COBECORE

Congo basin eco-climatological data recovery and valorisation

UNIVERSITEIT GENT

Africa TERVUREN

Botanic Garden Meise

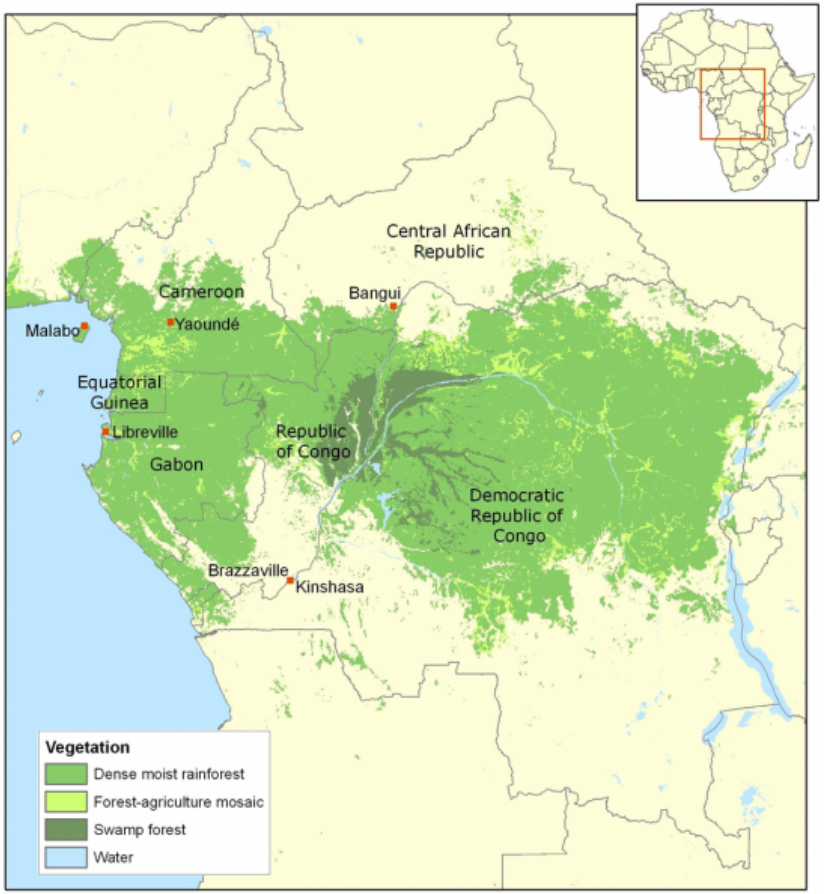
Rijksarchief Archives de l'État

Belgian Science Policy Office

belspo

African Rainforest

- ~630 million ha
- stores ~ 66 Pg C
- ecosystem services
  - 6% GDP for forestry
  - still a carbon sink



Tropical forests are global epicentres of biodiversity and important modulators of climate change[1], and are mainly constrained by rainfall patterns[1–3]. The severe short-term droughts that occurred recently in Amazonia have drawn attention to the vulnerability of tropical forests to climatic disturbances[4–9]. The central African rainforests, the second-largest on Earth, have experienced a long-term drying trend[10,11]

How will the Congo Basin Forest respond
... to a warmer / drier world ?
- physiologically
- species composition
- carbon balance perspective

... increased anthropogenic pressure ?
- fragmentation
- biodiversity loss

LETTER

doi:10.1038/nature13265

Widespread decline of Congo rainforest greenness in the past decade

Liming Zhou[1], Yuhong Tian[2], Ranga B. Myneni[3], Philippe Ciais[4], Sassan Saatchi[5], Yi Y. Liu[6], Shilong Piao[7], Haishan Chen[8], Eric F. Vermote[9], Conghe Song[10,11] & Taehee Hwang[12]

Congo Basin

- eco-climatologically currently under-represented
- faced with little (raw) legacy data

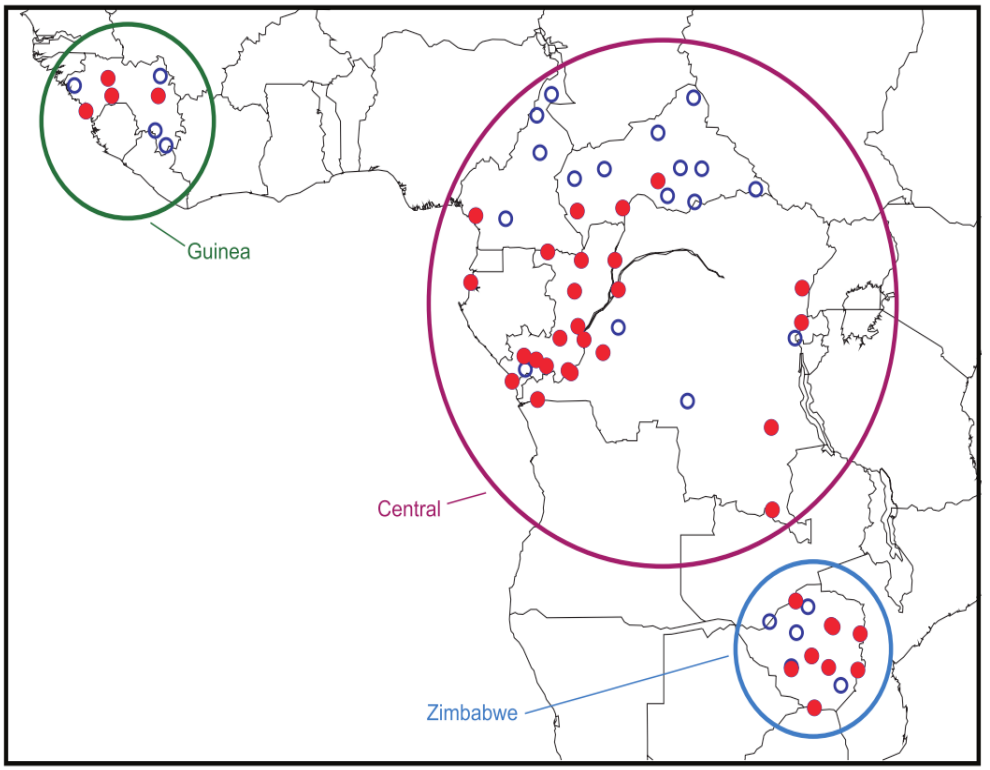


Figure 1. Location of the stations brought to the Brazzaville workshop. Stations with inadequate fidelity or length of period of record for use in this analysis are shown as open blue circles. Stations shown by solid red circles were used to produce three regional analyses: (1) Guinea includes stations from Guinea Conakry, (2) Central covers western central Africa and includes stations from Cameroon, Central African Republic, Democratic Republic of Congo, Gabon and Republic of Congo, and (3) Zimbabwe.

- Ongoing (contemporary) research is important
  - following talk will touch upon this
- Yet, often dependent on historical data !

Global Change Biology

Global Change Biology (2012) **18**, 675–684, doi: 10.1111/j.1365-2486.2011.02561.x

Increased tree densities in South African savannas: >50 years of data suggests CO_2 as a driver

R. BUITENWERF*, W. J. BOND*, N. STEVENS†‡ and W. S. W. TROLLOPE§

- long term data provides insight, which
  - ... can not be provided with contemporary measurements alone
  - ... or easily approximated through manipulation experiments

Changes in temperature and precipitation extremes in western central Africa, Guinea Conakry, and Zimbabwe, 1955–2006

E. Aguilar,[1] A. Aziz Barry,[2] M. Brunet,[1,3] L. Ekang,[4] A. Fernandes,[5] M. Massoukina,[6] J. Mbah,[7] A. Mhanda,[8] D. J. do Nascimento,[9] T. C. Peterson,[10] O. Thamba Umba,[11] M. Tomou,[12] and X. Zhang[13]

Received 21 August 2008; revised 17 October 2008; accepted 18 November 2008; published 29 January 2009.

- a concise picture of Congo Basin climatology requires *in situ* data
- currently missing

Tropical forest warming: looking backwards for more insights

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[3] Max-Planck-Institute for Chemistry, Biogeochemistry Department, P.O. Box 3060, 55020 Mainz, Germany
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- dendrochronology is highly dependent on climatological data to link wood to eco-physiological processes
- by definition requires historical data which quickly span multiple decades

Trends in Ecology & Evolution

CellPress

Review

Old Plants, New Tricks: Phenological Research Using Herbarium Specimens

Charles G. Willis,[1,*] Elizabeth R. Ellwood,[2,*] Richard B. Primack,[3] Charles C. Davis,[1] Katelin D. Pearson,[2] Amanda S. Gallinat,[3] Jenn M. Yost,[4] Gil Nelson,[2] Susan J. Mazer,[5] Natalie L. Rossington,[5] Tim H. Sparks,[6,7] and Pamela S. Soltis[8]

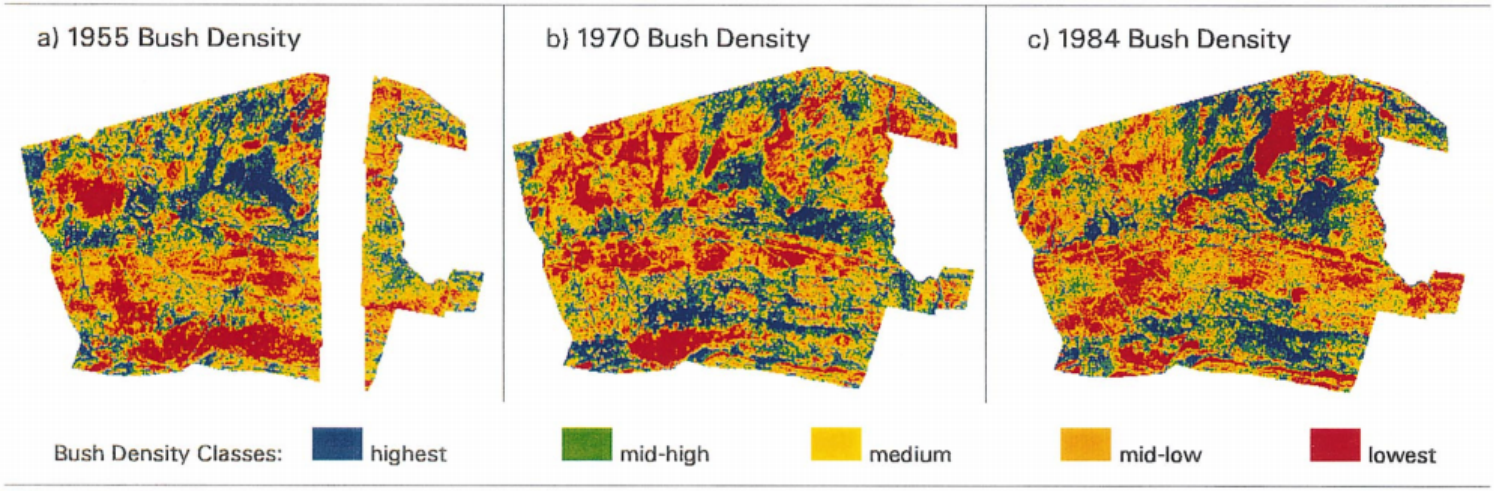
ELSEVIER

Remote Sensing of Environment

Volume 66, Issue 3, December 1998, Pages 317-330

Textural Analysis of Historical Aerial Photography to Characterize Woody Plant Encroachment in South African Savanna

Andrew T Hudak*, Carol A Wessman*



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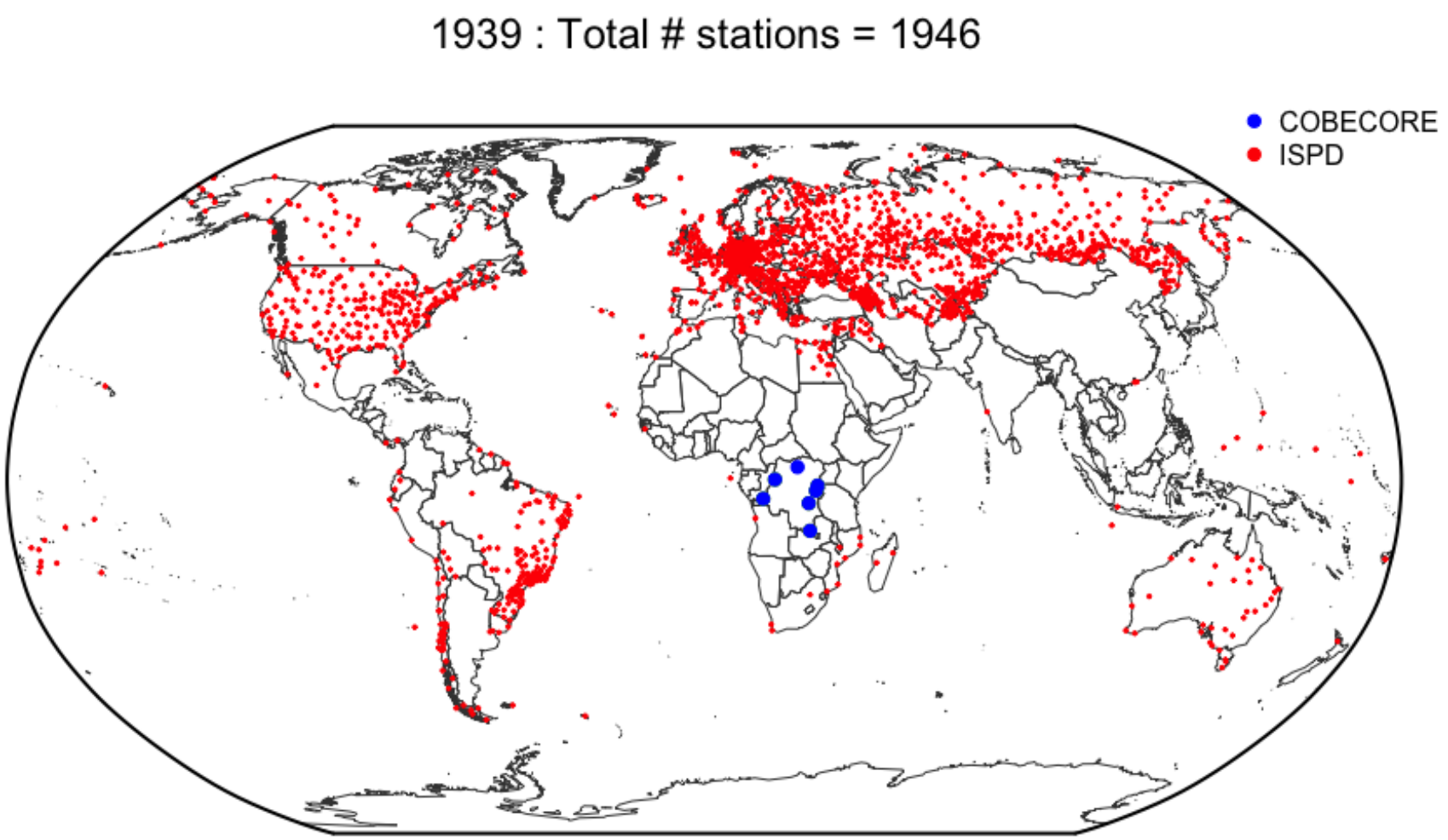
Congo basin eco-climatological data recovery and valorisation



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- research looks back in time for context
  - to support other measurements
  - in model driven re-analysis
  - and analysis in its own right (contrasting before / after)
- Accessible legacy data is lacking for most of the Congo Basin !

- COBECORE will provide
  - long term data + context
  - by making historical analog data digitally accessible
  - and extracting data from collections

Data to recovered or acquired:

- climatology across the Congo Basin (19xx ~ 1960).
- cloud free aerial photography (1958) covering the current Yangambi MaB reserve
- leaf traits from (historical) herbarium specimen collected during the same era.
- a final comprehensive database

[for the full proposal: http://cobecore.org/proposal/]

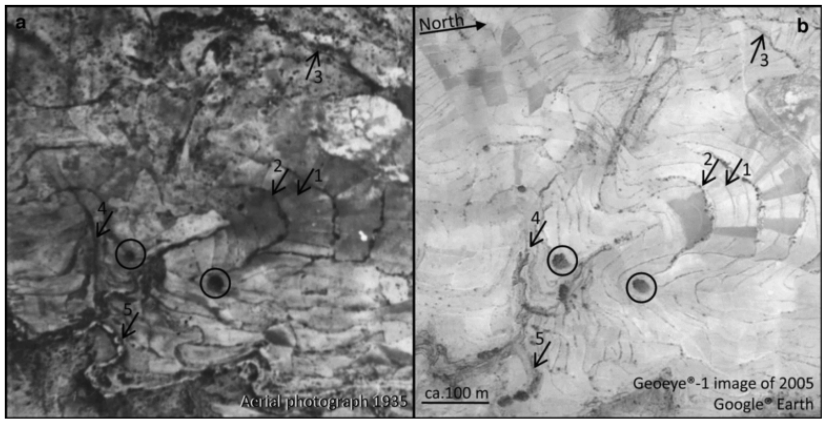

Fig. 8. Comparison of (a) an aerial photograph (©EMA) covering an area near Nebelet (Tigray, Ethiopia), that was acquired in 1935, and (b) the corresponding GeoEye-1 satellite image acquired in 2005 [32].

- relies on:
  - a network of partners and expertise
  - on (international) collaborations for valorization and dissemination
- supports interdisciplinary research
  - e.g., on the interface between engineering and history

ELSEVIER

Journal of Cultural Heritage

Volume 17, January–February 2016, Pages 170-178

Original article

Recovery of the aerial photographs of Ethiopia in the 1930s

Jan Nyssen [a], Gordon Petrie [b], Sultan Mohamed [c], Gezahegne Gebremeskel [c], Valérie Seghers [a], Martijn Debever [a], Kiros Meles Hadgu [d, e], Cornelis Stal [a], Paolo Billi [f], Philippe Demaeyer [a], Mitiku Haile [g], Amaury Frankl [a]

Methodology

- Standardized digitization protocols
  - INEAC data
  - Stomatal counts
- Crowd sourcing for transcription of both climate data and / or stomatal density counts (Zooniverse)
  - e.g., www.junglerhythms.org
- Structure from motion (PhotoScan) & standard georeferencing for aerial photos
  - post-processing using:
    - FOTO based texture metrics
    - Object based approaches (GEOBIA)
    - manual classification
    - ...

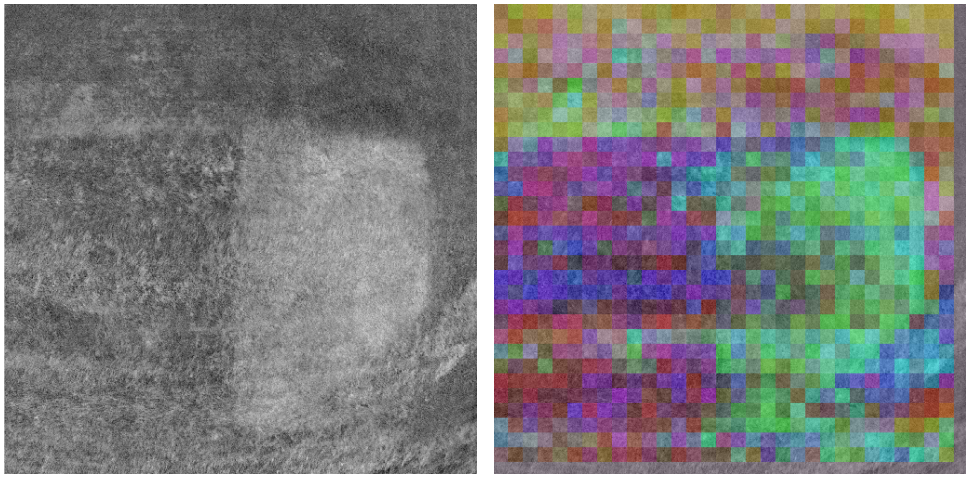

FOTO (Fourier Transform Textural Ordination)

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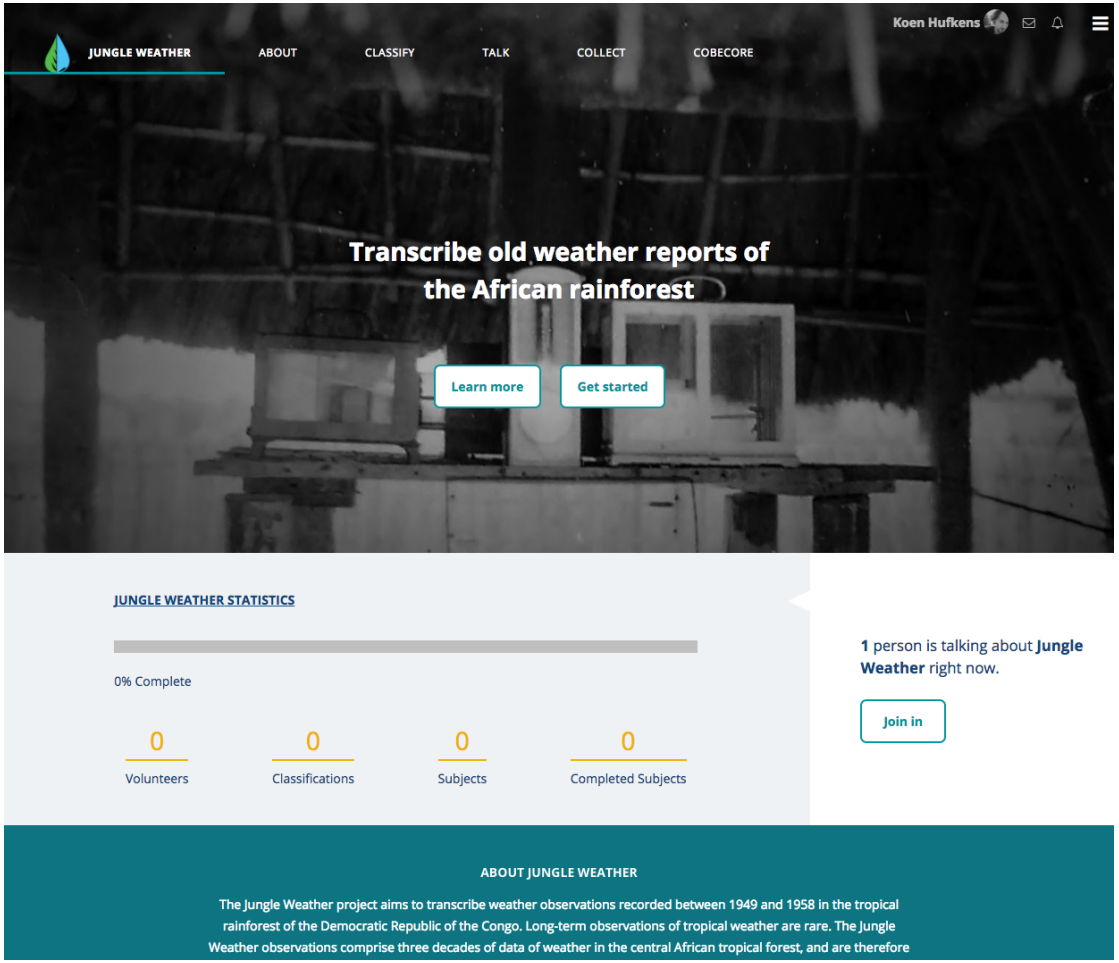
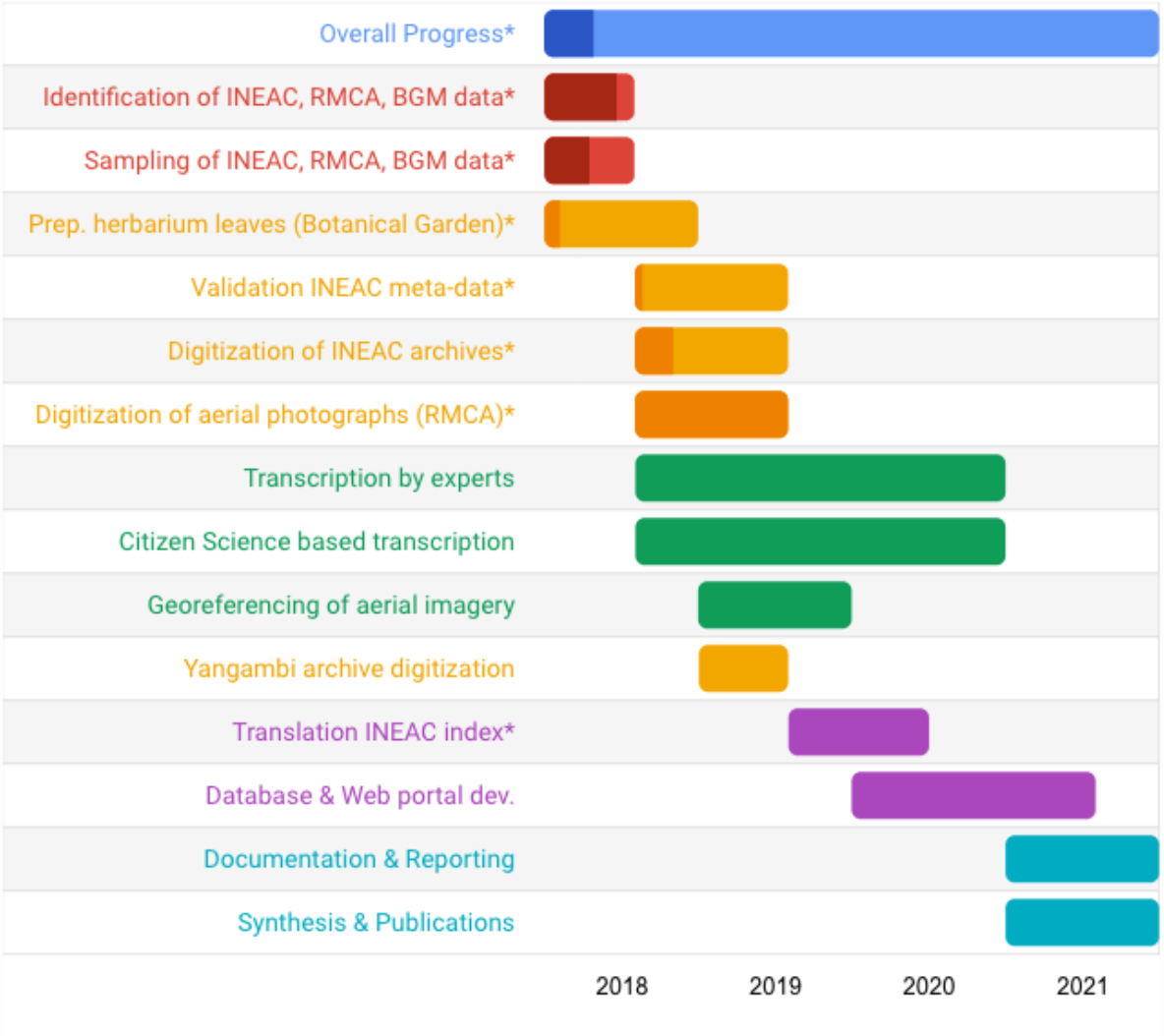


https://www.zooniverse.org/projects/khufkens/jungle-weather



http://cobecore.org/progress/