



INTERNATIONAL COFFEE ORGANIZATION  
ORGANIZACIÓN INTERNACIONAL DEL CAFÉ  
ORGANIZAÇÃO INTERNACIONAL DO CAFÉ  
ORGANISATION INTERNATIONALE DU CAFÉ

PJ 3/11

10 February 2011  
Original: Spanish

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Projects Committee  
1<sup>st</sup> Meeting  
30 March 2011  
London, United Kingdom

**Adaptation to climate change  
in the PROMECAFE region**

## **Background**

This document, submitted by PROMECAFE, contains the summary of a new project proposal designed to study the implications of climate change for coffee productivity and quality in the coffee producing regions of Central America and the Caribbean, as well as to provide some idea as to where high-quality coffee is likely to grow in the future and the extent to which the suitability of these areas is likely to change over a given period.

## **Action**

The Projects Committee is requested to consider this proposal as well as the recommendations of the Virtual Screening Committee (VSC) and, if appropriate, to recommend its approval by the Council.

## PROJECT SUMMARY

1. **Project title:** Adaptation to climate change in the PROMECAFE region
2. **Duration:** 3 years
3. **Location:** Central America and the Caribbean
4. **Nature of Project:** To carry out a study of the effects of climate change on coffee productivity and quality in the coffee producing regions of Central America and the Caribbean, as well as to provide some idea as to where high-quality coffee is likely to grow in the future and the extent to which the suitability of these areas is likely to change over a given period.
5. **Estimated total cost:** US\$600,000
6. **Financing sought from the Fund:** US\$300,000
7. **Counterpart contribution:** US\$300,000 (contribution in kind)  
Coffee Institutions Associated to PROMECAFE
8. **Project Executing Agency (PEA):** International Center for Tropical Agriculture (CIAT)
9. **Supervisory body:** International Coffee Organization (ICO)
10. **Estimated starting date:** Pending

## **Introduction**

1. All climate models show that the climate is changing and will continue to change. The global circulation models (GCMs) used by scientists to make predictions on the nature and index of climate change indicate that temperatures will rise and that there will be radical changes in precipitation patterns. The implications for coffee growing communities in Meso-America are generally very serious.

2. Coffee growing is highly vulnerable to climate change and this change is likely to bring socio-economic and environmental challenges as a result of changes in crop adaptability. This means that it is essential to identify and develop adaptation strategies applicable from farm level to national level.

3. In order to develop these adaptation strategies it is important to understand the decisive factors involved in change. Climate change models predict that in the near future coffee growing will lose its adaptability due to factors related to lower precipitation and temperature increases.

4. For coffee production in general it is essential to have a clear understanding of probable impacts and to develop adaptation strategies that make it possible to understand the implications of climate change for coffee productivity and quality in coffee-producing regions as well as to provide some idea as to where high-quality coffee is likely to grow in the future and the extent to which the suitability of these areas is likely to change over a certain period. Coffee institutions also need to know how soil use patterns are likely to change in order to plan their research and make suitable investments, ensuring that producers find sustainable and competitive options for the future.

5. The subject of climate change will have growing importance in the institutional and political context. It is high on the Central American agenda and has been incorporated into the main regional policies and strategies.

## **Other Participating Institutions**

- Anacafé, Guatemala
- PROCAFE Foundation, El Salvador
- IHCAFE, Honduras
- ICAFE, Costa Rica
- MIDA, Panama
- Coffee Industry Board of Jamaica
- CODOCAFE, Dominican Republic

### **Project objectives**

6. To examine the effects of climate change on coffee productivity and quality in the coffee producing regions of Central America and the Caribbean, as well as to predict where high-quality coffee is likely to grow in the future, and the extent to which the suitability of these areas is likely to change by the year 2050.

7. Many of the data needed for this analysis are already available in coffee-producing organizations and were used in projects on Designation of Origin and Identification of Environmental Niches for high-quality coffee. CIAT was able to use existing data to carry out spatial analyses and simulate prediction models to design climate change adaptation strategies. The specific data needed are geographical coordinates (georeferentiation) of coffee farms, cupping data (sensory attributes) defining the cup quality of the coffee, the final cupping score, environmental and terrain databases, socio-economic databases or surveys of coffee producers.

### **Expected results**

- Climate change data generated by each country
- Technical personnel of national organizations trained in databases and the use of Geographic Information System (SIG) tools for coffee and alternative crops
- Predictions of current and future adaptability of coffee-producing regions
- High-quality coffee environmental niches identified
- Interactions of sensory attributes of coffee and climatic variables determined
- Alternative crops identified and production systems adapted to current and future climate change conditions
- Socio-economic impacts of climate change quantified in regions with contrasting conditions
- Adaptation strategies designed for specific locations
- On-line information for coffee farms to obtain feedback on climate change strategies.

### **Related projects and previous work**

8. CIAT is part of the Consultative Group on International Agricultural Research (CGIAR), comprising a consortium of countries, regional and international organizations and private foundations which support a world network of research centres. In its work, CIAT collaborates with many entities ranging from farmers to farmers organizations, indigenous communities, grassroots organizations, national agricultural research systems, non-governmental organizations, universities, the private sector and development projects.

## **Project components**

**Component 1: Generate short- and long-term climate change data and different scenarios for greenhouse gas emissions.**

### **Objective**

9. To generate climatic data predicted under different scenarios for each decade from 2020 to 2050 for each country in the Meso-American region.

### **Results**

- Climate change data generated for each country. It is proposed to use the 18 most representative models from the evaluation report of the Intergovernmental Panel on Climate Change (IPCC) held in 2007, using a process of downscaling of the GCMs to resolutions of 0.5 arco-minutes (approximately 1km) for each decade to 2050, and monthly WorldClim variables (precipitation, average, minimum and maximum temperatures) and scenario A2a ('business as usual') as the base line.

### **Activities**

- (a) Climate change data generated by mathematical models of the general circulation of a planetary atmosphere or ocean (GCMs), on the basis of equations used to carry out complex calculations in computer programmes commonly used for weather forecasting, understanding the climate and projecting climate change.
- (b) Evaluation of similitude levels of different models and variation coefficient between the models. The data generated can be used by institutions for their research work and projects.
- (c) Standardization of data for each country.

### **Resources**

- Expert climate data processing personnel (3 experts for 9 months).
- Specialized hardware and software.
- Back-up material and dissemination of the information generated.

### **Timetable**

10. Activities related to generation of climate data will have a duration of 9 months from the start of the project.

## **Costs**

11. The estimated cost of the first component is US\$63,000. CIAT can contribute 50% of this cost in kind, including use of high capacity servers (hardware) and payment of qualified personnel to carry out data generation processes.

## **Component 2: Training and equipment for project sustainability**

### **Objective**

12. To strengthen local capacity in national institutions, enabling producers and technicians to make use of the information, to interpret the data generated and information management so as to fill gaps in individual and institutional knowledge and ensure project sustainability.

### **Results**

- Technical personnel of national organizations trained in use of databases and SIG tools for coffee and alternative crops.

### **Activities**

- (a) Preparation of work plans for training. Work plans can vary from country to country since progress made will probably differ.
- (b) Revision of infrastructure (hardware and software).
- (c) Analysis of existing human capacities.
- (d) Preparation of training manuals.
- (e) Organization of training workshops in the region.
- (f) Dissemination of technologies, methodologies and tools which prove successful for the region.

### **Resources**

- Two SIG experts with experience in training, coffee and climate change.
- One expert in design of adaptation strategies.
- Equipment: one computer per country with software and cartographic databases.

### **Timetable**

13. Duration of activities for training of technical personnel will be two semesters divided into two stages. The first stage will be between the 10<sup>th</sup> and 15<sup>th</sup> month from the start of the project. Training in database management and SIG applied to climate data will be undertaken during this stage.

14. The second stage will be carried out between the 28<sup>th</sup> and 33<sup>rd</sup> months from the start of the project. Design of adaptation strategies will be undertaken during this stage.

### **Costs**

15. The estimated cost of this component is US\$140,000. CIAT in collaboration with national institutions can contribute 50% in kind to cover payment of qualified personnel carrying out training activities and technicians involved in this training.

### **Component 3: Predicting future adaptability in coffee producing areas**

#### **Objective**

16. To estimate future distribution on the basis of predicted changes in climatic parameters.

#### **Results**

- Predictions of current and future adaptability in coffee producing areas.

#### **Activities**

- (a) Georeferentiation of coffee farms in each country.
- (b) Modelling of distribution and evaluation of environmental niches for coffee farms in Central America and the Caribbean. The results of global climate models will be used to predict the areas likely to be adversely affected by climate change in a given period and under different greenhouse gas (GHG) emissions scenarios.
- (c) Maximum entropy data will be used to determine the adaptability of the coffee crop to current and future environmental conditions. MAXENT and CaNaSTA software will be used for this purpose.

## **Resources**

- Two climate change and coffee quality experts.
- Two coffee cupping experts for each country.

## **Timetable**

17. These activities will be carried out during the first nine months of the project; this provision includes compilation of information on coffee quality.

## **Costs**

18. The estimated cost of this component is US\$70,000. CIAT in collaboration with national institutions can contribute 50% in kind, including payment of qualified personnel to carry out georeferenciación of coffee farms. In addition CIAT will contribute software and tools to predict the future behaviour of coffee in terms of production, response to coffee crop pests and diseases.

## **Component 4: Evaluate climate change impacts on coffee quality and production**

### **Objective**

19. To estimate the influence of climatic parameters on coffee quality and production.

### **Results**

- Environmental niches for high quality coffee identified.
- Interactions between sensory attributes of coffee and climate variables determined.

### **Activities**

- (a) Annual compilation of data on coffee productivity and quality of participating coffee farmers.
- (b) To understand the relationship between coffee productivity and quality and climatic factors.
- (c) To simulate the impact of future climate change on coffee productivity and quality.



## **Resources**

- Two climate change and coffee quality experts.
- Two coffee cupping experts for each country.

## **Timetable**

20. Distribution and evaluation models of environmental niches will be prepared between months 6 and 12. Evaluation of the impact of future climate change on coffee productivity and quality will be carried out between months 10 and 15.

## **Costs**

21. The estimated cost of this component is US\$70,000. CIAT in collaboration with national institutions can contribute 50% in kind, including provision of qualified personnel to carry out cupping activities. In addition, CIAT will contribute software and tools for predicting the future behaviour of coffee in terms of coffee production and quality in relation to climate.

## **Component 5: Identify alternative crops under different predicted climate change scenarios**

### **Objective**

22. To predict changes in the adaptability of the most valuable commodity crops under different progressive climate change scenarios.

### **Results**

- Alternative crops identified and production systems adapted to current and future climate change conditions.

### **Activities**

- (a) Compile databases of national and local institutions on both basic food crops and export crops, area planted and geographical location of crop production systems, pressure from pests and diseases.
- (b) Review determining factors (limiting and ideal factors) for producing at least ten selected crops.

- (c) Generate these factors for progressive climate change, taking into account GCMs and emissions scenarios.
- (d) Compare, evaluate and adapt different models for predicting crop adaptability based on algorithms such as Ecocrop and Maximum Entropy (MaxEnt).
- (e) Predict crop adaptability with progressive climate change for each year until 2050.

### **Resources**

- Two experts in climate change and alternative crops.

### **Timetable**

23. The component for identification of alternative crops will have a duration of 12 months, distributed between the 9<sup>th</sup> and 20<sup>th</sup> months.

### **Costs**

24. The estimated cost of this component is US\$56,000. CIAT in collaboration with national institutions can contribute 50% in kind, including provision of qualified personnel to carry out surveys and compile information from national censuses and public institutions. In addition, CIAT will contribute software and tools to predict future crop behaviour.

### **Component 6: Evaluate the implications of climate change in terms of socio-economic parameters.**

#### **Objective**

25. To evaluate the socio-economic impact of climate change on producer livelihoods and the vulnerability level of production system.

#### **Results**

- Socio-economic impacts of climate change quantified in regions having contrasting conditions.

#### **Activities**

- (a) Identify regions with different anticipated impacts and contrasting and complementary socio-cultural conditions.
- (b) Characterize communities on the basis of social and economic conditions by carrying out field surveys.

- (c) Identify social dimensions of global change in communities using qualitative analysis of socio-economic data.
- (d) Analyse the vulnerability of livelihoods in coffee farms.

#### **Resources**

- One expert in climate change and livelihood vulnerability (socio-economic analysis).

#### **Timetable**

26. This component will have a duration of nine months, distributed between the 12<sup>th</sup> and 21<sup>st</sup> months.

#### **Costs**

27. The estimated cost of this component is US\$70,000. CIAT in collaboration with national institutions can contribute 50% in kind, including provision of qualified personnel to carry out surveys and conduct workshops with producers from contrasting regions.

### **Component 7: Design adaptation strategies for the coffee sector.**

#### **Objective**

28. To develop specific adaptation strategies for the most significant crops.

#### **Results**

- Adaptation strategies designed for specific locations.

#### **Activities**

- (a) Assist producer organizations and national institutions to design suitable adaptation scenarios.
- (b) Develop coordinated workshops in each country for the dissemination of climate change information and data, distribution of instruments to support decision-making and participatory design of adaptation strategies.
- (c) Analysis of possible scenarios with other stakeholders in the supply chain to determine possible impacts on the overall supply chain and to support participatory design of adaptation strategies along the entire chain.

## **Resources**

- Two experts in climate change and adaptation strategies.

## **Timetable**

29. This component will have a duration of 6 months, distributed between months 18 and 24 from the start of the project.

## **Costs**

30. The estimated cost of this component is US\$70,000. CIAT in collaboration with national institutions can contribute 50% in kind, including provision of qualified personnel to carry out surveys and conduct workshops with technicians and producers.

## **Component 8: On-line platform for improving decision-making**

### **Objective**

31. To promote access to information that will permit structured and secure exchange between producers and other stakeholders in the supply chain.

### **Results**

- On-line information for coffee farms to obtain feedback on climate change strategies.

### **Activities**

- (a) Compilation of data: Global Positioning System (GPS) and cupping data, information on coffee farms, varieties, products, yields, farm management, infrastructure.
- (b) Database pruning.
- (c) Placing information on line.
- (d) Workshops for training technicians of the organizations involved.
- (e) Feedback on information.

### **Resources**

- One expert in Information and Communications Technology (ICT).

### **Timetable**

32. This component will have a duration of 18 months from month 12, distributed between months 12 and 30 from the start of the project.

### **Costs**

33. The estimated cost of this component is US\$75,000. CIAT in collaboration with national institutions will contribute 50% in kind, including provision of qualified personnel for compilation of data and placing information on-line.