Initial SSP Land Use Results: Implications for Near-term IAM Development

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(and many others who did the hard work of developing and running the scenarios)

CCI/IA Workshop
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Snowmass, Colorado
Fun Fact: Google Search Results for “IAMC SSP”

Search Results

Is IAMC.ssp malicious? - KnownFile.com

What is iamc.ssp - Fix and Repair iamc.ssp ERROR
www.errorslibrary.com/exe/error/iamc.ssp

(2011) Integrated SMA/SSP - IIASA
webarchive.iiasa.ac.at/Research/ENE/IAMC/sma-ssp.html

iamc.ssp Error Fix - AdvancedFix
advancedfix.com/windows-exe-files/how-to-fix-iamc-ssp.html
iamc.ssp is a normal program file

SMA-SSP Scenarios Workshop
www.globalchange.umd.edu/iamc/events/sma-ssp-scenarios-workshop/

How to Fix iamc.ssp Error - PC Max Utilities

Have you been receiving iamc.ssp error message or infected with iamc.ssp malware? Follow this iamc.ssp error fix guide to fix it completely. Learn more.
What Are the Questions?

- Are the models’ implementations of SSPs consistent with the underlying land use storylines?
  - What information do we need to assess this question?

- What are the challenges in comparing LU results across models and SSPs?
  - SSP harmonization
  - Definitions
    - Regions
    - Variables
  - Data reporting

- What do the initial results show?
  - Forest area
  - Cropland

- What decisions need to be made as the SSPs and SPAs are refined?
Existing scenarios: Models x RCPs x SSPs x SPAs

- 5 x 4 x 5 x 5(?) = 500* scenarios!
  (*Not all combinations may be appropriate or feasible)
  - First round: only SPA0, different models ran different RCP-SSP combinations
  - Need for marker scenarios?

Further harmonization?
- Regional definitions, time steps
- Land use, base year data...

Focus on a core set of scenarios?
- How to choose?
- Do the scenarios span reasonable ranges for the “right” variables?
**Legend (There are a LOT of scenarios!)**

## REFERENCE

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCAMSSP1</td>
<td>MESSAGE-GLOBIOMSSP1 - REMIND-MAGPIESSP1 - AIM/CGESSP1 - IMAGESSP1</td>
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<tr>
<td>GCAMSSP2</td>
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<td>GCAMSSP3</td>
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<tr>
<td>GCAMSSP5</td>
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## RCP 4.5 – SPA0

<table>
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<tr>
<td>GCAMSSP1-45</td>
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Challenges: Harmonization

- Improvements to the harmonization of socio-economic drivers
  - Are there other factors that should be harmonized?

- Radiative forcing pathways
  - Overshoots vs. stabilization
  - Acceptable range and definition?
Challenges: Regional Definitions
Total Land Area by Region and Model

- Comparisons across models’ native regions difficult
  - Regional definitions may vary between energy-economic and land components
- Even five aggregated regions are not completely consistent
Challenges: Variable Definition (& Data Reporting)
Cropland in 2005

- Various definitions of “cropland”
  - Fallow land
  - Energy crops
- Incomplete reporting is a significant issue (hopefully easy to correct)
Example 1:
Forest Cover
Global Forest Area: Three SSPs by Model

► Definition of forest varies by model
  ■ Harmonization in base year?

► Patterns across SSPs vary by model
  ■ Is there a need for more guidance/harmonization in SSP storylines?
SSP Storylines: Forest Protection

Forest protection levels (consistent with SPAs?)
- Strong - strong forest protection, limited non-agricultural land for conversion
- Weak - weak forest protection, high availability of non-agricultural land for conversion

SSP1
- Low Income - Strong
- Medium Income - Strong
- High Income - Strong

SSP2
- Low Income - Medium
- Medium Income - Medium
- High Income - Medium

SSP3
- Low Income - Weak
- Medium Income - Weak
- High Income - Weak

SSP4
- Low Income - Weak
- Medium Income - Medium
- High Income - Strong

SSP5
- Low Income - Medium
- Medium Income - Medium
- High Income - Medium
Low Income Regions: Change in Forest Area

- **SSP1**
  - Low Income - Strong
  - Medium Income - Strong
  - High Income – Strong

- **SSP2**
  - Low Income - Medium
  - Medium Income - Medium
  - High Income - Medium

- **SSP3**
  - Low Income - Weak
  - Medium Income - Weak
  - High Income - Weak
Medium Income Regions: Change in Forest Area

**SSP1**
- Low Income - Strong
- Medium Income - Strong
- High Income – Strong

**SSP2**
- Low Income - Medium
- Medium Income - Medium
- High Income - Medium

**SSP3**
- Low Income - Weak
- Medium Income - Weak
- High Income - Weak

“MESSAGE” = MESSAGE-GLOBIOM
“REMIND” = ReMIND-MagPIE
High Income Regions: Change in Forest Area

- **SSP1**
  - Low Income - Strong
  - Medium Income - Strong
  - High Income – Strong

- **SSP2**
  - Low Income - Medium
  - Medium Income - Medium
  - High Income - Medium

- **SSP3**
  - Low Income - Weak
  - Medium Income - Weak
  - High Income - Weak
Example 2:

Cropland
SSP Storylines: Land Productivity

- **SSP1** - faster catch-up of low-income countries; sustainability focus
  - Low Income - Rapid
  - Medium Income - Rapid
  - High Income - Medium

- **SSP2** - declining rates for high-income countries, converging rates for low-income countries
  - Low Income - Medium
  - Medium Income - Medium
  - High Income - Medium

- **SSP3** - lower rates everywhere
  - Low Income - Slow
  - Medium Income - Slow
  - High Income - Slow

- **SSP4** - no convergence between low-income and high-income regions
  - Low Income - Slow
  - Medium Income - Medium
  - High Income - Rapid

- **SSP5** - high yield growth
  - Low Income - Rapid
  - Medium Income - Rapid
  - High Income - Rapid
Global Cropland Range: All SSPs in GCAM

- Spread of Reference cropland area bounded by SSP 3 (high) and SSP 1 (low), with SSPs 4 and 5 between SSPs 1 and 2
  - Is this the “right” amount of differentiation?

- Similar pattern for RCP 4.5
  - SSPs 2 and 5 nearly identical
SSP Consistency: Global Cropland Ranges

- Results vary across SSPs within each model
- Ranges are generally larger across IAMs within each SSP
  - Differences in definition of cropland
Low Income Regions: Change in Cereal Yields

- **SSP1** - faster catch-up of low-income countries; sustainability focus
  - Low Income - Rapid
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Cereal Yield Growth Rates
Comparison of Low to High Income Regions

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Issues for Further Exploration

- **Improved data reporting**
  - Many missing variables… (will likely be fixed in future rounds)

- **Increased harmonization across IAMs could improve comparisons and analysis**
  - Regional and variable definitions
  - Base year land use?
  - Identify a core set of runs

- **Limit the number of scenario combinations?**
  - Similar to the discussion of uncertainty around impacts last week, too many scenario may be confusing

- **Need for clear guidance on use of scenario data**
  - Which RCP-SSP-SPA combinations should be considered?
  - Instructions for user communities to discourage picking and choosing across inconsistent combinations?
    - Don’t mix RCP 8.5 with an SSP 1 world!
Medium Income Regions: Cereal Yields

- **SSP1** - faster catch-up of low-income countries; sustainability focus
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Global Energy Cropland: All SSPs in GCAM

- Unlike total cropland and forest area, GCAM range of LU for energy crops bounded by SSPs 4 and 5
  - ... Why?
- Much larger spread in RCP 4.5 compared to Reference
Global Energy Cropland: Three SSPs by Model

- Reference scenarios:
  - Large differences in energy cropland across models
  - Comparatively small spread across SSPs within model
- RCP4.5 shows a more consistent pattern for both models and SSPs
  - Limited results…