Introduction to ALU Software for National GHG Inventory and Mitigation Analysis

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Software program developed in VB.net framework
- Stand-alone program
Relational database developed in a Microsoft JET database
- Three databases
SQL code reads and writes data between the graphical user interface and the database

What is ALU?
- Primary Purpose: Support reporting of GHG emissions to the UNFCCC
- Greenhouse Gas Inventory Software Program
  - Developed for LULUCF and Agricultural Sectors
  - Based on IPCC methods (96 GL and GPG)
  - Emphasis on incorporation of good practices
  - Accommodates IPCC Tier 1 methods, but allows compilers to advance inventory with the Tier 2 method capability
  - User-interface guiding compiler through inventory process of data entry and calculations

ALU Software Scope
- Data management capability
  - Manage activity data, emission factors, emission results
  - Can incorporate GIS-based data on land use and land use change derived from remote sensing imagery
- Perform mitigation analysis
  - ALU facilitates mitigation analysis using the inventory as the baseline
- Documentation and archive for all data and results
  - Self-contained database with data used in inventory as well as documentation for references and results
  - Institutional memory for long-term sustainability of GHG inventory

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GHGs: Land Use and Livestock

Biomass C Stock Changes
Non-CO₂ GHG Emissions from Burning

CH₄ and N₂O from Manure
Soil N₂O Emissions
Rice Methane
Enteric Methane
Soil C Stock Changes

From 2006 IPCC Guidelines
**ALU Software Design Features**

- Main window that allows easy access to all parts of the program
- Validation checks and internal tracking of data completeness
  - Quick access to next step for each source category
- Hierarchical data entry framework
- Ability to create multiple databases and transfer to other computers
  - Could even work from network drives

**ALU Software Design Features**

- Data saved by program when exiting a form, during validation or by clicking save icons
- Navigation controls
- Most data and documentation can be exported
  - Some data can also be imported
- User-identity and time stamps
- Electronic manual in PDF format
  - Accessed through the help icons or drop-down menus
  - Can be printed

**ALU Land Use Session**

**Spatial Data (Geographic Information System)**

**Text File (Import into ALU)**

```
1102, TRMM, HAC, FL, 35117.19922
1103, TRMM, HAC, GL, 65306
1104, TRMM, HAC, GL, 9724.410156
1105, TRMM, HAC, OL, 215.460006
1106, TRMM, HAC, SM, 373.23001
1107, TRMM, HAC, CL, 4032.090087
1110, TRMM, HAC, WL, 7.559999
1111, TRMM, HAC, FL, 0.449999
1111, TRMM, HAC, WL, 2316.23999
1202, TMSD, HAC, FL, 106793
1203, TMSD, HAC, GL, 721293
1204, TMSD, HAC, GL, 292541
1205, TMSD, HAC, OL, 20048.59961
1206, TMSD, HAC, SM, 4145.759765
1207, TMSD, HAC, CL, 229119
1209, TMSD, HAC, WL, 3208.050048
1210, TMSD, HAC, FL, 31221.69922
1211, TMSD, HAC, WL, 41818.60156
3102, TRMM, VOL, FL, 51673.30078
3103, TRMM, VOL, GL, 20436.19922
3104, TRMM, VOL, GL, 3905.370117
```

**Export Module I, Primary Data:** Enter activity data on land use change and management
Climate and Soil

Land Use Areas

Approach 2/3 Activity Data

Add Land Use Subcategories

Land Use and Management

Deforestation
Timber Harvest
Fuelwood Gathering
Shifting Cultivation
Fires

Other Disturbance

Climate, Soil and Land Use Data

Areas for systems

Management Systems

Primary Data for Rice

Enter Additional Management Data

Enter Area Data

Rice Management

Climate and Soil Land Use Areas Approach 2/3 Activity Data Add Land Use Subcategories Climate, Soil and Land Use Data Areas for systems Management Systems Primary Data for Rice Enter Additional Management Data Enter Area Data Rice Management
Module II: Enter rice methane emission factors

Factors needed to estimate rice methane emissions

Available Factor Files
Compiler has options to assign new country-specific values

Calculation for rice methane emission factor
Equation and Legend
Review emission factors

Module III: Program calculates emissions and stock changes using equations from IPCC GL and GPG

Calculation to estimate rice methane emissions
Equation and Legend
Review results for rice methane emissions

Inventory compiler exports results into spreadsheets for reporting
Mitigation Analysis

- Inventories are used to consider mitigation options and monitor outcomes of policy actions intended to reduce emissions
- Evaluating mitigation potentials can involve a variety of drivers including technological change, population growth, and economic growth
- ALU facilitates mitigation analysis using the inventory as the baseline

Scope of Analysis

- Analyze the potential change in greenhouse gas emissions from changing management of land and livestock
- Use existing inventory in ALU as the baseline
- Include multiple source categories influenced by practice
  - Within Agriculture and LULUCF
- Biophysical potentials produced by ALU, but projections can be informed by economic forecasts of commodity production and consequences for management of land and livestock
Approaches for Mitigation Analysis

- Whole Session Approach
  - Focus on all practices
  - Maximum utility
  - Assesses all drivers of emissions and mitigation potential
  - i.e., Population growth, economic growth and technology

- Practice-Based Approach
  - Focus on specific practice
  - Assesses technology as a driver of emissions and mitigation potential

Start mitigation analysis from task bar

Select mitigation analysis approach

Select mitigation category

Select strategy

Select baseline type

Select baseline session

Enter Mitigation Practices for Rice Management
Similar analysis for other practices

- Deforestation
- Crop residue management
- Livestock enteric methane emissions
- Manure management
- Grassland burning
- etc. ....

Future Releases of ALU

- Addressing uncertainty in the inventory using ALU
  - Recommended by IPCC
  - Incorporate simple error propagation methods
- Develop carbon stock change method for biomass
  - ALU currently has the growth-loss method only
  - Facilitate carbon stock change estimation with National Forest Inventory
- Enhanced sheep characterization
  - Tier 2 emission factors
- More mitigation options

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More Information:
http://www.epa.gov/climatechange/emissions/ghginventorycapacitybuilding/index.html
http://www.nrel.colostate.edu/projects/ALUsoftware/