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

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

CCI/IA Workshop
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Snowmass, Colorado

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Fun Fact: Google Search Results for "IAMC SSP"

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Search Results

Is *IAMC.ssp* malicious? - KnownFile.com
*www.knownfile.com/.../solved-problem-with-**iamc**.**ssp**-file-easy-steps-to-...**iamc.ssp**.*

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
*www.pcmaxutilities.com/wikiexefiles/**iamc-ssp**-error-fix-guide.html*
Have you been recieving *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?

Challenges to Land Use Analysis with the Initial SSP Runs and More Questions

- 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!)

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REFERENCE

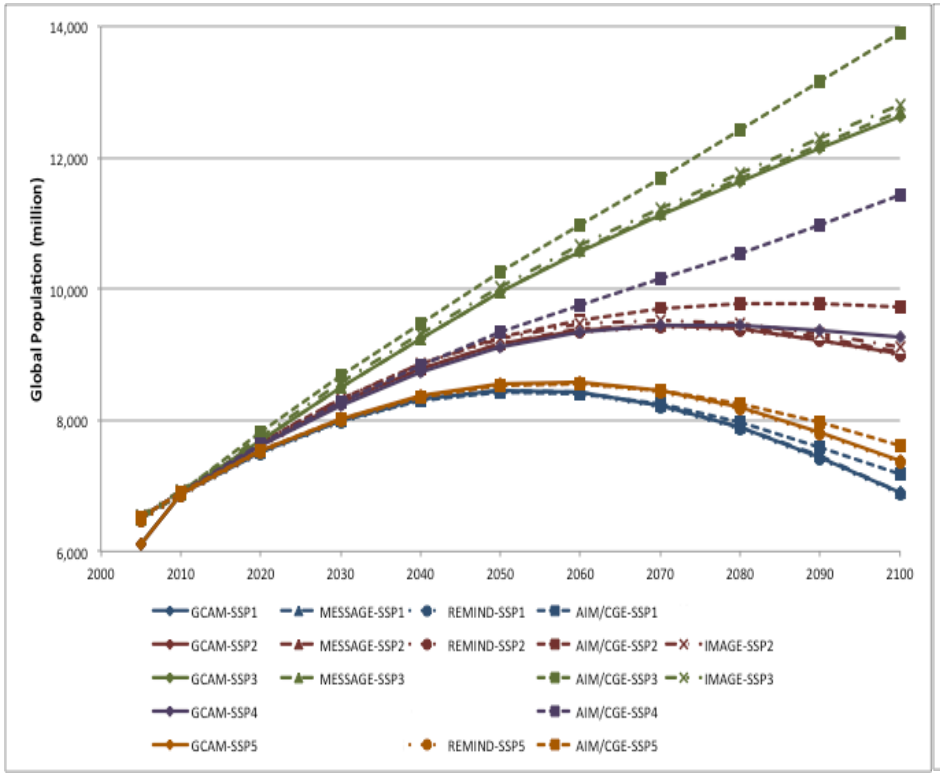
GCAMSSP1	MESSAGE-GLOBIOMSSP1	REMIND-MAGPIESSP1	AIM/CGESSP1	IMAGESSP1
GCAMSSP2	MESSAGE-GLOBIOMSSP2	REMIND-MAGPIESSP2	AIM/CGESSP2	IMAGESSP2
GCAMSSP3	MESSAGE-GLOBIOMSSP3	REMIND-MAGPIESSP3	AIM/CGESSP3	IMAGESSP3
GCAMSSP4	MESSAGE-GLOBIOMSSP4	REMIND-MAGPIESSP4	AIM/CGESSP4	IMAGESSP4
GCAMSSP5	MESSAGE-GLOBIOMSSP5	REMIND-MAGPIESSP5	AIM/CGESSP5	IMAGESSP5

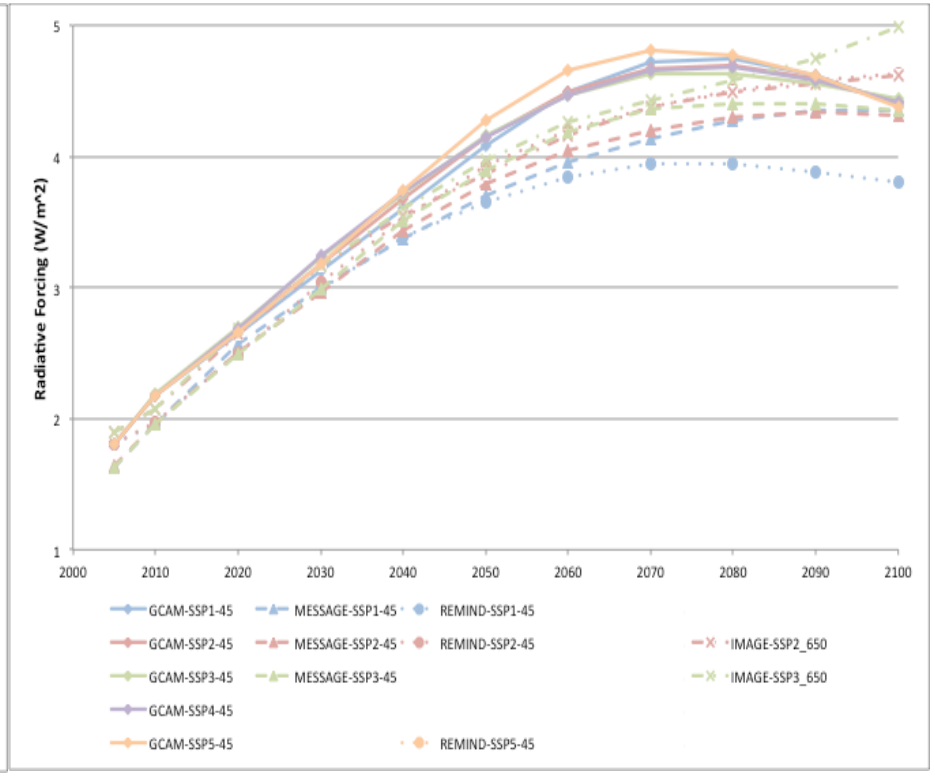
RCP 4.5 – SPA0

GCAMSSP1-45	MESSAGE-GLOBIOMSSP1-45	REMIND-MAGPIESSP1-45	AIM/CGESSP1-45	IMAGESSP1_650
GCAMSSP2-45	MESSAGE-GLOBIOMSSP2-45	REMIND-MAGPIESSP2-45	AIM/CGESSP2-45	IMAGESSP2_650
GCAMSSP3-45	MESSAGE-GLOBIOMSSP3-45	REMIND-MAGPIESSP3-45	AIM/CGESSP3-45	IMAGESSP3_650
GCAMSSP4-45	MESSAGE-GLOBIOMSSP4-45	REMIND-MAGPIESSP4-45	AIM/CGESSP4-45	IMAGESSP4_650
GCAMSSP5-45	MESSAGE-GLOBIOMSSP5-45	REMIND-MAGPIESSP5-45	AIM/CGESSP5-45	IMAGESSP5_650

Challenges: Harmonization

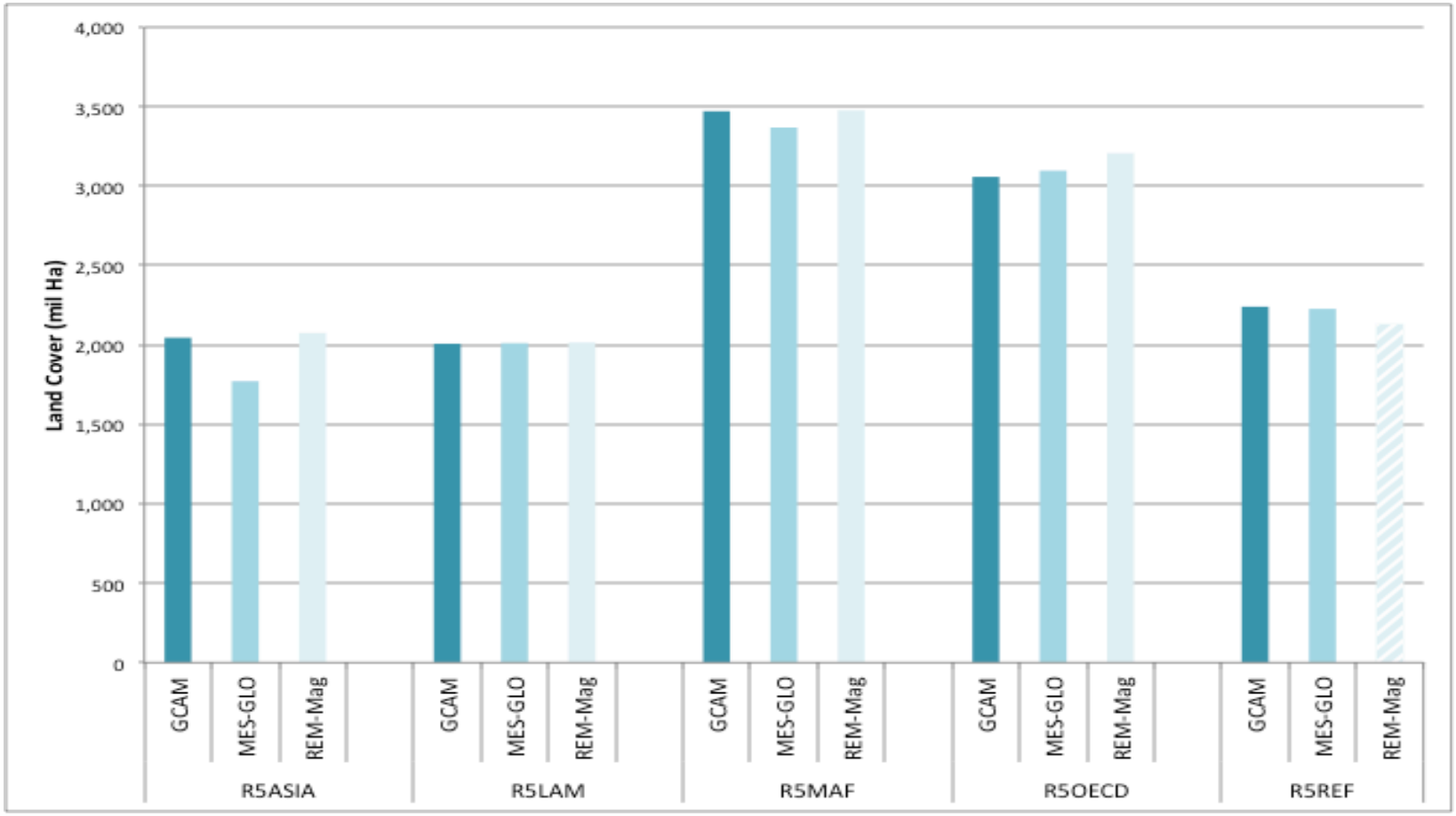
- Improvements to the harmonization of socio-economic drivers
  - Are there other factors that should be harmonized?
- Radiative forcing pathways
  - Overshoots vs. stabilization
  - Acceptable range and definition?





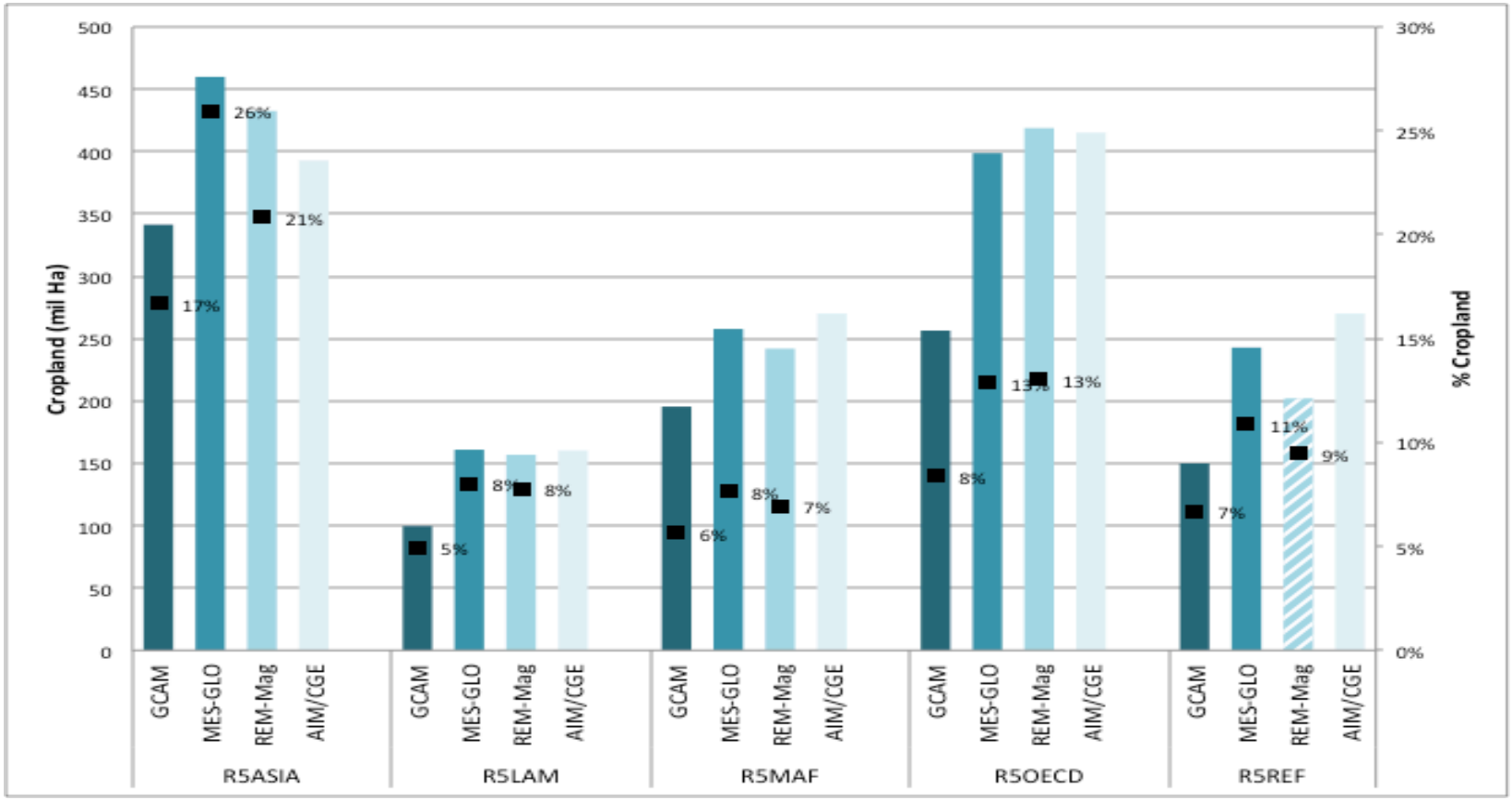
Challenges: Regional Definitions
Total Land Area by Region and Model

- 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

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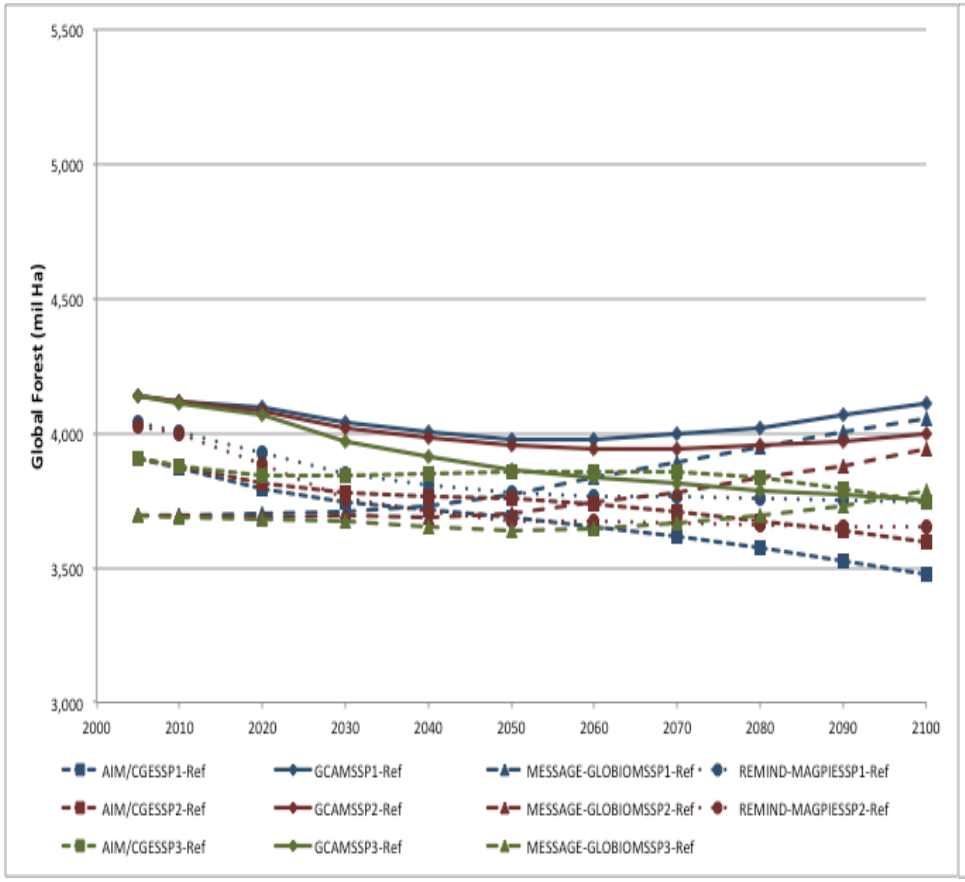
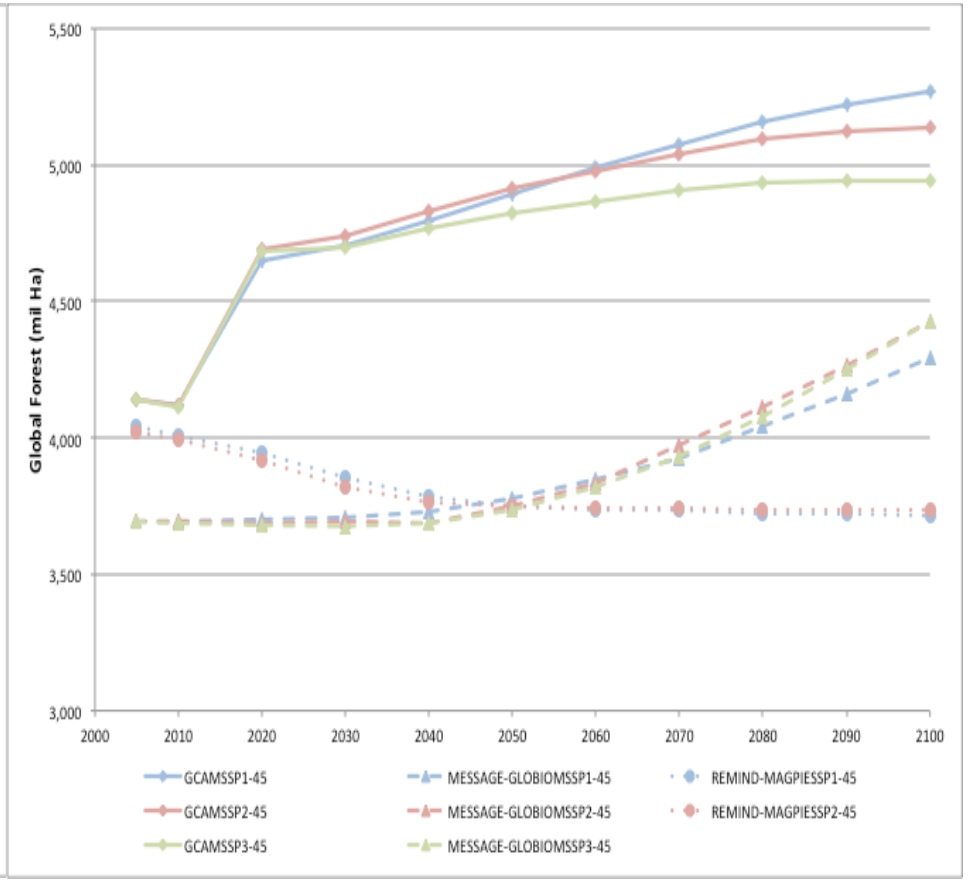
- Definition of forest varies by model
  - Harmonization in base year?
- Patterns across SSPs vary by model
  - Is there a need for more guidance/harmonization in SSP storylines?





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

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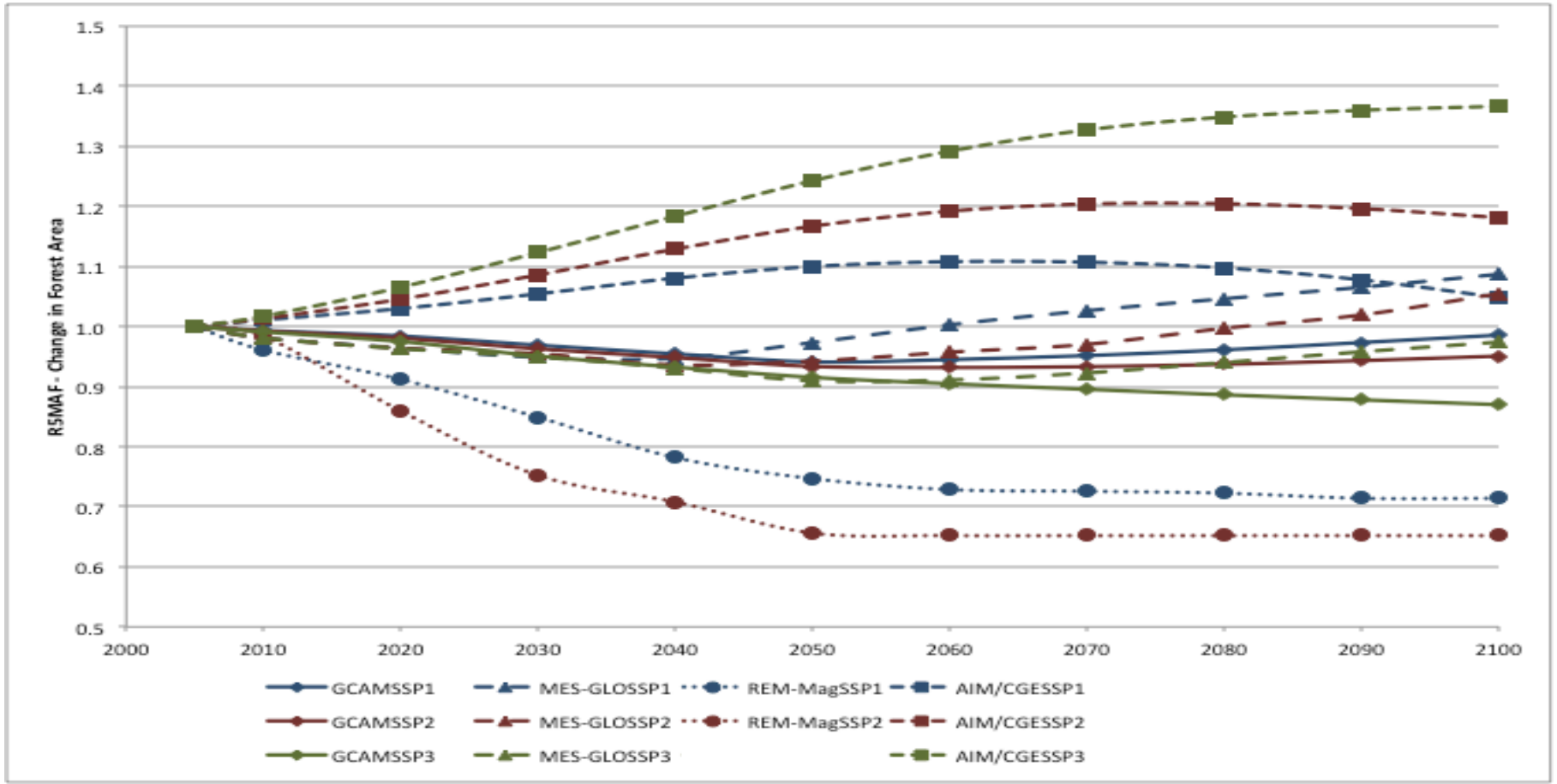
- SSP1
  - Low Income - Strong
  - Medium Income - Strong
  - High Income – Strong
- SSP2
  - Low Income - Medium
  - Medium Income - Medium
  - High Income - Medium
- SSP3
  - Low Income - Weak
  - Medium Income - Weak
  - High Income - Weak



Medium Income Regions: Change in Forest Area

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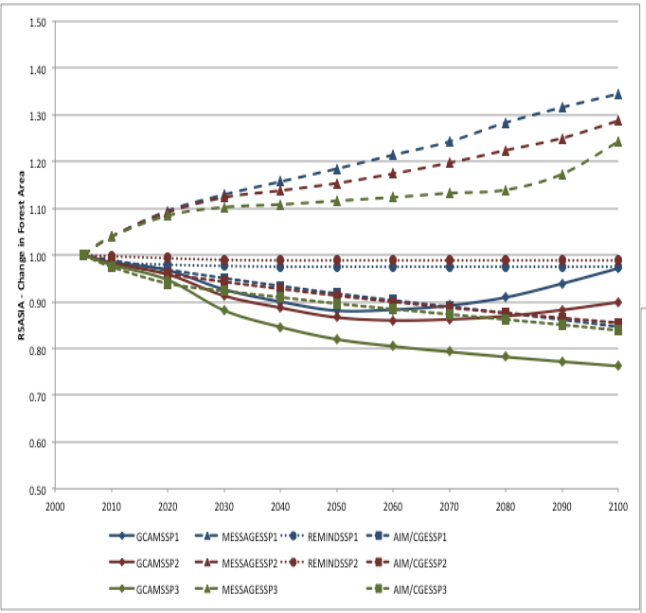
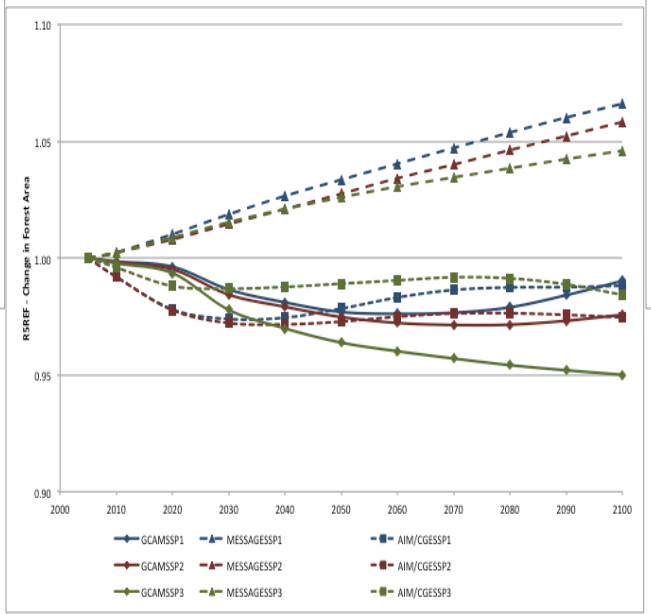
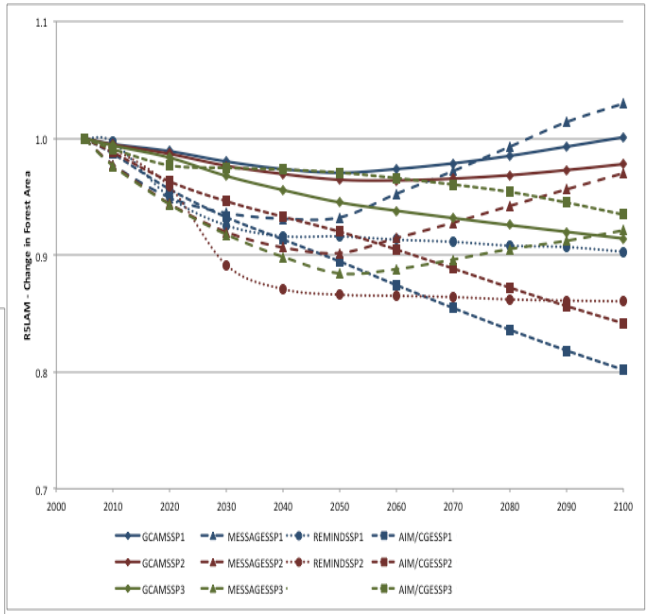
- **SSP1**
  - Low Income - Strong
  - Medium Income - Strong
  - High Income – Strong
- **SSP2**
  - Low Income - Medium
  - Medium Income - Medium
  - High Income - Medium
- **SSP3**
  - Low Income - Weak
  - Medium Income - Weak
  - High Income - Weak



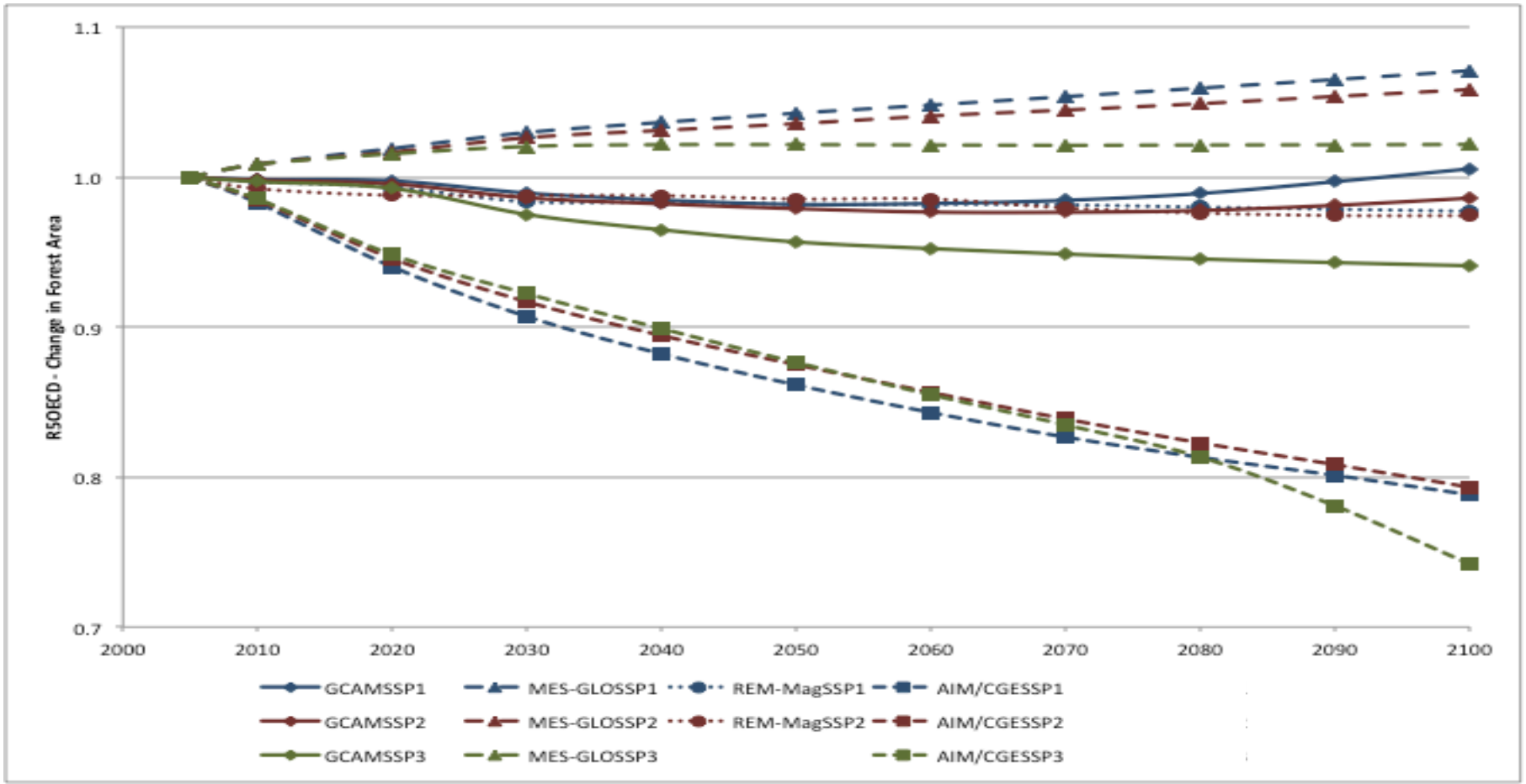
"MESSAGE" = MESSAGE-GLOBIOM
"REMIND" = ReMIND-MagPIE





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



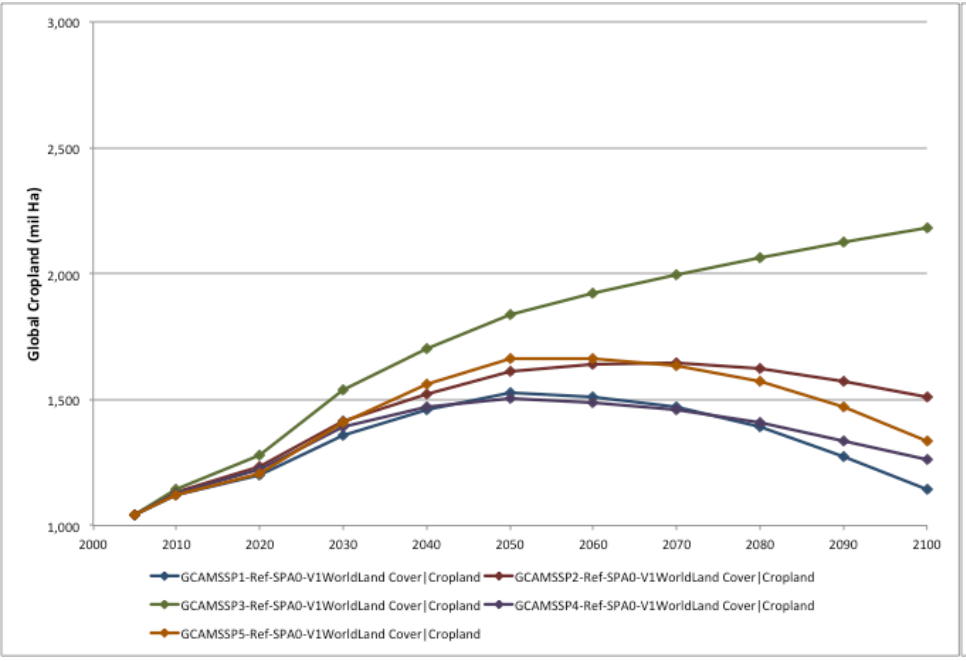
Example 2:
Cropland

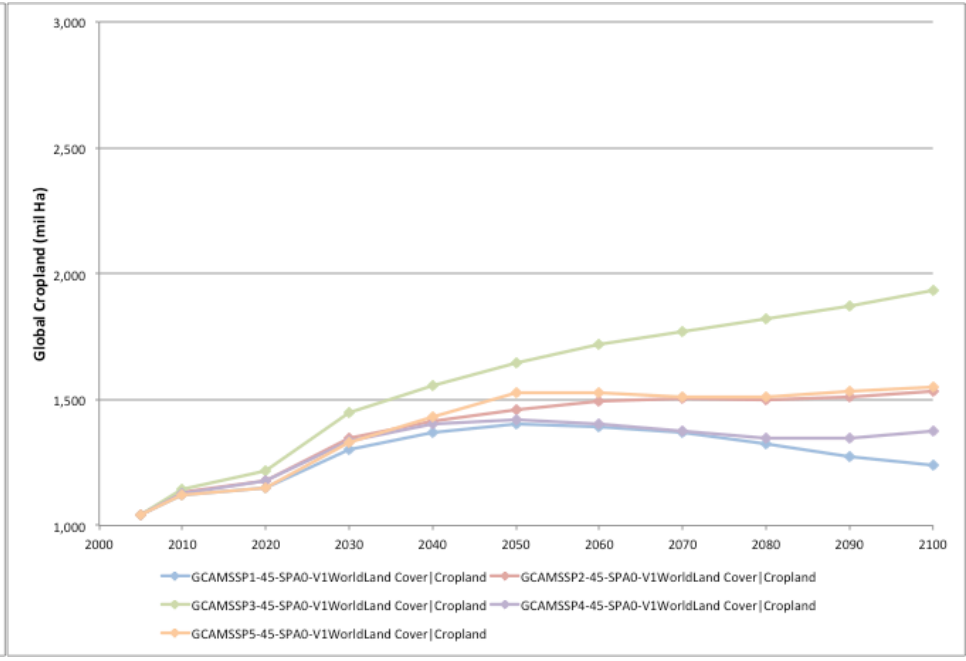
SSP Storylines: Land Productivity

- 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

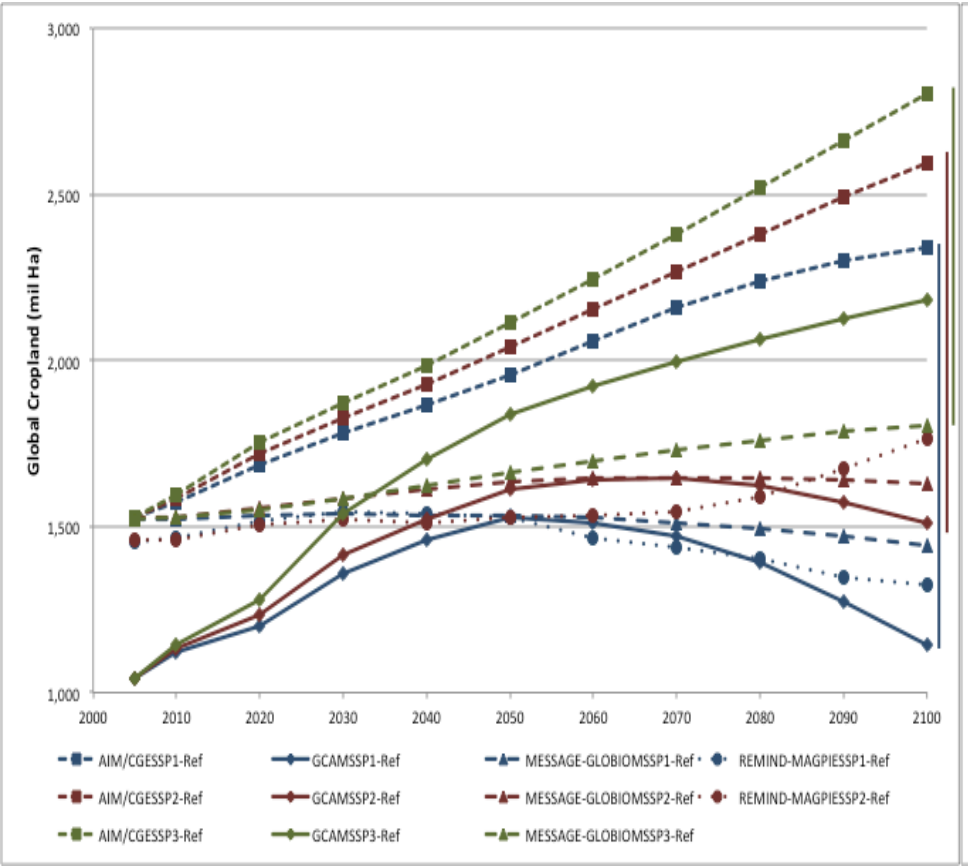
- Spread of Reference cropland area bounded by SSP 3 (high) and SSP 1 (low), with SSPs 4 and 5 between SSPs 1 and 2
  - Is this the “right” amount of differentiation?
- Similar pattern for RCP 4.5
  - SSPs 2 and 5 nearly identical

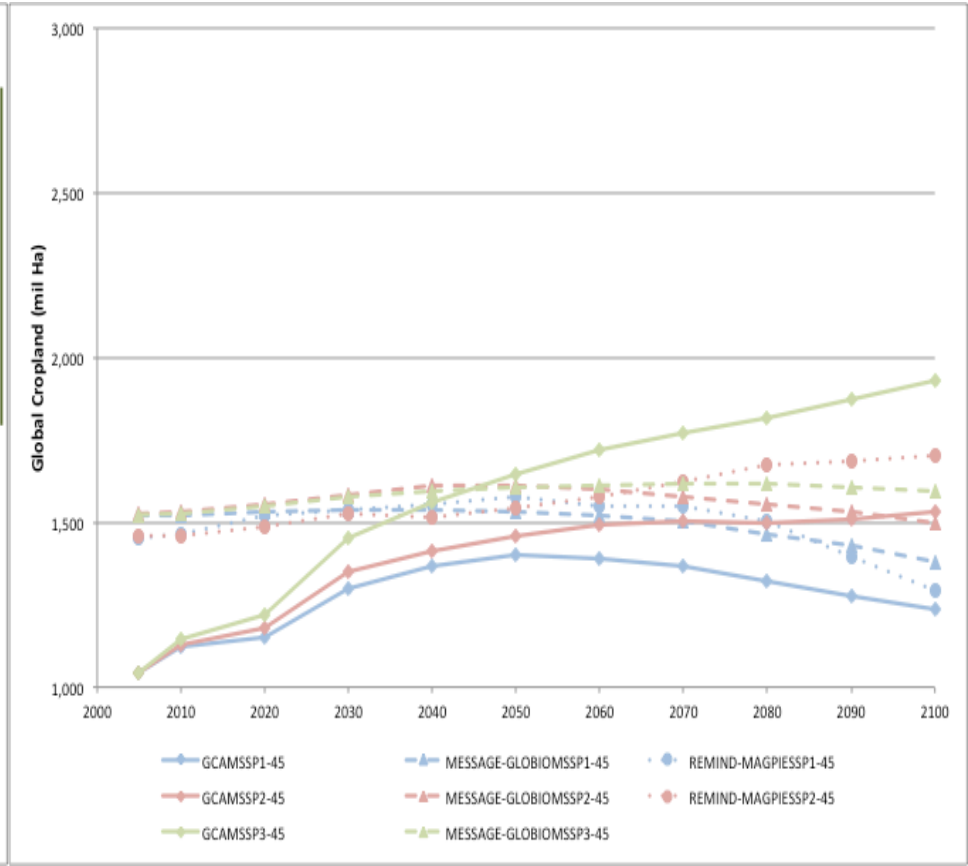




SSP Consistency: Global Cropland Ranges

- 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

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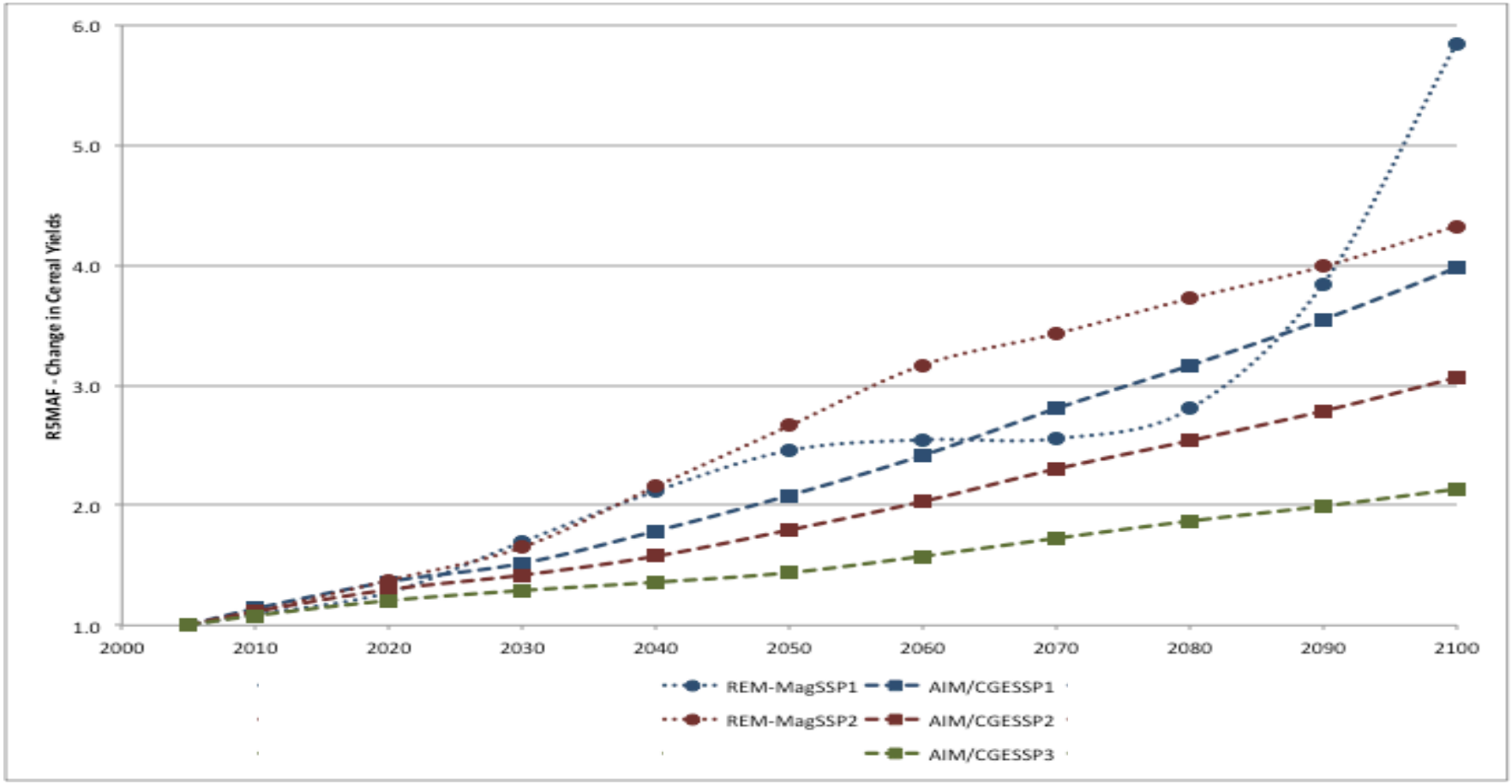
- SSP1 - faster catch-up of low-income countries; sustainability focus
  - Low Income - Rapid
  - Medium Income - Rapid
  - High Income - Medium
- SSP2 – declining rates for high-income countries, converging rates for low-income countries
  - Low Income - Medium
  - Medium Income - Medium
  - High Income - Medium
- SSP3 - lower rates everywhere
  - Low Income - Slow
  - Medium Income - Slow
  - High Income - Slow



Cereal Yield Growth Rates
Comparison of Low to High Income Regions

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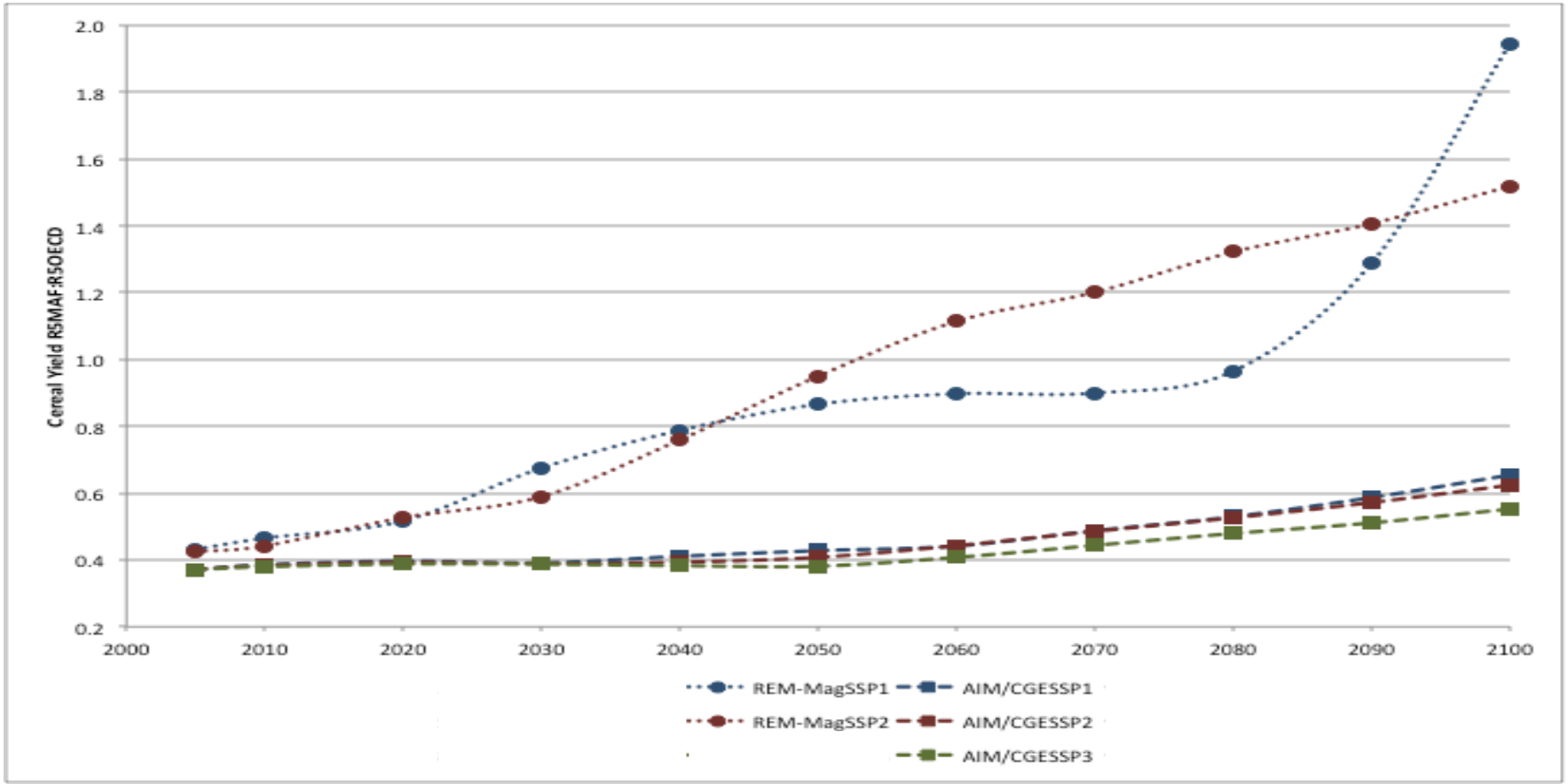
  - Medium Income - Slow
  - High Income - Slow



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

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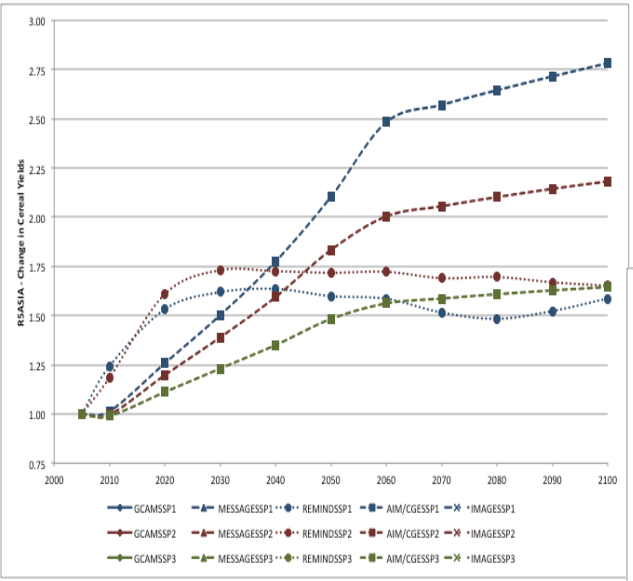
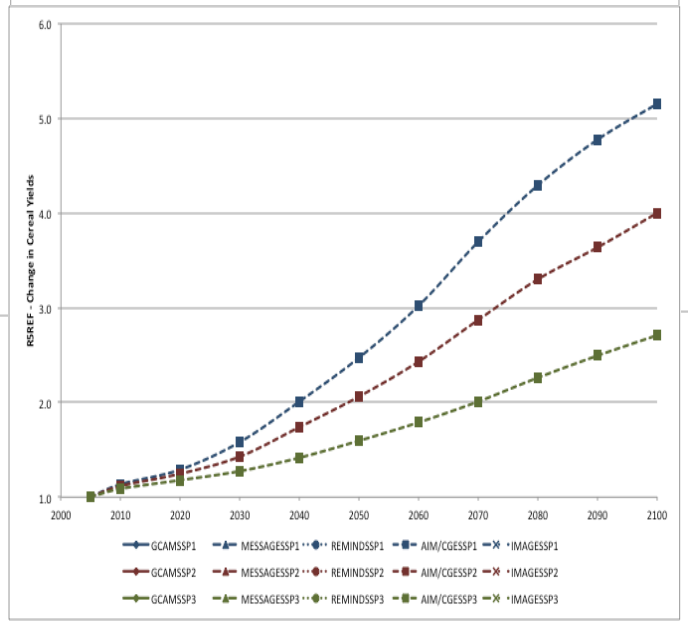
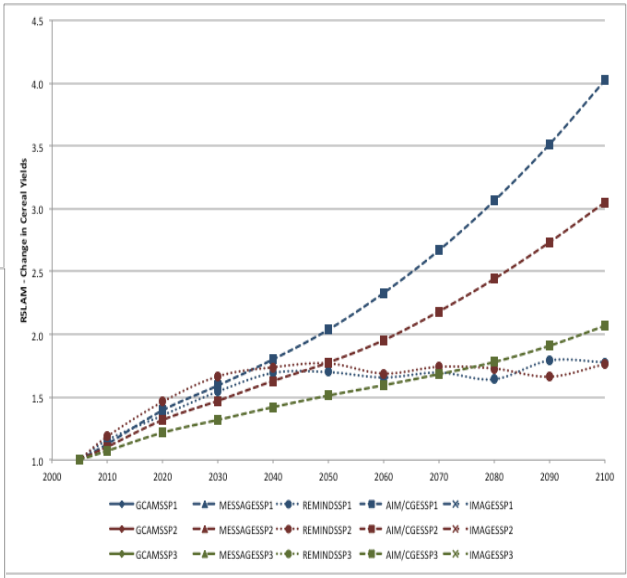
  - Medium Income - Slow
  - High Income - Slow







High Income Regions: Cereal Yields

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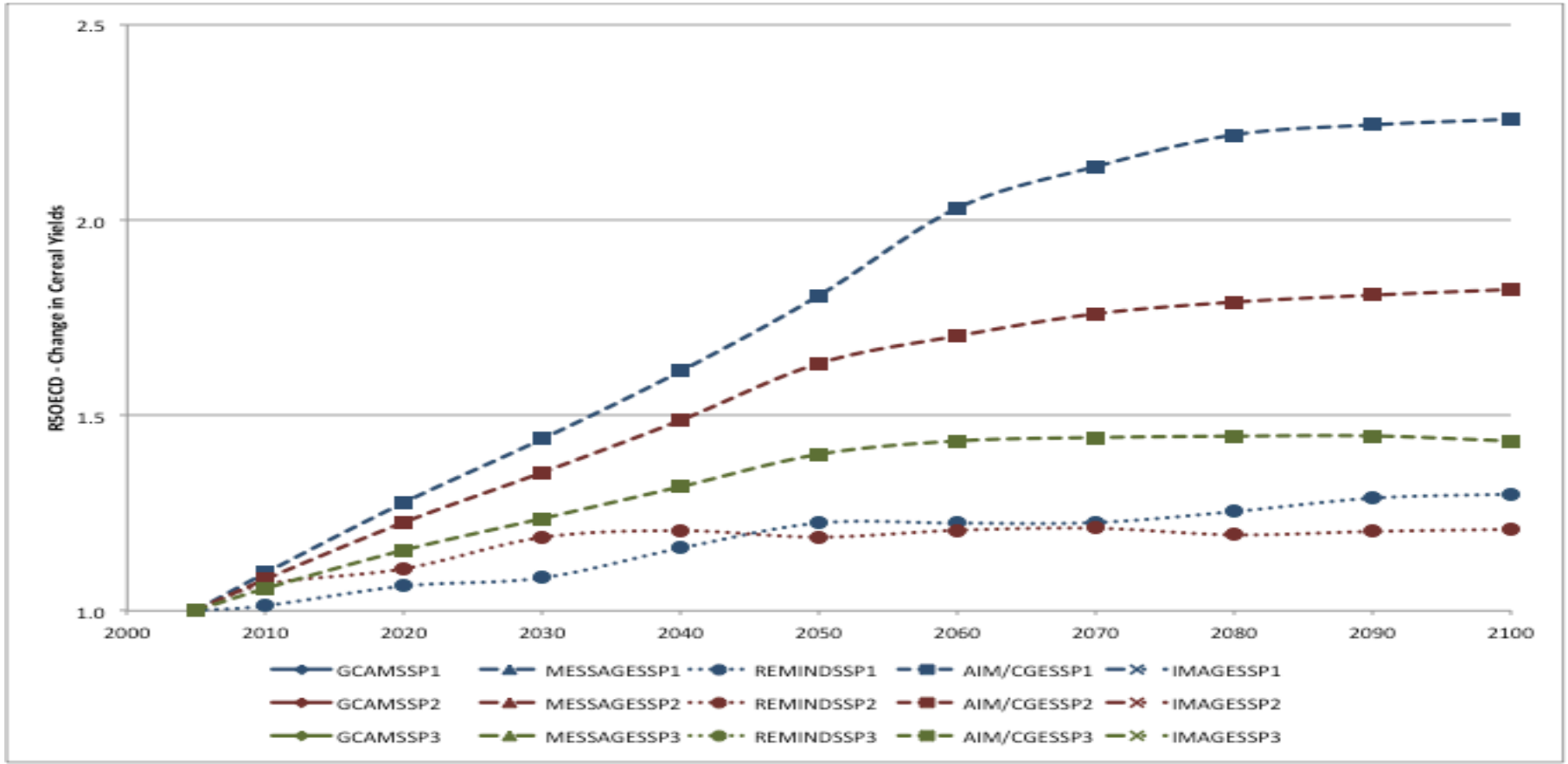

Cereal Yield Growth Rates

Comparison of Medium to High Income Regions

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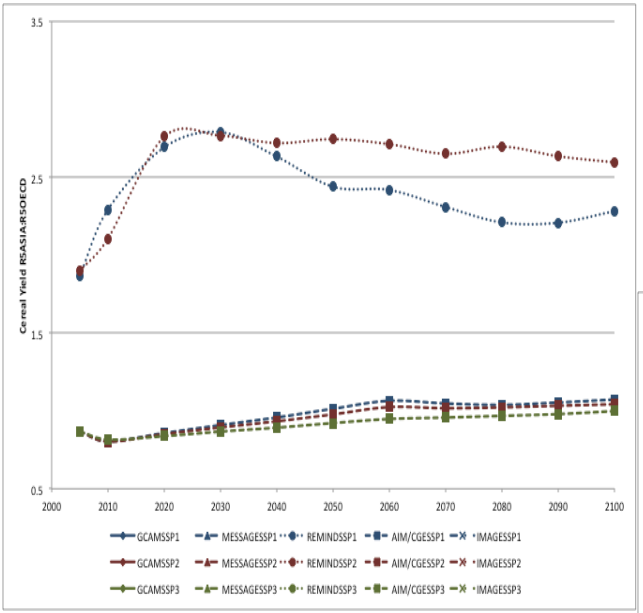
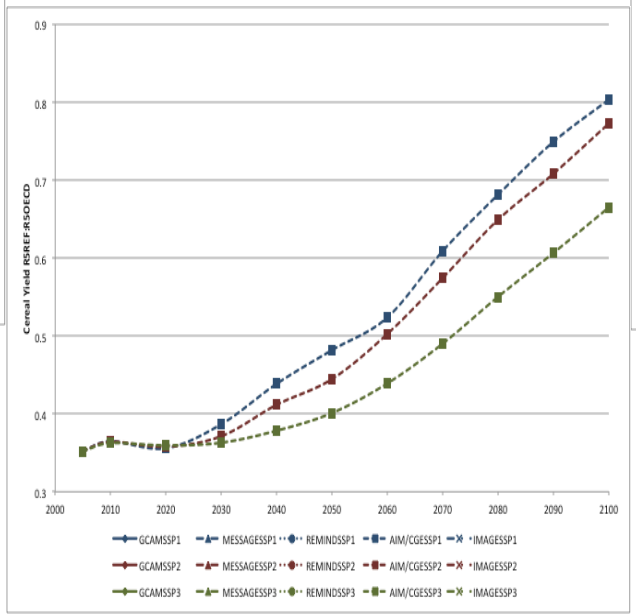
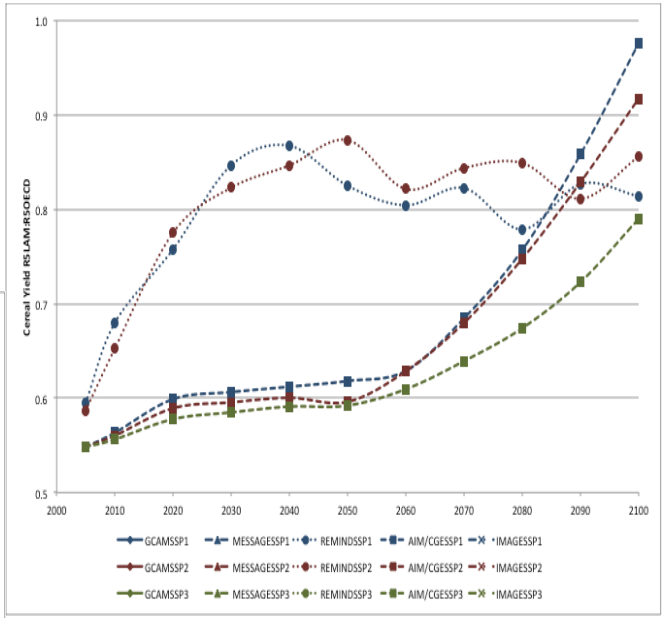
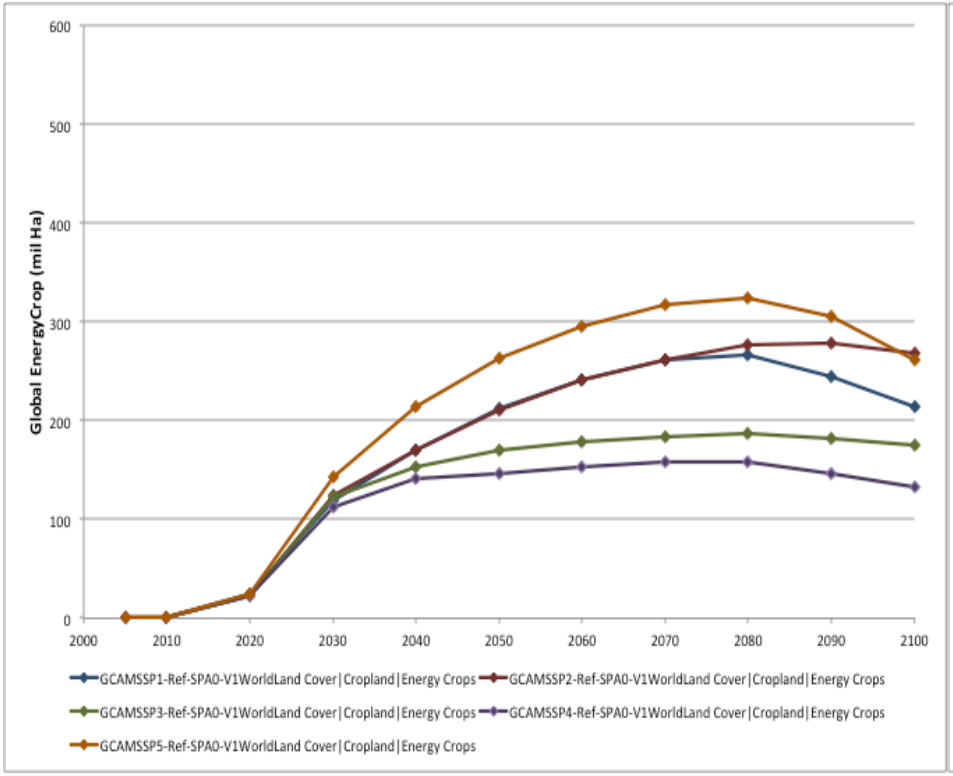


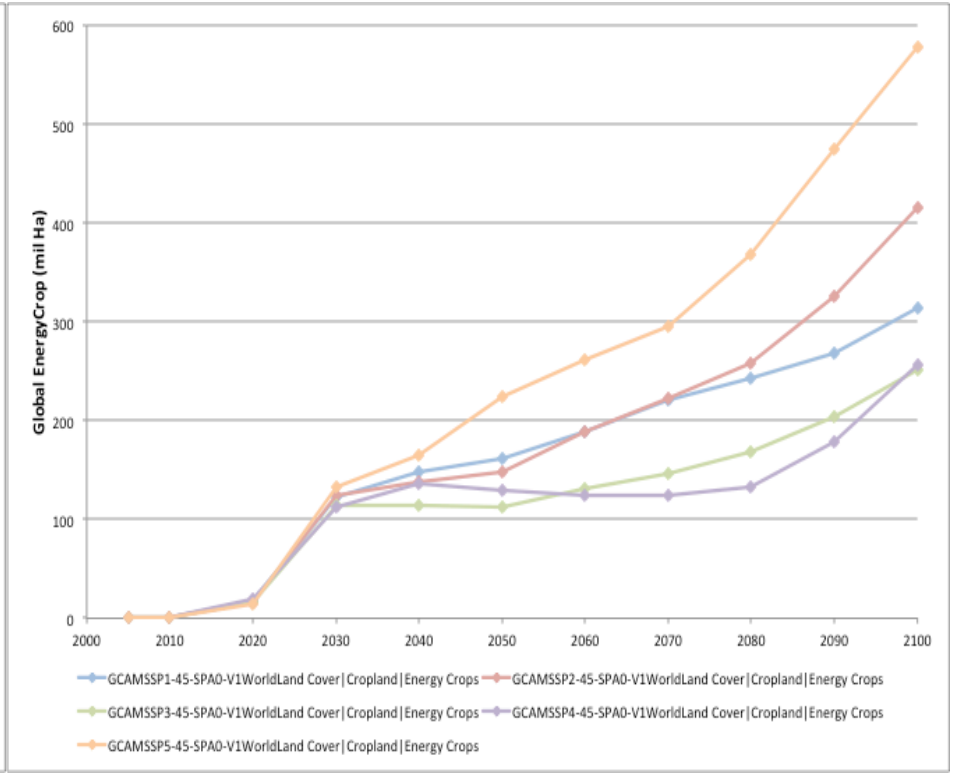




Global Energy Cropland: All SSPs in GCAM

- 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…