# Towards understanding the effects of informal harvesting of Sand Forest in Maputaland, South Africa

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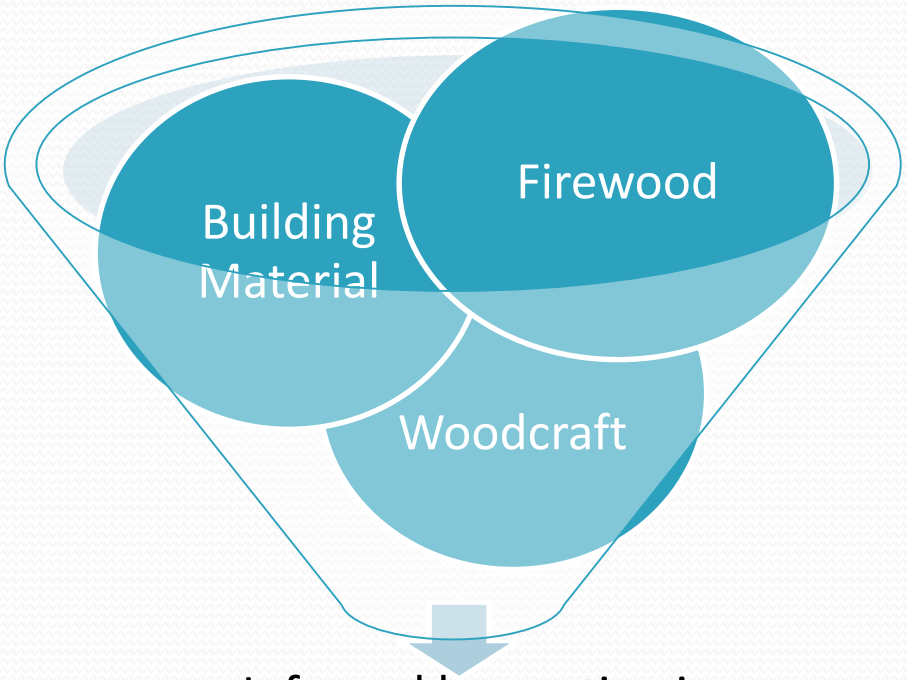
# Background

- Sand Forest is regarded as being **critically** endangered.
- Considered to hold **various endemic species**, several of which are viewed as being **rare and atypical**.
- The use of **wooded ecosystems** for basic household needs is a fundamental element of the **livelihoods** of rural communities in developing countries, and is evident in rural communities within Maputaland.

# Background




Informal harvesting in rural communities

- In rural communities, forest resource contribute **20%** of total **livelihoods**.
- In **68%** of rural electrified households, fuelwood is still **primary** source of energy in SADC.
- Rural households opt for fuelwood as a primary source of energy even where wood resources become **less available** and the **cost** of collecting or purchasing fuelwood **increases**.

# Background

- Considering the following factors:
  - Sand Forest is unique and endangered;
  - Wooded ecosystems form part of community livelihoods;
  - Increasing rural population within areas that Sand Forest is situated;
  - Currently there is a lack of knowledge on the extent of the human impact on Sand Forest in communal areas; and
  - Sand Forest is subjected to uncontrolled utilisation within communal areas.

*"What is the extent of informal wood harvesting on Sand Forest within the South African section of Maputaland? And what notions from earth observation data can be made towards understanding the effects?"*

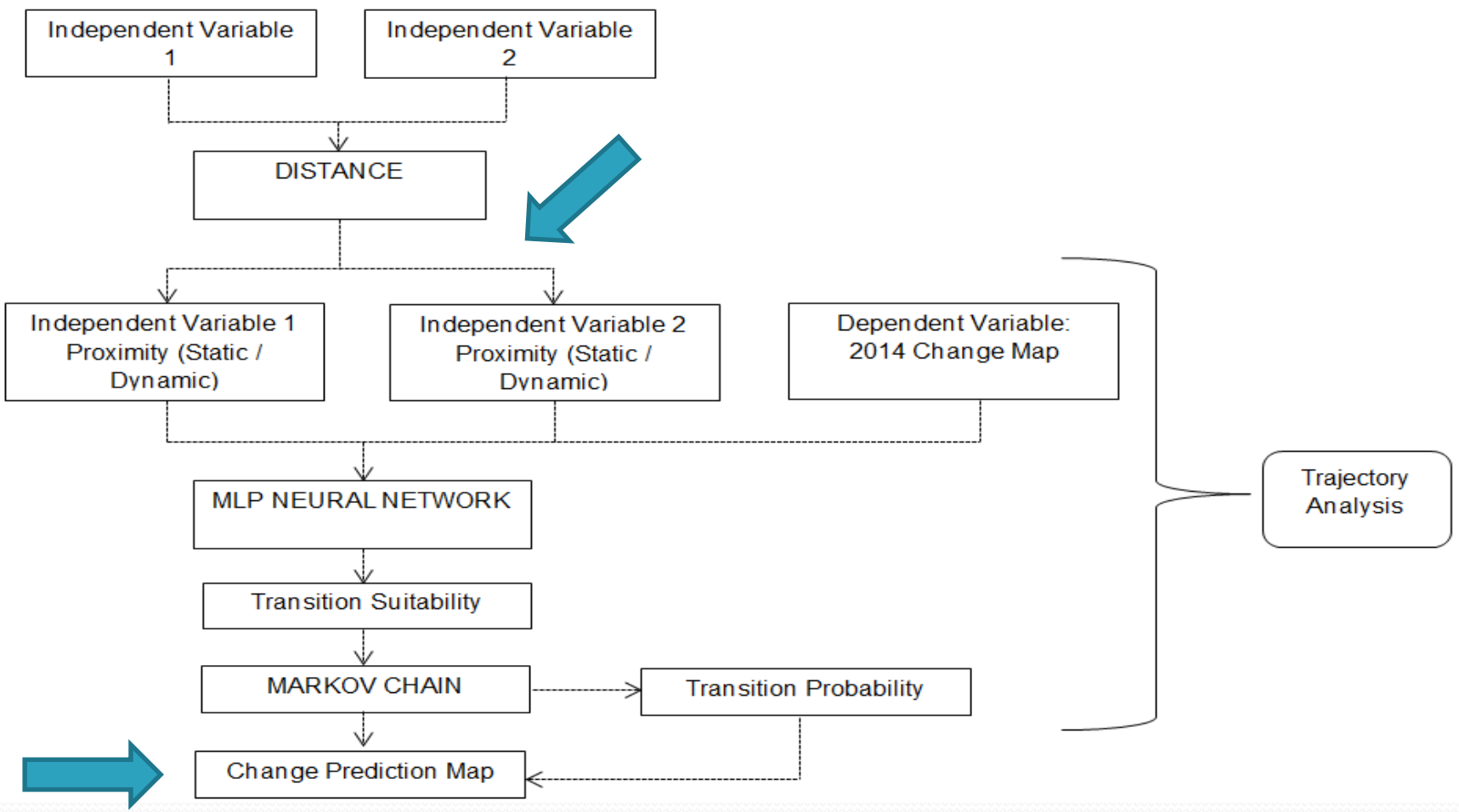
# Methodology Summary

- **Data:** Landsat 5 TM (1998, 2004) & Landsat 8 OLI (2014) - dates selected due to data availability.

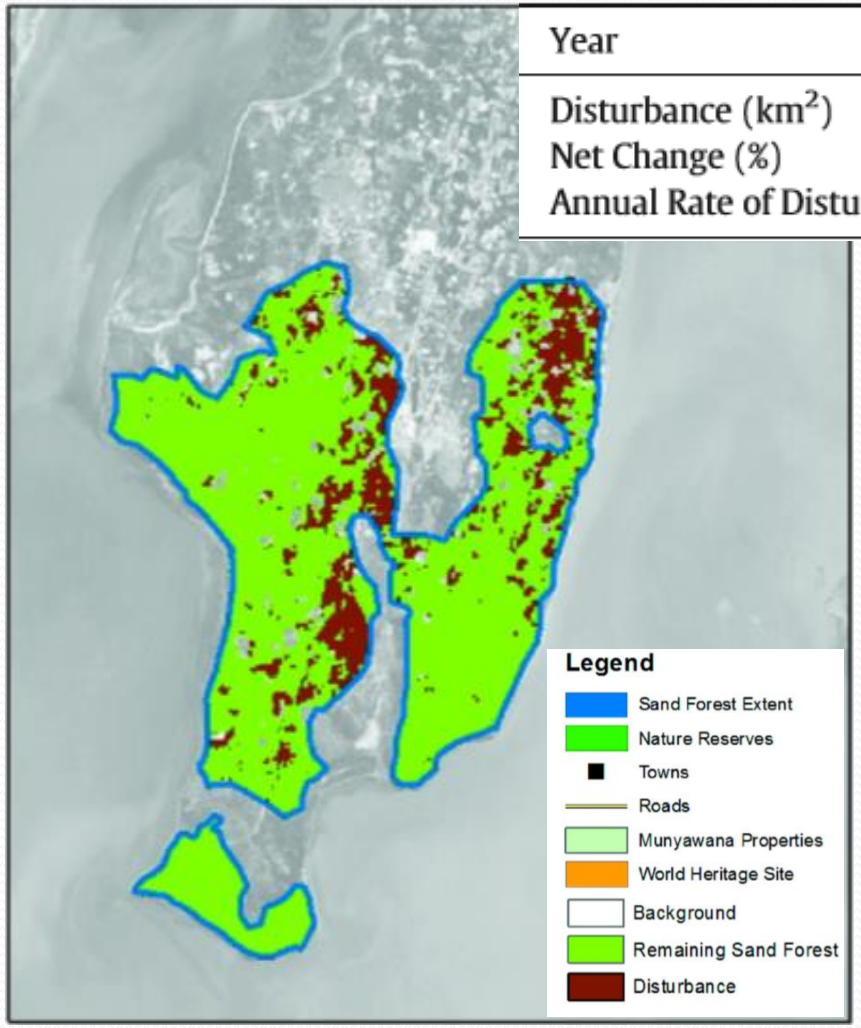
- **Index Used:** The Disturbance Index (*Healey et al., 2005*) was chosen for its potential sensitivity to detect the anthropogenic disturbances experienced from informal wood harvesting within Sand Forest as it has been widely successful in monitoring disturbances in forests.

- **Trajectory Analysis:** Markov chain has been used comprehensively to model trends of land use change at varying scales.

# Methodology Summary



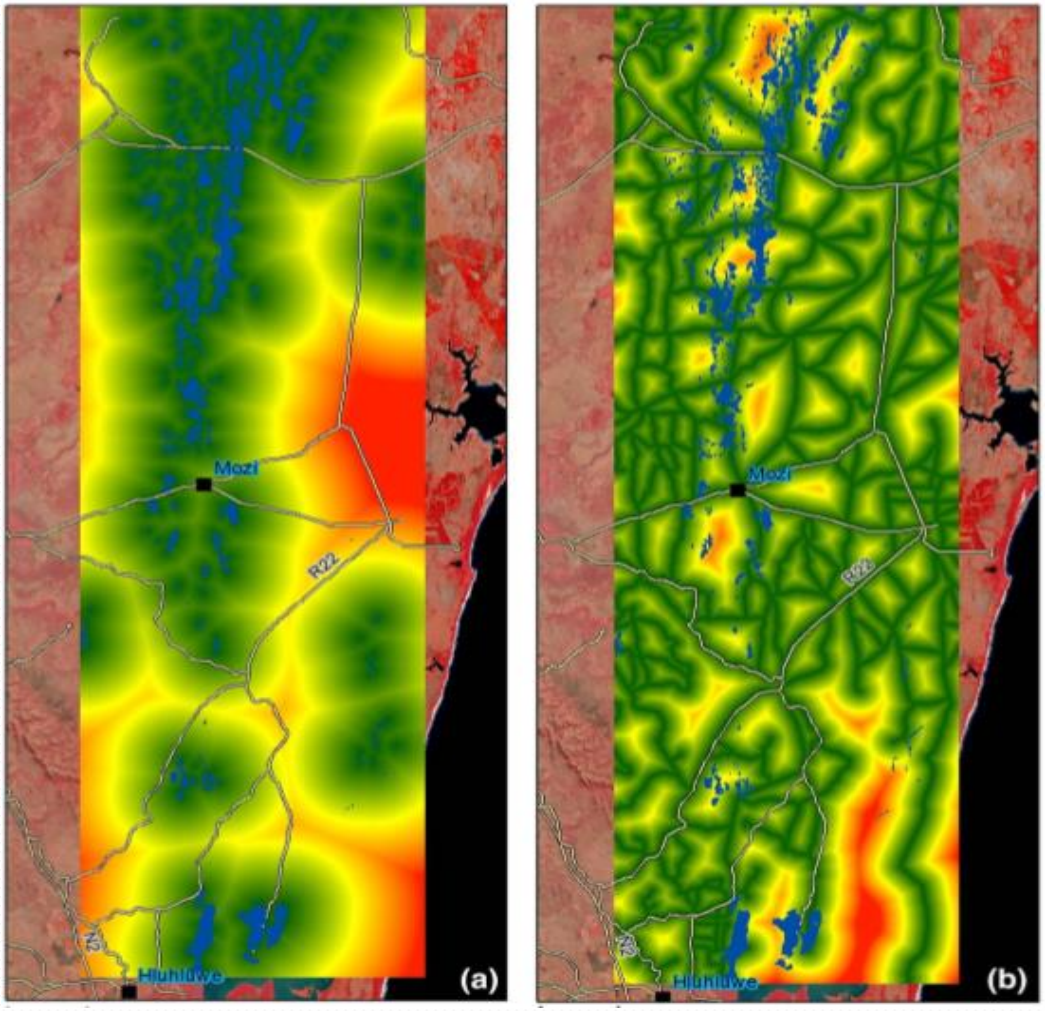
# Results: Current Trends




| Year | 1998–2004 | 2004–2014 | 1998–2014 |
|---|---|---|---|
| Disturbance ($km^2$) | 5.02 | 10.51 | 15.53 |
| Net Change (%) | −2.123 | −4.539 | −6.566 |
| Annual Rate of Disturbance (%) | 0.354 | 0.454 | 0.4102 |

- Perspective: In South Africa a S&EIA is required for a development that removes **0.2 km²** of indigenous vegetation / removal is on average **0.97 km²** per year.
- The success of the Disturbance Index
  - Relationship between soil; vegetation; and canopy & soil moisture.
  - Responds to changes in disturbance, through having an inverted purpose as opposed to the other spectral indices.

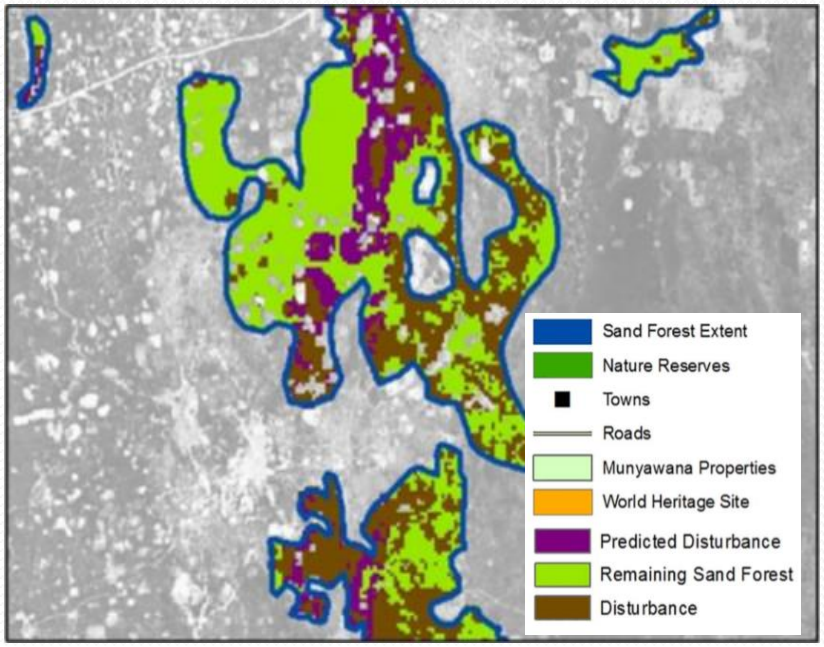
# Results: Current Trends




- Through observations and analysis of current trends, **proximity to roads and to informal settlements** were most relevant independent variables.

# Results: Future Trends

| Year | 1998 | 2014 | 2024 | 2014–2024 | 1998–2024 |
|---|---|---|---|---|---|
| Sand Forest ($km^2$) | 236.66 | 221.13 | 211.09 | – | – |
| Disturbance ($km^2$) | – | – | – | 10.04 | 25.57 |
| Net change (%) | – | – | – | − 4.540 | − 10.807 |
| Annual rate of disturbance (%) | – | – | – | 0.454 | 0.416 |



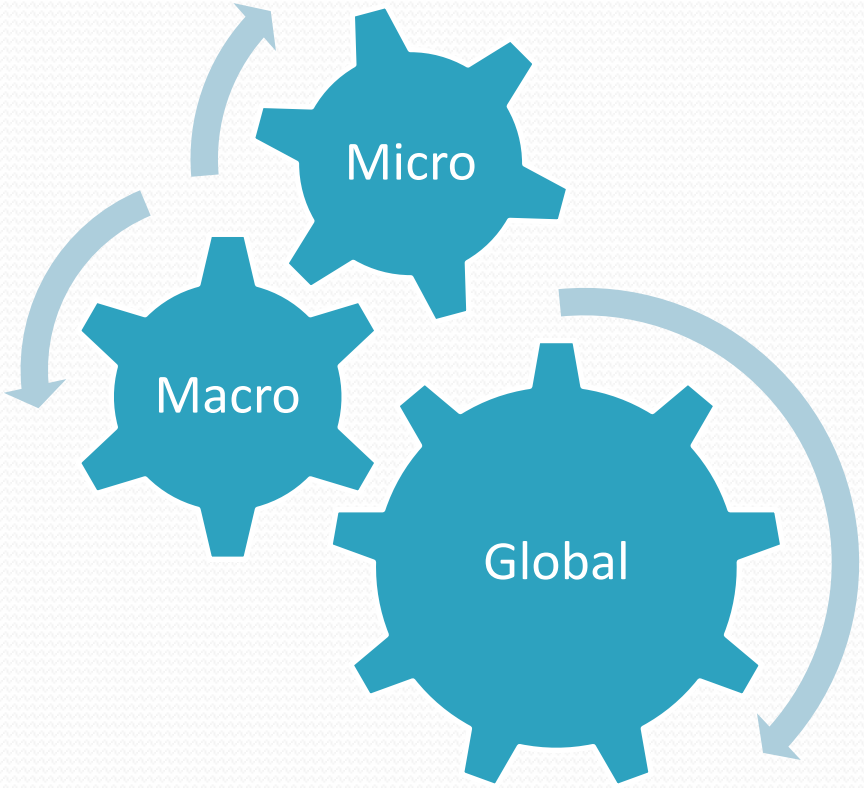

- Evaluate the performance of Markov chain:
  - **Change prediction** model for 2014, based on the 2004 change dataset was carried out.
  - The change prediction for 2014 was **8.13 km²**, whilst the actual change was **10.51 km²**.
  - Markov chain **underestimates** the magnitude of change - possibly due to additional variables.
  - Markov chain for predicting the 2024 changes, it should be understood that the prediction will produce a "**best-case scenario**" for Sand Forest.

# Influence of Informal Harvesting

Effects on the ecological system (e.g. ecological functioning)

Effects on communities (e.g. Conflict and unwanted social interactions)

Effects of the social-ecological system



# Decision-making Recommendation

- The **protection of natural resources** in Maputaland has been considered from various points of view, including **conservation** and **resource management**.

- However, this **approach** to resource-management planning is generally **conservation and protection focused**, and **does not quantify** the **livelihood security** requirements of the communities.

- Developing a natural resource management strategy for the entire Maputaland with **conservation targets as the main aim** and community upliftment as a secondary objective may result in **further loss** of natural resources.

# Decision-making Recommendation

- A **recommended approach** would be the development of a resource management and utilisation strategy that has **objectives** for
  - Conservation;
  - community upliftment; and
  - utilisation (i.e. involve identifying areas for sustainable utilisation and those that can be sacrificed).
- The **recommended approach** (FUTURE RESEARCH)
  - (1) determine the conservation targets for Sand Forest;
  - (2) identify suitable area for community based ecotourism; and
  - (3) determine the utilisation requirements of the communities to meet their livelihood security needs.
- The information developed through this study is vital for the development of such a strategy.

# Conclusion

- The results of the study reveal the **value of earth observation**, in being able to determine changes in forest edge and canopy not only over a long period of time but also over a large distance.

- Shows the suitability of the **DI** and **Markov chain** in such analysis.

- Developing **quantified observed and predicted trends** in Sand Forest, provides clearer understanding of the processes affecting Sand Forest and allowing for notions to be formed on the impacts that could emerge from these trends.

- In particular, information derived is a first step towards developing an effective resource management and utilisation strategy.

# Thank You

R. Nel, K.F. Mearns & M. Jordaan, 2017. Trajectory analysis of informal Sand Forest harvesting using Markov Chain, within Maputaland, Northern KwaZulu-Natal. *Journal of Ecological Informatics*, 42C (2017) pp. 121-128. https://doi.org/10.1016/j.ecoinf.2017.10.012

R. Nel, K.F. Mearns & M. Jordaan, 2017. Modelling informal Sand Forest harvesting using a Disturbance Index from Landsat, in Maputaland (South Africa). *Journal of Ecological Informatics*, 39 (2017) pp. 1-9. http://dx.doi.org/10.1016/j.ecoinf.2017.02.005