Green Infrastructure: Using a holistic approach

Promoting Avoidance through Cost Effective Routing of Linear Infrastructure

Geoffrey Mwedde
Regional Manager
Wildlife Conservation Society
Uganda Country Programme

Florence, Italy
22 April, 2015

Presentation Outline

- Introduction
- Study Goals
- Methods
- Results
- Conclusions
- Recommendations
- Acknowledgements

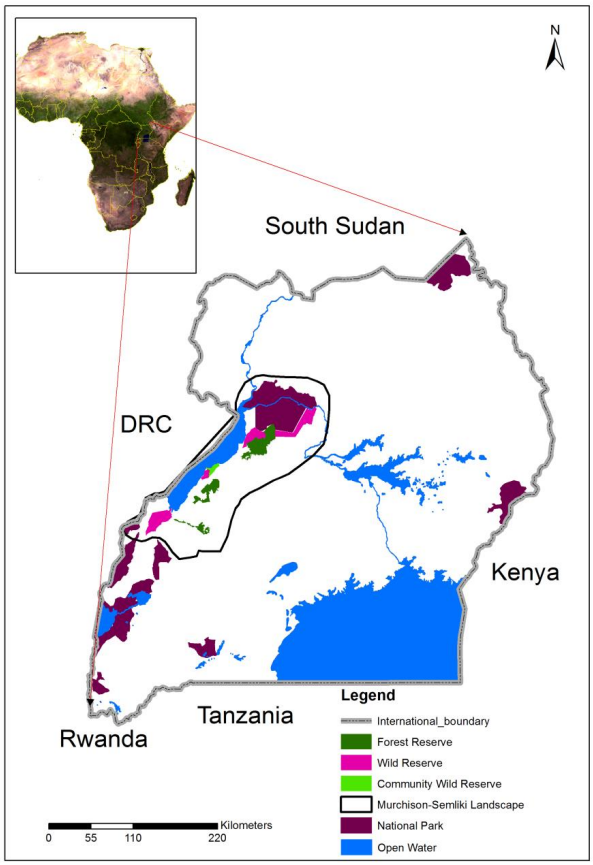
Photo: Oleg Znamenskiy

Introduction

Location:

Murchison-Semliki (MS) Landscape

In Albertine Rift (AR)



… Introduction…

Development Project Context

- Uganda Population 34.9 million (174 people/sq.km); growth rate 3% p.a.
- 19.5% below poverty line
- Over 6.5 billion barrels of oil (MEMD, 2014)
- 21 oil and/or gas discoveries to date
- Natural gas reserves estimated: 350 billion cubic feet.
- 14,000 Km^2 of high petroleum potential areas remain unlicensed.
- US$800 million from tourism

… Introduction

Project's Environmental Context

- AR: half of Africa's bird & 40% of mammals
- M-S landscape: 37 species endemic to AR; 49 threatened
- Ramsar sites e.g. Murchison Falls & Albert Nile delta
- Impacts of Infrastructure development
  - Land fragmentation
  - Habitat destruction
  - Increased resource offtake (legal and illegal)
- Impacts are external costs to infrastructure project

Infrastructure stakeholders

Study goal

Mitigation Hierarchy

- **Avoid**
  - **Minimize**

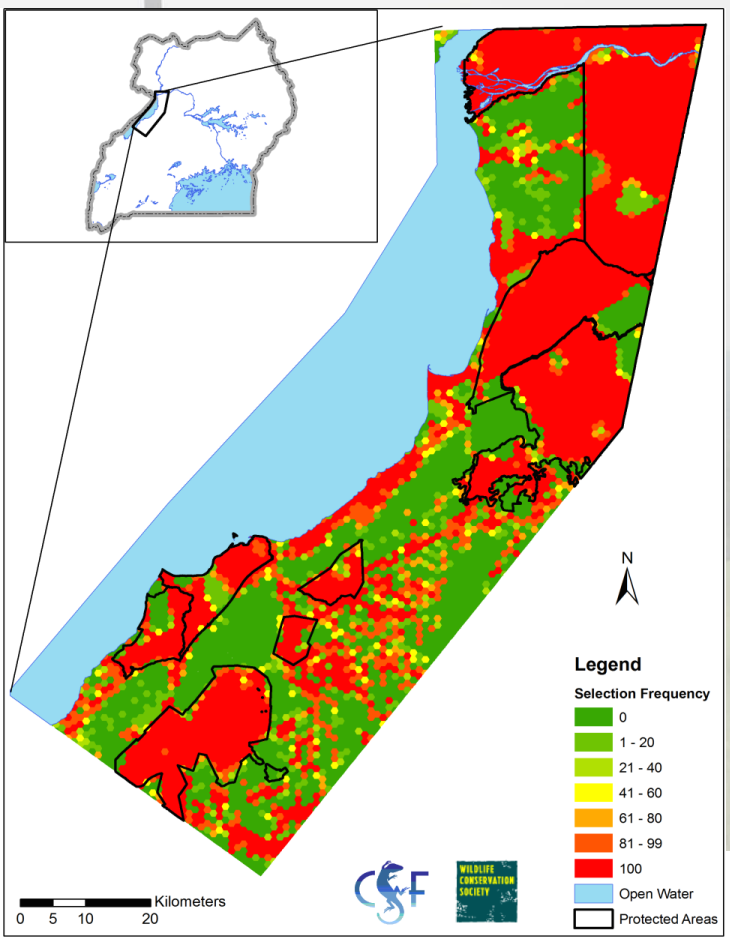
AIM

To demonstrate a method of identifying linear infrastructure routes that avoid areas that would impact on important conservation features.

Methods: (1) Marxan Analysis

To identify the best areas for conservation

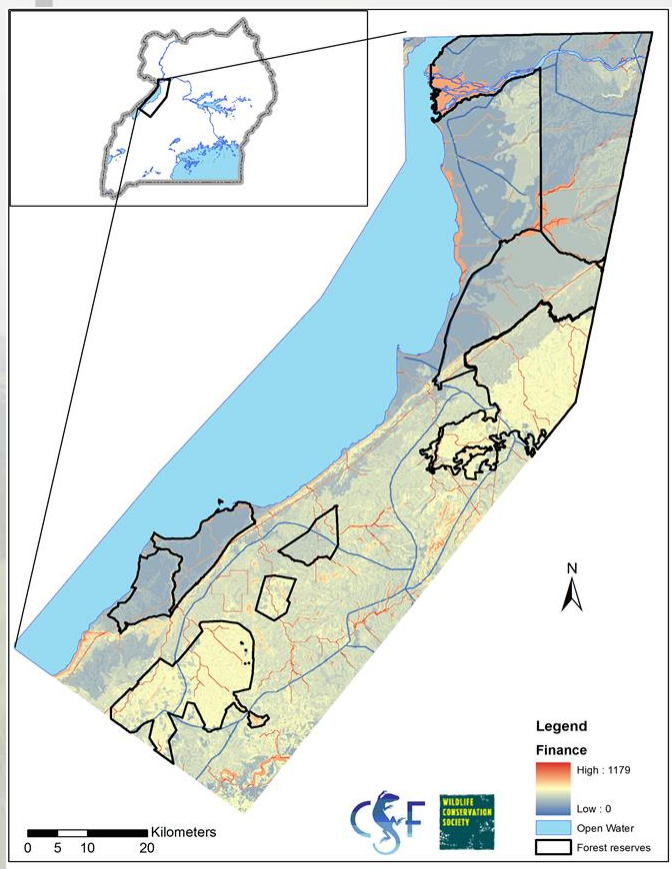
- Set features and targets
- Socio-econ. cost based on proximity to settlements, roads; towns



Methods: (2) Least Cost Path (LCP)

Financial cost proxies:

- Consulted various experts
  - Land cover
  - Rivers
  - Slope
  - Roads



Methods: Example of cost proxies - LCP

Financial Factors: Land cover, Rivers, Slope, Roads

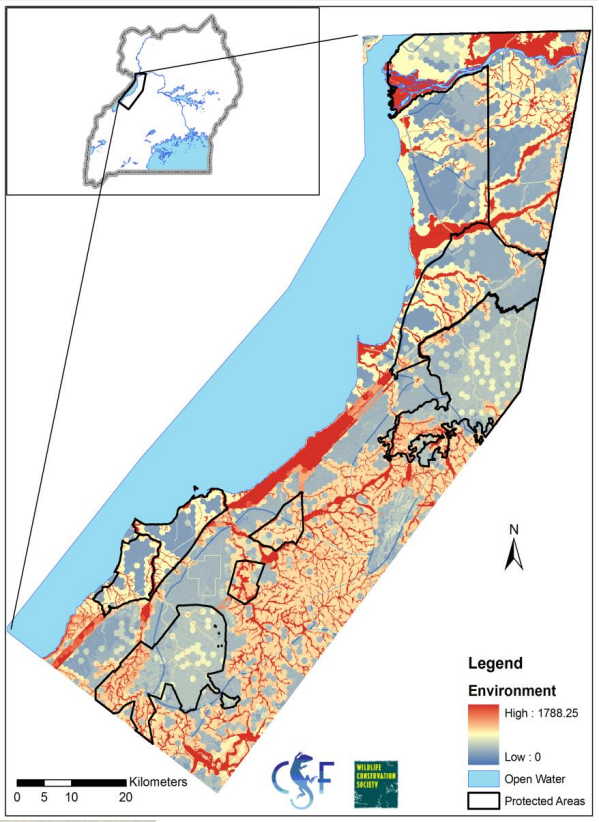
Weights costings only		
Factor	**Standardised values**	**Weight**
Land cover		**20**
Open water	15	
Wetland	12	
Built up	12	
Forest	5	
Plantation	4	
Farmland	3	
Wooded	2	
Barren (Grassland & Bushlan	0	

Methods: Least Cost Path (LCP)

Environmental Cost Layer

Environmental Factors:

- Environmental dimensions of social factors PLUS:
- Wildlife Corridors
- Areas of high BD – Level 1
- Areas of high BD – Level 2



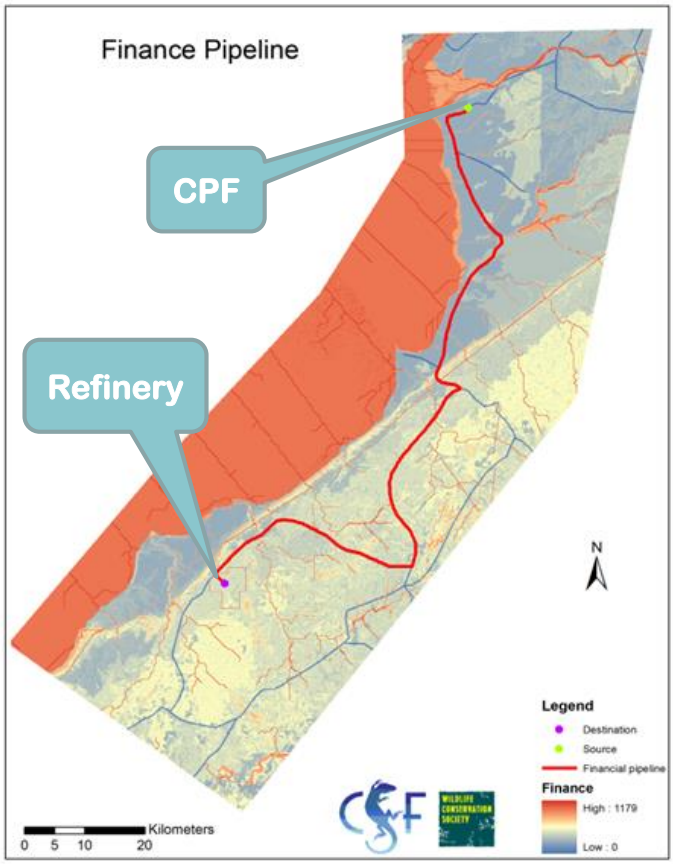
Example of environmental cost proxies

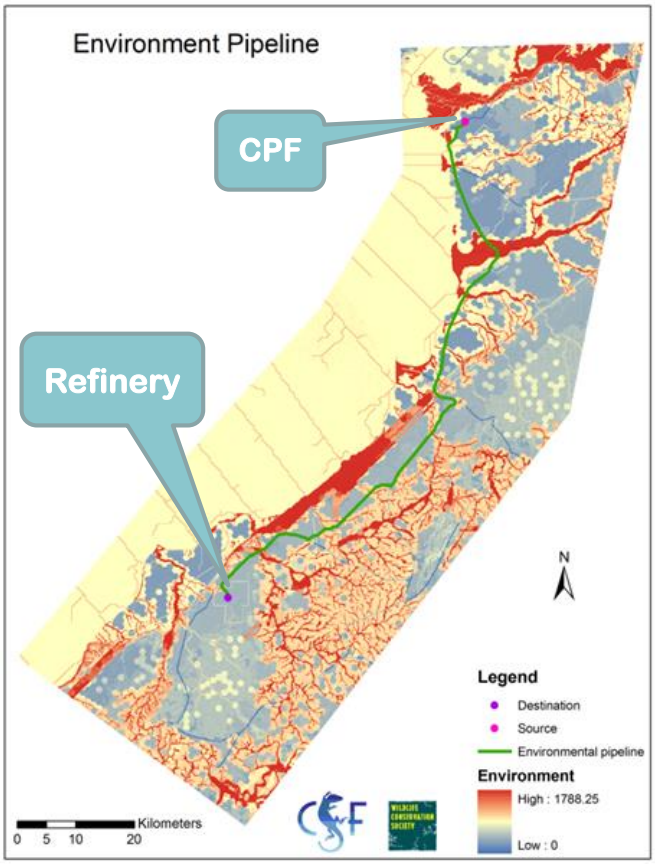
Environmental Factors: Land cover, Rivers, Slope, Roads PLUS Wildlife Corridors, Areas of high BD – Levels 1&2

Weights with environment costs

Factor	Standardised values	Weight
Land cover		**15**
Open water	15	
Wetland	**12**	
Built up	12	
Forest	5	
Plantation	4	
Farmland	3	
Wooded	2	
Barren (Grassland & Bush	0	

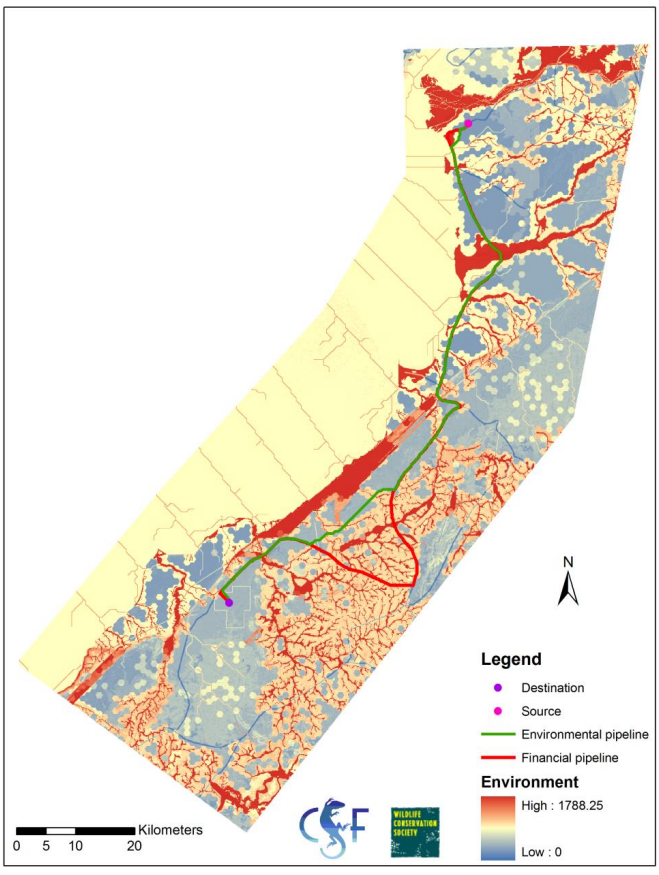
Results





Results: Two routes compared

– Environmental avoids high BD area



…Results

- Financial LCP 137km for the Financial
- Financial plus environmental LCP length - 117km
- The Financial with Environmental Consideration scenario resulted in a 54% increase in relative financial costs

Results: Impact on conservation features

Conservation Feature	Impact (% area) within ROW		Impact (% area) in <1km of ROW	
	Scenario 1 Fin. LCP	Scenario 2 Fin. w/env. LCP	Scenario 1 Fin. LCP	Scenario 2 Fin. w/env. LCP
Hippopotamus	4.81	4.57	13.01	12.78
Giraffe	4.74	4.5	13.15	12.86
Elephant	4.02	3.81	11.37	10.92
Mangabey	2.01	1.34	2.01	1.34
Nahan's Francolin	1.62	1.29	4.78	4.57
Lion	1.22	1.22	2.55	2.55
Shoebill	0.65	0.43	1.89	1.49
Hyena	0.00	0.00	0.00	0.00
Grasslands	5.65	4.22	13.98	11.31
Woodlands	3.87	3.35	10.6	10.18
Tropical High Forest	2.71	2.43	7.46	6.85
Wetlands	1.21	0.58	4.21	2.14

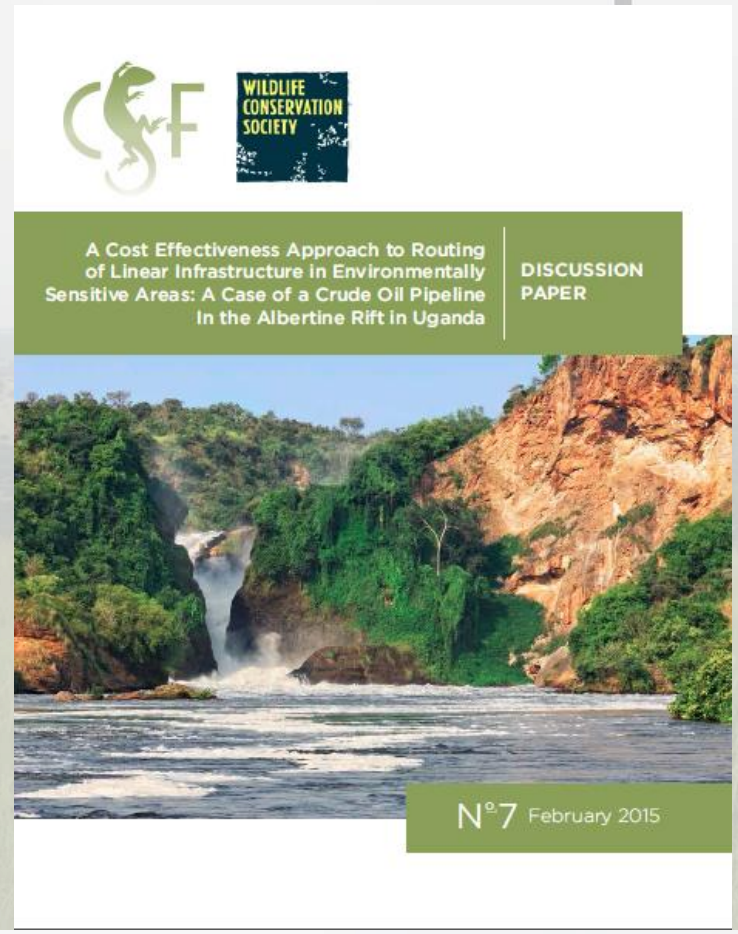
Conclusions

- There is significant scope for reducing environmental impacts using this approach
- Consideration of environmental factors resulted in a shorter but more expensive route in financial terms
- Inclusion of socioeconomic variables, precise financial and environmental costs at landscape level would be helpful

Recommendations

- Use more recent data with higher resolution
- Further analysis to assess impacts in detail – micro routing
- Consider subterranean features such as seismic activity and hydrology
- Incorporate species habitat fragmentation effects

Discussion Paper



Available at:

www.conservation-strategy.org

Acknowledgements

Co-authors:

- Geoffrey Mwedde
- Grace Nangendo
- Dan Segan
- Irene Burgues
- Rhona Barr
- Andy Plumptre

Contributors

- Joseph Bull
- John Fay
- Hedley Grantham
- Aaron Bruner

Thank You

Questions?

Contacts

Wildlife Conservation Society, Uganda Country Programme
Plot 802 Kiwaffu Road, Kansanga
P. O. Box: 7487,
Kampala, Uganda
E-mail: gmwedde@wcs.org
wcsuganda@wcs.org; www.wcs.org; www.conservation-strategy.org