Variation in environmental risks from cocoa expansion and intensification in West Africa requires context specific responses

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With support from

Background

- West African Upper Guinean forest: biodiversity hotspot, globally important ecosystem services
- Since 1975: >15% forest loss to farming and other uses
- Low shade systems dominate (± 80%) in major producing countries, others more diverse
- Area under cocoa production is still expanding, also inside protected forests
- Cocoa = fastest expanding export-oriented crop across SSA (Ordway et al. 2019)

Cocoa environmental sustainability efforts

Commitments, initiatives, projects by governments, private sector, NGOs etc. → Expected outcomes

- Zero-deforestation commitments (protect and restore forests)
- Cocoa productivity support
- Climate Smart Cocoa/Agroforestry promotion and support

Biodiversity and Ecosystem Services (incl. cocoa)

From cocoa and other products

Understanding risks and opportunities

- To prioritise sustainability interventions, we need to understand:
  - Potential risks: where and with what effect on biodiversity and ecosystem services
  - Opportunities for mitigation/restoration: spatial planning and cocoa system design

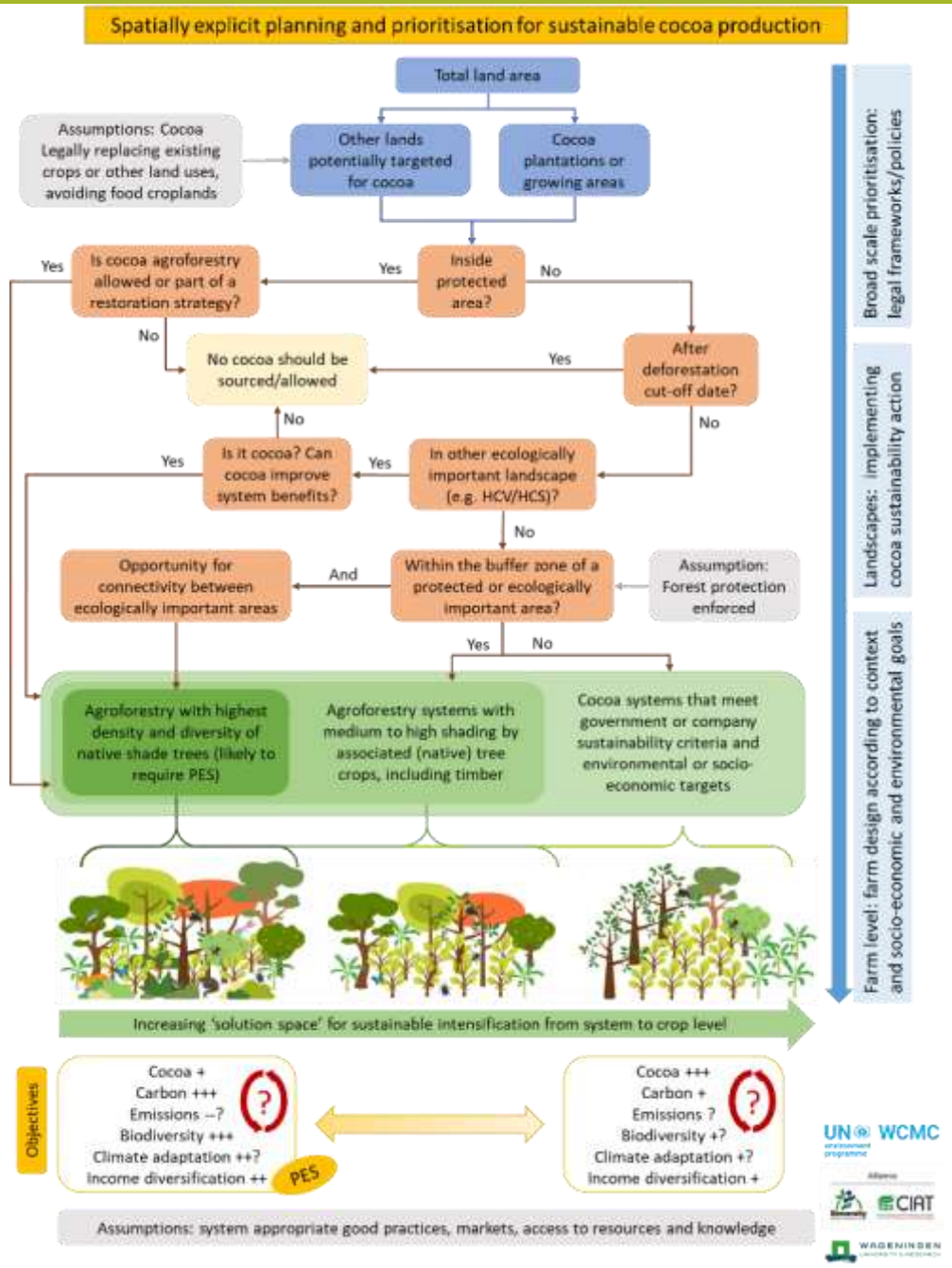
- Risks : cocoa expansion, landscape simplification, climate change, responses focussing on one aspect
- Opportunities: potential synergies between biodiversity, production and other ecosystem services at farm and landscapes level

Understanding risks and opportunities

Consider risks and opportunities for meeting
Different sustainability objectives: national to local level

- Zero-deforestation
- Forest/tree cover restoration
- Cocoa productivity
- Farmer livelihoods

=> Spatial planning and system design



Understanding risks and opportunities

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Research question

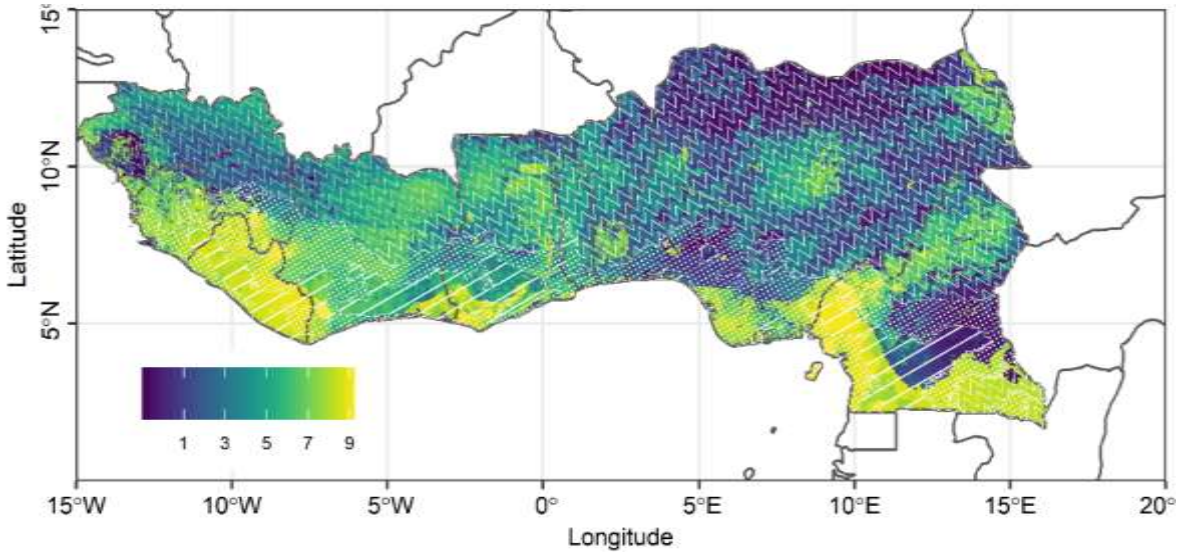
- Where is current and future pressure from cocoa most likely in the cocoa growing region of West Africa, with risks to biodiversity and ecosystem services?

Approach

- Map areas important for biodiversity and ecosystem services (carbon, water, forest products)
- Assess potential pressure from expansion:
  - Spatial overlays with current suitability and under climate change
  - Projecting forward deforestation
  - Modelling land use change impacts assuming full sun cocoa replacing forest

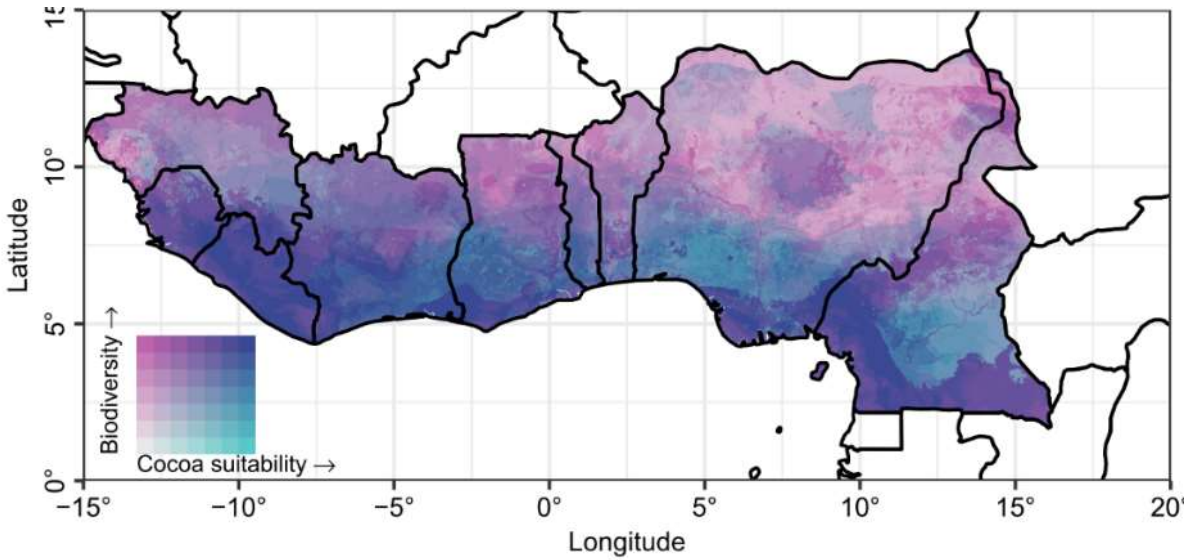
Sassen et al. 2022, Land Use Policy

Results: biodiversity

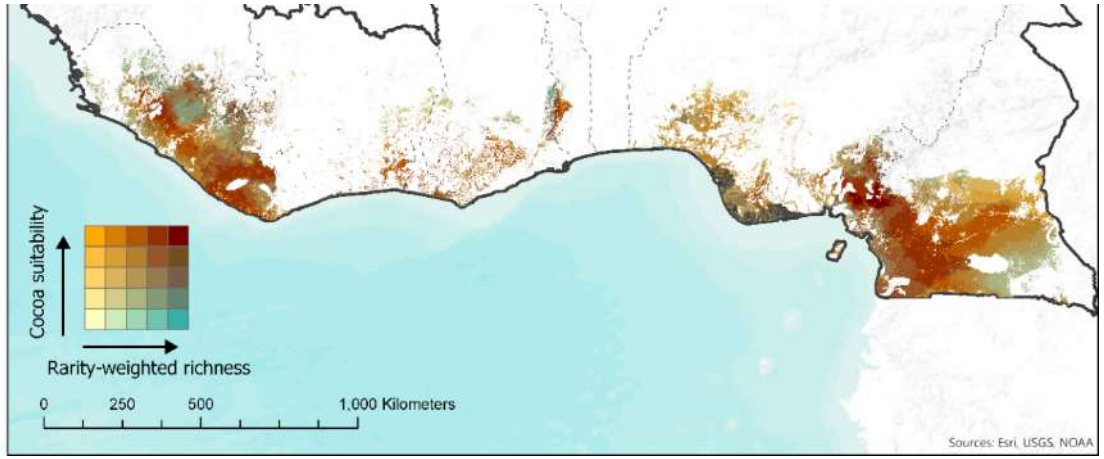


Baseline biodiversity significance. Striped areas (remain suitable), dotted areas (remain suitable with certain adaptation needs) and waves (are or become unsuitable)

Biodiversity in remaining forests at risk from expansion
Rural/cocoa landscapes at risk from intensification?



Biodiversity significance and current cocoa suitability (Schroth et al. 2017)



Cocoa suitability and biodiversity (rarity-weighted richness) in forests outside protected areas

Sassen et al. 2022, Land Use Policy

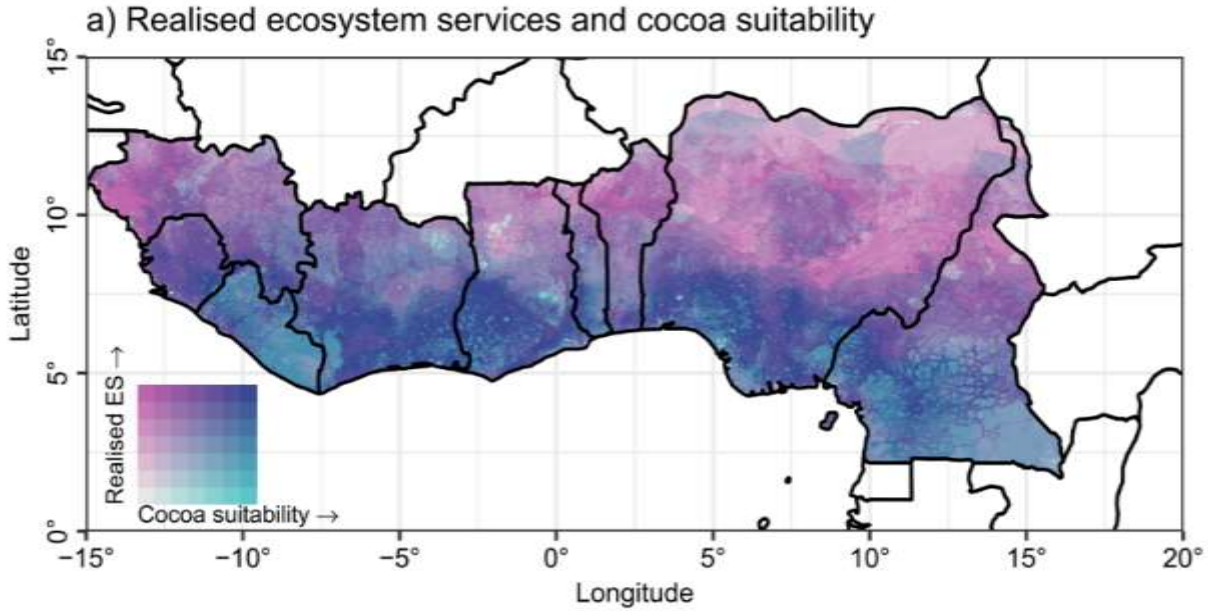
Results: ecosystem services

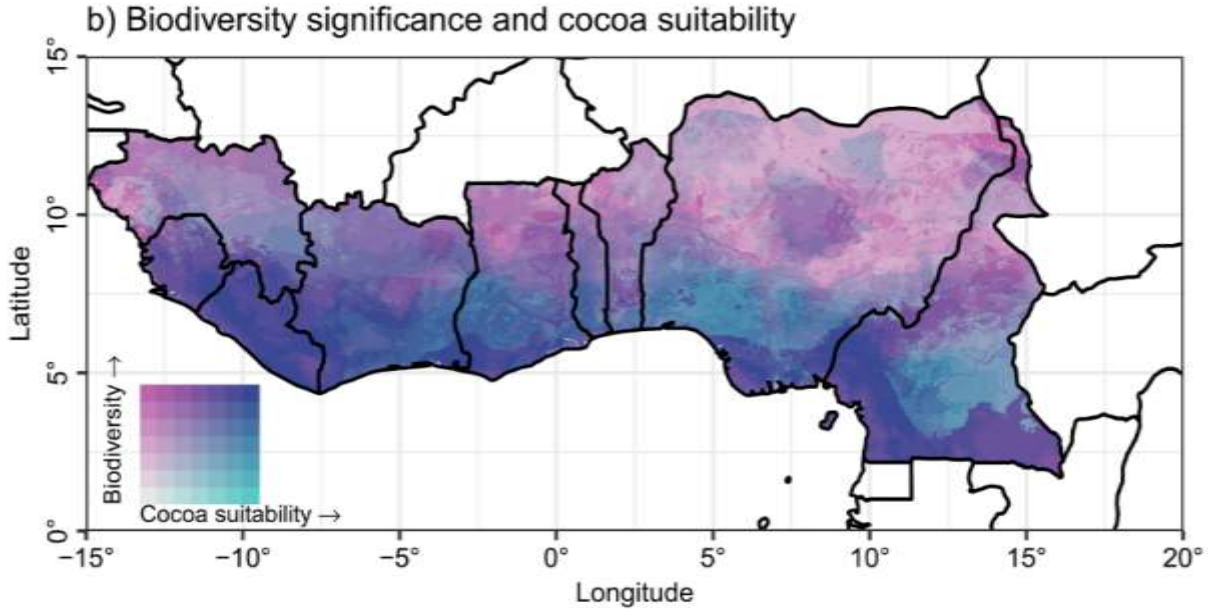
Remaining forests = high **potential** services (incl. carbon sequestration)

-> zero deforestation/ increase productivity

Rural landscapes = high **realised** services (water regulation, soil retention, wood and non-wood products etc.)

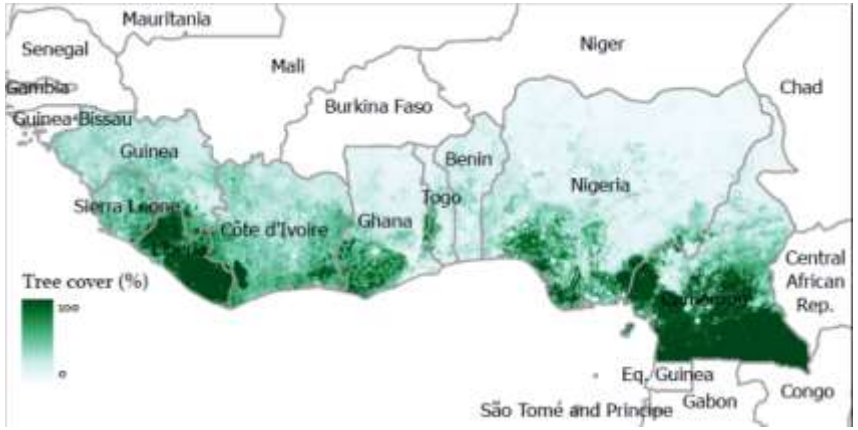
-> promote agroforestry systems?





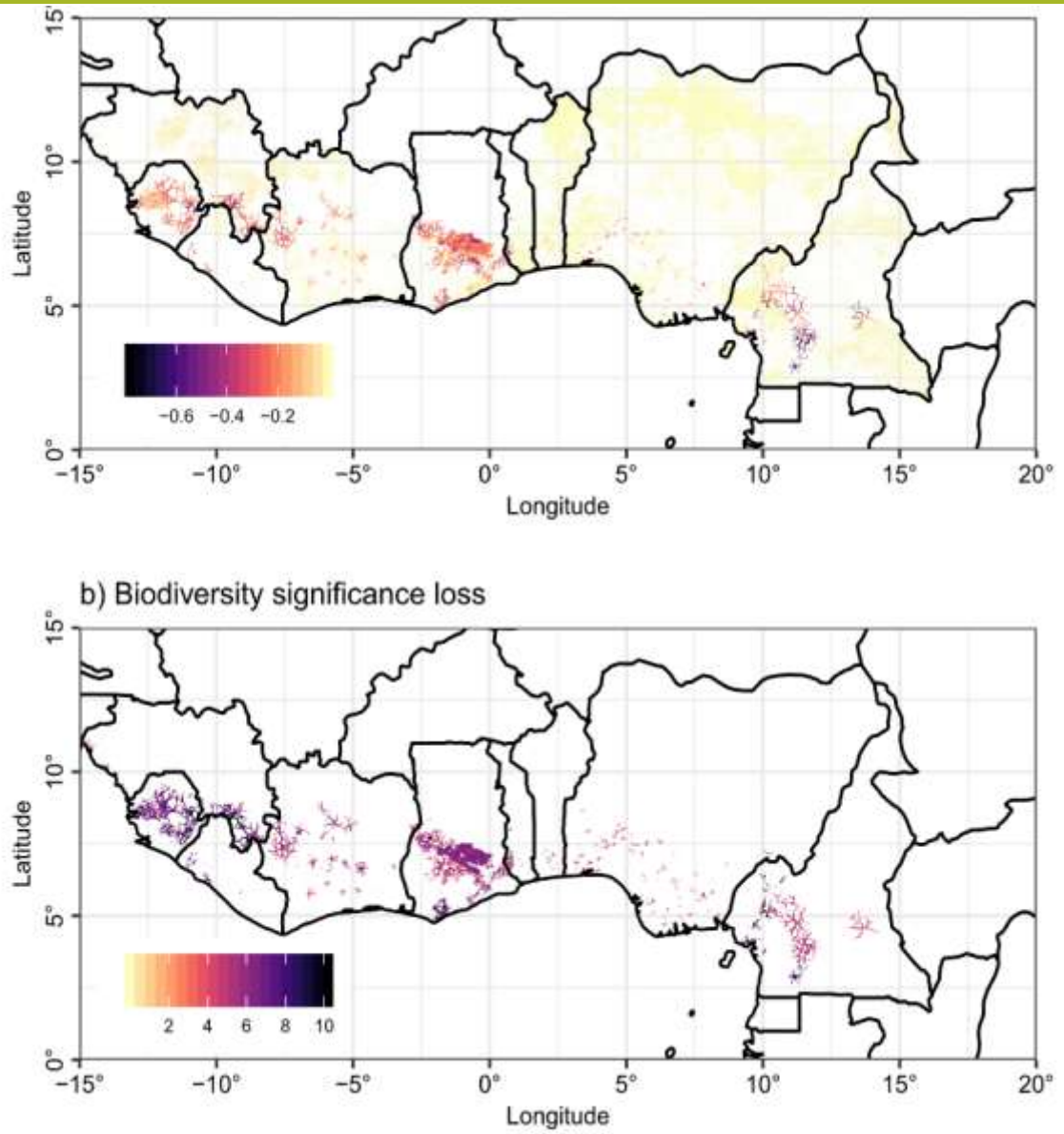
Sassen et al. 2022, Land Use Policy

Results: pressure from deforestation



Fractional tree cover (Copernicus/ Buchorn *et al.* 2019)

Continuation of current deforestation trends (due to cocoa or other land uses) poses a significant risk to biodiversity and ecosystem services



a) Relative loss in bundle of ecosystem services for deforestation scenario;
b) Loss in biodiversity for deforestation scenario

Sassen et al. 2022, Land Use Policy

Discussion

TRADE, DEVELOPMENT & THE ENVIRONMENT HUB

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Study limitations

- Lack of spatial data on cocoa growing areas
- Difficult to attribute deforestation to (small scale) cocoa
- Other factors than climate may also affect the suitability for cocoa growing
- Cocoa not considered as provisioning ecosystem service
- No consideration of economic values of other ecosystem services

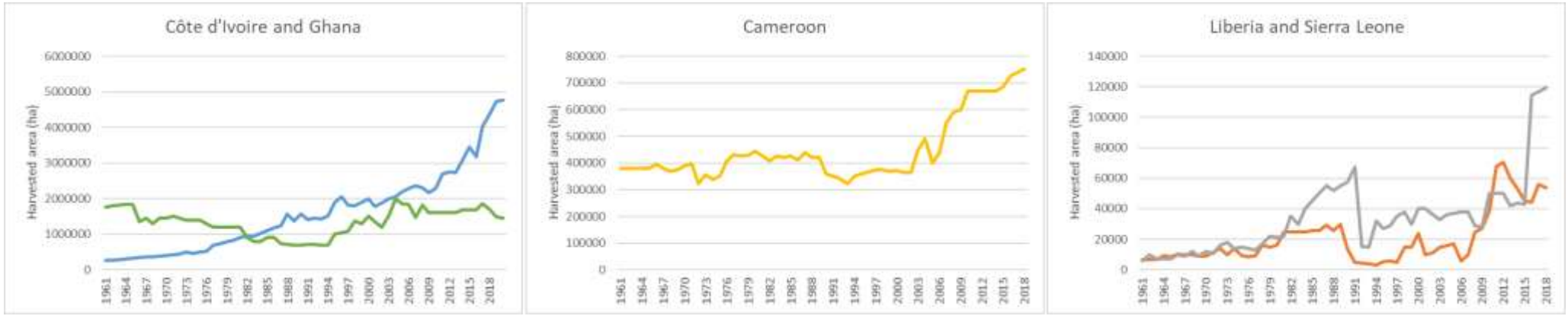
Though country specific cocoa development policy context + recent cocoa area expansion + deforestation trends + vulnerability to future climate change

= reasonable inferences about potential future forest and trees cover loss risks due to cocoa

Sassen et al. 2022, Land Use Policy

Discussion

- Many remaining **unprotected forests** in West Africa are highly suitable for cocoa growing
- Likely role of cocoa in forest / tree cover loss varies per country :
  - History of deforestation
  - Trends in cocoa area/ government objectives for cocoa production



- **Climate change** impacts expected vary across the region
  - Potential shifts to areas important for biodiversity and ecosystem services

Sassen et al. 2022, Land Use Policy

Conclusions

- Risks to biodiversity and ecosystem services in the west African cocoa belt vary:
  - In remaining forests from cocoa (and other crops) expansion
  - In existing cocoa landscapes from tree cover loss

- Need for sustainable, climate resilient intensification approaches for cocoa to increase cocoa system productivity on existing land over the longer term

- Need for context specific action, and to prioritise action

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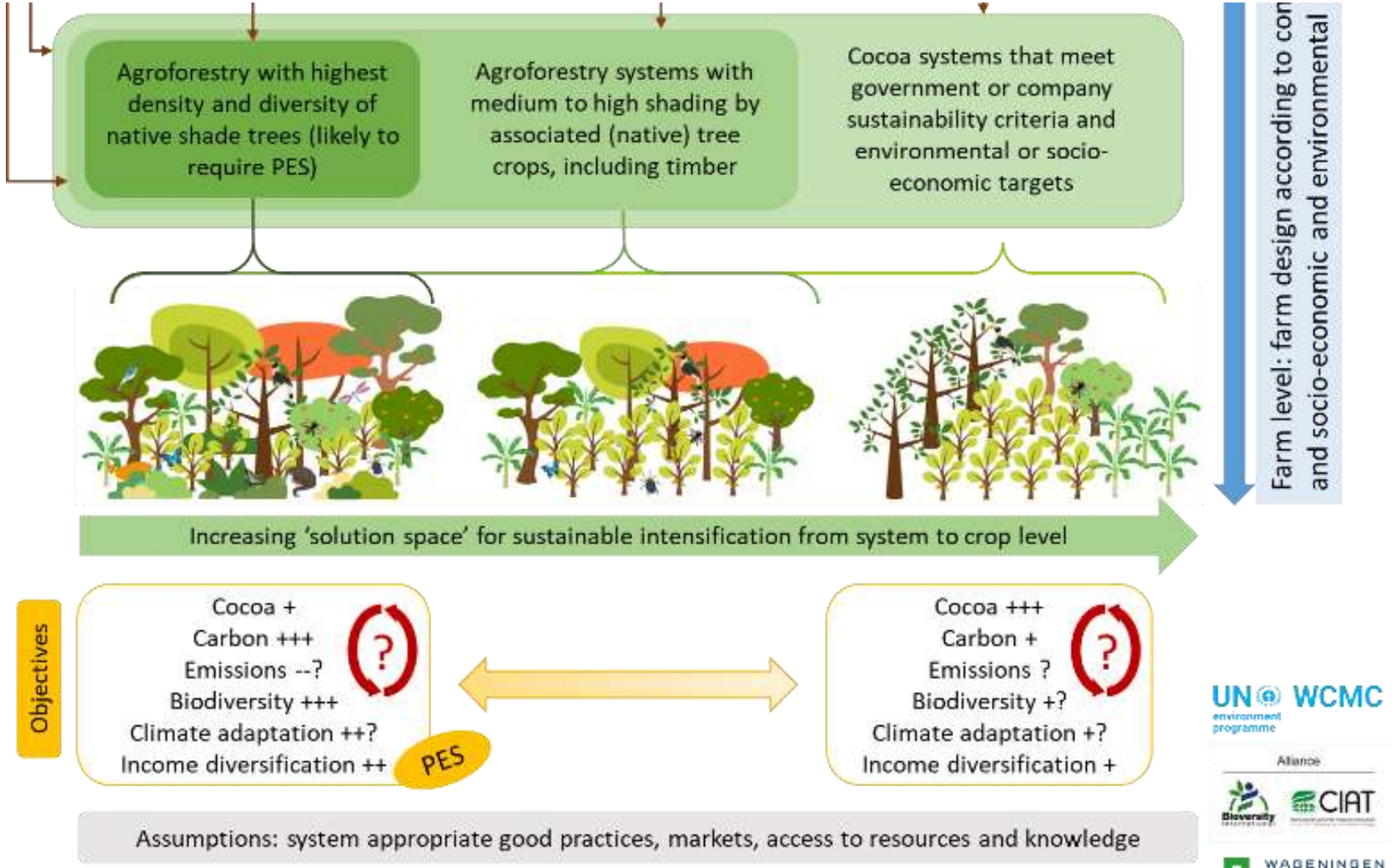
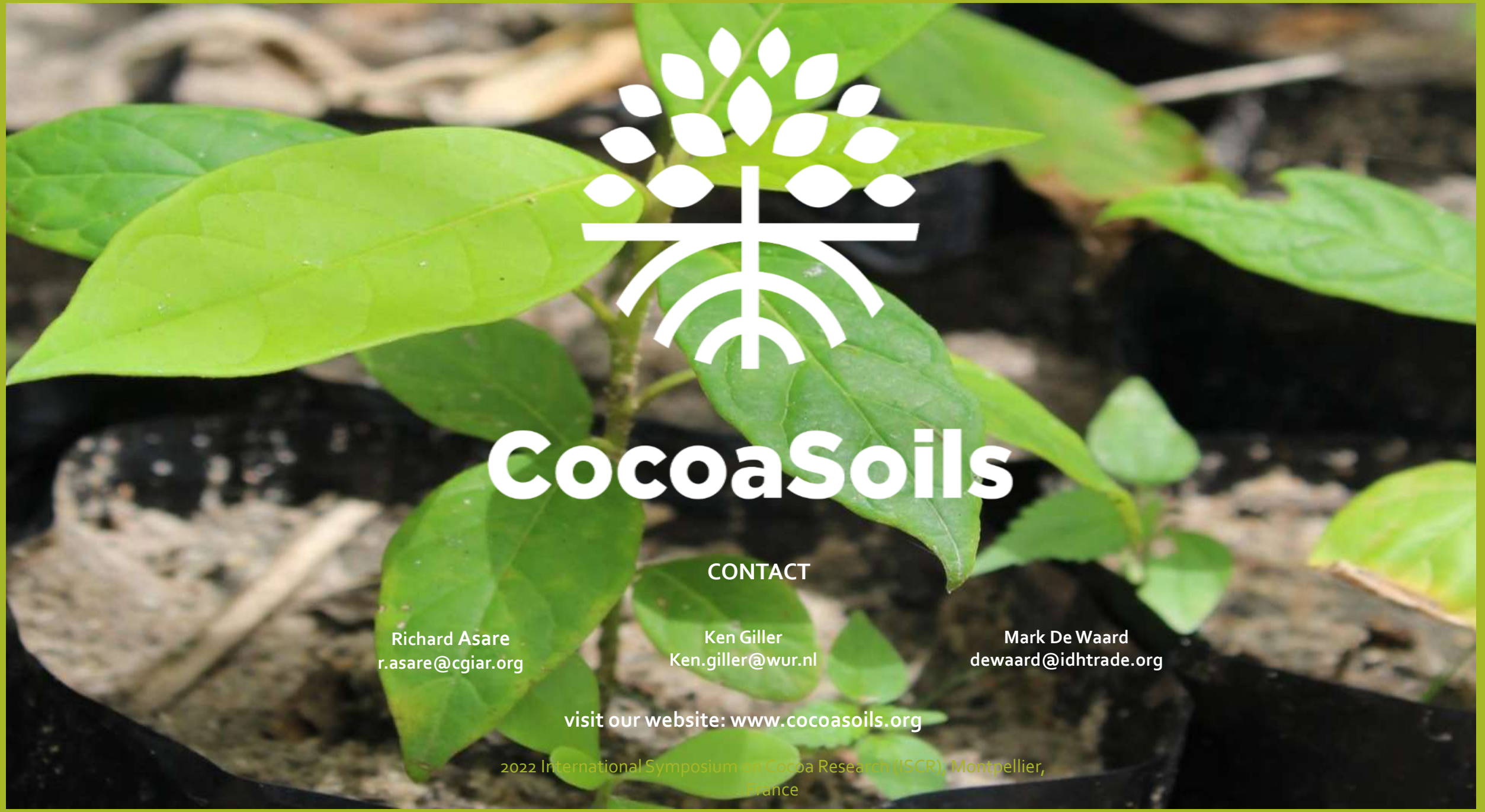
Further work

What systems for what objectives where?



See also, poster: Understanding the links between cocoa management and productivity, biodiversity and ecosystem services in West Africa (Maney et al. 2022)



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Background

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Cocoa, biodiversity and ecosystem services

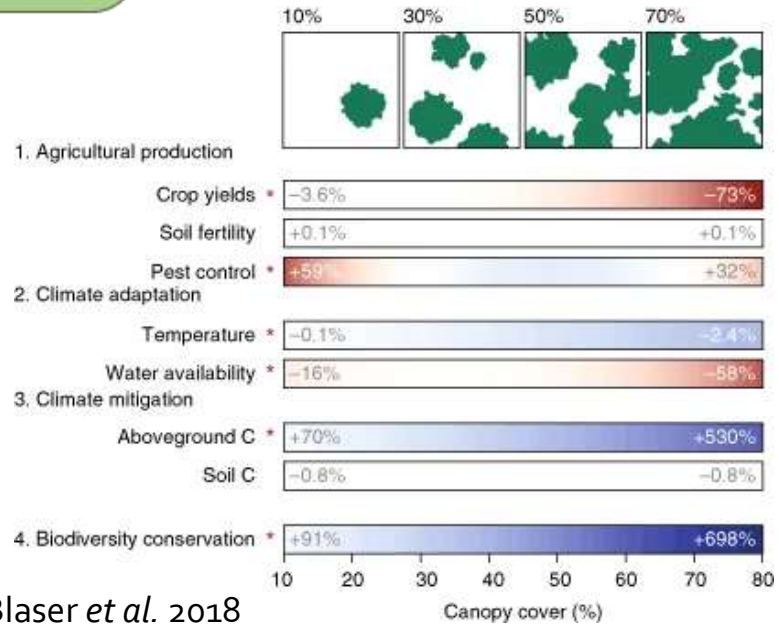
Ecosystem services in cocoa landscapes

Regulating
- Climate
- Diseases and pests
- Water
- Erosion
- Pollination
- Carbon sequestration

Supporting
- Nutrient cycling
- Soil formation
- Primary production (light, water, nutrients)

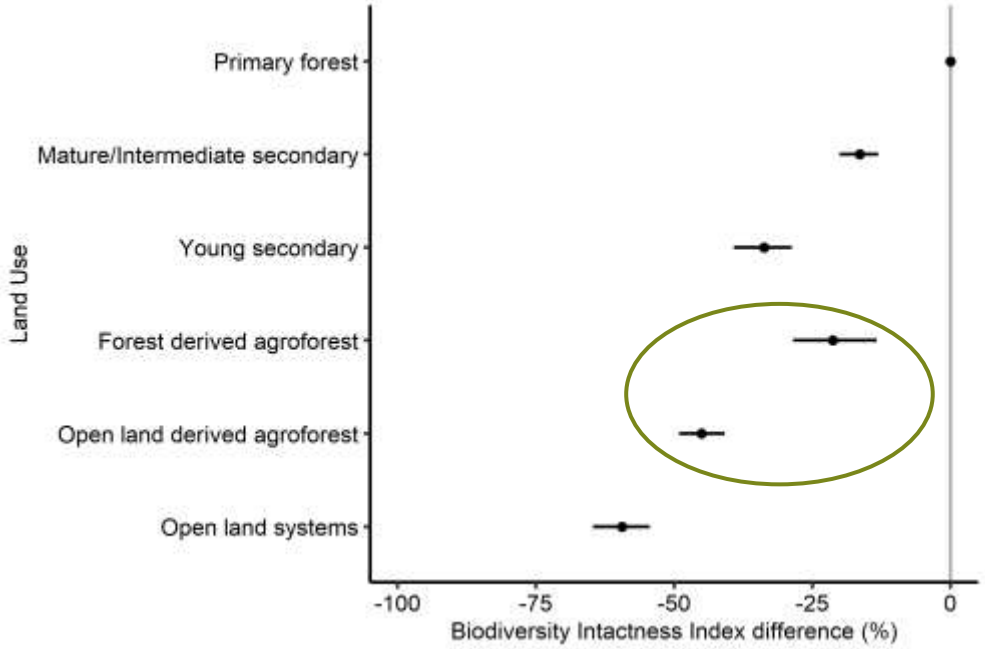
Provisioning
- Food
- Wood and fibre
- Fuel
- Fresh water

Cultural
- Aesthetic
- Spiritual
- Recreational



Blaser *et al.* 2018

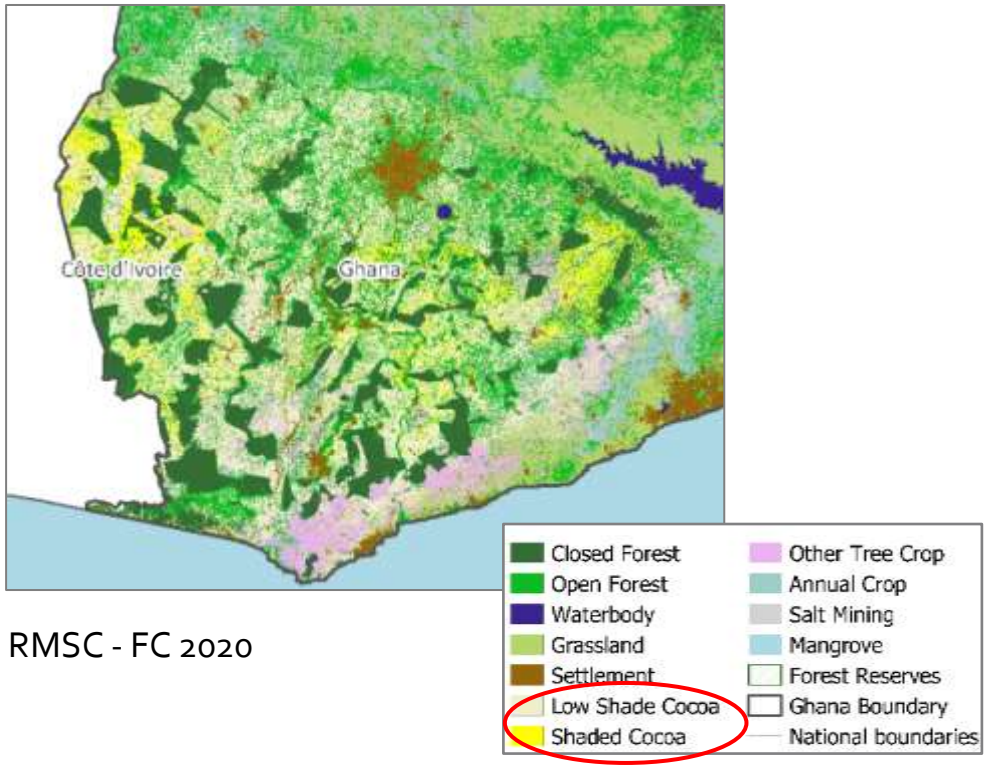
Biodiversity in cocoa related land uses



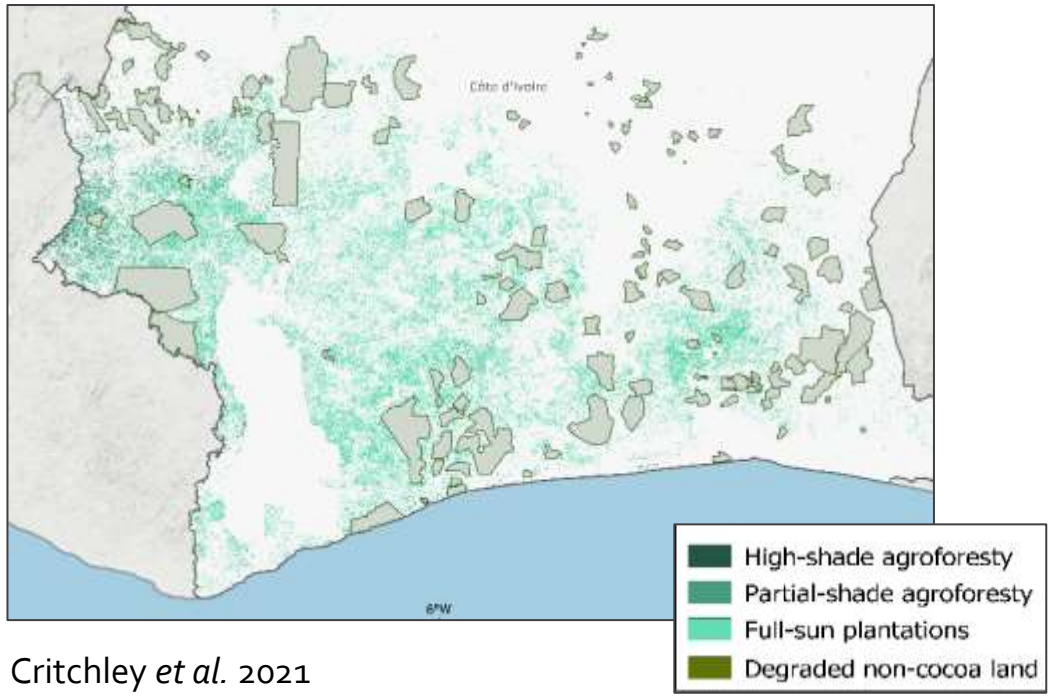
Maney *et al.* 2022

Background

Low shade systems dominate (± 80%) in major producing countries, others more diverse



RMSC - FC 2020



Critchley *et al.* 2021

Methods

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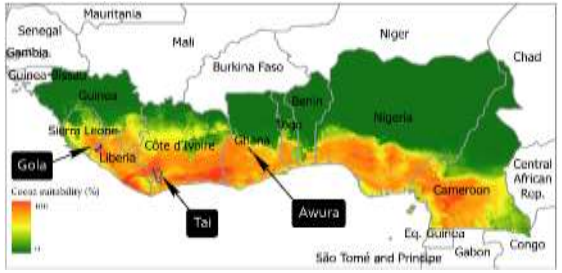
Areas important for biodiversity and ecosystem services

- Rarity-weighted richness metric (Hill et al., 2019).
- Change metric from van Soesbergen et al. (2017) in the deforestation scenario
- Ecosystem services assessment tool Co$tingNature V3 (Mulligan et al. 2010, Mulligan, 2015): fuelwood, non-wood forest products, clean water provision, carbon and natural hazard mitigation

Methods



Schroth et al, 2016)

Projected deforestation to 2050

Pressures

- Proxy for likelihood of current cocoa cultivation and risk of expansion: climatic suitability for cocoa, current and in 2050 (Schroth et al, 2016)
- Modelled potential cocoa-driven deforestation : rule-based land use change model (QUICKLUC 2.0, Mulligan, 2015).
- Deforestation rates from Terra-I (Reymondin et al., 2012): 2010- 2017 projected forward to 2050 within areas currently suitable for cocoa
- Modelling land use change assuming a full sun system replacing forest

=> bivariate maps to visualise the geographic relationship between variables