GIS Application in Environmental Impact Assessment (EIA) & Case studies

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Outline

• Introduction
• Objective & Methodology
• Literature review
• Case Studies
• Analysis/Findings
• Conclusions
• Recommendations
Introduction

- EIA
  - Identify
  - Predict
  - Evaluate
  - Mitigate
    - the biophysical, social, and other relevant effects of development proposals

- Decision (IAIA)

- GIS
  - Capture
  - Store
  - Manipulate
  - Analyze
  - Manage
  - Present

- Decision (Burrough and McDonnell, 1998)
EIA steps

- **Screening**
- Consideration of possible **alternatives**
- **Preliminary assessment**
- **Scoping**
- **Main EIA study**
  - An *Environmental Impact Statement (EIS)*
- **Review**
- **Monitoring** of project implementation and operation
- An **audit** of the project after its completion

*(Antonio 2009)*
GIS

- Capture
- Store
- Manipulate
- Analyze
- Manage
- present

(Burrough and McDonnell, 1998)

www.ce.utexas.edu/prof/maidment/giswr2005
GIS applications

GIS and EIA relationship
Use of GIS in EIA

- Used at all stage of EIA process for
  - data management
  - Overlay, classification and analysis
  - trend analysis
  - provide data for impact modeling
  - visualize the impact
  - habitat and aesthetic analysis
  - public consultation

(Joaõo and Fonseca, 1996)
Purpose of this study & source of info.

- **Purpose of this Paper**
  - Introduce the EIA and GIS
  - Review the importance & history of GIS and EIA
  - Current and feature relationship
  - GIS application in EIA
  - Finally, case studies regarding GIS application in EIA

- **Sources of information**
  - Google scholar
  - science direct
  - web of knowledge
  - Scirus
  - Scopus
  - KFUPM electronic data bases

- **Three case study**
Literature review

• **EIA history**
  - First and second World War
  - Silent spring (1962)
    • Environmental degradation
    • Increased Public Awareness
  - National Environmental Policy Act in 1970
    • USA is the first country to ratify legislation on EIA
    • UNC Stockholm in 1972
    • Australia (1974)
    • Thailand (1975)
    • France (1976)
    • Philippines (1978)
    • Israel (1981)
    • Pakistan (1983)
    • Canada (1973)
  - Currently, including most developing countries

Rachel Carson (1962), Silent spring
Case study 1: EIA for Dam Construction Using GIS/RS, Valsad district of Gujarat, India, by Shibani Maitra
GROUNDWATER PROSPECT
LAND CAPABILITY
Case study 2: GIS-Based Assessment of Soil Erosion at Nihe Gou Catchment, Chunhua County of Shaanxi Province, China, Qing-feng & Fa-qi, 2008

\[ A = R \times K \times L \times S \times C \times P \]
amount of soil erosion in 1977 and 2003
amount of soil erosion in 1977 and 2003
amount of soil erosion in 1977 and 2003
Risk analysis
Study case 3: EIA of mountain tourism in developing regions: A study in Ladakh, Indian Himalaya, Geneletti & Dawa, 2009

- Scoping
- Baseline study
- Impact modeling
Digital elevation model and main trekking trails of Ladakh
Dumping sites and campsites.
Off-road driving tracks and vehicle influx in the Changthang region
Vulnerability maps of environmental receptors (1: high vulnerability, 0: no vulnerability)

- Soil erosion susceptibility
- Groundwater vulnerability
- Trail fragmentation index
- Overgrazing

Legend:
- 0 - 0.11
- 0.11 - 0.22
- 0.22 - 0.33
- 0.33 - 0.44
- 0.44 - 0.55
- 0.55 - 0.66
- 0.67 - 0.77
- 0.78 - 0.88
- 0.89 - 1
Watershed-based impact maps combined along stressors.

a) Trekking
b) Camping
c) Dumping
d) Pack animal grazing
e) Off-road driving.

Legend
- 0 - 0.11 Low impact
- 0.11 - 0.22
- 0.22 - 0.33
- 0.33 - 0.44
- 0.44 - 0.55
- 0.55 - 0.66
- 0.66 - 0.77
- 0.77 - 0.88
- 0.88 - 1 High impact
Watershed-based impact map combined along receptors
Watershed-based composite impact map (impact of all stressors on all receptors)
Conclusion

• EIA
  • Systematic process for evaluating the potential env’tal effect of proposed actions
  • Applied to projects, programs, plans, and policies
  • Outcome of EIA is a report

• EIA trends
  • Past trend was application to projects
  • Future applications
    • strategic env’tal assessment
    • Corporate env’tal management (ISO 140000)
Conclusion

- Environmental problems are spatial problems
- Environmental data can almost always be georeferenced
- GIS include many environmental applications
- EIA is only a part
- EIA and the broader field of environmental management usually require much more than spatial analysis and GIS
- GIS is therefore an appropriate tool for environmental analysis
I Thank You All