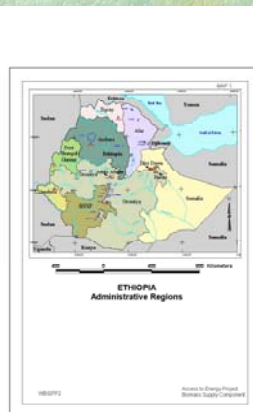


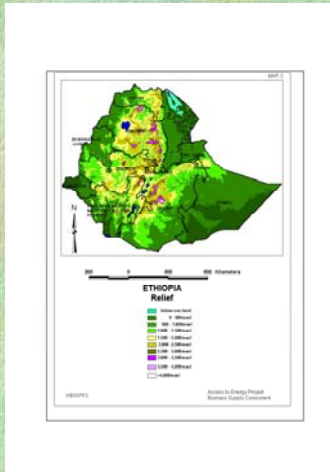
FEATURES AND ISSUES RELATED TO THE ETHIOPIAN BIOMASS ENERGY SECTOR



REGIONAL STATES OF ETHIOPIA



MAJOR RELIEF OF ETHIOPIA



POPULATION

» *ETHIOPIA*

- **POPULATION: 67 MILLION**
- **90 PERCENT ARE RURAL:**

THE HIGHLANDS

- **HIGHLANDS (OVER 1,500masl)**
 - **COVER 43 % OF COUNTRY**
 - **88 PERCENT OF POPULATION**
 - **95 % OF CULTIVATED LAND**
 - **75 % OF LIVESTOCK**
 - **LONG HISTORY OF HUMAN SETTLEMENT**

THE LOWLANDS

- » **LOWLANDS BELOW 1,500masl**
- » **LOWLANDS IN THE EAST, SOUTHEAST AND SOUTH**
- **ANNUAL RAINFALL LESS THAN 600mm**
- **ACACIA SHRUBLAND TO DESERT**
- **TRANSHUMANT PASTORALISTS**
- **LOW POPULATION DENSITIES**

» **LOWLAND IN THE
SOUTHWEST AND WEST**

- **ANNUAL RAINFALL OVER 800mm**
- **COMBRETUM-TERMINALIA WOODLAND AND
LOWLAND BAMBOO**
- **SHIFTING CULTIVATORS**
- **TRYPANOSOMIASIS AND MALARIA**
- **LOW POPULATION DENSITIES**

**THE WOODY BIOMASS INVENTORY
AND STRATEGIC PLANNING
PROJECT**

- **IDENTIFIED 1984 WB/UNDP ENERGY
SECTOR STUDY**
- **PHASE I – 1989 TO 1995 25 % OF COUNTRY**
- **BRIDGING PHASE 1996 – 1998**
- **PHASE II – 1999 – 2003 – 75 % OF COUNTRY**
- **“REGIONAL” APPROACH**
- **NINE STRATEGIC PLANS AND INVESTMENT
PROGRAMMES**
- **BEING IMPLEMENTED UNDER “ACCESS TO
ENERGY PROJECT”**

WOODY BIOMASS ENERGY SECTOR

- **COMPRISES:**

- **MAJOR SOURCES: WOOD, CHARCOAL,
CROP RESIDUES, ANIMAL DUNG**

- **MINOR SOURCES: SAW DUST,
BAGASSE**

- **USERS:**

- **94 % RURAL AND URBAN
HOUSEHOLDS**

- **6 % COMMERCIAL SERVICES,
COTTAGE INDUSTRIES, INDUSTRY**

HOUSEHOLD BIOMASS ENERGY CONSUMPTION PATTERNS

- **FUELWOOD : 45.7 MILLION TONS (78%
OF ENERGY)**

- **CHARCOAL 0.25 MILLION TONS (1 %
OF ENERGY)**

- **RESIDUES 5.2 MILLION TONS (9 %
OF ENERGY)**

- **DUNG 8.8 MILLION TONS (12
% OF ENERGY)**

- **“MODERN” ENERGY CONTRIBUTES
ONLY 1 % OF HOUSEHOLDS ENERGY
CONSUMPTION**

BIOMASS ENERGY SUPPLY PATTERNS

- **STANDING STOCK 939 MILLION TONS
(1,565 MILLION M³)**
- **ANNUAL INCREMENT 45 MILLION
TONS (75 MILLION M³)**
- **DEAD WOOD USED AS FUEL 8
MILLION TONS (14 MILLION M³)**
- **0.8 MILLION TONS (1.3 MILLION M³) OF
WOOD FROM AGRICULTURAL
CLEARING**
- **CROP RESIDUES 24 MILLION TONS**
- **DUNG 27 MILLION TONS**

NATIONAL WOODY BIOMASS SUPPLY - CONSUMPTION BALANCES

- **TOTAL WOOD CONSUMPTION = 47.6
MILLION TONS (79.4 MILLION M³)**
- **(PLUS CHARCOAL) CONSUMPTION**
- **(EXCLUDING INDUSTRY)**

- **ANNUAL INCREMENT = 45 MILLION
TONS (75 MILLION M³)**

- **DEAD WOOD = 8.4 MILLION TONS (14
MILLION M³)**

- **AGRICULTURAL CLEARING = 0.8
MILLION TONS (1.3 MILLION M³)**

THE PROBLEM IS LOCAL NOT NATIONAL

- **OUT OF 482 WEREDAS SURVEYED 336 WEREDAS ARE CONSUMING MORE THAN THEIR WOODY BIOMASS ANNUAL INCREMENT**
- **MOST OVER-CONSUMING WEREDAS LOCATED IN THE HIGHLANDS**

TRENDS IN WOODY BIOMASS SUPPLY

- **PRIOR TO 1991:**
 - **PROHIBITION ON TREE CUTTING**
 - **FREQUENT RE-ALLOCATION OF FARM PLOTS TO ACCOMADATE NEW FAMILIES**
 - **STRONG FEELING OF LAND AND TREE TENURE INSECURITY**
 - **NO INVESTMENT IN TREE PLANTING BY FARMERS**

- **POST 1991:**
 - **LIFTING OF BAN ON TREE CUTTING**
 - **FORMAL ACKNOWLEDGEMENT OF INDIVIDUAL TREE TENURE AND FREEDOM OF DISPOSAL**
 - **MASSIVE INCREASE IN DEMAND FOR CONSTRUCTION POLES AS ECONOMY TAKES OFF**
 - **BIG INCREASE IN ON-FARM TREE PLANTING (EUCALYPTUS) FOR POLES**
 - **FUELWOOD A BY-PRODUCT**
 - **RATE OF PLANTING RELATED TO PROXIMITY TO ROADS AND MARKETS**

TRENDS IN BIOMASS FUELS CONSUMPTION

- **RURAL HOUSEHOLDS**
 - **INCREASE IN USE OF WOOD FUEL**
 - **DECREASE IN USE OF DUNG RELATED TO:**
 - **(INCREASE IN WOOD SUPPLY)**
 - **(ELIMINATION OF FERTILIZER SUBSIDIES AND INCREASE IN FERTILIZER PRICE - INCREASE IN PERCEIVED VALUE OF DUNG)**

– URBAN HOUSEHOLDS

- **INCREASE IN USE OF ELECTRICITY DUE TO EXPANSION OF CONNECTIONS**
- **INCREASE IN THE USE OF CHARCOAL DUE TO REDUCTION OF CONTROLS ON CHARCOAL TRADING**
- **DECREASE IN THE USE OF WOOD FUEL DUE TO FUEL SUBSTITUTION**
- **INCREASE IN USE OF KEROSENE DUE TO BETTER DISTRIBUTION**

PART 2

- **ISSUES RELATED TO CONSUMPTION AND SUPPLY OF BIOMASS FUELS IN ETHIOPIA**

1. INTEGRATED NATURE OF BIOMASS FUEL SUPPLY AND LAND USE SYSTEMS IN ETHIOPIA

- **WOOD, RESIDUES AND DUNG COME FROM THE FARM**
- **RESIDUES: VALUE AS LIVESTOCK FEED
1.825 TONS OF RESIDUES FEED ONE
TROPICAL LIVESTOCK UNIT (COMPETITION
FOR ON-FARM RESOURCES)**
- **DUNG: VALUE AS SOIL NUTRIENTS - 1 TON
DUNG 16 KGS OF NITROGEN: 16 KGS OF
NITROGEN INCREASE CROP YIELD BY 96KGS
(COMPETITION FOR ON-FARM RESOURCES)**

2. FUELWOOD SUPPLY AND PRODUCTION OF CONSTRUCTION POLES

- **FARMERS PLANT TREES FOR POLES
NOT FUELWOOD**
- **FUELWOOD IS A BY-PRODUCT**
- **IMPLICATION FOR BIOMASS ENERGY
PLANNING**
- ***MUST CONSIDER DEMAND AND SUPPLY
OF CONSTRUCTION POLES***

3. FUELWOOD COLLECTION NOT RESPONSIBLE FOR DEFORRESTATION

- **IN THE FOREST AREAS:**
 - **CLEARING FOR AGRICULTURE MOST IMPORTANT FACTOR IN DESTRUCTION OF HIGH FOREST**

- **IN WOODLAND AREAS**
 - **SHIFTING CULTIVATION AND INCREASING POPULATION PRESSURE AND SHORTENING OF TREE FALLOWS**

 - **CLEARING FOR LARGE SCALE AGRICULTURE**

4. BURNING OF DUNG AND CROP RESIDUES AS FUEL AND SOIL NUTRIENT DEPLETION

- **ESTIMATED 44,000 TONS OF NITROGEN LOST**

- **ESTIMATED 18,000 TONS OF PHOSPHOROUS LOST**

- **CROP PRODUCTION FOREGONE IS 271,000 TONS OF GRAIN**

- **3 % OF ETHIOPIA'S TOTAL ANNUAL GRAIN PRODUCTION**

- **ENOUGH TO FEED OVER 1 MILLION PEOPLE FOR A YEAR**

5. POTENTIALS FOR INCREASING BIOMASS ENERGY AND END USE EFFICIENCY

- **URBAN HOUSEHOLDS**
- **90% ENERGY EXPENDED ON COOKING**
- **VERY SUCCESSFUL DISSEMINATION OF TWO STOVES UNDER PRIVATE ENTERPRISE:**
 - **“MIRT” STOVE FOR “MITAD” BAKING**
 - **“LEKECH” CHARCOAL STOVE**
- **BUT - RECENT ELECTRICITY TARRIF INCREASES STOPPED ADOPTION AND USE OF ELECTRIC “MITAD” STOVE**

- **RURAL HOUSEHOLDS**
- **RURAL HOUSEHOLDS DO NOT USE CHARCOAL (NO DEMAND FOR “LAKECH” STOVE**
- **RURAL INCOMES VERY LOW**
- **RURAL MARKETS FOR “MIRT” STOVE VERY THIN,**
- **NO INCENTIVES FOR “MIRT” STOVE MAKERS TO GO INTO RURAL AREAS OR SMALL TOWNS**

METHODOLOGY

LAND COVER MAPPING

- VISUAL INTERPRETATION OF 1:250,000 LANDSAT TM COLOUR COMPOSITE FOLLOWED BY GROUND AND AERIAL FIELD CHECKS
- TRANSFER LANDCOVER MAPPING UNITS TO 1:250,000 TOPOGRAPHIC SHEETS AND DIGITIZE INTO COMPUTERIZED GEOGRAPHICAL INFORMATION SYSTEM
- USING UNSUPERVISED CLASSIFICATION OF LANDSAT TM DIGITAL RESOLVE INTO 15 – 20 CLUSTERS
- WITHIN EACH MAPPING UNIT INTERPRET EACH CLUSTER AND ASSIGN TO SPECIFIC LAND COVER TYPE
- FIELD VERIFICATION OF INTERPRETED CLUSTERS
- FINAL REVISION AND PRODUCTION OF LAND COVER MAP

METHODOLOGY

WOODY BIOMASS INVENTORY

- WOODY BIOMASS STOCK:
 - DETERMINE NUMBER OF SAMPLE PLOTS AND TRANSECTS REQUIRED FOR EACH LAND COVER TYPE IN EACH AGRO-ECOLOGICAL ZONE
 - IN GIS RANDOMLY LOCATE START POINTS OF EACH TRANSECT AND RANDOMLY SELECT COMPASS BEARING
 - LOCATE TRANSECT START POINT IN FIELD: MEASURE STEM DIAMETER ALL WOODY STEMS > 10CMS IN MAIN PLOTS: ALL WOODY STEMS IN SUB PLOTS
 - FOR REPRESENTATIVE SUB SAMPLE OF TREES CUT AND WEIGH ALL WOODY BIOMASS AND DETERMINE MOISTURE CONTENT

- UNDERTAKE REGRESSION ANALYSIS BY SPECIES BY AGRO-ECOLOGICAL ZONE TO DETERMIN WEIGHT - STEM DIAMETER RELATIONSHIPS
- DETERMINE TOTAL WOODY BIOMASS PER HECTARE BY LAND COVER TYPE BY AGRO-ECOLOGICAL ZONE AFTER CONVERTING TO OVEN DRY WEIGHT

- .WOODY BIOMASS YIELD
 - SELECT REPRESENTATIVE TREES BY SPECIES BY AGRO-ECOLOGICAL ZONE
 - ACCURATELY MEASURE STEM DIAMETER AT BREAST HEIGHT (dbh) – 1.3 METERS
 - RE-VISIT AND MEASURE DBH OVER AS MANY YEARS AS POSSIBLE AT SAME TIME OF YEAR USING SAME TECHNICIAN WHERE POSSIBLE
 - FOR SUB-SAMPLE CUT MARIAUX WINDOW IN CAMBIAN. FELL AND CUT DISC TWO YEARS LATER AND COMAPRE RING GROWTH WITH RAINFALL RECORDS

- FROM DISCS CUT DURING WEIGHING OPERATION DETERMIN WHERE POSSIBLE THE NUMBER OF RINGS AND COMPARE WITH DBH
- FROM REPEATED STEM MEASUREMENTS AND FROM RING COUNTS DETERMIN ANNUAL INCREMENT

METHODOLOGY SOCIO-ECONOMIC SURVEY

- DETERMIN NUMBER OF SAMPLE HOUSEHOLDS PER REGION AND ASSIGN TO FARMING SYSTEMS BASED PROPRTIONAL TO POPULATION IN FARMING SYSTEM AREA
- RANDOMLY ASSIGN HOUSEHOLDS TO SPECIFIC WEREDAS AND TO SPECIFIC FARMERS ASSOCIATIONS
- APPLY HOUSEHOLD QUESTIONAIRES TO SAMPLE HOUSEHOLDS
- APPLY QUESTIONAIRES TO COMMUNITY FOCUSED GROUP, TO REPRESENTATIVE WOMEN'S GROUP, TO F.A. OFFICIALS, TO WEREDA OFFICIALS
- CODE AND ENETER DATA INTO COMPUTER PROGRAMME (MS ACCESS)
- PRODUCE REQUIRED TABLES
- PRODUCE FINAL REPORT