Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Quantitative Analysis of Environmental Co-benefits from GHG Mitigation Strategies

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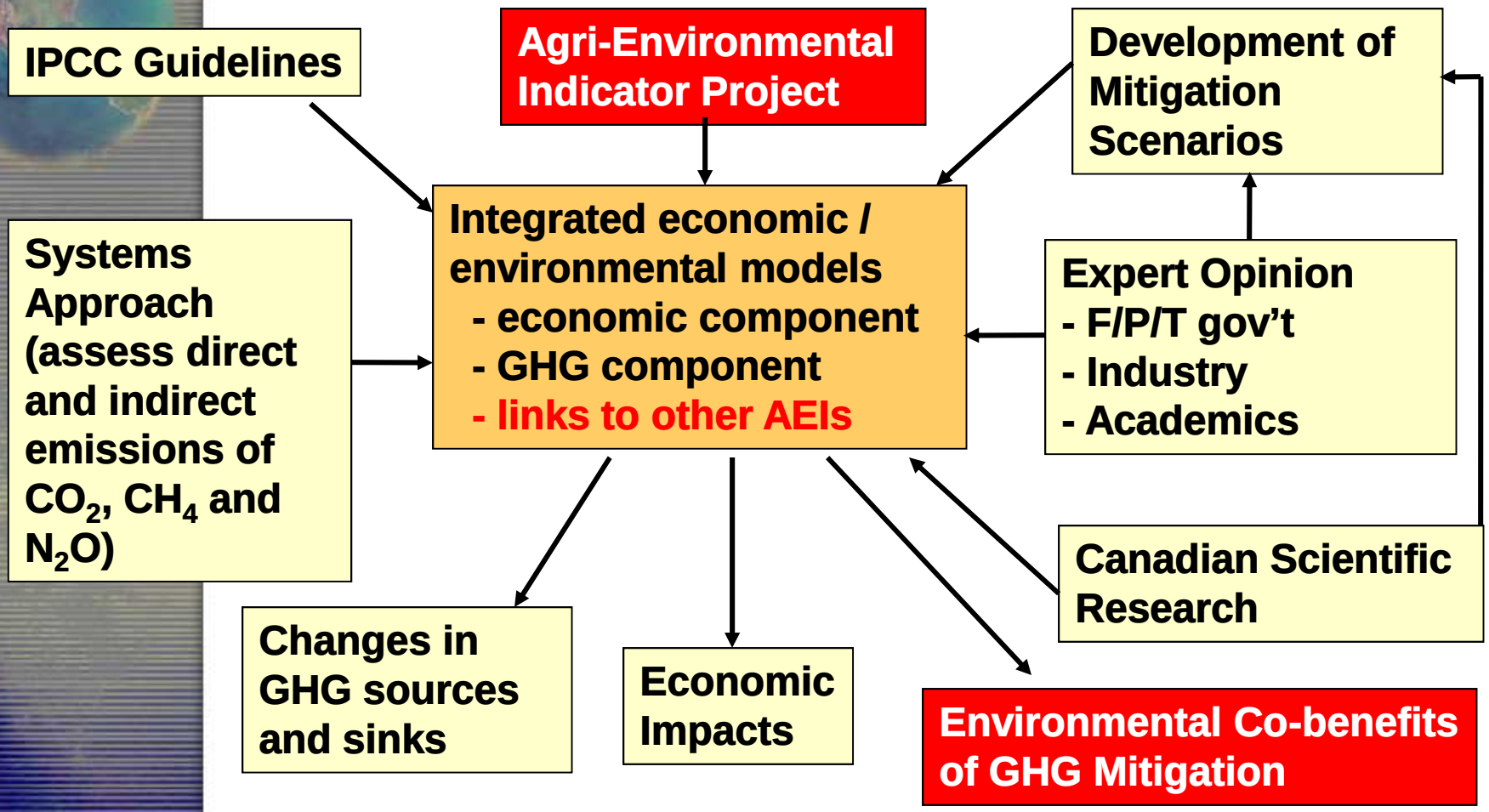
Canada

Outline of Presentation

- Background
- Objectives
- Analytical Framework
- Policy Model
- Agri-Environmental Indicator Models
- Scenario Selection
- Scenario Example
- Summary of Analytical Results
- Future Directions

Integrating Science and Economics for Policy Capacity

Background



Agricultural Policy Framework - Environmental Component

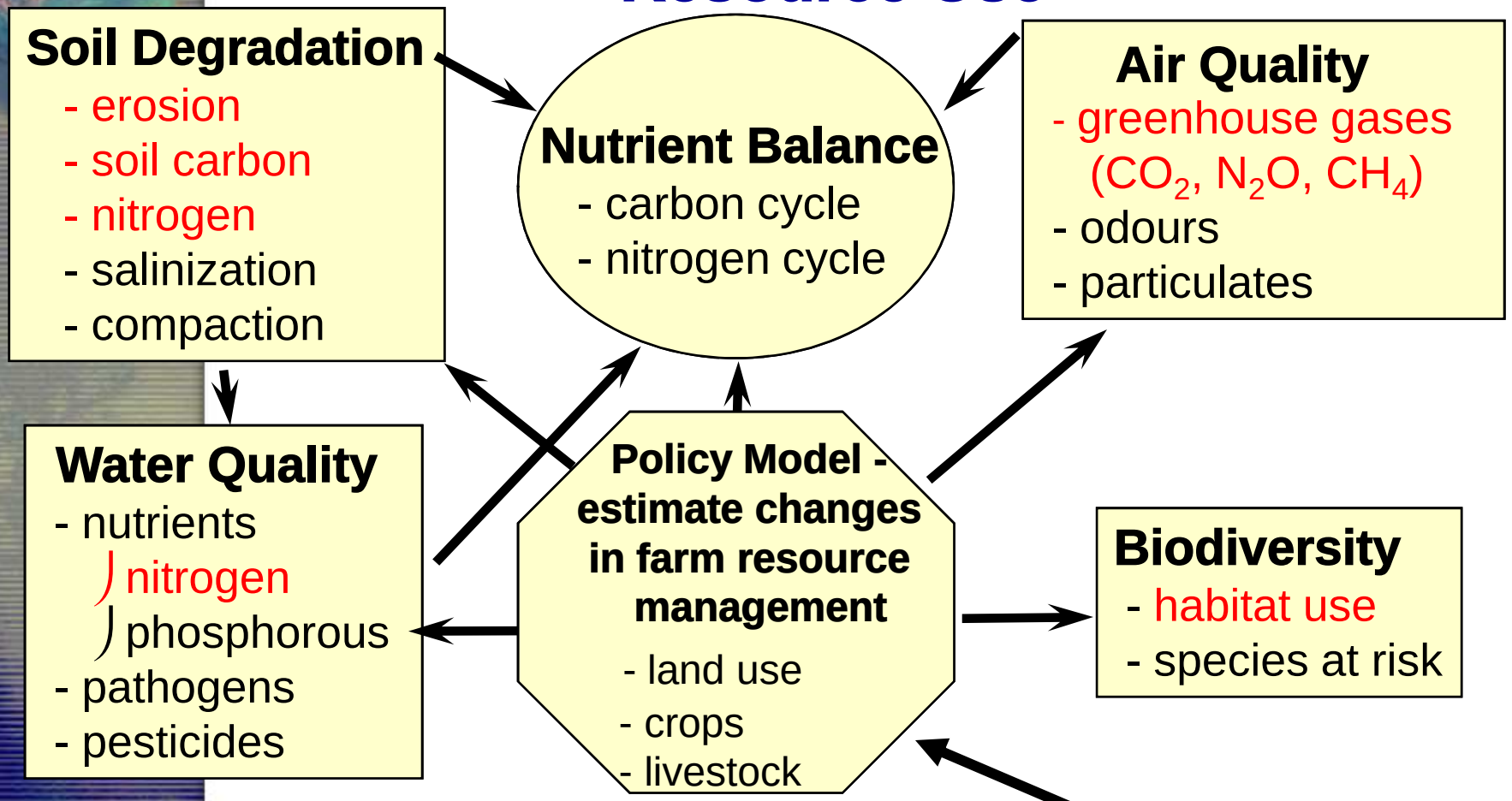
õ **Develop meaningful and measurable environmental and farm management goals**

APF Provincial Environmental Targets

- Federal/Provincial commitment to set specific environmental outcome targets
- Use existing economic and AEI models to quantify expected outcomes
- Provide scientifically based quantitative analysis to assist process of establishing provincial environmental targets under APF
- Determine strengths and weaknesses of prototype for future environmental assessment analysis
- Assess future improvements to model development and analysis

Analytical Framework

Promote Sustainable and Profitable Resource Use



Farm Environmental Planning:
Managing land and water, nutrients, and pests

Policy Model - CRAM

- Static, non-linear optimization model
- Maximizes producer + consumer surplus
- Integrates all sectors of primary agriculture
- Regional supply/demand
- Inter-provincial and international trade
- Government policies/subsidies
- Transportation and handling
- Land is the only resource constraint
- Crop supply response determined by relative profitability of alternative crops

CRAM - Geographic Coverage

Suite of Agri-Environmental Indicators based on AAFC's AEI Report

- Risk of soil erosion from water
- Risk of soil erosion from wind
- Bare soil days
- Risk of water contamination from nitrogen
- Residual Nitrogen
- Greenhouse gases (Sinks and emission reductions)
- Biodiversity in terms of wildlife habitat

Changing activity levels in CRAM in terms of land use, land use management and animal production will affect environmental outcomes

AEIs - Key Drivers

- Soil erosion from water - RUSLEFAC - (crop, tillage, soil)
- Soil erosion from wind - Wind Erosion Equation - (crop, tillage, summerfallow, soil)
- Bare soil days - (crop residue, tillage, snow cover)
- Residual Nitrogen - (crop, N fertilizer, manure)
- Risk of water contamination from nitrogen based on estimate of residual N and precipitation - IROWC-N - (rainfall, residual N)
- Greenhouse gases - (CEEMA) - (CO_2, CH_4, N_2O)
- Biodiversity in terms of wildlife habitat - (land use index)

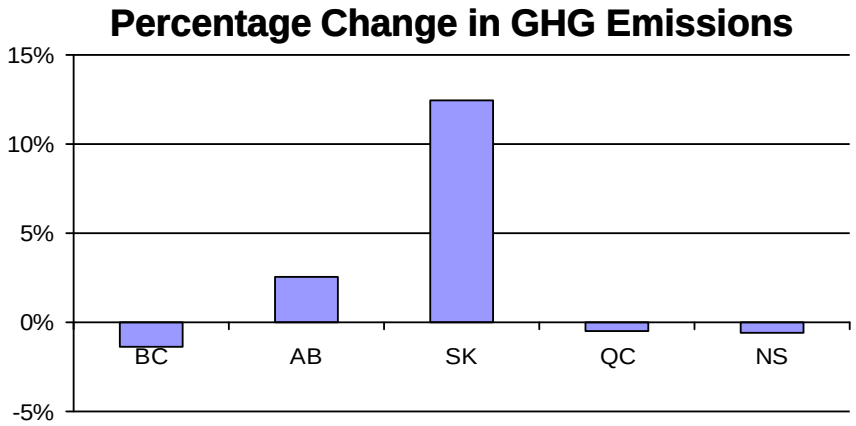
Scenarios Selected for Analysis

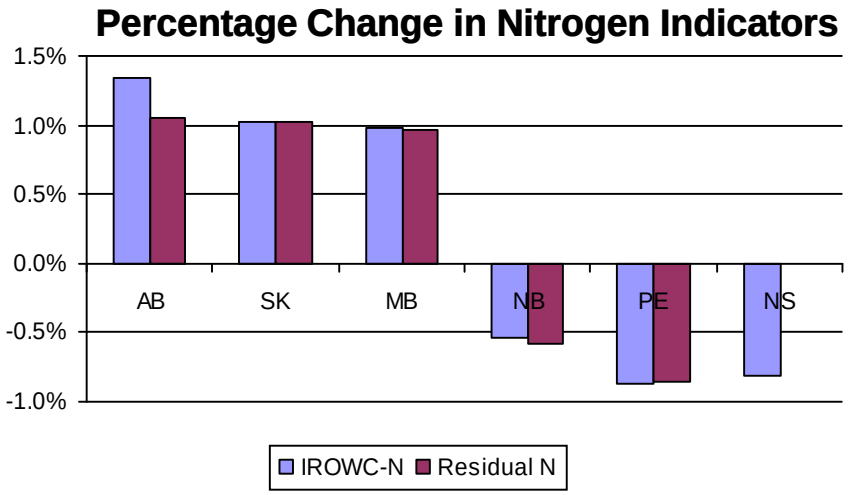
- **Soil Management**
  - ✓ Increased use of conservation tillage
  - ✓ Decreased use of summerfallow
  - ✓ Increased use of forage in rotations
  - ✓ Conversion of marginal land to permanent cover
  - ✓ Increased use of terracing
- **Pasture Management**
  - ✓ Increased use of complimentary and rotational grazing
- **Nutrient Management**
  - ✓ Better management of matching N applied to crop demands
- **Livestock Management**
  - ✓ Improve Management of Protein in Diets
- **Shelterbelts and Plantation Forestry**
  - ✓ Increased use of forestry on marginal agricultural land

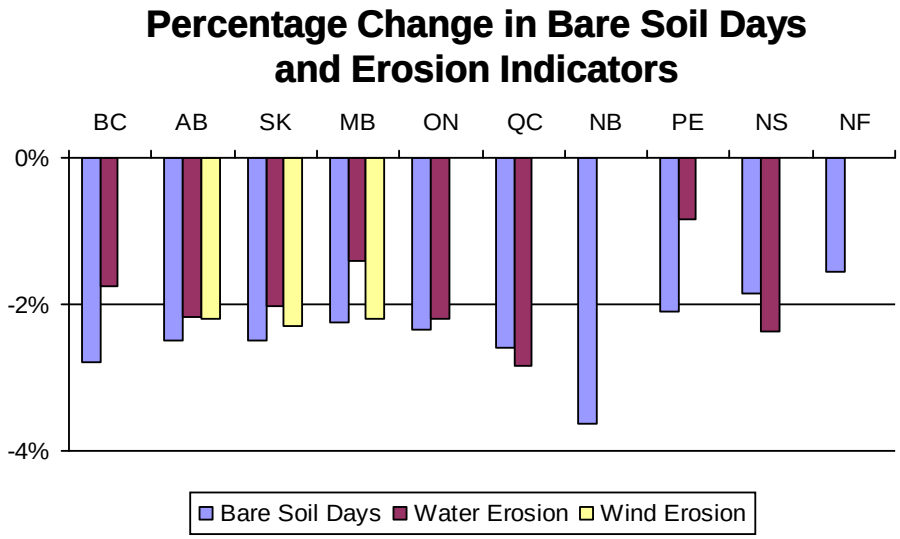
Scenario Example

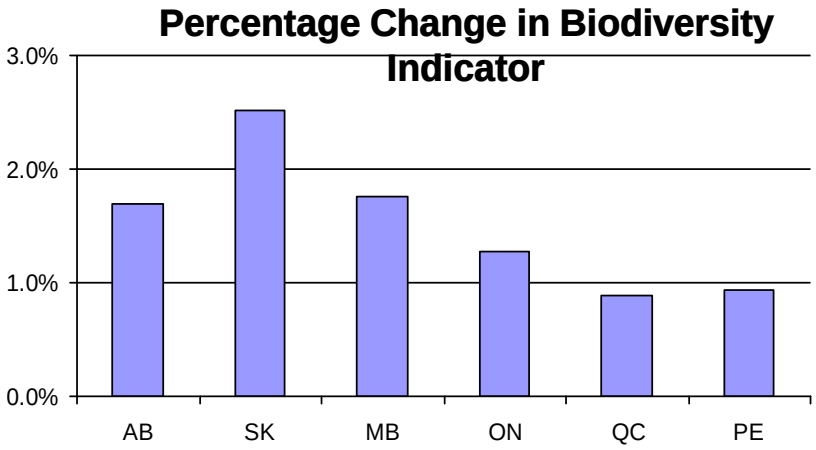
Increase Forage in Crop Rotations

Applicable Regions **All Provinces**

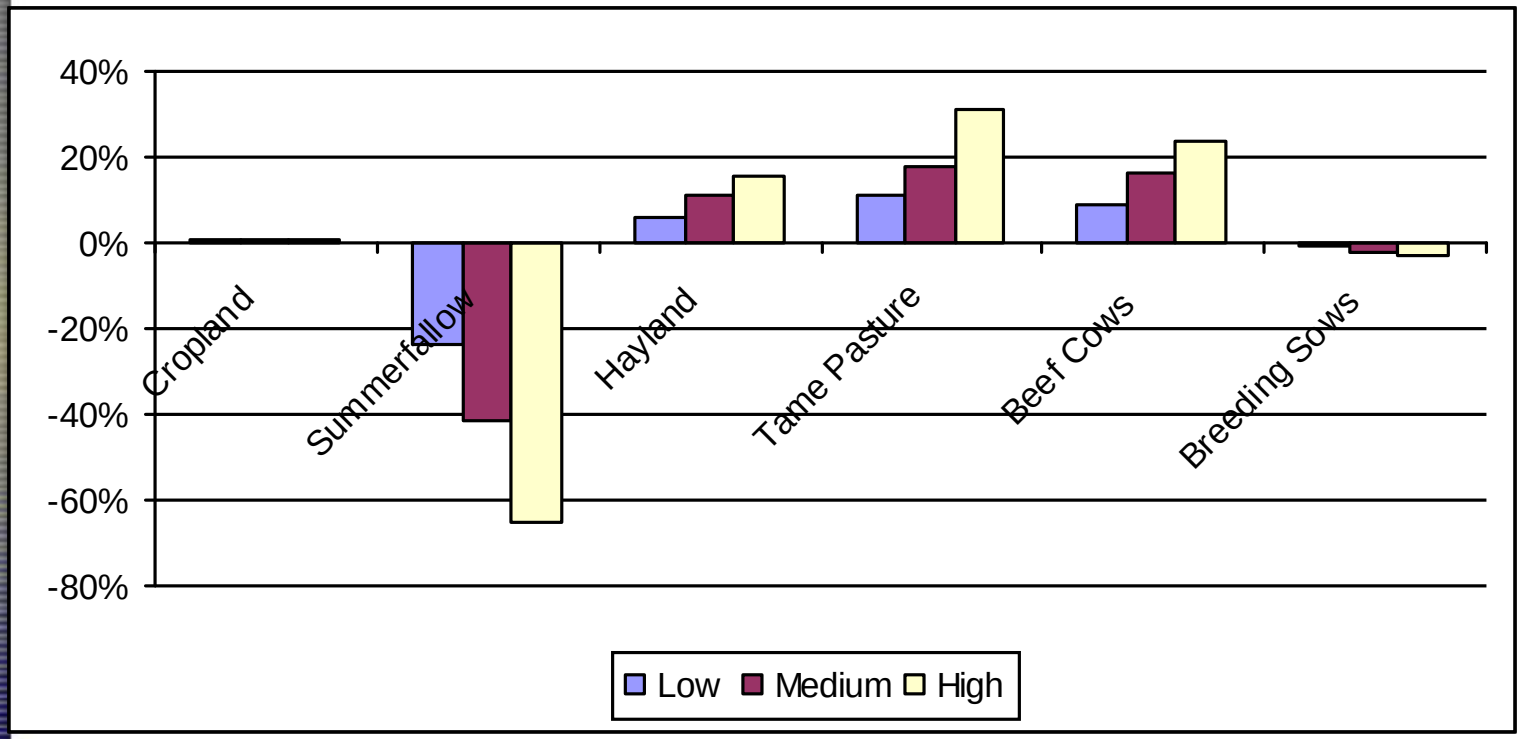




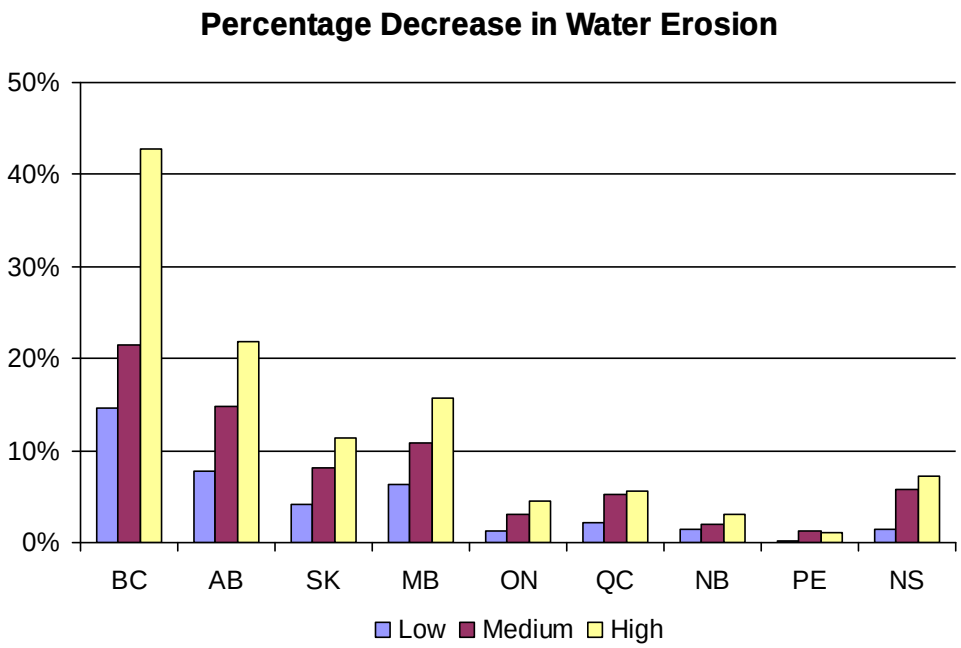


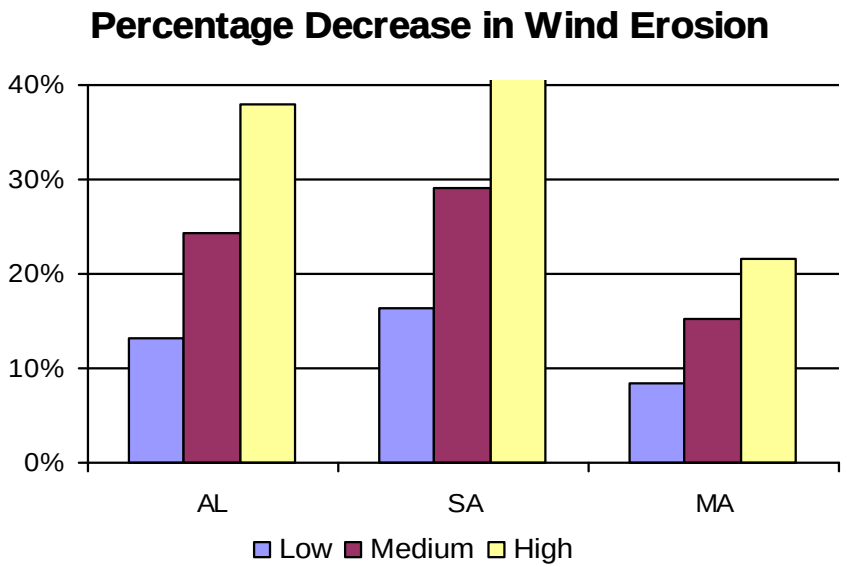


Combined Scenario : National Resource Impacts (from CRAM)

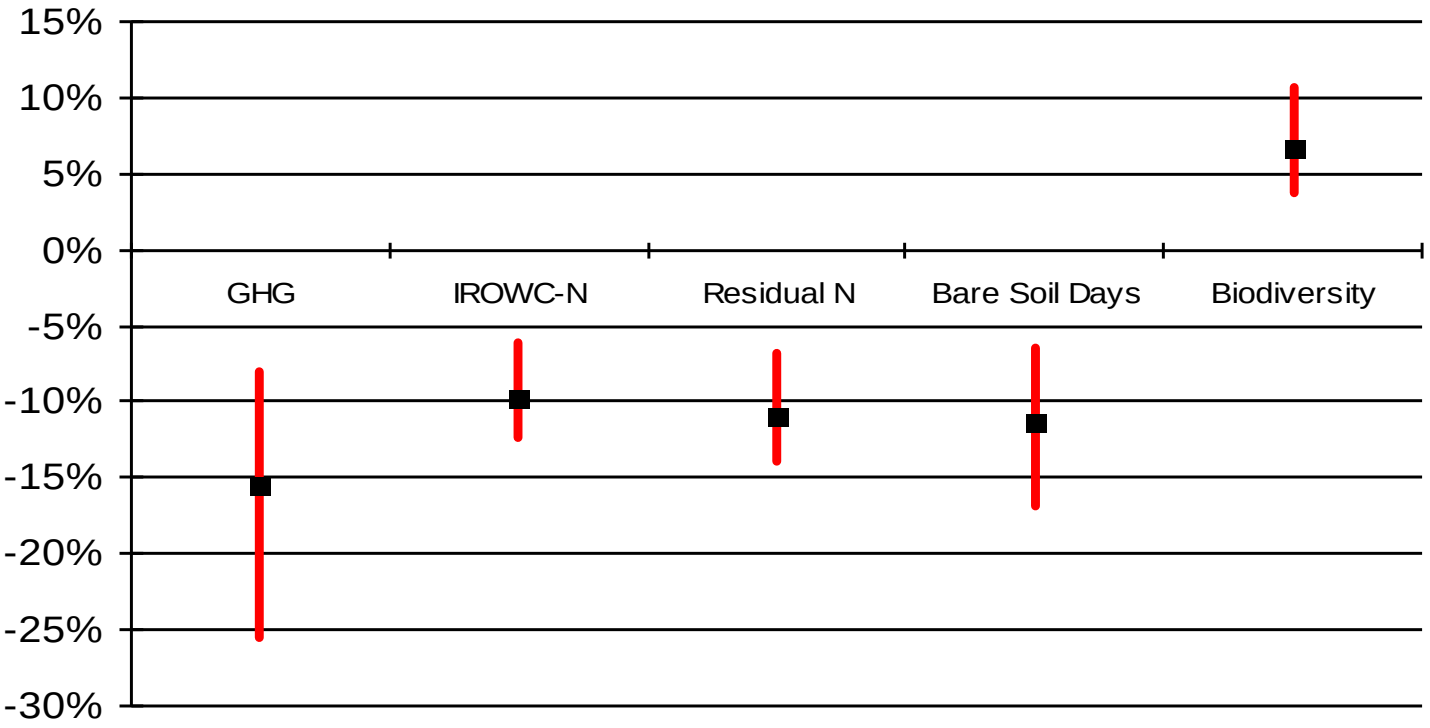


Combined Scenario : Provincial Erosion Impacts





National Summary of the Percentage Change in AEIs from 2008 BAU for Low, Medium and High Adoption Rates



Summary and Limitations

- Demonstrates capacity to predict quantitative impacts of agriculture on the environment
- Increasing demands for policy development and analysis
- Limitations of analytical tools
  - refinement of existing AEIs
  - need for additional AEIs
  - spatial limitations of policy vs. AEI models
  - data gaps
  - economic impacts

National Agri-environmental Health Analysis and Reporting Program (NAHARP)