

Cocoa Agroforestry

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CATIE, Turrialba, Costa Rica
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Cacao is grown together with other useful plants, including fruit, timber trees, annual and perennial crops.

Companion plants provide “shade” to the cocoa trees. “Shade” includes light attenuation, changes in wind speed, air humidity, UV, etc.

Companion plants + cocoa trees = Shade canopies.

Some shade canopies are rich in plant and animal species and structurally complex (vertical, horizontal and temporal stratification).

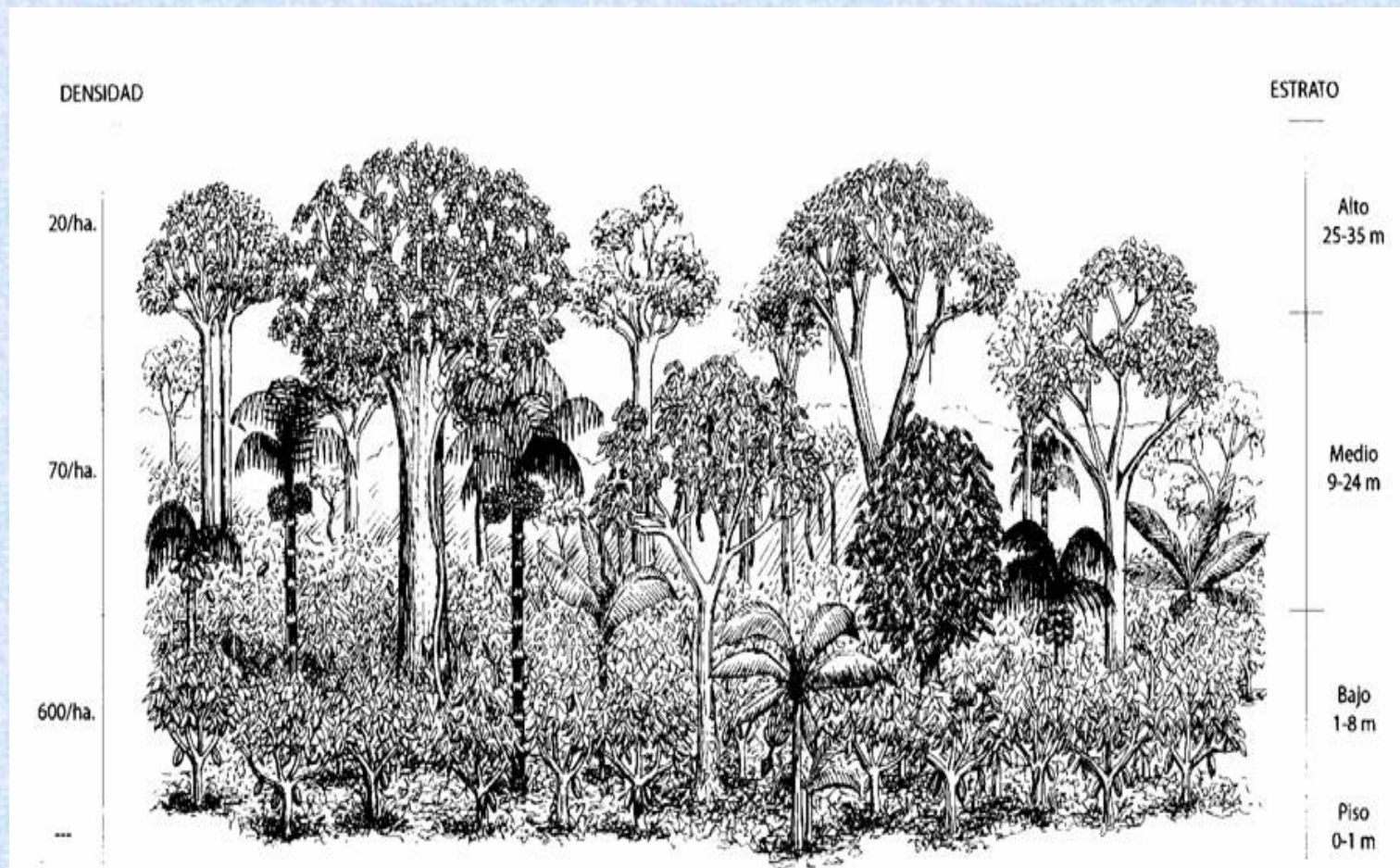


Figura 1. Doseles cacaoteros.

Most shade canopies are very simple in both plant species richness and structural complexity. Easy management.



Farmers retain or plant trees and other useful plants in the cocoa farm to:

Generate early returns by intercropping young cocoa with annual crops (cocoyam, cassava, yam, maize, melon, cowpea, pineapple, and many more crop species).

Foto: Lopped off cocoa trees to mulch yams at times of low cocoa prices and low yields due to monilia. Panama, 2004.



Increase and diversify income by intercropping cocoa with perennial crops (coconuts, kola, oilpalm, rubber, “plantains”, and many other crop species). Improve farm financial status.



Dubón and Sanchez, FHIA, Honduras, 2006

	Gross revenues (US\$, 14 years)			
System	Cacao	Fruit	Timber	Total
Cacao + shade only	8377	-	-	8377
Cacao + laurel (timber)	7180	-	12057	19238
Cacao + Cedro (timber)	9298	-	18037	27335
Cacao + Rambutan	8722	15176	-	23899

Timber trees in cocoa farms: a saving account, a safenet to cope with unexpected family needs, adding value to property.

Timber harvested from cocoa farms when monilia depressed cocoa yields and cocoa prices were very low. *Cordia alliodora*, Siquirres, Costa Rica, 1985.



Proper shade canopies to favour growth and yield of the cacao trees, and to reduce losses by pests and diseases.



Crowns vary in height, width, leafing and branching patterns

Manipulate tree crowns, tree density and select proper species to regulate shade.

Conserve plant biodiversity. Rolim & Chiarello. 2004. Biodiversity Conservation 13:2679-2694.

Cocoa retain 50% tree species.
Many tree species in cocoa are planted or secondary species of little conservation value. Climax species does not regenerate properly in cocoa farms. Native forest needed in cocoa landscapes

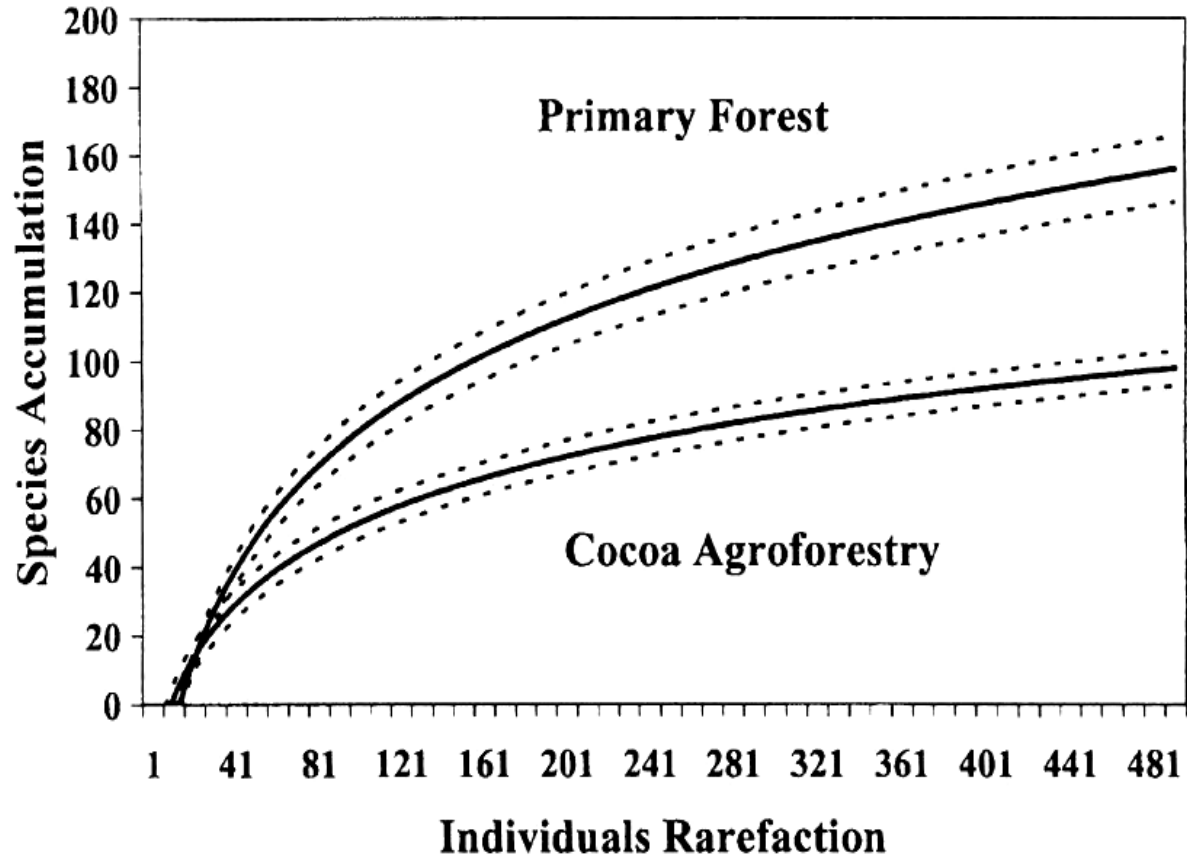


Figure 3. Expected number of species in cocoa agroforestry in Rio Doce and in primary forest (Vale do Rio Doce Forest Reserve, see Figure 1). Individual rarefaction curves (solid lines curve) and confidence intervals computed with 95% (broken lines curve).

Key findings in Talamanca, Costa Rica

- Cocoa agroforestry systems have similar (and sometimes higher!) species richness of bats and birds as forest habitats
- Species composition of cocoa agroforestry systems differs from forests
 - Loss of bird and bat forest dependent species
 - Under-storey insectivorous birds are missing
- Cocoa agroforestry systems have much greater conservation value than non-agroforestry land uses (e.g. plantains)
- Cocoa agroforestry systems with greater tree diversity and density conserve more birds and bat species than those with simple canopies

Tree density and growth can be enhanced in cocoa farms to capture and store atmospheric C in wood without adversely affecting cocoa yields.

System	Mean carbon storage (tC/ha)	Mean fixation rate (tC/ha/year)
Fallows (natural regeneration)	50	6,5
Trees on crop plantations		
Cocoa low C level	30	0,9
Cocoa medium C level	60	1,1
Cocoa high C level	90	1,3
Banana	20	1,5
Plantain	8	0,5
Grasslands	10	0,8
Riparian forests	70	0,1

Global society is now aware (and worried!) of climate change

Positive proof of global warming.



**18th
Century**

1900

1950

1970

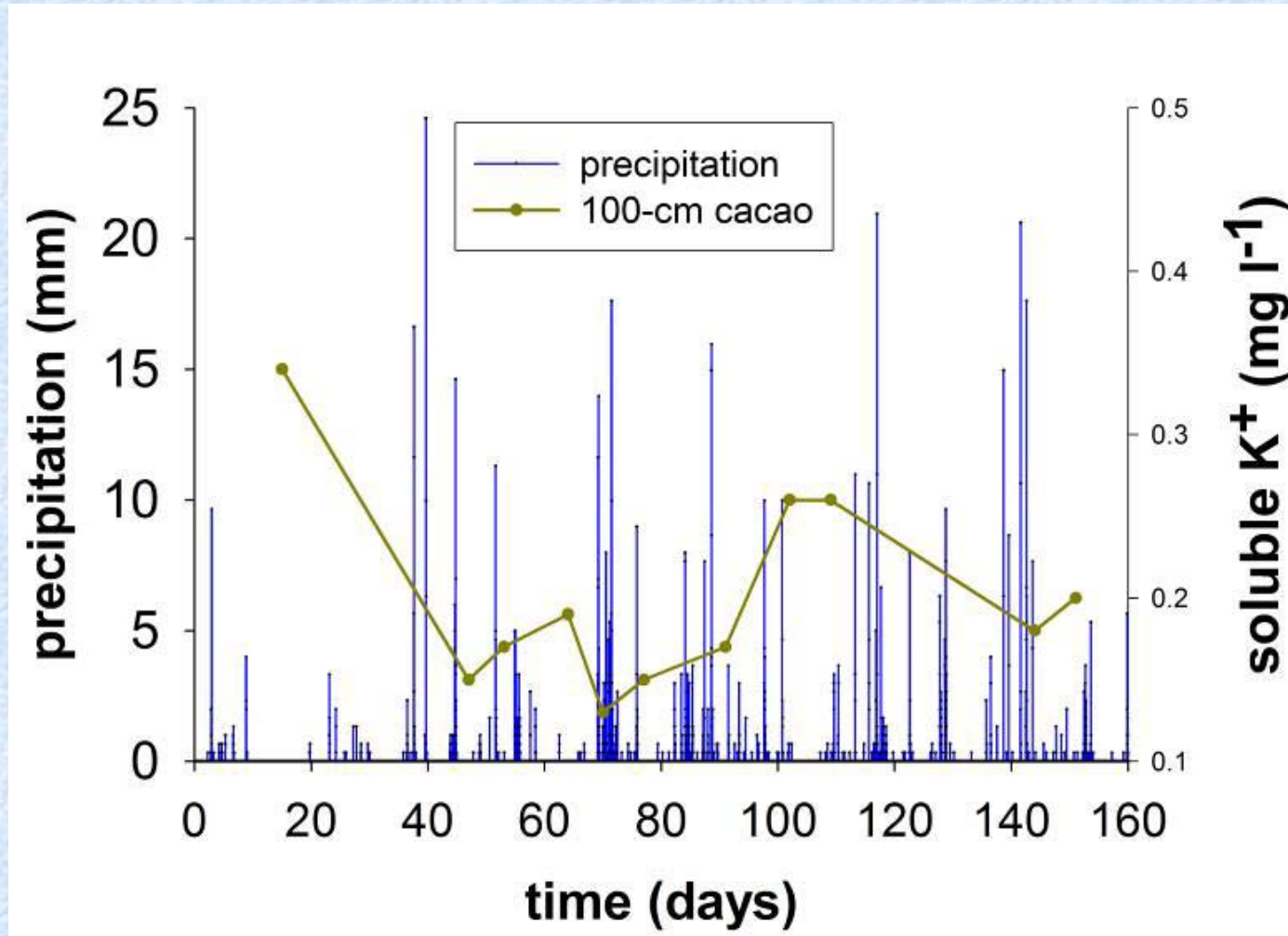
1980

1990

Trees in cocoa farms help to conserve soil

- Good soil cover (1-4 t ha⁻¹ of litter), little erosion (11 t ha⁻¹ y⁻¹).
- Large stocks of nutrients in soil and biomass.
- Large transfer of nutrients to the soil (litterfall 10±4 t ha⁻¹ y⁻¹) supports cocoa yields
- Soil nutrients decrease over time in cocoa plantations

Leaching of base cations (Ca^{2+} , Mg^{2+} , K^+) is low, cacao agroforestry systems, Talamanca, Costa Rica.



Cocoa agroforestry holds great promise to cocoa farms. However, most shade canopies have:

- Excessive or deficient shade
- Un-even spatial distribution of shade cover
- Sub-optimal botanical composition mismatch farmer's goals



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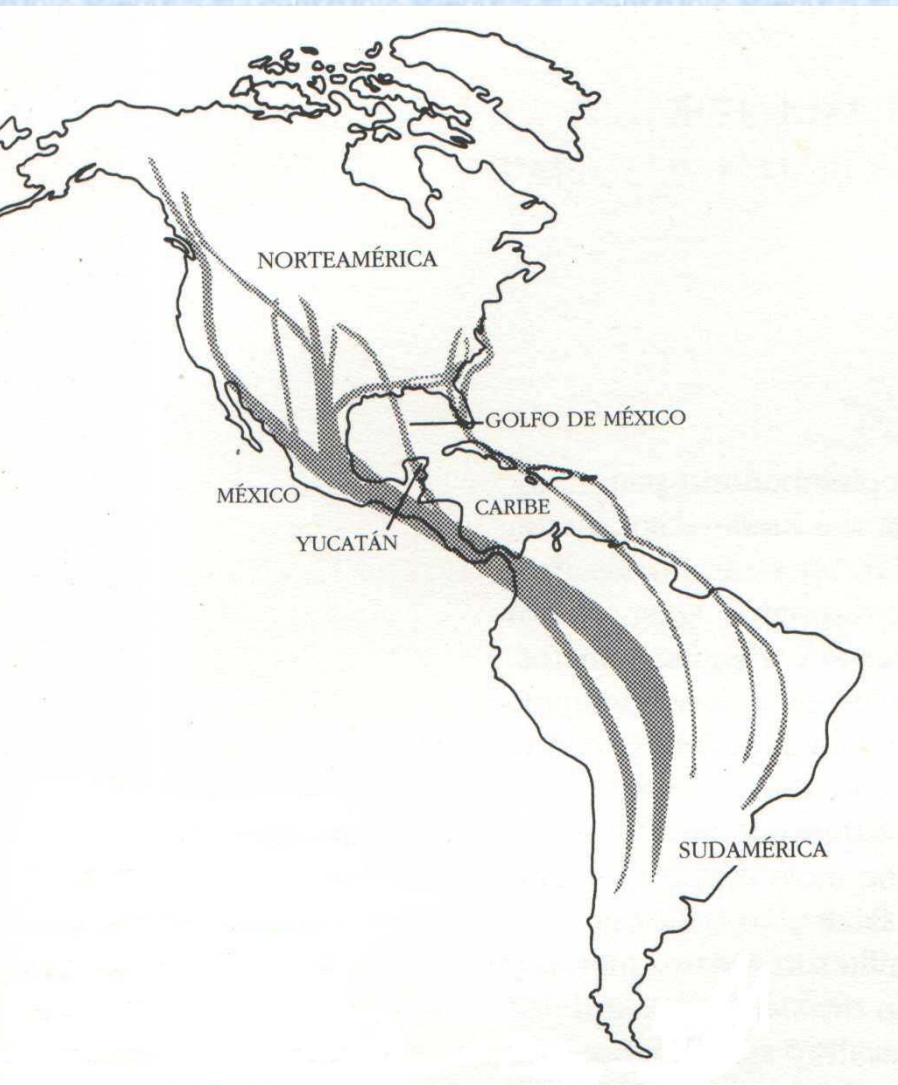
What to do?.
Consolidate
agroforestry
science and
technology in
the cocoa sector.

Fund
INAFORESTA!

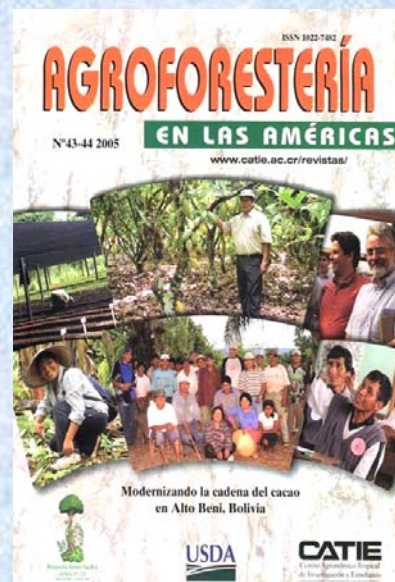
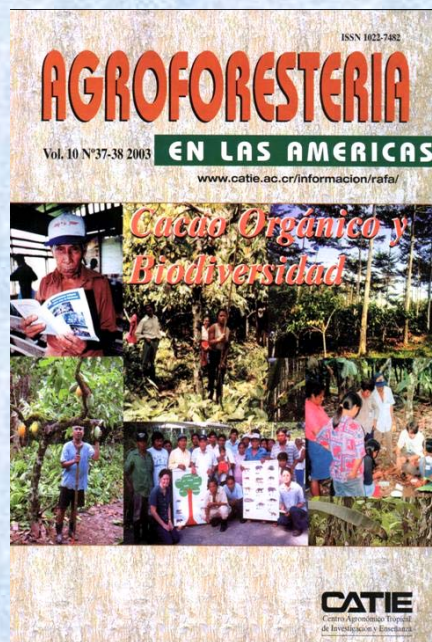
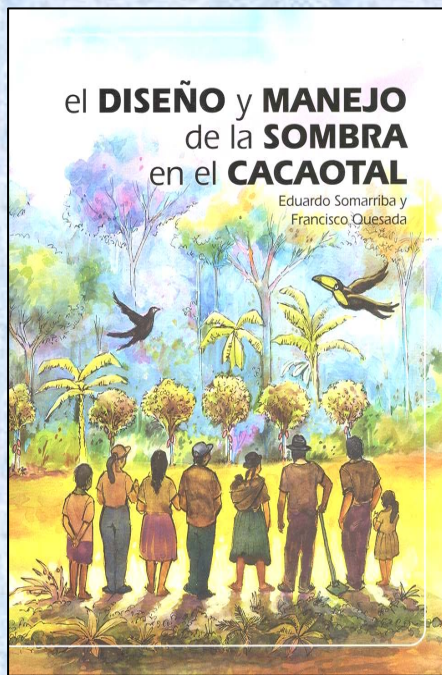
What to do?. Incorporate agroforestry in R&D cocoa projects. Cocoa Agroforestry in Farmer Field Schools curricula.



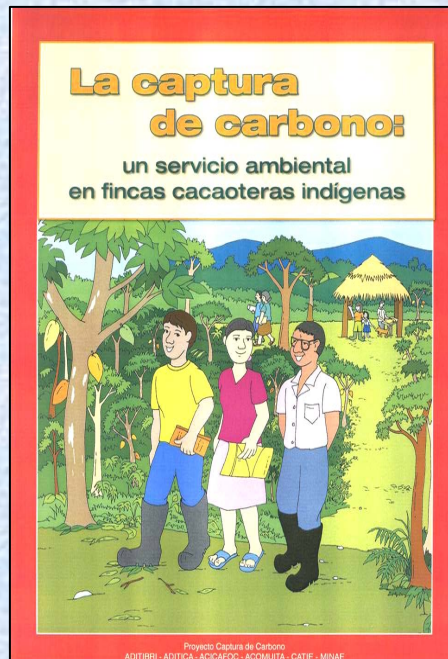
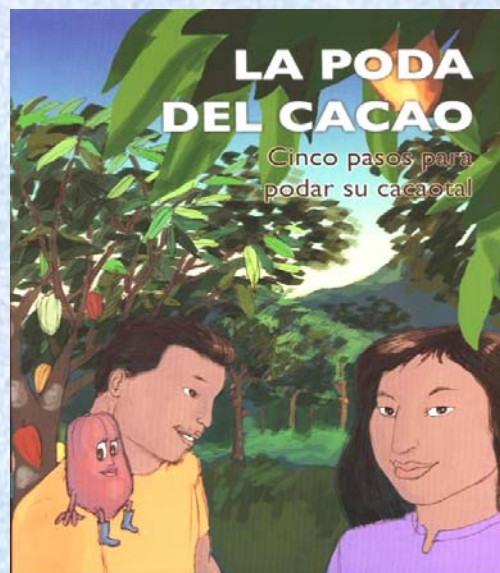
What to do?. Fund cocoa AF research.



- Shade, cocoa productivity, diversification, households, finances.
- Conservation of nutrients water, and biodiversity; maintain climax tree species; cocoa landscapes
- Tree planting in cocoa to store and sell C; make it work.



What to do?. Publish more and exchange information worldwide.
INAFORESTA bibliographic database.



What to do?.
Multi-product
approach to
sustainable cocoa
farming, processing
and marketing.

Improve policy and
legislation to
promote tree
planting and
utilization in cocoa
(e.g. national
forestry laws)



Agroforestry is an un-realized potential in sustainable cocoa development.

We have a lot to do!

Thank you

