Testing the Dynamic Habitat Indices from MODIS for biodiversity and conservation

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NASA MODIS Science Team Meeting, 6/9/2016
Outline

I. Background: the Dynamic Habitat Indices

II. Datasets: Composite and annual DHIs

III. Case studies: DHIs and biodiversity
The Dynamic Habitat Indices

• Understanding biodiversity patterns is a BIG scientific question
The Dynamic Habitat Indices

- Understanding biodiversity patterns is a BIG scientific question

- Biodiversity loss is a major challenge for society

BBC NEWS

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Tuesday, 21 May, 2002, 12:48 GMT 14:48 UK
Quarter of mammals "face extinction"

Siberian tigers may vanish within three decades
By Corinne Podger
BBC science correspondent

Almost a quarter of the world’s mammals face extinction within 30 years, according to a United Nations report on the state of the global environment.
The Dynamic Habitat Indices

• Biodiversity theory predicts high species richness where:
  – Available energy is high
  – Minimum energy is high
  – Variability in energy is low
The Dynamic Habitat Indices

• Plant productivity is a proxy for the energy available for biotic communities
• The DHIs summarize three key attributes of annual productivity
  – Cumulative
  – Minimum
  – Variability (CV)
The Dynamic Habitat Indices

FPAR – Cumulative
The Dynamic Habitat Indices

FPAR – Minimum
The Dynamic Habitat Indices
The Dynamic Habitat Indices

FPAR DHIs

Variability, Cumulative, and Minimum in RGB
Outline

I. Background: the Dynamic Habitat Indices

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Datasets

• MODIS Composite DHIs for 2003-2014
  – Why: MODIS vegetation data have some noise and phenology varies among years
  – The median of all observations for a date
  – Only good MODIS QA flags
  – No-data as functional zeros
    • Northern Latitudes
    • Snow and deserts
Datasets

FPAR July 2002
Datasets

FPAR January 2002
# Datasets

<table>
<thead>
<tr>
<th>Index</th>
<th>Product</th>
<th>Platform</th>
<th>Temporal resolution</th>
<th>Spatial resolution</th>
<th>Composite DHI</th>
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Datasets

Composite EVI DHIs
Datasets

Composite LAI DHIs
Datasets
Datasets
Datasets

• Annual DHIs
  – Why: One person’s noise is another’s data
  – Smoothing annual phenology
    • Iterative median
    • Savitzky-Golay
## Datasets

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<th>Index</th>
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Datasets

FPAR DHIs 2003
Datasets

FPAR DHIs 2012
Outline

I. Background: the Dynamic Habitat Indices

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DHIs and global biodiversity

Composite FPAR DHIs
DHIs and global biodiversity

Amphibians
DHIs and global biodiversity

Mammals
DHIs and global biodiversity

Birds
DHIs and global biodiversity

<table>
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<tr>
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<th>DHI-Cumulative</th>
<th>DHI-Minimum</th>
<th>DHI-Variability</th>
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<td>Amphibians</td>
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<td>0.70</td>
<td>-0.51</td>
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<td>Birds</td>
<td>0.70</td>
<td>0.71</td>
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<tr>
<td>Mammals</td>
<td>0.70</td>
<td>0.71</td>
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Pearson’s correlation coefficients ($r$)
DHIs and global biodiversity
DHIs and global biodiversity

Composite FPAR DHIs
DHIs and global biodiversity

Composite FPAR DHIs
Composite FPAR DHIs
Composite FPAR DHIs
Thailand – bird species richness
Thailand – bird species richness

$R^2 = 0.63$
Thailand – bird species richness
Thailand – Bird habitat

Texture of FPAR DHI-1 (cumulative)
Thailand – Bird habitat

*Anorrhinus tickelli*

Habitat composition model

Habitat + texture model
Outline

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Conclusions

I. Background

– The DHIs are based on biodiversity theory

– Three aspects of productivity that are key for biodiversity
Conclusions

II. Datasets: largely completed
   – Composite DHIs
   – Annual DHIs
   – Next: online data viewing and downloading
Conclusions

III. DHIs and biodiversity

– All three DHIs predict global species richness of amphibians, mammals, and birds
– For birds in Thailand, cumulative DHI mattered most
– Complementary to other predictors
– More in progress…
Thank you!
Thailand – DHI-1 texture
Thailand – Bird habitat