Agricultural and Land Use Software Approach for Estimating Reductions in Emissions from Deforestation and Forest Degradation

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Acknowledgements:

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ALU Software Design Team: Dean Selby, Mark Easter, Shannon Spencer, Stephen Williams

Regional Capacity Building Projects

- **Central America and new project in Southeast Asia**
  - **Goal: Improve GHG inventory for reporting to UNFCCC**
- **Foci of capacity building**
  - **Improving national system including institutional arrangements, QA/QC, key category analysis, archiving, institutional memory (US-EPA)**
  - **Applying good practices in LULUCF and Agricultural sectors (CSU)**
  - **Incorporating remote-sensing based data into inventory (NASA)**
- **Tools**
  - **National systems software**
  - **Agriculture and Land Use Inventory Program (ALU)**

Overview of Activities

- **Kick-off workshop**
  - Inventory compilers presented current state of inventory
  - Overview of tools and data needs
  - Discussion on objectives and goals
- **In-country training**
  - Overview of inventory methods
  - Activity data collection
  - Training on tools
- **Web site**
  - Distribution of tools and other guidance documents
- **Wrap-up workshop**
  - Inventory compilers presented improvements in inventory
  - Discussion on further assistance

What is ALU?

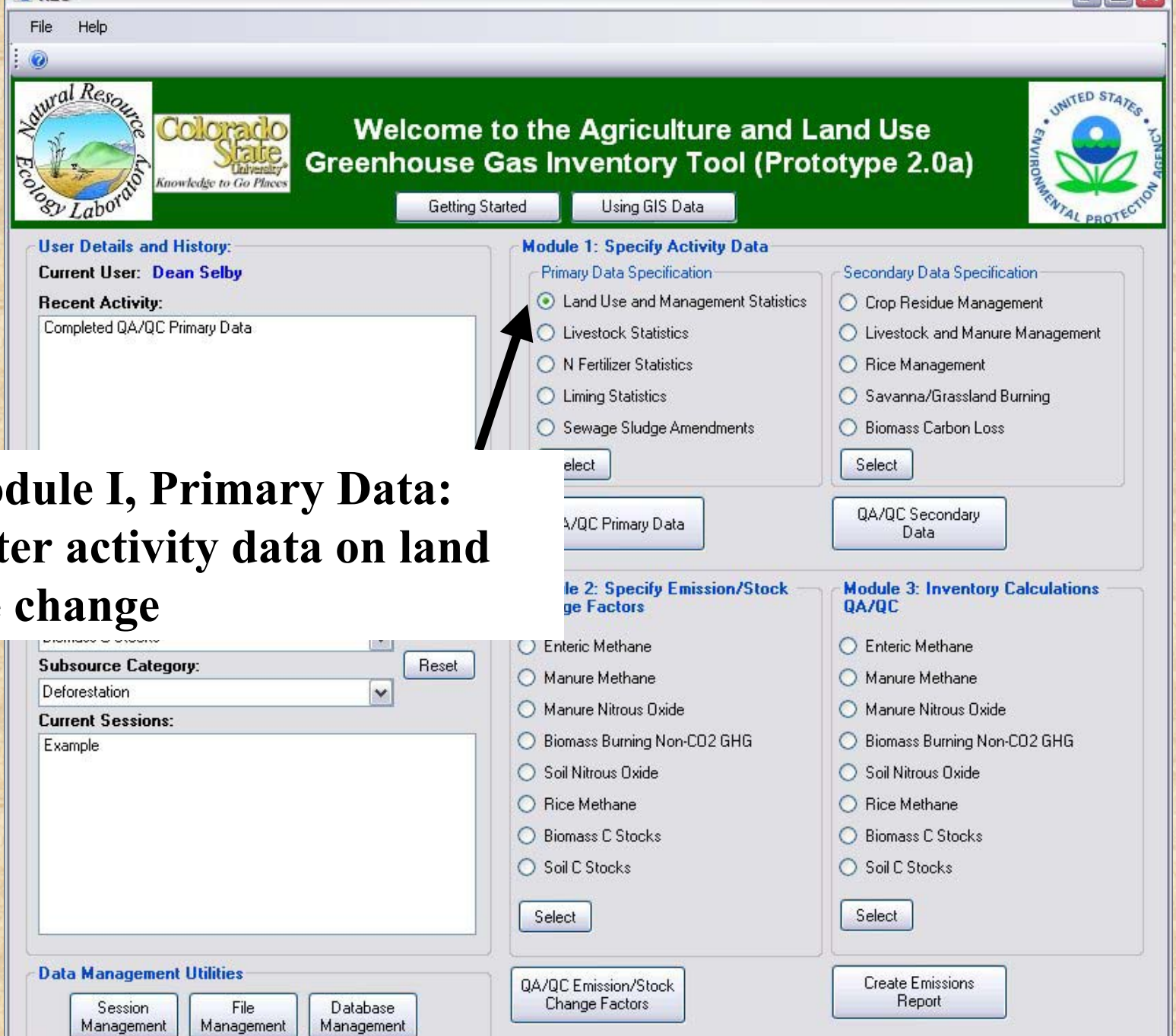
- **Greenhouse Gas Inventory Software Program**
  - **Developed for LULUCF and Agricultural Sectors**
  - **Based on IPCC methods (96 GL and GPG)**
    - **Emphasis on incorporation of good practices**
  - **Accommodates IPCC Tier 1 and 2 methods**
- **User-interface guiding compiler through inventory process with an underlying relational database structure**
  - **Activity data entry, emission factor assignment and emission/stock change estimation**
- **Digital archive for inventory data**
  - **Institutional memory**

Some Key Features of ALU

- **Flexibility with choice of activity data**
  - **Option to use Approach 1, 2 or 3 activity data**
- **May import activity data from remote-sensing imagery, and combine with forestry statistics and agricultural census data**
  - **Complete and consistent representation of land**
- **Option to use default or region-specific factors**
  - **Tier 1 and 2 method**
- **Explicit Quality Assurance/Quality Control steps**
  - **Activity data entry, factor assignments and calculations**
- **Produces tabular results and maps for LULUCF**
  - **All calculations provided for transparency**

Assessing REDD Activities

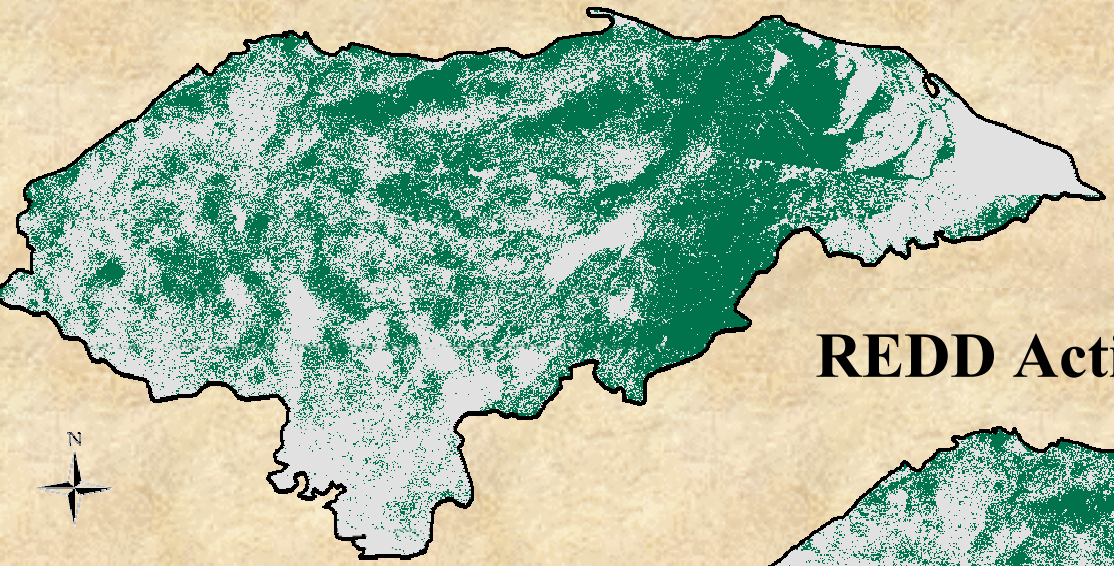
- **Estimate national/sub-national reference scenarios**
  - **Evaluate potential for mitigation from reference scenario**
  - **Account for displacement of emissions at the respective scales**
- **Estimate biomass C stock change from deforestation and forest degradation**
- **Facilitate verification**
  - **Tabular results and maps can be analyzed for consistency with ground-based sampling or other information**
- **Option to integrate REDD activity in national or sub-national GHG inventory**



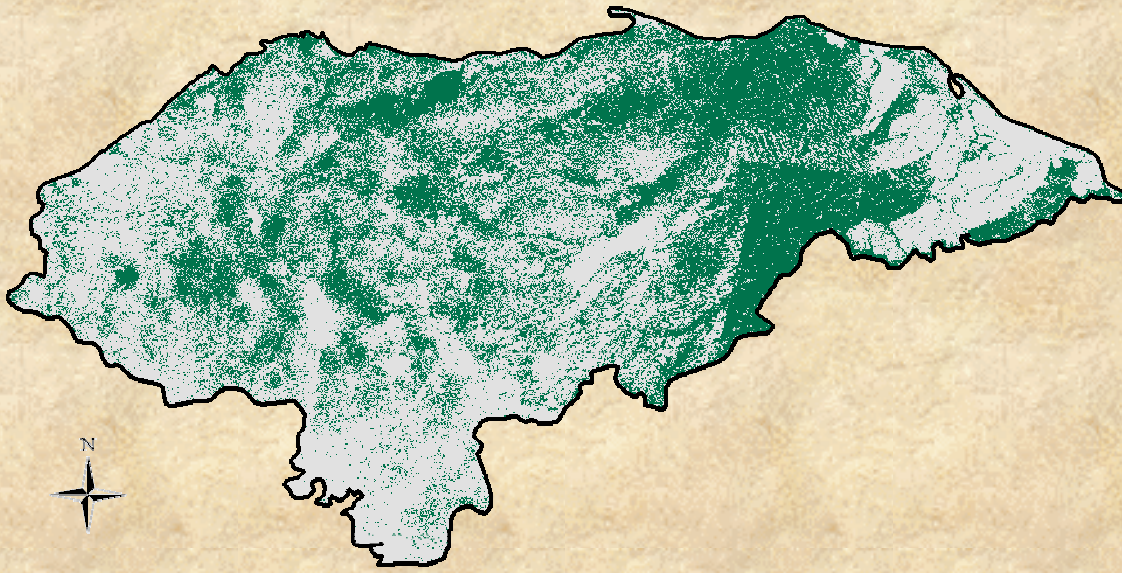
Module I, Primary Data: Enter activity data on land use change

Remote Sensing Imagery

Reference Scenario Forest Cover

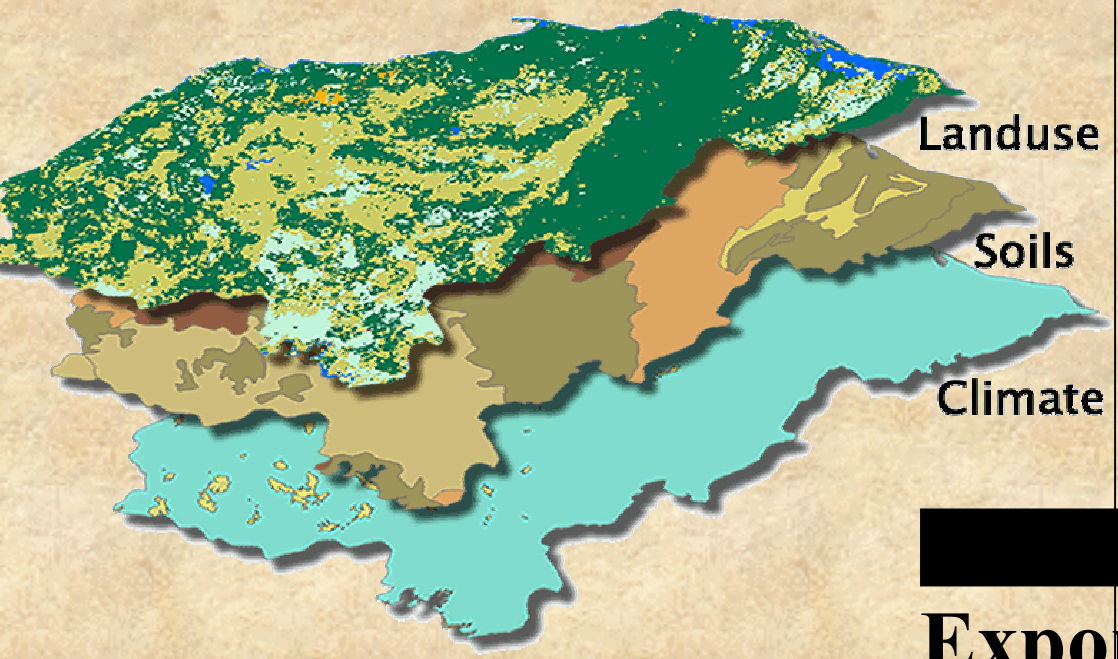


REDD Activity Period Forest Cover



Images courtesy of Jason Tullis, Univ. of Arkansas

Spatial Data
(Digital)

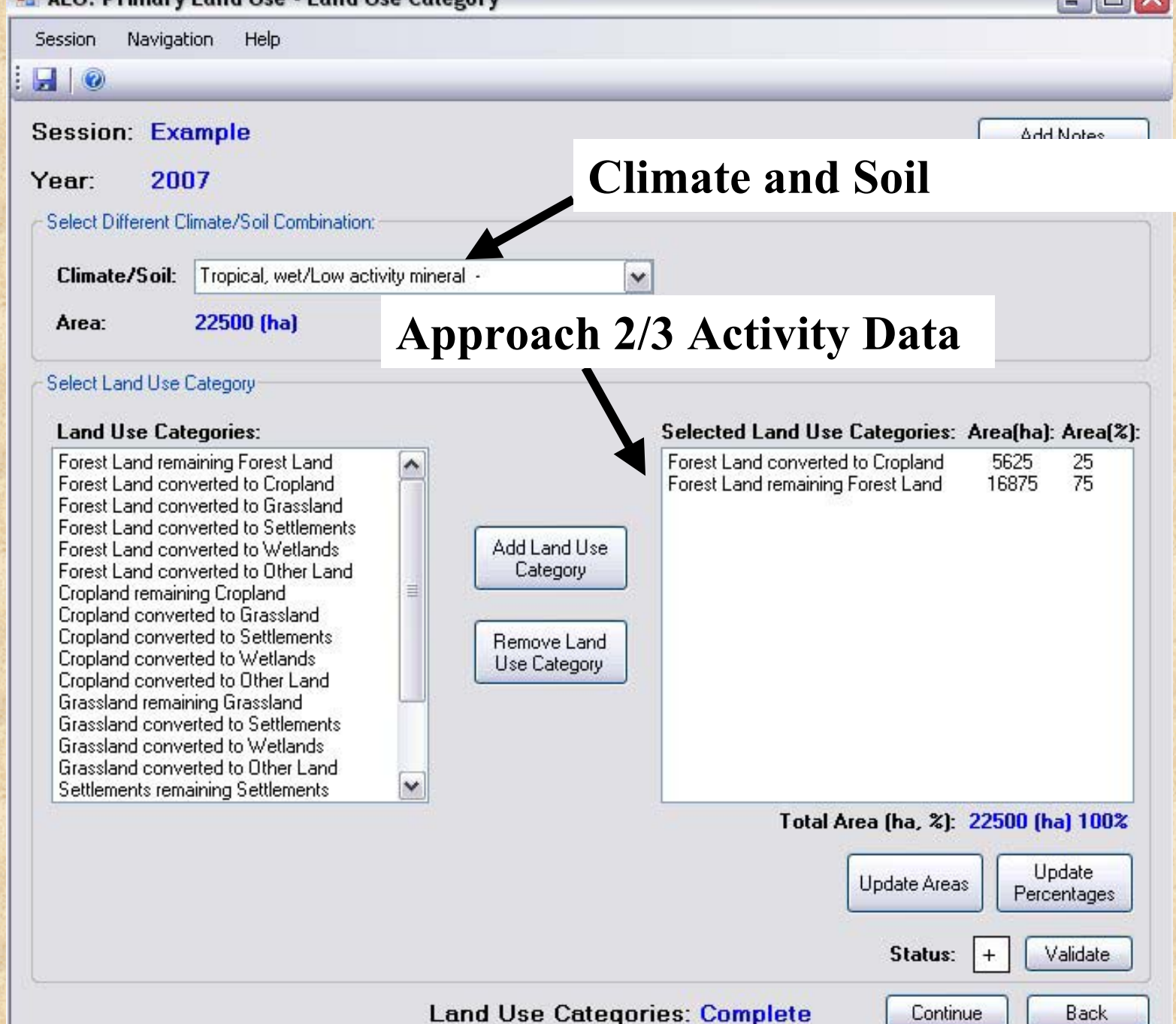


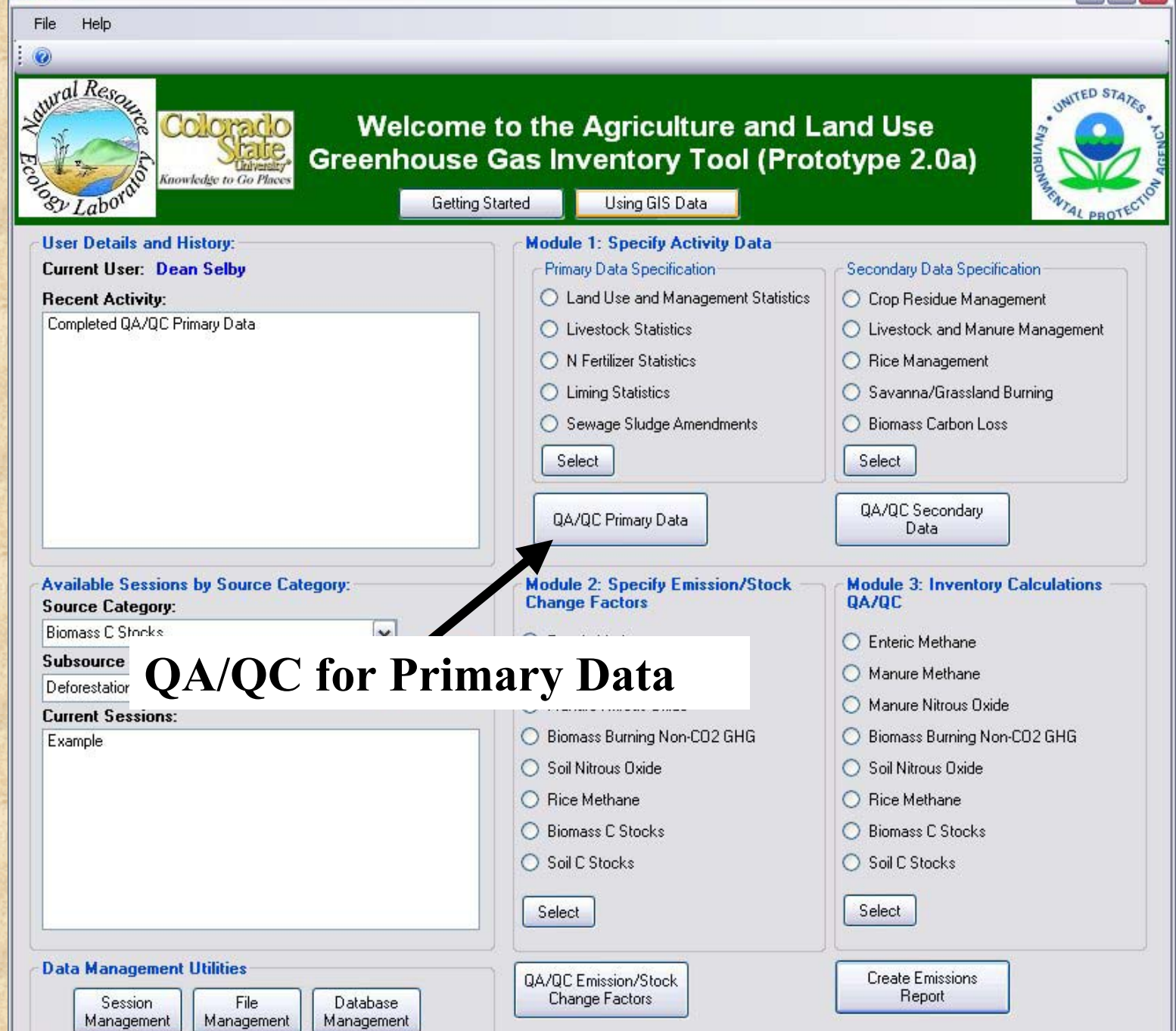
Export

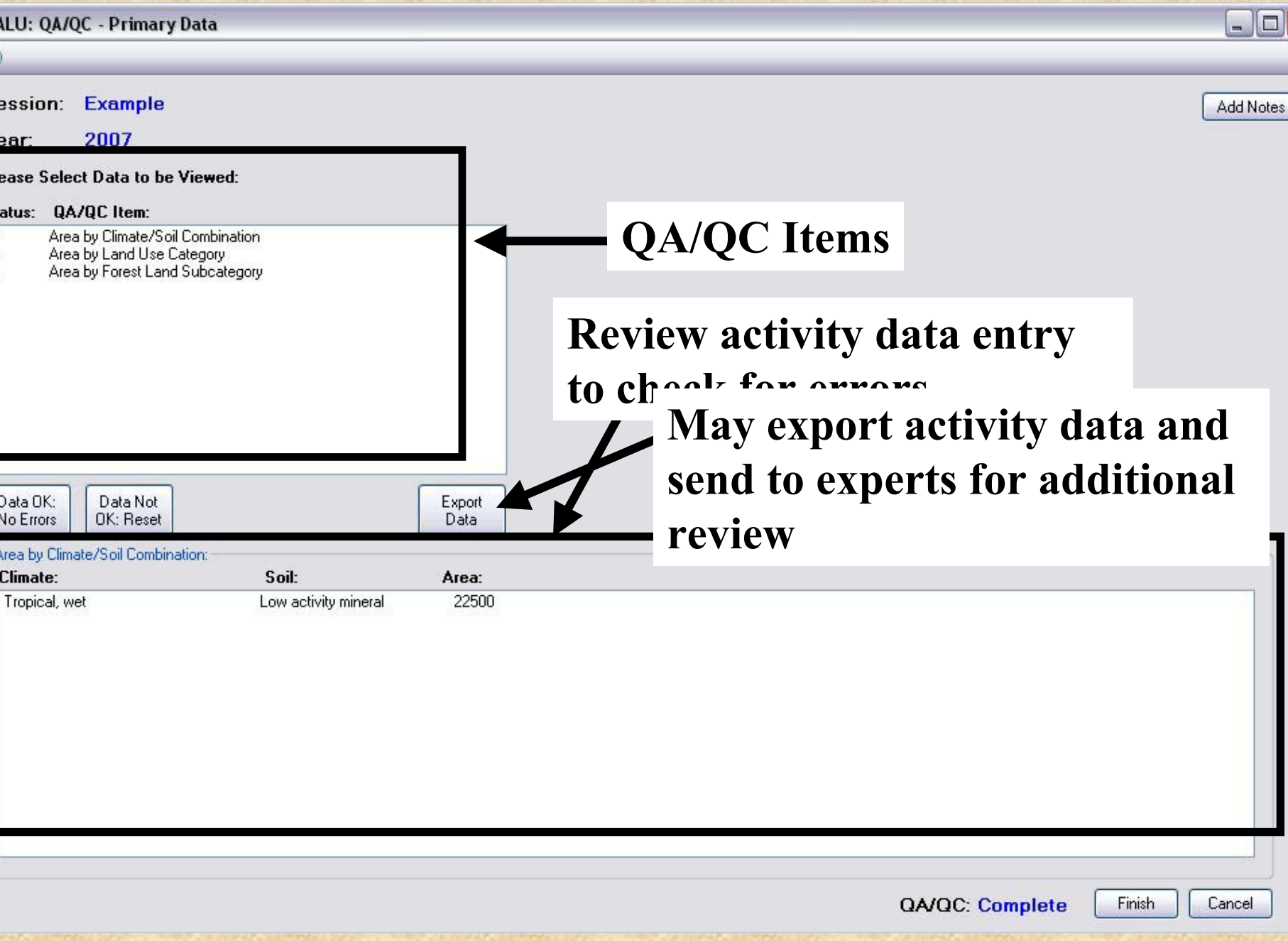
Text File
(Import to ALU)

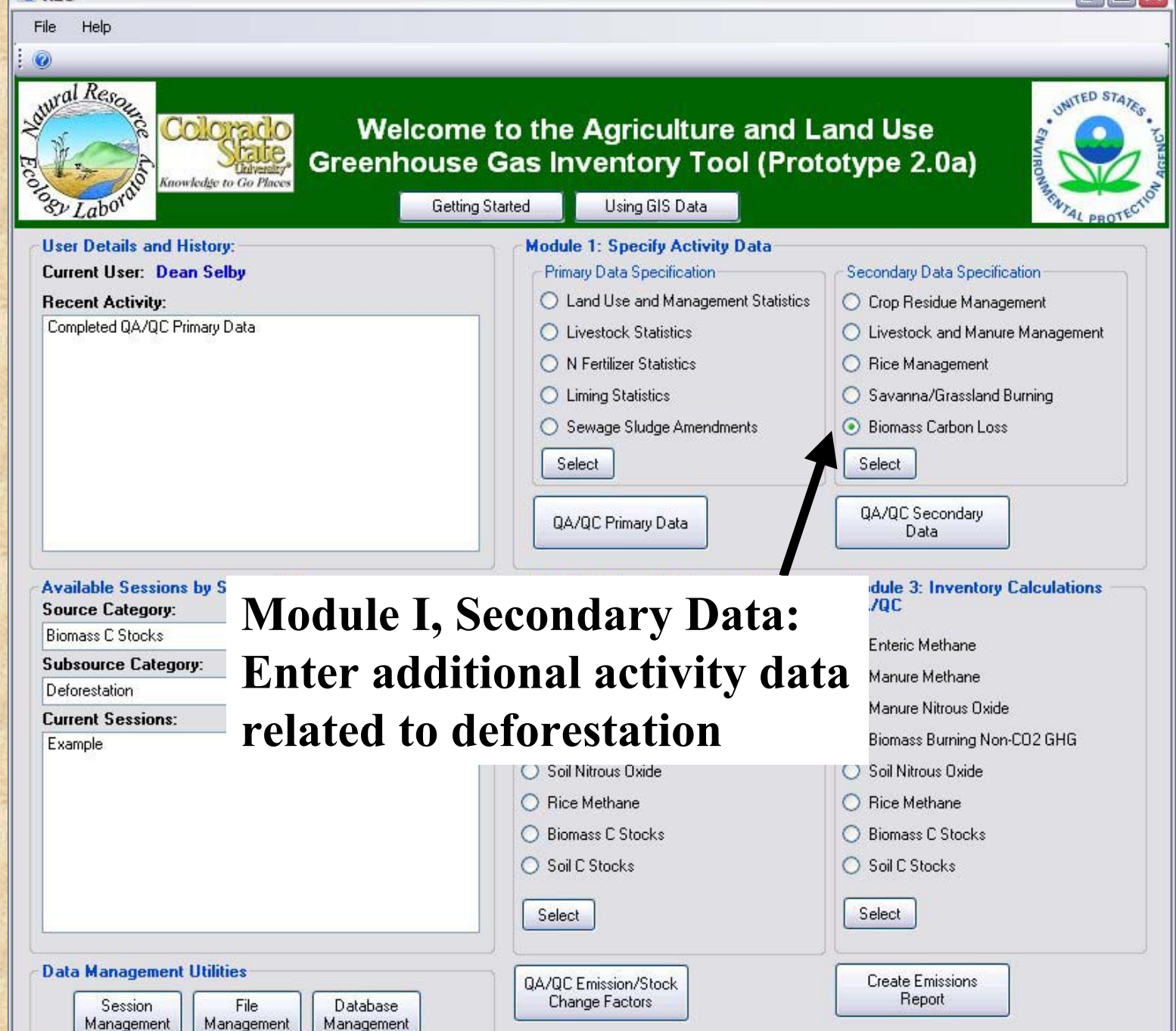
```
climate,soil,lutype,area
TRM,HAM,CRO,2919894.20
TRM,HAM,FOR,3359760.83
TRM,HAM,GRA,1041601.15
TRM,HAM,SET,3877.62
TRM,HAM,WET,143290.34
TRM,LAM,CRO,566015.12
TRM,LAM,FOR,2786199.48
TRM,LAM,GRA,92800.60
TRM,LAM,SET,3816.94
TRM,LAM,WET,73629.06
TRM,VOL,CRO,40697.90
TRM,VOL,FOR,127249.06
TRM,VOL,GRA,4463.06
TRM,VOL,WET,1821.44
TRM,WET,CRO,21314.42
TRM,WET,FOR,24314.44
TRM,WET,GRA,27586.35
TRM,WET,SET,315.95
TRM,WET,WET,7699.40
TMM,HAM,CRO,20028.59
TMM,HAM,FOR,75022.50
TMM,HAM,GRA,1685.64
TMM,LAM,CRO,3131.15
TMM,LAM,FOR,7102.60
TMM,LAM,GRA,159.96
TMM,LAM,WET,472.70
TMM,VOL,CRO,11870.78
TMM,VOL,FOR,49932.65
TMM,VOL,GRA,899.75
```

Sources: Remote Sensing Imagery, National Scale Mapping Projects (e.g., soils), Land Use Surveys

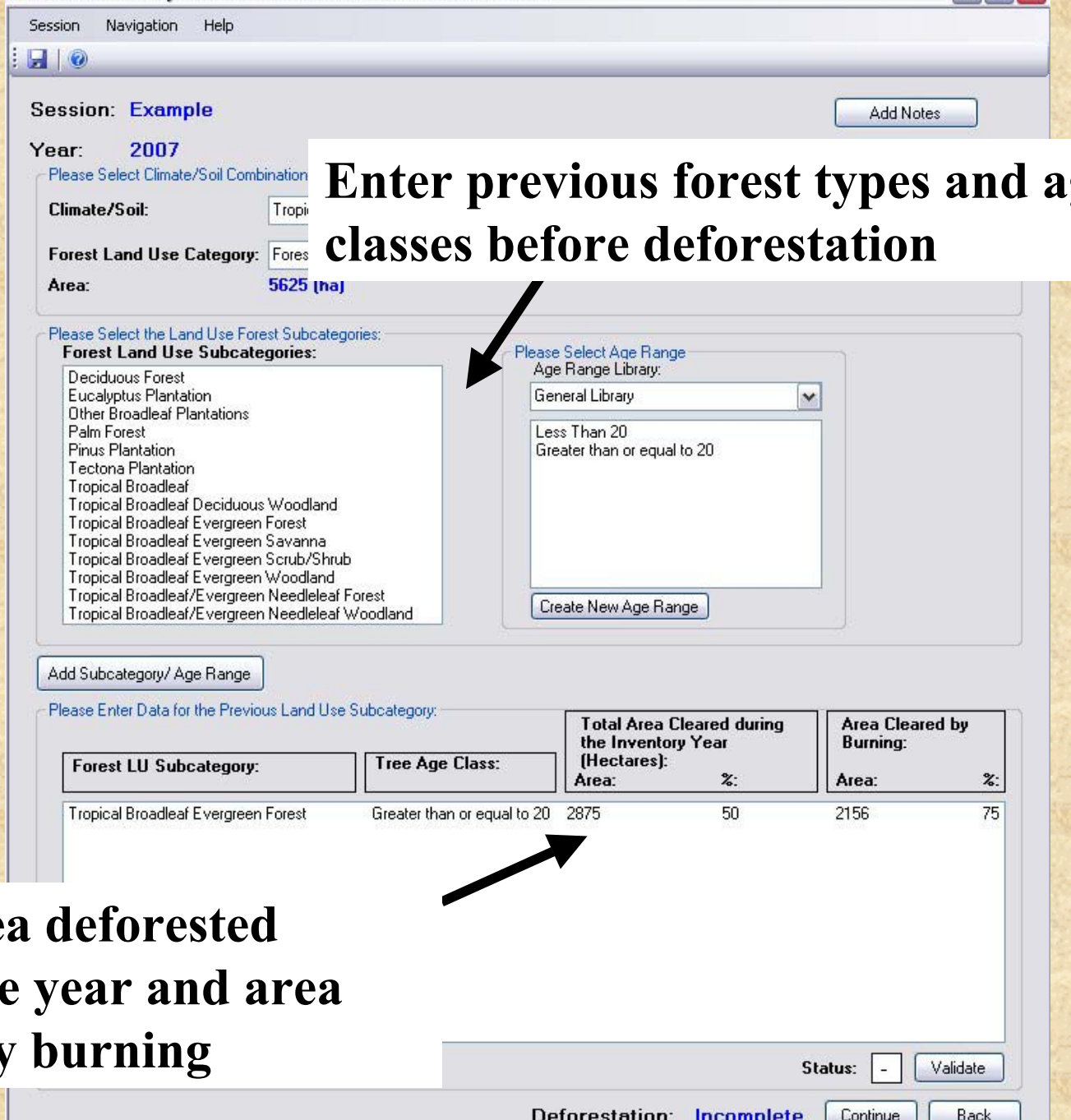

Session Navigation Help
Session: Example
Year: 2007
Add Notes
Climate and Soil
Select Different Climate/Soil Combination:
Climate/Soil: Tropical, wet/Low activity mineral -
Area: 22500 (ha)
Approach 2/3 Activity Data
Select Land Use Category
Land Use Categories:
Forest Land remaining Forest Land
Forest Land converted to Cropland
Forest Land converted to Grassland
Forest Land converted to Settlements
Forest Land converted to Wetlands
Forest Land converted to Other Land
Cropland remaining Cropland
Cropland converted to Grassland
Cropland converted to Settlements
Cropland converted to Wetlands
Cropland converted to Other Land
Grassland remaining Grassland
Grassland converted to Settlements
Grassland converted to Wetlands
Grassland converted to Other Land
Settlements remaining Settlements
Add Land Use Category
Remove Land Use Category
Selected Land Use Categories: Area(ha): Area(%):
Forest Land converted to Cropland 5625 25
Forest Land remaining Forest Land 16875 75
Total Area (ha, %): 22500 (ha) 100%
Update Areas
Update Percentages
Status: +
Validate
Land Use Categories: Complete
Continue
Back


File
Help
Welcome to the Agriculture and Land Use Greenhouse Gas Inventory Tool (Prototype 2.0a)
Getting Started
Using GIS Data
User Details and History:
Current User: Dean Selby
Recent Activity:
Completed QA/QC Primary Data
Module 1: Specify Activity Data
Primary Data Specification
Land Use and Management Statistics
Livestock Statistics
N Fertilizer Statistics
Liming Statistics
Sewage Sludge Amendments
Select
Secondary Data Specification
Crop Residue Management
Livestock and Manure Management
Rice Management
Savanna/Grassland Burning
Biomass Carbon Loss
Select
QA/QC Primary Data
QA/QC Secondary Data
Available Sessions by Source Category:
Source Category:
Biomass C Stocks
Subsource
Deforestation
Current Sessions:
Example
Module 2: Specify Emission/Stock Change Factors
Biomass Burning Non-CO2 GHG
Soil Nitrous Oxide
Rice Methane
Biomass C Stocks
Soil C Stocks
Select
Module 3: Inventory Calculations QA/QC
Enteric Methane
Manure Methane
Manure Nitrous Oxide
Biomass Burning Non-CO2 GHG
Soil Nitrous Oxide
Rice Methane
Biomass C Stocks
Soil C Stocks
Select
Data Management Utilities
Session Management
File Management
Database Management
QA/QC Emission/Stock Change Factors
Create Emissions Report
QA/QC for Primary Data

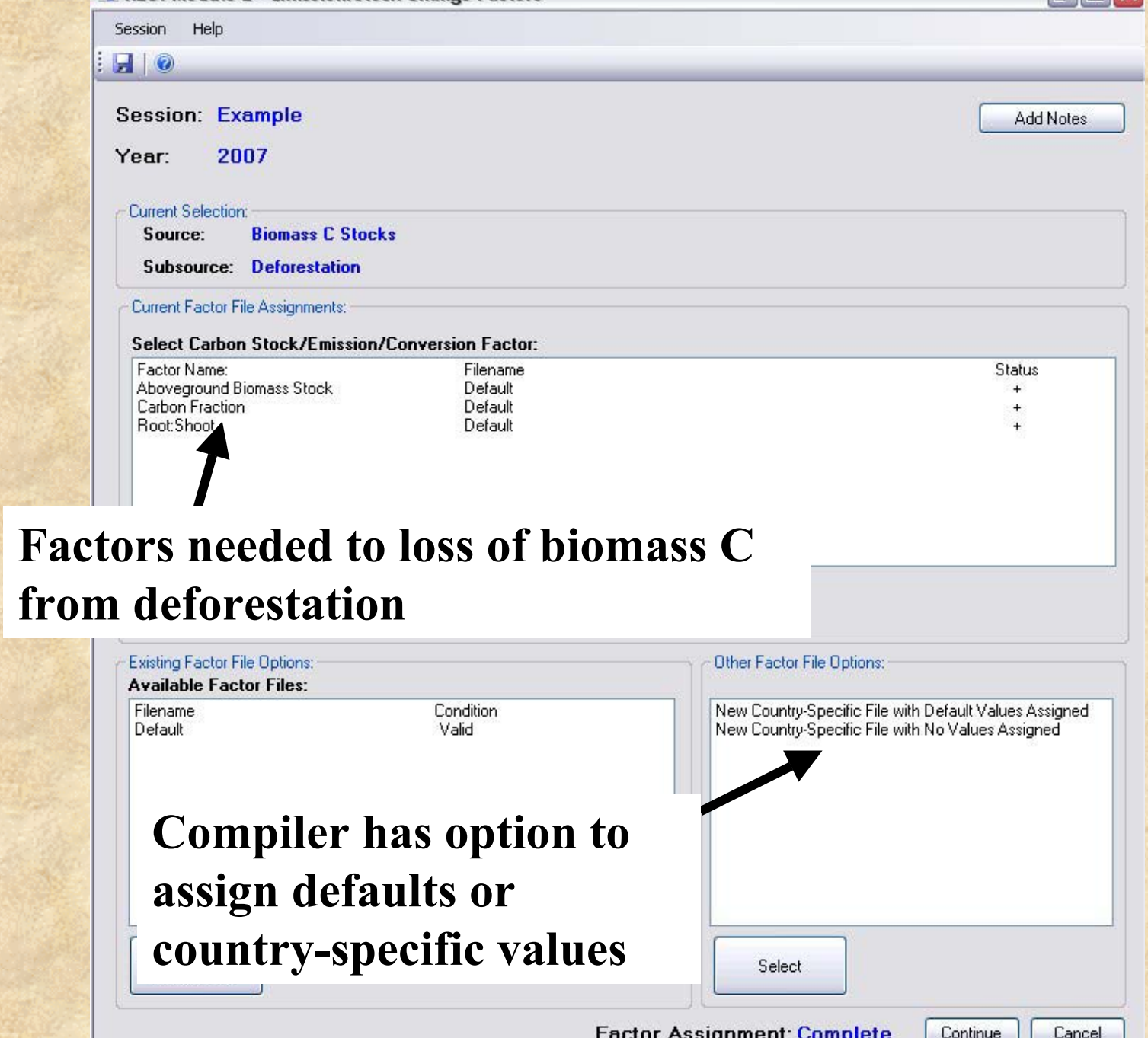

ALU: QA/QC - Primary Data
ession: Example
ear: 2007
Add Notes
ease Select Data to be Viewed:
atus: QA/QC Item:
Area by Climate/Soil Combination
Area by Land Use Category
Area by Forest Land Subcategory
QA/QC Items
Review activity data entry to check for errors
May export activity data and send to experts for additional review
Data OK: No Errors
Data Not OK: Reset
Export Data
Area by Climate/Soil Combination:
Climate:
Soil:
Area:
Tropical, wet
Low activity mineral
22500
QA/QC: Complete
Finish
Cancel

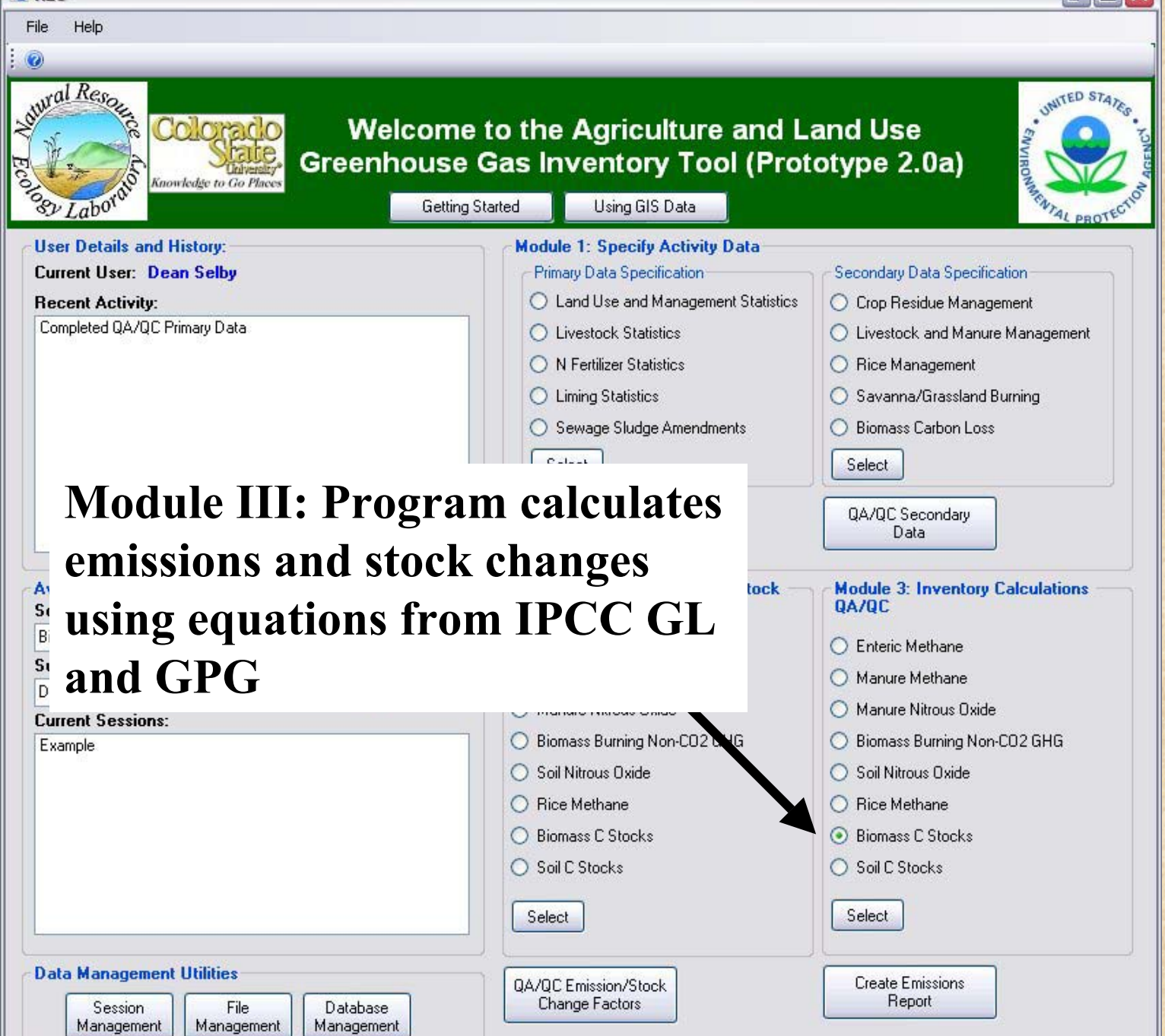


Module I, Secondary Data: Enter additional activity data related to deforestation


Session Navigation Help
Session: Example
Add Notes
Year: 2007
Please Select Climate/Soil Combination
Climate/Soil:
Forest Land Use Category:
Area: 5625 (ha)
Enter previous forest types and age classes before deforestation
Please Select the Land Use Forest Subcategories:
Forest Land Use Subcategories:
Deciduous Forest
Eucalyptus Plantation
Other Broadleaf Plantations
Palm Forest
Pinus Plantation
Tectona Plantation
Tropical Broadleaf
Tropical Broadleaf Deciduous Woodland
Tropical Broadleaf Evergreen Forest
Tropical Broadleaf Evergreen Savanna
Tropical Broadleaf Evergreen Scrub/Shrub
Tropical Broadleaf Evergreen Woodland
Tropical Broadleaf/Evergreen Needleleaf Forest
Tropical Broadleaf/Evergreen Needleleaf Woodland
Please Select Age Range
Age Range Library:
General Library
Less Than 20
Greater than or equal to 20
Create New Age Range
Add Subcategory/ Age Range
Please Enter Data for the Previous Land Use Subcategory:
Forest LU Subcategory:
Tree Age Class:
Total Area Cleared during the Inventory Year (Hectares):
Area:
%:
Area Cleared by Burning:
Area:
%:
Tropical Broadleaf Evergreen Forest
Greater than or equal to 20
2875
50
2156
75
Insert area deforested during the year and area cleared by burning
Status:
Validate
Deforestation: Incomplete
Continue
Back

Module II: Enter stock change factors for deforestation


Session Help
Session: Example
Year: 2007
Add Notes
Current Selection:
Source: Biomass C Stocks
Subsource: Deforestation
Current Factor File Assignments:
Select Carbon Stock/Emission/Conversion Factor:
Factor Name: Filename Status
Aboveground Biomass Stock Default +
Carbon Fraction Default +
Root:Shoot Default +
Factors needed to loss of biomass C from deforestation
Existing Factor File Options:
Available Factor Files:
Filename Condition
Default Valid
Other Factor File Options:
New Country-Specific File with Default Values Assigned
New Country-Specific File with No Values Assigned
Compiler has option to assign defaults or country-specific values
Select
Factor Assignment: Complete
Continue
Cancel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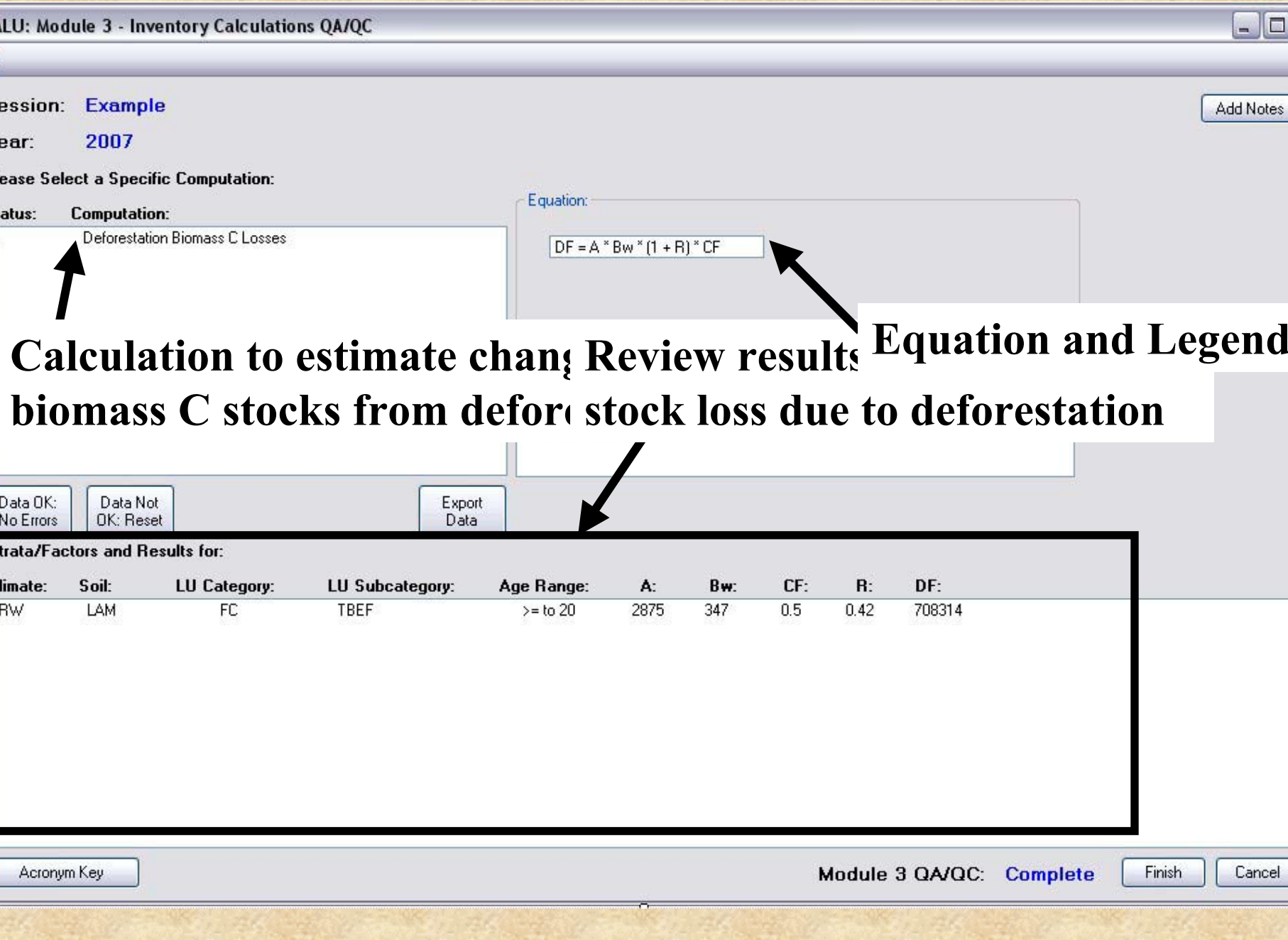
Liming Statistics
Sewage Sludge Amendments
Secondary Data Specification
Crop Residue Management
Livestock and Manure Management
Rice Management
Savanna/Grassland Burning
Biomass Carbon Loss
Select
QA/QC Secondary Data
Module III: Program calculates emissions and stock changes using equations from IPCC GL and GPG
Current Sessions:
Example
Module 3: Inventory Calculations QA/QC
Enteric Methane
Manure Methane
Manure Nitrous Oxide
Biomass Burning Non-CO2 GHG
Soil Nitrous Oxide
Rice Methane
Biomass C Stocks
Soil C Stocks
Select
Select
Data Management Utilities
Session Management
File Management
Database Management
QA/QC Emission/Stock Change Factors
Create Emissions Report


LU: Module 3 - Inventory Calculations QA/QC
ession: Example
ear: 2007
Add Notes
ease Select a Specific Computation:
atus: Computation:
Deforestation Biomass C Losses
Equation:
DF = A * Bw * (1 + R) * CF
Calculation to estimate chan
Review results
Equation and Legend
biomass C stocks from defor
stock loss due to deforestation
Data OK: No Errors
Data Not OK: Reset
Export Data
trata/Factors and Results for:
limate: Soil: LU Category: LU Subcategory: Age Range: A: Bw: CF: R: DF:
RW LAM FC TBEF >= to 20 2875 347 0.5 0.42 708314
Acronym Key
Module 3 QA/QC: Complete
Finish
Cancel

Module IV: Inventory compiler exports results into spreadsheets for reporting

File Edit View Insert Format Tools Data S-PLUS Window Help

Arial 10 B I U

Reply with Changes... End Review...

E12

Biomass C - Summary

Reporting Year: 1990
Session Name: GIS Test
Version Time Stamp: 11/29/2006 9:25:24 AM

Source	Sub-Source	Net Change in Woody Biomass C Stock (Gg)	Net CO_2 Emissions (Gg)
Biomass C	Croplands	797.1	2922.8
	Grasslands/Savanna	0.0	0.0
	Forestlands	232513.3	852548.9
	Forest Conversion to Other Uses	-2078.2	-7620.2
	Shifting Cultivation	0.0	0.0
	Total	231232.2	847851.5

* Stock changes for biomass C related to fuelwood gathering and harvesting were computed using the volume method approach provided in IPCC GPG 2003 for harvesting in forestland. Note that removals for harvesting could also be reported in area if the data were available on an area basis (instead of volume).

Source-Biomass C | GrandTotal | Subsource-Forest s1 | Subsource-Forest s2 | Subsource-Forest s3 | Subsource-Forest s4

Improvements in ALU from Experience

- **Originally developed in MS Access®**
  - **Required user to have same version of MS Access® and software patches as software developers**
  - **Re-developing ALU to work as a stand-alone program**
- **More user-friendly!**
  - **Improved navigation tools and form layout**
- **Developed an activity data workbook**
  - **Workbook can be distributed to contractors/personnel who compile activity data in worksheets**
- **Ability to map results for LULUCF sources**
- **Release of new version in January 2009**

Additional Refinements

- **ALU could be refined to address uncertainty**
- **Develop a mitigation module for projections of GHG trends with various mitigation options**

Concluding Remarks

- **Regional capacity building projects could be used to facilitate technology transfer and training for developing countries participating in REDD**
- **Software tools, such as ALU, can guide compiler through the process**
- **Tools can integrate data on REDD activities from remote sensing, forest inventories and other relevant information, estimating C stock change in reference scenarios and REDD activities**
  - **Evaluate mitigation and displacement of emissions**
- **Option to integrate REDD activity assessment into national/sub-national GHG inventories**

Thanks for your attention!

More information:
http://www.nrel.colostate.edu/projects/ghgtool/