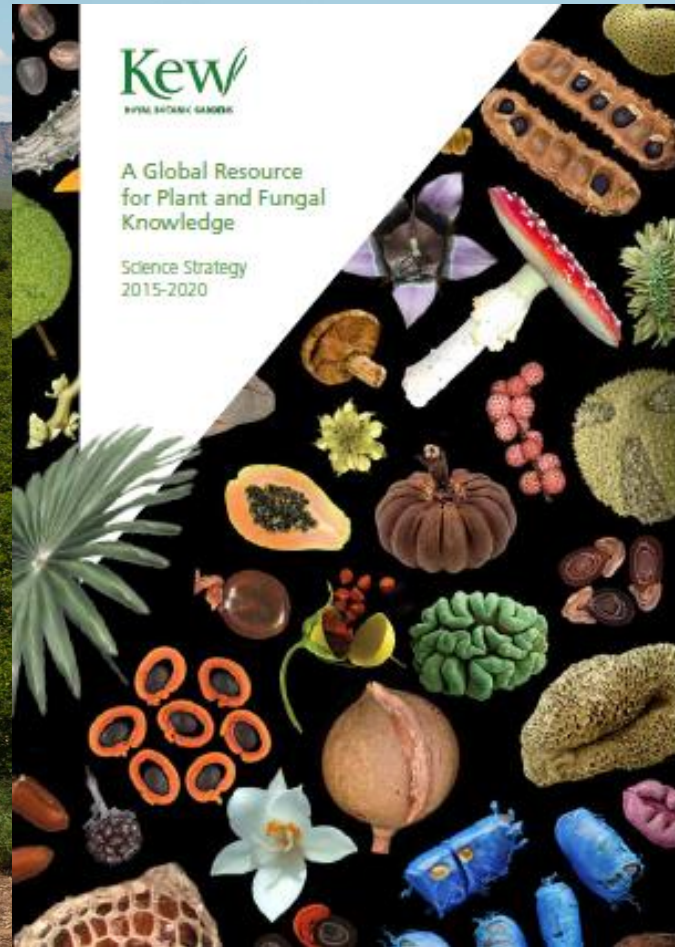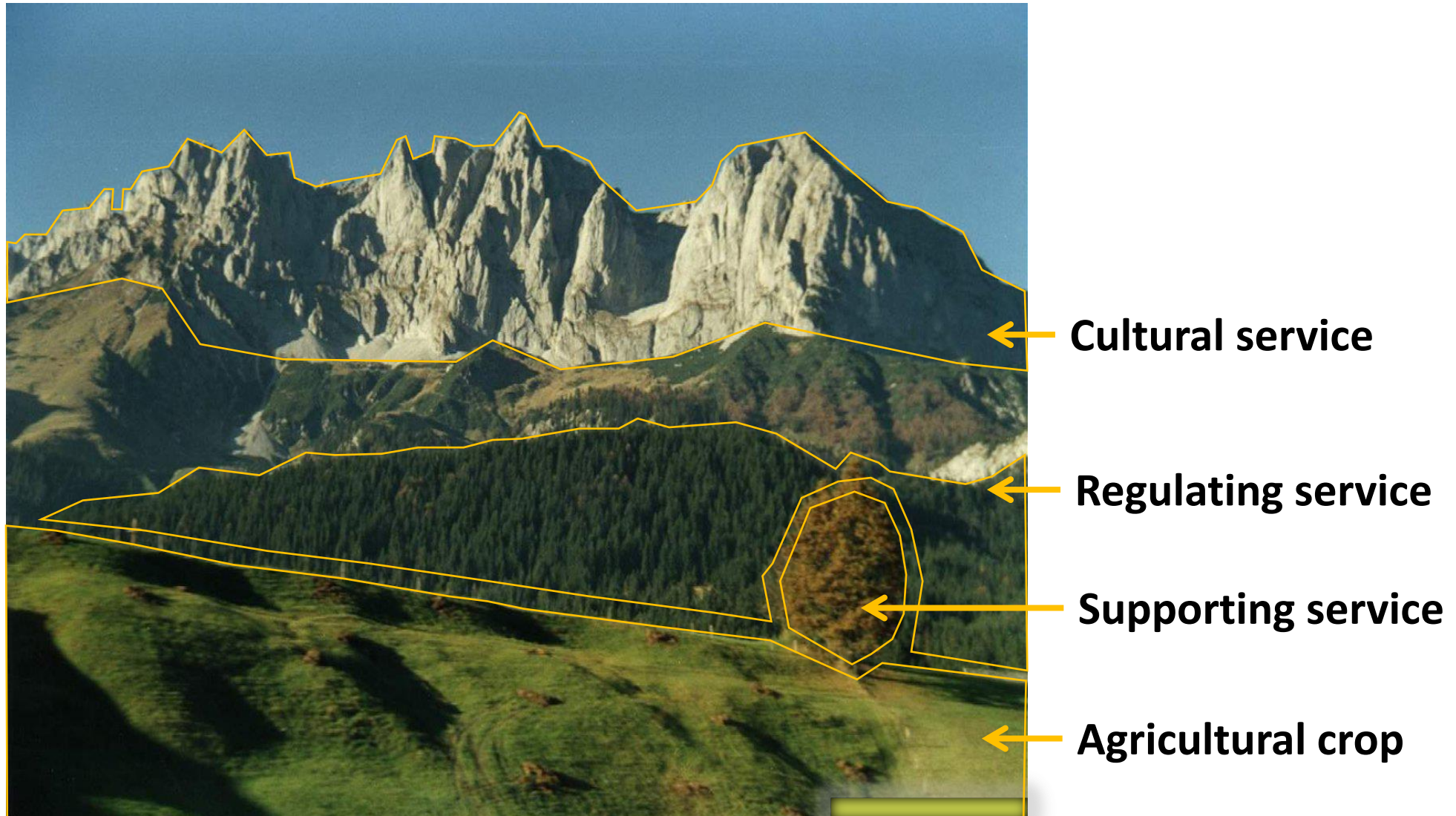# Business opportunities and challenges of mainstreaming biodiversity into the agricultural sector

"Mainstreaming biodiversity into the agricultural sector" what does this mean?

Cultural service

Regulating service

Supporting service

Agricultural crop

So what are the <u>opportunities</u> to be obtained from mainstreaming biodiversity into the agricultural sector?

1. Soil erosion protection and water regulation

2. Climate regulation

3. Pollination services

4. Critical knowledge and a gene pool to ensure resilient, climate smart crop

Opportunities to be obtained from mainstreaming biodiversity: E.g. Pollination services

Non-native feral honey bees (*Apis mellifera*)

What is the value of this patch of biodiverse forest in the agricultural landscape?

T.H. Ricketts et a., 2004, PNAS, 101, 12579-12582

- Insect pollination:
  - Improved coffee yields by 20%
  - Improved coffee quality by 27%

- Insect pollination services worth $60,000 for one Costa Rica farm/yr.

T.H. Ricketts et a., 2004, PNAS, 101, 12579-12582

# Opportunities to be obtained from mainstreaming biodiversity:
E.g. Critical knowledge and a diverse gene pool to ensure resilient, climate smart crops – case study of coffee

- Coffee supports 25 million farming families worldwide and more than 100 million people.

- ~125 species found in the wild in biodiverse evironment

- We drink only two species – Arabica (*Coffea arabica*) and Robusta (*Coffea canephora*)

- *Coffea arabica* originated from Ethiopia and is now distributed around the world

Understanding the environmental tolerances of *Coffea arabica* through mapping populations growing in wild in Ethiopia
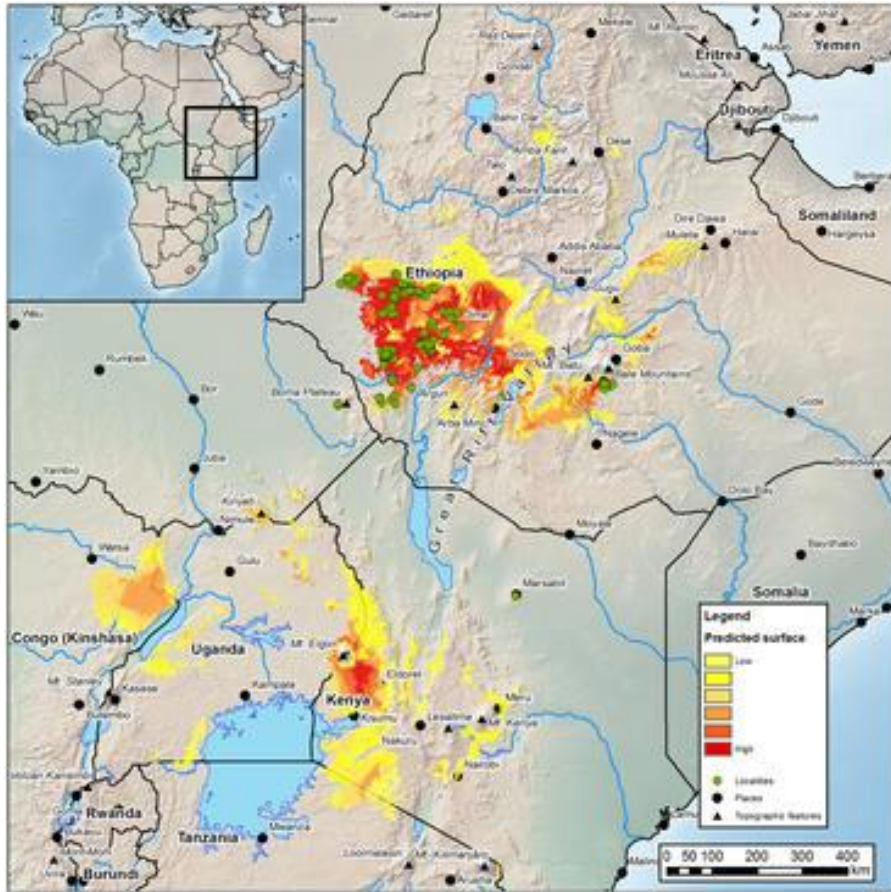
Predicted (coloured areas) and actual (green dots) distribution of indigenous (wild) Arabica.

Severely stressed coffee plants at the end of the dry season in western Ethiopia (Photo: A. Davis)

Using knowledge from distribution of wild populations enabled modelling and prediction of good and bad regions for coffee production in Ethiopia in the future

A. Davis et al., (2012) *PLoS ONE,* 7, e47981.

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KEW   **ECFF**
Environment & Coffee Forest Forum

Coffee Atlas
of Ethiopia

Aaron Davis
Justin Moat
Tim Wilkinson

Ethiopia is the birth-place of coffee drinking, the main home of Wild Arabica coffee (*Coffea arabica*) and Africa's largest coffee producer. Fifteen million Ethiopians are coffee farmers. Ethiopian coffee is world-renowned for its diversity of flavour profiles, including those of the celebrated coffees of Harar, Limu, Sidamo, and Yirgacheffe.

The aim of the *Coffee Atlas of Ethiopia* is to inform the reader about the coffee landscape of Ethiopia. It shows where coffee is grown, where the natural coffee forests are located, and where coffee could be grown. The Atlas maps are accompanied by information on coffee farming, environment and climate, and a description of the main coffee areas. Also included in the Atlas are key coffee origins, coffee towns and coffee delivery centres, as well as other useful items. The Atlas can be used to assess the potential and vulnerability for coffee farming in Ethiopia, as well as provide a logistics resource for the coffee sector and those otherwise working with, or interested in, coffee. It is also an essential reference for resource managers, researchers, and conservationists.
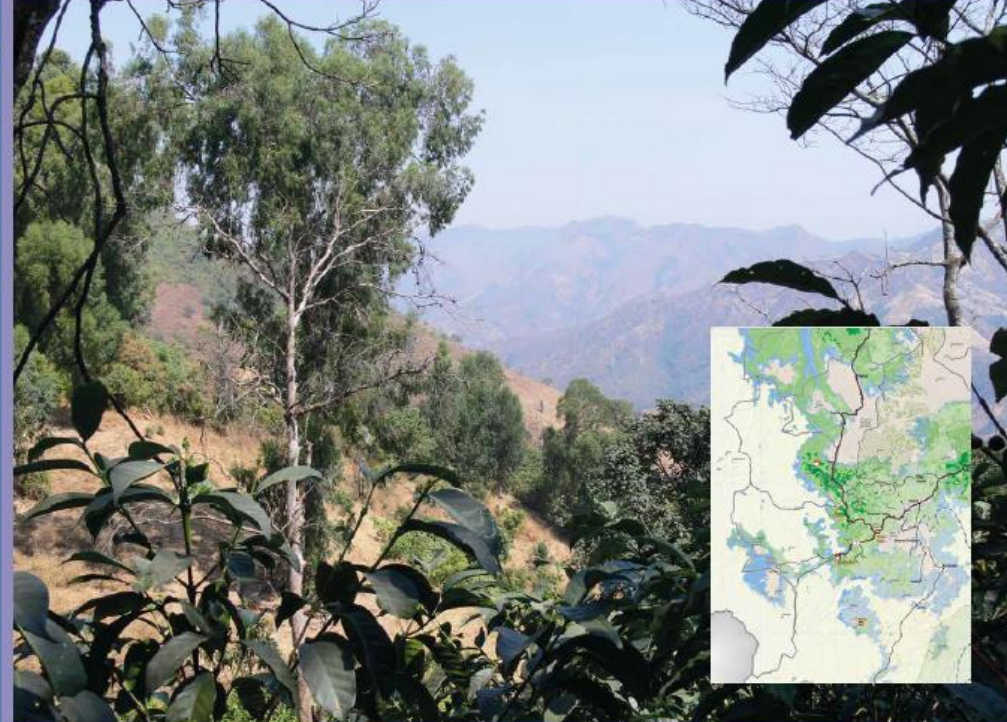
Funded by the SCIP Fund

UKaid from the British people

NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

MINISTRY OF FOREIGN AFFAIRS OF DENMARK

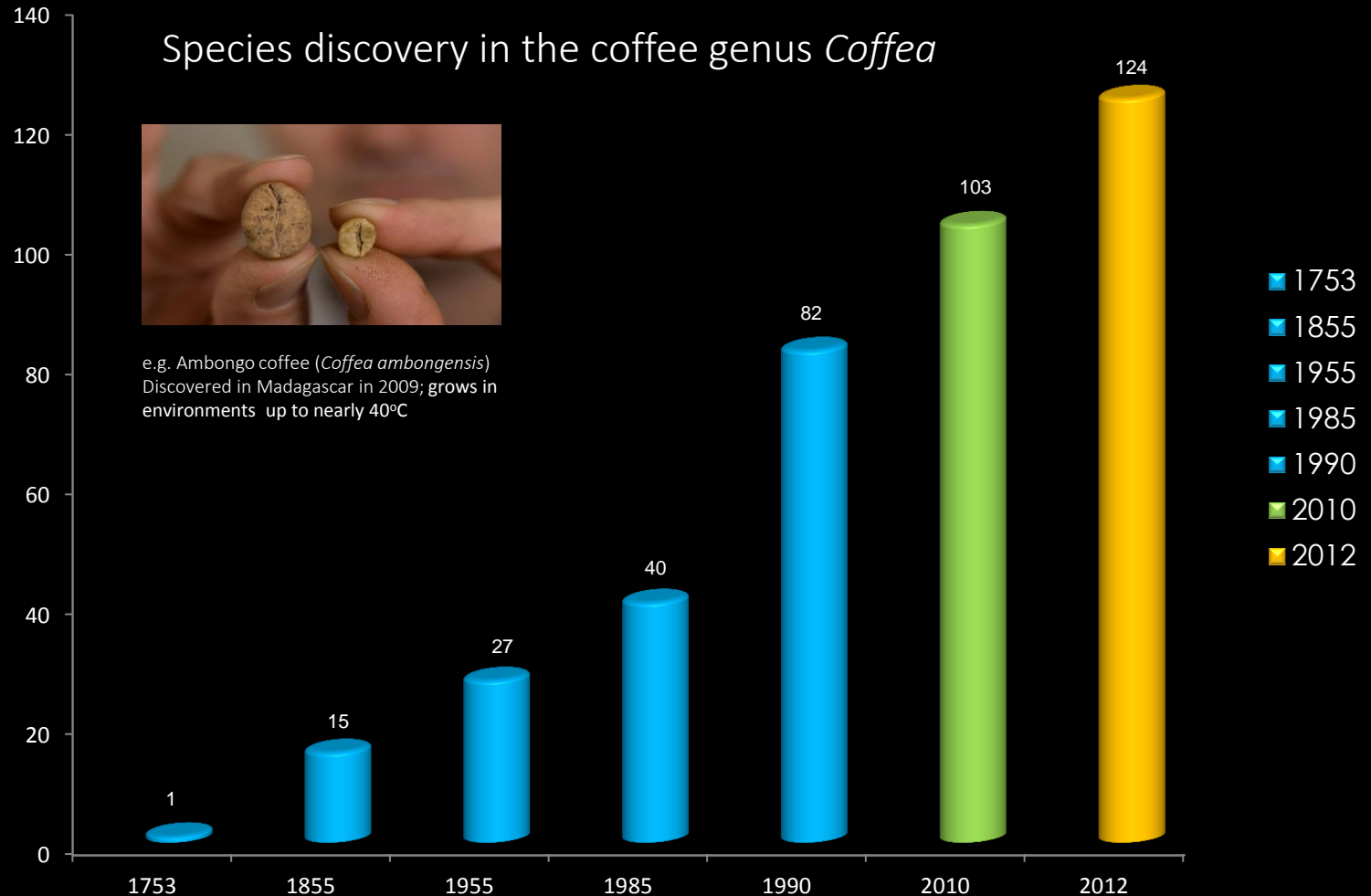Coffee Atlas of Ethiopia   Aaron Davis Justin Moat Tim Wilkinson

Kew

Discovery of new species of coffee in wild also provides diverse gene pool and potential for new resilient crops
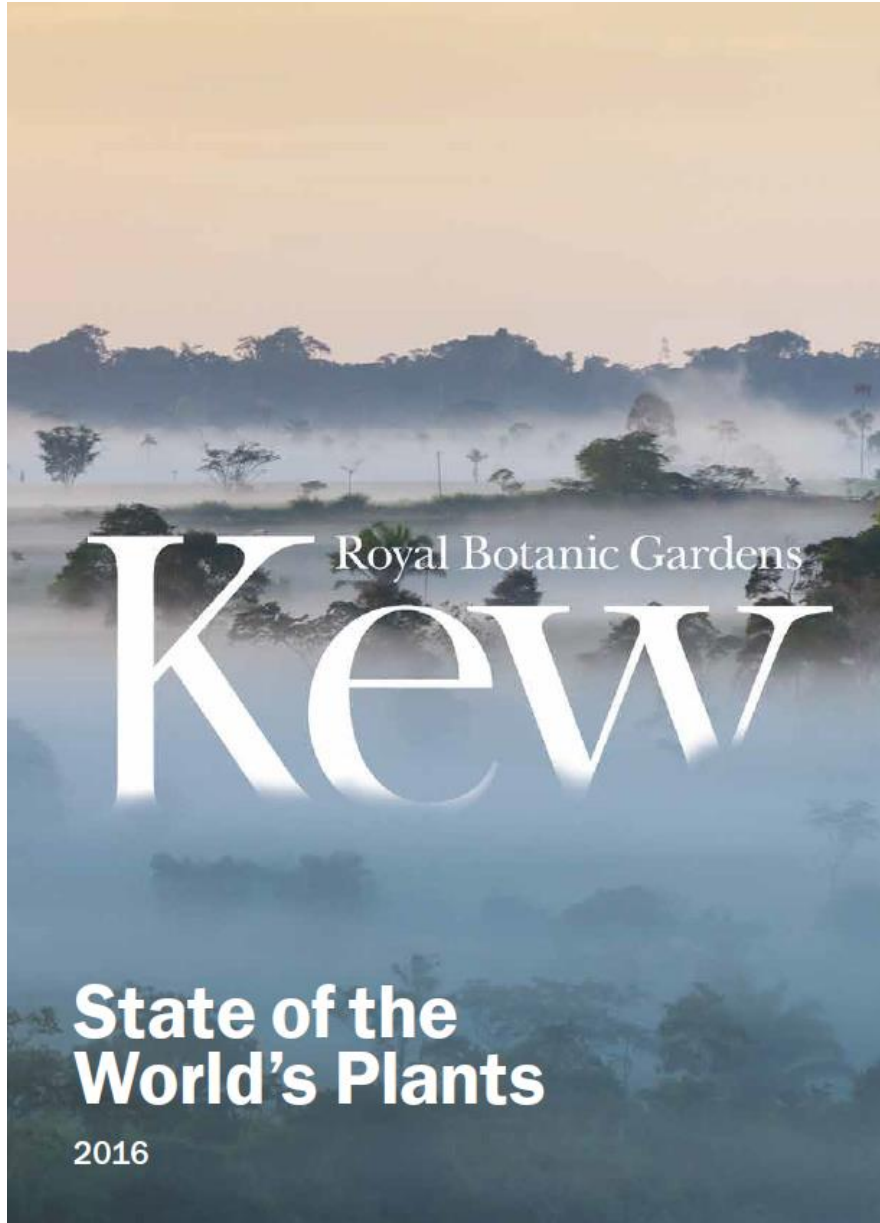
Species discovery in the coffee genus *Coffea*

e.g. Ambongo coffee (*Coffea ambongensis*)
Discovered in Madagascar in 2009; **grows in environments up to nearly 40ºC**

Western Madagascar 1997

What are the <u>challenges</u> of mainstreaming biodiversity into the agricultural sector?

1. Lack of plant biodiversity data for some of the most biodiverse regions

2. Often poor knowledge on the natural distribution of many plant species and the ecosystem services that they provide

3. Poor dissemination and availability of biodiversity and ecosystem service data for businesses

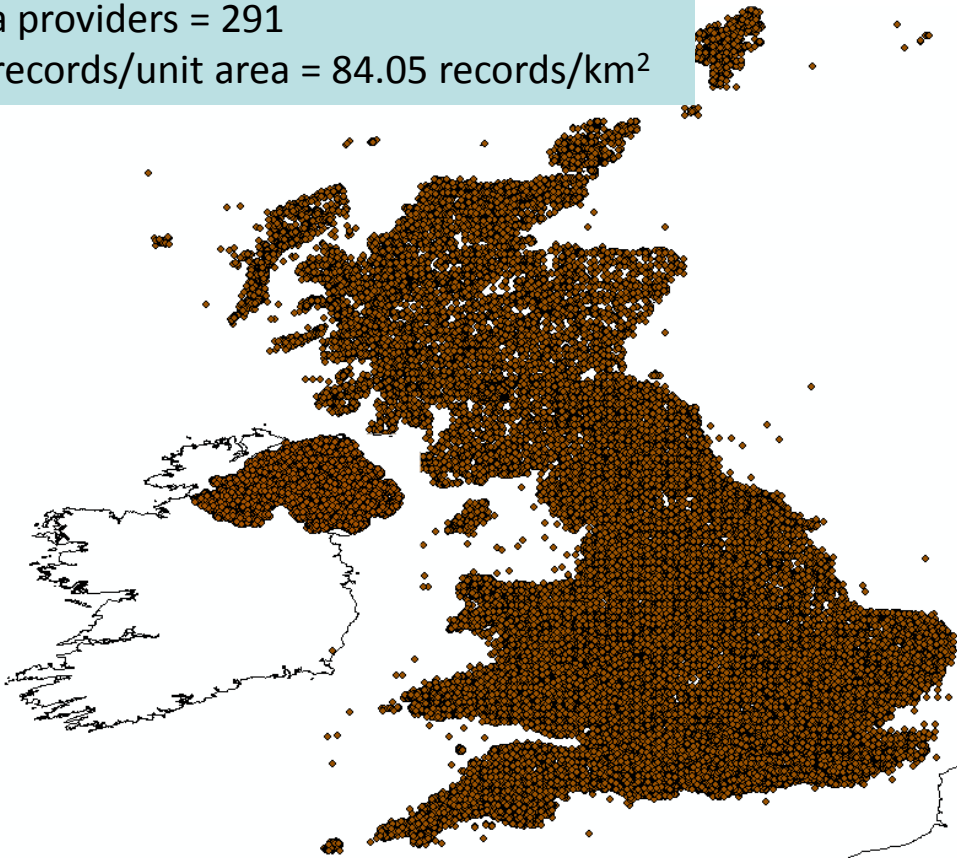# Geo-located plant species occurrence records found in the Global Biodiversity Informatics Facility (GBIF)

UK

Area = 243,610 km2

GBIF records = 20,477,248

data providers = 291

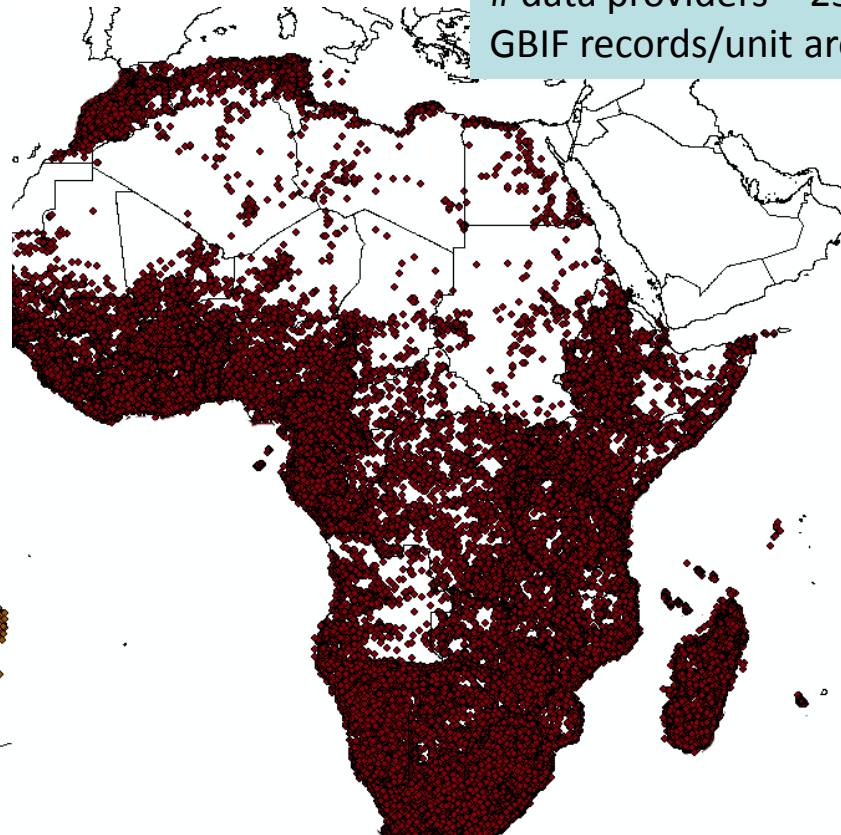GBIF records/unit area = 84.05 records/km^2

Africa

Area = 30,221,500 km2

GBIF records = 2,773,022

data providers = 236

GBIF records/unit area = 0.091 records/km^2

The UK has nearly 1000x more plant records per km^2 than Africa

Challenge 2: Often poor knowledge on the natural diversity and distribution of the plant species & the ecosystem services that they provide

E.g. What trees should be planted and where for CO_2 drawdown?

Or
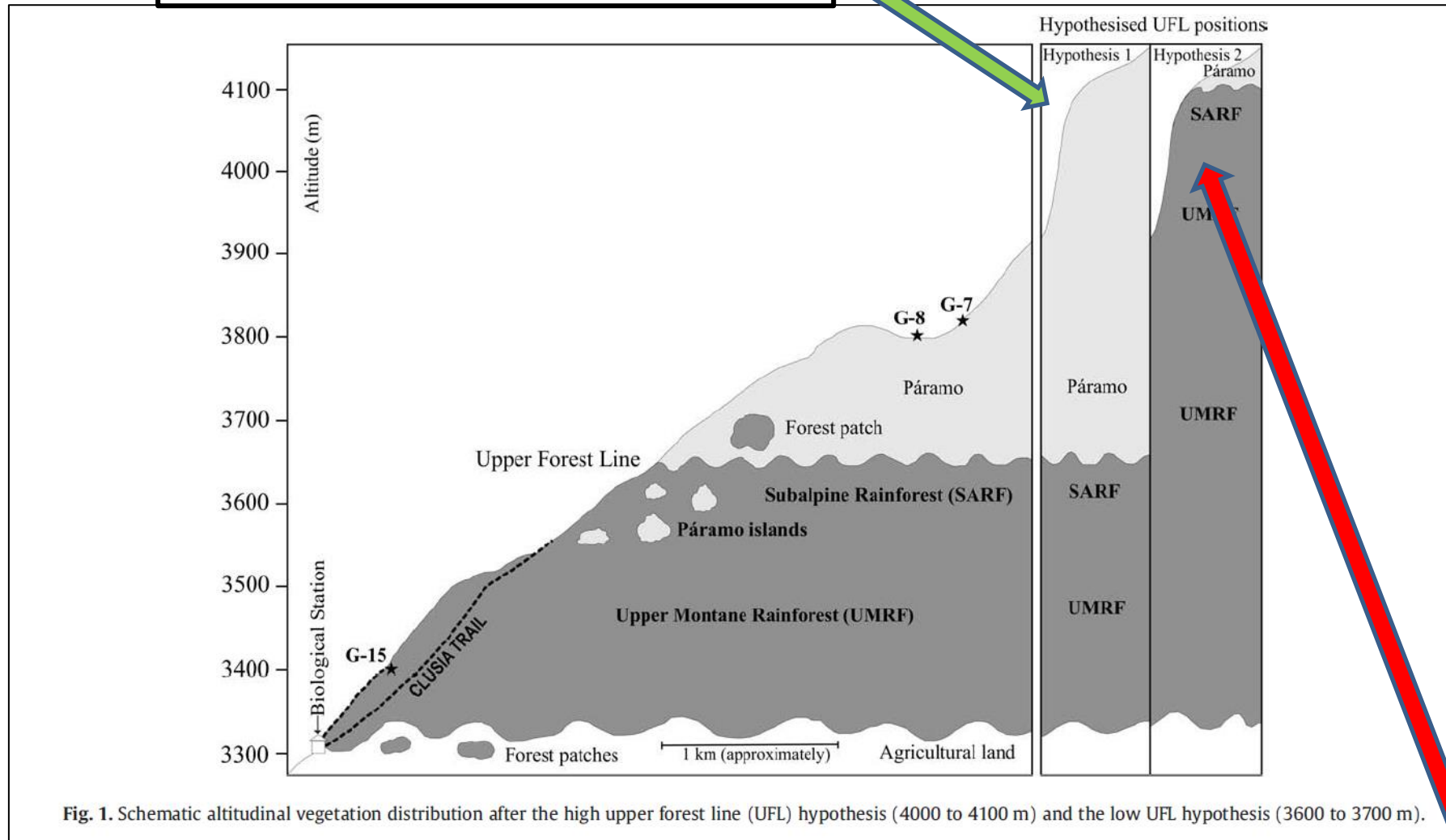

High altitude Paramo grasslands, Ecuador

High altitude *Pinus and Eucalyptus* plantations?

Hypothesis 1: Paramo is naturally occurring high altitude vegetation type: i.e. Not suitable for tree plantations

√

Fig. 1. Schematic altitudinal vegetation distribution after the high upper forest line (UFL) hypothesis (4000 to 4100 m) and the low UFL hypothesis (3600 to 3700 m).

Hypothesis 2: Upper landscapes used to be forested but previously cleared by human activity: i.e. Suitable for tree plantations

X

Olivera, M. & Hoogheimstra (2010) Review of Palaeobotany and Palynology, 163,113-126
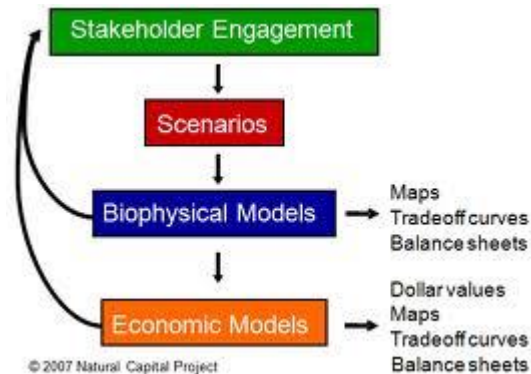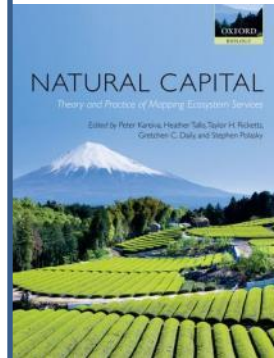
Challenge 3: Often poor dissemination and availability of biodiversity and ecosystem service data for businesses

ARIES (ARtificial Intelligence for Ecosystem Services)

InVEST
(Integrated Valuation of Ecosystem Services and Tradeoffs)

Some of the currently available web-based tools to determine ecosystem service provision across landscapes

ESValue

ARIES (ARtificial Intelligence for Ecosystem Services)

End-user needs to work with the ARIES team; developed for specific area; one site output requires **200-300 hours** of Senior GIS technician time

InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs)

Time varies depending on the site and the technician's expertise; one site output requires **160-280 hours** of Senior GIS technician time

ESValue

~ 200 hours for one site; requires GIS expertise, expert knowledge of ecological relationships plus data from stakeholders

EcoAIM (Ecological Asset Inventory and Management)

>25 hours; involves reviewing, downloading, converting and uploading data by stakeholder

(http://www.bsr.org/reports/BSR_ESTM_WG_Comp_ES_Tools_Synthesis3.pdf)

Summary:

- Business opportunities of mainstreaming biodiversity into agricultural sector are huge

- Still considerable challenges with biodiversity data collection and analysis

- Also serious problems with dissemination of biodiversity data & knowledge to business

- Far greater partnership needed between businesses & academic institutions to realise full potential of opportunities

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Kew

Estado de las Plantas del Mundo

Perspectiva Anual de Kew sobre la situación de las plantas a escala global

2016