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Report No: 50353-YE

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED GRANT FROM THE
GLOBAL ENVIRONMENT FACILITY TRUST FUND

IN THE AMOUNT OF US$4.0 MILLION

TO THE

REPUBLIC OF YEMEN

FOR AN

AGRO-BIODIVERSITY AND CLIMATE ADAPTATION PROJECT

May 5, 2010

Sustainable Development Department
Middle East and North Africa Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective - March 21, 2010)

Currency Unit	=	Yemeni Rials (YER)
US$ 1	=	YER 218.21
SDR 1	=	US$1.56277

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AAA	Analytic and Advisory Activities
ACAP	Agro-biodiversity and Climate Adaptation Project
AREA	Agricultural Research and Extension Authority
BNPP	Bank-Netherland Partnership Program
CALI	Costing Adaptation through Local Institutions
CAMA	Civil Aviation and Meteorology Authority
CAS	Country Assistance Strategy
CBY	Central Bank of Yemen
CCIG	Climate Change Initiative Grant (under PHRD)
CERA	Climate and Environmental data Retrieval and Archiving
COCA	Central Organization for Control and Auditing
EPA	Environment Protection Authority
ERM	Entity-Relationship Model
ESMP	Environmental and Social Management Plan
ESW	Economic and Sector Work
FU	Field Unit
GCM	General Circulation Model
GDFRDC	General Directorate for Forests, Range and Desertification Control
GDIS	General Directorate of Irrigation Structures
GDOFI	General Directorate of On-Farm Irrigation
GDSLR	General Directorate of Surveys and Land Reclamation
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIS	Geographic Information System
GoY	Government of Yemen
GPS	Global Positioning System
GSCP	Groundwater and Soil Conservation Project
GSMC	General Seed Multiplication Corporation
ICARDA	International Center for Agricultural Research in the Dry Areas
IDDEALES	Initiatives de Développement Durable et Equitable et Actions Locales pour les Echanges de Savoir
ILRS	Irrigation and Land Reclamation Sector

IMCCC	Inter-Ministerial Committee on Climate Change
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
JSDF	Japan Social Development Fund
LDCF	Least Developed Country Fund
M&E	Monitoring and Evaluation
MAI	Ministry of Agriculture and Irrigation
MCM	Mesoscale Climate Model
MOF	Ministry of Finance
MWE	Ministry of Water and Environment
NGO	Non-governmental Organization
NIP	National Irrigation Program
NWP	Numerical Weather Prediction
NWRA	National Water Resources Authority
PHRD	Policy and Human Resources Development Fund (Japan) – see CCIG
PIF	Project Identification Form
PIM	Project Implementation Manual
PPCR	Pilot Program for Climate Resilience
PSC	Project Steering Committee
PCU	Project Coordination Unit
PSU	Project Support Unit
RALP	Rainfed Agriculture and Livestock Project
RWDGD	Rural Women Development General Directorate
SDPRR	Socio-Economic Development Plan for Poverty Reduction
SFD	Social Fund for Development
SOE	Statement of Expenditures
SRES	Special Report on Emission Scenarios
TCC	Technical Coordination Committee
TOR	Terms of Reference
TFESSD	Trust Fund for Environmentally and Socially Sustainable Development
TRMM	Tropical Rainfall Measuring Mission
UML	Unified Modeling Language
WSSP	Water Sector Strategy Program
YASAD	Yemeni Association for Sustainable Agricultural Development
YGRC	Yemeni Genetic Resources Centre

Vice President:	Shamshad Akhtar
Country Director:	A. David Craig
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Sector Manager:	Luis Constantino
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REPUBLIC OF YEMEN
Agro-biodiversity and Climate Adaptation Project

CONTENTS

REPUBLIC OF YEMEN

AGRO-BIODIVERSITY AND CLIMATE ADAPTATION PROJECT

PROJECT APPRAISAL DOCUMENT

MIDDLE EAST AND NORTH AFRICA

MNSSD

Date: May 5, 2010	Team Leader: Kanta K. Rigaud
Country Director: A. David Craig	Sectors: Crops (60%); General agriculture, fishing and forestry sector (40%)
Sector Manager/Director: Luis F. Constantino	
Project ID: P103922	Themes: Climate change (67%); Biodiversity (33%)
Focal Area: Climate change	
Environmental Assessment: Partial Assessment	Joint IFC:
	Joint Level:
Lending Instrument: Specific Investment Loan	

Project Financing Data

[ ] Loan [ ] Credit [X] Grant [ ] Guarantee [ ] Other:

For Loans/Credits/Others:
Total Bank financing (US$m.): 0.00
Proposed terms:

Financing Plan (US$m)

Source	Local	Foreign	Total
RECIPIENT	0.418	0.000	0.418
Global Environment Facility (GEF)	3.408	0.592	4.000
Beneficiaries	0.280	0.000	0.280
PHRD-CCIG	0.390	0.210	0.600
Total:	4.496	0.802	5.298

Recipient:
Yemen, Republic of

Responsible Agency:
Ministry of Agriculture and Irrigation
PO Box 2805
Zira'ah Street
Yemen, Republic of
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FY	2011	2012	2013	2014	2015
Annual	320,000.00	1,082,000.00	1,626,000.00	922,000.00	50,000.00
Cumulative	320,000.00	1,402,000.00	3,028,000.00	3,950,000.00	4,000,000.00

Project implementation period: 4 years; Start August 31, 2010 End: August 31, 2014
Expected effectiveness date: August 31, 2010
Expected closing date: August 31, 2014

Does the project depart from the CAS in content or other significant respects? ***Ref. PAD I.C.***	[ ]Yes [X] No
Does the project require any exceptions from Bank policies? ***Ref. PAD IV.G.***	[ ]Yes [X] No
Have these been approved by Bank management?	[ ]Yes [ ] No
Is approval for any policy exception sought from the Board?	[ ]Yes [X] No
Does the project include any critical risks rated "substantial" or "high"? ***Ref. PAD III.E.***	[ ]Yes [X] No
Does the project meet the Regional criteria for readiness for implementation? ***Ref. PAD IV.G.***	[X]Yes [ ] No

Project development objective ***Ref. PAD II.C., Technical Annex 3***
The Project development objectives are: (a) to enhance capacity and awareness at key national agencies and at local levels, to respond to climate variability and change; and (b) to better equip local communities to cope with climate change through the conservation and use of agro-biodiversity.

Global Environment objective ***Ref. PAD II.C., Technical Annex 3***
Same as above.

Project description *[one-sentence summary of each component]* ***Ref. PAD II.D., Technical Annex 4***
The Project will have four components. Component 1 will build on the traditional knowledge of farmers and develop an inventory of local agro-biodiversity, and identify and test selected landraces for climate resilience. Information on the agro-biodiversity resources will be used to develop natural resource management and alternative income-generation plans with the communities as part of a "no regrets" approach to building climate resilience in the highlands. Component 2 will focus on raising awareness on climatic changes and developing initial local predictive capacity of weather patterns and long-term climate change scenarios for the country. Component 3 will focus on integrating climate resilience into rain-fed agriculture. At the national level this will done through capacity development of the MAI and development of a climate-resilient rain-fed agriculture strategy and at the local level through the development and piloting of a menu of coping strategies in partnership with the communities. Component 4 will focus on project management, coordination, and monitoring and evaluation.

Which safeguard policies are triggered, if any? ***Ref. PAD IV.F., Technical Annex 10***
OP 4.01 (Environmental Assessment) and OP 4.09 (Pest Management)

Significant, non-standard conditions, **if any**, for:

Board presentation: n/a

Grant Effectiveness:
(a) Execution of the TF Grant Agreement; and (b) Project Steering Committee (PSC) has been established with composition, resources and terms of reference satisfactory to the World Bank

Covenants applicable to project implementation: n/a

1. STRATEGIC CONTEXT AND RATIONALE

A. Country and sector issues

1. **Rainfed agriculture is the primary means of livelihood and a safety net for a majority of the rural poor in the highlands.** Yemen is one of the poorest countries in the world with over 40% of the population living in poverty, and a low per capita GDP of US$930. Although, in general, poverty has declined in the country, rural poverty declined only marginally from 42.8% in 1998 to 40.1% in 2005-06, making it one of the foremost challenges the country continues to face. Agriculture is the largest employer in the country, with nearly 74% of the population engaged in it directly or indirectly. Agriculture development in the past has largely focused on irrigated areas. However, more than half of the country's cultivated area is under rainfed and subsistence farming conditions. For the nearly 84% of the poor in the rural areas that depend on rainfed agriculture, it is the primary source of livelihood and food security. The Government of Yemen's Socioeconomic Development Plan for Poverty Reduction (SDPPR 2006-10) identifies increasing the efficiency of rainfed agriculture as one of its strategies to address rural poverty.

2. **Rainfed agriculture is highly vulnerable to the impacts of Climate Change.** According to Yemen's National Adaptation Program of Action (NAPA), and based on IPCC (Intergovernmental Panel for Climate Change) projections, temperatures across the country are expected to rise anywhere between 1.4 and 2.8 degrees Celsius by 2050. Precipitation and cloud cover patterns are more uncertain, and rainfall variability is likely to be more pronounced, i.e. it is projected to decrease by about 24% or increase by about 35%, depending on the global circulation model used to generate the scenarios. Given the uncertainty presented by current climate models, the precise extent of the vulnerability of rainfed agriculture is not known and needs to be assessed. However, there is general consensus on increased variability in precipitation, which raises the risk of crop failure and loss of livelihoods in a region where the level of poverty is already high and water is a scarce resource. One study estimates that climate change could lead to a 50% reduction of crop yields for rain-based agricultural crops by 2020.

3. **The agro-biodiversity of the highlands, together with the traditional knowledge of farmers, has been the cornerstone of communities' ability to adapt to changing climatic conditions in the past.** Farmers in this area have for centuries cultivated in one of the driest and harshest terrains in the world. The agro-ecosystems of this region, however, are rich in agro-biodiversity of several important crops - sorghum, barley, and chick pea are some of the globally important crops with a history of early domestication in this area. Several landraces of these crops found today are a result of purposive selection by farmers to meet local soil and climatic conditions. In addition, many wild relatives of these crops and other wild species found in field edges and remnant natural habitats have forage and medicinal value. Traditional methods of water harvesting and storage as well as terrace construction and maintenance have immense value in protecting the agro-ecosystems in the highlands against adverse climatic and environmental events. However, information on these resources is being lost as some farmers migrate to towns and others adopt modern high-yielding varieties and increasingly depend on irrigation for farming.

4. **With systematic documentation and testing for climate resilience, these agro-biodiversity resources and the traditional knowledge have the potential to 'climate proof' rainfed agriculture in the future.** The wealth of information which farmers have accumulated over generations regarding the useful attributes of different landraces, seed collection and storage, water harvesting and storage, and terrace building techniques has helped in coping with pests, drought, soil erosion, and other adverse environmental and climatic events. It is estimated that there are nearly 40,000 landraces of sorghum alone, which provides a wide genetic pool for crop improvement programs to meet the challenges of climate change. Several wild relatives of crops and lesser known species have the potential to be tapped as food sources in the future as more regions in the world need food plants that can survive droughts, floods, and other climatic extremes. As water continues to become scarcer in the highlands, traditional water harvesting and terrace building techniques have a vital role in the management of these resources, to cope with the uncertain changes in climate.

5. **However, to build climate resilience, there is a need to understand the extent and direction of climate change in the country.** Yemen has a complex situation as the country lies in the latitudinal band where global circulation models differ in projected precipitation trends. There is no consensus among the 21 global climate models in the IPCC Fourth Assessment Report about the sign of the projected changes in winter, summer, or annual rainfall or its distribution pattern over Yemen (Wilby 2008). The effect of complex topography of the highlands is poorly modeled in current global climate models and there are few, if any, regional climate models that provide detailed scenarios for Yemen. This makes the situation with respect to rainfed agriculture particularly difficult as crop choice, cropping pattern, and crop management are all rainfall-dependent. Information on future climate scenarios is necessary to ensure that coping strategies designed are indeed 'climate resilient'. The main challenge to the development of precise scenarios for Yemen is the paucity of homogenous and continuous time series climate data.

6. **It is essential to develop national capacity in climate data collection and analysis to generate country-specific climate scenarios.** Climate data in Yemen are collected and processed by several agencies, including the Civil Aviation and Meteorology Authority (CAMA), the National Water Resources Authority (NWRA), the Agricultural Research and Extension Authority, and the Irrigation Sector under MAI. These data are of typically daily resolution with an average record length of around 10 years or less. The lack of long-term systematic data makes it difficult to evaluate long-term trends in climate variables, especially for extremes. Weather stations for data collection are under different agencies, each collecting data to meet its own mandate. Density of stations is low, and data collected from the stations under different agencies are not easily comparable. Data sharing and exchange are usually cumbersome, involving bureaucratic procedures. Although the results may not be evident in the short term, it is essential that the building blocks to develop this capacity are put in place now, to ensure that the country has adequate national data to respond effectively to the climate challenge in the coming decades. The proposed Agro-biodiversity and Climate Adaptation Project (ACAP) would lay the foundation for the development of national capacity in climate modeling and analysis. This capacity generation would benefit from the Pilot Program for Climate

Resilience (PPCR) which has been launched in the country[1]. The PPCR is an umbrella program that offers the resources and national-level coordination to develop this capacity further and scale it up through the planned programs. Some of the representatives in the inter-ministerial coordinating body for the PPCR would be on the Steering Committee for the ACAP, thus enabling the flow of information and lessons between the two.

7. **Conservation of agro-biodiversity is critical to building climate resilience of the rainfed agro-ecosystems, as is enhancing national capacity in climate modeling and analysis.** The ACAP aims to do both. It recognizes that development of capacity in climate analysis needs sustained long-term efforts and, therefore, will lay the building blocks for this process which will be scaled up and continued through the programs of the PPCR, which is a long-term national initiative.

8. While capacity for climate analysis is being developed, the ACAP will engage communities with 'win-win' or 'no regrets' strategies to enable sustainable management of the natural resources and diversify livelihoods as a safety net. This will be facilitated through the preparation of natural resource management plans and creation of income-generating actvities which use local agro-biodiversity. Activities financed would include small water harvesting and storage structures, terrace building and maintenance, and income generating actvities such as seed multiplication of local landraces, revival of local fruit- and nut-bearing varities, as well as raising and processing local varieties of medicinal and aromatic herbs.

B. Rationale for Bank involvement

9. ***Long-term involvement in the agriculture sector.*** IDA has been supporting the development of the agriculture sector in Yemen for over three decades. Past portfolio included projects in agricultural research and extension and productivity improvement. Recent IDA projects have focused on groundwater and soil conservation (FY04), irrigation improvement (FY01), and on rainfed agriculture and livestock (FY04). The ACAP would continue to support the agriculture sector, while broadening the focus to meet the challenges posed by climate change. The ACAP is strategically aligned with both the GSCP and the RALP (see Annex 2). With the GSCP the proposed Project will collaborate to encourage water harvesting and increasing irrigation efficiency as part of a climate-resilient "win-win strategy". The proposed Project will collaborate with RALP through its activities under Component 1, which are complementary to Component 1 of RALP, to include climate considerations in the identification and improvement of local landraces of cereals and lentils.

10. ***Bank as the convener of the CIF and PPCR.*** As the convener of the Climate Investment Fund and the Pilot Program on Climate Resilience (PPCR) the Bank provides intellectual leadership on the issue of building climate resilience and 'climate proofing' development in some of the least developed countries. The ACAP is one of the first pilot operations to address adaptation on the ground in a country selected for the PPCR. As such, it will benefit from the Bank's wider role in the climate change dialogue with Yemen and at the same time demonstrate adaptation for scaling up through the PPCR.

[1] The overarching objective of the PPCR is to help highly vulnerable countries pilot and demonstrate ways to integrate climate risk and resilience into core development planning, while complementing other ongoing activities.

11. ***Synergies with country-level AAA on climate change.*** The World Bank has a number of on-going Analytic and Advisory Activities (AAA) on climate change in Yemen (Annex 2) which the ACAP complements and benefits from. The ACAP draws from the DFID-funded 'Real Options Methodology' which will estimate the costs and benefits of the adaption to climate change. In addition, the ACAP would benefit from an ongoing BNPP-funded study to develop climate change scenarios, and another on climate impacts on water resource management in agriculture. In addition, there are two other pieces of ongoing economic sector work (ESW) which are directly relevant to the objectives of the ACAP: 'Costing Adaptation through Local Institutions', which will use this Project as a case study, and the 'Rural Community Resilience to Climate Change'. The ACAP will also complement analytical work that will be undertaken through the PPCR.

C. Higher level objectives to which the project contributes

12. ***Contribution to the Government of Yemen's SDPPR (2006-2010), NAPA, and the strategy for biodiversity conservation.*** The SDPPR's goals for the agriculture sector at the macro level include "increased efficiencies and average annual growth rate of 4.5%, with due attention to environmental sustainability, increased income from agriculture through developing/promoting rainfed agriculture, and building dams and water dikes." The ACAP is aligned with the SDPPR's objectives for the agriculture sector, in particular with its objective to increase food security and increasing efficiency of water management.

13. The ACAP is consistent with, and advances the adaptation vision of, GoY's National Adaptation Program of Action (NAPA). It directly contributes to the NAPA's vision for agriculture which is "protection of Yemen's agricultural diversity from degradation, maintaining agricultural resources and developing sustainable agricultural programs, taking climate variability and change into consideration". Specifically, it addresses the priority adaptation activities identified in the agriculture and water sectors, which are rehabilitation and maintenance of mountainous terraces, development and implementation of sustainable land management strategies to combat desertification and degradation, and promotion of research on drought-resistant and heat- and salinity-tolerant crops.

14. The Government's of Yemen's rural development and agricultural development strategies not only stress the importance of agriculture as the driving force for development in the rainfed highlands of Yemen, but also the need to take advantage of local agro-biodiversity and local knowledge to prevent further land degradation and to help farmers adapt to climate change. The final draft of the National Biodiversity Strategy and Action Plan includes the short-, medium-, and long-term objectives and activities on all aspects of biodiversity, including agricultural biodiversity, which are addressed by the ACAP.

15. **Consistency with CAS objectives.** The ACAP directly addresses the current CAS (FY10-13) strategic objective 4, which is to 'Help manage natural resources scarcity and natural risks' and CAS thematic area 4.2 – 'mitigate the impact of natural disasters and invest in climate change adaptation'. It also contributes to the CAS thematic area 1.4 – 'support selected drivers of non-oil growth', in particular, to the identified priority activity of increasing agricultural productivity in rainfed areas.

16. **Consistency with GEF-4 focal area priorities.** The ACAP is consistent with and responds to the pilot window - the 'Strategic Priority on Adaptation' under the Climate Change focal area. It will pilot and test the design of improved coping strategies through the use and conservation of agro-biodiversity resources in the rainfed highlands. The experiences and lessons from this pilot would assist other communities, both in the region and globally, as they seek to address the issue of adaptation to climate change. The GEF support relates to the incremental cost of addressing the global externality of climate change. The activities and programs of the World Bank Groundwater and Soil Conservation Project (US$40 million IDA and US$15 million Grant) would constitute the baseline for the proposed Project. The proposed Project is also complementary to the Rainfed Agriculture and Livestock Project (Component 1 – Farmer-based system of Seed Improvement, and Component 3 - Productive Rural Development).

2. PROJECT DESCRIPTION

A. Lending instrument

17. The ACAP would be implemented with support from the GEF with a US$4.0 million grant extending over four years. The financing instrument is deemed appropriate as this is designed as a pilot operation. The operation will have complementary parallel financing from the PHRD CCI Grant (under the Climate Change window), and in part through complementary activities from the on-going IDA-financed Ground Water and Soil Conservation Project (GSCP) with which it will share the Project Coordination Unit (PCU). This arrangement will increase the leverage of the proposed operation in influencing the policy dialogue, both within the Ministry of Agriculture and Irrigation and with the other implementing agencies of the government.

B. [If Applicable] Program objective and phases

C. Project development objective and key indicators

18. The **project development objectives** are to:

a) Enhance capacity and awareness at key national agencies and at local levels to respond to climate variability and change; and

b) Better equip local communities to cope with climate change through the conservation and use of agro-biodiversity.

19. The **project outcome indicators** are:

- Strategy for Climate-Resilient Agriculture for Rainfed Highlands adopted and applied by key national agencies; and

- Lessons from the community pilots are documented and scaled up.

20. The ACAP will provide a suite of options to farmers in the rainfed highlands to cope with climate change by building the knowledge base on climate change and agro-biodiversity. At the national level, the Project will initiate improvements in collection, recording, analysis, and

sharing of climate data and development of national/regional climate models. Climate-related data is currently being recorded in monitoring stations under the authority of various organizations such as CAMA, NWRA, AREA and the Irrigation Sector of MAI, for their purposes and with little coordination. The ACAP will help in creating a coordination and cooperation mechanism among such entities.

21. Simultaneously, at the community level, the Project will finance documentation of agro-biodiversity and traditional knowledge of the highlands and development of agro-biodiversity-based resource management plans, which will be used to develop and pilot alternative livelihood options, to build climate resilience and serve as a safety net for the communities in the highlands. The interventions initiated under the ACAP are intended to be the building blocks which will help meet the challenges of climate change over the long term. These pilot initiatives and the building blocks will assist in the scaling up through program-wide approaches on climate resilience, e.g., through the PPCR, but also through mainstreaming of specific coping options and strategies through ongoing operations in the GSCP and RALP, and the NIP.

22. The outcome and key indicators are provided in **Annex 3**.

Geographical scope and location

23. A map with project areas is given in Annex 16. Site selection was undertaken through purposively selected biophysical agro-ecological gradients to improve sample representativeness. Site selection was done to:

a. include project sites located along a mesoscale geographic gradient,
b. cover some of the most important areas of rainfed highlands,
c. cover a range of altitudes within the highlands,
d. cover a range of mean annual precipitation,
e. cover a range of agro-ecological gradients, and
f. overlap with the governorates of ongoing complementary projects to allow for scale-up.

24. Based on these criteria the following districts have been selected:

Governorate	**District**	**Remarks**
Al Mahweet [RALP]	Alrogm Almahweet	Northern extension of the mesoscale transect; ongoing RAL and GSC projects
Sana´a [RALP]	Blad Alros Bani Matter	Northern central part of the mesoscale transect; ongoing RALP and GSCP
Ibb	Alsadah Badan	Southern central part of the mesoscale transect; high-altitudinal gradients; preceding agro-biodiversity projects; GSCP
Taiz	Saber Almoasat	Southern extension of the mesoscale transect; preceding agro-biodiversity projects and GSCP

D. Project components

25. The Project will have four components. Component 1 will build on the traditional knowledge of farmers and develop an inventory of local agro-biodiversity, and identify and test selected landraces for climate resilience. Information on the agro-biodiversity resources will be used to develop natural resource management and alternative income-generation plans with the communities as part of a 'no regrets' approach to building climate resilience in the highlands. Component 2 will focus on raising awareness on climatic changes and developing initial local predictive capacity of weather patterns and long-term climate change scenarios for the country. Component 3 will focus on integrating climate resilience into rainfed agriculture. At the national level this will done through capacity development of the MAI and development of a climate-resilient rainfed agriculture strategy and at the local level through the development and piloting of a menu of coping strategies in partnership with the communities. Component 4 will focus on project management, coordination, and monitoring and evaluation. The detailed project description is provided in Annex 4.

Component 1: Agro-biodiversity and Local Knowledge Utilization and Assessment [GEF: US$366,500]

Objective: To prepare inventories of landraces and other agro-biodiversity and develop vulnerability profiles of selected landraces.

Outcome: Information to enhance and develop agro-biodiversity-based coping strategies in place.

26. Activities financed under this component would include: (a) preparation of inventories of local agro-biodiversity and knowledge from farmers on adaptive characteristics of local landraces and wild relatives of crop species; (b) development of climate resilience profiles of selected landraces, after testing and piloting for resilience to impacts of climate change; and (c) preparation of a feasibility report for the development of micro-enterprises using this agro-biodiversity. This will indicate the potential for alternative income generation through sustainable use of agro-biodiversity in the area.

Sub-components:

1.1 Agro-biodiversity Inventories

1.2 Development of Climate Resilient Profiles of Selected Landraces

1.3 Micro Enterprises Assessment Report on Agro-biodiversity Utilization and Development of Business Plans for Income-generation Activities

Component 2: Climate Change Modeling and Capacity Building [GEF: US$600,000]

Objective: To lay the foundation for development of national capacity in climate modeling and data analysis.

Outcome: Enhanced capacity of national institutions to develop climate scenarios based on regional climate models.

27. This component will finance activities which will be the building blocks for developing capacity in climate change analysis and modeling. More specifically, the ACAP will finance: (1) development of an improved climate database, including upgrading of select weather monitoring stations; (2) 'downscaling' global climate models for relevance and use in-country; (3) development of technical capacity, specifically in relation to climate information management and modeling; and (4) sharing climate information inputs and outputs with other agencies and users.

Sub-components:

2.1 Development of Improved Climate Database
2.2 Downscaling Climate Models
2.3 Training and Technical Capacity Development
2.4 Sharing Climate Information Inputs and Outputs

Component 3: Integrating Climate Change into Rainfed Agriculture [GEF: US$2,801,300]

Objective: To develop a strategic approach to integrate climate change into rainfed agriculture.

Outcome: Pilot coping strategies implemented; policies and investment plans of rainfed agriculture reflect climate considerations.

28. This component will have three sub-components. The first sub-component will finance capacity building activities at for the MAI and the communities. Technical capacity of MAI staff will be developed to take climate change into account when designing rainfed agriculture programs. At the community level training programs for awareness-raising on climate change issues would be financed.

29. The second sub-component will finance piloting of coping mechanisms with communities, for better management of natural resources and for diversifying income generation activities. Under the former would be activities such as small-scale upgrading of water harvesting and storage structures as well as terrace rehabilitation and flood protection structures. As part of the latter, income generation activities that use local agro-biodiversity will be financed.

30. Under the third sub-component, a detailed assessment of the vulnerability of rainfed agriculture to climate change will be financed. This will be followed by consultations with stakeholders to develop a climate-resilient, rainfed agriculture strategy which the MAI would adopt.

Sub-components:

3.1 Raising Awareness and Capacity Building at National and Local Levels on Climate Change
3.2 Piloting Coping Strategies at Local Landscape Units
3.3 Preparation of a Climate-Resilient Agriculture Strategy for Rainfed Highlands

Component 4: Project Management, Coordination, and Monitoring and Evaluation [GEF: US$232,200]

Objective: To enable effective coordination and management of the Project.

Outcome: Effective project management**,** monitoring, and improved coordination.

31. Project implementation will be overseen by the GSCP PCU. The PCU is headed by a Project Director and has staff to oversee procurement, financial management, and administrative support functions. On the technical side the team will include a specialist in climate change, natural resources management, and monitoring and evaluation.

32. A monitoring system will be put in place that tracks performance of the PCU in relation to: (a) progress in achieving scheduled activities and outputs and against each component; (b) expenditure against budget allocations; (c) project impact on key outcomes and indicators of achievement; and (d) implementation of the environmental and social management plan. Indicators and monitoring mechanisms are detailed in Annex 3.

33. Overall strategic guidance for the Project is provided by the Steering Committee chaired by the Minister for Agriculture and Irrigation with membership from the Ministry of Planning and International Cooperation (MOPIC), Ministry of Finance (MOF), Deputy Minister Irrigation and Land Reclamation (MAI), Deputy Minister Agricultural Production Development Sector (MAI), the Civil Aviation and Meteorology Authority (CAMA), the National Water Resources Authority (NWRA), the Agricultural Research and Extension Authority (AREA), the Environment Protection Authority (EPA), and the Project Coordination Unit of ACAP.

34. A Technical Coordination Committee (TCC) chaired by the Deputy Minister for Irrigation and Land Reclamation and comprising members from CAMA, NWRA, AREA, and others will be established to provide technical advice on an *ad hoc* basis for the project.

E. Lessons learned and reflected in the project design

35. The project design draws on lessons from ongoing and completed projects, including the GSCP, RALP, and the Seeds and Agriculture Services Project. Some early lessons from analytical work on how to deal with climate change, in terms of information, knowledge, and approaches, have also shaped the design of the Project.

36. ***Focus on rainfed and irrigated agriculture.*** The project design takes into consideration a key lesson from the Seeds and Agriculture Services Project [P03917], the ICR for which stated that - "c*onsidering that about 60% of agriculture in Yemen is under rainfed conditions, follow-on projects should place more emphasis on rainfed agriculture."* This is coupled with the fact that the highlands are globally important agro-ecosystems, holding critical agro-biodiversity resources that could provide locally-based solutions to cope with climate change and enhance food security both in Yemen and elsewhere. Even so, the Project will also provide lessons and feedback to irrigated areas through its close alignment with the GSCP, which extends to 10 Field Units serving 15 governorates, and covers both rainfed and irrigated areas.

37. ***Choice of project sites.*** The Seeds and Agriculture Services Project recognized that "the pattern and distribution of rainfall as well as temperature in Yemen varies from one region to the other. This unique microclimatic situation should be taken into account during the implementation stage in future projects for variety development and testing activities." Thus, the ACAP is designed to test and pilot coping options along a mesoscale transect that covers a range of altitudes, mean annual precipitation, and agro-ecological gradients within the rainfed highlands.

38. ***Mainstreaming climate change considerations into existing programs and projects.*** The proposed Project will pilot and test coping mechanisms and then scale up through ongoing interventions - GSCP and RALP. This will benefit Component 2 of the GSCP by introducing climate-resilience measures in the implementation of spate irrigation improvement, wadi bank protection works, water harvesting structures and soil conservation works through the WUAs. It will benefit the RALP's Component 1 by introducing climate considerations into the seed improvement program. Component 3 of this will mainstream climate considerations into the policy and planning process through its engagement and preparation of a Climate-Resilient Agriculture Strategy for Rainfed Highlands.

39. ***Enhancing the knowledge base.*** Previous project investments have focused on providing infrastructure as a means to enhance capacity in the rural areas. However, in the long term, without sufficient enhancement of the knowledge base coupled with enhancement of capacities and capabilities, these investments in infrastructure do not provide the expected returns. This would be especially true in the context of addressing climate issues where it is critical to adopt a systematic and science-based approach to ensure that rigor is built into the design of coping measures. The ACAP, therefore, focuses on developing the knowledge base and skills, especially in the areas of climate data collection and analysis, and forecasting climate scenarios. This enhanced knowledge is then used to enhance climate resilience through the various components. In addition, this knowledge will also be used to inform investments being undertaken by the GSCP, where the project sites are common to both. The water users associations (WUAs) formed by GSCP would participate in awareness programs on water conservation and climate issues.

40. ***Win-win solutions in the short term to adapt to climate change in the longer term.*** Although farmers may understand the potential impacts of climate change in the longer term, it is important to provide tangible, short-term benefits as incentives for sustainable management of natural resources. The Project will actively foster community participation in the planning and implementation of small-scale income-generation projects linked to conservation of agro-biodiversity and natural resources and community planning and management of water, terraces, pastures, etc., to elicit active participation by the communities.

41. ***Extension through farmers' networks and water users associations.*** The use of farmers' groups, both informal networks and cooperatives in extension activities has been proven to be successful in the MNA region as well as in operations in other regions, when compared to conventional mode of extension service delivery through staff of agriculture departments. The Project will work with farmers' networks to revive traditional seed storage and exchange systems to conserve important local varieties. The Project will also work with the WUAs to broaden their mandate to include climate issues in their water management strategies and awareness campaigns.

F. Alternatives considered and reasons for rejection

42. ***A purely scientific program of Technical Assistance with no community investments:*** This alternative was considered and rejected, as designing coping mechanisms in a laboratory setting would not be pragmatic and would not have the benefit of "learning by doing" and feedback from farmers, the ultimate users of the coping mechanisms.

43. ***A community-based natural resource management project with no inputs from climate modeling:*** This alternative was considered and rejected because it is increasingly evident that the natural ecosystems are themselves vulnerable to climate change. Instead, the Project will use the traditional knowledge of the agro-ecosystems, coupled with improved climate understanding over time, to design a range of coping mechanisms. While 'win-win' or 'no-regrets' measures are important and have a place in adaptation, they themselves could be vulnerable in the longer term if they are not underpinned by increasingly rigorous scientific and technical knowledge. This engagement in climate aspects was also important to raise directly the awareness and capacity of key stakeholders on the climate elements.

3. IMPLEMENTATION

A. Partnership arrangements (if applicable)

44. A wide range of stakeholders will be involved in the Project, many of whom have already helped to shape the project design. They will participate during implementation in different ways - as contributing technical agencies and partners in line with their institutional mandates. Community cooperatives and WUAs will also be directly involved in the project delivery.

Institutional and implementation arrangements

45. The ACAP will be implemented over 4 years, with primary coordination provided by the Ministry of Agriculture and Irrigation, and day-to-day implementation by the Project Coordination Unit currently implementing the GSCP. Following the closure of the Groundwater and Soil Conservation Project, the PCU will be placed under the National Irrigation Program (NIP), which is the umbrella program being implemented by the Ministry of Agriculture and Irrigation (MAI), as part of the Water Sector Strategy Program (WSSP). The PCU comprises the Project Director, supported by core staff including for procurement and financial management. In addition, there would be an expert with international experience to deal with climate change and natural resource management issues and another to deal with M&E. The PCU will be supported in implementation by its Field Units (FUs) in Sana'a (supporting Al Mahweet) and Taiz (supporting the work in Ibb). The FUs have experience in implementing terrace construction, water harvesting and storage structures, spate irrigation, and wadi bank protection, in addition to working with the Water Users Associations.

46. Overall strategic guidance for will be provided by the Project Steering Committee (PSC) chaired by the Minister for Agriculture and Irrigation, with membership from the following Ministries and agencies: MOPIC, MAI, MOF, CAMA, AREA, EPA, NWRA, and the PCU.

Implementation of partnership arrangements

47. At the community level, the ACAP follows closely the approach adopted by the GSCP, where the main focus is to work in partnerships with local formal or informal/traditional institutions. Famers and communities participating in the community projects under the sub-component 3.2, which involves upgrading small-scale community infrastructure and agro-biodiversity-based income generation activities, are responsible for managing their resources sustainably. In-kind community contributions (such as labor) are emphasized for local ownership and sustainability of the projects.

48. The ACAP will build on the expertise of the GSCP relating to the participatory approach for mobilizing and sensitizing the communities, and establishing and strengthening of traditional farmer networks, including women's networks. With the help of sociologists, GSCP has assisted in WUA formation, capacity building, and implementation support for sustainable WUAs. The ACAP will seek to use this extensive network of WUAs in working with communities for piloting coping strategies in local landscape units. This can be done by expanding the capacities of the WUAs with technical support from a team of specialist in adaptation planning and natural resource conservation.

49. *Public Awareness and Community Sensitization Activities*: The PCU will coordinate the development of models for public awareness campaigns in the communities on climate change phenomena, the consequences of unsustainable natural resource use, and strategies for dealing with floods and droughts - extreme weather events that have increased in frequency in the last few years. These campaigns will be conducted in the project area by the FUs, and they consist of field demonstrations, farmer-based hands-on training sessions, co-learning, twinning programs, local workshops, booklets, and posters, among other vehicles, and use communication tools that take into account the high level of illiteracy in these areas, particularly for females.

B. Sustainability and Replicability

50. *Institutional sustainability:* This pilot project comes at a timely moment. The Government has just set up an Inter-Ministerial Committee on Climate Change (IMCCC) under the chairmanship of the Deputy Prime Minister for Economical Affairs and Minister of Planning and International Cooperation. All key agencies and ministries are represented on this committee that is to assist Yemen to mainstream climate change into the national development planning processes and into the work of the line ministries and agencies. The Project will benefit directly from this process where the Ministry of Agriculture is a key member, and for which the EPA serves as the Technical Secretariat. Both will provide a link between the lessons and results of this Project to the national process. This pilot project will also directly inform and in turn benefit from the Pilot Program for Climate Resilience. The design of the Project has sought to ensure that the project benefits and outcomes will be institutionally sustained beyond the end of the Project.

51. *Technical sustainability*: Components1 and 2, which deal with agro-biodiversity and climate aspects, respectively, will work through the relevant agencies (e.g., AREA,CAMA, EPA,GSMC) to enhance technical capacities and capabilities both for the implementation of the various components and to enable mainstreaming climate issues into their institutional agendas.

Specifically, the arrangement will allow for data, information, and results generated to be utilized and sustained. The Technical Coordination Committee of the Project will specifically allow for the continued exchange of ideas, experiences, and lessons which will enhance the core technical capabilities of these institutions.

52. *Replicability and scale-up:* Any scale-up of the climate modeling work and uptake of the piloted coping strategies to the other rainfed highlands, or as general principles or reforms for the broader agricultural agenda, will have to be promoted – largely through component 3 – both at the project and program levels. This Project will seek to initiate the scale-up largely through the GSCP and RALP which extend over a wide range of governorates in rainfed areas. The policy work, through the development of a national agriculture strategy for rainfed highlands, will also need to ensure that climate is mainstreamed in all future plans and programs.

C. Critical risks and possible controversial aspects

Risk factors	***Description of risk***	***Rating[a] of risk***	***Mitigation measures***	***Rating[a] of residual risk***
I. Country and Sector Level Risks				
Macro-economic Framework	***The impact of the global crisis has affected Yemen--***the sharp fall in world oil prices and the consequent shrinking in public expenditure, are depressing economic activity. While the financial sector has remained relatively unharmed due to its relative insulation, the impact on the real sector is expected to be significant through declines in FDI, remittances (especially from the Gulf), and external financing. ***Although external debt has steadily declined, its sustainability continues to be at risk*** due to Yemen's vulnerability to global oil prices, and to sustained difficulties in implementing fiscal and subsidy reforms. Domestic debt is on the rise—estimated at nearly 16 percent of GDP in 2008. ***Diminished ability and commitment of Government to reform that supports the Bank Group's country assistance strategy (CAS)***. Further reform efforts will be key to the effective implementation of the programs supported under the CAS–yet may be tough in the face of a difficult external context and possible popular opposition. Capacity constraints may further hamper the Government's ability to design and implement critical reforms.	Moderate	1. Generating non-oil growth and increasing non-oil revenues: current investment in natural gas production and liquefaction, as well as in tourism and agriculture. 2. Oil exploration 3. Continued dialogue between Government and private sector, as well as sensitization of taxpayers. 4. Measures have been designed to strengthen fiduciary systems (procurement and financial management). Budget and expenditure planning and discipline are improving already. 5. Continued dialogue and careful macroeconomic monitoring by the World Bank and the IMF. 6. Reform of the civil service and adoption of wages strategy linked to reforms.	Low
Country	Poor communication on projects status	Moderate	1. Following the conversion of	Low

Risk factors	*Description of risk*	*Rating[a] of risk*	*Mitigation measures*	*Rating[a] of residual risk*
Engagement With World Bank	during preparation, and delays in the ratification of financing agreement by the parliament. Other delays include: (i) late effectiveness of projects; (ii) low readiness of procurement packages at the time of effectiveness; (iii) slow pace of the procurement process itself; (iv) complex design, given local implementation capacity; and (v) over-optimistic assessments of Government ownership or changes in the institutional environment.		IDA assistance from credit to grants for FY09, parliamentary approval will not be requested and delays will no longer be expected. 2. Close monitoring of the lending portfolio through, *inter alia*, the CPPR follow-up committee. 3. CPPRs were conducted in FY08, and more recently in FY10, to address implementation problems and new projects designed with these constraints in mind.	
Country Governance	• Weakness of the bureaucracy and low capacity of public service delivery • Market-unfriendly policies and low quality of contract enforcement.	Substantial	The first pillar of the current CAS aims at diversifying growth through better governance and better delivery of public services. The Bank has funded the civil service modernization project to support this pillar.	Moderate
Systemic Corruption	WBI and Transparency International ranked Yemen 141 out of 180 (a decline from 2007: 131 out of 180); and under the 2008 Corruption Perceptions Index was 2.3 out of 10. There is a risk that this perception can have a negative impact on new investments in particular and business environment in general. ***Fiduciary risks***-- mainly related to the misuse of resources made available under Bank Group-financed projects. A secondary risk is that "ring-fenced" fiduciary arrangements result in undermining institutional capacity development efforts. Public finance management practices are not at international norms.	Moderate		Moderate
Other (for example risks, political/election risks, country engagement with other MDBs/donors, social and environmental	Challenge in addressing the scarcity of natural resources—depletion of water resources and environmental degradation. Weakness in managing natural disaster and climate change adaptation. Weak presence of the central administration in the remote areas, especially in the northern/desert areas.	Substantial	1. The Bank Group has been working with donors in support of the National Water Sector Support and Investment Program. The Bank Group will further expand this work, with a focus on: (i) reduction of groundwater abstraction to more sustainable levels; (ii) expansion of water and sanitation coverage in	Moderate

Risk factors	*Description of risk*	*Rating[a] of risk*	*Mitigation measures*	*Rating[a] of residual risk*
risks at the country level)			rural/peri-urban areas; (iii) enhancement of irrigation efficiency and productivity. 2. The Bank Group had provided financial and Technical Assistance to help respond to natural disasters and prepare a national strategy to increase resilience to the impact of climate change. The Bank will continue this, with a focus on: (i) strengthening the capacity of relevant Government agencies to establish an advanced alert system and to manage natural disasters and their aftermath; (iii) support the implementation of priority elements of the climate change strategy (and help enhance cross-sectoral approaches) 3. To ensure implementation success of operations in remote areas, the Bank will seek to support demand-driven projects (by local communities).	
II. Sector Policies and Institutions				
Sector Specific Risks	1.GoY and MAI do not elaborate policy on mainstreaming climate-resilience measures in their agriculture strategy and programs 2. Increase in demand and sale price of Qat increases the rainfed area under its cultivation	Moderate Substantial	1. The Bank is engaging with the GoY through several AAAs and dialogue for the PPCR. Component 3 of the project will directly address this risk by engaging key staff in the dialogue on climate agenda. 2. IDA TA and analytical work on Gender, Youth and Qat as proposed in the CAS will address this issue. Intercropping of other crops with qat will also be promoted.	Low Moderate
III. Operation-specific Risks				
Technical Design	1. Current understanding of climate change may not provide a sufficiently clear indication of the directions of change for the Project, and hence for defining measures that it will develop to manage change. 2. The availability of limited historical data for Yemen's rainfed highlands	Moderate Substantial	1. The Project will mitigate this risk by suggesting strategies that build broader resilience to change, and by taking advantage of the most advanced knowledge of the impacts of climate change for application in Yemen. 2. The Project will mitigate this risk by rigorously identifying	Low Moderate

Risk factors	*Description of risk*	*Rating[a] of risk*	*Mitigation measures*	*Rating[a] of residual risk*
	may pose a challenge.		weaknesses in national data, and recommending improvements on this front, and also by undertaking climate modelling, using global models that are scaled down for testing, and application to the local environment in Yemen.	
Implementation Capacity And Sustainability	1. The capacity of the institutions to deal with climate aspects of the project is limited.	Substantial	1. The Project will include intensive and specialized training in climate modeling for technical staff of line agencies (e.g., CAMA, NWRA, etc.) to address these capacity gaps – and to build capacity through on-the-job and other provisions in the project.	Moderate
	2. The GSCP PCU does not have technical expertise in the area of agro-biodiversity and climate change	Moderate	2. The PCU will be strengthened with an expert with international experience and skills in climate change and natural resources management to oversee technical aspects of project implementation and coordinate with other agencies involved.	Low
Financial Management	The Project increases the load on the financial management and oversight functions of the PCU.	Substantial	The GSCP PCU has been assessed as having robust financial management systems in place, with computerized accounting systems that can easily be expanded to carry out accounting for additional projects.	Moderate
Social And Environmental Safeguards	The Project causes adverse environmental and social impacts.	Low	An Environmental and Social Impact Assessment and an Environmental and Social Management Plan as per standard requirements have been prepared and will guide implementation.	Low
IV. Overall Risk (Including Reputational Risk)				
Overall Risk	Technical design and capacity risks remain for the overall Project, given that adaptation to climate change is a new subject and there is limited understanding at this stage on the likely impacts in Yemen. Nevertheless, the cost of business-as-usual and/or inaction are higher than any project interventions.	Substantial	Very specific mitigation measures are proposed, which will take into account the information gaps. The Project will build capacity for long-term resilience.	Moderate

Traditional Knowledge Utilization						
C2: Climate Change Modeling and Capacity Building	600,000	0	250,000	0	850,000	0
C3: Integrating Climate Change into Rainfed Agriculture	2,801,300	0	320,000	280,000	3,401,300	2,970,000**
C4: Project Management, Coordination and M&E	232,200	418,000	30,000	0	680,200	0
Total Project Costs	**4,000,000**	**418,000**	**600,000**	**280,000**	**5,298,000**	**5,270,000**

*complementary activities from Rainfed Agriculture Livestock Project

** complementary activities from Groundwater Soil Conservation Project (including $640K from beneficiaries)

Economic analyses

56. The standard cost-benefit analysis applied to project assessment fails to adequately appraise the additional economic value of more flexible adaptation strategies. In this Project, the Real Option Methodology was applied (Annex 9). The Real Option Methodology provides a framework to evaluate adaptation projects at an early stage of preparation, not only on the basis of the expected amount of adaptation to be achieved, but also in terms of the increase in flexibility associated with decisions (adaptability), with a view to test the methodology and gain insights for the project design. This pilot application will allow for a more robust treatment of adaptation, and could also inform and generate guidelines for the economic analysis of other adaptation projects.

57. The methodology[2] applied consists of a 3-step procedure: (1) identifying the stakeholders of the process of adaptation to climate change, (2) eliciting information from stakeholders on the main features of this process through narratives and stylized facts obtained from participative interviews and systematic survey[3] techniques, (3) explore and evaluate the main options to deal with the climate change and the corresponding capabilities. Because of the complex, multi-agent nature of adaptation, the methodology is designed to investigate the options to adapt to climate change as the result of the build-up of collective capabilities of local communities, institutions, and individual agents. These capabilities are to be interpreted as the ability to adapt and are the result of the accumulation of human and non-human capital, and of the development of tacit or procedural knowledge, whereby stakeholders' vulnerability is reduced, and their resilience and longer term environmental fitness increased.

58. Table 11 (Annex 9) shows the final assessment of option values under alternative hypotheses on the levels of uncertainty induced by climate change. These options correspond to the capabilities that could be created by an investment program addressing some of the main bottlenecks of agricultural growth. In light of the uncertainties of the country economic

[2]Further details on the methodology are presented in: Knudsen, O.K. and Scandizzo, P.L., *The Artful Face of Uncertainty*, ESD Working Paper, The World Bank, 2007, and in Pennisi G. and Scandizzo P.L. "Economic Evaluation in an Age of Uncertainty", *Evaluation*, Vol. 12, n.1, pp. 77-94, 2006.

[3]Two surveys have been carried out: one for farmers and one for other stakeholders. The farmers' survey aims at collecting data on key agro-economic variables and on the farmer's beliefs and opinions on climate change, its impact on agriculture, and the options available to respond to them. The stakeholders' survey aims at expanding the narratives collected during the interviews of the first field mission, and is designed to elicit opinions and interpretations on the features of agricultural growth, climate change, and the main options available for farmers and policy makers.

Memo items:

1. 2007 and 2008 CPIA ratings (overall and four clusters)
   2007 Overall: 3.05; 2008 Overall: 3.2
   a. Economic Management: 3.5
   b. Structural Policies: 3.2
   c. Policy of Social Inclusion/Equity: 3.1
   d. Public Sector Management and Institutions:2007: 2.9 ; 2008: 3.0
2. IEG rating (% of projects rated unsatisfactory—MU, U, or HU—over last five years both for the country portfolio and the sector): MNA: 15.8%, Yemen: 50%
3. Other governance and corruption indicators such as those prepared by WBI and Transparency International:

2008 Corruption Perceptions Index: 2.3 (rank 141 out of 180)

2008 WBI Governance Indicator	Year	Percentile Rank (0-100)	Governance Score (-2.5 to +2.5)
Voice and Accountability	2008	14.9	-1.18
Political Stability	2008	5.7	-1.89
Government Effectiveness	2008	12.8	-0.99
Regulatory Quality	2008	24.2	-0.70
Rule of Law	2008	18.7	-0.93
Control of Corruption	2008	27.1	-0.73

Source: www.transparency.org, http://go.worldbank.org/AL5SDP3T90

[a] Rating of risks on a four-point scale – High, Substantial, Moderate, Low – according to the likelihood of occurrence and magnitude of potential adverse impact.

D. Grant conditions and covenants

53. There was one condition of negotiation: namely, the PIM to be updated and adopted by the Recipient before negotiations. This condition was met.

54. There are two conditions of Effectiveness: (a) the execution of the TF Grant Agreement; and (b) the PSC has been established with a composition, resources and terms of reference satisfactory to the World Bank.

4. APPRAISAL SUMMARY

A. Economic and financial analyses

Financial analyses

55. *Project financing:* The project sources of financing are summarized in Table 1. This Project Appraisal pertains to the Grant of US$4.0 million financed by the GEF. In addition, there is $0.418 million from government counterpart contribution; $0.60 million from PHRD, and $0.28 million from beneficiary contribution giving a total project cost of $5.298 million. The project will be complemented with activities from two ongoing IDA operations, namely the Groundwater Soil Conservation Project and the Rainfed Agriculture Livestock Project.

Table 1: Project Costs

	Project Financing					**Other contributions**
Project Components	**GEF US$**	**Government of Yemen (US$)**	**CCIG US$**	**Beneficiaries (in kind) (US$)**	**Total (US$)**	**IDA and Beneficiaries (US$)**
C1:Agro-biodiversity &	366,500	0	0	0	366,500	2,300,000*

conditions and those created for agriculture by climate change, the capabilities created through real options appear to be as valuable as the expected NPV of the investment, and even more valuable, if one considers the risk of hitting a particularly unfavorable scenario. The options created can be considered cross-cutting effects of the project components and represent benefits that would be neglected in the usual evaluation of expected consequences of implementation per individual component.

Incremental Cost Analyses

59. The GEF support relates to the incremental cost of addressing the global externality of climate change (see Annex 15). The activities and programs of the World Bank-supported GSCP and RALP constitute the baseline, specifically Component 1 (Farmer-based system of Seed Improvement of RALP) and Component 2 (Improvement of Spate Irrigation, Water Harvesting and Soil Conservation of GSCP). Addressing the adaptation issue by targeting agro-biodiversity, which is globally and nationally important, the Bank-supported operation would greatly assist in mainstreaming the global externality of climate change into the agricultural sector. Most importantly, this proposed GEF project will ensure that the shifts towards increased productivity are sustainable and climate-resilient. The Bank project provides an ideal vehicle for the uptake of the GEF project's results, thereby ensuring sustainability.

B. Technical

60. A detailed technical review of the current state of climate modeling capacity in the country was carried out by Tu Dresden[4], and an earlier review was carried out by Wilby[5]. In addition, a field survey of farmers was undertaken to understand their perceptions regarding climate change and coping options[6]. Other technical studies that have contributed to the design include the Real Option Methodology for economic analysis and a review of women's role in agriculture[7]. While there are no agreements on the precise climate change scenarios for Yemen, there is general agreement that the impacts of climate change could be devastating for the fragile agro-ecosystems of the highlands.

61. There exists considerable technical capacity, both in the fields of agriculture and agro-biodiversity, in the MAI, AREA, and the Universities. However, the main technical issues that could affect the Project are in terms of the relative novelty of the subject of climate change and the limited capacity in the country for climate modeling and data analyses. Institutional coordination is another area where the Project could face considerable challenges. The Project will address these issues through Components 2 and 3 which relate to building capacity in climate modeling and enhancing awareness in the MAI on the climate agenda. The Government of Yemen recognizes the climate risks and has demonstrated strong commitment to addressing those through a number of initiatives on climate change which will help in building overall capacity of relevant institutions.

[4] Bernhofer, C., and others (2009): Climate Modeling for the Rainfed Highlands of Yemen.
[5] Rob Wilby (2008): Climate Change Scenarios for the Republic of Yemen; The World Bank.
[6] Mohamed Farea and Barbara Kostner (2009): Field Survey on Agro-biodiversity.
[7] Ameen Al Hakimi and Anhar Abdulkarim Ya'ni (2008): Women and Coping Strategies for Adaptation to Climate Change using Agro-biodiversity Resources in the Rainfed Highlands of Yemen.

C. Fiduciary

62. *Project costs and sources of financing*. The total cost for the implementation of the project is estimated at US$5.298 million. This includes a grant of US$4.0 million from the GEF to cover the incremental costs associated with the generation of global benefits, US$0.60 million in parallel financing from the Climate Change Initiative Grant (CCIG under PHRD), US$0.418 million of government counterpart co-financing (in-kind and to cover the project management costs), and US$0.280 million as beneficiary contribution. There will be complementary financing of US$5.27million from ongoing IDA projects (RALP and GSCP). Fiduciary management will pertain to the grant of US$4.0million financed by the GEF.

63. The project preparation cost was US$0.412 million, inclusive of US$0.20 million project preparation grant from the GEF, US$0.172 million from CCIG, US$0.025 from a Japan Social Development Fund (JSDF) seed grant, and a contribution of US$15,000 from the Government of Yemen.

64. ***Financial Management:*** The Project is financed by a US $4.0million grant from the GEF and will be implemented over 4 years, with primary coordination provided by the Ministry of Agriculture and Irrigation, and implementation oversight provided by the Project Coordination Unit (PCU) currently implementing the GSCP. The PCU comprises the Project Director, supported by core staff including for procurement and financial management. The PCU will be supported in implementation by two of its Field Units (FUs): Sana'a (also covering Al Mahweet), and Taiz (supporting the work in Ibb).

65. The project FM design reflects centralized implementation with limited decentralization of some of the activities (small-scale works and training of community members under Component 3 of the Project), using the GSCP's Field Units, which are already in place and have experience in the Bank's FM and disbursement procedures. The PCU, which is already in place and responsible for the Bank-financed project GSCP, will be responsible for handling all Project funds, keeping the Project accounts and reporting on the Project financial position including the preparation of the Project's annual financial statements. The PCU will be staffed with financial staff comprised of a Financial Manager and an accountant. Additionally, each FU will be staffed with at least one accountant (already in place) assigned to work on this Project. The financial staff will be subject to training on the project design to better manage and control the flow of information and requests between the communities, technical agencies, the PCU, and the FUs.

66. The overall project FM risk was assessed as *Moderate, after the mitigating measures described in the FM* Annex 7, mainly due to the implementation structure using an existing PCU with significant experience in managing Bank-financed projects and satisfactory FM arrangements. Nonetheless, the PCU will be entrusted with additional work under the proposed Project, including some activities where the PCU may not have prior experience in implementing. This added work load may impact the implementation pace of the Project.

67. The PCU will be responsible to prepare and submit to the Bank the Project's quarterly Interim Financial Reports (IFRs) and the Project annual financial statements. These statements will include all project expenditures including the PCU's activities. The quarterly IFRs will be

reviewed by an independent external auditor, and found acceptable to the World Bank and Central Organization for Control and Auditing (COCA). An independent external auditor will be engaged to audit, annually, the project financial statements.

68. ***Procurement*:** The procurement of goods and services will be coordinated and supervised by the Procurement Officer in the PCU, who reports to the Project Director. All procurement of goods, works, and services, financed in whole or in part by GEF funds, would be by competitive bids and contracted in accordance with World Bank procedures and guidelines. In addition, when selecting, contracting, and monitoring consultants for the project activities, the Government of Yemen will abide by the guidelines set by the World Bank (see Annex 8).

69. ***Disbursement:*** To ensure that funds are readily available for project implementation, a US Dollar segregated Designated Account (DA) will be opened at the Central Bank of Yemen (CBY) and will be managed by the PCU. Additionally, two sub-accounts will be opened and managed by the FUs; one in Sana'a and another in Taiz for managing disbursement activities for small-scale works and training of community members for community infrastructure under Component 3 of the Project. Initial advances will be provided to the FUs' sub-accounts, based on a cash forecast prepared by the FUs and approved by the PCU up to the sub-account ceilings of US$100,000, and replenishments will be remitted as activities are implemented and upon proper settlement of the advances with the PCU.

70. ***Auditing***: The Annual Audited Financial Statements are due within 6 months of the recipient's year-end (December 31). Annual audits of the Grant will be conducted by independent private auditors. The external audit report should encompass all activities under the grant agreement and should be conducted in accordance with and according to International Standards on Auditing. The report should be accompanied by a management comments letter issued by the auditor on observations noted on the Implementing Agency's internal control procedures.

D. Social

71. The Bank safeguards team confirms that the Project does not trigger OP 4.12. More specifically, the project activities will not result in: (i) involuntary taking of land; (ii) relocation or resettlement; (iii) loss of assets or access to assets, and (iv) loss of income sources or means of livelihood. The project activities are designed to result in stabilizing, increasing, and diversifying income for participating communities as a critical response to coping with climate change. The Recipient has prepared an Environmental and Social Impact Assessment (ESIA) which is satisfactory to the Bank and which confirms this position.

72. ***Social analysis and participation*:** The Project is designed to be implemented in a participatory way, with a focus on both men and women farmers, and will involve the participation of local community-based organizations/groups. A number of stakeholders (including local community representatives and women organizations) were involved in the preparation of the Project through workshops, consultations, and community outreach. This process was concluded in the participatory processes of the ESIA, which included a thorough social analysis and identified the key stakeholders and beneficiaries of the Project. This guarantees the local ownership and ensures sustainability of the Project.

73. ***Key social issues identified in the ESIA***: The ESIA sought to understand which groups are likely to be affected and what barriers exist that the Project can address that will mitigate and also encourage participation of all communities, and most importantly, the vulnerable in these communities. The ESIA found that building the skills of farmers with participation tools will encourage farmers' participation in project activities, particularly under sub-component 3.2 that involve upgrading small-scale community infrastructure and agro-biodiversity-based income generation activities. The Project has a strong focus on gender, and promoting the role of female farmers, especially in traditional knowledge. The changing climatic conditions are seen as an opportunity to empower women farmers, making them important players in the preservation of indigenous agro-biodiversity and valuing them as recipients of critical knowledge that will help reduce their level of poverty and better manage natural resources. Increasing awareness and education levels among women especially of their rights and mobilizing them into committees and associations will enable them to recognize their strengths and to share responsibilities with the community more effectively.

E. Environment

74. The Project is expected to have positive environmental and social benefits. It will assist communities in the rainfed highlands to adapt to climate change by using agro-biodiversity resources in the highlands. Changes in climatic conditions threaten the sustainability of livelihoods of these communities in the rainfed highlands. Components 1 and 2 of the Project provide the basis for designing coping strategies to adapt to climate change under component 3. Project activities under sub-component 3.2 (under component 3) -"Piloting coping strategies in local landscape units" - will include among other activities: (i) the upgrading of small-scale community infrastructure as coping strategies; and (ii) piloting agro-biodiversity-based income generation activities. Examples of (i) could include: upgrading of terraces; creation or enhancement of community seed storage facilities; soil conservation measures, small flood protection structures, etc. Examples of (ii) could include: planting, preparation and packaging of medicinal herbs (aromatic and spices); beekeeping; and construction of small nurseries/home-gardens with a preference for those using grey water and other conservation methods to produce plants, vegetables, fruits, aromatic and medicinal plants; etc.

75. These activities will contribute directly to positive environmental and social benefits and are not expected to result in any large-scale and/or irreversible negative impacts. Additionally, individual sub-projects will be screened in order to identify any potential adverse environmental and social impacts, and to identify appropriate mitigation measures. The ESIA includes a chapter (10) on screening of sub-projects, which also consists of a checklist. ACAP sub-projects (those coping mechanisms identified and to be carried out by water user groups and communities under Component 3 of the Project) are not expected to be of category A in nature, and the screening process will ensure that any such sub-projects will not be approved for funding/implementation. All sub-projects under ACAP (Component 3) will be undertaken purely on a voluntary and demand basis, and implemented by the communities (farmers and residents) themselves. Fiduciary responsibilities will remain with the PCU.

76. The Project is classified as environmental category B and designed to ensure compliance with the requirements of the following safeguard polices that are triggered: Environmental Assessment (OP 4.01) and Pest Management (OP 4.09). An environmental and social impact

assessment was undertaken which underscored the largely positive environmental and social impacts that will be generated through the Project. An Environmental and Social Management Plan (ESMP) has also been prepared. The ESIA also includes a brief Integrated Pest Management Plan (IPM). The policy has been triggered for precautionary purposes. The policy on Physical Cultural Resources (OP 4.11) will not be triggered by project activities. However, as a precautionary measure, the sub-projects will be required to screen for physical cultural resources and chance-finds, and procedures for this have been included in the ESMP. No other environmental policies are triggered as a result of project activities.

F. Safeguard policies

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[ ]	[X]
Pest Management (OP 4.09)	[X]	[ ]
Physical Cultural Resources (OP/BP 4.11)	[ ]	[X]
Involuntary Resettlement (OP/BP 4.12)	[ ]	[X]
Indigenous Peoples (OP/BP 4.10)	[ ]	[X]
Forests (OP/BP 4.36)	[ ]	[X]
Safety of Dams (OP/BP 4.37)	[ ]	[X]
Projects in Disputed Areas (OP/BP 7.60)*	[ ]	[X]
Projects on International Waterways (OP/BP 7.50)	[ ]	[X]

77. The ESIA has been disclosed prior to appraisal in the country and in the Bank's Infoshop. Also, the executive summary of the ESIA has been translated into Arabic and disclosed at the Bank Infoshop and in-country in easily accessible places to the public, including the Ministry of Agriculture and Irrigation website.

G. Policy Exceptions and Readiness

78. Checklist for readiness.

- The TORs for PCU staff and other key positions have been prepared and agreed upon during appraisal.
- Compliance with environmental, procurement, and financial management arrangements has been assessed and found satisfactory.
- Bidding documents for year 1 will be ready prior to Board date.
- Year 1 procurement plan has been prepared and is satisfactory.

* *By supporting the proposed Project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas*

Annex 1: Country and Sector or Program Background

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

1. The ecology and agro-biodiversity8 of the rainfed highlands. The highlands of Yemen are part of the Southwestern Arabian montane woodlands9 – an eco-region of global significance in the Arabian highlands above 2,000 m, which includes part of the Asir Mountains of Saudi Arabia and most of the western highlands of Yemen. The Asir Mountain chain is the highest land in the Arabian Peninsula, which tilts from west to east. East of the mountains the land slopes gradually to the Arabian Gulf. The climate of the region varies considerably depending on altitude, aspect, and season. This eco-region supports about 2000 plant species, of which about 170 are endemic, and several bird species which are also endemic to this area. The proposed Project will cover selected areas in the highlands in the Republic of Yemen (see map in Annex 17).

2. This eco-region is also important for its wealth of agro-biodiversity and traditional agricultural practices which are of global significance. For several thousand years, agriculture has been an important human activity in the western highlands of Yemen, a volcanic region with elevations between 1,000 and 3,600 m parallel to the Red Sea coast, with temperate climate and monsoon rains, and marked by the construction of terraces on steep mountain slopes. Crop diversity comprised of cultivated crop varieties, heterogeneous landraces, and wild relatives, is still an integral part of the agro-ecosystems of the highlands. Among the major crops sorghum, barley, and wheat have a large variety of landraces that have adapted to the varying ecological conditions of the highlands. About 40 varieties and landraces of wheat belonging to five species, and hundreds of landraces of Sorghum are currently cultivated; other crops with a wide range of local varieties include lentils, coffee, pomegranate, grape, and date palm. Wild crop relatives have been used and are still used as food supplements and as a means of survival during times of drought and famine. Some of the well-known wild crop relatives in this eco-region are of pomegranate, cotton, and olive.

3. These landraces have evolved through natural selection and selective breeding by traditional agricultural practices over long periods. This diversity is the basis for successful agriculture and the sustainable use of the country's scarce water and soil resources and for future crop improvement to develop varieties that perform under severe water stress - drought or flood conditions.

4. ***Current state of the rainfed highlands and agro-biodiversity.*** Historically, Yemen was a good example of economic and sustainable use of the available natural resources, where conservation of soil, crops and rangelands were part of the traditional systems, and where agricultural terraces were built and maintained for conserving water and preventing soil erosion. However, in recent decades, Yemen's natural heritage and unique environment have been undermined by the endemic poverty, water scarcity, and land degradation in the rural areas. Of the population living in poverty, 84% are in rural areas, dependent on rainfed

[8]Information from "State of Plant Genetic Resources for Food and Agriculture in Yemen – Country Report", February 2009. FAO, Rome.
[9]Wild World – 200 eco-regions of the world identified by the World Wildlife Fund.

farming for sustenance. Declining cereal production is having an impact on the food security of the rural population – 43% of rural households are food insecure and 53% of rural children are stunted. Cereal self-sufficiency is about 25 percent of the domestic use; the rest is imported.

5. ***The importance of climate change for Yemen.*** Yemen is already experiencing the impacts of climate change. Temperature records from the seventies indicate continuous warming over time, with more rapid warming in summer (+0.2°C/decade) than in winter (+0.15°C/decade). In terms of rainfall, while there does not seem be an obvious trend of total annual precipitation[10], extreme events are increasingly becoming a source of concern. Further changes are expected for the future, with considerable impacts on freshwater availability in the country, and hence on rainfed agriculture. According to the Intergovernmental Panel on Climate Change (IPCC) 4th assessment report, Yemen is expected to warm by between 3-4°C by 2080 under the A1B SRES (Special Report on Emissions Scenarios) simulation scenario - which is roughly 1.5 times the global mean response. The outlook for precipitation is less obvious. There is no clear pattern of consensus amongst the 21 Global Circulation Models (GCMs) by IPCC IV about the sign of the projected changes in winter, summer, or annual rainfall over Yemen. The projected distribution of precipitation in Yemen will also be more erratic, with possible higher frequency of high-intensity events. This will have significant implications on flood risks, land degradation, and availability of water for various uses, including agriculture, urban areas, and the industrial sector. A more detailed analysis of the climate situation for Yemen based on the preparatory analytical work for this Project is given in Annex 16.

Sector Issues that Affect Agro-biodiversity and Climate Adaptation

6. Increased migration of men to urban areas. The oil boom of the seventies started the trend of male migration to Gulf countries for employment and higher wages. Women often stayed behind and took on the additional responsibility of farm management. With overseas remittances providing much needed cash, the villages in the highlands saw the development of a market economy, and less reliance on own production. This contributed to some neglect of farm lands and terraces. Further, women were not fully equipped to undertake building and maintenance of terraces, leading to a general decline in the quality of highlands farms. The deterioration of terraces has been increasingly leading to flooding, in addition to loss of fertile soil, affecting crop production in general and leading to a decline in the agro-biodiversity found in field boundaries and terraces.

7. ***Poor natural resource management practices.*** Rapid urbanization has contributed to increasing desertification as well as deterioration of terraces and rangeland degradation. In addition, over-grazing and over-cutting of trees and shrubs for fuel consumption has led to degradation of pastures. However, the main resource management problem in Yemen is with respect to over-exploitation of groundwater for agriculture. Yemen is one of the most water-scarce nations in the world. The per capita water availability is 150 m3/yr – well below the average for the Middle East and North Africa (1250 m3/yr), and the United Nations threshold for classifying regions as water-scarce (1000 m3/yr). Agriculture accounts for 93% of

[10] Some regions in the country are becoming drier, others wetter. For example, since 1970 annual rainfall has fallen at all 7 stations close to Wadi Tuban whereas 6 out of 11 show modest increases in the Wadi Zabid.

for classifying regions as water-scarce (1000 m3/yr). Agriculture accounts for 93% of Yemen's potable water consumption (Wilby 2008). It is widely accepted that excessive drawing of groundwater and poor irrigation management have led to this crisis.

8. ***Increase in area under Qat cultivation.*** The area planted by Qat is estimated at 141,000 hectares, which is about 10% of the agricultural land in Yemen. It has been increasing at an annual rate of 3.5% between 1970 and 2006. There was a 79% increase in Qat production (from 76,000 tons to 136,000 tons) between 1991 and 2006. Over the same period, coffee production increased by only 39%, while the production of grapes fell by more than 30% (FAO 2008).

9. From the perspective agro-biodiversity and climate adaptation, the main effects of Qat expansion are on the water table and on the agro-biodiversity of crops such as sorghum, millets, barley, grapes, and coffee. While there have not been studies that estimate the impact on the agro-biodiversity of these crops and other lesser known species, the fact that Qat has completely replaced traditional crops in several farms in the highlands is a pointer to the detrimental effect it could have on the diversity of landraces and wild relatives of crops.

10. The rapidly expanding Qat areas are also exhausting the groundwater table due to excessive pumping. The total water consumption for Qat production increased from 0.67 billion cubic meters (bcm) in 1996 to 0.77 bcm in 2000, or around 23% of the total water use and about 25% of the total water use for the agriculture sector (FAO 2008).

11. ***Discontinuation of sustainable farming practices and a focus on high-yielding varieties.*** The agriculture policy of Yemen is increasingly market-orientated. Irrigation with mechanized pumping of groundwater has brought about self-sufficiency in fruit and vegetable production. At the same time there has been a general decline in the traditional practices of soil and water conservation. As older farmers migrate to towns and Gulf countries the younger generation is less familiar with traditional practices of cultivation, soil and water conservation, the characteristics of different landraces, etc.

12. On the other hand, the government too has not been able to generate the requisite capacity and funding for agro-biodiversity research, although there have been significant developments in agricultural sciences. Many crop improvement programs have been focused on high-yielding varieties with high inputs and water requirement. The improved varieties are characterized by homogeneity and high yields, while the local crop varieties are low-yielding but highly adapted to the rainfed environment (FAO 2009).

Government Response and Strategy

13. Government policy on agro-biodiversity in articulated in the National Biodiversity Strategy and Action Plan (NBSAP) 2005, under Strategic Goal 2: "Sustainable Use of Natural Resources: Area of Intervention – Agro-biodiversity: Conservation of biological resources through the adoption of ecologically sustainable agricultural and pastoral management practices, including control of fertilizer and pesticides, terrace management, traditional land use and water management systems, introduction of modern irrigation systems, etc." The NBSAP recognizes that in situ conservation of agro-biodiversity is still the dominant system,

where the farmers actively conserve and utilize most of the major crop landraces. However, ex-situ conservation programs have been initiated. Presently, there are two Plant Genetic Resources centers (gene banks) for short and medium storage: one in the Agricultural Research and Extension Authority, Dhamar, and the other in the Faculty of Agriculture, Sana'a University. Most of the activities of these centers are focused on collections of genetic resources.

14. On the climate side the National Adaptation Plan of Action (NAPA) is the main document that lays out GoY's policy for adaptation. The NAPA is mainly focused on water and soil conservation as well as maintenance of terraces in the highlands. The GoY is actively engaged in a dialogue on the Pilot Program from Climate Resilience with the Bank and other multilateral and bilateral agencies.

Annex 2: Major Related Projects Financed by the Bank and/or other Agencies

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

1. The list of completed and on-going projects that are relevant are presented in Table 2.

Table 2: List of Related Projects

Project Financed by	Project Title	Latest Supervision/ ICR Ratings	
		PDO	IP
IDA/JSDF	Ground Water and Soil Conservation Project (on-going)	S	S
IDA	Rainfed Agriculture and Livestock Project (on-going)	MS	MS
DA	Seed and Agricultural Services Project [closed]	S	S

2. The ACAP is complementary to both the GSCP and RALP and will link up with both through different components. The objectives of the GSCP are to assist the GoY in promoting groundwater conservation in farming areas and increasing surface and groundwater availability through: (i) improving irrigation water use efficiency, (ii) improving recharge and protection of watersheds; and (iii) supporting the groundwater management framework and institutions that will have the incentive and capacity to manage local water resources in a sustainable manner.

3. The ACAP will provide strategic guidance to the GSCP on developing climate resilience in GSCP's activities - irrigation efficiency, improving water harvesting and storage, and soil conservation in both rainfed and irrigated areas. This guidance will bring climate awareness not only to the GSCP's activities under the present IDA investment, but would also inform the Ministry of Water and Environment's Water Sector Strategy Project (WSSP) that aims to develop a national strategy for the sector, and which will be implemented by the same PCU.

4. The ACAP will share the PCU facilities and staff with the GSCP and also work in the field through the GSCP's Field Units and the Water Users Associations (WUAs) which have been formed by the GSCP. Several of the PCU staff would be common to both projects, allowing continuous and seamless exchange of knowledge and information during implementation between the two projects. In addition to the positive synergies this arrangement is likely to generate in the four project governorates, it would also influence GSCP activities in all the 10 governorates where the ACAP is not implemented.

5. The GSCP's work with communities through WUAs would be complemented by the ACAP under Component 3 which will strengthen these community organizations to champion climate-resilient agriculture in both rainfed and irrigated areas. Farmers who are members of the WUAs and participate in water conservation and irrigation management under GSCP would also receive awareness training on climate issues in relation to water conservation, traditional water harvesting and storage, and guidance on crop management through the use of agro-biodiversity through the ACAP. Some of the WUA members could be eligible for income-generation grants.

6. The objective of the RALP is to enable the poor rural producers in rainfed areas to:

   (a) Improve their production and marketing systems;
   (b) Protect their assets: soil, water, rangeland, seeds and animals; and
   (c) Get organized for the purposes of (a) and (b) above.

7. The ACAP and RALP will have complementary activities under two components. Component 1 of ACAP will help inform the activities of Component 1 of the RALP which focus on development of improved seed from a number of local landraces selected for vigor and yield. The ACAP will provide information to select and develop 'climate-resilient' varieties.

8. In areas where project sites of both projects overlap, community income generation and upgrading of small infrastructure through the RALP (Component 3) would include climate proofing measures, developed under the ACAP's Component 3. Efforts would be made to include the communities working with the RALP in the awareness training programs of the ACAP.

9. Overall, the synergies with RALP would enable the ACAP to influence the response to climate change in a larger part of the rainfed highlands than would be feasible if such cross linkages were not made. A system for information exchange between the two projects would be developed to facilitate this learning.

10. Table 3 lists a number of projects and analytical work that are underway, at various stages of progress, and which are directly relevant to the ACAP. Some of these have analyses which have already informed and fed into the design of the Project. The Pilot Program for Climate Resilience (PPCR), through its preparatory and investment phases, will also be directly relevant. The primary objective of the PPCR is to help highly vulnerable countries pilot and demonstrate ways to integrate climate risk and resilience into core development planning while complementing other ongoing activities.

Table 3: Planned and on-going analytical work, projects and programs directly relevant to ACAP

	Timeframe	**Budget (Million US $)**	**Financer/ Co-financer**	**Task type**	**Expected Outcomes**	**Counterpart agencies/other Association**
1	6 m to 1 yr. Preparation	1.5	Climate Investment Funds	PPCR Pilot phase	Climate Resilient Development Plan;	Relevant Ministries; research institutes, and other organizations
2	4 yrs. Implementation	30	PPCR	PPCR investment phase	Investment and capacity building activities in key effected sectors	Relevant Ministries and other organizations
3	Jan/Feb 2009	0.30	BNPP	TA	Dataset of historical climate data; CC projections for 2030, 2050, and 2080 time horizons; downscaled global climate projections to local stations	NWRA; CAMA; Complements climate modeling work under ACAP

4	December 2008 to December 2009	0.24	BNPP; TFESSD	TA	Quantification of the impacts of climate change and variability (both in physical and in economic terms) on agricultural and water sectors.	Min. of Water and Environment; Min. of Agriculture and Irrigation; NWRA; CAMA; Yemen Remote Sensing Center; Complements climate modeling work under ACAP
5	FY09 - FY11	0.15	BNPP	Study	Diagnostic of terrace maintenance and environmental management and impact analysis of RALP soil conservation and water harvesting.	Ministry of Agriculture; complements RALP & ACAP
9		0.35	DFID	Study	Atlas of probabilistic losses, reports on application of catastrophic risk modeling, design criteria for flood training works and guidelines for flood management.	Ministry of Urban Planning, Hadramawt and other Governorates

Annex 3: Results Framework and Monitoring

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

Results Framework

PDO	Project Outcome Indicators	Use of Project Outcome Information
To enhance capacity and awareness at key national agencies and at local levels, to respond to climate variability and change To better equip local communities to cope with climate change through the conservation and use of agro-biodiversity	Strategy for Climate Resilient Agriculture for Rain-fed Highlands adopted and applied by key national agencies Lessons from the community pilots are documented and scaled up	At MTR Project will be reviewed against the indicators. Activities and funds will be re-aligned according to the findings
Intermediate Outcomes	**Intermediate Outcome Indicators**	**Use of Intermediate Outcome Monitoring**
Component 1: Agro-biodiversity and Traditional Knowledge Assessment & Utilization		
Information to enhance and develop agro-biodiversity based coping strategies in place	By YR2, inventory of agro-biodiversity resources completed and documented By YR2, climate resilience profiles of at least 5 land races developed, and these landraces piloted	If inventory has not been completed by 18 months, it indicates that Component 3 could be hampered and the methodology will be revised If the number of land races piloted is lower than 5, it could flag problems either in laboratory analysis or in field testing
Component 2: Climate Change Modeling and Capacity Building		
Enhanced capacity of national agencies to develop climate scenarios based on regional climate models	By YR1, existing MOU on sharing and harmonization of climate data strengthened and institutionalized in relevant climate related agencies By YR4, number of trained technical specialists in climate related agencies to undertake climate modeling Improved local data sets developed and local capacity to predict regional climate change based on global circulation model output enhanced	If MOU is not operational by end of YR1, it demonstrates lack of commitment to the project Incomplete downscaled climate models may signal either inadequate training or capacity building in relevant agencies; or insufficient network of climate monitoring stations

Component 3: Integrating Climate Change into Rain-fed Agriculture in the Highlands		
Designed and piloted coping strategies for climate resilience using agro-biodiversity resources, in select communities in the rain-fed highlands	By end of YR2, number of community coping strategies designed and developed By end of YR3, at least 20 coping strategies are tested and piloted in local landscape units	Number of piloted coping strategies will indicate communities' understanding of climate resilience If the coping strategies are working, it presents a potential for scale up as part of climate resilience strategy. If they are not working, coping strategies will need to be redesigned
Policies and investment plans of rain-fed agriculture reflect climate considerations	By end of YR3, draft Strategy for Climate Resilient Agriculture for Rain-fed Highlands endorsed by MAI	Draft Strategy signals broad consensus among relevant stakeholders and commitment from implementing agencies
Component 4: Project Management, Coordination, and Monitoring and Evaluation		
Effective project management, monitoring and improved coordination	By end of YR1, monitoring and evaluation system in place MTR findings and lessons learned are being incorporated into PIM	Failure to meet indicators will imply ineffective functioning of PCU To assess functioning of PCU and where necessary make appropriate adjustments Provide basis for project implementation support

Arrangements for results monitoring

		Target Values					Data Collection and Reporting		
Project Income Indicators	**Baseline**	**YR1**	**YR2**	**YR3**	**YR4**		**Frequency and Reports**	**Data Collection Instruments**	**Responsibility for Data Collection**
Lessons learned from the community pilots are being captured and scaled up	0	n/a	n/a	Lessons learned captured and documented	Scaling up begins		Bi-annually	Participatory evaluation	MAI and PCU
Strategy for Climate Resilient Agriculture for Rain-fed Highlands adopted and applied by key national agencies	Limited and fragmented understanding and capacity to deal with climate change	Ongoing	Ongoing	Ongoing	Strategy is being adopted and implemented		Annually	Records and reports	PCU
Intermediate Outcome Indicators									
Component 1: Agro-biodiversity and Traditional Knowledge Assessment & Utilization									
By YR2, inventory of agro-biodiversity resources completed and documented	Inventory does not exist	20%	100%				Bi-annually	Records and reports	AREA
By YR2, climate resilience profiles of at least 5 land races developed, and these landraces piloted	0	2	5				Bi-annually	Records and reports	AREA
Component 2: Climate Change Modeling and Capacity Building									
By YR1, existing MOU on sharing and harmonization of climate data strengthened and institutionalized in relevant climate related agencies	Existing MOU not operational	50%	100%				Bi-annually	Minutes of meetings with agencies; Reports from PCU	CAMA

By YR4, number of trained technical specialists in climate related agencies to undertake climate modeling	0	0	6	6	8		Bi-annually	Records and reports	CAMA
Improved local data sets developed and local capacity to predict regional climate change based on global circulation model output enhanced on a pilot basis	Minimal local data sets available	10%	40%	60%	100%		Bi-annually	Records and reports	CAMA
Component 3: Integrating Climate Change into Rain-fed Agriculture in the Highlands									
By end of YR2, number of community coping strategies developed	0	0	100%				Annually	Records and reports	MAI
By end of YR3, at least 20 coping strategies are tested and piloted in local landscape units	0	0	5	20			Bi-annually	Surveys and reports	MAI
By end of YR3, draft Strategy for Climate Resilient Agriculture for Rain-fed Highlands endorsed by MAI	Climate considerations not included in Strategy	Consultations and Meetings	Drafting Strategy	Strategy drafted and endorsed			Bi-annually	Meeting minutes and reports	MAI
Component 4: Project Management, Coordination, and Monitoring and Evaluation									
By end of YR1, monitoring and evaluation system in place	0	M&E system in use					Annually	Records of reports	PCU
MTR findings and lessons learned are being incorporated into PIM	0	0	0	PIM is revised			Bi-Annually	Records and reports	PCU

Annex 4: Detailed Project Description

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

Project Development Objective

1. The Project development objectives are to:

    a) Enhance capacity and awareness at key national agencies and at local levels to respond to climate variability and change; and

    b) Better equip local communities to cope with climate change through the conservation and use of agro-biodiversity.

2. The project outcome indicators are:

    - Strategy for Climate-Resilient Agriculture for Rainfed Highlands adopted and applied by key national agencies; and

    - Lessons learned from the community pilots are being captured and scaled up.

3. This Project will provide a suite of options to farmers in the rainfed highlands to cope with climate change by building the knowledge base on climate change and agro-biodiversity. At the national level, the Project will initiate improvements in collection, recording, and analysis of climate data and development of national/regional climate models. Climate-related data is currently being recorded in monitoring stations under the authority of various organizations such as CAMA, NWRA, and AREA for their own purposes and with little coordination. The Project will help in creating a coordination and cooperation mechanism among such entities.

4. Simultaneously, at the community level, the Project will finance documentation of agro-biodiversity and traditional knowledge of the highlands and development of agro-biodiversity-based resource management plans, which will be used to develop and pilot alternative livelihood options, build climate resilience, and serve as a safety net for the communities in the highlands. The interventions initiated under this Project are intended to be the building blocks which will help meet the challenges of climate change over the long term. These pilot initiatives and the constituent building blocks will assist in the scaling up through program-wide approaches on climate resilience, e.g., through the PPCR, but also through mainstreaming of specific coping options and strategies through ongoing operations in the GSCP and RALP.

Geographical scope and location

5. The selection of appropriate sites for piloting the coping mechanisms is crucial for the Project. The pilot sites have to represent the critical agro-biodiversity of the highlands, and also be suitable for the development of interventions with the active participation of farmers. Following the implementation of the Project, the sites should be able to function as examples for replication and scaling-up in other sites. The first level of selection of governorates was based on the following criteria, to ensure that the sites would:

a. be located along a mesoscale geographic gradient;
b. cover most important areas of rainfed highlands;
c. cover a range of altitudes within in the highlands;
d. cover a range of mean annual precipitation;
e. cover a range of agro-ecological gradients; and
f. partially overlap with the governorates of the RALP project.

6. Site selection at the next level was carried out to identify districts where the project would be implemented. This was done to ensure that each location fulfilled all or most of the following criteria:

a. representative agro-ecosystems;
b. continued practice of traditional farming techniques;
c. availability of typical local crops;
d. availability of (reasonably intact) terrace systems;
e. mixture of cropping and animal husbandry, including the use of pasture;
f. willingness of local people including women to take part in the Project;
g. availability of data related to soil, water, climate, biodiversity, and agriculture;
h. availability of information from preceding projects at the sites;
i. potential cooperation with other on-going projects at the sites, esp. the GSCP and RALP projects;
j. possibility to undertake activities from field to catchment level, including altitudinal and agro-ecological gradients; and
k. possibility to undertake activities from family/group member to community/district levels.

7. The following governorates and districts have been selected as the respective candidate sites for the Project. A map with project areas is provided in Annex 17.

Table 4: Project Sites

Governorate	**District**	**Remarks**
Al Mahweet	Alrogm Almahweet	Northern extension of the mesoscale transect; GSCP sites
Sana´a	Blad Alros Bani Matter	Northern central part of the mesoscale transect; GSCP sites
Ibb	Alsadah Badan	Southern central part of the mesoscale transect; high altitudinal gradients; preceding agro-biodiversity projects; GSCP sites
Taiz	Saber Almoasat	Southern extension of the mesoscale transect; preceding agro-biodiversity projects; GSCP sites

Project components

8. The Project will have four components. Component 1 will build on the traditional knowledge of farmers, develop an inventory of local agro-biodiversity, and identify and test selected landraces for climate resilience. Information on the agro-biodiversity resources will be used to develop natural resource management and alternative income-generation plans with the

communities as part of a 'no regrets' approach to building climate resilience in the highlands. Component 2 will focus on raising awareness on climatic changes and developing initial local predictive capacity of weather patterns and long-term climate change scenarios for the country. Component 3 will focus on integrating climate resilience into rainfed agriculture. At the national level this will done through capacity development of the MAI and development of a climte-resilient rainfed strategy and at the local level through the development and piloting of a menu of coping strategies in partnership with the communities. Component 4 will focus on project management, coordination, and monitoring and evaluation. The project implementation manual (PIM) contains detailed information to guide the PCU and FUs in implementation.

Component 1: Agro-biodiversity and Local Knowledge Utilization and Assessment [GEF: US$366,500]

Objective: To prepare inventories of landraces and other agro-biodiversity and develop climate resilience profiles of selected landraces

Outcome: Information to enhance and develop agro-biodiversity-based coping strategies in place.

9. This component would build on the existing knowledge base of farmers who, up to now, have survived by adopting diverse coping strategies. As changing economic and livelihood patterns rapidly dilute the traditional knowledge of farmers, there is an urgent need to document this traditional knowledge. In this context, this component will facilitate the distillation of knowledge from the farmers on adaptive characteristics of the local landraces and their wild relatives. These inventories will be complemented with information from other existing databases. Climate resilience profiles for selected landraces will be developed after testing and piloting for resilience to impacts of climate change. In addition, the information on agro-biodiversity and farming systems will be used to develop natural resource management plans in collaboration with the communities. These plans would outline the requirements of soil and water conservation and agro-biodiversity harvest and use. They will indicate the potential for alternative income generation through sustainable use of agro-biodiversity in the area.

Sub-component 1.1: Agro-biodiversity Inventories

10. The main activities under this sub-component will be:

    1.1.1 Stocktaking of existing inventories
    1.1.2 Agro-biodiversity field inventories
    1.1.3 Laboratory analysis and validation

11. Implementation will start with reviews of preceding and on-going inventories. New inventories at the study sites would be planned and conducted together with the local people (esp. women). Traditional knowledge is currently being documented within projects of AREA, and by NGOs such as the Yemeni Association for Sustainable Agriculture

Development (YASAD), the Initiatives for Sustainable and Equitable Development Local Actions for Knowledge Exchange (IDDEALES), and other organizations.

12. With respect to landraces of crops, *ex-situ* seed storage from different regions of the Yemeni highlands and documentation in seed data banks is carried out at the Genetic Resource Centre at AREA and the Yemeni Genetic Resource Centre (YGRC) at Sana´a University. The number of conservation facilities has increased from 7 in 1996 to 22 in 2006, and they conserve more than 6,000 accessions. Further, morphological descriptions of seeds and phenotypes have been conducted. Therefore, it will be necessary to check for duplicates with the existing accessions. Polymerase studies will be conducted on selected landraces to verify nomenclature.

Sub-component 1.2: Development of Climate Resilient Profiles of Selected Landraces

13. The activities under this sub-component will be:

    1.2.1 Selection of landraces for field experiments
    1.2.2 Lab and field tests of selected landraces to develop climate resilience profiles

14. With the information from the field inventories a shortlist of landraces will be developed for further testing under experimental conditions. The shortlist will be developed in partnership with farmers' groups and would include landraces that are perceived by farmers as important for food or forage. Landraces will be shortlisted not necessarily for high yields, but for their performance under conditions of climatic stress – drought, flood, frost, high temperature, etc. The RALP project already works on 8 landraces selected largely on the premise of increased yields, and this Project will explore to see if there could be an overlap with any of these landraces.

15. A field-testing methodology will be developed for the selected landraces to test their performance under experimental conditions. Field tests would be conducted at appropriate field centers of AREA and in some farmers' fields. Simultaneously, laboratory analysis of some of the selected landraces will be carried out to test germination rates and seed quality.

Sub-component 1.3: Micro-Enterprises Assessment Report on Agro-biodiversity Utilization and Traditional Knowledge and Development of Business Plans for Income-generation Activities

1.3.1 Assessment of agro-biodiversity-based micro-enterprises and development of business plans

16. The final activity would be preparation of a report which identifies options and micro-enterprises, including as assessment of their economic feasibility for alternative/supplementary livelihood options based on the utilization of agro-biodiversity (e.g., beekeeping, traditional medicines, and revival of traditional culinary recipes). Building on the details of the agro-biodiversity in the selected project sites, business plans will be

developed of income-generation activities, using some of the species/landraces with potential for such activities.

Component 2. Climate Modeling and Capacity Building [GEF: US$600,000]

Objective: To develop national capacity in climate modeling and data analysis

Outcome: Enhanced capacity of national institutions to develop climate scenarios based on regional climate models

17. Climate change will contribute to the general uncertainty in Yemeni agriculture. This has various reasons: (i) precipitation is a tricky climate element and exact projections - even on precipitation trends only - are hard to make, (ii) Yemen lies in a latitudinal band were global circulation models differ in projected precipitation trends (some indicate more and some less precipitation, but there is observational evidence of increased variability of rainfall), (iii) the effect of complex topography (typical for Yemeni highlands) is poorly modeled in current climate models, and (iv) data to validate existing climate model output against measurements are limited. Therefore, both the selection of a proper modeling strategy or feasible model chain as well as necessary "tuning" of models or model outputs seems almost impossible. However, it will be useful to check on the possible boundaries of future climate change to limit the uncertainty. A more detailed assessment of the current situation with respect to climate data analysis and modeling is given in Annex 16.

18. Key steps to achieve the objective outlined above include: (i) to build a pilot database for a better statistical description of the Yemeni climate and for climate model validation; (ii) to assess and use existing GCM outputs and future GCM results to derive probable changes and their expected range; (iii) to combine existing data records (including available products based on remote sensing like TRMM and additional measurements started in the GEF project) to mimic the range of possible climate futures for areas/sites representing rainfed agriculture in the highlands of Yemen, and (iv) to utilize mesoscale climate models designed and parameterized for a similar region for regional downscaling or other techniques of regional downscaling.

Sub-component 2.1: Development of Improved Climate Database

19. Currently there is limited localized information, capacity and organizational arrangements associated with climatic data collection, storing and processing – which to date has been compiled through a variety of agencies, including the Civil Aviation and Meteorology Authority (CAMA), National Water Resources Authority (NWRA), Environment Protection Authority (EPA), and AREA. This system is clearly insufficient and needs to be fortified to meet the challenges of improved climate prediction models. Activities under this sub-component would include:

2.1.1 Meta data survey and collection on historic climate data;
2.1.2 Data collection of agro-meteorological data at selected sites (including upgrading of select weather monitoring stations);
2.1.3 Assessment of small-scale variability of rainfall;

2.1.4 Data assessment and processing; preparation of the data for validation and downscaling of climate models;
2.1.5 Statistical analysis on the climate of rainfed highlands of Yemen;
2.1.6 Assessment of institutional capacity and needs in data collection and analysis of CAMA, NWRA, AREA, and EPA, including the number and capacity of weather stations; and
2.1.7 Establishing a data transparency policy: Exchange of meta information on climate data of all relevant organizations (CAMA, NWRA, EPA, AREA, and Irrigation Sector under MAI), including the terms of the exchange of historic climate data and plans to establish new networks of meteorological, climate, and agricultural measurement stations and sites.

20. *Upgrading selected weather monitoring stations.* Small-scale upgrading of equipment in weather monitoring stations (of AREA, CAMA, NWRA, Irrigation Sector under MAI, others) would be financed under the Project to enable regular collection of temperature and precipitation data.

Sub-component 2.2: Downscaling Climate Models

21. Activities under this sub-component will be focused on establishing access to global data bases like CERA for GCM (Global Circulation Model) output data, processing the GCM output data for *the* larger region of Yemen (including neighboring regions), and analyzing the GCM output for statistical characteristics (trends, quantiles, regional patterns of climate variables, esp. precipitation). Activities would include:

2.2.1 Assessment of existing GCM results;
2.2.2 Analysis of existing GCM results (statistical evaluation, interpretation and processing);
2.2.3 Assessment of historic climate data from selected sites; and
2.2.4 Building scenario data for climate (esp. precipitation) in rainfed highlands of Yemen based on collection of new datasets.

Sub-component 2.3: Training and Technical Capability development

22. There exists a basic to intermediate climate data management capacity in Yemen due to the sufficiently large proportion of trained people in relevant institutions like CAMA and EPA. This data management capacity needs to be enhanced to deal with large spatial datasets from model outputs or remote sensing. The climate modeling capacity in Yemen is not sufficient yet. There are insufficient University level programs of study in Atmospheric Sciences. A pre-requisite for advances in climate modeling will be training at international centers of excellence, where those models are developed and applied. This sub-component, therefore, focuses on developing the capability of technical specialists within CAMA, NWRA, and AREA to undertake climate modeling. The main activities would be:

2.3.1 Masters-level training of technical and scientific personnel through an internationally acclaimed center for climate modeling; and
2.3.2 Custom training of 6-8 technical staff members from CAMA, NWRA, AREA, and Irrigation Sector under MAI in climate modeling.

Sub-component 2.4: Sharing Climate Information Inputs and Outputs

2.4.1 Identify key climate data sources/agencies;
2.4.2 Agreed arrangements on data collation; and standards for data collection towards harmonization;
2.4.3 Awareness raising and capacity for targeted users; and
2.4.4 Sharing outputs with end-users.

Component 3: Integrating Climate Change into Rainfed Agriculture [GEF: US$2,801,300]

Objective: To develop a strategic approach to integrate climate change into rainfed agriculture.

Outcome: Pilot coping strategies implemented; policies and investment plans of rainfed agriculture reflect climate considerations.

23. Coping mechanisms would be developed and piloted using the knowledge generated in Component 1 from the agro-biodiversity inventories and the climate resilience profiles of selected landraces. In addition, community-based pragmatic 'win-win' options for adaptation will be developed and implemented by the communities. These would be small-scale infrastructure and income-generation activities that use local agro-biodiversity, which will not only help in sustainable management of natural resources, but will also help in the diversification of income sources for the communities. This approach is premised on the fact that climate change is an issue that involves long time scales, beyond the scope of an individual's or a community's time horizon for planning. Diversifying livelihood options and sustainable management of natural resources, especially water, would have immediate positive impacts on the resource base and incomes.

Sub-component 3.1: Raising Awareness and Capacity Building at National and Local Levels on Climate Change

24. Activities under this sub-component will address capacity at two levels. At the policy/program level, awareness and technical capacity of staff in the MAI would be developed to take climate change into account in designing rainfed agriculture programs. At the community level the aim is to increase awareness of climate phenomena and the need to develop response strategies. A simple system to broadcast weekly weather forecasts to farmers would be established with the information generated from Component 2 by CAMA.

3.1.1. Broad-based awareness programs to decision makers, implementing agencies, and communities

25. The program would be undertaken at two levels: at the community level, farmers' networks would be involved in disseminating information through workshops on climate change phenomena, the consequences of unsustainable natural resource use, strategies for dealing with floods and droughts, and extreme weather events that have increased in frequency in the last few years. The program would consist of field demonstrations, farmer-based hands-on training sessions, co-learning, twinning programs, local workshops, booklets, and posters,

among other vehicles, and use communication tools that take into account the high level of illiteracy in these areas, particularly for females. Additionally, events such as festivals for seeds, traditional cooking, and agricultural knowledge will be held in several villages. Facilitation teams would be responsible for designing and implementing the awareness raising program, which would be based on the needs articulated in the agro-biodiversity and adaptation plans. For implementing agencies and decision makers, short training programs would be organized through NWRA and CAMA to share information on climate change, potential impacts on the rainfed areas, and how to incorporate climate considerations into the policies and plans of respective agencies.

3.1.2. Targeted technical training programs for MAI

26. These special training programs would focus on climate change impacts on rainfed agriculture, and the specific actions that MAI needs to take to respond effectively to the challenge.

3.1.3. System for transmission of weather forecasts and early warning system to farmers

27. In collaboration with CAMA, a program for frequent weather updates for farmers would be developed, to provide weekly and monthly forecasts of rainfall and temperature and extreme events. Low-cost innovative technologies would be used to deliver this information to farmers in a timely manner (e.g., SMS text messaging).

Sub-component 3.2: Piloting Coping Strategies in Local Landscape Units

28. Coping strategies in this context could be information, a technology, or a technique that enables farmers to adapt agricultural practices to changing climatic conditions. In the proposed Project coping strategies could be a combination of all or some of the following:

- information that alerts farmers to changing weather conditions;
- information on crop varieties/landraces or new crops suited to changed soil, temperature, and precipitation conditions; and
- crop management techniques to ensure success under new temperature/precipitation regimes – different sowing, inter-cropping, fertilizing, pruning, irrigation and harvesting protocols; and sustainable pest management techniques.

3.2.1. Establishing and strengthening of traditional farmer networks, including women's networks

29. Traditional farmer networks and Water Users' Groups would be strengthened with incentives for group activities and workshops on adaptation. These groups would be the main channels for awareness raising on climate change and the coping mechanisms. They would also be the primary channels for scaling up implementation of coping mechanisms through the ongoing RALP and the Groundwater and Soil Conservation Project of the Bank.

3.2.2 Targeted capacity building to access small grants to implement agro-biodiversity-based plans

30. Community groups would be given training on landscape-level planning to conserve and sustainably use local agro-biodiversity, and implement soil and water conservation measures. This training would inform community members, especially women, of the options available to diversify their income sources through the use and value addition to local agro-biodiversity. The training would also include preparation of agro-biodiversity-based small- and micro-scale business plans.

3.2.3. Developing agro-biodiversity based coping plans at local landscape units

31. Inventories of traditional knowledge and agro-biodiversity of the highlands would provide the baseline information on plant genetic resources of the highlands. Selected pilot communities in the rainfed highlands of Yemen will be supported in natural resource conservation and adaptation planning. The purpose of these plans is to identify ways to preserve local agro-biodiversity that has potential for conservation and income generation, and soil and water conservation needs in the landscape unit. These plans would address the needs of the communities as they relate to the sustainable and productive use of natural resources, which will help in adaptation to climate change. The gender dimension will be addressed through women-only discussions. Each committee would be accompanied by a local agro-biodiversity specialist. Eight to ten rainfed villages will be selected along relevant gradients of land cover/land use intensification and altitudinal zones from within a number of governorates, including Taiz, Al-Mahweet, Ibb, and Sana'a.

3.2.4. Upgrading small scale community infrastructure as coping strategies

32. Each of the pilot communities will benefit from small-scale upgrading of infrastructure. This upgrading will be tied to conservation of water, soil, terraces, and seed storage - among others – and seek to maximize the use of local knowledge and adaptation practices. The kinds of projects envisaged include:

    a) upgrading of terraces;

    b) creation or enhancement of community seed storage facilities to store wild relatives and landraces of seeds that have an important resilient value;

    c) construction of efficient water storage;

    d) establishment of community center for conservation;

    e) establishment of model farm;

    f) soil conservation; and

    g) small flood protection structures.

33. Each village will benefit from 2 to 3 upgrading sub-projects, which will have been prioritized in the community agro-biodiversity-based coping plans. Labor-intensive activities would rely primarily on labor from the community. For instance, terraces, which have a high water retention quality on hill sides and whose deterioration could contribute to more extreme

floods in the lowlands, would be upgraded by local farmers and residents, who will be learning skills that are needed for conservation and who will be responsible for the upkeep of terraces, and for eventually transferring the knowledge to others in the village. This is an important capacity building exercise.

34. In-kind community donations, up to 10% of the cost of sub-project, will be emphasized to help with the sustainability of the sub-project, such as the donation of labor. Each community will implement one sub-project at a time. Only after successful implementation of the first activity they would request funds for a subsequent activity.

35. The upgrading activities will be accompanied by a team of specialists to ensure the conservation aspects of each project. Additionally, conservation-related training sessions will be organized to benefit the community as a whole. Each of the sub-projects will be monitored and evaluated once it is up and running. This will help replicate projects in other communities and make necessary amendments to them. User surveys will also be carried out periodically to get feedback on the projects and to make needed improvements.

3.2.5 Piloting agro-biodiversity-based income-generation activities

36. The aim of this activity is to offer communities a practical way of alleviating poverty through the sustainable use and conservation of agro-biodiversity resources by financing small, sustainable projects run by farmers in the targeted rainfed areas. For instance, native species (that have both ecological and economic importance) that have been lost could be re-introduced to re-populate local areas and yield a diversified portfolio of income streams to enhance resilience of local communities against climatic and other shocks. Additionally, they will be encouraged to test new practices that will increase the productivity of crops and improve water usage. The kinds of projects that would be financed include:

    a) Construction of small nurseries/home-gardens with a preference for those using grey water and other conservation methods. These would produce plants, vegetables, fruits, aromatic and medicinal plants;
    b) planting, preparation, and packaging of medicinal herbs (aromatic and spices);
    c) small home-based catering business specializing in traditional recipes;
    d) agro-processing;
    e) beekeeping;
    f) planting of almond trees; and
    g) producing traditional ceramic ware for conservation purposes (to house seeds, etc.).

37. Each sub-project will be prepared and implemented by a small, self-selected group of 2 to 3 individuals. Sub-projects will be selected for funding according to pre-set criteria which include the sustainability of the project, and use of indigenous/local knowledge and conservation techniques, amongst other things. The poverty level of the recipient as well as his/or her skill-set will also be a determining factor. Special efforts will be made to target female-headed households.

38. These income generation sub- projects will have a cap of US$3,000/individual sub-project. The community will also be asked to provide in-kind support of up to 10% of the cost of the

sub-project. For instance, a farmer interested in a small nursery can allow other farmers to use his land for the same purpose, and the return from the sale of the produce will be split equally amongst them.

39. Farmers involved in small income generation projects will be accompanied in the process of developing the project idea and implementing it. In the case of projects targeting increased crop productivity or the use of new more productive seeds, for instance, an agro-biodiversity specialist will accompany these projects and document the agricultural calendar, soil, water input, and productivity of seeds to ensure their sustainability and to make any necessary adjustments along the way. In the case of traditional recipes and medicinal herbs, a social specialist will accompany the process to document the kinds of recipes and herbs and their benefits. This process of documentation is critical in ensuring that traditional methods of farming, cooking, water use, and seed conservation are not lost, and can be replicated by other farmers, particularly young women, who are often not exposed to the sort of experiences their mothers were exposed to.

40. Additionally, sub-project participants will be provided with technical, logistical, and training support towards improving capacities in matters of production, conservation, processing, and marketing. This training support will also be based on the needs articulated in the agro-biodiversity plans. The marketing aspect in particular will be paid close attention; because of the restrictions on women's mobility, a designated specialist will be in charge of marketing the goods in markets and during festivals. Fiduciary responsibilities for such sub-projects will remain with the PCU.

Sub-component 3.3: Preparation of a Climate-Resilient Agriculture Strategy for Rainfed Highlands

3.3.1 Vulnerability Assessment of agriculture in rainfed highlands

41. A detailed assessment will be commissioned to assess the vulnerability of the rainfed highlands to climate change. This study will identify the impacts on crop productivity, cropping pattern, food production, rural employment, and other socio-economic parameters due to changes in temperature and rainfall, soil loss, and increase in frequency of extreme weather events. The study will provide guidance to decision makers on the costs of not making rainfed agriculture climate resilient and result in a draft climate-resilient rainfed agriculture strategy for the country.

3.3.2 Stakeholder consultations with relevant agencies including communities and civil society

42. The MAI will organize stakeholder consultations to discuss the vulnerability assessment report and draft rainfed agriculture strategy with a wide range of stakeholders including civil society and communities. The aim of this exercise is to build consensus for the strategy.

3.3.3 Development of agriculture strategy for rainfed highlands

43. The MAI, based on feedback from stakeholders, will prepare the strategy which will be endorsed by the Government of Yemen.

Component 4: Project Management, Coordination, Monitoring and Evaluation [GEF: US$232,200]

44. The objective of this component is effective management to support project implementation. The PCU will liaise with the technical agencies for implementation and nurture/facilitate coordination between the components.

45. Project implementation will be overseen by the PCU, which will be under the Ministry of Agriculture and Irrigation. The PCU will be headed by a Project Director and have staff to oversee procurement, financial management, and administrative support functions as well as an expert with international experience and skills on climate change and natural resource management issues to provide technical oversight for the project.

46. A monitoring system will be put in place that tracks performance of the PCU and its partners in relation to: (a) progress in achieving scheduled activities and outputs; (b) expenditure against budget allocations; and (c) project impacts on key outcomes and indicators of achievement. Indicators and monitoring mechanisms are detailed in Annex 3.

47. Overall strategic guidance for the project is provided by the Steering Committee chaired by the Minister for Agriculture and Irrigation with membership from the following Ministries/agencies:

- *Ministry of Planning and International Cooperation (MOPIC)*
- *Ministry of Finance (MOF)*
- *Deputy Minister Irrigation and Land Reclamation (MAI)*
- *Deputy Minister Agricultural Production Development Sector (MAI)*
- *The Civil Aviation and Meteorology Authority (CAMA)*
- *The National Water Resources Authority (NWRA)*
- *The Agricultural Research and Extension Authority (AREA),*
- *The Environment Protection Authority (EPA)*
- *The Project Coordination Unit (ACAP)*

48. A Technical Coordination Committee (TCC) will be established to provide technical advice on *ad hoc* basis on the project. Its role will primarily be one of information sharing. The TCC will comprise representatives of the following key ministries and institutions:

- *Deputy Minister Irrigation and Land Reclamation, MAI (Chair)*
- *The National Water Resources Authority (NWRA)*
- *The Civil Aviation and Meteorology Authority (CAMA)*
- *The Agricultural Research and Extension Authority (AREA)*
- *The Project Coordination Unit (ACAP)*
- *Ad-hoc members*

Annex 5: Project Costs

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

Table 1: Project Costs by Financier

	Project Financing				
Project Components	**GEF US$**	**Government of Yemen (US$)**	**CCIG US$**	**Beneficiaries (in kind) (US$)**	**Total (US$)**
C1:Agro-biodiversity & Traditional Knowledge Utilization	366,500	0	0	0	366,500
C2: Climate Change Modeling and Capacity Building	600,000	0	250,000	0	850,000
C3: Integrating Climate Change into Rainfed Agriculture	2,801,300	0	320,000	280,000	3,401,300
C4: Project Management, Coordination and Monitoring and Evaluation	232,200	418,000	30,000	0	680,200
Total Project Costs	**4,000,000**	**418,000**	**600,000**	**280,000**	**5,298,000**

*Complementary activities from RALP in the order of $2.3 million and GSCP in the order of $2.97 million (including $640K from beneficiaries) will support component 1 and 3 respectively.

** No funds allocated for contingencies.

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Table 2: Project Costs [US$]

	Local				Foreign		Total
Project Component	**GEF**	**CCIG**	**GoY**	**Benefic -iaries**	**GEF**	**CCIG**	
C1:Agro-biodiversity & Traditional Knowledge Utilization	239,500				127,000		366,500
C2: Climate Change Modeling and Capacity Building	250,000	175,000			350,000	75,000	850,000
C3: Integrating Climate Change into Rainfed Agriculture	2,686,300	185,000		280,000	115,000	135,000	3,401,300
C4: Project Management, Coordination and Monitoring and Evaluation	232,200	30,000	418,000				680,200
Total	**3,408,000**	**390,000**	**418,000**	**280,000**	**592,000**	**210,000**	**5,298,000**

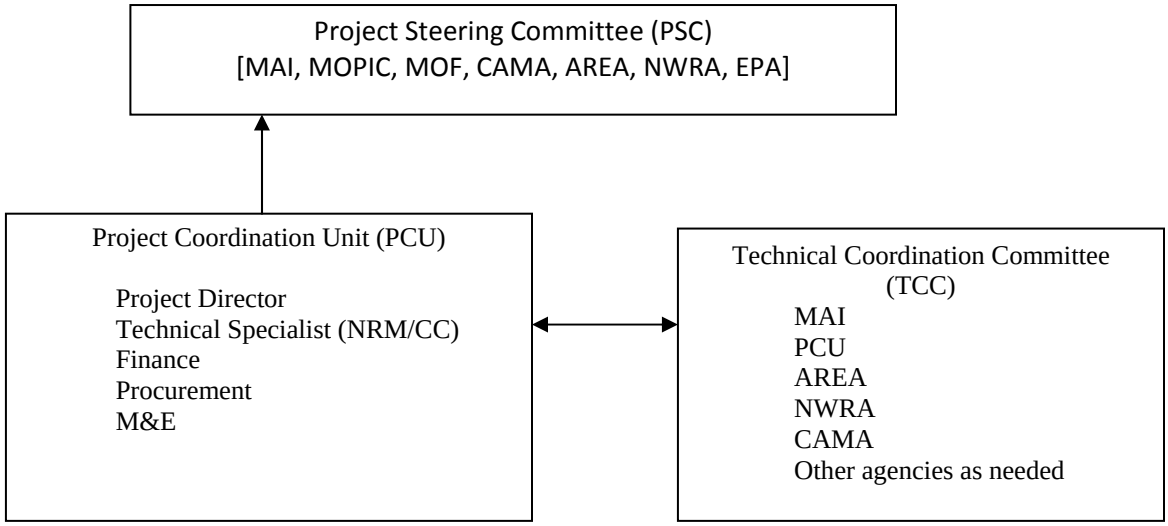
Annex 6: Implementation Arrangements

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

1. The Ministry of Agriculture and Irrigation (MAI) is the main implementing agency for the Project and will be responsible for providing strategic oversight, coordinating funds flow, coordinating with other agencies, and monitoring and reporting on the results. Project administration will be carried out by the Project Coordination Unit, which is currently overseeing implementation of the Ground Water and Soil Conservation Project financed by the World Bank. Following the closure of the Groundwater and Soil Conservation Project, the PCU will be placed under the National Irrigation Program (NIP), which is the umbrella program being implemented by the Ministry of Agriculture and Irrigation (MAI), as part of the Water Sector Strategy Program (WSSP).

A. PROJECT MANAGEMENT

2. **Overview and Structure**: The GSCP PCU will be responsible for implementation of all project activities under the guidance of the Project Steering Committee, which will be established by Effectiveness to provide strategic guidance and oversight for the Project. Additionally, a Technical Coordination Committee will be established to provide technical advice to the Project, and it will meet as and when required.



The Project Implementation Unit (PCU)

3. **Staffing:** The Project Implementation Unit (PCU) for the Project consists of the following positions: Project Director, Financial Specialist, Procurement Specialist, Monitoring and Evaluation Officer, and Support Staff. Additional to these staff a technical specialist with international experience on natural resource management (NRM) and climate change (CC) issues will be hired to oversee the technical aspects of the Project.

4. **Responsibilities:** The PCU will be responsible for ensuring effective project implementation and specifically:

   - Ensuring active participation of beneficiaries and the local population;
   - Ensuring timely and adequate technical cooperation from identified specialized agencies such as CAMA, NWRA, and AREA for input into Components 1 and 2, respectively;
   - Ensuring the participation of government organizations;
   - Liaising with the other MAI staff and other stakeholders;
   - Procuring services and equipment in accordance with the World Bank's procurement guidelines;
   - Preparation of annual work plans and budgets;
   - Preparation and submission of quarterly and annual progress reports to the Steering Committee;
   - Accounting for project expenditures, which are to be audited annually;
   - Monitoring and evaluation of project activities;
   - Organizing the Steering Committee meetings;
   - Organizing Technical Coordination Committee meetings;
   - Securing the committed co-financing to the Project from the government;
   - Liaising and coordinating with the RALP and other relevant projects; and
   - Updating the PIM and ensuring that the FUs follow the guidance in the PIM during implementation.

Project Steering Committee

5. The Ministry of Agriculture and Irrigation (MAI) will be the government's focal point for the Project, and as Chair of the Project Steering Committee (PSC) will provide strategic coordination and monitor progress.

6. The PSC will meet every two/three months to provide strategic direction for project implementation and assess the Project's progress against planned outputs, and will at the same time seek to ensure that the necessary inter-agency coordination is in place and working well. The PSC will comprise of key ministries and institutions that have an influential role in the development of the rainfed highlands of Yemen. The terms of references of the PSC will be reflected in the PIM. The members of the Committees would include the following:
   - *The Ministry of Agriculture and Irrigation (MAI) (Chair)*
   - *The Deputy Minister of Irrigation and Land Reclamation (MAI)*
   - *Deputy Minister, Agricultural Production Development Sector (MAI)*
   - *Ministry of Planning and International Cooperation (MOPIC)*
   - *Ministry of Finance (MOF)*
   - *The Civil Aviation and Meteorology Authority (CAMA)*
   - *The National Water Resources Authority (NWRA)*
   - *The Agricultural Research and Extension Authority (AREA)*
   - *Environment Protection Authority (EPA)*

Technical Coordination Committee

7. The Technical Coordination Committee (TCC) will be an *ad hoc* committee to co-ordinate and guide the implementation of the Project, and will meet at least two times in a year. This committee would discuss technical issues and enable information exchange between project components as needed. The Deputy Minister for Irrigation and Land Reclamation will chair the TCC. Members would include representatives from:

    - *The Ministry of Agriculture and Irrigation (MAI);*
    - *The Civil Aviation and Meteorology Authority (CAMA);*
    - *The Agricultural Research and Extension Authority (AREA);*
    - *The PCU; and*
    - *Other members as needed.*

Implementation Responsibility for Project Components

8. The GSCP PCU will be responsible for all fiduciary matters, financial management, and maintenance of project books of accounts. The PCU will manage all procurement for the Project and carry out all financial management and reporting to the Bank.

Annex 7: Financial Management and Disbursement Arrangements

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

A. General

1. Implementation will be based on the ring-fencing method and will be managed by an experienced PCU under the Ministry of Agriculture and Irrigation (MAI). This PCU is already in place[11] and is staffed with a qualified and experienced team, consisting of a Project Director, a Finance Officer, a Procurement Officer, and other technical and support staff. The Project activities under Components 1, 2 and 3 including, part of the project management costs under Component 4 will be financed by the GEF grant proceeds of US $ 4.0million. The Government will be required to make available counterpart funds to co-finance the activities of Component 4. The PCU will be responsible for implementing the Project's Financial Management (FM) aspects on behalf of, and under the guidance of, the MAI through the Project Steering Committee chaired by the Minister for Agriculture and Irrigation with membership from the following Ministries and agencies: MOPIC, CAMA, AREA, EPA, NWRA, PCU, and MoF.

2. Procurement and contract management, including payments and financial management, will all be centralized at the PCU, except for some of the activities (small-scale works and training of community members for community infrastructure) under Component 3 of the Project, for which the PCU will be using its Field Units (FUs), which are already in place, and which have experience in the Bank's FM and disbursement procedures. Sub-accounts will be opened and managed by the FUs in Sana'a and Taiz for managing disbursement activities for such activities under Component 3. Advances will be provided to the FUs' sub-accounts, up to the sub-accounts ceilings of US$100,000, based on a cash forecast prepared by the FUs and approved by the PCU, and replenishments will be remitted as activities are implemented and upon proper settlement of the advances.

3. The overall project FM risk was assessed as *Moderate*, mainly due to the implementation structure using an existing PCU with significant experience in managing Bank-financed projects and satisfactory FM arrangements. Nonetheless, the PCU will be entrusted with an additional work load under the proposed Project and with some activities where the PCU may not have prior experience in implementing. This added work load may impact the implementation pace of the Project. Measures mitigating the above risk have been defined and agreed upon with the Recipient. These measures include: (i) enhancing the PCU's capacity through hiring an expert with international experience and skills to deal with climate change and natural resource management issues, including M&E; and (ii) ensuring more frequent supervision and support to be provided by the Bank's team to ensure capacity is adequate for implementation, and to address any weaknesses. The FM arrangements, risks, and mitigation measures are described below.

[11] The PCU is presently entrusted with the implementation of the Bank-financed Groundwater & Soil Conservation Project (GSCP).

4. The PCU will manage all the financial aspects of the GEF grant proceeds of US $4.0million under the project. (e.g., accounting, recording, and reporting through the use of an automated accounting system and based on an acceptable manual of procedures and management of the disbursement process). The PCU will prepare, and submit to the Bank, the Project's quarterly Interim Financial Reports (IFRs) and annual financial statements. The PCU's Financial Manager will receive support and training and will be supported by an accountant from the current PCU's staff, or one will be recruited after effectiveness to strengthen the Unit's capacity.

5. An independent external auditor, acceptable to the Bank and COCA, will be engaged by the PCU to perform the audit and issue an independent opinion on the Project financial statements. The audit report with audited financial statements should be submitted to the Bank no later than six months following the closing date of each fiscal year being audited.

B. Risk Assessment

Country Risks

6. As reported and outlined in the Country Assistance Strategy (CAS) of 2009, poor governance remains a critical issue in Yemen. The Country Public Expenditure and Financial Accountability report (PEFA, 2008) indicated that there had been some progress in the fiscal area, particularly in terms of budget expenditure classification and consolidation of investments. However, a lack of progress was observed on achieving budget comprehensiveness and implementing a broader fiscal framework based on multi-year expenditures framework. Efforts to move forward in reforming budget implementation, cash management, accounting, and reporting have been pinned on the design and implementation of the IDA-supported Accounting Financial Management Information System (AFMIS), which has been experiencing significant delays, but such efforts will continue under IDA's current pipeline project supporting Public Financial Management. These factors, as well as the poor quality of education and training in accounting, have contributed to the generally observed insufficiencies of the financial reporting and auditing systems in the country. The above Country Risks result in having higher potential exposure to corruption, which in turn is mitigated through the Project's design, which follows the ring-fencing approach based on the PCU structure. In addition, this structure is the result of the government not achieving budget comprehensiveness.

Issue / Risk	Risk Before MM	Mitigating Measures (MM)	Risk After MM
The findings of the various country assessments conducted recently indicate a lack of progress on achieving sufficient public financial management reforms, including governance, accounting, and auditing systems in the country.	High	Use of the country system to manage the FM activities of the Project needs to be enhanced. Thus, the Project design follows the ring-fencing method based on the PCU structure which will be managing all the FM activities including preparing and submitting to the Bank quarterly IFRs and annual financial statements, reviewed and audited by an external auditor.	Substantial

Project Financial Management Risks

Issue / Risk	Risk Before MM	Comments/ Mitigating Measures (MM)	Risk After MM
Implementing Entity			
The PCU, co-financed by the Grant and Government proceeds, is responsible for implementing the Project on behalf of the MAI. The PCU will be entrusted with additional work load under the proposed Project including some activities where the PCU may not have prior experience in implementing.	Substantial	The Project will be implemented following the ring-fencing method by the already established PCU, and staffed with a Project Director, a Finance Officer, a Procurement Officer, and other Technical and support staff. The PCU's capacity will be enhanced through hiring an expert with international experience to deal with climate change and natural resource management issues, including M&E, and by ensuring more frequent supervision and support to be provided by the Bank's team to guarantee that capacity is adequate for implementation and to address any weaknesses.	Moderate
Staffing			
Staff capacity to manage the financial management activities of the Project.	Substantial	The PCU's Finance Officer is qualified and experienced in implementing Bank-financed projects. He will be supported by an accountant from the PCU's staff, or one will be recruited after effectiveness to support the PCU's capacity. FM supervision will be provided on an on-going basis through the World Bank's FM Specialist.	Moderate
Information System			
An automated accounting system capable of recording and generating required reports.	Moderate	The PCU has an acceptable automated accounting system which follows cash basis accounting and which is capable of recording all project activities, generating required reports such as the quarterly IFRs, and annual financial statements. The format of the IFRs will be the same as currently used by the GSCP, but reflecting the components, activities, and categories of this Project.	Low
Internal Controls & Accounting Policies and Procedures			
Appropriate and comprehensive procedures manual.	Moderate	The PCU has an acceptable manual of procedures prepared under GSCP, which was used as a basis to prepare a manual specific to this Project to define the project's policies and procedures including control procedures, flow of funds, and defining the roles and responsibilities of the PCU and FUs.	Low

Flow of Information and Funds			
The Grant funds will be made available to the PCU.	Moderate	Flow of funds and reporting are designed to be simplified and managed centrally by the PCU. The grant proceeds will be channeled through the PCU and deposited into a segregated US$ Designated Account (DA) at the Central Bank of Yemen (CBY) and disbursed in accordance with the Bank's disbursements guidelines. Advances and Reimbursements will be the main disbursement methods, along with Direct Payment and Special Commitments. Requests for receiving grant funds will be initiated through the use of Withdrawal Applications (WAs) and accompanied by Statement of Expenditures (SOE) or Summary Sheets and supporting documents as per the Project's Disbursement Letter. Additionally, sub-accounts will be opened and managed by the FUs in Sana'a and Taiz for managing disbursement activities for small-scale works and training of community members for community infrastructure under Component 3 of the Project. Advances will be provided to the FUs' sub-accounts, based on a cash-forecast prepared by the FUs and approved by the PCU, and replenishments will be remitted as activities implemented and upon proper settlement of the advances.	Low
Activity based risks – Components 1, 2 & 3			
The Project's activities under Components 1, 2 & 3 include a number of consultancy services and trainings which are complex technically.	Substantial	The PCU will be strengthened with an expert with international experience in climate change and natural resources management to oversee technical aspects of project implementation and to coordinate with other agencies involved. The PCU has experience in implementing Component 3, like activities involving Water Users Associations (WUAs), and they have detailed procedures for selection and formation of WUAs, and selection of farmers for some on-farm irrigation improvements.	Moderate
External Audit			
Audit profession in Yemen requires enhancement.	High	The Bank is working with the audit profession in Yemen to enhance the capacity through various actions including training workshops and audit toolkits for Bank-financed projects. An independent private external auditor acceptable to the Bank will be hired to audit the project accounts according to TORs for which the Bank will grant a No objection.	Substantial

Overall Inherent Risk Before MM	*Substantial*	*Overall Inherent Risk after MM*	*Moderate*

Overall FM Risk Assessment

7. As detailed above, the inherent risk in the Country is **High**, and the project financial management risk assessment is **Substantial**. The successful implementation of the mitigation measures, which have been agreed upon with the Recipient, will eventually reduce the project financial management risk to **Moderate.**

C. Financial Management and Disbursements Arrangements

I. Implementation Entities, Accounting, and Staffing

8. The PCU, established at MAI, will be responsible for the planning, budgeting, overall supervision of the activities, consolidating project information, and reporting on these activities to all stakeholders. A Finance Officer is in place at the PCU to manage the project's accounts and finances. The Finance Officer will be supported by an accountant from the existing PCU, or one will be recruited after Project effectiveness to strengthen the PCU's capacity.

9. In parallel, the procurement and financial management will be implemented centrally at the PCU with technical inputs and advice from the specialized agencies (e.g., AREA, CAMA, and others).

10. The PCU has an acceptable automated accounting system which follows cash basis accounting and capable of recording all project activities, generating required reports such as the quarterly IFRs and annual financial statements. The content and format of the IFRs were agreed upon during Project Negotiation and follow the form under the ongoing IDA-finance project, GSCP.

II. Flow of Funds

11. A segregated Designated Account (DA) will be opened by the MAI and will be managed by the PCU. The account will be denominated in US Dollar and will be opened at the Central Bank of Yemen (CBY). The PCU will be responsible for the project funds including transferring the funds to their FUs. Deposits into, and payments from, the DA will be made in accordance with the disbursement letter and Bank Disbursement Guidelines. The PCU will prepare withdrawal applications with the related supporting documents, signed by the designated signatories. Additionally, sub-accounts will be opened and managed by the FUs in Sana'a and Taiz for managing disbursement activities for small-scale works and training of community members for community infrastructure under Component 3 of the Project. Advances will be provided to the FUs' sub-accounts, based on an initial cash forecast prepared by the FUs and approved by the PCU. Transaction-based replenishments will be effected as activities are implemented and upon proper settlement of the advances. The FUs

will submit Statement of Expenditures to the PCU in order to receive regular replenishments of the sub-accounts.

III. Financial Reporting

12. In line with the Bank guidelines, the following reports will be required under this Project:

Quarterly: The PCU will be required to generate separate quarterly Interim un-audited financial reports (IFRs) and submit them to the Bank as part of the Project's progress report or separately. These reports will consist of the following:

- Statement of sources and uses of funds by category of expenditure, and statement of uses of funds by project component, indicating funds received, quarterly cash forecast, an expenditure report comparing actual and planned expenditures by activity, and the DA's reconciliation statement; and
- Contracts listing: to include a listing of all contracts showing amounts committed and disbursed under each category as of the report date.

These reports will be generated through the automated accounting system that is already in place at the PCU and should be remitted to the Bank within 45 days from the end of the quarter as per the Project's Grant Agreement. The proposed format of the reports was agreed upon during project negotiation. The quarterly IFRs will be reviewed by the independent external auditor.

Annually: Project Financial Statements (PFS) will be prepared annually following the cash basis of accounting with disclosure of the unpaid commitments at the report date, and will be subject to external audit, and the audited PFS will be submitted to the Bank within six months from year-end. The PFS will include:

- Statement of sources and uses of funds, indicating sources of funds received and project expenditures by category of expenditure;
- Appropriate schedules, classifying project expenditures by component, showing yearly and cumulative balances;
- DA reconciliation statement, reconciling opening and year-end balances;
- Statement of payments made using Statements of Expenditures (SOEs) procedures as defined in the legal agreement;
- Statement of project commitments, i.e. the unpaid balances under the Project's signed contracts; and
- Status of advances/expenditures made and incurred by the FUs.

IV. Auditing

13. The Project's financial statements will be audited by an independent private–sector auditor. The external independent auditor must be acceptable to the Bank, and his TOR will be

prepared and submitted for the Bank's no objection, at least nine months prior to the end of the Project's fiscal year. The external auditor report (in English) shall encompass all project components and activities under the Legal Agreement and shall be in accordance with internationally accepted auditing standards, e.g., International Standards on Auditing (ISA). The audit report and opinion will cover the Project's financial statements, reconciliation and use of the Designated Account (DA), use of direct payments, and withdrawals based on Statements of Expenditure (SOEs). In addition, the auditor is required to prepare a "management letter" indentifying any observations, comments and deficiencies in the system and controls, that the auditor considers pertinent, and shall provide recommendations for their improvements. The PCU will recruit the external auditor, and the audit costs will be financed by the project proceeds.

V. Disbursement Arrangements

14. The proceeds of the Grant will be disbursed in accordance with the Bank's disbursements guidelines as outlined in the Disbursement Letter. Advance and Reimbursement-based disbursements will be the main methods used under this Project. Accordingly, requests for payments from the grant account will be initiated through the use of Withdrawal Applications (WAs) either for Advances, Direct Payments, Reimbursements, and Replenishments to the Designated Account, or Issuance of Special Commitments. All WAs will include appropriate supporting documentation, including detailed SOEs for reimbursements and replenishments to the DA.

Table 5: Allocations of the Grant Proceeds

Category	Amount of the Grant Allocated (expressed in USD)	Percentage of Expenditures to be Financed (inclusive of taxes)
1. Goods, works, consultants' services, Training and Incremental Operating Costs under the Project	4,000,000	100%
TOTAL AMOUNT	**$4,000,000**	

Statement of Expenditures (SOE)

15. During implementation, SOEs will be used as supporting documentation for disbursement of all expenditures relating to: (i) goods under contracts costing less than US$500,000; (ii) works under contract costing less than US$2 million; (iii) consulting firms under contracts costing less than US$200,000 and individual consultants under contracts costing less than US$100,000; and (iv) training costs and incremental operating costs, under such terms and conditions as the Bank shall specify by notice to the Recipient. The supporting documentation will be maintained at the PCU and will be made available for review by the

Bank supervision missions upon request. Documentation relating to SOEs would be retained for up to one year from the date the Bank receives the audit report for the fiscal year in which the last WA from the Grant was made.

Designated Account (DA)

16. One segregated Designated Account (DA) will be opened at the Central Bank of Yemen. The DA will be used to hold the Grant's funds, and from which disbursements to vendors, consultants, and other project activities will be made. No payments for goods or services other than those related to the Project will be made from the account. An authorized allocation of US$400,000 (representing approximately four months of eligible expenditures financed by the Grant) will be used as the DA's ceiling. Authorized signatories, names, and corresponding specimens of their signatures will be submitted to the Bank prior to the receipt of the first WA.

17. Chart A below summarizes the flow of funds from the Bank and the Government to the PCU's segregated DA and Counterpart funds account, respectively, through WAs, to finance the Project's eligible expenditures. Payment requests from the DA for eligible expenditures will be approved by the PCU's Finance Officer and Director, and supported by the acceptance of the Lead Agencies for relevant activities where the Agencies are the beneficiary of the activities, and then the payment requests will be sent to the MOF for approval of payment from the DA at CBY. Payment requests from the counterpart funds for eligible expenditures will be approved by the PCU's Finance Officer (representing MOF) and Director, and checks will be issued from the counterpart account at CBY.

18. **Corruption:** Fraud and corruption may affect the project resources. The above fiduciary arrangements, including ring-fencing, reporting and audit arrangements, will reasonably tackle the risk of corruption from a technical perspective through the fiduciary arrangements but may not be effective in case of collusion.

19. **Bank Supervision:** The Financial management of the Project will be supervised by the Bank in conjunction with its overall supervision of the Project, and at least twice a year.

Chart (A) Flow of funds chart

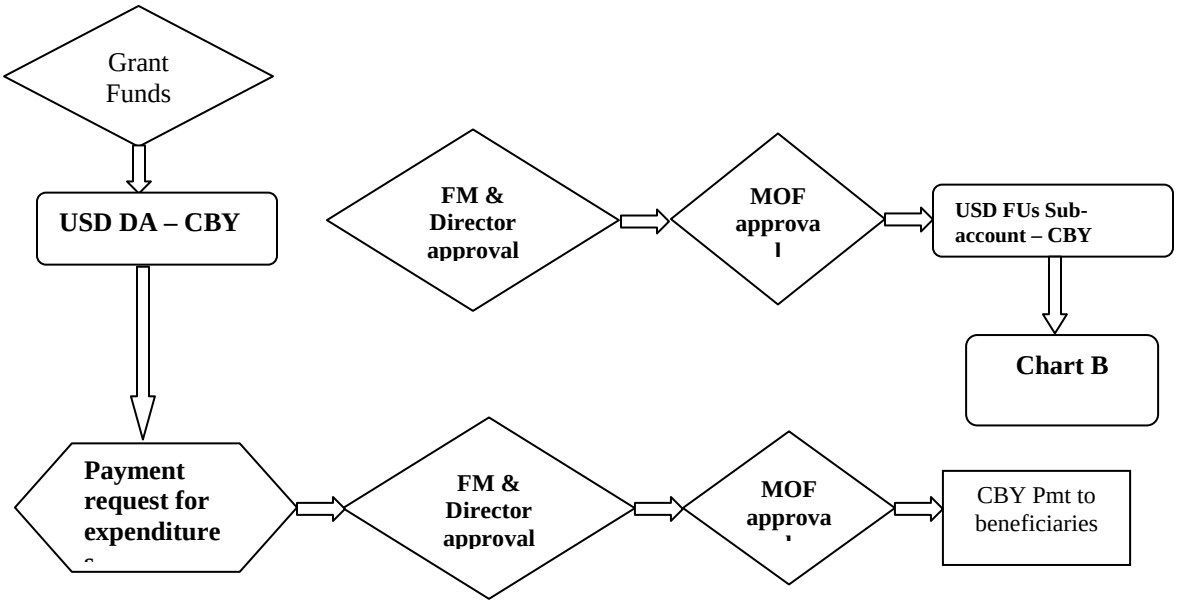
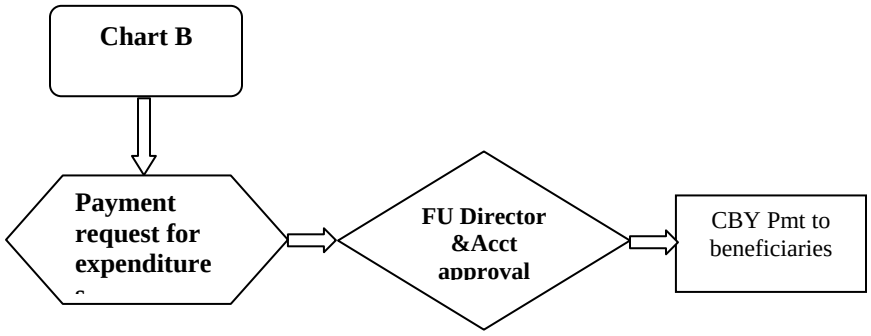


Chart (B) Sub-account flow of funds chart



Note: The transfer of funds from the DA to the FUs' sub-accounts is based on cash forecast and approvals of the PCU's FM and Director as well as the MOF. Then, from the sub-accounts, payments are made via checks signed by the FU's Director and accountant

Annex 8: Procurement Arrangements

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

A. General

1. Procurement for the proposed Project would be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated May 2004 and revised October 2006; and "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated May 2004 and revised October 2006, and the provisions stipulated in the Legal Agreement. The **various** items under different expenditure categories are described in general below. For each contract to be financed by the Grant, the different procurement methods or consultant selection methods, the need for pre-qualification, estimated costs, prior review requirements, and time frame are agreed between the Recipient and the Bank in the Procurement Plan. The Procurement Plan will be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity. Table 1 in Section E provides a summary of the overall costs for each procurement category.

Procurement Arrangements

2. **Procurement of Works**: The total cost of Works to be procured is estimated at US$2.00million, of which US$ 1.825million is from GEF and US$ 0.175 million is from parallel financing under the CCIG. Works procured under this Project would include: civil works for field stations; collection of agro-meteorological data; upgrading select weather stations; upgrading terraces through multiple contracts; water storage through multiple contracts; soil conservation measures (vegetative-planting); small flood protection measures at multiple locations through community contracts; upgrading community infrastructure (community seed stores and community centers); and income-generations activities (multiple contracts using community contracting).

3. Civil works under the proposed Grant are generally small and geographically dispersed in local communities (with **contract** values not of interest to foreign bidders, with perhaps a few exceptions) and would be carried out under National Competitive Bidding (NCB) procedures. NCB contracts would be open to eligible foreign bidders if they wished to participate.

4. **Community Contracting:** This method of procurement will be used for goods and works under Part C (Sub-Component 3.1 activities relating to community participation) of the Project for contracts valued at less than US $10,000. Such procurement will be carried out by eligible communities according to the policies and procedures set out under the Groundwater Conservation Project Manual for "Direct Financing of communities", which is part of the Operational Manual, and as satisfactory to the Association, as the same may be amended from time to time with the prior approval of the Association.

5. **Procurement of Goods:** The total cost of goods to be procured is estimated at US$ 0.8796 million, of which US$0.7896 million is from GEF and US$ 0.090 million is from parallel

financing under the CCIG. Goods to be procured are presented in the table under Section E, and these include: laboratory equipment for soil-plant analysis; field testing equipments, computers and furniture; equipment for field and desk inventory; field evaluation equipment; equipment for collection of agro-meteorological data; upgrading select weather stations; weather alert system; goods for four Model Farms (1-2 ha each) for field demonstration and farmers' training in disseminating information on climate change with RCC tanks, booster pumps, drip system, etc.; survey equipment, and vehicles.

6. The procurement of goods with estimated contract values of less than US$ 500,000, as stated on the **Procurement** Plan, would be procured through NCB. Goods less than US$ 50,000 would be procured through National Shopping (NS) as described in the procurement guidelines, clause 3.5.

7. The procurement will be done using the Bank's Standard Bidding Documents (SBD) for all ICB and National Standard Bidding Document (SBD) agreed with or satisfactory to the Bank.

8. The procedures to be followed for National Competitive Bidding under this paragraph shall be those set forth in the Recipient's Law No. 23 for 2007, concerning Government Tenders, Auctions and Stores, and its Regulations, subject to the following additional procedures:

    (A) A Recipient-owned enterprise in the Republic of Yemen shall be eligible to bid only if it can establish that it is legally and financially autonomous, operates under commercial law, and is not a dependent agency of the Recipient;

    (B) Bidding (or pre-qualification, if required) shall not be restricted to any particular class of contractors or suppliers, and non-registered contractors and suppliers shall also be eligible to participate;

    (C) Tenders shall be advertised for at least two (2) consecutive days in two (2) local newspapers of wide circulation;

    (D) Prospective bidders shall be allowed a minimum of thirty (30) days for the preparation and submission of bids, such thirty (30) days to begin with the availability of the bidding documents or the advertisement, whichever is later;

    (E) Until national standard bidding documents acceptable to the Association are available, bidding documents approved by the Association shall be used, and may be prepared in Arabic;

    (F) Registration shall not be used to assess bidders' qualifications; qualification criteria (in case pre-qualification was not carried out), and the method of evaluating the qualification of each bidder shall be stated in the bidding documents, and before contract award. The bidder having submitted the lowest evaluated responsive bid shall be subject to post-qualification;

(G) A foreign bidder shall not be required to register or to appoint an agent as a condition for submitting his bid and, if determined to be the lowest evaluated responsive bidder, shall be given reasonable opportunity to register, without let or hindrance; the registration process shall not be applicable to sub-contractors;

(H) All bids shall be submitted in sealed envelopes and may be submitted, at the bidder's option, in person or by courier service;

(I) All bids shall be opened at the same time in a public bid opening which bidders shall be allowed to attend and which shall follow immediately after the deadline for submission of bids;

(J) Evaluation of bids shall be carried out in strict adherence to the criteria declared in the bidding documents, and contracts shall be awarded to the lowest evaluated responsive bidder, without resorting to the rejection of bids above or below a certain percentage of the pre-bid estimate (bid price bracketing);

(K) No bidder shall be requested or permitted to modify his bid after the bid closing date shall has elapsed, and bids submitted after the deadline for submission of bids shall be returned to the bidder unopened;

(L) Post-bidding negotiations with the lowest or any other bidder shall not be permitted;

(M) Under exceptional circumstances, the procuring entity may, before the expiration of bid validity, request all bidders in writing to extend the validity of their bids, in which case bidders shall not be requested nor permitted to amend the price or any other condition of their bids; a bidder shall have the right to refuse to grant such an extension without forfeiting his bid security, but any bidder granting such extension shall be required to provide a corresponding extension of its bid security;

(N) Price adjustment provisions may be included in contracts for works with duration of more than eighteen months;

(O) Rejection of all bids is justified when there is lack of effective competition, or when bids are not substantially responsive; however, lack of competition shall not be determined solely on the basis of the number of bidders; and

(P) Each contract financed from the proceeds of the Grant shall provide that the contractor or supplier shall permit the Association, at its request, to inspect their accounts and records relating to the performance of the contract and to have such accounts and records audited by auditors appointed by the Association.

9. The procurement procedures and SBDs to be used for each procurement method, as well as model contracts for works and goods procured, are presented in the new national Procurement Law for all NCB.

10. **Selection of Consultants:** The total cost of consultancy services to be procured is estimated at US$ 1.065 million, of which US$ 0.890 million is from the GEF, and US$ 0.175 million is from parallel financing under the CCIG. The GEF amount for consultant services includes US $0.174million for services of the following consultants -Financial Management, Auditor, Procurement Specialist and Project Director and support staff, who will be responsible for project management and maintaining fiduciary standards as per Bank requirements. The total cost of capacity building and training to be procured is estimated at US$0.655 million, of which US$ 0.495million is from the GEF, and US$0.160 million is from CCIG. Consultancy services procured under this Project would include: For component 1: stocktaking report of existing agro-biodiversity inventories through desk inventory; agro-biodiversity and traditional knowledge field inventories; laboratory analysis and validation of select varieties/landraces to characterize, selection of landraces for field experiment; execution of field experiments; micro-enterprise assessment report based on agro-biodiversity utilization & traditional knowledge. For component 2 consultant services would include: data collection and building pilot database including data needs assessment; institutional capacity assessment and data transparency & sharing policy report; collection of agro-meteorological data from agro-met stations; establishing a Climatic Information System (CIS) with CAMA, AREA, MAI, NWRA, etc. Under component 3, consultant services procured include: strengthening farmers' networks; farmer and other stakeholder training; vulnerability assessment; stakeholder consultations; and strategy preparation. Under component 4, consultant services procured will include: climate change and natural resources management including M&E, training, and auditor. Shortlists of consultants for services estimated to cost less than US$ 200,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

11. To ensure institutional sustainability, the project may have the option to work through government technical agencies (e.g. the Agricultural Research and Extension Authority (AREA) and Civil Aviation and Meteorology Authority (CAMA)) to undertake specific capacity building and other activities in line with their institutional mandates under Single Source Selection (SSS) contracts. SSS should follow the consultant guidelines clauses 3.9, 3.10, 3.11, 3.12, and 3.13. Government-owned enterprises or institutions in the Recipient's country may participate only if they can establish that they (i) are legally and financially autonomous, (ii) operate under commercial law, and (iii) are not dependent agencies of the Recipient or Sub-Recipient. As an exception to the above, when the services of government-owned universities or research centers in the Recipient's country are of unique and exceptional nature, and their participation is critical to project implementation, the Bank may agree on the hiring of those institutions on a case-by-case basis. On the same basis, university professors or scientists from research institutes can be contracted individually under Bank financing.

12. Incremental Operation Costs will include expenses incurred for the implementation of the Project, including utility charges, rent for office space for the project implementation unit, transportation, maintenance, and insurance of vehicles, fuel, office supplies, banking charges, communication services, local travel cost, and per diem, but excluding salaries of officials of the Recipient's civil service.

B. Assessment of the agency's capacity to implement procurement

13. Procurement activities will be carried out by the Project Coordination Unit of the Groundwater and Soil Conservation Project (GSCP), with disbursement for some activities under component 3 through the Field Units of the GSCP. The PCU is staffed by a Project Director, Finance Manager, M&E and support staff, and the procurement function is staffed by a Procurement Officer and an Assistant Procurement Officer, with experience in IDA procurements and guidelines.

14. An assessment of the capacity of the Implementing Agency to implement procurement actions for the Project was carried out by the Bank on January 5, 2010. The assessment reviewed the organizational structure for implementing the Project.

15. The key issues and risks concerning procurement for implementation of the Project have been identified and include:

    a. The existing Project Coordination Unit (PCU), in anticipation of the start up of the proposed ACAP, will use the existing staffing structure and infrastructure facilities established under GSCP to enable an early start-up for the ACAP;

    b. The staff of the PCU includes the unit manager, financial manager, a procurement officer with experience in IDA procurements and guidelines, M&E and supportive staff. They are all qualified, with the head of unit also having procurement experience on IDA-financed projects;

    c. The PCU will have a full complement of IDA Implementation and Procurement Manuals which will be taken over from the existing PCU of the GSCP.

16. The corrective measures which have been agreed are:

    a. Build on the existing PCU of the GSCP. Take over the establishment of the PCU, to build upon it. The PCU will strengthen its procurement capabilities;

    b. IDA will assist in training the procurement staff at the PCU and the Ministry of Agriculture and Irrigation on procurement guidelines, preparation of bidding document, bid evaluation, and contract management;

    c. IDA guidelines should be followed for all types of procurement;

    d. Where possible, consultants should be engaged to assist with design and supervision of the civil works contracts, in addition to procurement training in the first year of implementation for the contracting industry; and

    e. Local consulting firms should be strengthened by encouraging them to participate with international consulting firms in submitting proposals for the consulting assignments of the project.

17. The overall project risk for procurement is MODERATE.

Prior Review Thresholds

18. The contracts subject to Bank Prior Review are mentioned in the Procurement Plan and generally based on the following thresholds.

Works	Equal US$ 2,000,000
Goods	Equal US$ 500,000
Consultant firms	US$ 200,000 for firms, TORs, EOI, shortlist, and all single-source selections.
Individual Consultants	US$ 100,000

Post Review

19. Monitoring and evaluation of procurement performance at all levels (national and community) will be carried out for procurement under the prior review thresholds during IDA supervision missions and through annual ex-post procurement audits. At a minimum, 1 out of 10 contracts, managed by the ACAP, will be subject to post review.

20. Prior review thresholds and procurement methods thresholds will be updated regularly by using a Procurement Plan format acceptable to the bank.

C. Procurement Plan

21. The Recipient, at appraisal, developed a Procurement Plan for project implementation which provides the basis for the procurement methods. This Plan has been agreed between the Grant Recipient and the Project Team on March 22, 2010, and is attached. It will also be available in the project's database and in the Bank's external website. The Procurement Plan will be updated, in agreement with the Project Team, semi-annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

D. Frequency of Procurement Supervision

22. In addition to the prior review supervision to be carried out from Bank offices, the capacity assessment of the Implementing Agency has recommended annually supervision missions to visit the field to carry out post review of procurement actions.

E. Details of the Procurement Arrangements

Table 6: Summary of the Agro-biodiversity and Climate Adaptation Project (ACAP) Costs

Components	**Financers**	**Works and Goods (US$)**	**Consultancy Services (US$)**	**Capacity Building (US$)**	**Total (US$)**
C1: Agro-biodiversity and Traditional Knowledge Utilization	***GEF***	141,500.00	155,000.00	70,000.00	366,500.00
	CCIG	-	-	-	-
	Total	**141,500.00**	**155,000.00**	**70,000.00**	**366,500.00**
C2: Climate Change Modeling and Capacity Building	***GEF***	40,000.00	300,000.00	260,000.00	600,000.00
	CCIG	175,000.00	-	75,000.00	250,000.00
	Total	**215,000.00**	**300,000.00**	**335,000.00**	**850,000.00**
C3: Integrating Climate Change into Rainfed Agriculture	***GEF***	2,375,300.00	261,000.00	165,000.00	2,801,300.00
	CCIG	60,000.00	175,000.00	85,000.00	320,000.00
	Total	**2,435,300.00**	**436,000.00**	**250,000.00**	**3,121,300.00**
C4: Project Coordination and Management	***GEF***	58,100.00	174,100.00	-	232,200.00
	CCIG	30,000.00	-	-	
	Total	**88,100.00**	**174,100.00**	**-**	**232,200.00**
GEF & CCIG TOTAL	***GEF***	**2,614,900.00**	**890,100.00**	**495,000.00**	**4,000,000.00**
	CCIG	**265,000.00**	**175,000.00**	**160,000.00**	**600,000.00**
	Total	**2,879,900.00**	**1,064,200.00**	**655,000.00**	**4,600,000.00**
Government Counterpart Contribution (Component 4)					**418,000.00**
TOTAL					**5,018,000.00***

*This does not include the $0.280 million from beneficiary contribution, which will put the total project cost at $5.298 million.

Goods, Works, and Non-Consulting Services

List of contract packages to be procured following NCB, NS, and community contracting:

Table 7: Works

id	Location/ Description	Cost Estimate US$ mil	Source of fund	P. method	Bank Review	Plan / Actual	Preparation of Bid Doc. Date	Bid invitation Date	Contract Signed Date
WORKS									
Works-1/ Comp 1	Civil works for field station	0.040	GEF	NS	Post	Plan	15-Oct-10	30-Oct-10	30-Nov-10
						Actual			
Works-2 Comp 2	Collection of Agro-met data & upgrading - select weather stations	0.175	CCIG	NCB	Post	Plan	25-Aug-10	NA	30-Oct-10
						Actual			
Works-3 Comp 2	Small-scale rehabilitation of rainfall/agro-met stations	0.040	GEF	NS	Post	Plan	15-Sep-10	NA	19-Nov-10
						Actual			
Works-4 / Comp 3	Upgrading terraces (4x500=20000 m); many contracts	0.300	GEF	CDD	Post	Plan	15-Aug-10	NA	5-Jun-12
						Actual			
Works-5 / Comp 3	Water storages (4x10=40 nos.); many contracts	0.310	GEF	CDD	Post	Plan	15-Aug-10	NA	5-Jun-12
						Actual			
Works-6 / Comp 3	Soil conservation measures (vegetative-planting of trees (5x25=100 ha); many contracts	0.250	GEF	CDD	Post	Plan	15-Aug-10	NA	5-Jun-12
						Actual			
Works-7 / Comp 3	Small flood protection measures (multiple (c.25) locations) through community contracts*	0.2053	GEF	CDD	Post	Plan	15-Aug-10	NA	5-Jun-12
						Actual			
Works-8 / Comp 3	Upgrading community infrastructure (community seed stores + community centers)	0.330	GEF	NCB	Prior	Plan	1-Jan-11	16-Jan-11	16-Apr-11
						Actual			
Works-9 / Comp 3	Income generation (multiple contracts)	0.350	GEF	CDD	Post	Plan	15-Aug-11	NA	5-Jun-13
						Actual			
Total GEF		**1.825**							
Total CCIG		**0.175**							
Total Works		**2.000**							

Table 8: Goods

id #	Location/ Description	Cost Estimate US$ mil	Source of Fund	P. method	Bank Review	Plan / Actual	Preparation of Bid Doc. Date	Bid invitation Date	Contract Signed Date
GOODS									
Goods-1/ Comp 1	Lab Equipment for soil-plant analysis lab, including field testing equipment	0.062	GEF	NCB	Post	Plan	15-Aug-10	30-Aug-10	30-Nov-10
						Actual			
Goods-2/ Comp 1	Field evaluation equipment (Green House)	0.0395	GEF	NS	Post	Plan	15-Oct-10	30-Oct-10	28-Jan-11
						Actual			
Goods-3/ Comp 3	Weather alert system	0.115	GEF	NCB	Post	Plan	15-Sep-10	30-Sep-10	29-Dec-10
						Actual			
Goods-4 / Comp 3	Equipment for technical training; for MAI	0.020	CCIG	NS	Post	Plan	25-Aug-10	25-Aug-10	8-Nov-10
						Actual			
Goods-5/ Comp 3	Four Model Farms (1-2 ha each) for field demonstration and farmers' training in disseminating information on climate change with RCC tanks, booster pumps, drip system, etc.	0.040	CCIG	NS	Post	Plan	15-Sep-10	15-Sep-10	29-Nov-10
						Actual			
Goods-6/ Comp 3	Survey equipment; four sets	0.040	GEF	NS	Post	Plan	15-Sep-10	15-Sep-10	29-Nov-10
						Actual			
Goods-7/ Comp 3	Income generation (multi contracts)	0.475	GEF	CDD	Post	Plan	15-Sep-10	15-Sep-10	29-Nov-10
						Actual			
Goods-8/Comp4	Vehicles (3)	0.0581	GEF	NCB	Post	Plan	1 -Sep-10	16-Sep-10	30-Dec-10
						Actual			
Goods-9/Comp4	Vehicle (1)	0.030	CCIG	NCB	Post				
	Total GEF	**0.7896**							
	Total CCIG	**0.090**							
	Total Goods	**0.8796**							

a. ICB contracts estimated to cost above US$2,000,000 per contract and for works, and ICB contracts estimated to cost above US$500,000 for goods, will be subject to prior review by the Bank.

Consulting Services

a. List of consulting assignments with shortlist of international firms.

Table 9: Consulting Services

Bid #	Description	Selection Method	Cost Estimate (US$ mil)	Source of Fund	Bank Review	Plan / Actual	EOI Advert.	TOR/ Shortlist to be finalized	Contract Signing
Consultancy Services									
CS-1/ Comp 1	Agro-biodiversity & traditional knowledge - desk and field inventories and micro enterprise assessment report	CQ	0.065	GEF	Post	Plan	30-Sep-10	30-Oct-10	30-Nov-10
						Actual			
CS-2/ Comp 1	Lab Analysis and validation to select verities/landraces to characterize and eliminate duplicates -in institutions with laboratory analysis. Selection of landraces for field experiment (1.2.1 & 1.2.2 to be done together); Lab Analysis and field tests of selected landraces: for germination, growth-methodology; identify and train farmers and carry out field trials.	SSS	0.090	GEF	Prior	Plan	9-Nov-10	9-Dec-10	9-Jan-11
						Actual			
CS-3/ Comp 2	Assessment of historic climate data+ Computer and climate Software +	SSS	0.130	GEF	Prior	Plan	20-Aug-10	20-Sep-10	20-Nov-10
						Actual			
CS-4/comp 2	Data collection and building pilot database + Computer, server, software, modems, printers and other accessories for CIS to be established in CAMA with linkages to NWRA, AREA, MAI and CAMA field offices + Establishing Climatic Information System (CIS) in CAMA with linkages to NWRA, AREA and MAI (consultancy services)	CQ	0.150	GEF	Prior	Plan	15-Oct-10	15-Nov-10	15-Dec-10
						Actual			
CS-5/ Comp 2	Institutional capacity assessment & data transparency & sharing policy – report and MOU on data sharing	IC	0.020	GEF	Post	Plan	30-Aug-10	30-Sep-10	30-Nov-10
						Actual			
CS-6/ Comp 3	Vulnerability assessment & strategy preparation	IC	0.040	CCIG	Post	Plan	15-Aug-11	15-Sep-11	15-Oct-11
						Actual			
CS-7/ Comp3	Income Generation(for a number of different fields)- multiple contracts	IC	0.080	GEF	Post	Plan	15-May-11	15-Jun-11	15-July-11
						Actual			
CS-8 /Comp3	Technical expert to deal with climate change and natural resources management including M&E (**24months** / time based contract)	IC	0.135	CCIG	Prior	Plan	15-Aug-11	15-Sep-11	15-Oct-11
						Actual	15-Aug-10	15-Sep-10	15-Oct-10
CS-8a/Comp3	Technical expert to deal with climate change and natural resources management including M&E (**12months** / time based contract)	IC	0.115	GEF		Plan			
CS-9 /Comp3	National Technical Specialist on climate change (24 months / time based contract)	IC	0.036	GEF	Post	Plan	15-Aug-10	15-Sep-10	15-Oct-10
						Actual			
CS-10/Comp3	Sociologist (20 months / time based contract)	IC	0.030	GEF	Post	Plan	15-May-11	15-Jun-11	15-July-11
						Actual			
CS-11/Comp4	Consultancy services under Component 4 (multiple contracts)	IC	0.1741	GEF					
	Total GEF		**0.890**						
	Total CCIG		**0.175**						
	TOTAL Consultancy Services		**1.065**						

Table 10: Capacity Building and Training

SL No.	Expected Outcome/ Activity Description	Estimated Cost US$ (million)	Source of Fund
CAPACITY BUILDING			
COMPONENT 1			
1	Training for molecular analysis	0.030	GEF
2	Training for field inventory	0.020	GEF
3	Farmer orientation	0.020	GEF
Total COMPONENT 1		**0.070**	
COMPONENT 2			
1	Training for data collection	0.020	GEF
2	Assessment of existing GCM results; climate data assessment, training &modeling for 2.2.1-2.2.4	0.075	CCIG
3	Masters level program	0.200	GEF
4	Customized training for technical staff for line agencies; sharing of climate information	0.040	GEF
Total for COMPONENT 2		**0.335**	
Component 3			
1	Training for senior governmental officials (5)	0.050	GEF
2	Technical training for MAI (10)	0.085	CCIG
3	Strengthening farmers' networks	0.020	GEF
4	Farmer training	0.030	GEF
5	Community planning	0.020	GEF
6	Field demonstration and farmers' training	0.020	GEF
7	Stakeholder consultations (10)	0.025	GEF
Total for Component 3		**0.250**	
Total GEF		**0.495**	
Total CCIG **TOTAL OF TOTAL**		**0.16** **0.655**	

1. Consultancy services estimated to cost above US$ 200,000 per contract, and single-source selection of consultants (firms), will be subject to prior review by the Bank.

2. Shortlists composed entirely of national consultants: Shortlists of consultants for services estimated to cost less than US$200,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

Annex 9: Economic and Financial Analysis

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

1. Planning adaptation may prove quite challenging, given the many uncertainties relating to climate change scenarios and socio-economic pathways, which ultimately impact the projections of the patterns of exposure and vulnerability to climate change. In this complex, fast changing, and unpredictable environment, there are multiple risks of selecting today adaptation options which could later entail high socio-economic regrets (e.g., investments in infrastructure projects ultimately not adequate and impossible to finally recoup) if the eventuality of future learning (on climate change trends, on likely impacts, on adaptation options, and on vulnerability) is not part of the decision process. In this context, instead, robust adaptation strategies will seek, through a high level of flexibility, to enhance the future capacity to adjust actions in the light of new information, to maximize opportunities and minimize losses should adverse conditions prevail.

2. The standard cost-benefit analysis applied to project assessment fails to adequately appraise the additional economic value of more flexible adaptation strategies. In this Project, the Real Option Methodology was applied. The Real Option Methodology provides a framework to evaluate adaptation projects at an early stage of preparation, not only on the basis of the expected amount of adaptation to be achieved, but also in terms of the increase in flexibility associated with decisions (adaptability), with a view to test the methodology and gain insights for the project design. This pilot application will allow for a more robust treatment of adaptation, and could also inform and generate guidelines for the economic analysis of other adaptation projects.

3. The methodology[12] applied consists of a 3-step procedure: (1) identifying the stakeholders of the process of adaptation to climate change, (2) eliciting information from stakeholders on the main features of this process through narratives and stylized facts obtained from participative interviews and systematic survey[13] techniques, and (3) explore and evaluate main options to deal with the climate change and the corresponding capabilities. Because of the complex, multi-agent nature of adaptation, the methodology is designed to investigate the options to adapt to climate change as the result of the buildup of collective capabilities of local communities, institutions, and individual agents. These capabilities are to be interpreted as the ability to adapt and are the result of the accumulation of human and non-human capital, and of the development of tacit or procedural knowledge, whereby stakeholders' vulnerability is reduced, and their resilience and longer term environmental fitness increased.

4. The word "option" is loosely used in everyday language as a synonym for choice. From a theoretical point of view, however, a real option can be given a precise definition as the

[12]Further details on the methodology are presented in: Knudsen, O.K. and Scandizzo, P.L., *The Artful Face of Uncertainty*, ESD Working Paper, The World Bank, 2007 and in Pennisi G. and Scandizzo P.L. "Economic Evaluation in an Age of Uncertainty", *Evaluation*, Vol. 12, n.1, pp. 77-94, 2006.

[13]Two surveys have been carried out: one for farmers and one for other stakeholders. The farmers' survey aims at collecting data on key agro-economic variables and on the farmer's beliefs and opinions on climate change, its impact on agriculture and the options available to respond to them. The stakeholders' survey aims at expanding the narratives collected during the interviews of the first field mission and is designed to elicit opinions and interpretations on the features of agricultural growth, climate change and the main options available for farmers and policy makers.

faculty, but not the obligation, of undertaking an action, which is expected to bring about a benefit (the "underlying" asset) at a given cost (the "exercise" price). This definition implies that a real option, which can be measured through a variety of techniques derived from cost-benefit analysis and the theory of financial derivatives, can be seen as an economic construct, incorporating concepts such as power, rights, and contingent wealth. In order for a real option to arise, furthermore, it is not sufficient that a subject is empowered with a specific set of rights. It is also necessary that the exercise of these rights results in an irreversible outcome under dynamic uncertainty, i.e. under uncertainty that can only be resolved by the passing of time.

5. Specific effects of climate change in Yemen are still largely uncertain, but the stakeholders' interviews carried out in the study suggest that there is wide consensus on four features: (i) an increase in the average temperature (and perhaps a decrease in the rainy season), (ii) a variation (increase or decrease depending on a variety of circumstances) of average rainfall, (iii) an increase in the volatility of rainfall, (iv) an increase in frequency of extreme events (droughts and floods). Stakeholders also generally agreed that adaptability of Yemeni agro-ecological systems to these changes may require both permanent adaptations and coping mechanisms from increasing flexibility. Long-term adaptation will depend both on changes in mean conditions, such as cumulative heat and timing of frosts, as well as on those associated with the variability and extremes.

6. In this context, which combines changes in means and distribution of agriculture-related variables, four general types of options were identified, whose underlying asset (i.e. the benefit expected from the contingent action to be undertaken), respectively, concerns the need: (i) to reduce the damages of transitory adverse events (coping options), (ii) to exploit favorable developments (opportunity options), (iii) to recover and gain strength from negative developments/events (rebound options), and (iv) to adapt to permanent changes (adaptation options). It is important to underline that it is the faculty to pursue one or more of these objectives that can be characterized as an option, and not the specific actions to undertake, which are instead to be considered the basis for the costs to be borne to achieve the results desired. These options are not mutually exclusive, as some of them may belong to more than one category (e.g., actions to create coping options may also yield permanent adaptation routines). Furthermore, in the case of Yemen, most stakeholders also share the opinion that these options mainly consist of proactive (rather than reactive) adaptation mechanisms, i.e. of those mechanisms that aim to anticipate future changes and respond to the uncertainties surrounding those changes.

7. In terms of project choices, real options can be seen as embodying capability building in terms of human and non-human capital. Capability, however, is often a hidden dimension of project design, which typically concentrates on actions that are expected to bring about a sufficient flow of benefits within a given time. Because of the uncertainties surrounding the forms and times of climate change, capability draws instead its value from the fact that farmers, households, and communities may be rendered less vulnerable, more resilient, and more flexible by being empowered to face alternative states of the world through the faculty to undertake a range of effective actions at a given cost. This faculty, characterized as a set of real options, is the building block of adaptability, a form of capability defined as the ability to flexibly adjust to external circumstances. Such ability constitutes a contingent asset whose

value exceeds its expected net present value (NPV) of an amount that is larger, the larger the uncertainty of relevant future events. A project action, such as for example the rehabilitation and maintenance of terraces, will thus typically have two types of benefits: (i) the expected NPV from the flow of net benefits caused by its implementation, and (ii) the expected increase in net worth of the agents involved from the creation of new options to flexibly respond to dynamic uncertainty and, in particular, to climate changes.

8. The Table below presents the final assessment of option values and the Extended Net Present Value (i.e. the expected NPV plus the value of the options created minus the value of the options destroyed) under three alternative hypotheses on the levels of uncertainty induced by climate change. The options created reflect the capabilities that could be created by a specific investment program that we have hypothesized and which addresses some of the main problems of Yemeni agriculture. The option destroyed is the option to defer, over time, such an investment (i.e. the so called "waiting option"). As a matter of convenience, the figures presented refer to one hectare of cultivated land. The actual size of the module on which to implement the investment, however, will depend on the project component. The common feature of all these types of investment will be the possibility of implementing investments in more than one stage, thereby utilizing earlier stages to gather information on climate change and various uncertain aspects of adaptation that will create options to reformulate investment of later stages.

Table 11: Yemen Rainfed Agriculture: Options Values and Extended Net Present Values under alternative volatility scenarios induced by climate change

	Strike price (USD/ha)	**Stock (USD/ha)**	**Discount rate**	**Dividend yield**	**Duration**	**Volatility**	**Option value (USD/ha)**	**Volatility +**	**Option value +**	**Volatility ++**	**Option value ++**
Diversify production with high-value crops	5275	8551	10%	3%	100	32%	4774	52%	5456	72%	6139
Rehabilitate and maintain terraces and spate irrigation systems	11818	19159	10%	3%	10	34%	7884	54%	8296	74%	8921
Change agricultural practices in response to climate change	5620	9110	10%	3%	10	35%	3753	55%	3959	75%	4261
Education and training	7438	12059	10%	3%	100	39%	7050	59%	8050	79%	8952
Increase farm size	2530	4102	10%	3%	10	35%	1690	55%	1783	75%	1919
Abandon unsuitable areas and crops	4290	6954	10%	3%	10	98%	3587	118%	3871	138%	4144
Abandon groundwater-intensive irrigation	13555	21974	10%	3%	10	38%	9102	58%	9652	78%	10416

systems											
Create and maintain water harvesting systems	4181	6777	10%	3%	10	75%	3169	95%	3453	115%	3732
Introduce plasticulture and precision irrigation*	2800	4539	10%	3%	100	30%	2502	50%	2857	70%	3225
Option to wait	57507	46027	10%	3%	10	46%	4777	66%	7892	86%	11270
NPVE							41250		42001		42955

9. The analysis developed in this annex quantifies benefits and costs of a development project for Yemeni rainfed agriculture. The type of project examined is unusual for a series of reasons. First, its main components are designed to remove some of the bottlenecks to development, but, at the same time, they aim to strike a balance between innovation and conservation. Traditional techniques may be in fact as important as modern technology to achieve performance without losing resilience against the uncertain prospects of climate change. Second, the investment actions that we have identified concern two distinct levels of adoption: (i) at the community and possibly nationwide level, constituted by activities such as agricultural research, experimentation, rural education, training and demonstrative programs of various kinds, and (ii) at a more micro-level, for individual farmers, farms, or group of farms, consisting of capabilities, i.e. the development of adaptability features, such as higher flexibility, better knowledge and information opportunities, and wider possibilities of coping with climate change in its various forms. Third, these capabilities do not necessarily turn into higher consumption or income flows, but are nevertheless associated with net benefits, in the sense that they endow the stakeholders involved with greater wealth in the form of human and non-human capital. Fourth, the value of this wealth is contingent on the state of nature, but its expected value can be estimated as the value of the real options, i.e. the higher entitlement of faculties, that correspond to the increase in adaptability fostered by the investment considered.

10. Finally, the values of the real options identified through this procedure turns out to be much larger than the net expected benefits from the underlying project. In fact, as an element of endowment of a resilient and opportunistic farm, they can be considered the objective to be achieved through a program of enabling investment projects. The investment project that we have considered as a point of departure of our analysis can thus be considered a hypothesis to exemplify the path from enabling investment to capability building. The relevant policy question would be to design the best enabling project (or series of projects) that can help create the options that we have identified and measured, and spread them over the largest possible area.

Annex 10: Safeguard Policy Issues

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

1. The proposed Project is expected to have positive outcomes from an environmental standpoint. The Project is designed to provide economic, social, and environmental benefits to the communities in the rainfed highlands of Yemen by helping them adapt to climate change, using agro-biodiversity resources in the highlands.

2. It proposes to accomplish this by helping communities: develop improved crop varieties that are likely to be better adapted to shifts in climate patterns, adopt coping mechanisms for climate resilience, and improve strategies for rainfed agriculture. With a goal of reducing vulnerability and improving livelihoods of local communities, project activities aim to enhance the conservation of agro-ecosystem and utilization of agro-biodiversity resources. Project design also includes training of community members on methods to enhance agro-ecosystem stability and awareness on climate change and sustainable natural resource management. Community natural resource management plans will be developed and small-scale income generation projects will be established through the use of local agro-biodiversity, which could entail in the upgrading of small-scale community infrastructure. However, these activities are not expected to result in any large-scale and/or irreversible negative impacts.

3. The interventions initiated under this Project are intended to be the building blocks which will help meet the challenges of climate change over the long term. Additionally, some specific coping options and strategies will be mainstreamed through the on-going operations or the IDA-funded Groundwater and Soil Conservation Project (GSCP) and the Rainfed Agriculture and Livestock Project (RALP).

Environmental Implications

4. Components 1 and 2 provide the basis for designing coping strategies to adapt to climate change under Component 3. Project activities under sub-component 3.2 (under Component 3) on "Piloting coping strategies in local landscape units" will include among other activities: (i) upgrading of small scale community infrastructure as coping strategies; and (ii) piloting agro-biodiversity-based income-generation activities. Activities under these sub-components could result in temporary and/or site specific environmental impacts that could be mitigated with the implementation of suitable mitigation measures. Following are examples of activities under the sub-components:

5. *Upgrading of small-scale community infrastructure as coping strategies*: Each of the pilot communities will benefit from small-scale upgrading of infrastructure (as outlined in their community agro-biodiversity-based coping plans), which will be tied to conservation of water, soil, terraces, and seed storage - among others – and seek to maximize the use of local knowledge and adaptation practices. The kinds of projects envisaged include:

a) upgrading of terraces;

b) creation or enhancement of community seed storage facilities to store wild relatives and landraces of seeds that have an important resilient value;

c) construction of efficient water storage;

d) establishment of community center for conservation;

e) establishment of model farm;

f) soil conservation; and

g) small flood protection structures.

6. *Piloting agro-biodiversity-based income-generation activities:* Small sustainable projects run by farmers in the targeted rainfed areas will be financed as a means of alleviating poverty through the sustainable use and conservation of agro-biodiversity resources. The kinds of projects that would be financed could include:

   a) planting, preparation and packaging of medicinal herbs (aromatic and spices);

   b) small home-based catering business specializing in traditional recipes;

   c) agro-processing;

   d) beekeeping;

   e) planting of almond trees;

   f) producing traditional ceramic ware for conservation purposes (for house seeds, etc.);

   g) construction of small nurseries/home-gardens with a preference for those using grey water and other conservation methods. These would produce plants, vegetables, fruits, aromatic and medicinal plants

Environmental Safeguard Policies

7. The proposed Project is classified as environmental category B, and is designed to ensure compliance with the requirements the following safeguard polices that are triggered: Environmental Assessment (OP 4.01) and Pest Management (OP 4.09). The Project will include small-scale income generation sub-projects linked to conservation of agro-biodiversity and natural *resources*, and community-level planning and management of water, terraces, pastures, etc., to elicit active participation by the communities. Despite the largely positive project environmental and social impacts anticipated, to ensure conformity with environmental safeguard policies, the Grant Recipient has prepared an Environmental and Social Impact Assessment and included an Environmental and Social Management Plan (ESMP) as well as a brief Integrated Pest Management Plan (IPM).

8. With regards to the Pest Management Policy (OP 4.09), the Project will not procure pesticides but rather encourage the use of environmentally-friendly agrochemicals. Further, the IPM will provide guidance on the safe use of agro-chemicals, fertilizers, and use of other pest management techniques. Capacity building of farmers and MAI staff in IPM will be

undertaken to address any pest management concerns. The policy is triggered for precautionary purposes. Additionally, under the GSCP, the project governorate Field Units of the PCU have been provided with an action plan for IPM. They have also developed a farmer education program that stresses IPM practices. These practices and procedures on IPM will continue with the ACAP. The policy on Physical Cultural Resources (OP 4.11) will not be triggered by project activities. However, the sub-projects will be screened for physical cultural resources, and chance-finds procedures will be followed as outlined in the ESMP. No other safeguard policies are triggered as a result of project activities. The Project does not anticipate, and will not fund any category A type sub-projects; the screening process will ensure this.

9. During early stages of project preparation and at the QER, the team triggered the Safeguard Policy OP 4.12 on Involuntary Resettlement as a precautionary measure, particularly in light of sub-component 3.2 (3.2.4 and 3.2.5) of the Project that focuses on Piloting Coping Strategies in local landscape units. However, as project preparation progressed, the team has further defined the project components, sub-components, and activities. Consequently, it is now confirmed with the Regional Safeguards Coordinator that project activities will not result in: (i) involuntary taking of land; (ii) relocation or resettlement; (iii) loss of assets or access to assets, and (iv) loss of income sources or means of livelihood. Furthermore, project activities are designed to result in stabilizing, increasing, and diversifying income for participating communities as a critical response to coping with climate change. Environmental and Social Impact Assessment (ESIA) carried out by the Recipient also independently concluded that OP 4.12 is not triggered by project activities. Consequently, the decision taken was to un-trigger the involuntary resettlement safeguard policy OP 4.1214. This process has been documented and the minutes have been filed in IRIS.

Environmental and Social Management Plan

10. The ESMP includes potential environmental and social impacts and recommends mitigation measures for all project components. The Project has developed geographic, ecological, social, and environmental criteria for site and community selection. However, given that the exact locations of sub-projects are not known at this time, the ESMP has included screening checklist/criteria, potential impacts, and recommended mitigation measures for the various likely interventions. The Project Implementation Unit (PCU) will be in charge of implementing Component 3, and will therefore will be responsible to ensure that all sub-project proposals undergo a screening process (described in the ESIA) before they are approved for implementation. The screening process will help to: (i) confirm environmental category (B or C in nature); (ii) include mitigation measures according to potential impacts depending on sub-project design; (iii) include chance-finds procedures as relevant; and (iv) include IPM measures as relevant, before approval of the sub-project for funding and implementation.

11. Tables 9 and 10 of the ESIA include the environmental and social management plans, respectively. The ESMP tables list details on project activities; potential impacts; impact significance rating; mitigation measures; responsibility for implementation and monitoring;

[14] This issue was fully discussed with the Regional Safeguards Coordinator on January 5, 2010.

and time frame. Table 11 includes recommended parameters for monitoring activities to be carried out during the life of the Project; location; frequency and responsibility. Table 12 of the ESIA includes details on recommendations for training and capacity building for various target groups for successful implementation of the Project; trainers; frequency and cost.

Capacity for Safeguards Implementation and Monitoring

12. The Project will be implemented over 4 years, with primary coordination provided by the Ministry of Agriculture and Irrigation (MAI), and day-to-day implementation oversight provided by a Project Implementation Unit (PCU). The PCU will comprise of the Project Director, supported by core staff, including for procurement and financial management. In addition, there would be an expert with international experience and skills to deal with climate change and natural resource management issues, including M&E. The PCU has already built sufficient capacity under the on-going Groundwater and Soil Conservation Project (GSCP) to ensure safeguard compliance. As recommended by the ESIA, additional training and capacity strengthening will be undertaken as necessary by the Project at both the PCU level (M&E specialist and international technical specialist on Bank safeguard policies, and on requirements for monitoring and reporting), and community level (specifically in the areas of natural resource management, integrated pest management, impacts of climate change and development of climate resilient coping strategies, chance-finds procedures, etc.).

13. The implementation of the environmental and social measures of the ESMP can be monitored since all environmental and social actions are linked to project components and to their performance indicators. A small M&E unit exists in the PCU for monitoring the progress of the Project and evaluating the performance of the Project, including its environmental and social impacts. The PCU field units will include information on project compliance with ESMP in their quarterly reports, which the PCU will include in their reporting to IDA.

Cost of Implementation of ESMP

14. Budgetary resources for implementing the ESMP (mitigation measures as well as capacity building and training) and M&E will be allocated as part of the project implementation arrangements. The cost of ESMP implementation is estimated at US$322,000. The indicated cost includes the cost of training and capacity building on social and environmental issues relating to the Project.

Safeguards Reporting

15. The Recipient will be required to undertake monitoring and evaluation of implementation of safeguard policies and compliance with ESMP, and include a section as part of the quarterly and annual progress reports that are submitted to the Steering Committee and the Bank. Relevant consultants will be hired by the PCU for ensuring compliance with safeguards, and for reporting on compliance, as necessary.

Annex 11: Project Preparation and Supervision

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

	Planned	Actual
PCN review	May 8, 2007	May 17, 2007
Initial PID to PIC		May 23, 2007
Initial ISDS to PIC		June 5, 2007
Appraisal	January 11, 2010	
Negotiations	March 21-22, 2010	
Board/RVP approval	May 27, 2010	
Planned date of effectiveness	August 31, 2010	
Planned date of mid-term review	August 31, 2012	
Planned closing date	August 31, 2014	

Key institution responsible for preparation of the project: Ministry of Agriculture and Irrigation, Government of Yemen.

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Kanta Kumari Rigaud	Task Team Leader	MNSEN
Laila Al Hamad	Senior Social Development Specialist	MNSSO
Banu Setlur	Environmental Specialist	MNSEN
Niels Holm Nielsen	Hazard Risk Management Specialist	LCSUW
Syviengxay Creger	Program Assistant	MNSSD
Ahmedou Ould Hamed	Lead Procurement Specialist	MNAPR
Moad Alrubaidi	Financial Management Specialist	MNAFM
Ayman El Guindy	Procurement Specialist	MNAPR
Danielle Malek	Senior Counsel	LEGEM
Renee Desclaux	Senior Finance Officer	CTRFC
Madhavi M. Pillai	Consultant, Natural Resources Management	MNSSD
Minna Kononen	Consultant, Social Development	SDV
Naji Abu Hatim	Senior Rural Development Specialist	MNSSD
Pierre Rondot	Senior Sector Economist	MNSSD

Bank funds expended to date on project preparation:

1. Bank resources: $114,220.24
2. Trust funds: $48,936.80
3. Total: $163,157.04

Estimated Approval and Supervision costs:

Remaining costs to approval: $10,000

Estimated annual supervision cost: $50,000

Annex 12: Documents in the Project File

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

Table 12: List of Documents on File

Document Title	Source
Project Implementation Plan	Tu Dresden (Project Preparation Consultant)
PCN	Bank Staff
Project Information Form- GEF	Bank Staff
Project Preparation Grant Request- GEF	Bank Staff
PPG Grant Agreement	Bank Staff
Japan CCIG Grant Agreement	Bank Staff
Aide Memoires	Bank Staff
JSDF Seed Grant Study " Women and Coping Strategies for Adaptation to Climate Change using Agro-biodiversity Resources in the Rainfed Highlands of Yemen"	Dr. Ameen Al Hakimi & Eng. Anhar Abdulkarim Ya'ni (consultants)
Thematic Reports on: a) Climate Change b) Agro-biodiversity c) Coping Mechanisms d) Institutional Assessment	Tu Dresden
Field Survey on Agro-biodiversity in the Rainfed Highlands	Tu Dresden
Report from the Training Workshop on Climate Modeling	Tu Dresden
Yemen Rainfed Agriculture: Real Option Design and Evaluation Study	Pasquale Lucio Scandizzo & Adriana Paolantonio (consultants)
Environmental and Social Impact Assessment (ESIA)	Government of Yemen (Consultant Dr Taha Taher)

Annex 13: Statement of Loans and Credits

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

			Original Amount in US$ Millions						Difference between expected and actual disbursements	
Project ID	FY	Purpose	IBRD	IDA	SF	GEF	Cancel.	Undisb.	Orig.	Frm. Rev'd
P092211	2009	RY-RURAL ENERGY ACCESS	0.00	25.00	0.00	0.00	0.00	26.35	0.00	0.00
P107037	2009	RY-WATER SECTOR SUPPORT	0.00	90.00	0.00	0.00	0.00	87.73	0.00	0.00
P089761	2008	Sec. Educ. Dev. and Girls Access Project	0.00	20.00	0.00	0.00	0.00	19.81	1.82	0.01
P101453	2008	RY-INSTITUTIONAL REFORM CREDIT (DPL)	0.00	50.93	0.00	0.00	0.00	25.55	-26.99	0.00
P089259	2007	RY Rainfed Agriculture and Livestock	0.00	20.00	0.00	0.00	0.00	16.82	6.61	1.76
P086308	2007	RY-Second Vocational Training Project	0.00	15.00	0.00	0.00	0.00	15.97	3.67	0.00
P085231	2006	RY- SECOND RURAL ACCESS	0.00	40.00	0.00	0.00	0.00	17.39	6.20	0.00
P086865	2006	RY-POWER SECTOR	0.00	50.00	0.00	0.00	0.00	52.59	45.58	0.00
P086886	2006	RY-Fisheries Res. Mngmnt & Conservation	0.00	25.00	0.00	0.00	0.00	22.66	7.76	0.00
P076185	2005	RY-Basic Education Development Program	0.00	65.00	0.00	0.00	0.00	25.30	17.47	4.54
P082976	2004	RY-THIRD PUBLIC WORKS	0.00	74.84	0.00	0.00	0.00	22.86	-8.42	-2.52
P082498	2004	RY-SOCIAL FUND FOR DEVELOPMENT III	0.00	75.00	0.00	0.00	0.00	0.06	-17.38	-5.29
P074413	2004	RY-Groundwater & Soil Conserv Proj	0.00	70.00	0.00	0.00	0.00	33.87	4.15	-0.77
P057602	2003	RY URBAN WTR SUPPLY & SANITATION APL	0.00	130.00	0.00	0.00	4.74	50.23	34.48	12.03
P065111	2003	RY-PORT CITIES DEVELOPMENT PROGRAM	0.00	23.40	0.00	0.00	0.00	5.63	2.23	-2.74
P064981	2003	RY-SANA'A BASIN WATER MGMNT	0.00	24.00	0.00	0.00	0.00	7.49	4.65	1.40
P070092	2002	RY TAIZ MUNICIPAL DEV & FLOOD PROTEC	0.00	100.20	0.00	0.00	0.00	45.18	-16.99	0.89
P005906	2001	RY-RURAL WATER SUPPLY & SANITATION	0.00	40.00	0.00	0.00	0.00	10.05	-12.61	-1.22
P050706	2000	RY-CIVIL SERVICE MODERN	0.00	44.00	0.00	0.00	0.00	20.44	2.72	2.72
		Total:	0.00	982.37	0.00	0.00	4.74	505.98	54.95	10.81

*in the case of Yemen, this would refer to Credits and Grants

YEMEN, REPUBLIC OF
STATEMENT OF IFC's
Held and Disbursed Portfolio
In Millions of US Dollars

		Committed				Disbursed			
		IFC				IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
1999	ACSM	6.37	0.00	0.00	0.00	6.37	0.00	0.00	0.00
2002	Ahlia Water	1.36	0.00	0.00	0.00	1.36	0.00	0.00	0.00
2006	NCC Yemen	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total portfolio:	42.73	0.00	0.00	0.00	7.73	0.00	0.00	0.00

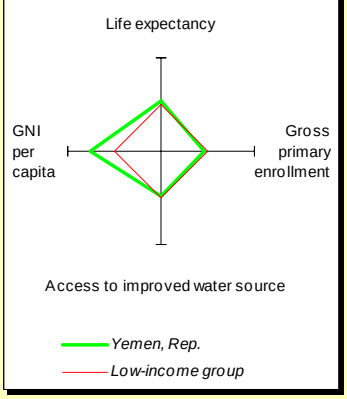
		Approvals Pending Commitment			
FY Approval	Company	Loan	Equity	Quasi	Partic.
2006	HSA	0.00	0.00	0.00	0.00
2006	Ras Issa	0.05	0.00	0.00	0.17
	Total pending commitment:	0.05	0.00	0.00	0.17

Annex 14: Country at a Glance

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

POVERTY and SOCIAL	Yemen	M. East & North Africa	Low-income
2007			
Population, mid-year *(millions)*	22.4	313	1,296
GNI per capita *(Atlas method, US$)*	870	2,794	578
GNI *(Atlas method, US$ billions)*	19.4	876	749
Average annual growth, 2001-07			
Population *(%)*	3.0	1.8	2.2
Labor force *(%)*	4.2	3.6	2.7
Most recent estimate (latest year available, 2001-07)			
Poverty *(% of population below national poverty line)*	..	..	..
Urban population *(% of total population)*	30	57	32
Life expectancy at birth *(years)*	62	70	57
Infant mortality *(per 1,000 live births)*	75	34	85
Child malnutrition *(% of children under 5)*	41	..	29
Access to an improved water source *(% of population)*	66	89	68
Literacy *(% of population age 15+)*	54	73	61
Gross primary enrollment *(% of school-age population)*	87	105	94
Male	100	108	100
Female	74	103	89

Development diamond*

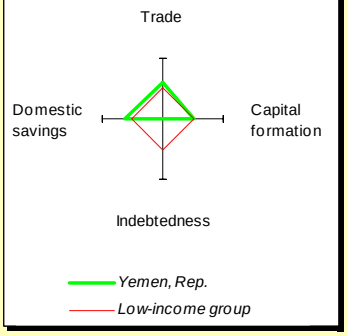


KEY ECONOMIC RATIOS and LONG-TERM TRENDS

	1987	1997	2006	2007
GDP *(US$ billions)*	..	6.9	19.1	22.5
Gross capital formation/GDP	..	24.7	..	..
Exports of goods and services/GDP	..	35.8	..	..
Gross domestic savings/GDP	..	16.0	..	..
Gross national savings/GDP	..	25.0	..	..
Current account balance/GDP	..	0.3	..	..
Interest payments/GDP	..	0.4	0.3	..
Total debt/GDP	..	55.8	29.2	..
Total debt service/exports	..	2.6	..	..
Present value of debt/GDP	..	..	19.5	..
Present value of debt/exports	..	..	..	..

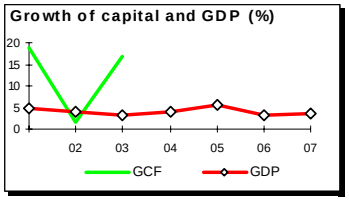
	1987-97	1997-07	2006	2007	2007-11
(average annual growth)					
GDP	6.0	4.1	3.2	3.6	..
GDP per capita	1.5	1.0	0.1	0.6	..
Exports of goods and services	27.2	8.6	..	..	..

Economic ratios*



STRUCTURE of the ECONOMY

	1987	1997	2006	2007
(% of GDP)				
Agriculture	..	16.3	..	..
Industry	..	43.2	..	..
Manufacturing	..	10.3	..	..
Services	..	40.5	..	..
Household final consumption expenditure	..	71.0	..	..
General gov't final consumption expenditure	..	13.0	..	..
Imports of goods and services	..	44.5	..	..



	1987-97	1997-07	2006	2007
(average annual growth)				
Agriculture	4.7	3.3	..	..
Industry	8.4	4.5	..	..
Manufacturing	5.0	9.9	..	..
Services	5.4	4.3	..	..
Household final consumption expenditure	3.0	1.5	..	..
General gov't final consumption expenditure	-0.1	8.7	..	..
Gross capital formation	14.6	0.8	..	..
Imports of goods and services	15.9	3.0	..	..

Note: 2007 data are preliminary estimates.

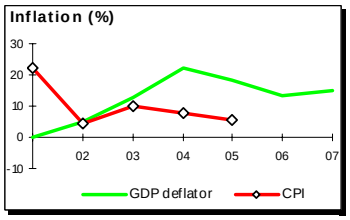
This table was produced from the Development Economics LDB database.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will be incomplete.

Yemen, Rep.

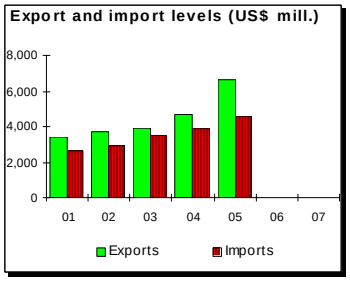
PRICES and GOVERNMENT FINANCE

	1987	1997	2006	2007
Domestic prices				
(% change)				
Consumer prices	..	2.2	..	..
Implicit GDP deflator	..	11.8	13.6	15.0
Government finance				
(% of GDP, includes current grants)				
Current revenue	..	32.0	..	..
Current budget balance	..	4.8	..	..
Overall surplus/deficit	..	-1.5	..	..



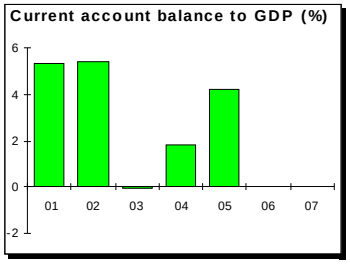
TRADE

	1987	1997	2006	2007
(US$ millions)				
Total exports (fob)	..	2,274	..	..
Crude oil (government share)	..	1,012	..	..
Crude oil (company share)	..	933	..	..
Manufactures	..	26	..	..
Total imports (cif)	..	2,407	..	..
Food	..	992	..	..
Fuel and energy	..	231	..	..
Capital goods	..	440	..	..
Export price index *(2000=100)*	..	71	..	..
Import price index *(2000=100)*	..	107	..	..
Terms of trade *(2000=100)*	..	67	..	..



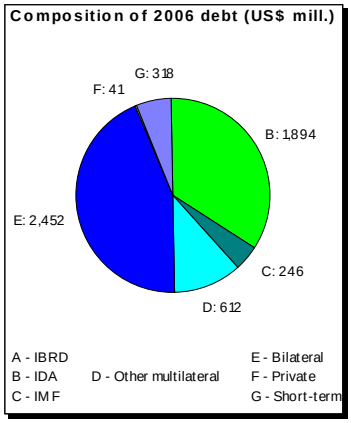
BALANCE of PAYMENTS

	1987	1997	2006	2007
(US$ millions)				
Exports of goods and services	..	2,482	..	..
Imports of goods and services	..	3,084	..	..
Resource balance	..	-602	..	..
Net income	..	-601	..	..
Net current transfers	..	1,226	..	..
Current account balance	..	22	..	..
Financing items (net)	..	-50	..	..
Changes in net reserves	..	28	..	..
Memo:				
Reserves including gold *(US$ millions)*	..	1,222	..	..
Conversion rate *(DEC, local/US$)*	..	129.3	197.1	199.0



EXTERNAL DEBT and RESOURCE FLOWS

	1987	1997	2006	2007
(US$ millions)				
Total debt outstanding and disbursed	4,585	3,874	5,563	..
IBRD	0	0	0	0
IDA	473	934	1,894	2,058
Total debt service	268	98	226	..
IBRD	0	0	0	0
IDA	6	16	45	49
Composition of net resource flows				
Official grants	241	133	139	..
Official creditors	94	87	245	..
Private creditors	174	0	7	..
Foreign direct investment (net inflows)	1	-139	1,121	..
Portfolio equity (net inflows)	0	0	0	..
World Bank program				
Commitments	66	149	98	30
Disbursements	41	89	160	122
Principal repayments	1	10	31	34
Net flows	39	79	129	88
Interest payments	4	7	15	15
Net transfers	35	72	115	73



Note: This table was produced from the Development Economics LDB database. 9/24/08

Annex 15: Incremental Cost Analysis

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

I. Background of the rainfed highlands and status of agro-biodiversity

1. **The ecology and agro-biodiversity**[15] **of the rainfed highlands**. The highlands of Yemen are part of the *Southwestern Arabian montane woodlands*[16] – an eco-region of global significance in the Arabian highlands above 2,000 m, which includes part of the Asir Mountains of Saudi Arabia and most of the western highlands of Yemen. The Asir Mountain chain is the highest land in the Arabian Peninsula, which tilts from west to east. East of the mountains the land slopes gradually to the Arabian Gulf. The climate of the region varies considerably, depending on altitude, aspect, and season. This eco-region supports about 2000 plant species, of which about 170 are endemic, and several bird species which are also endemic to this area. The proposed Project will cover selected areas in the highlands in the Republic of Yemen (see map in Annex 17).

2. This eco-region is also important for its wealth of agro-biodiversity and traditional agricultural practices which are of global significance. For several thousand years, agriculture has been an important human activity in the western highlands of Yemen [a volcanic region with elevations between 1,000 and 3,600m parallel to the Red Sea coast, with temperate climate and monsoon rains], marked by the construction of terraces on steep mountain slopes. Crop diversity comprised of cultivated crop varieties, heterogeneous landraces, and wild relatives, is still an integral part of the agro-ecosystems of the highlands. Among the major crops, sorghum, barley and wheat have a large variety of landraces that have adapted to the varying ecological conditions of the highlands. About 40 varieties and landraces of wheat belonging to five species, and hundreds of landraces of sorghum are currently cultivated; other crops with a wide range of local varieties include lentils, coffee, pomegranate, grape, and date palm. Wild crop relatives have been used and are still used as food supplements and as a means of survival during times of drought and famine. Some of the well-known wild crop relatives in this eco-region are of pomegranate, cotton, and olive.

3. Landraces of crop species have evolved through natural selection and selective breeding by farmers. This diversity is the basis for successful agriculture and the sustainable use of the country's scarce water and soil resources, and has potential for the future, to develop varieties that perform under severe water stress - drought or flood conditions.

II. The Baseline: On-going interventions through the Groundwater and Soil Conservation Project (GSCP) and the Rainfed Agriculture and Livestock Project (RALP)

4. The national Ministry of Agriculture and Irrigation continues to promote research into crop varieties that are high-yielding, and amenable to growing in the valleys where irrigation is available. However, Yemen is one of the most water-scarce countries in the world, and the

[15]Information from "State of Plant Genetic Resources for Food and Agriculture in Yemen –Country Report", February 2009. FAO, Rome.
[16]Wild World – 200 eco-regions of the world identified by the World Wildlife Fund.

World Bank has been supporting projects that help the country's poor farmers in the rainfed areas and help improve the recharge of aquifers in these areas. The activities under the World Bank-supported RAL and the GSC projects constitute the baseline for the proposed Project.

5. **Component 1 of RALP (Farmer-based system of seed improvement and management):** This component aims at the development of farmer-based seed production and supply system for the conservation and sustainable use of landraces of sorghum, maize, millet, wheat, barley, cowpea, peas, lentil, faba bean, and fenugreek in five governorates of Yemen. Landraces are collected from the rainfed highlands and characterized and improved through farmer participation. Both in-situ and ex-situ measures are used for conserving important landraces. The following activities are financed under this component, which have a direct bearing on the agro-biodiversity of the highlands:

   Landrace improvement and maintenance

   - Crop improvement through collection and characterization of landraces; participatory genetic improvement of common varieties of cereals and pulses;
   - Variety maintenance – through pure see lots; and
   - Capacity building and technical backstopping for ex-situ and on-farm conservation and maintenance of landraces

   Promotion of seed producer groups

   - Enhancing on farm seed production;
   - Technical training and training of farmers on seed storage and quality assurance; and
   - Establishment of seed producer groups.

6. **Component 3 of RALP (Productive Rural Development):** This component is expected to help farmer-producers to upgrade and diversify their agriculture and livestock production, processing, and marketing systems and better conserve soil and harvest water. Support is provided to rural producers organized at community and inter-community levels, through sub-projects, for financial and technical assistance. Sub-projects financed relate to enhancement of: (i) rainfed cereals and legumes production and post harvest handling, including seed production and management; (ii) livestock-raising, beekeeping, and marketing; (iii) small vegetable gardens; (iv) fruit production and post-harvest handling/marketing; (v) coffee production, post-harvest handling and marketing; (vi) handicraft production and marketing; and (vii) soil conservation and water harvesting.

7. **Component 2 of GSCP: Improvement of Spate Irrigation, Water Harvesting and Soil Conservation** - There are two sub-components under this component, which are implemented through the Water Users' Association and Water Users' Groups:

   - Small and medium spate irrigation improvement and rehabilitation – under which medium spate diversion works, canal control structures and wadi bank protection works are carried out. These activities are jointly identified with community members and will help in conserving soil during rains, and in storing water for irrigation and livestock; and

- Improvement of water harvesting structures and soil conservation in the uplands: Activities financed include rehabilitation of abandoned terraces, protection of land from water erosion on secondary and tertiary tributaries of wadis and protection of wadi banks and beds from erosion; the project also finances vegetative measures to ensure wadi banks stabilization and protection of terraces through tree planting.

8. The project also provides for on-farm water storage tanks and for the construction of traditional underground cisterns to collect rainwater for human **and** livestock and irrigation uses.

9. **The GEF Alternative**: The GEF Project will pilot strategies to make rainfed agriculture more 'climate resilient' in the highlands through the use and conservation of the agro-biodiversity of the highlands. In doing so, the Project will contribute to the global environment objective of protecting exceptional biodiversity and agro-biodiversity of the highlands of Yemen and will demonstrate adaptation to climate change to increase farmer's resilience to adverse impacts of climate change. The GEF Project will provide incremental benefits to the ongoing activities through the following three components:

10. **Component 1: Agro-biodiversity and Traditional Knowledge Utilization and Assessment:** The RALP project currently targets only important cereals, for collection and characterization of local landraces. The GEF project will expand the menu to add other useful and globally important species such as medicinal, oil producing, and forage species. The GEF Project will use the databases of agro-biodiversity created by the RALP and add to it by documenting the diversity of these plant varieties. The Project will also document traditional knowledge of farmers in the area with respect to farming practices, especially under drought and uncertain weather patterns, and the traditional uses of non-cereal species. The RALP currently tests landraces of selected cereals and lentils for high productivity and helps multiply the seed for use by the farmers. The GEF Project will, with the help of farming communities identify, verify, and characterize local landraces of new landraces. Of these, selected landraces will be lab- and field-tested to assess their potential for 'climate resilience'. Farmers will thereby have additional information on the performance of the landraces selected for seed multiplication under the RALP. Characterization for 'climate resilience' and protocols for seed multiplication of selected landraces will be further scaled up through Component 1 of the RALP. In the absence of the GEF Project the landraces selected and characterized under the RALP would not be tested for climate resilience and globally important agro-biodiversity other than that of cereals and legumes would not be documented for the future.

11. **Component2: Climate Change Modeling and Capacity Building:** At present the RALP and the GSCP do not provide any support to enhance the understanding of climate change *vis-à-vis* rainfed agriculture. The GEF Project will strengthen the capacity of national institutions in the vital area of climate data collection, analysis, and harmonizing, to meet the needs of climate adaptation in the rainfed highlands. The GEF Project will bring together the leading agencies on climate change in the country to establish a data collection and sharing protocol and develop future climate scenarios to help farmers reduce their vulnerability to climate change. Activities funded under this component are all incremental, as no baseline

activity on climate adaptation or improving climate resilience of rainfed agriculture has been undertaken in the country.

12. **Component 3: Integrating Climate Change into Rainfed Agriculture in the Highlands:** This component is closely aligned with Component 3 of RALP and Component 2 of the GSCP. The GEF Project will provide additional value by ensuring that all the farmer sub-projects are climate resilient - or by showing how similar productivity-enhancing sub-projects can be implemented through climate-resilient methods. It will demonstrate income generation through the conservation and use of agro-biodiversity, reduction of soil erosion, water harvesting, etc. It will increase the benefit of the RALP activities, by increasing climate awareness of the farmers and the MAI with respect to rainfed farming; it will establish methods for early warning and regular weather updates. In the areas where the GSCP is being implemented, the GEF Project will link the soil and water harvesting activities to climate adaptation and agro-biodiversity conservation. The WUGs and WUAs will be provided with additional income-generating opportunities; the on-going soil and water conservation activities will benefit the GEF activities of agro-biodiversity conservation and rainfed farming improvement. At the national level the GEF alternative would help the Ministry of Agriculture and Irrigation assess the vulnerability of the unique eco-region of the highlands to climate change and develop a national strategy to address those.

13. In the absence of the GEF Project the communities will continue with the livelihood and natural resource management activities without being made aware of the potential impacts of livelihoods and how they could better adapt themselves to such impacts.

1. Global Environmental Benefits and Strategic Fit

14. The project development objectives are to:

    1) Enhance capacity and awareness at key national agencies and at local levels, to respond to climate variability and change; and,
    2) Better equip local communities to cope with climate change through the conservation and use of agro-biodiversity in the rainfed highlands of Yemen.

15. Given that the Project will pilot demonstration of climate adaptation activities in a globally important eco-region and will address conservation and sustainable use of agro-biodiversity within this eco-region, the Project fits under the Climate Change focal area strategy of GEF–4. Within the Climate Change focal area strategy, the Project directly addresses Strategic Objective 8: '*support pilot and* demonstration *projects for adaptation to climate change*'. It addresses adaptation of rainfed agriculture and sustainable natural resource management in one of the regions of the world most vulnerable to climate change. The pilot adaptation activities will not only improve natural resource management in one of the most water-scarce regions of the world, they will provide a better understanding of how to mainstream climate adaptation in development and conserve globally important plant genetic diversity. It fits with the objectives outlined in '*Support to Adaptation Programming under GEF-4'*, funded through the *Strategic Pilot on Adaptation (SPA).*

2. Determination of Result-based Framework

16. A detailed Results Framework, including relevant indicators, risks, and assumptions is given in Annex 3 of the PAD. The following Table shows the roles of co-finance:

Role of Co-finance

Project Component	Cost Category	Costs (US$million)	Domestic Benefits	Global Benefits
Agro-biodiversity and Traditional Knowledge Utilization and Assessment	**Baseline**	15.89	Activities under RALP, especially component 1 contribute to conservation and multiplication of landraces of dominant cereals and legumes. The baseline of $15.89million refers to the undisbursed balance under the RALP. An amount of $2.33million (component 1) will be directly linked to the GEF project.	Conservation of important genetic diversity of sorghum and some lentils.
	With GEF and co-financing	16.256	Documentation and characterization of important agro-biodiversity; identification of landraces that benefit rain-fed farming under climate stress	Improved knowledge on genetic diversity of a range of useful species in the highlands of Yemen and of the traditional knowledge of farmers
	Increment	0.36	Farmers better informed on the useful traits of local landraces with respect to climate resilience; farmers benefit from planting lesser known/forgotten landraces	Globally important genetic diversity is documented and there is better knowledge on which landraces could be useful under different climatic stress conditions
Climate Change Modeling and Capacity Building	**Baseline**	1.19	Limited national action through preparation of NAPA; activities planned through the PPCR; several on-going analytical studies will contribute to the knowledge base on climate change (see Annex 2).	Climate change is recognized as a national challenge that needs to be addressed
	With GEF and co-finacing	2.04	Climate data analysis and modeling capacity developed in the country	Impacts of climate change on important ecosystems such as the Highlands are better understood
	Increment	0.85	Availability of local climate models lead to better planning for rainfed agriculture under different climate scenarios	Better description of possible future climate scenarios for Yemen leading to better planning for adaptation
Integrating Climate Change into Rainfed Agriculture in the Highlands	**Baseline**	13.91	The baseline reflects the GSCP project which is focused on water harvesting and improved efficiency of irrigation in the highlands. Component 2 of the GSCP ($2.97million) will be directly linked to the GEF ACAP.	Water harvesting and storage and improved irrigation efficiency is the first step in building climate resilience of the community.

	With GEF and co-financing	17.30	Income-generation activities through use and conservation - of local agro-biodiversity and better management of natural resources – especially water, as Yemen already faces acute and chronic water scarcity which if not addressed could result in food insecurity in the medium term.	Global benefits derived from actions that conserve plant genetic diversity of important food, forage and oil and fruit trees. Climate proofing of water and soil management will result in long term global benefits for conservation of agro-biodiversity.
	Increment	3.40	Piloting of adaptation activities for rainfed agriculture and using RALP as the project for scaling up.	Demonstration of adaptation activities and mainstreaming of climate adaptation in development programs

**Latest ISR estimate of undisbursed balance in the RALP and GSCP.*

Please see Annex 2 for details on the baseline for Component 2 and Annex 5 for details on co-financing by source and project component.

Annex 16: Climate Change Modeling for Yemen

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project

Characteristics of Yemen's Climate

1. The precipitation climatology of Yemen is largely controlled by migrations of the Inter Tropical Convergence Zone (ITCZ) and the descending limb of the Hadley cell. This results in a monsoon regime with summer rainfall maxima in the southwest, winter maximum along the coastal margin, and dry continental interior. Local topography exerts a very strong influence on both rainfall and temperature gradients (Wilby 2008). Specifics of Yemeni precipitation patterns include the high spatial and temporal variability in individual years as well as a high inter-annual variability. In most areas the rainy season is confined to two short periods: a spring (April, May) and a more pronounced summer (July and August) season. Local landraces of the most common agricultural crops (sorghum, wheat, lentils, etc.) will reflect this precipitation regime. Evapo-transpiration on the other hand will be extremely high and will tend to reduce the capability of soils to bridge dry spells or to allow further growth at the end of the rainy season. Yemen is characterized by five major eco-climatic zones: (1) a hot and humid coastal Tihama plain, 30-60 km wide, along the Red Sea and the Gulf of Aden, (2) the Yemen Highlands, a volcanic region with elevations between 1,000 and 3,600 m parallel to the Red Sea coast, with temperate climate and monsoon rains, (3) the dissected region of the Yemen High Plateaus and the Hadramawt - Mahra Uplands, with altitudes up to 1,000 m, (4) the Al-Rub Al-Khali desert interior, with a hot and dry climate, and (5) the islands, including Socotra in the Arabian Sea and more than 112 islands in the Red Sea.

Climate Data

2. There exists a basic to intermediate climate data management capacity in Yemen due to the sufficiently large proportion of trained people, at least in relevant institutions like CAMA or EPA. This contrasts to the generally poor data situation, in all aspects, like in amount, quality, and accessibility. This data management capacity can be enlarged on the basis of the existing one to meet growing demands, like to deal with large spatial data sets from model output or remote sensing.

3. Density of weather monitoring stations is limited, but increased considerably since about 15 yrs. At present, climate data are collected and processed by the Civil Aviation and Meteorology Authority, the National Water Resources Authority (NWRA), and the Ministry of Agriculture and Irrigation (AREA). These data are of typically daily resolution with an average record length of around 10 yrs or less. A database including tools for data evaluation does not exist and record length is often too short for most of the time-series analysis as well as density is limited which reduces the chance to test data by comparison to a neighboring station.

Climate Modeling

4. The climate modeling capacity in Yemen is not sufficient yet. There is –no relevant University program in Atmospheric Sciences. Climate related subjects are discussed in

context of adaptation in life sciences (agriculture, biology), in physical sciences (physics), and in geo-sciences (geography). A pre-requisite for advances in climate modeling will be training at regional centers of excellence, where those models are developed and applied.

5. Satellite data (Meteosat 2nd Generation, Meteosat 8) can be used for special investigations on smaller-scale variability of weather data and later for the downscaling of the GCM-based projections. Additional data for validation can be retrieved from remote sensing; especially the TRMM database (http://trmm.gsfc.nasa.gov/) is a useful source. Modeling with high resolution weather forecasting models is also an alternative to increase data available for cross checks and validation. Here the global forecasting web service located in Switzerland (http://www.meteoblue.com/en/) provides an excellent impression on the chances for local tools, adjusted for Alpine conditions, with some resemblance to Yemeni conditions.

6. To overcome the restriction in spatial resolution of GCMs, several methods were developed for spatial and temporal downscaling of GCM climate change scenarios and applied for regional impact assessment: empirical downscaling, statistical dynamical downscaling, and downscaling by dynamical modeling. All three methods may have to be carefully evaluated as a single method might yield misleading results. All three will suffer from limited data availability for cross-checking and validation. However, the least affected seems to be the dynamical modeling as it requires minimum input from actual measurements. But even those results will need a limited validation to allow a minimum of "tuning". This becomes especially important as any yield modeling in agriculture is based on empirical relationships (i.e. the climate trends will only result in reasonable trends in yield if also the absolute numbers - representing the climate - are correct!). Therefore, any quantitative modeling requires a database that reasonably describes at least the temporal variability of characteristic sites in the highlands of Yemen.

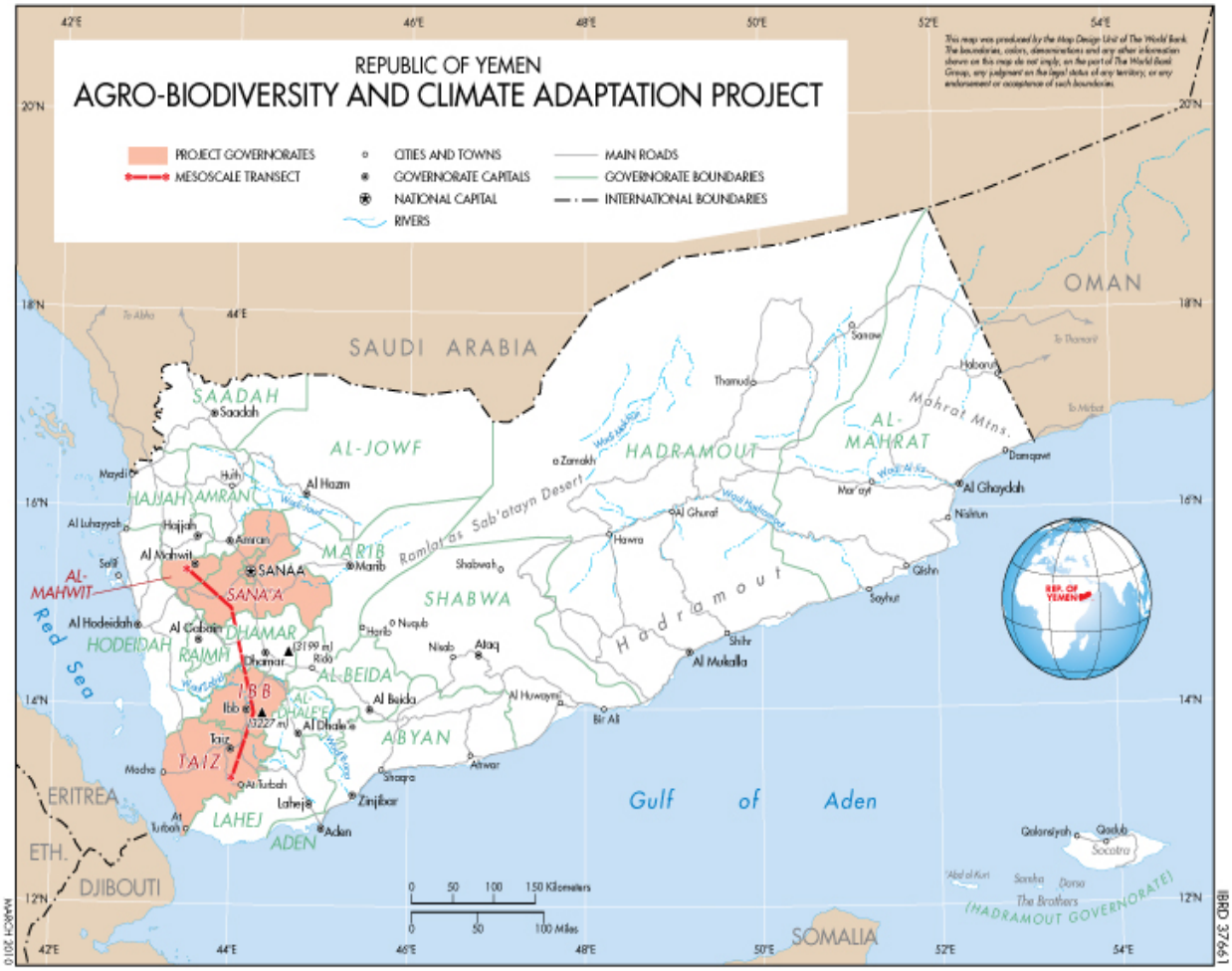
7. For preliminary results on climate trends, a model output of GCMs is recommended. This output is available through databases like the CERA database. The CERA database is hosted by the World Data Center for Climate at the Max-Planck Institute for Meteorology. In the database various types of climate data like model output, but also in-situ and remote sensing data, are stored. For the IPCC Fourth Assessment report several experiments are available like the experiments based on scenarios defined by the Special Report on Emission Scenarios (SRES) like A1B, A2 and B1 but also experiments based on non-SRES scenarios like PICTL, 20C3M, COMMIT, 1PT02X and 1PT04X. However, trends will be small and often not significant. Also, the limited spatial resolution limits the coverage of topographic effects and therefore the applicability to the Yemeni highlands.

8. Regardless of the approach to regionally downscaled data, users should carefully consider the large uncertainty of the data, both for the past and for the future. This is due to: (i) poor data coverage for validation, (ii) the large topographic enhancement of precipitation in Yemen, not well covered by existing models, and (iii) the fuzzy output of global models showing no clear sign of the precipitation trend in 21st century.

Source: Christian Bernhofer, and Klemens Barfus (2009): ***Climate Modeling for the Rainfed Highlands of Yemen***; adapted by Tu Dresden for the GEF-Agro-biodiversity and Climate Adaptation Project.

Annex 17: Map IBRD 37661

REPUBLIC OF YEMEN: Agro-biodiversity and Climate Adaptation Project



Map of Yemen indicating the governorates under the ACAP based on a mesoscale transect extending over the governorates of Al Mahweet, Sana´a, Ibb and Taiz.