A Decision Support System to Monitor and Inform Chimpanzee Habitat Management

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Partners
The mission of the Jane Goodall Institute is: to understand and protect chimpanzees, other apes and their habitats, and to work towards creating a critical mass of informed and compassionate citizens who will help to create a better world for people, other animals and our shared environment.
Chimpanzee and other great apes are facing extinction.

Data and knowledge gaps hinder effective and long-lasting conservation decisions.

Existing scientific data and information is not incorporated into conservation practice and does not influence the positions or change behaviors of decision-makers.

Top-down global solutions and on-the-ground social situations, capacities and needs in Africa are disconnected.

Resources are disproportionately invested in developing new products and technologies and do not reach crucial “last mile” where users make choices and decisions impacting the environment.

Technologies and tools are not developed with conservation applications and users in mind.

Building capacity to use and maintain the technology and tools are not usually part of the technology development cycle.
Converting pixels into conservation decisions

Science

Problems
Solutions

Decision-making

Society

Local knowledge values and behaviour

Source: Toomey et al. 2017
Converting pixels into conservation decisions

Source: Toomey et al. 2017
DSS Objective & Geographic Scope

- Develop a practical DSS to be used by the Jane Goodall Institute and partners to annually monitor and forecast chimpanzee habitat conditions to support decision-making from local to species range scales in Africa.
- DSS covers geographic ranges of all four sub-species of chimpanzees.
- Will enable systematic monitoring of habitat change over time.
Monitoring chimpanzee habitat loss
Cumulative per cent of annual forest loss taking place within each chimpanzee sub-species’ range. Solid lines refer to loss within a subspecies’ entire range while dashed lines refer to forest loss taking place only within the protected areas located inside each species’ range.
Modelling Range-Wide Chimpanzee (Pan troglodytes) Habitat Suitability Based on Landsat ETM+ and SRTM Data to Aid Conservation Efforts

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3 * Correspondence; E-Mail: sjantz@umd.edu
### Satellite-derived Input Data

<table>
<thead>
<tr>
<th>Spectral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band 3 median reflectance 2000-2005</td>
</tr>
<tr>
<td>Band 4 median reflectance 2000-2005</td>
</tr>
<tr>
<td>Band 5 median reflectance 2000-2005</td>
</tr>
<tr>
<td>Band 7 median reflectance 2000-2005</td>
</tr>
<tr>
<td>Normalized difference (band4/band3)</td>
</tr>
<tr>
<td>Normalized difference (band4/band5)</td>
</tr>
<tr>
<td>Normalized difference (band4/band7)</td>
</tr>
<tr>
<td>band3/band5</td>
</tr>
<tr>
<td>band3/band7</td>
</tr>
<tr>
<td>band5/band7</td>
</tr>
<tr>
<td>Forest structure</td>
</tr>
<tr>
<td>Percent canopy cover</td>
</tr>
<tr>
<td>Canopy height</td>
</tr>
<tr>
<td>Percent bare ground</td>
</tr>
<tr>
<td>Disturbance and fragmentation</td>
</tr>
<tr>
<td>Proximity to forest loss (minimum 0.5 ha)</td>
</tr>
<tr>
<td>Proximity of interior forest to forest edge (minimum 1 ha patch size)</td>
</tr>
<tr>
<td>Topographic</td>
</tr>
<tr>
<td>Elevation</td>
</tr>
<tr>
<td>Slope</td>
</tr>
<tr>
<td>Proximity to steep slopes (&gt;15°)</td>
</tr>
<tr>
<td>Proximity to rivers</td>
</tr>
</tbody>
</table>

15 Landsat ETM+ based “dynamic” variables derived from Hansen et al. (2013) data.

5 Shuttle Radar Topography Mission based “static” variables.
Crowdsourcing data from community monitoring, ranger patrols, research surveys, and UAVs)
5km resolution

30m resolution

Suitability
- High: 1
- Low: 0

Sub-species
- P. elliottii
- P. schweinfurthii
- P. troglodytes
- P. verus
1. From a single index to multiple indicators that inform a management process
2. Same EOS products can result in different indicators

OS Viability Analysis: Markings to Interpret Target Health

<table>
<thead>
<tr>
<th>Target</th>
<th>Category</th>
<th>KEA</th>
<th>Indicator</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chimp Habitat in Zambezian Miombo Woodland</td>
<td>Size</td>
<td>Area with tree cover</td>
<td>% of 2000 baseline area loss</td>
<td>&gt; 5% loss</td>
<td>2.5 - 5.0%</td>
<td>1 - 2.5%</td>
<td>&lt; 1% loss</td>
</tr>
<tr>
<td></td>
<td>Condition</td>
<td>Evergreen forest</td>
<td>% of 2000 baseline area loss</td>
<td>&gt; 5% loss</td>
<td>2.5 - 5.0%</td>
<td>1 - 2.5%</td>
<td>&lt; 1% loss</td>
</tr>
<tr>
<td></td>
<td>Landscape context</td>
<td>Distance to humans</td>
<td>Avg pixel dist to human feature</td>
<td>&lt; 250 m</td>
<td>250 - 500 m</td>
<td>500 - 1000 m</td>
<td>&gt; 1000 m</td>
</tr>
</tbody>
</table>
3. Focusing on the right indicators …

KEA: Size – Forest cover (Woodland & Evergreen Forest)

KEA: Condition – Evergreen Forest
4. Focusing on the right indicators summarized by relevant management units
5. Balancing resolution with the management question

Gombe National Park and the Greater Gombe Ecosystem

5. Balancing resolution with the management question

Forest & wood loss 2001-14
% loss to 2000 baseline
- 0.0 - 1.0 (Very Good)
- 1.1 - 2.5 (Good)
- 2.6 - 5.0 (Fair)
- 5.1 - 34.9 (Poor)

Survey area
- Chimpanzee presence (2015-16 surveys)
- Chimpanzee presence (2012-16 VMs) (Village Forest Monitors)

Gombe National Park
- Village Forest Reserves / Woodlots of the Gombe-Bunuri Ridge
- International boundaries

Map produced: Lilian Pinte / the Jane Goodall Institute
March 10, 2017
2005 - 2014 Digital Globe Imagery of Kigalye Village Forest Reserve
5. Balancing resolution with the management question
Total of 501 nests found; 4 sightings of chimps
Threats to the habitat
Illegal forest burning and conversion to farmland inside Masito East LA Forest Reserve as detected by GeoEye satellite 2010-2016.

Projected Coordinate System: Arc_1960_UTM_Zone_36S

Satellite image source: DigitalGlobe
Encroachment in Kibale National Park stopped by Uganda Wildlife Authority rangers using weekly GLAD forest loss alerts and Forest Watcher mobile app.
Encroachment in Kibale National Park stopped by Uganda Wildlife Authority rangers using weekly GLAD forest loss alerts and Forest Watcher mobile app.
the Jane Goodall Institute Habitat Health DSS
A Complete Geospatial Platform using Esri’s ArcGIS Enterprise and Microsoft Azure Cloud

Focused Applications
- Web
- Mobile
- Desktop

Coordination
Planning
Reporting
Communications
Field Operations

Local Data
EOS Data
ArcGIS Enterprise in Azure

Content & Distributed Services
Local communities and Governments of Tanzania, DRC, Uganda and Republic of Congo

THANK YOU!

the Jane Goodall Institute