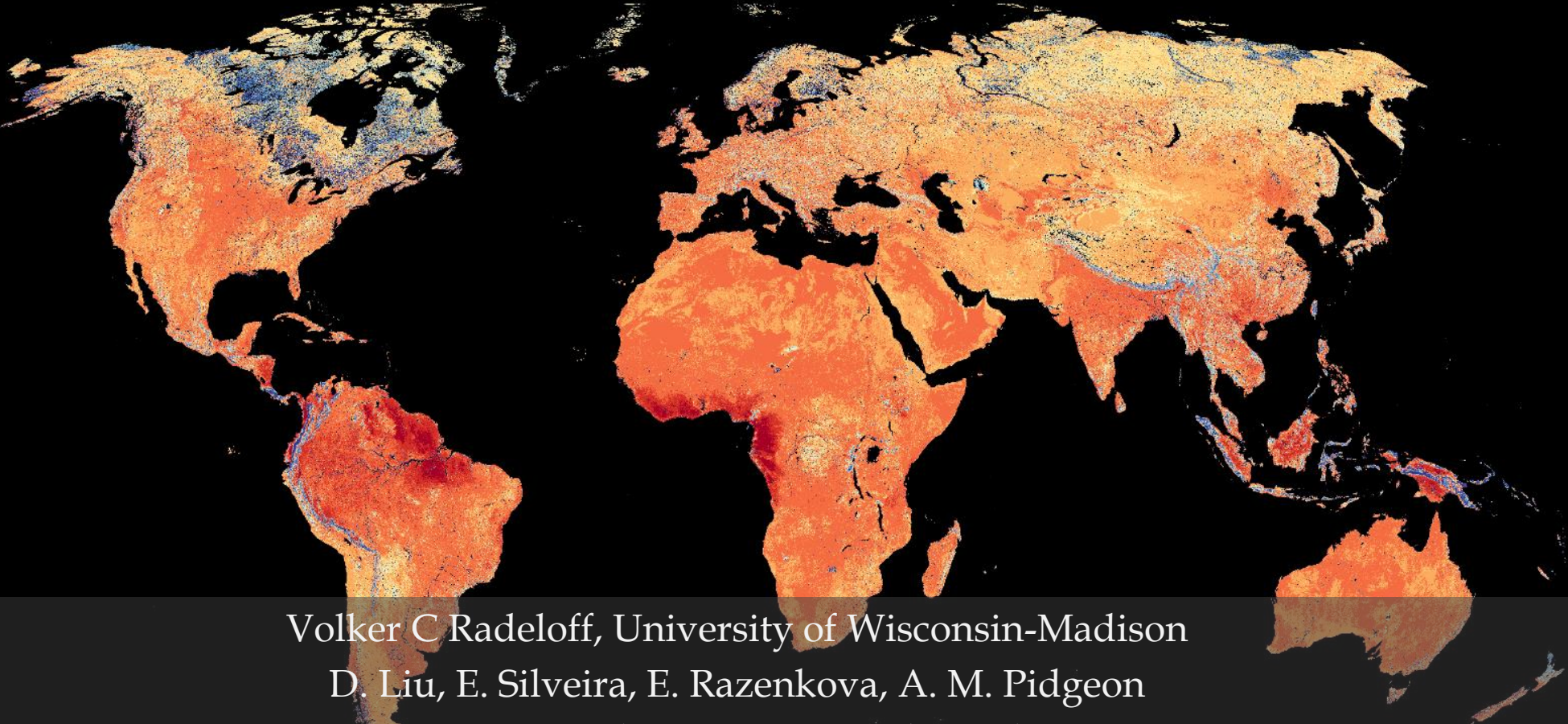


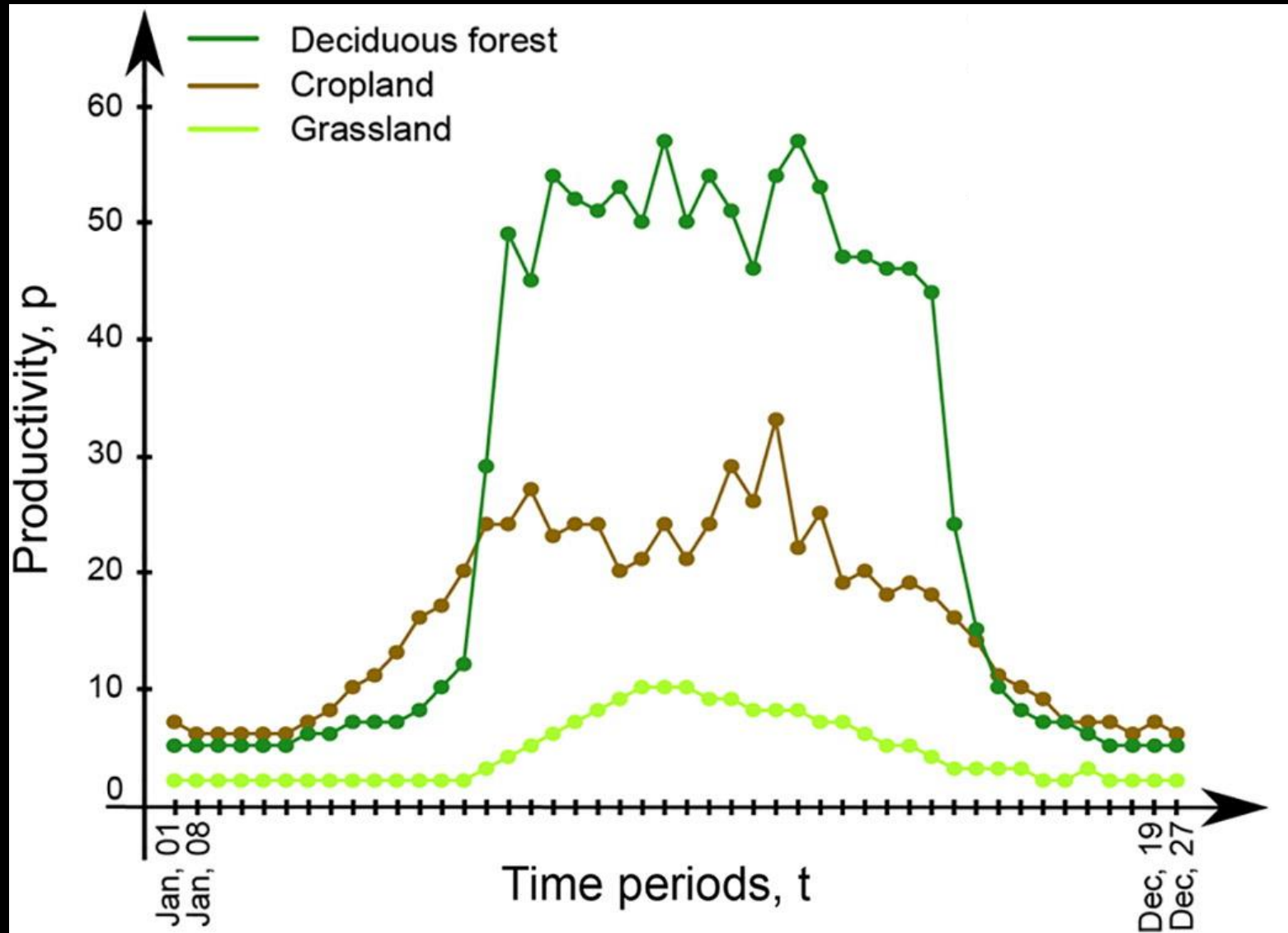
The Dynamic Habitat Indices from Terra, Aqua, Suomi NPP and JPSS data for biodiversity science and conservation



Volker C Radeloff, University of Wisconsin-Madison
D. Liu, E. Silveira, E. Razenkova, A. M. Pidgeon
N. Coops, D. Gudex-Cross, M. Hobi, and A. Ives



Introduction



Introduction

Ecology




Available energy
hypothesis

Environmental stress
hypothesis

Environmental variability
hypothesis



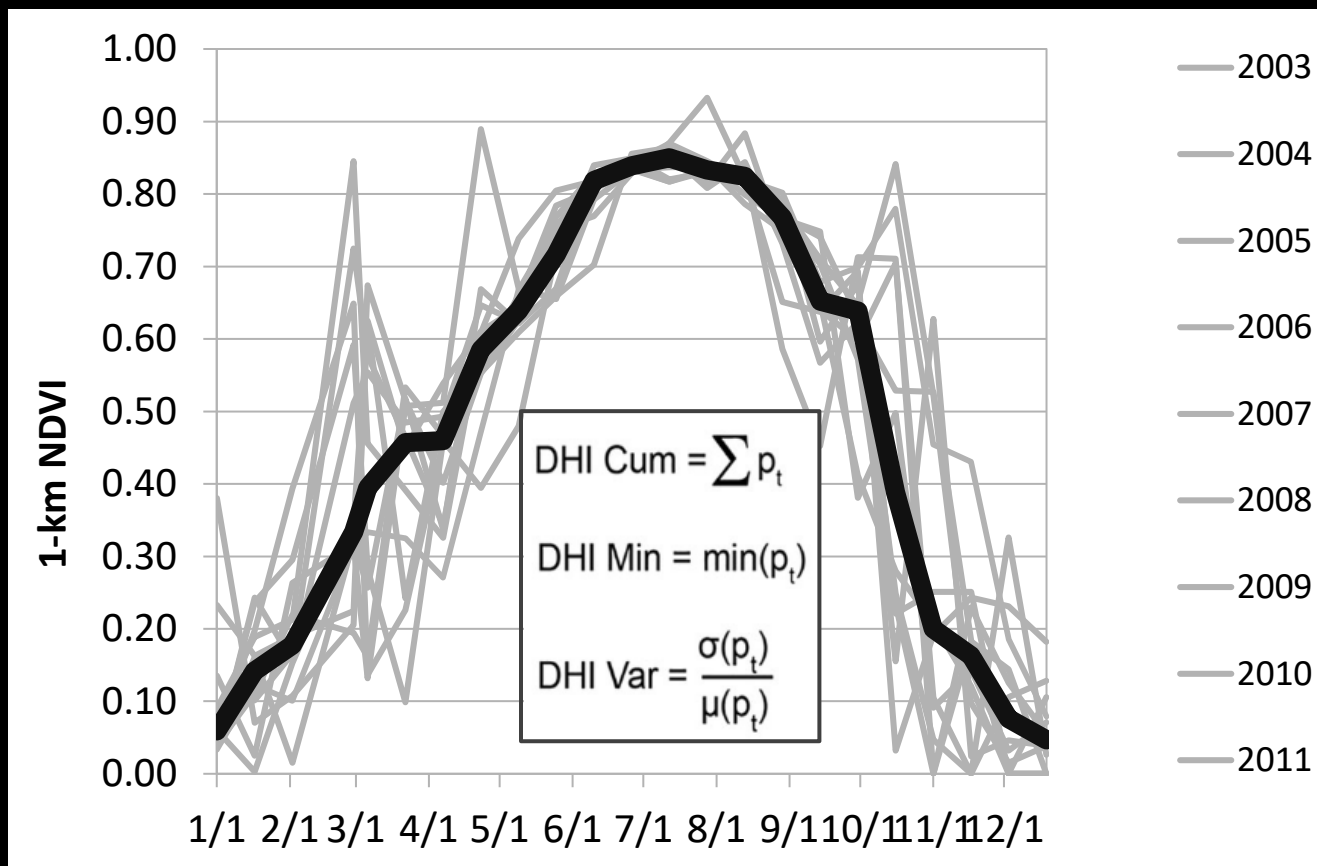
Introduction

Ecology		DHIs
Available energy hypothesis		Cumulative productivity
Environmental stress hypothesis		Minimum productivity
Environmental variability hypothesis		Coefficient of variation



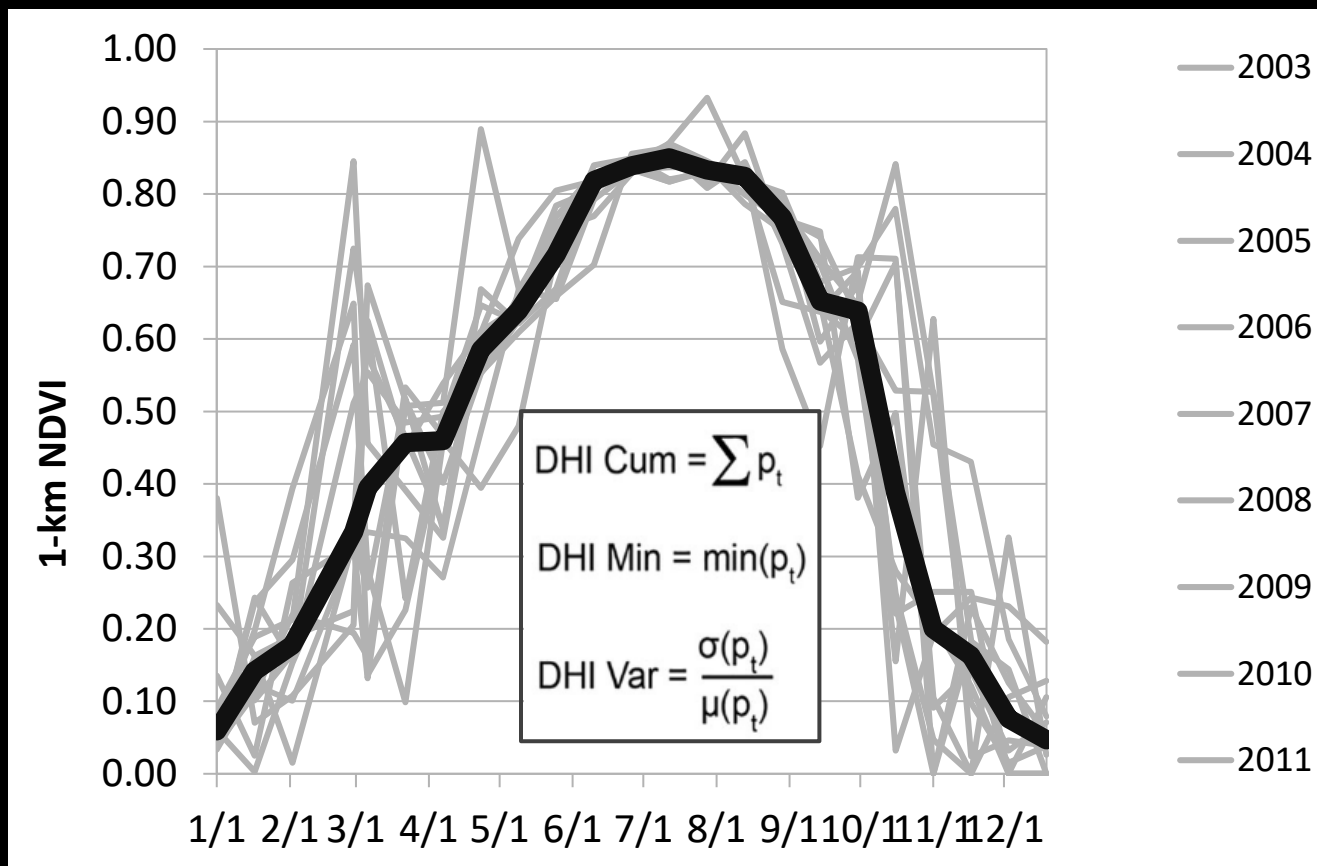
Introduction

Composite DHIs

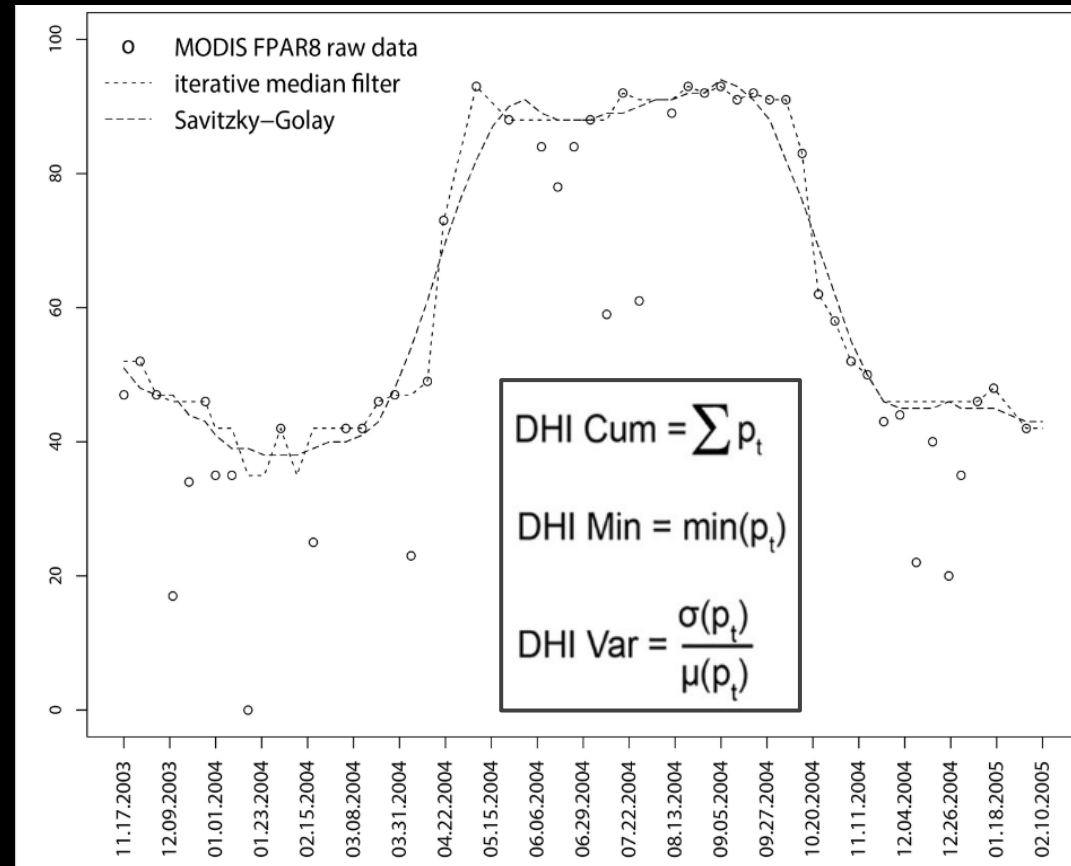


Introduction

Composite DHIs



Annual DHIs



Hobi et al. 2017, 2021
Radeloff, et al., 2019

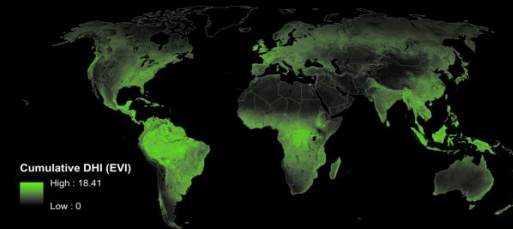


Introduction

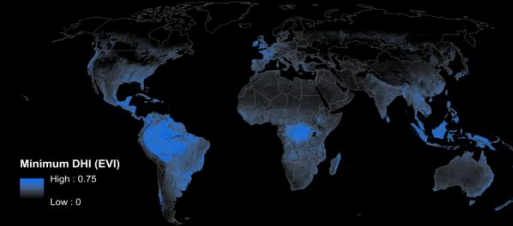
Ecology

DHIs

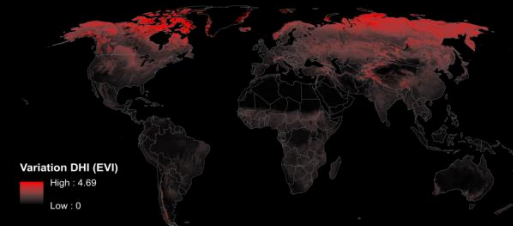
Available energy hypothesis



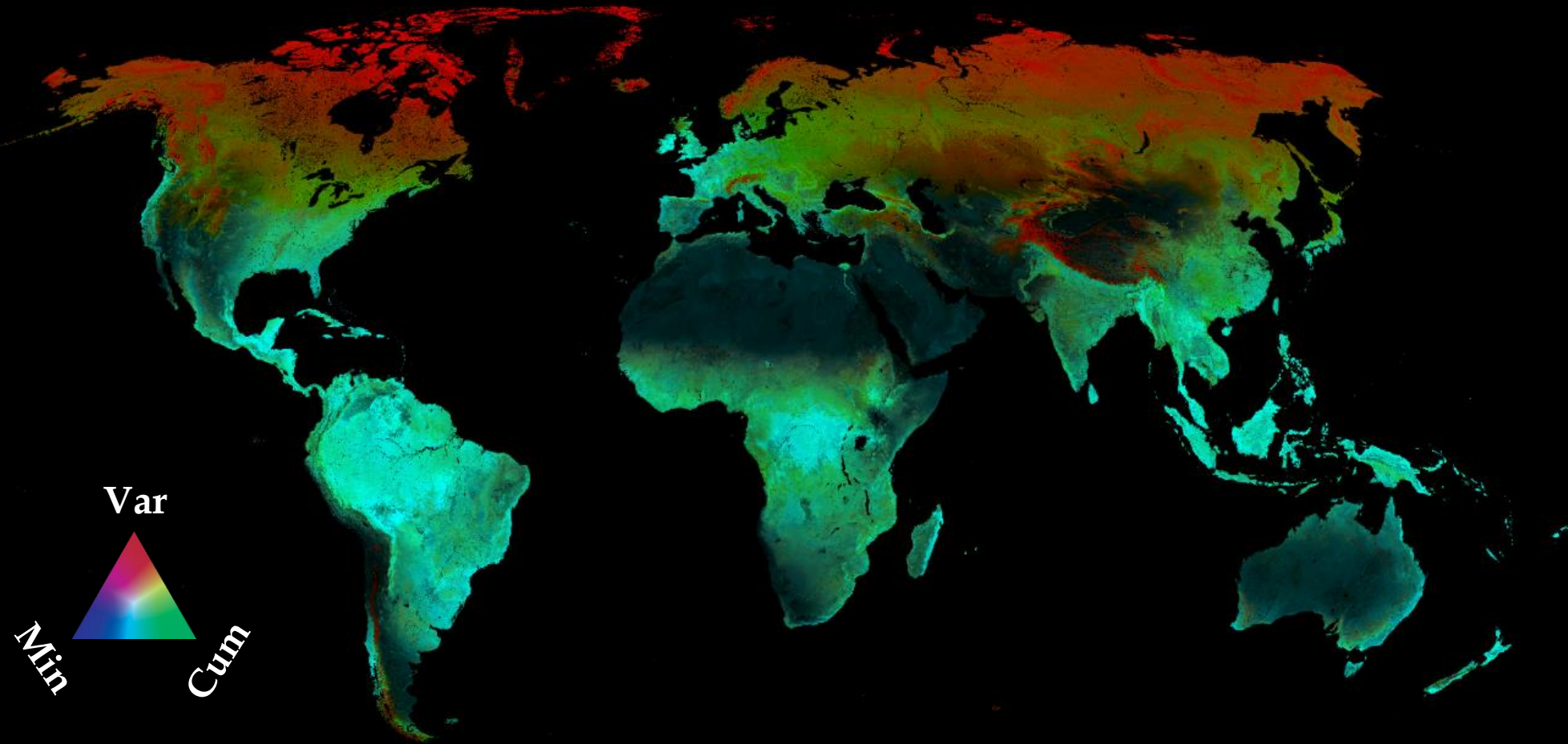
Environmental stress hypothesis



Environmental variability hypothesis



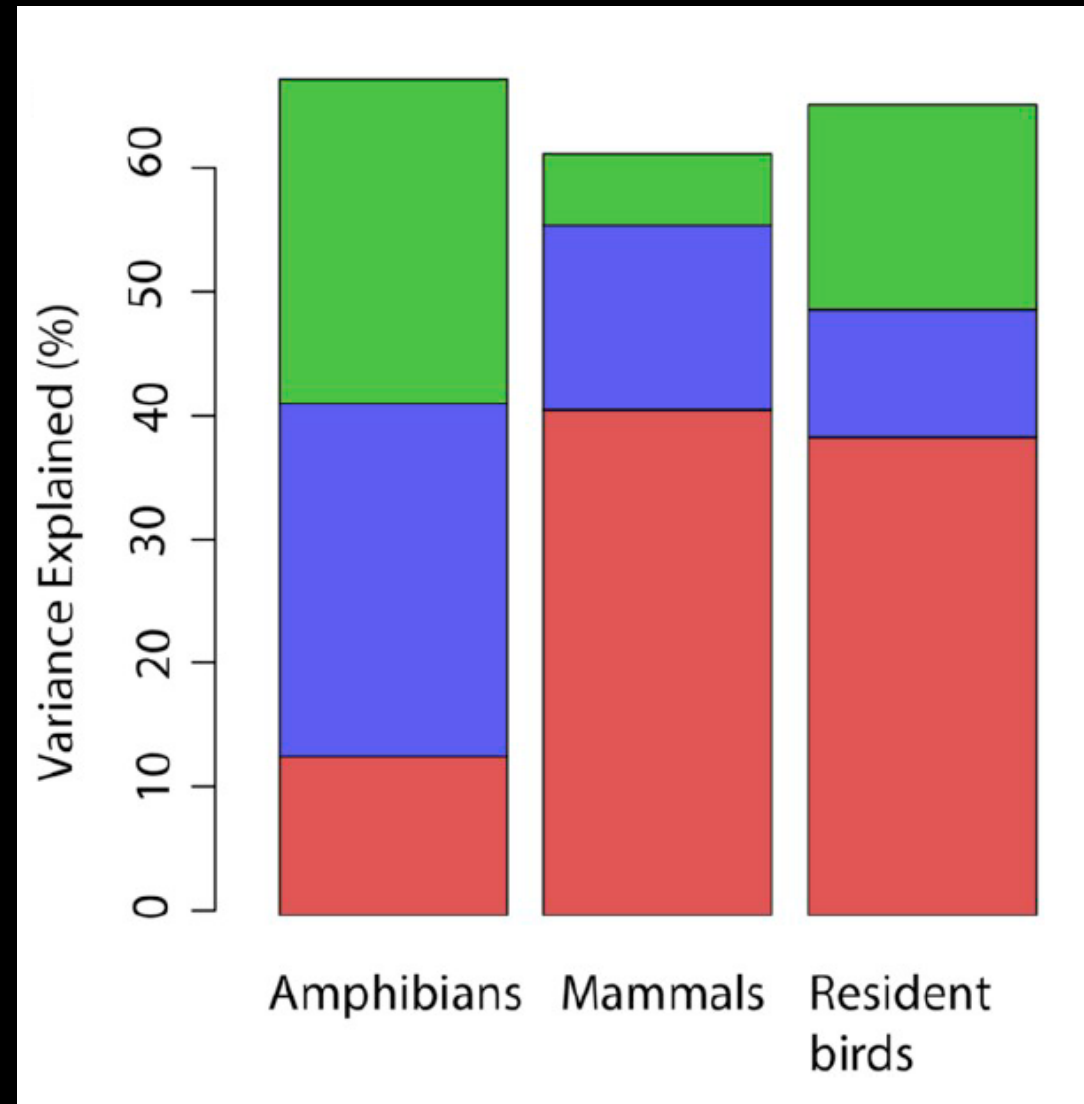
Introduction



Radeloff, et al., 2019, RSE



Introduction



Radeloff, et al., 2019, RSE



Introduction

UNIVERSITY of WISCONSIN-MADISON

SILVIS LAB
Spatial Analysis For Conservation and Sustainability

HOME PEOPLE RESEARCH PUBLICATIONS **MAPS & DATA** IN THE NEWS ABOUT US SIGN IN

DYNAMIC HABITAT INDICES

VARIABLE
 NDVI EVI FPAR

LAI GPP

BAND
 Composite RGB 5-1-2
 Band 1 - cumulative
 Band 2 - minimum
 Band 3 - seasonality

LAYER OPACITY

Show political borders

RELATED PUBLICATIONS

Raduloff, V. C., M. Dubinin, N. C. Coops, A. Allen, T. M. Brooks, M. Clayton, G. Costa, C. H. Graham, D. Halmer, A. R. Ives, D. Kelso, A. M. Pidgeon, G. Rapacciuolo, E. Razmkova, N. Suttate, B. E. Young, L. Zhu, and M. Hubi. 2019. The Dynamic Habitat Indices (DHIs) from MODIS and global biodiversity. *Remote Sensing of Environment*, 222: 204-214. PDF

Hubi, M.L., Dubinin, M., Graham, C.H., Coops, N.C., Clayton, M.J., Pidgeon, A.M., & Raduloff, V.C. 2012. A comparison of Dynamic Habitat Indices derived from different MODIS products as predictors of avian species richness. *Remote Sensing of Environment*, 195, 142-152. PDF

DOWNLOADS

All DHI datasets are single composite RGB images stored in GeoTIFF format at 1 kilometer spatial resolution. Map projection is WGS84 (EPSG:4326).

NDVI16 (NORMALIZED DIFFERENCE VEGETATION INDEX)
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 Composite DHIs (2003-2014)

EVI16 (ENHANCED VEGETATION INDEX)
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 Composite DHIs (2003-2014)

FPAR8 (FRACTION ABSORBED PHOTOSYNTHETICALLY ACTIVE RADIATION)
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 Composite DHIs (2003-2014)

LAI8 (LEAF AREA INDEX)
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 Composite DHIs (2003-2014)

GPP8 (GROSS PRIMARY PRODUCTIVITY)
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 Composite DHIs (2003-2014)



Outline

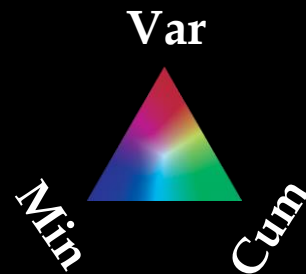
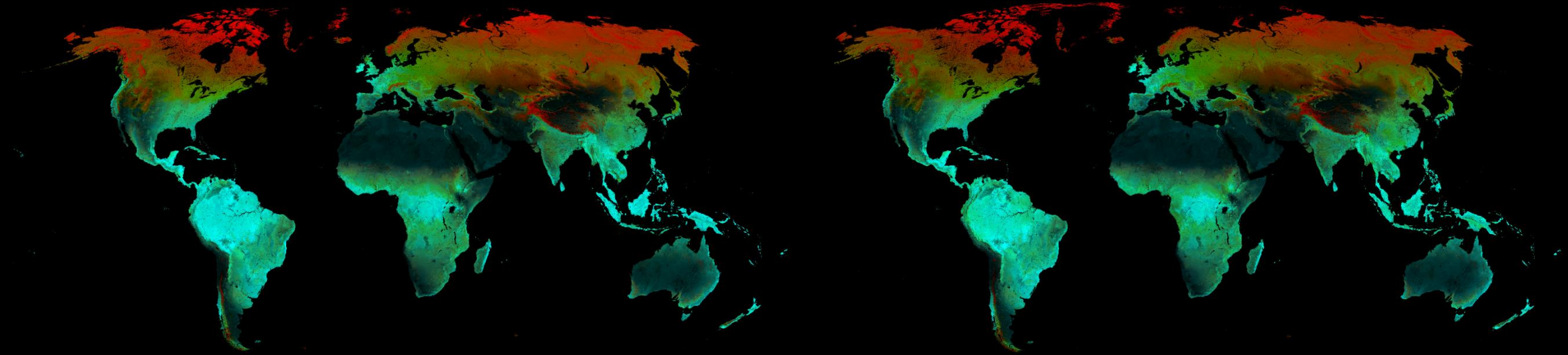
- Part I: DHIs from MODIS collection 5 versus 6
- Part II: DHIs from MODIS C6 versus VIIRS
- Part III: DHIs versus global species richness



Results

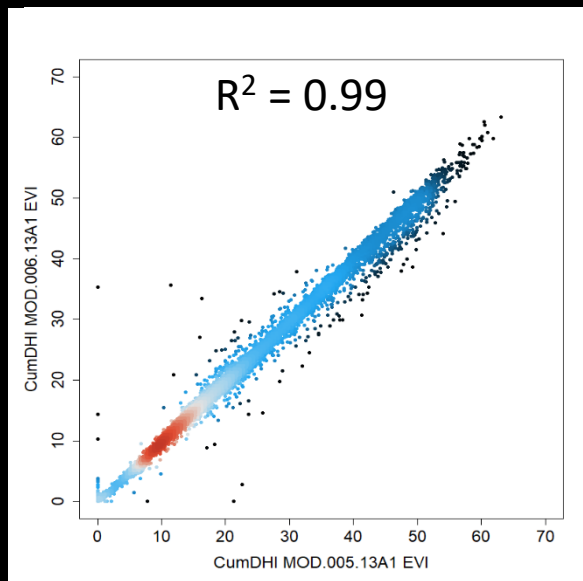
MODIS Collection 5

MODIS Collection 6

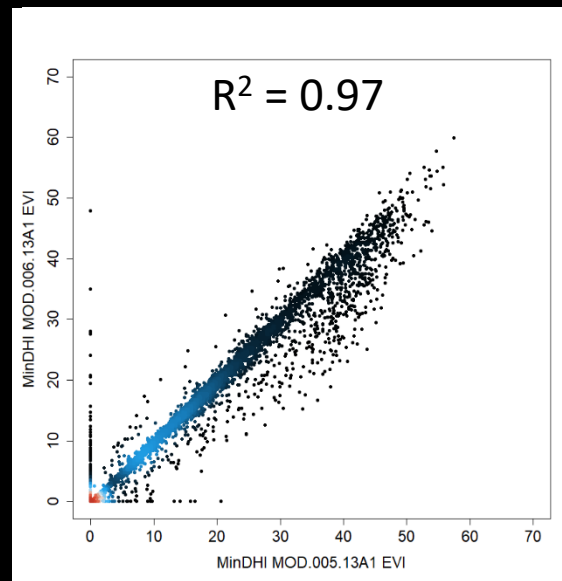


Results

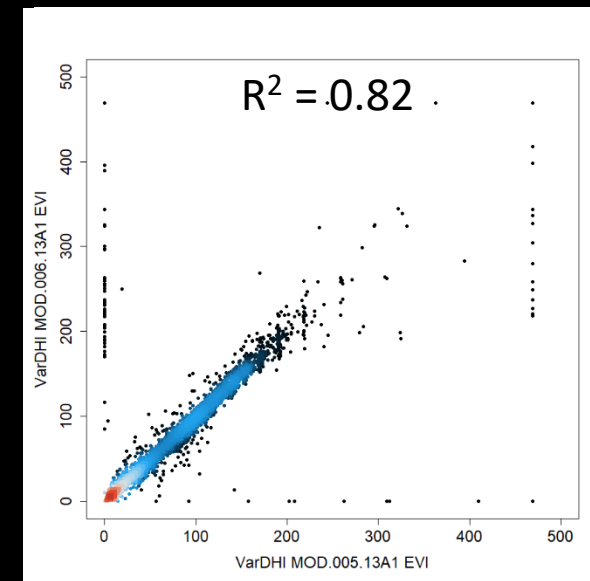
CumDHI



MinDHI

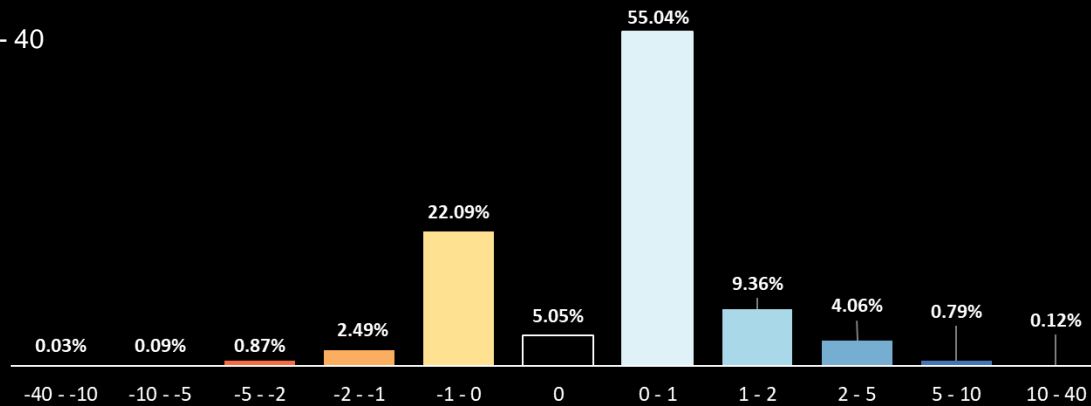
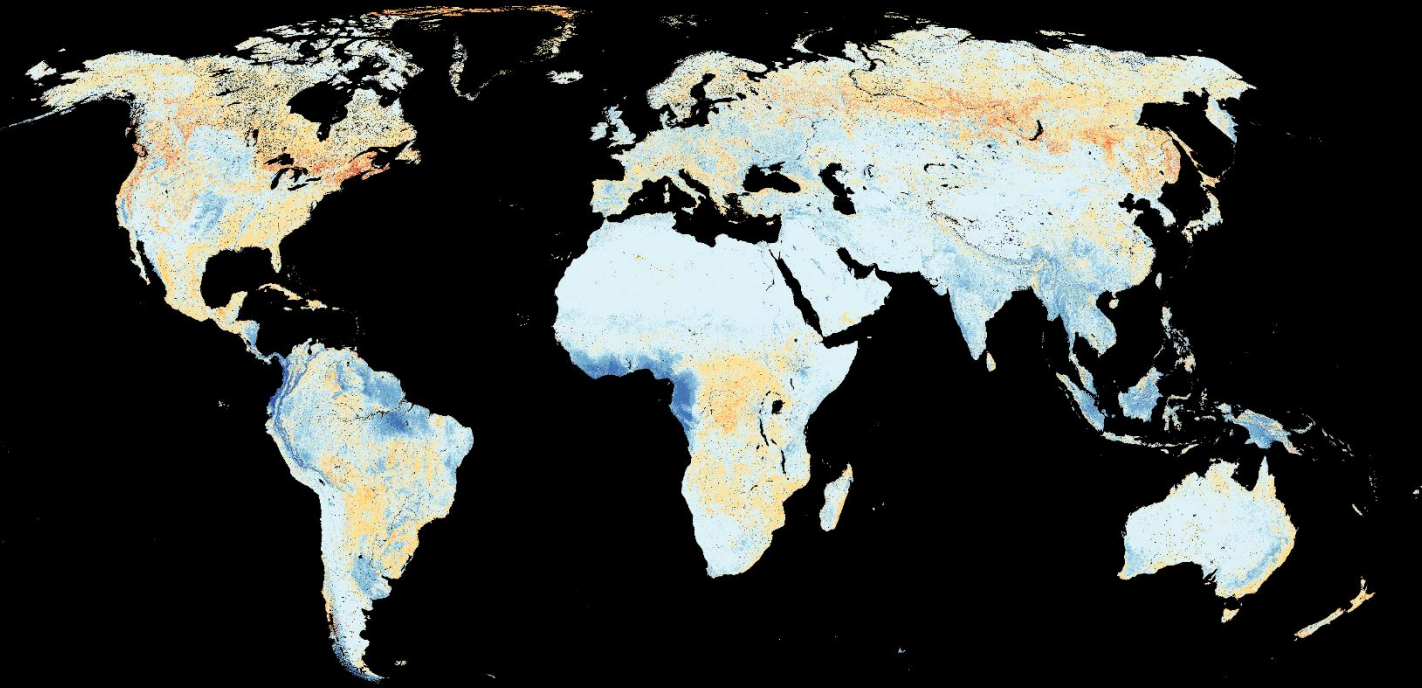


VarDHI



Results

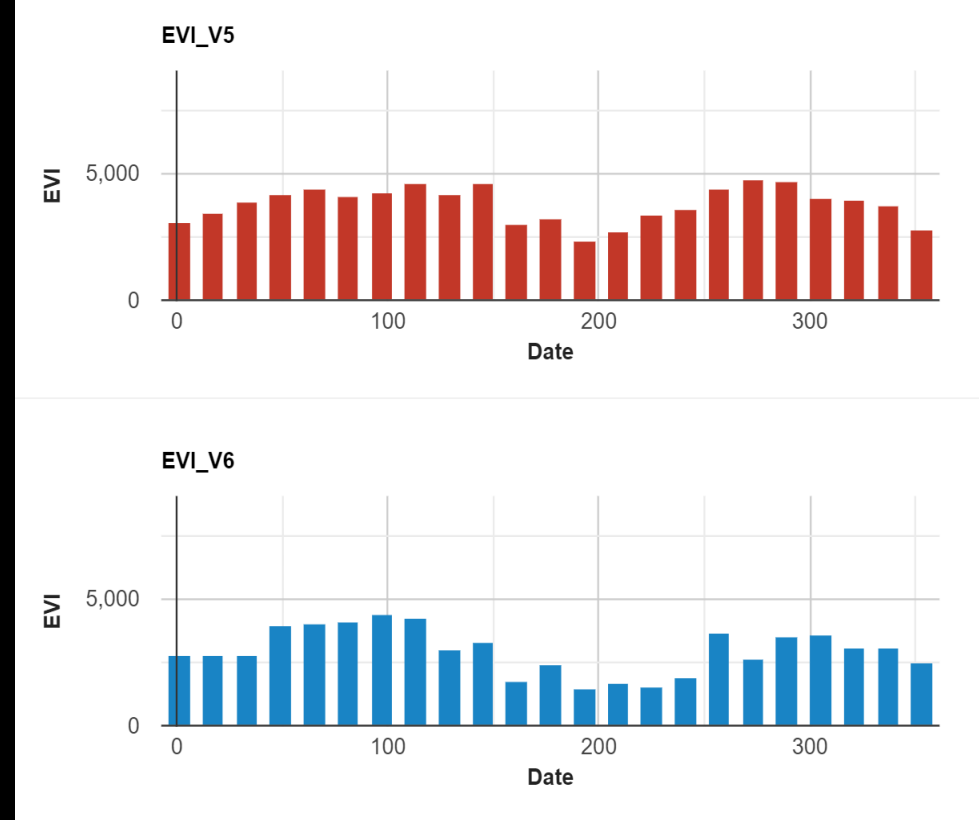
Cum-DHI difference



MOD.005.13A1
minus
MOD.006.13A1
for 2002-2017

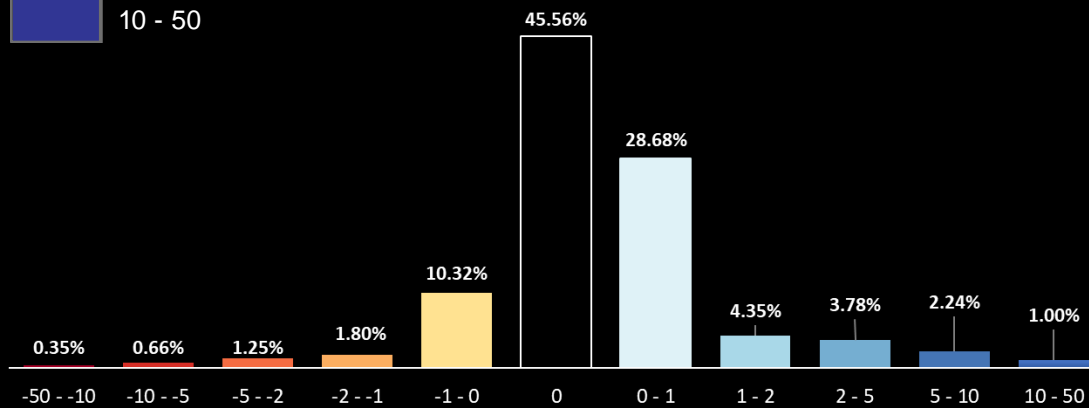
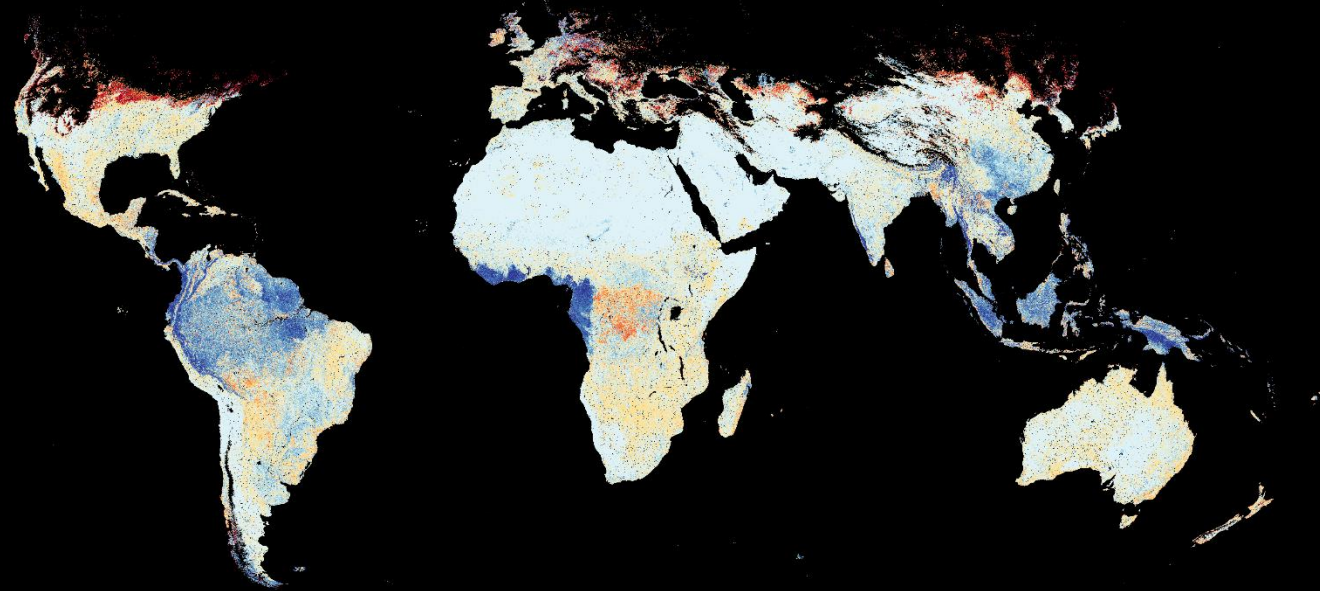
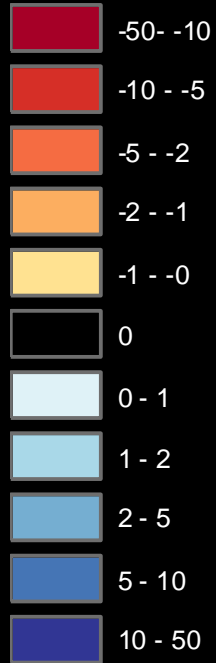


Results



Results

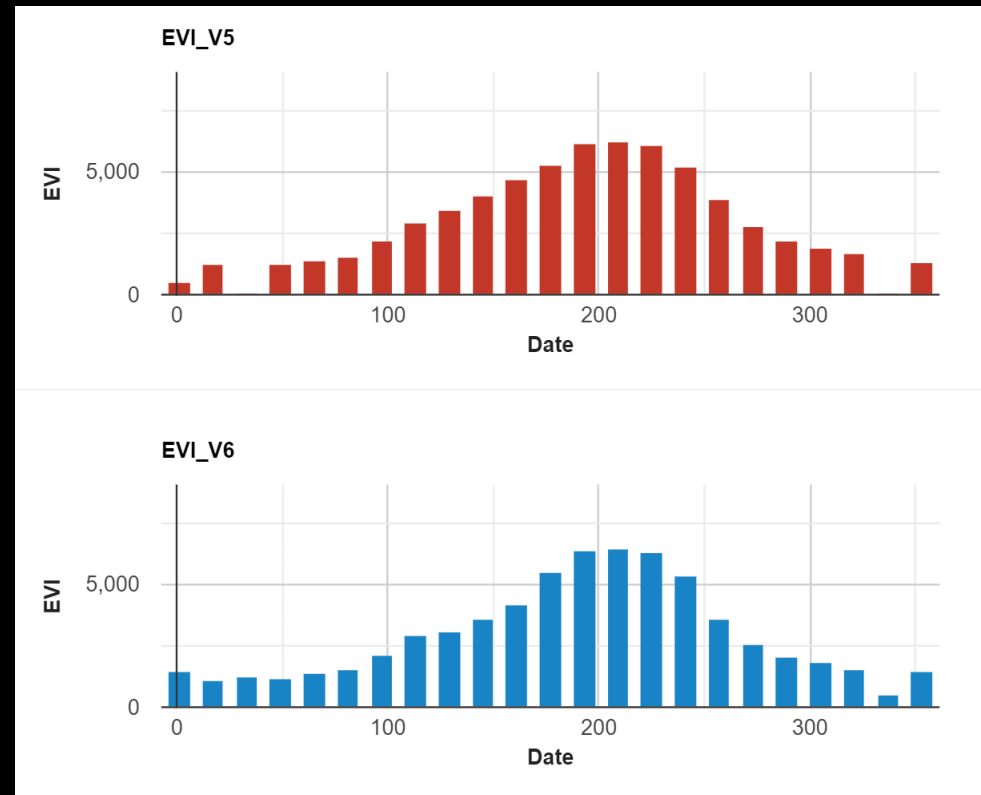
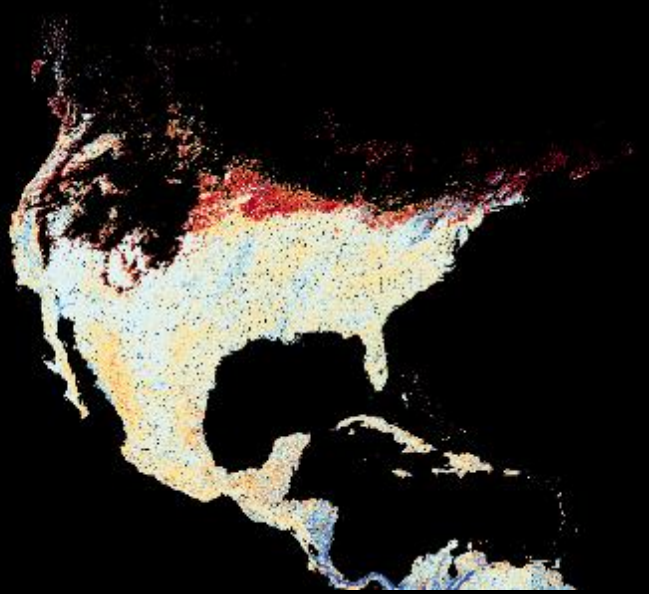
Min-DHI difference



MOD.005.13A1
minus
MOD.006.13A1
for 2002-2017

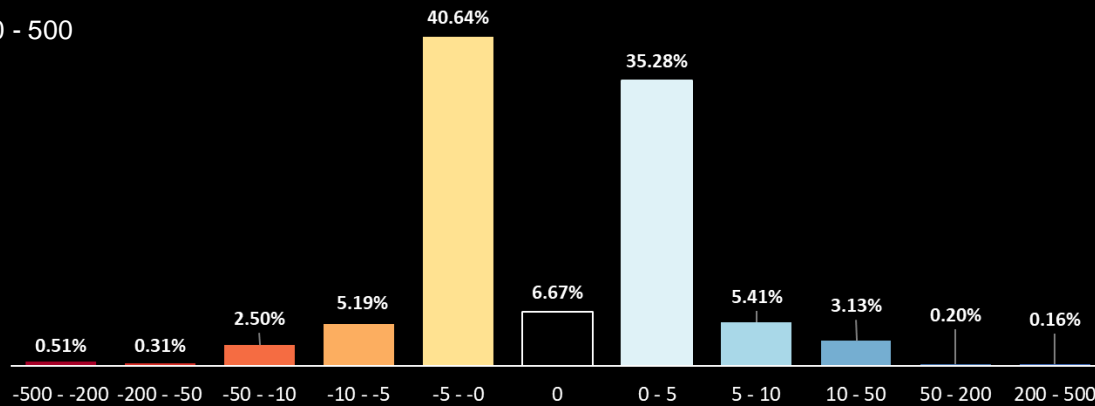
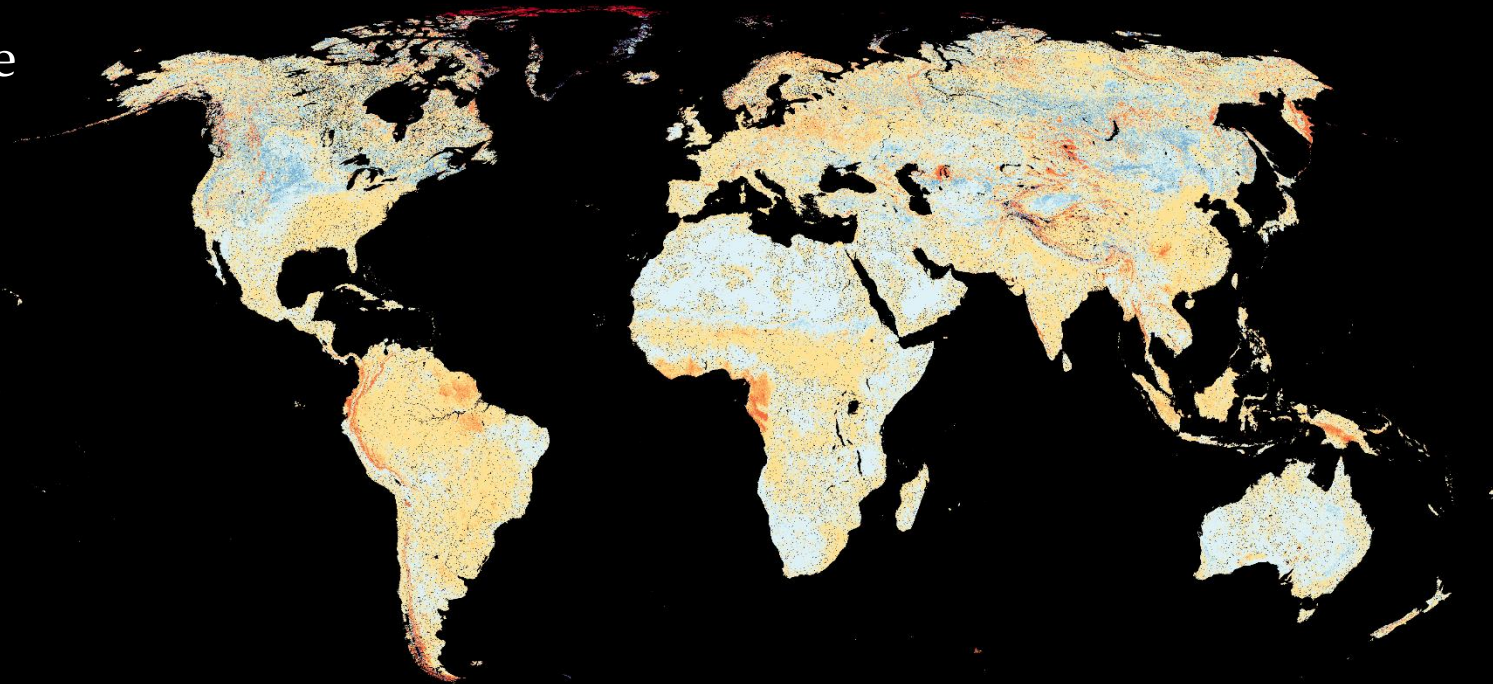


Results



Results

Var-DHI difference



MOD.005.13A1
minus
MOD.006.13A1
for 2002-2017



Outline

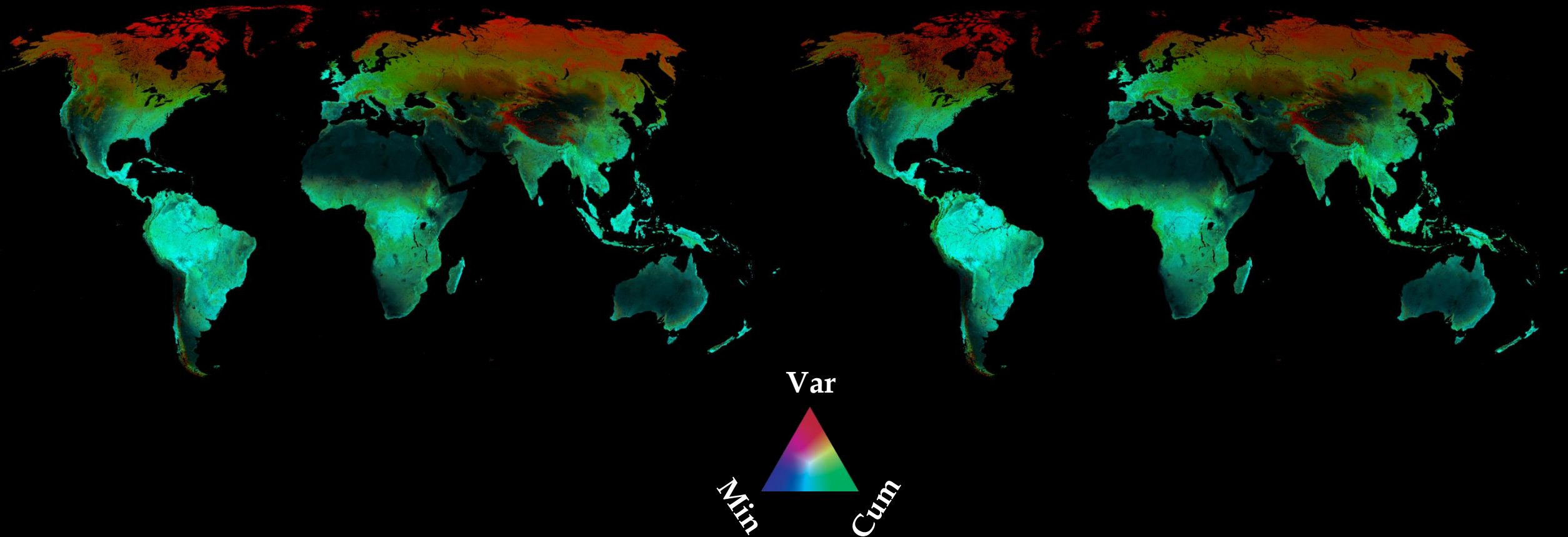
- Part I: DHIs from MODIS collection 5 versus 6
- Part II: DHIs from MODIS C6 versus VIIRS
- Part III: DHIs versus global species richness



Results

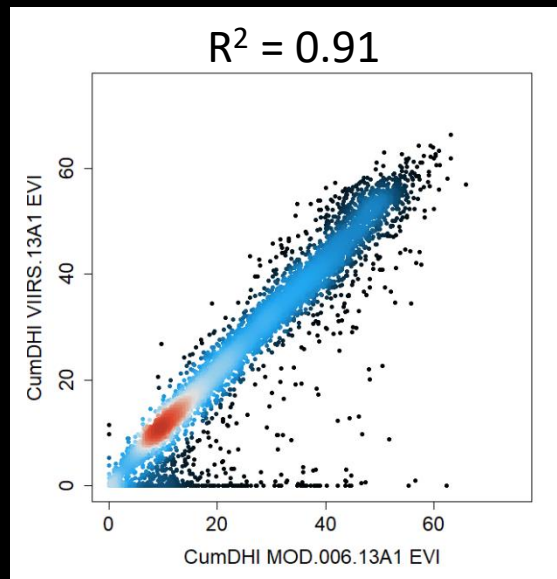
MODIS Collection 6

VIIRS

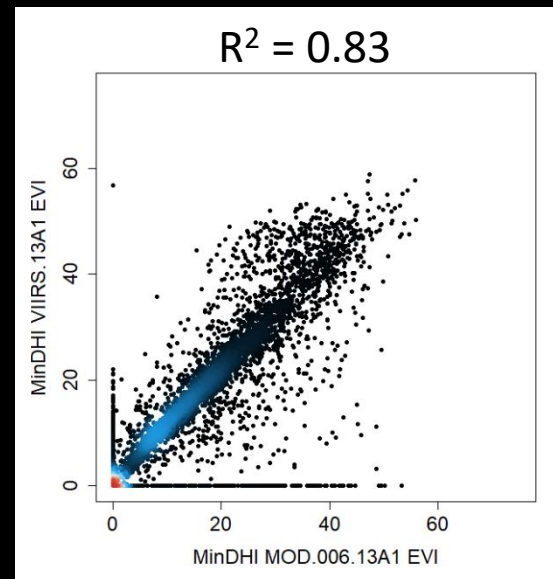


Results

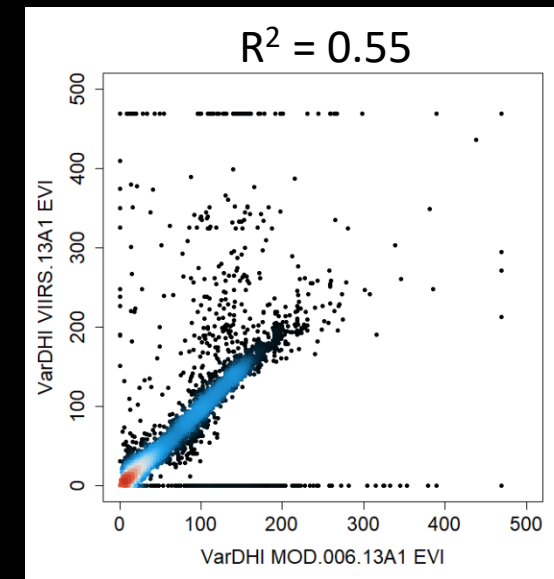
CumDHI



MinDHI

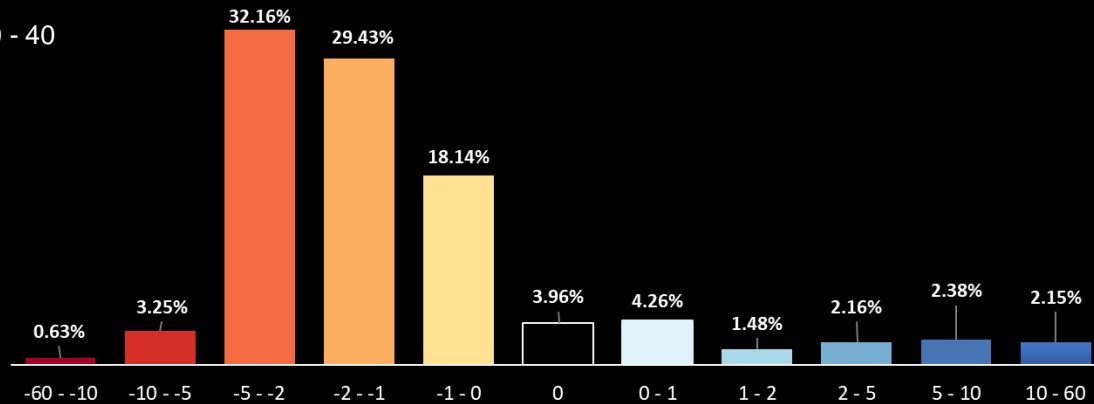
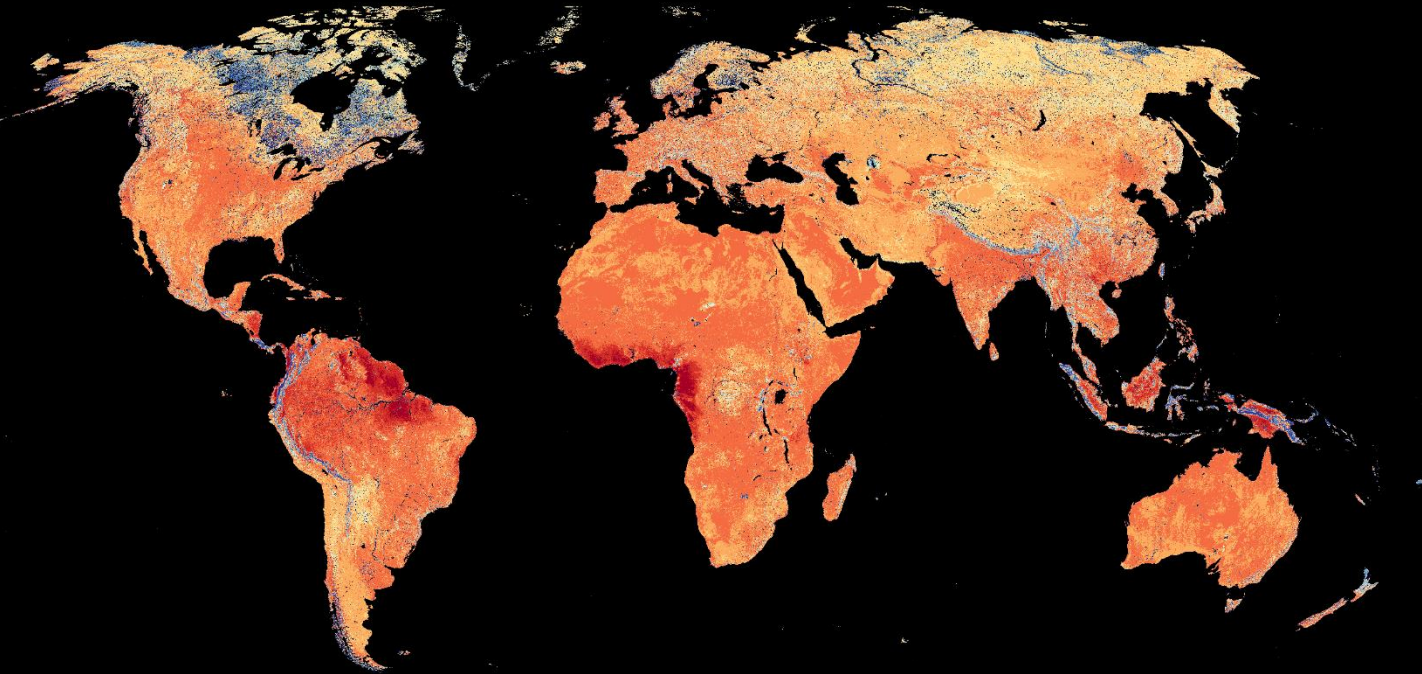
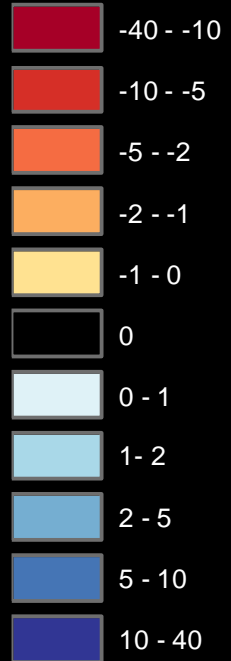


VarDHI



Results

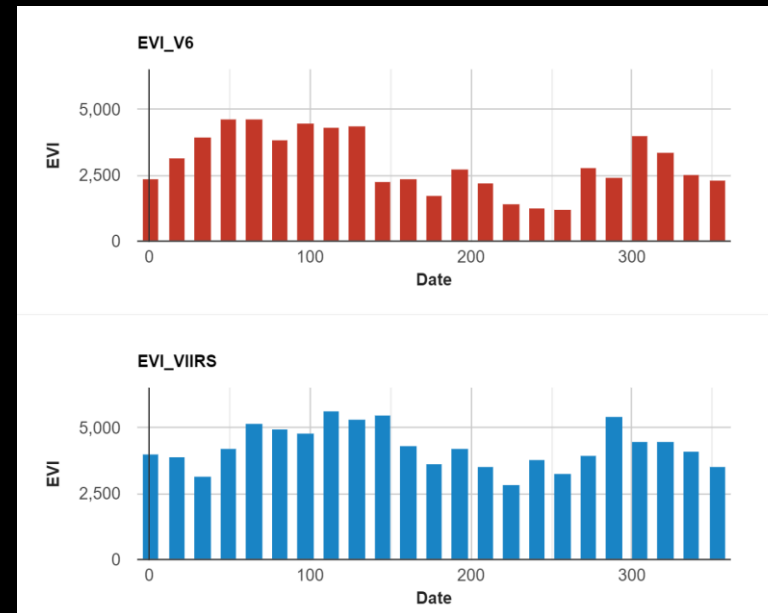
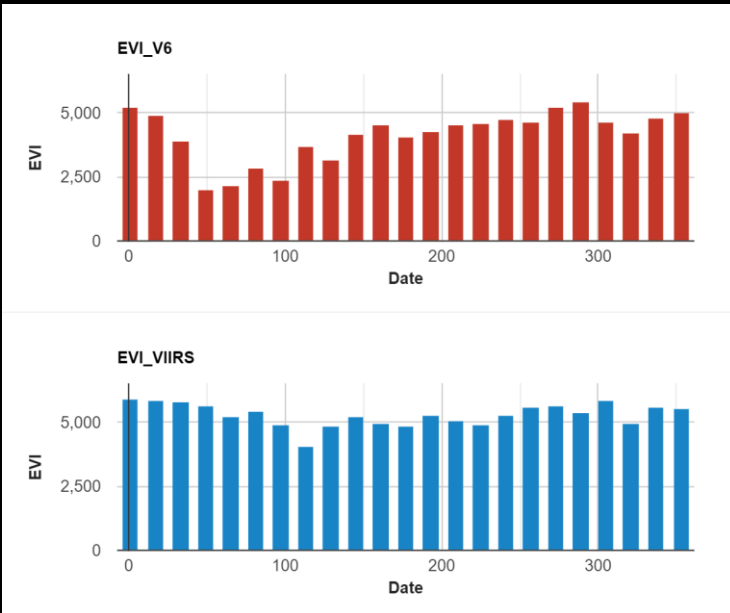
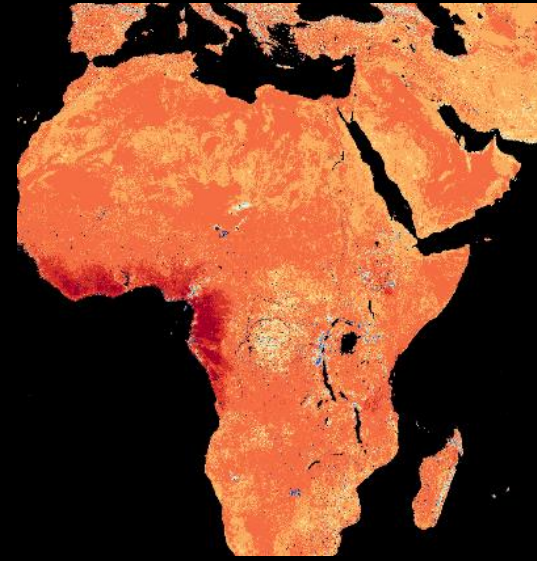
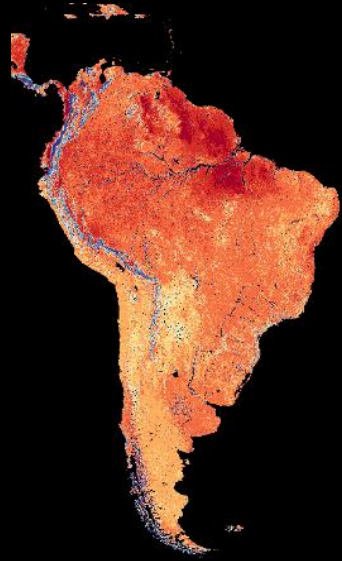
Cum-DHI difference



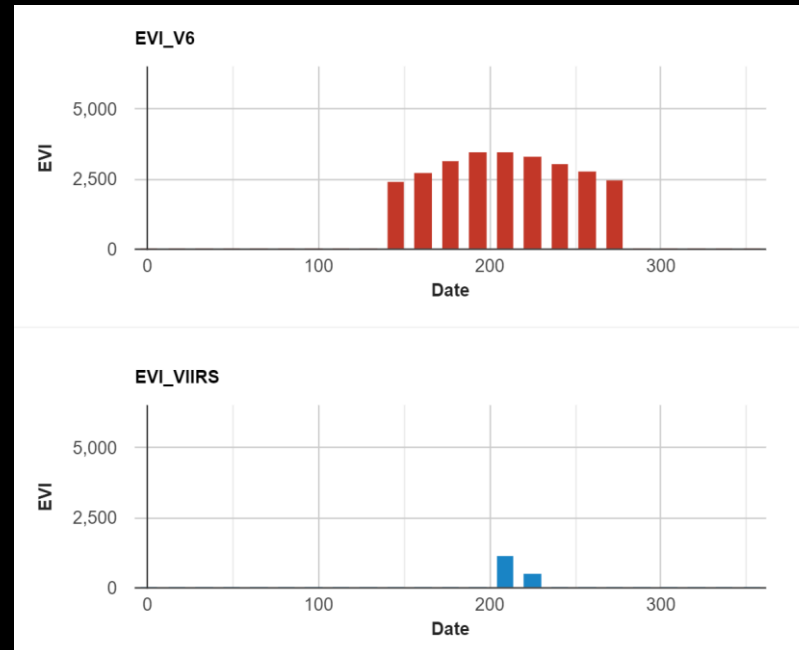
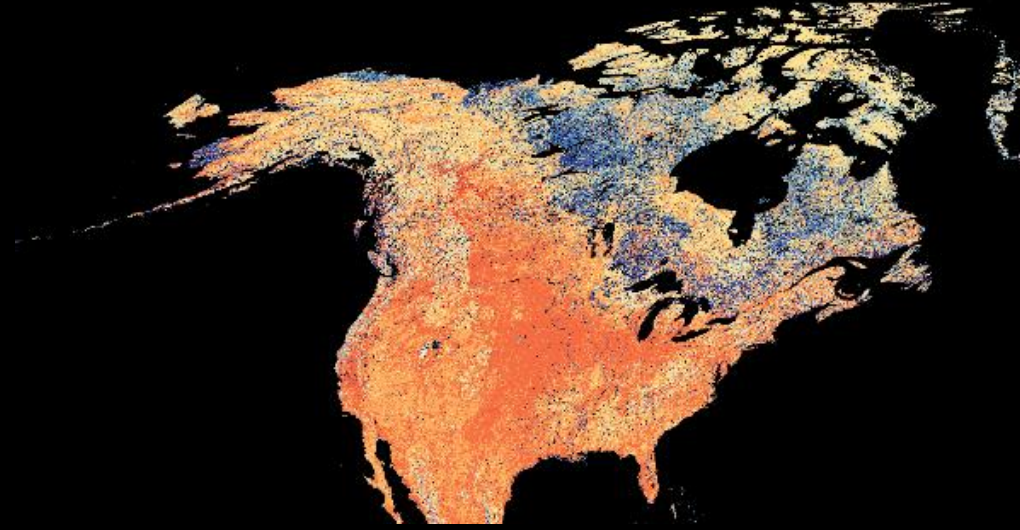
MOD.006.13A1
minus
VIIRS.VNP.13.A1
for 2012-2021



Results

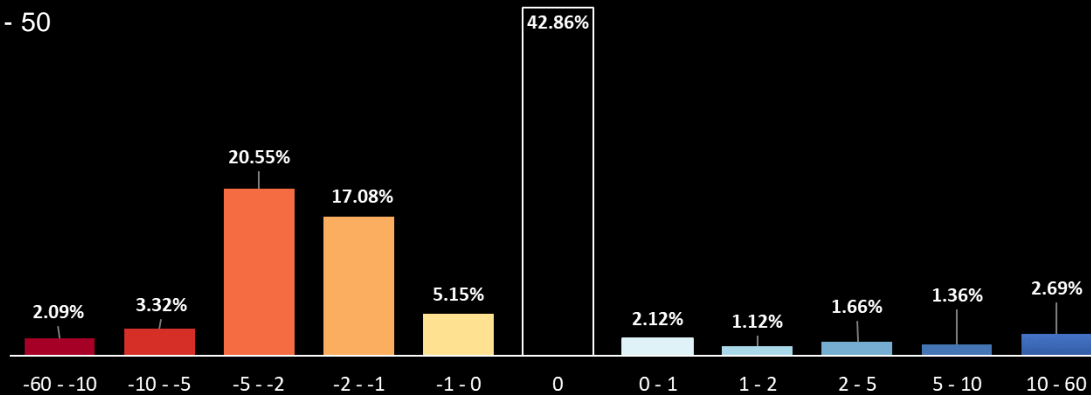
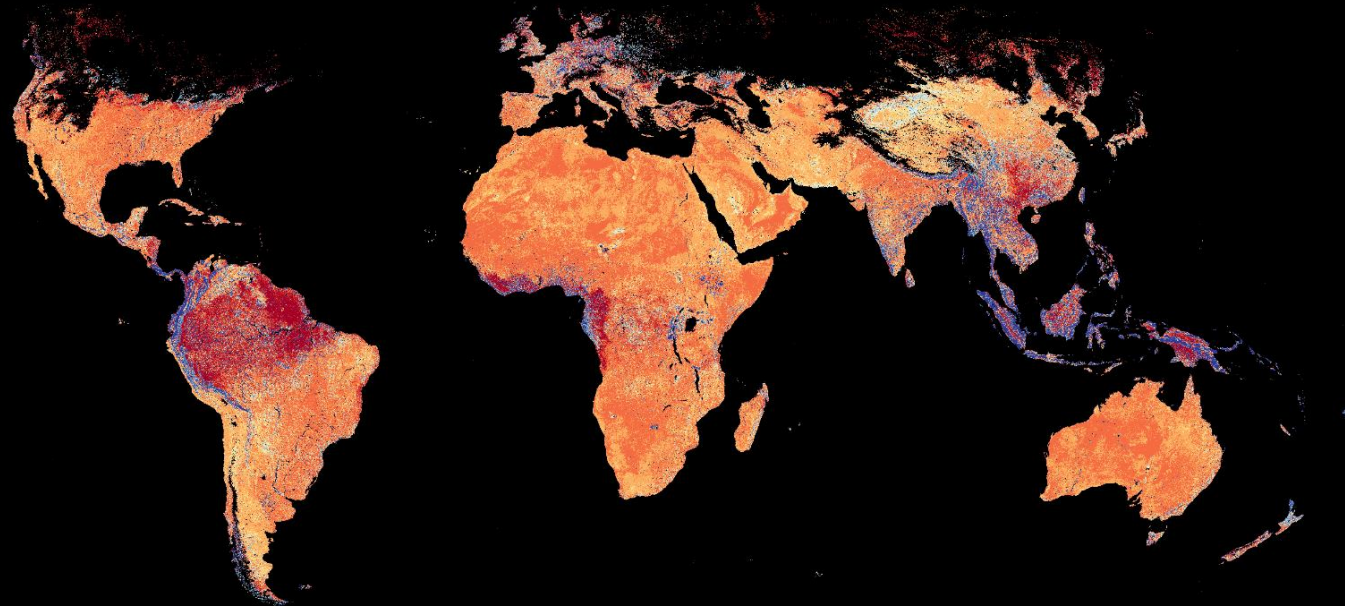


Results



Results

Min-DHI difference

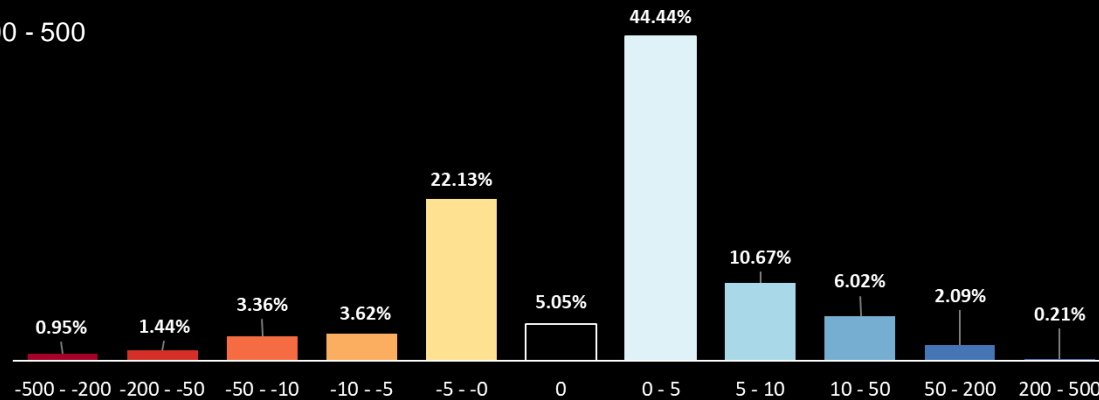
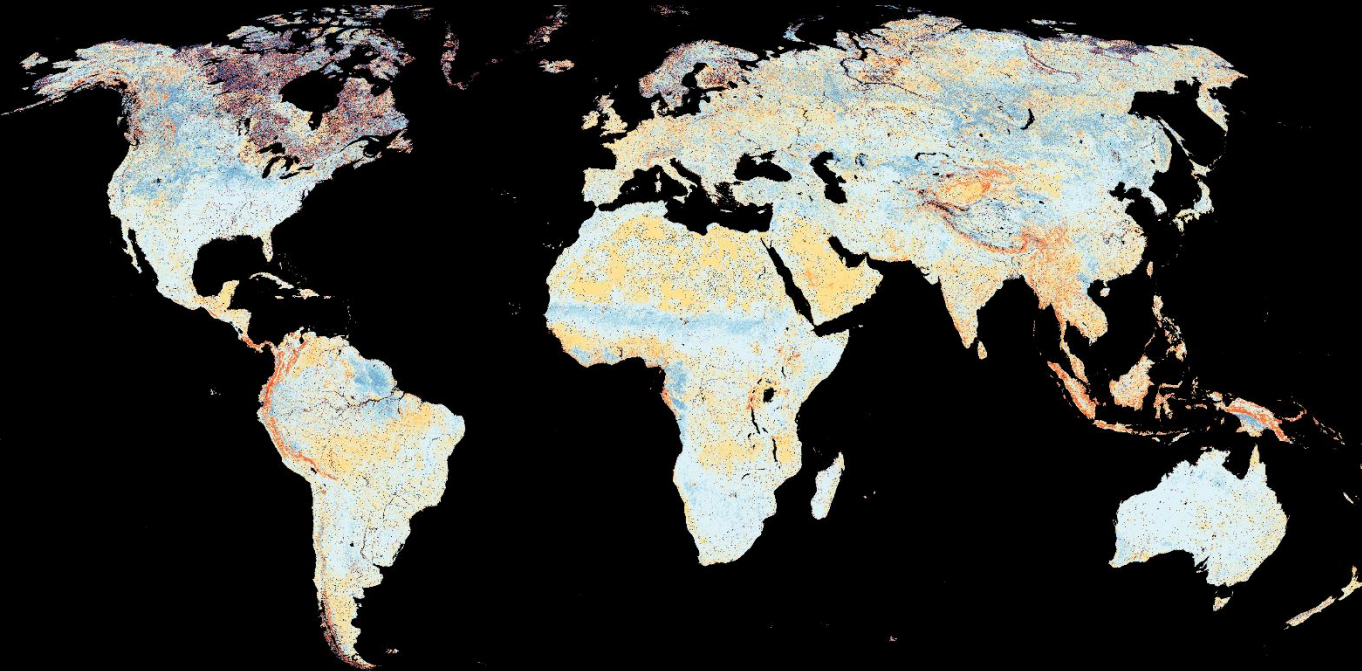
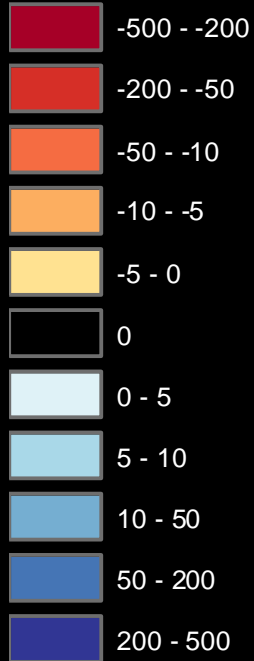


MOD.006.13A1
minus
VIIRS.VNP.13.A1
for 2012-2021



Results

Var-DHI difference



MOD.006.13A1
minus
VIIRS.VNP.13.A1
for 2012-2021



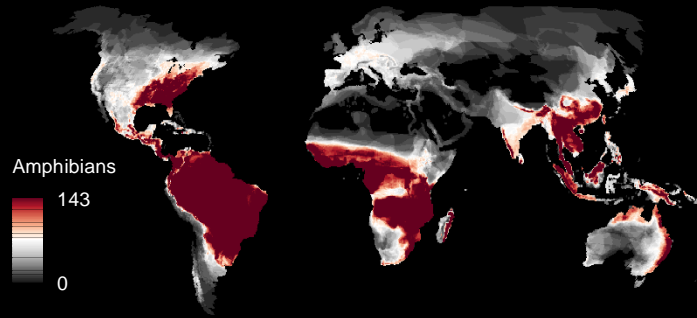
Outline

- Part I: DHIs from MODIS collection 5 versus 6
- Part II: DHIs from MODIS C6 versus VIIRS
- Part III: DHIs versus global species richness

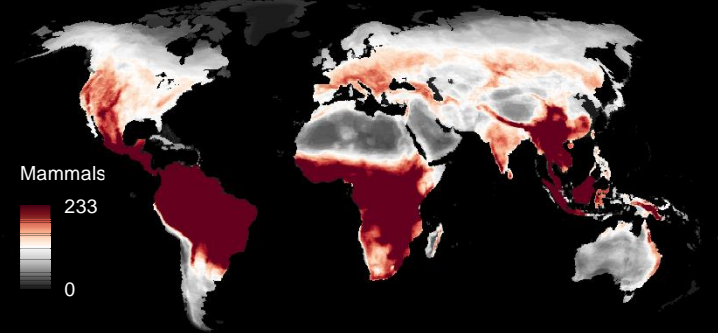


Results

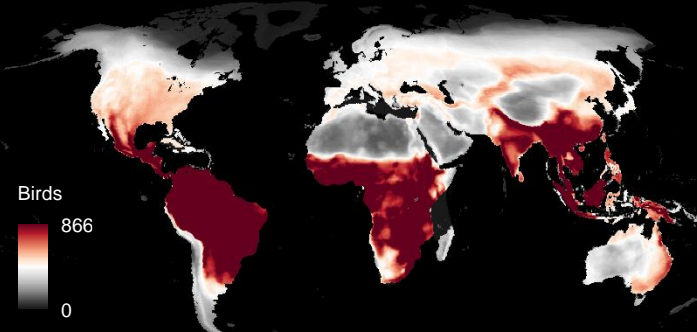
Amphibians



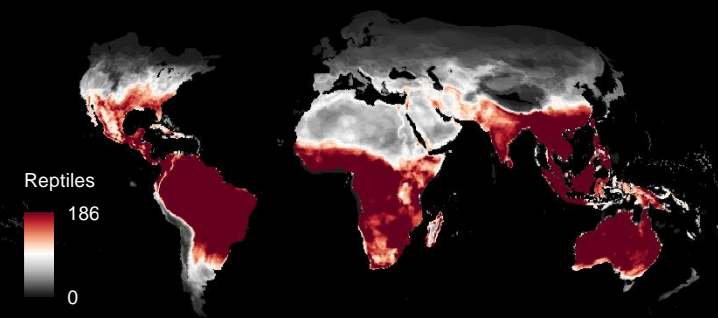
Mammals



Birds

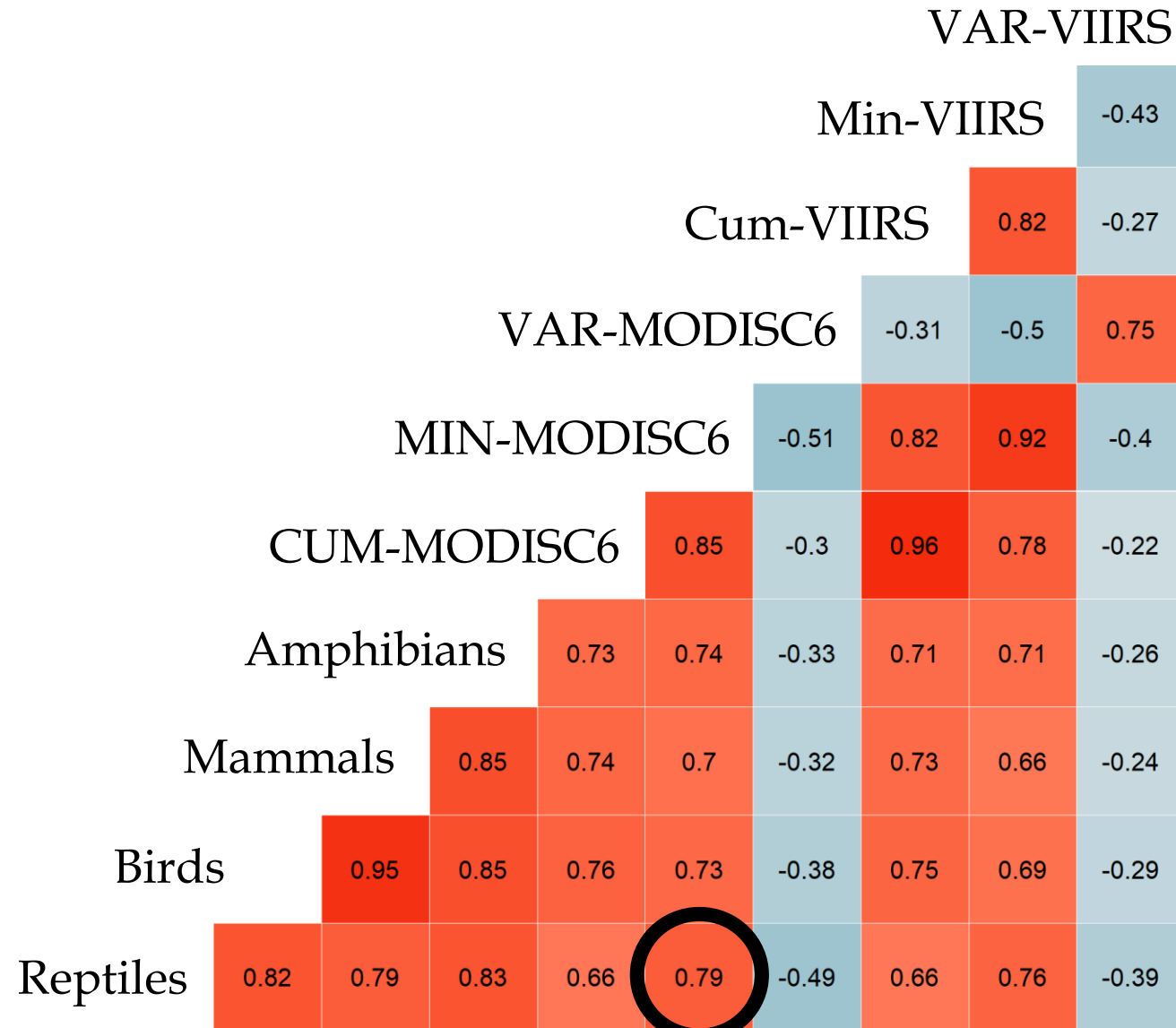


Reptiles

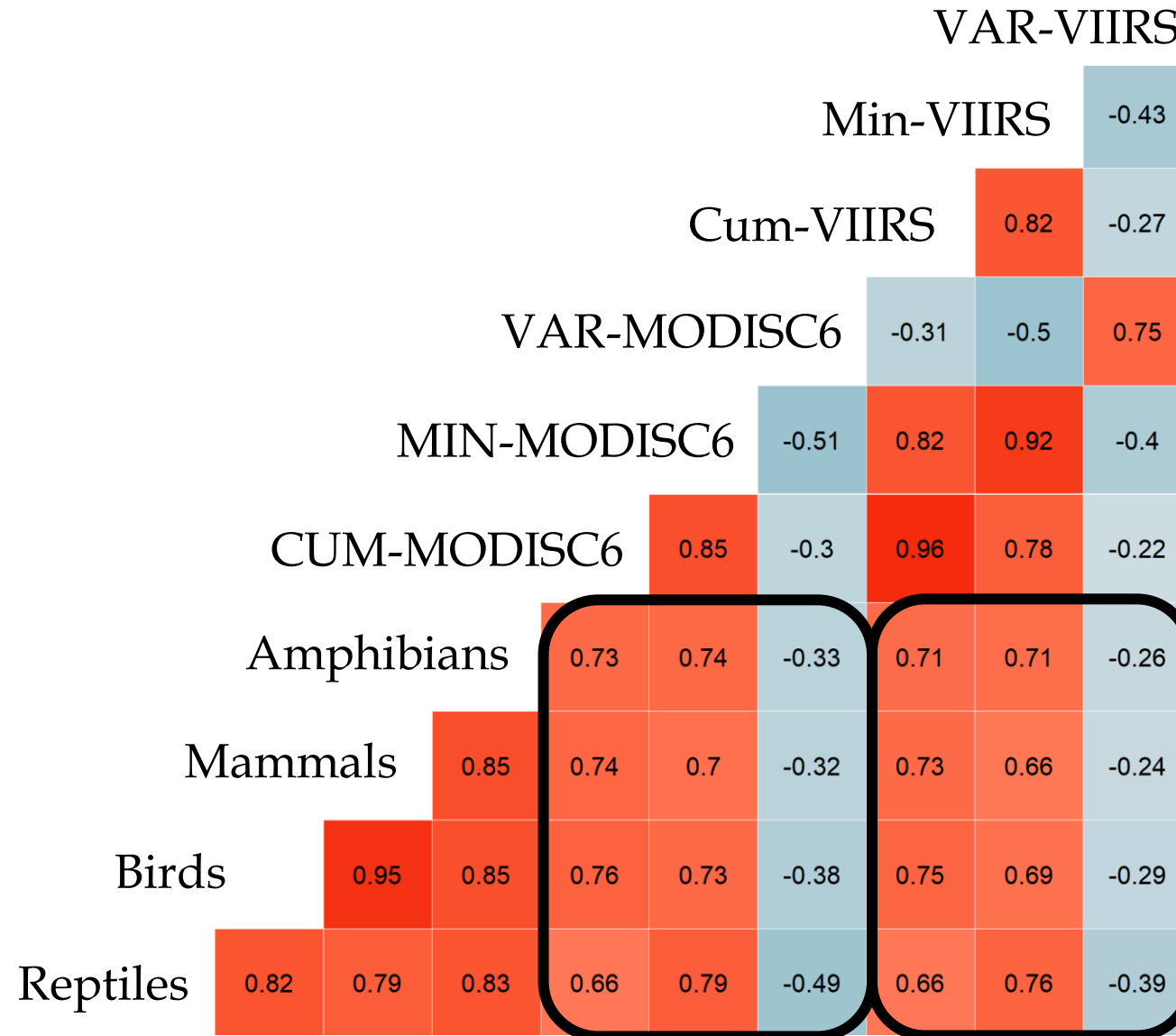


Cox, Young, Bowles, *et al.*
Nature (2022)

Results



Results



Conclusions

- Part I: DHIs from MODIS collection 5 versus 6
 - Major differences in some regions!
 - Recommendation: use MODIS collection 6 DHIs
 - Composite DHIs ready for:
 - MODIS 250, 500, 1000-m NDVI and EVI
 - MODIS 500-m LAI, FPAR, and GPP
 - We are happy to share!



Conclusions

- Part II: DHIs from MODIS C6 versus VIIRS
 - Major differences in large parts of the globe
 - Recommendation: use MODIS DHIs for now
 - Composite DHIs ready for:
 - VIIRS 500-m NDVI, EVI



Conclusions

- Part III: DHIs versus global species richness
 - The DHIs predict global richness of all four tetrapod taxa well



Conclusions

- Part III: DHIs versus global species richness
 - The DHIs predict global richness of all four tetrapod taxa well

Hobi, 2017, *Remote Sensing of Environment*

Radeloff, 2019, *Remote Sensing of Environment*

Hobi, 2021, *Ecological Indicators*

Rapacciuolo, 2017, *Global Ecology and Biogeography*

Coops, 2018, *Scientific Reports*

Marin, 2018, *Proceedings of the Royal Society B*

Coops, 2019, *Ecological Indicators*

Rapacciuolo, 2019, *Nature Ecology and Evolution*

Suttidate, 2019, *Remote Sensing of Environment*

Razenkova, 2020, *Scientific Reports*

Silveira, 2021, *Remote Sensing of Environment*

Silveira, 2022, *Ecological Applications*

Suttidate, 2021, *Global Ecology and Conservation*

Carroll, 2022, *Ecological Applications*



Conclusions

Richness

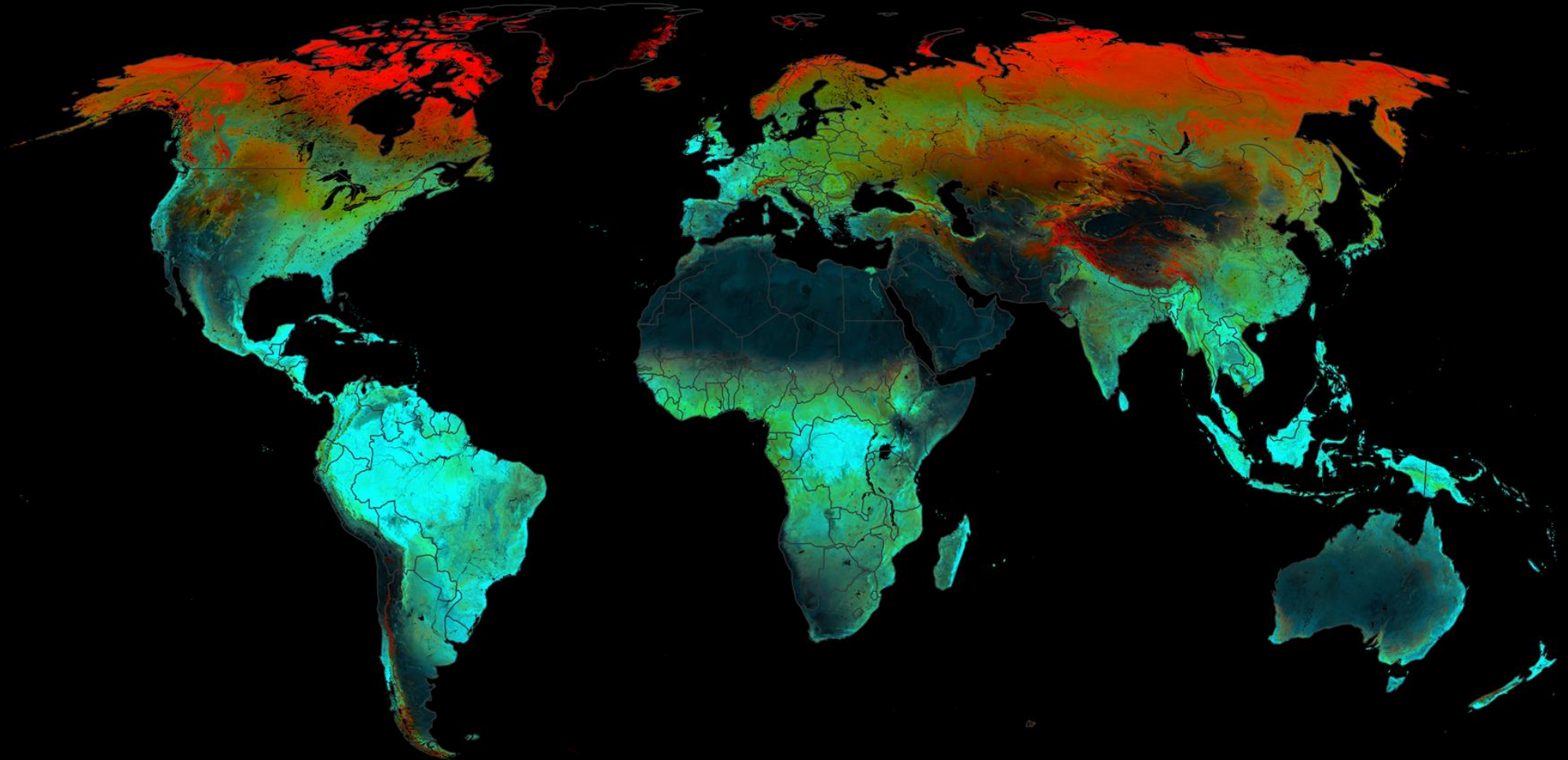
- Mammal richness / Xinjiang
- Bird diversity / France
- Raptor richness / Americas
- ...

Species distribution models

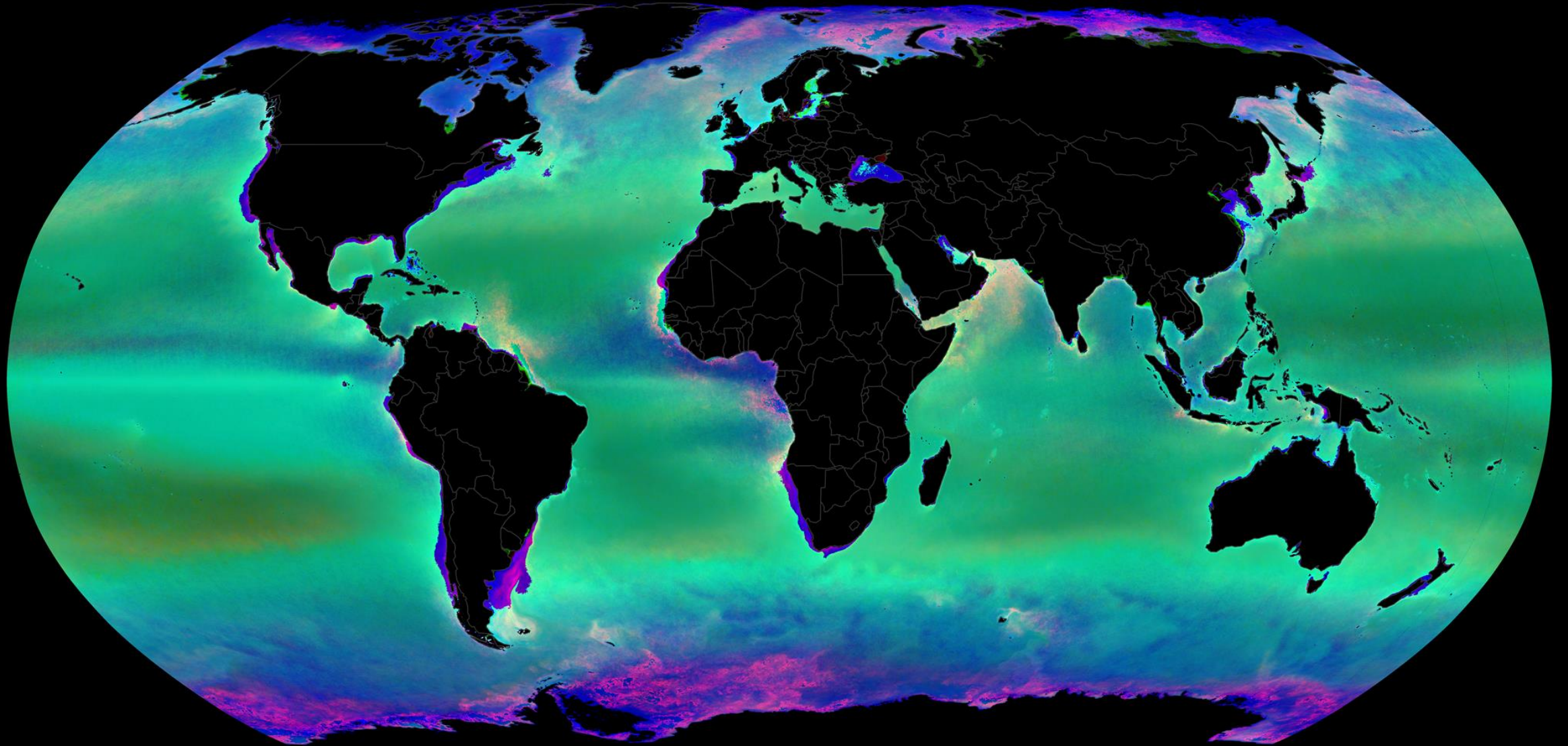
- Brown Bears / Cantabria
- Andean Condor / Argentina
- Grey Foxes / US
- Philippine Eagle / Philippines
- Purple-winged Ground Dove / Brazil
- Mountain Tapir / Peru
- Madagascar Serpent Eagle / Madagascar
- ...



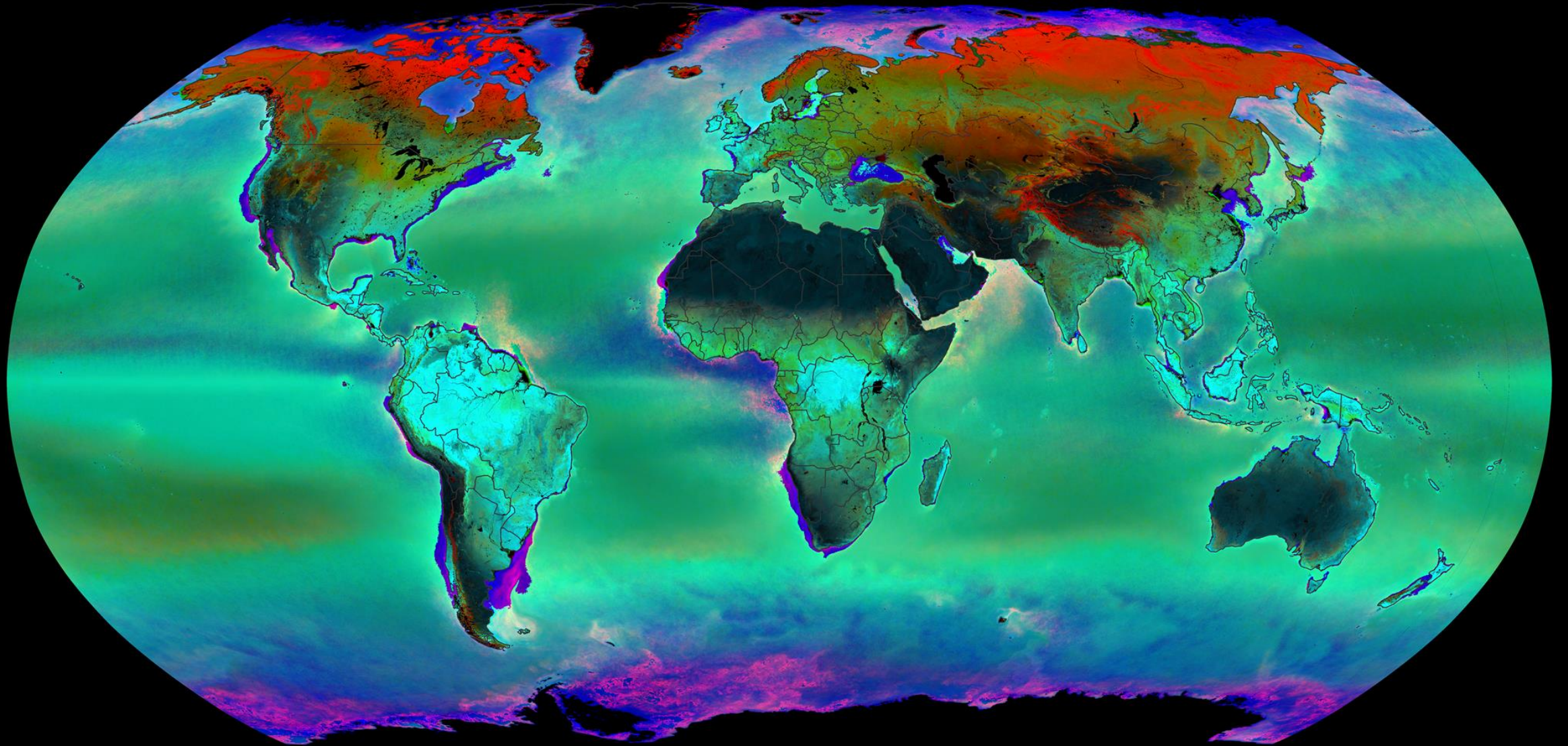
Conclusions



Conclusions



Conclusions



Conclusions

- The biodiversity community has relied on satellite products designed for non-biodiversity purposes
- There is a need for products that are designed for biodiversity science and conservation
- The DHIs are such a product



THANK YOU!!!

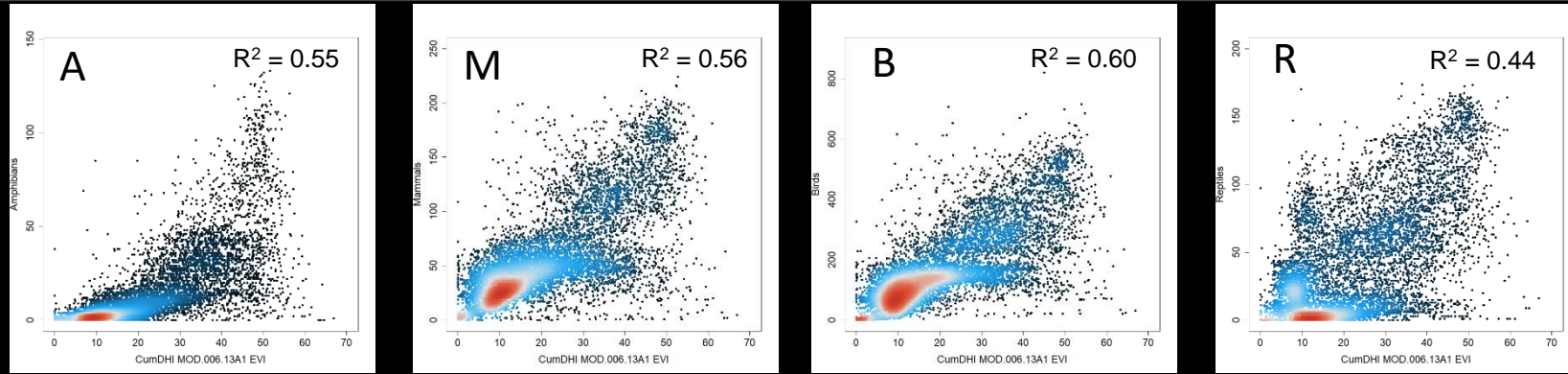


radeloff@wisc.edu
<http://silvis.forest.wisc.edu>

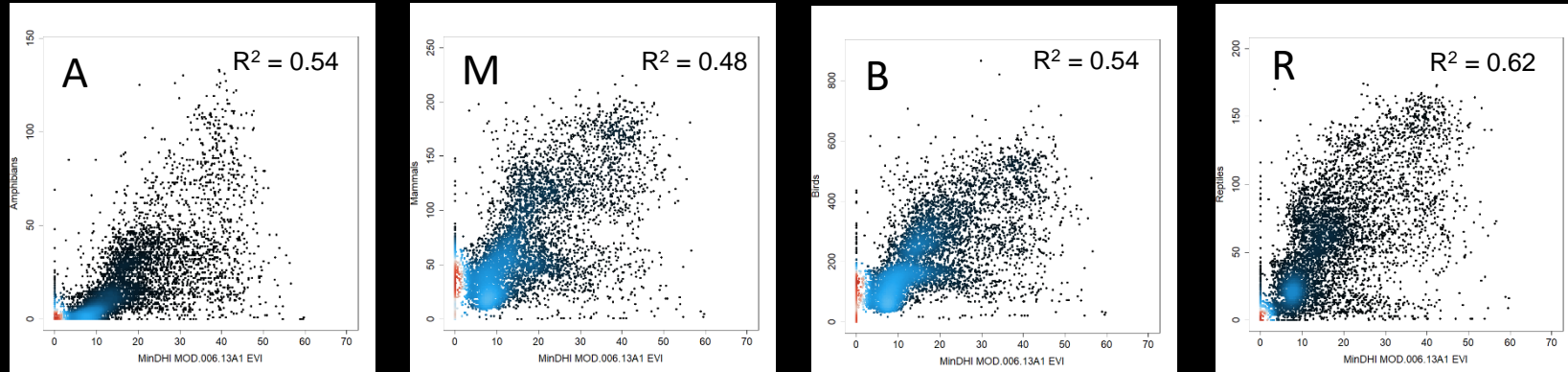


MOD006. 13A1.EVI DHIs versus Richness (2002-2021)

CumDHI



MinDHI



VarDHI

