natural and biotic factors including varying grassland burning regimes *viz.* cut and burn, harrowed and burn, or only burn adopted by management for their maintenance (De 2001). Uncertainty regarding resultant grassland composition and disturbance to grassland obligate species prompted the management and scientific communities concerned to develop an adaptive management strategy for long term conservation goals (Chadden *et al*. 2004). In view of this, the present study attempted to develop comprehensive GIS (Geographic Information System) spatial database and associated hard copy maps of park at the scale of 1:25,000, to support field practitioners for successful implementation of proposed Adaptive Grassland Management.

Methodology

Development of land use maps

We visually interpreted IRS P6 LISSIV (spatial resolution of 5.8 m) satellite data after radiometric and geometric corrections. The ground validation information was collected in March, 2005 and working scale was set at the scale of 1: 12,500 to allow a finer presentation at 1: 25,000. Overall accuracy and kappa statistics were also calculated.

Development of infrastructure maps

We extracted the data relevant from the developed spatial layers (Mathur and Midha 2008): railway network; power lines; buildings (residential colonies and permanent huts); road network (forest and metalled road); topography (contour, slope, aspect, and elevation map); drainage network (primary, secondary, and tertiary drainage lines). Each layer had a description of the geographical coverage; data attributes and was at the scale of 1:25,000.

Boundaries

The boundaries of the administrative units (forest range, block, beat and compartment) were manually digitized from paper source followed by re-projection and re-scaling.

Results

Land use theme consists of 10 classes identified within the park (680 sq km). The overall accuracy computed for the land use map was found to be 91.3 % and overall Kappa statistics was 0.9.

Extents and distribution of grassland types

One thirty seven sq km extent of grasslands was identified through land use mapping within DNP. The analysis identified two types of grasslands. This included Upland grasslands (grassy blanks on well drained soils within the Sal forest; dominant grasses included *Cyrtococcum patens*, *Desmostachya bipinnata*, *Imperata cylindrica*, and *Cymbopogon jwarancusa;* 6.1 % of area) and Lowland grasslands (found in low lying areas or water logged depressions; prominent grass species were *Phragmites karka*, *Saccharum narenga*, *Saccharum spontaneum*, and *Schlerostachya fusca;* 13.9 % of area).

Definition of other attributes

The land use classes found within grasslands or adjacent are: Sal (*Shorea robusta*) forests (predominant; covered 56.4 % of area); Mixed deciduous forest *(*common associates were: *Mallotus philippensis*, *Bombax ceiba*, *Syzygium cumini*, and *Acacia catechu*; 8.3 %); Tropical semi - evergreen forest (characterized by presence *Calamus tenuis*, *Lygodium flexuosum* and climbers. Prominent tree species: *Trewia nudiflora*, *Mallotus philippensis*, *Syzygium cumini*, and *Ficus hispida;* 2.1 %); Tropical seasonal swamp forest (found in swampy depressions. *Syzygium cumini* formed the main constituent with *Trewia nudiflora*, *Ficus racemosa*, *Mallotus philippensis*, and *Acacia catechu* ; 3.9 %); Teak plantation (5.0 %); Other plantations (*Eucalyptus citriodora*, *Acacia catechu*, *Dalbergia sissoo*, and *Terminalia arjuna*; 0.1 %); Swamp, water bodies and scrub (1.1 %) and River (1.2 %).

To present how the database would look like, a sample site; Sathiana range on south-western boundary of the park was chosen (Fig. 1). For better visualization, we presented the database on digital image.

Discussion and Conclusions

Spatial database and large scale maps could act as a decision making tool for identification of grassland patches which would ultimately be subjected to specific treatment and will also help in assessing vegetation patterns related to particular management activities. This will make the management decision planned, formal and more scientifically rigorous than the existing one. Further

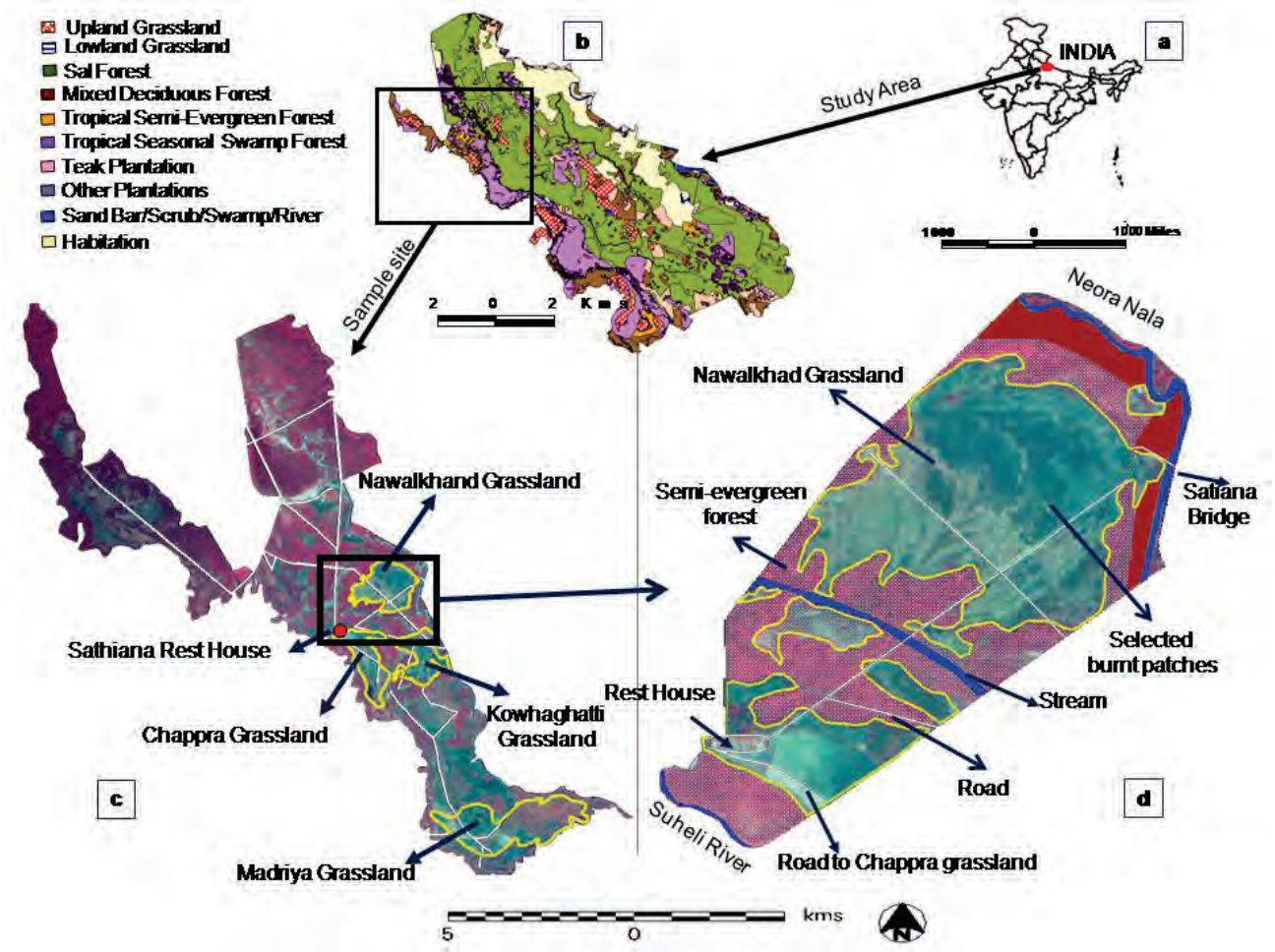

Figure 1. (a) Location of the study area; (b) Land use map of DNP; (c) Sample site to present the database (d) Sample site enlarged.

adaptive management typically has a modeling (Bunch 2000, Chadden *et al*. 2004) component (dynamic simulation modeling of hydrology and fire fuel), the database could make a contribution to this component by facilitating the baseline information as model input. Moreover, it can support spatially-explicit studies including identification of conservation-priority habitat core areas; habitat restoration initiatives; and ecological implications of land use planning alternatives. It is envisioned that this database will be the foundation of adaptive grassland management strategy efforts and other informed management decision.

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