Coffee Processing and Clean Energy Management in a Protected Forest in Ethiopia

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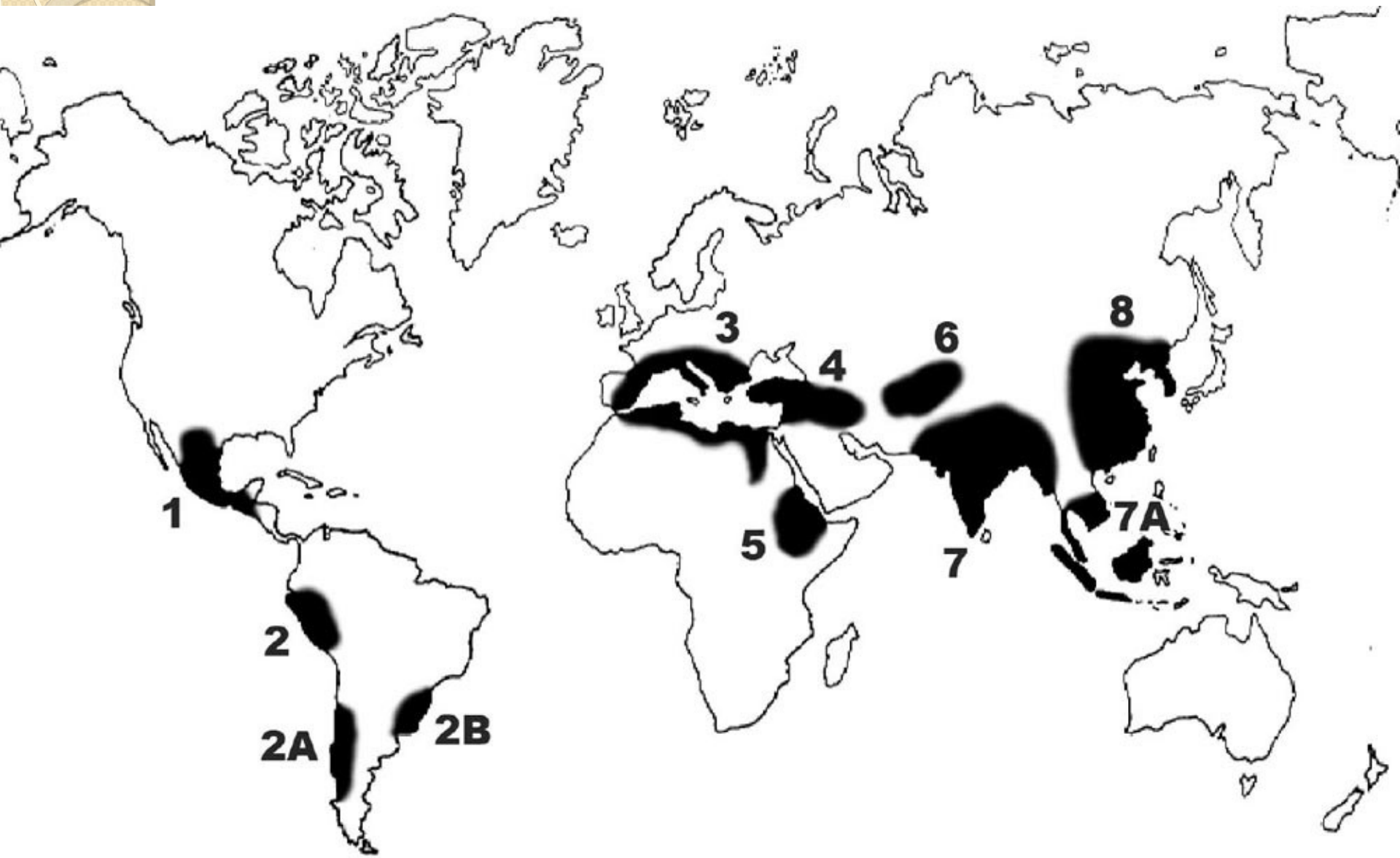
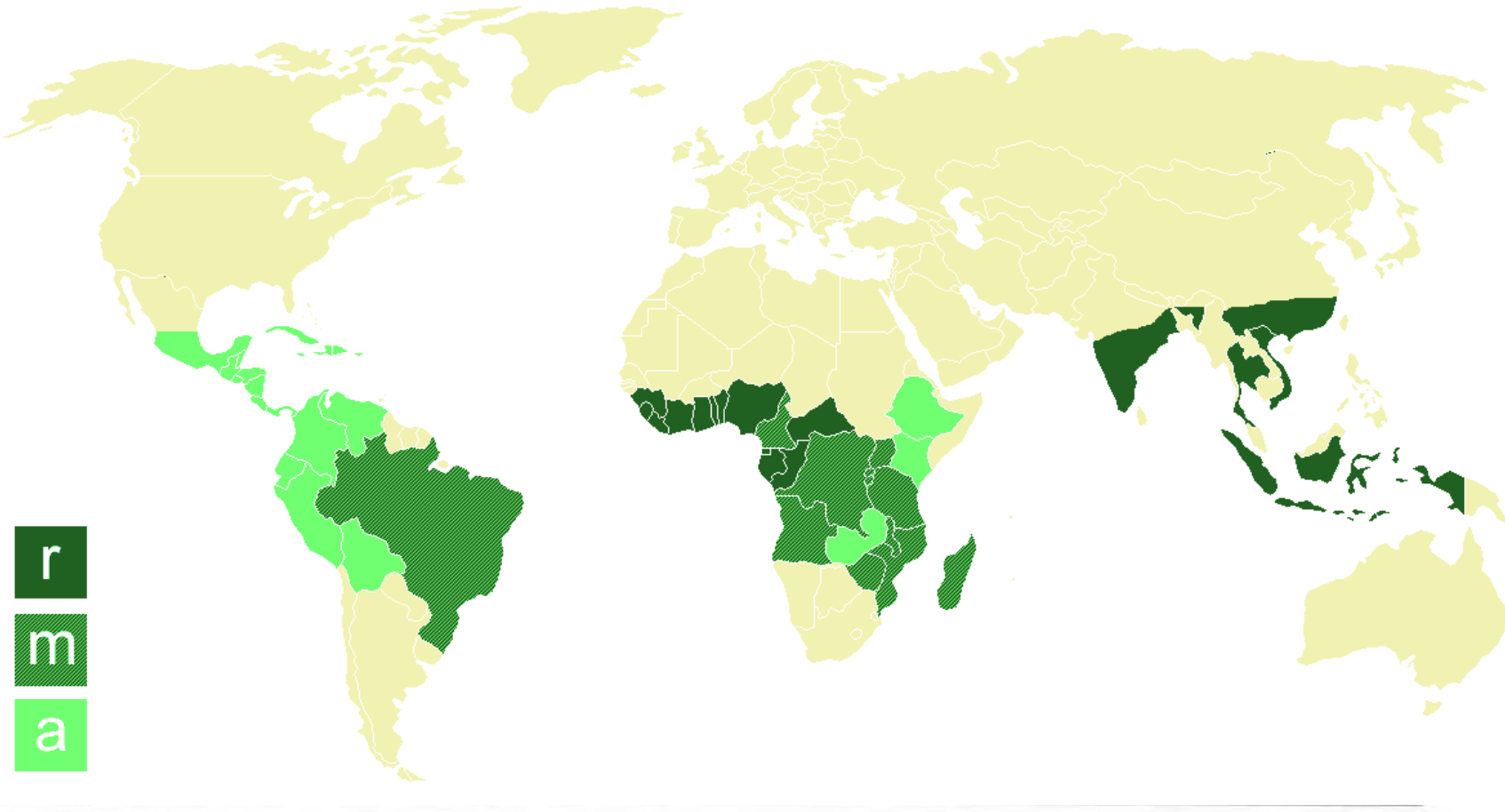
Background

- **Ethiopia** – landlocked country in the Horn of Africa
- Has the 2nd highest population in Africa- ca. 84 million, 85% rural engaged in agriculture
- It has diverse agro-ecology, ranging from the lowest and hottest place on Earth to humid alpine habitats on the highlands
- **Yayu Biosphere Reserve area (2010)**
  - A protected forest area, covers 6 districts
  - How and why it become a PA?

Ethiopia: a center of crop origin



Coffee: origin and distribution



Afromontane rainforests of Ethiopia: home of wild coffee = coffee forests

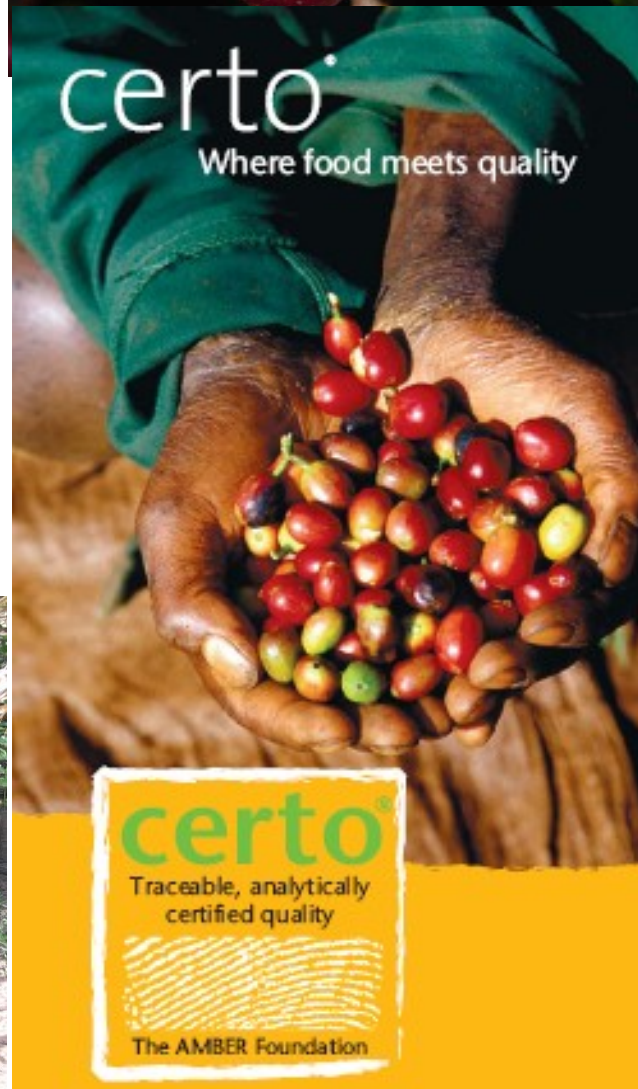
Coffee forest are important for Biodiversity conservation

Coffee forest are important for Biodiversity conservation…

- Part of the Eastern Afromontane Biodiversity Hotspot
  - Characterized by exceptional levels of plant endemism and by serious levels of habitat loss.

Socio-Economic Importance

- Coffee
  - 75% of HH cash income
  - 35% of foreign currency earnings
  - 25% employment
  - Deep-rooted coffee culture-social value

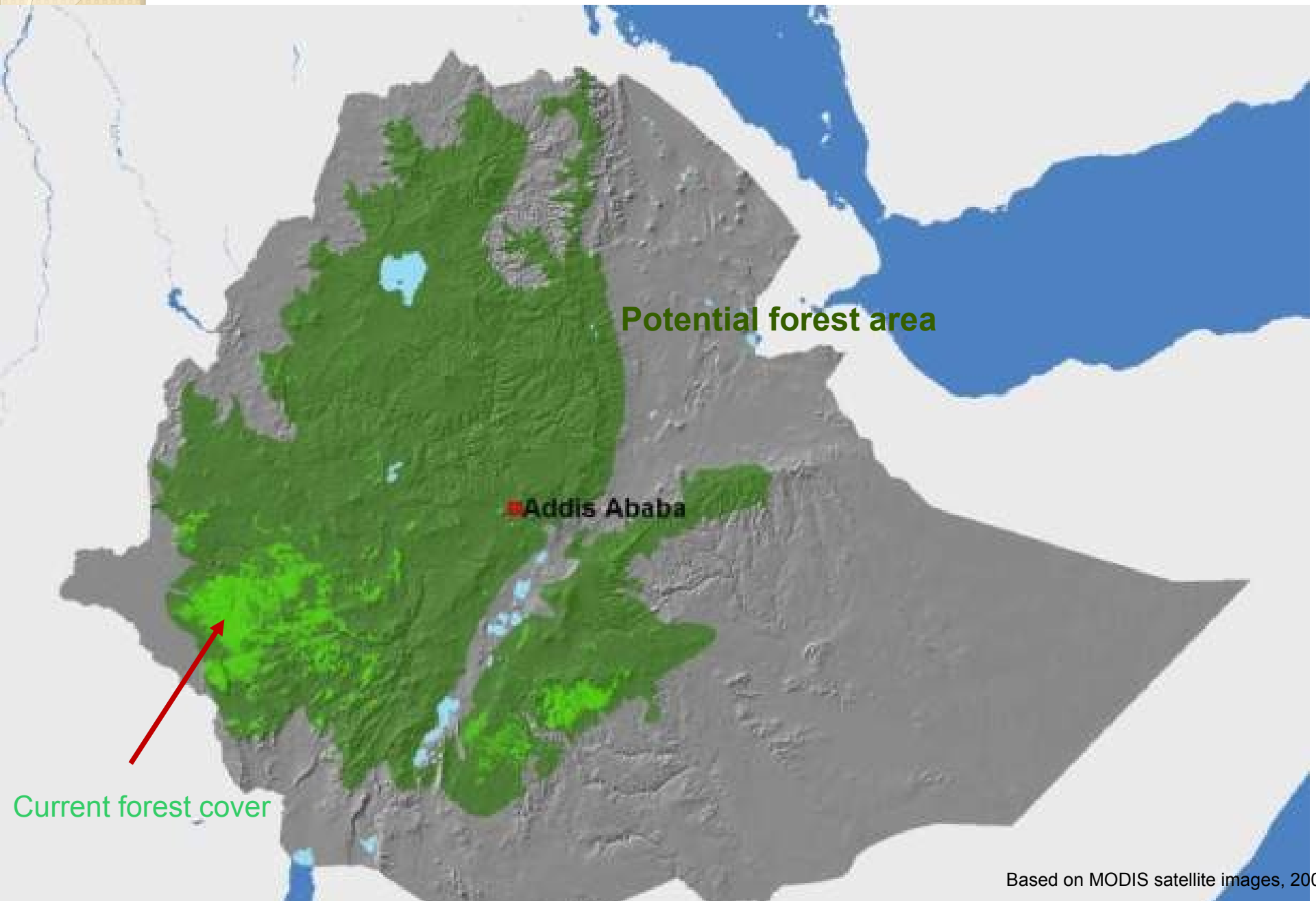


Threats on coffee forests

- Major threats are
  - Deforestation- conversion to farm land
  - Forest degradation- for coffee production
  - Loss of wild populations and local land races

- Over the past 30 years, 60% forest lost

Forest Cover: past and present



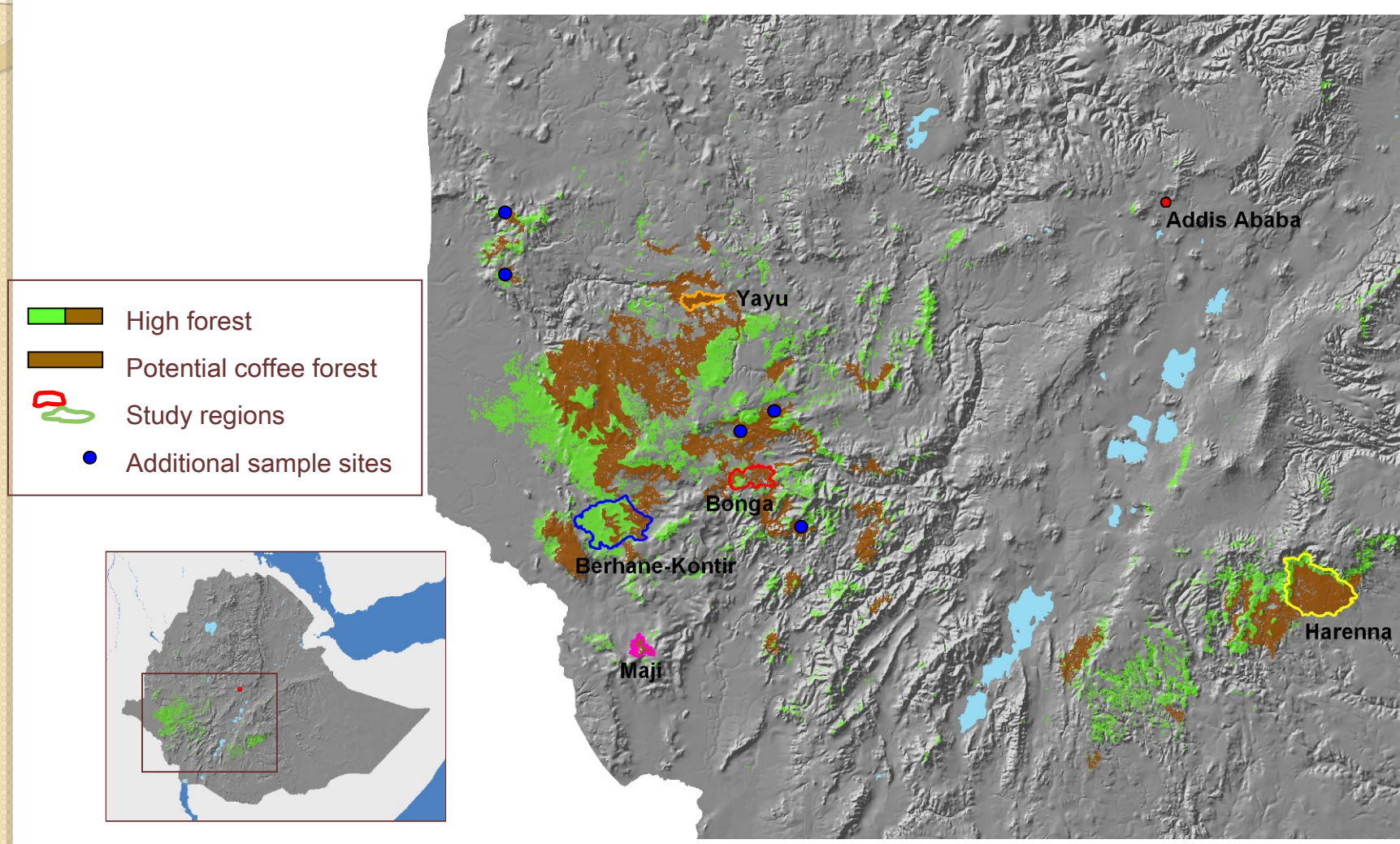
Based on MODIS satellite images, 200

Research on conservation & use of the wild populations of coffee in Ethiopia

CoCE Project:

- Interdisciplinary research 2002-2009, six components
  1. Floristic diversity and forest atlas
  2. Coffee genetic diversity
  3. Functional diversity- A-drought tolerance
  4. Functional diversity-B-disease and pest
  5. Economic value- forest & coffee genes
  6. Institutional arrangement

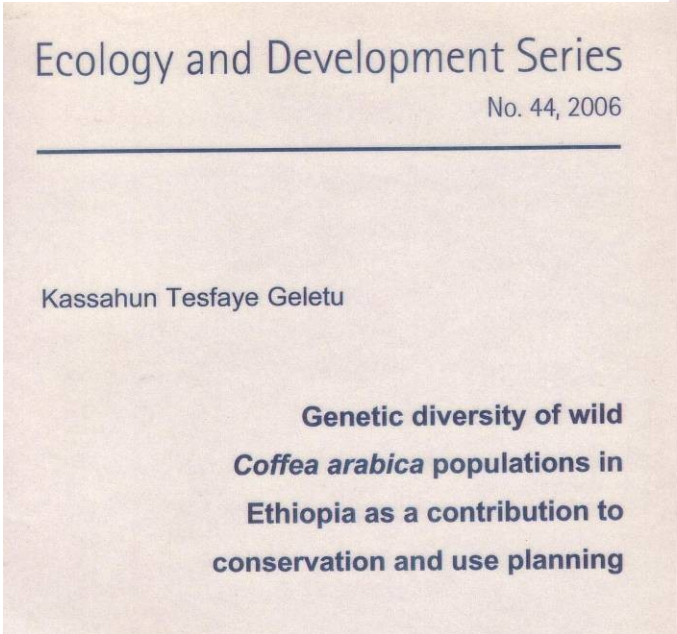
Coffee forest areas

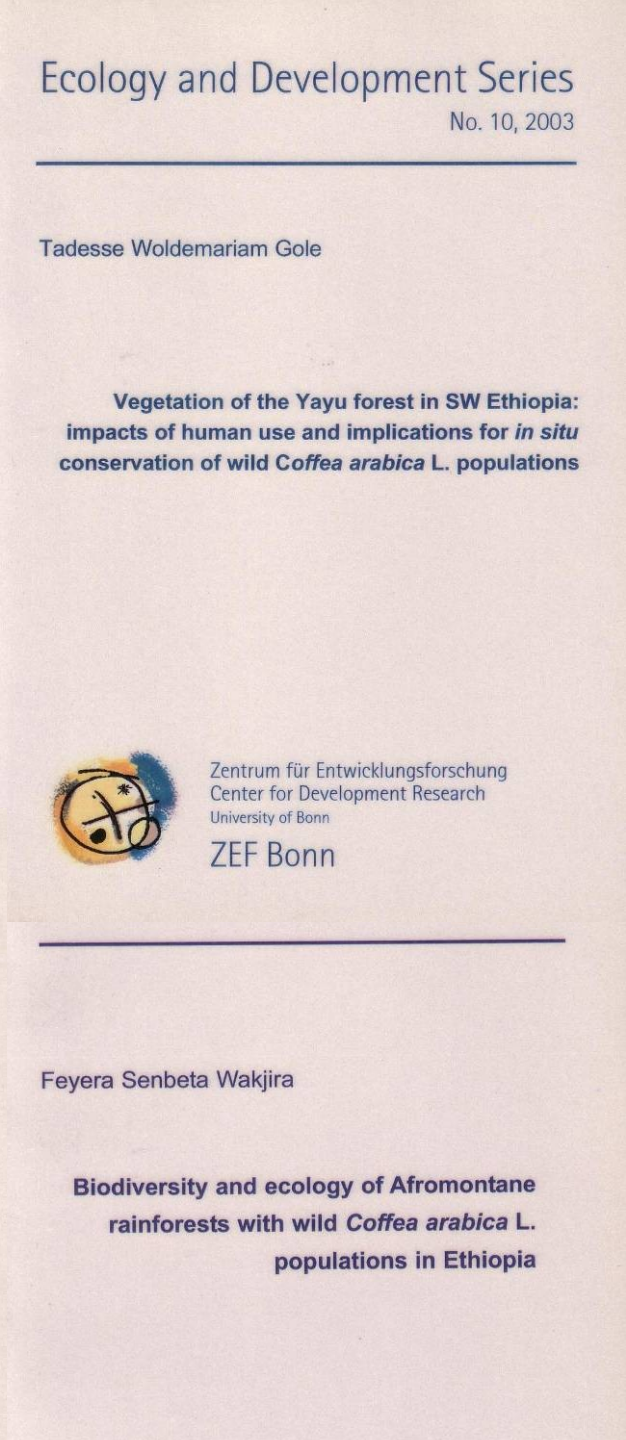


Researchers at work

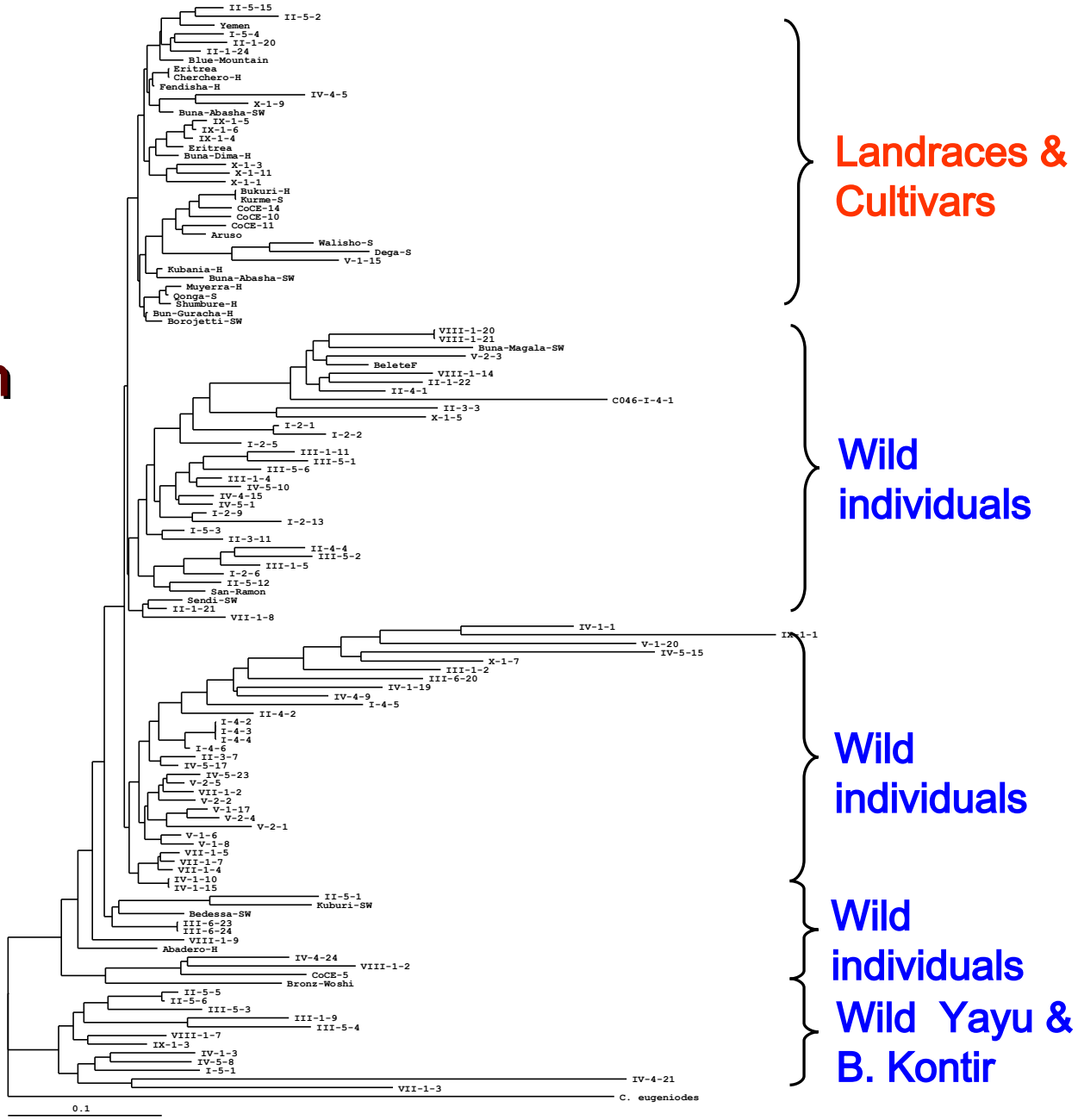
Findings

- High genetic variabilíty
- High species diversity
- Differences between different coffee forests interms of diversity
- Value of coffee gene:US$ 0.5-1.5 B
- Need for networks of conservation sites





Landraces & Cultivars different from Wild individuals



INTER REGIONAL

UNESCO Biosphere Reserve as option for sustainable management

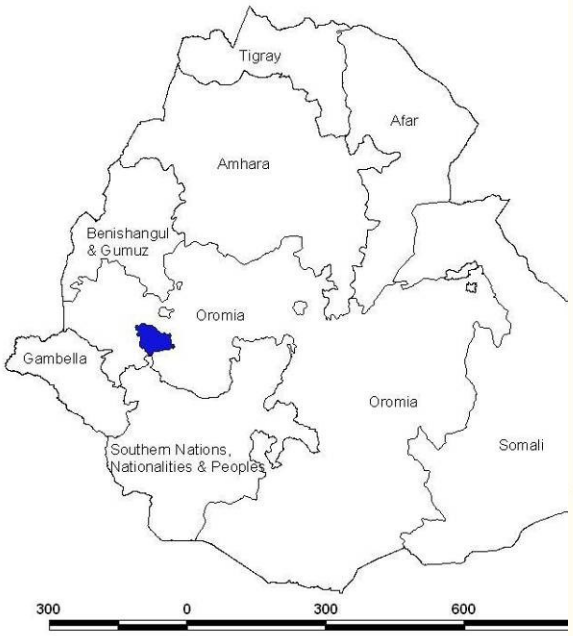
- Yayu Coffee Forest as model site
- Nomination process began in 2006
- Submitted to UNESCO in 2009
- UNESCO MAB's ICC approved in June 2010
- Management guidelines

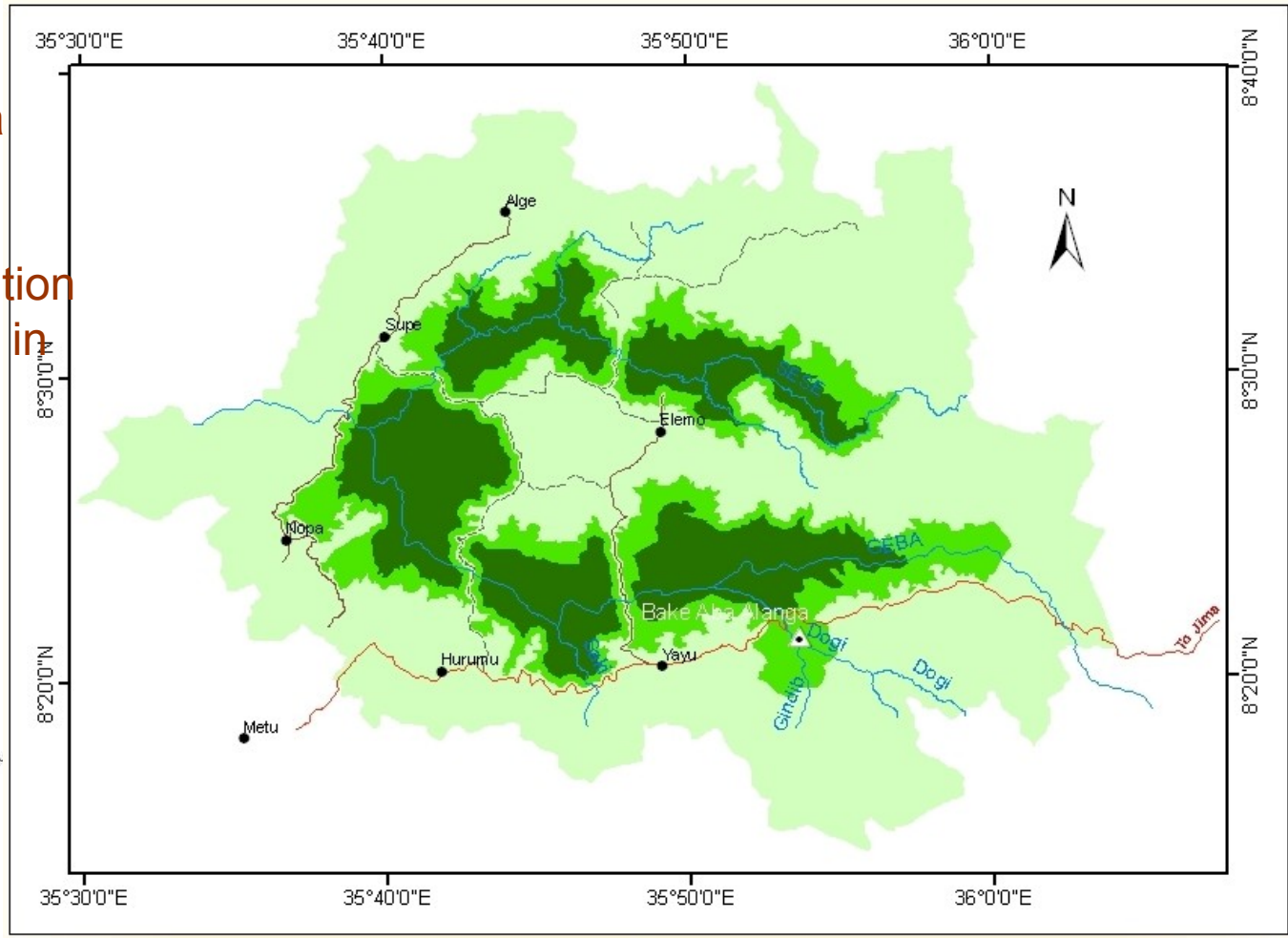
Protected forest with sustainable use concept:

Yayu Coffee Forest Biosphere Reserve

Ca. 170,000 Ha
- 28,000 core
- 22,000 buffer
- 120,000 transition

155,000 people in transition area





UNESCO Biosphere Reserve since 06/2010

Integrated sustainable development strategies for Yayu area

- Conservation Education and Research Center
  - To generate and disseminate knowledge on different aspects sustainable development
- Improved coffee production, processing
- Improved honey production, processing
- Fruits production, processing
- Value addition and marketing of local products
- Clean water supply and Small scale irrigation

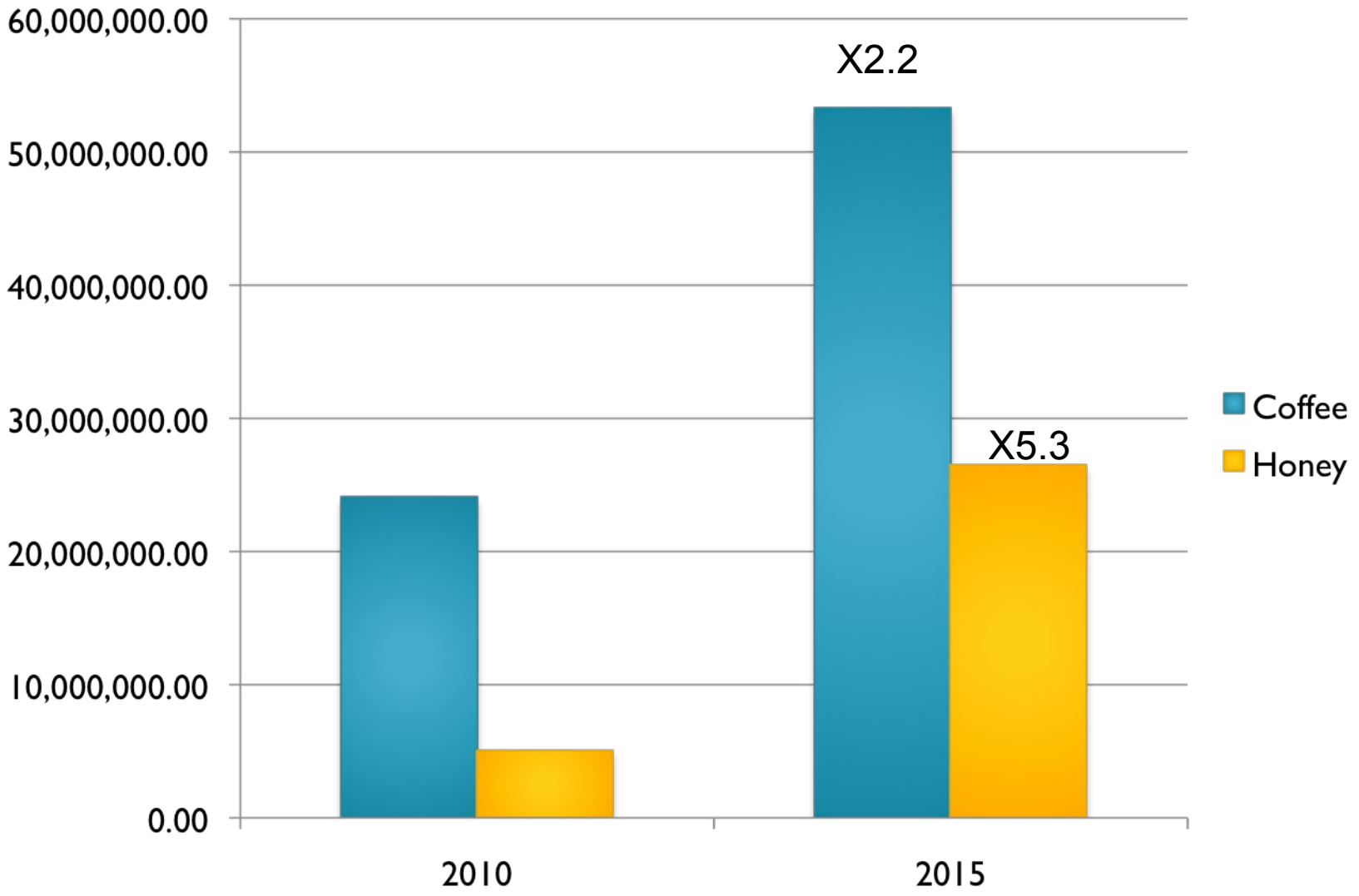
Coffee: production, processing


Pure Organic Honey
AMAR
Quality
Pure Organic Honey
AMAR

Value addition: processing & packing

DARARA Buna

Coffee and Honey Revenue



REDD+: Conservation+finance

- REDD+: **R**educed **E**mission from **D**eforestation and forest **D**egardation in developing countries

  i. REDD+ Project feasibility finalized

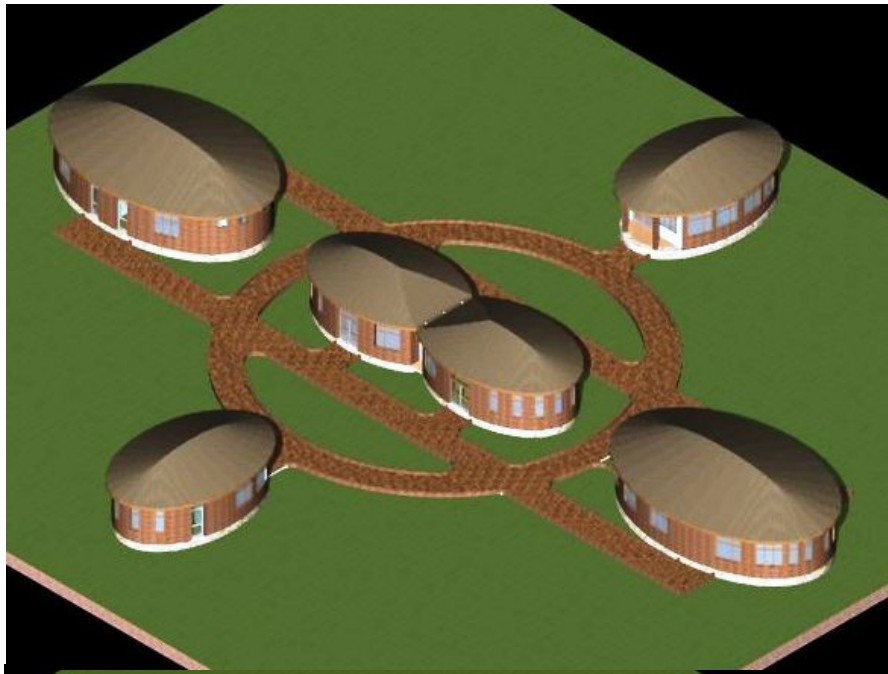
  ii. REDD+ PDD under development with a GEF fund

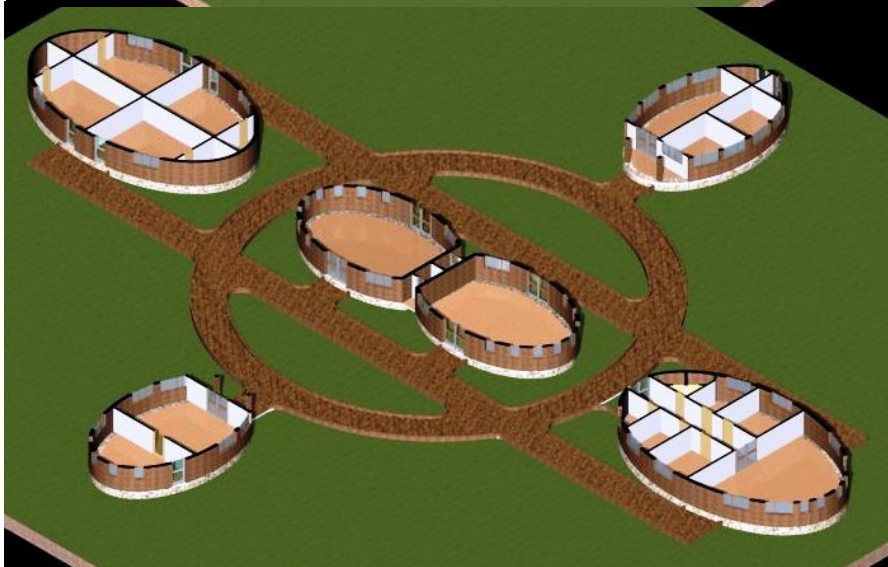
Benefits: If sold, it can generate a minimum net income of ca. $2.3 million per year from Yayu = sustainable finance for conservation, community development project

REDD+ Carbon Revenue- SW Oromia

	Area (ha)	*Expected VERs (tCO2)*	*Expected Flow (US$ in 20 yrs)*	*Expected Annual Income (US$)*
Yayu Coffee Forest BR	**85,837**	**9,316,872**	**46,584,358**	**2,329,218**
Illubabor Zone	**134,520**	**14,600,995**	**73,064,973**	**3,650,249**
Wollega & Jimma Zones	**322,205**	**34,972,595**	**174,862,973**	**8,743,149**
SW Oromiya Total	**542,562**	**58,890,461**	**294,452,304**	**14,722,615**

Layout of planned education and research center





Energy Sector in Ethiopia

- Ethiopia has enormous energy resources like biomass, hydro, wind, and geothermal
- Its potential for hydropower is 2nd only to Congo DRC in Africa
- However, we are far from using these potentials effectively and efficiently
- Use of modern energy sources is very low
  - 94% from traditional sources: fuelwood, animal dung, agricultural residue
  - 6% Modern sources: electricity, petroleum
- Electricity access- EEPCo reports 20%

Potential Renewable Energy Sourcse in Yayu

The major potential renewable energy sources in the area are

- Biomass based energy
  - energy from coffee waste
- Solar Energy
- Hydropower

Coffee waste

- Annual Coffee production in Ethiopia is about 240,000 green coffee
- This generates equal amount of waste (husk)
- In Yayu alone, over 20,000 tonnes of coffee waste is produced annually, and all not used
- Alternative uses for coffee husks include employing this solid residue as a supplement for **animal feed**, direct use as **fuel**, fermentation for the production of a diversity of products (**enzymes, citric acid** and **flavoring substances**), use as a substrate for growth of **mushrooms** and use as adsorbents

Coffee waste pile in Yayu

Energy from coffee waste/ husk

- Briquettes/ charcoal
- Ethanol
- Biogas
- Biodiesel

Briquette / Charcoal

Briquettes/ charcoal from husk

- On average, the percentage of charcoal produced by the carbonization of the coffee husk was 25.65% ± 0.495 (Debela 2010)
- In Yayu area alone, over 5,100 tonnes of briquettes can be produced
- Heating value of agglomerated briquette is about 5318.45 cal/g, while that of beehive briquette is 4033.3 cal/g
- This is comparable to charcoal from wood like prosopis, chat, …
- And hence has a great potential for local energy and generating cash income- supply to cement industry

Ethanol and Biogas

- Ethanol yield: 8.49±0.29 g/100 g dry basis, and hence has excellent potential
- Biogas outputs:

Digester	Volume of biogas (ml)	Volume of methane (ml)	% methane
A	575.5±15.69	304.91± 16.83	52.98
B	638.1±19.94	373.5 ±1.84	***58.53***
C	496.6±4.24	262.2	52.80
D	538.6±143.7	249.2±82.89	46.23

Solar Energy

- **Being in the tropic, there is high potential for solar energy**
  - We often say13 months of sunshine
- **There is high potential for rural elecrification**
- **In many parts of Ethiopia, there are initiatives to use solar energy**
  - For light- HH, schools, ….
  - Health centers, vet health posts
  - Pumping water
  - Telecommunication- esp. mobile network towers
- **It is not used in Yayu area up to now**

Hydropower

- Ethiopia is a mountainous country, with several rivers and streams
- Seasonal, but high rainfall in the highlands- often considered as the water tower of northeastern Africa
- Southwestern Ethiopia, including Yayu- has high potential for hydropower
- Five major rivers, including Geba
  - Plan to build 300 MW on Geba
  - Several possibilities for small hydropower stations on other rivers and streams

Knock-on effects of energy development

- Energy can have several +ve effects, like
  - Reduced pollution of water systems and air by coffee waste
  - Health benefits- reduced in-door pollution
  - Improved productivity, product quality and income
    - Coffee processing, packing
    - Fruits production, processing, packaging, storage
    - Small and micro-industries development
    - Job creation
  - Clean water supply
  - Access to modern technologies for schools
  - Access to information and market

Our partners

- Oromia State Agencies
  - OFWE, BoA, BoLEP
- Federal Government Agencies
  - MoA, MoST, IBC, EIAR, Univer.
- ZEF Bonn, Kew Gardens
- Oromia Coffee Coop Union / Rainforest A
- Federal Ministry for Education and Research- BMBF
- Volkswagen Foundation
- Federal Agency for Nature Co.
- Ernesto Illy Foundation/illycaffe´


Thank You