# Climate Smart Agriculture の現在と可能性

春名聡子
Research Analyst
International Food Policy Research Institute

# IFPRIとCGIAR

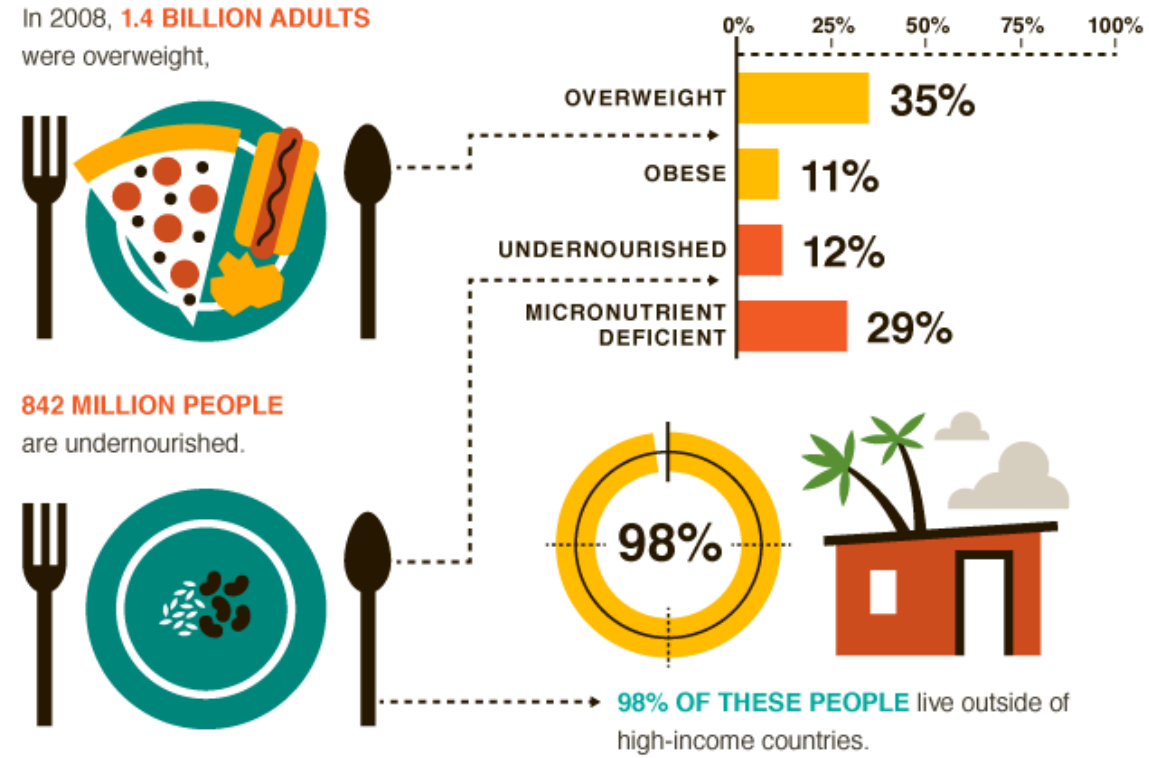
- IFPRI(International Food Policy Research Institute）:途上国の食糧政策の研究機関。スタッフ500人、アフリカアジアに地域オフィス。マクロミクロ経済学、栄養学、政策学、自然科学
- CGIAR(Consultative Group on International Agricultural Research): 食糧安全保障に関する15研究機関（国際機関）のコンソーシアム。マルチドナートラストファンド（理事：世銀)。途上国農業のリサーチ予算の10%
- IFPRIは他CGIAR下の機関と協同で戦略課題に取り組む（e.g. Climate Change, Agriculture and Food Security)。
- トップクラスのリサーチ＋Impact makingへ

RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

CCAFS

# 伸びる食糧需要と広がる栄養の偏り

- 2050年に世界の人口は96億人、食糧需要は+60%（BAU）
- 肥満46%、微量栄養素欠乏12%、栄養不足12%

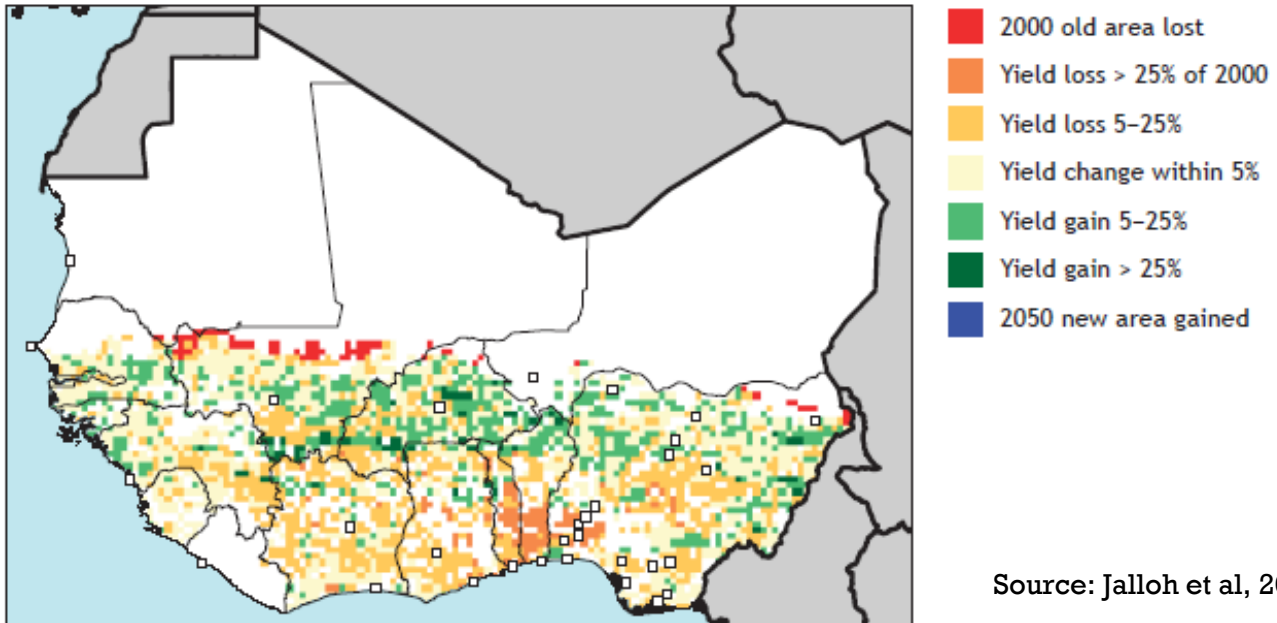



Source: FAO, 2013 ; WHO 2012

# 気候変動のインパクト

- 旱魃、洪水の増加（特に熱帯・低緯度地帯）、異常気象
- 気候帯自体の変化・海面上昇による作付可能地域の変化
- 病虫害
- 異常気象によるロジ・保管時のロス
- 資源紛争（水・土地）、食糧価格上昇
- 脆弱層の農民がさらに脆弱に

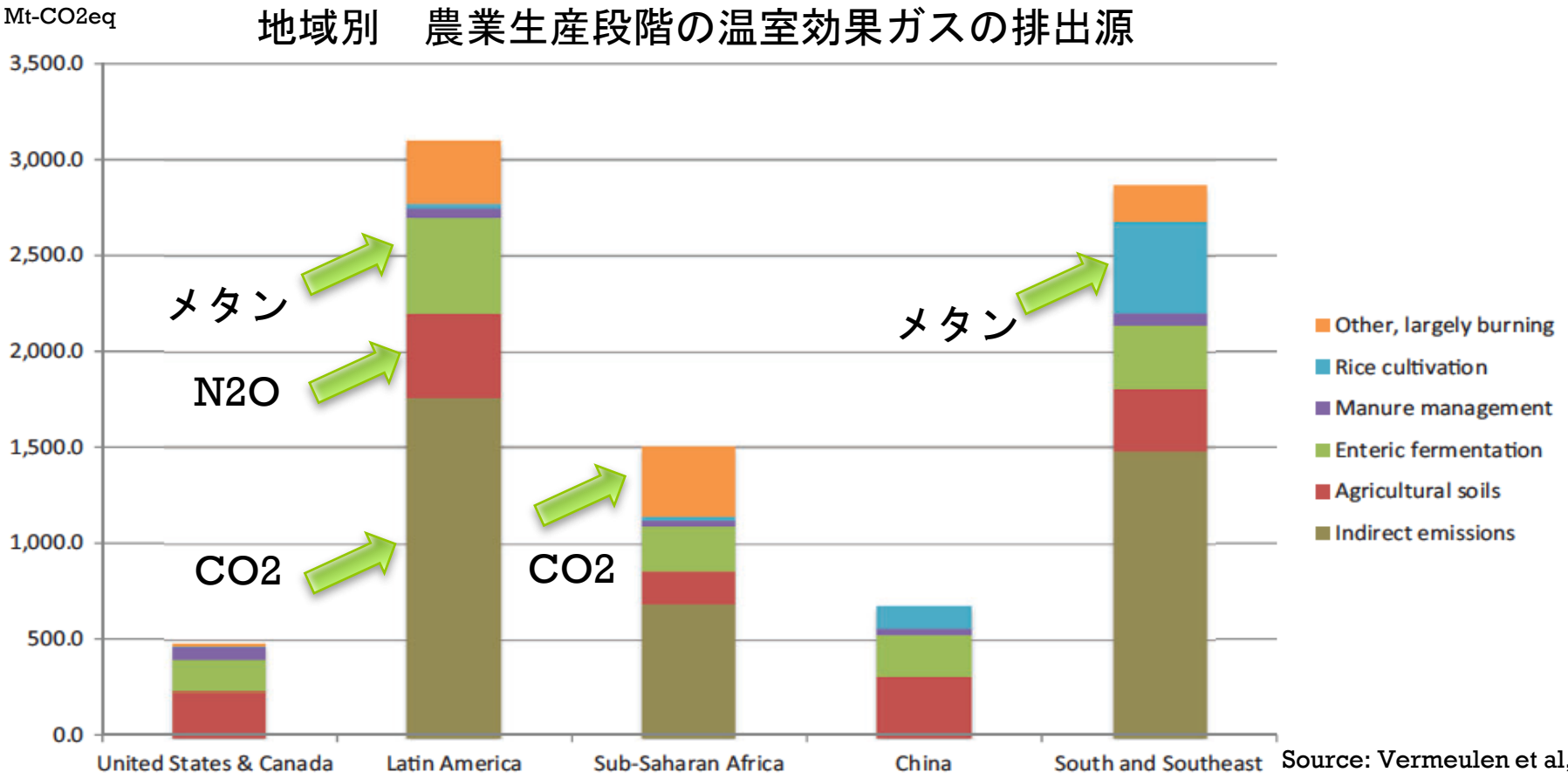
2050年西アフリカのメイズの収穫量変化




Source: Jalloh et al, 2013.

# 農業セクターの温室効果ガス

- 世界の排出量の15–29%
- 土地利用変化(世界の排出量の12-18%)の75%が農業由来
- 80–90%:生産、10-20%:投入物生産・加工・輸送・販売・廃棄




Source: Vermeulen et al, 2013

# 気候変動＝変化・不確定性・資源制約の時代の食糧生産パラダイム？

- 生産高拡大と貧困削減のための
  - 耕地面積拡大、高投入量・技術集約型農業　→　温室効果ガス
  - 単一作物生産　→　脆弱性（環境ストレス）
- 気候変動適応のための
  - 技術集約型農業（e.g.　農業ダム＋大規模灌漑）→　資源競争（水）、温室効果ガス
- 60年代と異なるパッケージとビジョン要

カリフォルニアの水危機

# 課題別のファイナンス・政策フレームワーク

- 農業開発ファイナンス
  - Official Development Assistance (ODA);
  - Foreign Direct Investment;
  - Private domestic sources
  - Funding from charitable foundations, NGOs, and farmer organisations.
- 気候変動ファイナンス
  - The Green Climate Fund
  - Regulated carbon markets such as the Clean Development Mechanism (CDM)
  - National Appropriate Mitigation Actions (NAMAs) and the Adaptation fund of UNFCCC;
  - The Climate Investment Funds administered by multilateral development banks
  - Voluntary carbon markets;
  - Company supply chain standards on climate and eco-certifications, and funding from charitable foundations, NGOs and farmer organisations.

**MITIGATION RECEIVED 95%**

of total global climate finance

**ADAPTATION RECEIVED 5%**

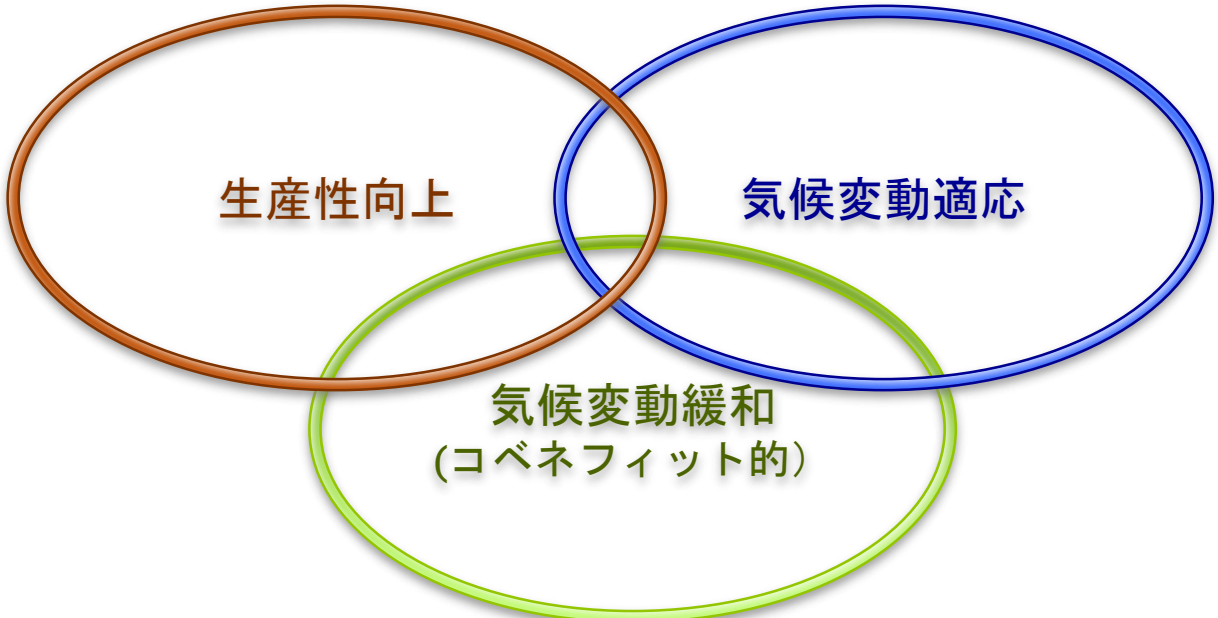
- 気候変動緩和政策
  - Nationally Appropriate Mitigation Actions (NAMAs)
  - Low emissions development plans
- 気候変動適応政策
  - National Adaptation Programmes of Action (NAPAs)
  - National Adaptation Plans (NAPs)
  - Climate change adaptation plans
- 気候変動政策全般
  - climate action plans, and

**82% OF COUNTRIES** had agriculture in their climate change adaptation plans and **38% HAVE INCLUDED** agriculture in NAMAs.


Source: Action Aid, 2011 II Wilkes et al 2013

# Climate Smart Agriculture(CSA)のアプローチ

- 21世紀の（特に途上国～新興国の）農業の主要3課題を解決する統合的フレームワークの構築（資金・政策・技術・実践：食糧安全保障、気候変動適応、気候変動緩和）
- トリプルウィン（気候変動への適応、生産性の向上、温室効果ガスの削減）



# 西アフリカのCSAの例:Zai + stone bund + tree planting

Adaptation

Water retention

Soil conservation

Productivity

100% more Yield

Revenue from crop trees

CO2 emission

C sequestration

# Silvopastoral with Leucaena



**Adaptation**

Water retention

Heat stress management

Soil conservation

**Productivity**

+300% milk yield

+400% weight gain

Productive tree: nutrition

**CO2 emission**

C sequestration

**methane emission**

-25-50% emission

# Agroforestry (banana + coffee)

Adaptation

Water conservation

Heat management

Pest control: coffee leaf rust

Soil conservation

Productivity

+50% Revenue

CO2 emission

+15-30 ton/ha soil sequestration

# Conservation agriculture (mix cropping+reduced tillage+residue)

Adaptation

Water conservation

Heat management

Soil conservation

Productivity

Long term yield improvement

Reduce weeding and tilling cost

Reduce herbicides

CO2 emission

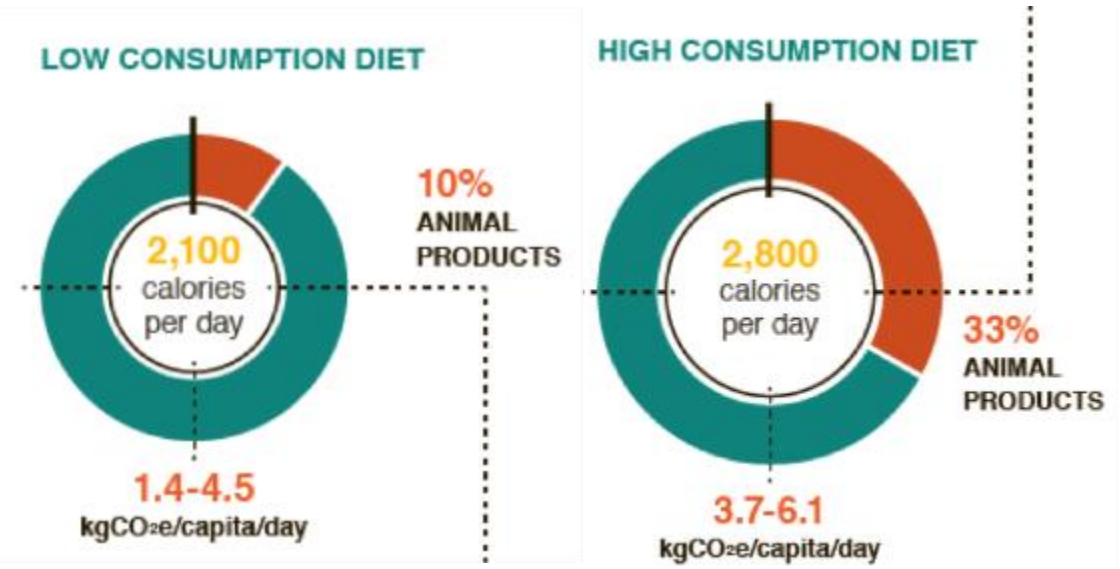
+ SOC

# 他CSAに組み込まれる技術・マネジメントの例（アフリカ）

| CSA-related activities | Main focus areas |
|---|---|
| Soil and water conservation | Crops |
| Breeding of drought-tolerant crop varieties | Crops: maize and small grains |
| Agroforestry | Crops and trees |
| Fodder banks for livestock | Livestock |
| Landscape/forest regeneration | Crops and trees |
| Renewable energy: solar, wind, biogas | Energy |
| Weather index insurance | Crops |
| Livestock improvement programmes | Livestock |
| Rangeland management | Livestock: clearing invasive species and testing grazing regimes such as high-intensity, short-duration rational systems |
| Water-efficient irrigation systems | Crops |
| Water harvesting | Crops and livestock |

# その他CSAで含まれるイシュー

- 食糧ロスの改善（世界の食糧の３分の１）
- エネルギー・生産加工過程
- 土地利用変化
- Climate Smart Eating?
- 土地所有権、ジェンダー、エクイティ




Source: Pradhan et al., 2013

# Climate Smart Agriculture(CSA)の歩み

- 2009年FAO（国連農業食糧機関）による提唱
- 2014年9月、UN Climate SummitでCSA alliance結成
  - 各国政府、NGO、研究機関、国際機関、民間企業が参加
  - ファイナンス（世銀他ドナー）、法的フレームワーク整備（各国政府他）、科学（研究機関他）の3グループ
  - CGIARは科学グループをリード、IFPRIはAfrican Unionの諮問等
  - World Bank: 農業案件の100%をCSAに
- 農業セクターの気候変動対策は今後CSAのフレームワークで進む

CLIMATE SMART

# CSA Alliance メンバー(09/14時点)

- Costa Rica
- France
- Guatemala
- Ireland
- Jamaica
- Japan
- Lithuania
- Mexico
- The Government of the Federal Republic of Nigeria
- Netherlands
- New Zealand
- Norway
- Republic of the Philippines
- Spain
- Sweden
- United Kingdom
- United States of America
- Vietnam (Ministry of Agriculture and Rural Development of the Socialist Republic of Vietnam)
- Switzerland

- Agriculture for Impact
- The Alliance of Religions and Conservation (ARC)
- Asian Farmers' Association for Sustainable Rural Development (AFA)
- Bosongo Community Veterinary and Agricultural project (BOSCOVET)
- CGIAR Consortium
- Colorado State University
- CSA Youth Network
- Eastern Africa Farmers' Federation
- Environment Defence Fund
- Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN)
- GFAR
- Yara International
- Gates Foundation
- Global Donor Platform for Rural Development
- Global Biotechnology Transfer Foundation
- Global Research Alliance on Agricultural Greenhouse Gases (GRA)
- IFDC/VFRC
- Inter-American Institute for Cooperation on Agriculture (IICA)
- International Coffee Organization
- International Fund for Agricultural Development (IFAD)
- Kellogg Company
- McDonald's
- NEPAD Agency
- Rainforest Alliance
- Solutions from the Land
- Southern African Confederation of Agricultural Unions (SACAU)
- SNV the Netherlands Development Organisation
- The Nature Conservancy
- Tropenbos International
- Uganda National Farmers Federation (UNFFE)
- Walmart
- World Agroforestry Centre (ICRAF)
- World Bank
- World Business Council for Sustainable Development (WBCSD)
- World Farmers' Organisation
- World Food Programme (WFP)
- Yara International

# CSAインディケーター（例）

- 既存のプロジェクトを評価し、CSA化を推進

| | CSA Practice | Climate Smartness | Adaptation | Mitigation | Productivity |
|---|---|---|---|---|---|
| Sugarcane 10% harvested area | Efficient management of water ■ Low adoption (<30%) |  | Less water demand, especially in dry season. | No significant benefits. | Greater productivity and stability. |
| | Pest- and disease-resistant varieties ■ High adoption (>60%) |  | Reduced yield loss due to pests and diseases in periods of abiotic stress. | Minor benefits from reduced chemical inputs. | Reduced yield loss. |

Information | Weather | Energy | Nitrogen | Carbon | Water

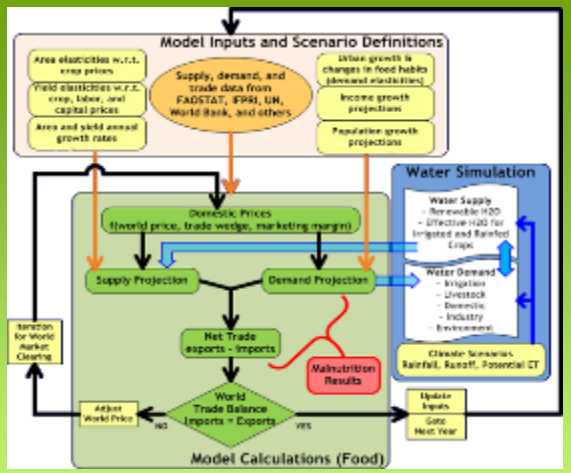
Source: World Bank; CIAT; CATIE, 2014

# CSAのポテンシャル

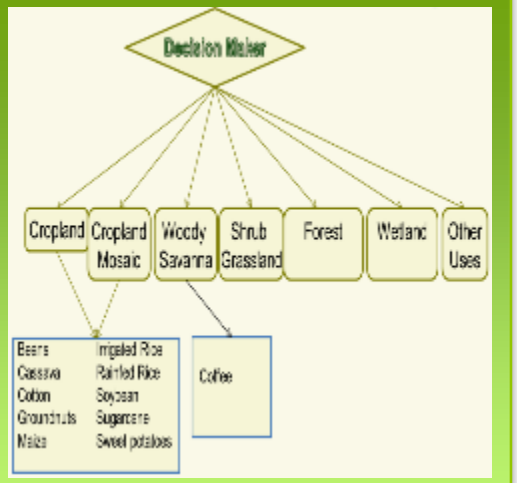
- 現時点ではアップスケールの事例はまだ少ないが
- イシュー横断の効率的・効果的な資金調達と政策実施
- スイートスポット：個別政策実施における相互矛盾を解決
- 国際交渉を待たず、ボランタリーに実践を推進→UNFCCCの交渉に農業セクターを載せる下地作り

# IFPRIの研究例：Low Emission Development project

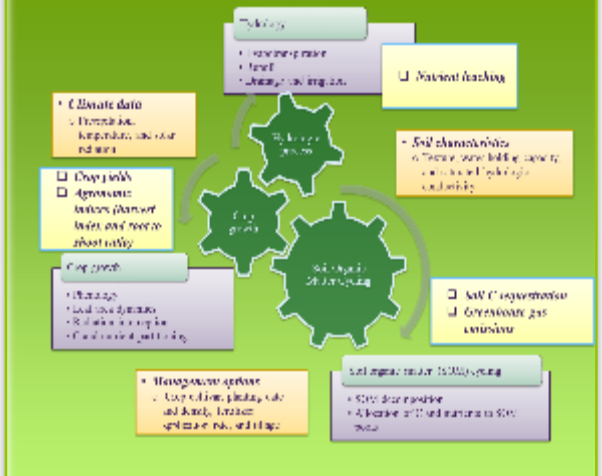
- CSAのフレームの中でも、土地利用変化政策を組み込むための議論はこれから：生産性増・緩和・適応の3目標を土地利用政策内でどう調和させるか　（このプロジェクトではダブルウィンが焦点です）




グローバル部分均衡モデル（食糧生産セクター）



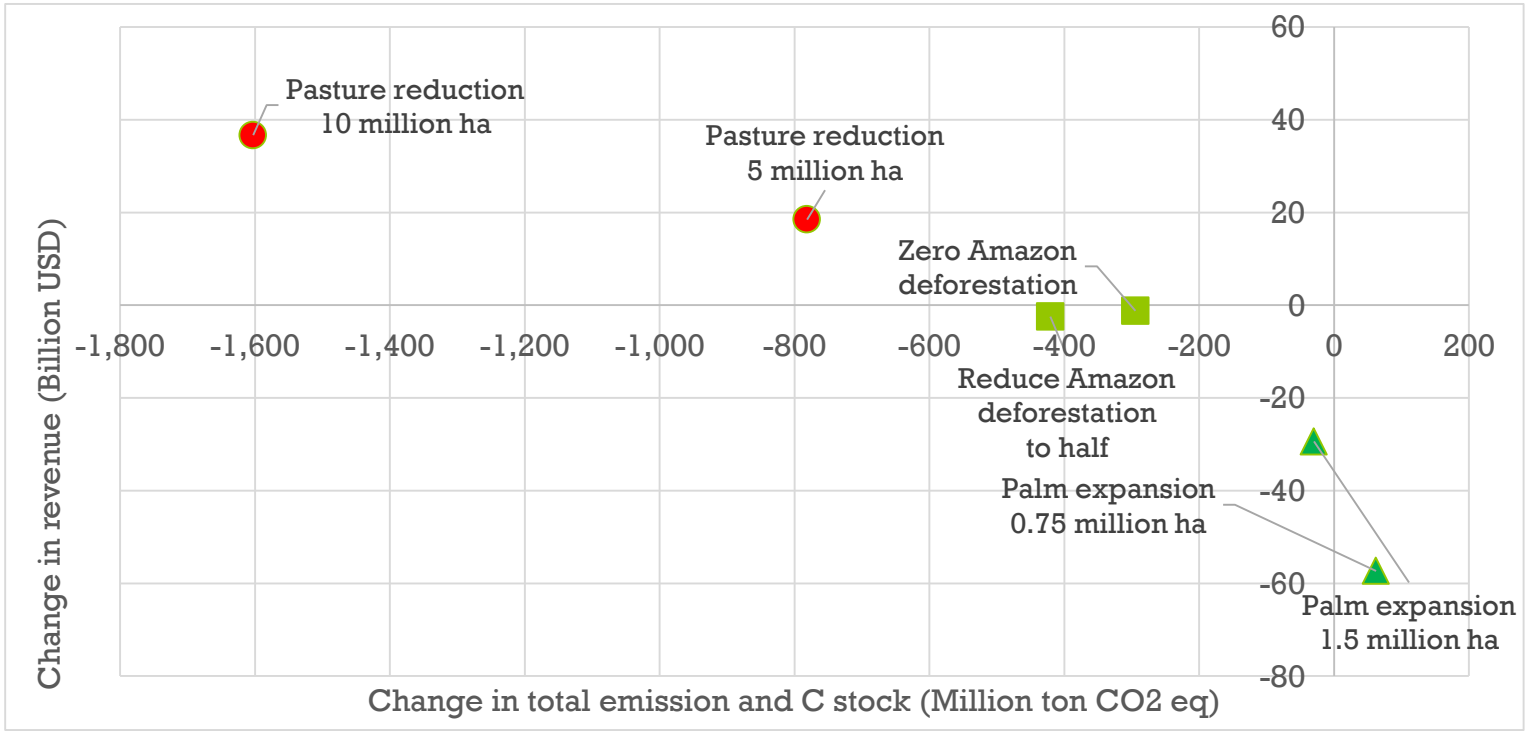

土地利用モデル



クロップモデル

# 政策有効性の将来予測

コロンビア政府のLow emission development　strategyの2030年における政策効果性の予測（農作物・牧畜・森林　分野横断）




- Lessons learned:
  - アップスケールとローカライゼーションの同時実現
  - セクター間コミュニケーション

# Discussion & Questions

**Table 1 Estimates of the relative contributions of different stages of the food chain to global greenhouse gas emissions**

| Stage of food chain[a] | | Emissions ($MtCO_2e$)[b] | Year of estimate | References |
|---|---|---|---|---|
| Preproduction | Fertilizer manufacture | 282–575 | 2007 | 24 |
| | Energy use in animal feed production | 60 | 2005 | 25 |
| | Pesticide production | 3–140 | 2007 | 24 |
| Production | Direct emissions from agriculture | 5,120–6,116 | 2005 | 26 |
| | Indirect emissions from agriculture | 2,198–6,567 | 2008 | Emissions from the supplementary material for Reference 23 combined with proportion due to agriculture from Reference 28 |
| Postproduction[c] | Primary and secondary processing | 192 | 2007 | Calculated from Reference 29 |
| | Storage, packaging, and transport | 396 | 2007 | Calculated from Reference 29 |
| | Refrigeration | 490 | 2004 | 30 |
| | Retail activities | 224 | 2007 | Calculated from Reference 29 |
| | Catering and domestic food management | 160 | 2007 | Calculated from Reference 29 |
| | Waste disposal | 72 | 2007 | Calculated from Reference 29 |

Source: Vermeulen et al, 2013.