Mapping flowering plants and landscape structure

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Landscape matrix, Bee health, ESS

Land use

Nutrition

Bee Health

Availability of melliperous plants

Bee keeping products (i.e. honey)

ESS

Human well being, pollination and Biodiversity
• How much natural (or relatively unmanaged) forage is needed for honey and pollination services?

• **Land use** patterns have changed
  – less forage material available for bee colonies

• **GIS/GPS** vital for mapping diseases
Deforestation and changes in LU

2002-2009, Kenya
Landscape (LS) indicators & variables

- LS **Phenology**: Abundance and distribution & of flowering plants
- LS **Structure**: Cropland vs. natural mosaic “adjacency”
- LS **Dynamics**: Deforestation, *expansion* of croplands
Solution?

how?
what sites?
what exactly?
scales?
needs?

➢ Derive and implement integrative geospatial approaches – by i.e. linking different data sets
## Integrative, multi data, scale solution

<table>
<thead>
<tr>
<th>Products</th>
<th>Site specific</th>
<th>Regional</th>
<th>Utility</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floral cycle, abundance</td>
<td>✔️</td>
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<td>Mwingi (Ke), kakamega (Ke.), Tolay (Et); sites in Madagascar &amp; Burkina F.</td>
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<td>GIS mapping of disease infections</td>
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<td>Bee diversity modelling</td>
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Floral cycle & abundance at key sites in Africa

Air- and space-borne imaging & \textit{in situ}

Interpretation & algorithm

"Green" tree
Bare soil
Flowering intensity
Floral cycle & abundance at key sites - crowdsourcing

Farmers and Apiary managers supply geo-tagged photos

Systematic collection of photos, data entries

Data interpretation & use
1. Cross verification, assimilation (RS)
2. Spatial & temporal distribution maps
Floral cycle & abundance at key sites- spectral profiling and hemispherical photos
Deforestation (2000-2012) over key project sites: Kakamega, Ke
Deforestation (2000-2012) over key project sites: Mt. Kenya
Deforestation (2000-2012) over key project sites: Madagascar
Reg. indicators – veg. productivity
Comparing veg. productivity & deforestation data

Vegetation productivity loss

- Forest loss
- Forest gain
Conclusions

Products have their limitations, i.e.

- **Deforestation** over Africa – only forest sites
- **Vegetation productivity** loss, includes deforestation but also degradation and LC transformation

- **Floral cycle & abundance**, LS structure and LU/LC change site specific
  - Upscaling will be investigated
Open questions

• Which *sampling design* for floral monitoring using smartphones/apps, etc?
• How to best link landscape matrix to Bee *Health indicators*, *i.e.* honey flow, pollen quality, quantity?
• How can *quantification of pollination effects* been done?
• *Utility* for working & research agenda?
Thank you for your attention!

EO Unit in icipe, member of GEO