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Adapting agriculture to climate change in Solomon Islands

Analysing the costs and benefits of options

Introduction

This brief sets out the findings from a cost benefit analysis (CBA) of the options that were considered under a programme to help farmers in Choiseul Province of the Solomon Islands to adapt to climate change by adopting new farming techniques. Climate change is a threat to food security in Choiseul. The Choiseul Integrated Climate Change Programme (CICCP) was implemented by the Pacific Community (SPC) in partnership with the United States Agency for International Development (USAID), and the Solomon Islands Government. The CBA was conducted in 2014 by AECOM Australia for the Pacific-Australia Climate Change Science and Adaptation Planning Program (PACCSAP).

Key Messages

- *Even without the threat of extreme weather events or climate change impacts, communities in the Solomon Islands' western Choiseul Province are experiencing a food security deficit.*
- *The adaptation measures implemented under the CICCP are expected to deliver net benefits in improving food security in Choiseul.*
- *With a benefit cost ratio (BCR) of 5.5, the adoption of contour farming is expected to yield a payoff of SB$5.5 for every dollar invested.*
- *Conservation agriculture is expected to yield a BCR of 3.7, or a return of SB$3.7 for every dollar invested.*

Food security in Choiseul Province

Food security is made up of five pillars: adequacy, availability/access, stability, utilisation, and safety and nutrition (SPC, 2011). Food security is affected by meteorological and climatic and non-climatic risks. The villages in Choiseul Province assisted by the CICCP are relatively food insecure, with inhabitants experiencing a food security deficit estimated to range from 108 to 544 Kcal per person per day on average. To put this into perspective, the WHO-FAO recommended nutritional requirement for the Solomon Islands is 2100 Kcal per person per day. Population growth and changes in weather and climatic risks will exacerbate the food security deficit in Choiseul.

Methodology

Scenarios

- 4 adaptation scenarios, each representing a different method of adapting food production systems to climate change, were considered against a baseline "without adaptation" scenario.
- The baseline scenario assumed that households will:
  - Continue with the same livelihood system; and
  - Continue to be exposed to non-climatic and climatic risks, without any adaptation initiatives.
- Adaptation scenarios considered following adaptation measures (see box on CICCP for details):

1. Engineering based contour farming
2. Vetiver grass (live) contour-based farming;
3. Conservation agriculture only; and
4. Combination of live-contour-based farming and conservation agriculture.

Baseline

- Costs considered under the "without adaptation" scenario include the impacts of climatic and non-climatic risks on food security in Choiseul. Quantified costs include the annual loss in crop output and food security due to:
  - Climatic risks;
  - Population-growth induced crop decline; and
  - Combined climatic and non-climatic risks.

Multiple cropping in Sepa, Choiseul Province, Solomon Islands.

Costs and benefits of the adaptation scenarios

- Benefits quantified include the expected output of traditional crops, and food security, with the adoption of contour-based agroforestry farming system under assumed climate change projections. This is calculated on the assumption that output will double on average in a mixed agroforestry cropping based 50m x 50m farm.
- Costs quantified include:
  - the cost of local labour, design input from contour design specialists, and the SPC-USAID project team required to implement the contour farming measures;
  - the cost of land-clearing, contour marking, obtaining and transporting vetiver grass from the government nursery, and vetiver grass planting;
  - annual maintenance cost for contour hedges; and
  - labour cost of gardening.
- Economic benefits are based on the value of energy content of only key traditional crops regularly cultivated and consumed in Sepa and Loimuni villages in Choiseul, calculated in terms of the energy content of rice.
- Family labour cost is assumed to be equivalent to 50 per cent of the normal wage rate in Choiseul Province.

Assumptions and uncertainties

The values of key parameters used for the study are set out in the table below. Given the uncertainty over the rate of change in climatic and non-climatic risk factors, such as the rate of population growth, sensitivity analysis was also conducted based on plausible alternative values of these parameters.

What does the CICCP do for food security in Solomon Islands?

Increasing the resilience of food production systems to climate change is the CICCP's objective. The programme is designed to achieve this by supporting local communities in implementing specific climate change adaptation initiatives that directly target crop production systems. Risks to food security identified in Choiseul Province include:

- *Climatic risks such as erratic weather patterns, increasing temperatures, altered rainfall patterns, sea level rise, and extreme tides; and*
- *Non-climatic risks including increasing population, pests and diseases, poor farm management practices, logging, coastal pollution, and overharvesting marine resources.*

The four climate change adaptation measures for food production systems in Choiseul considered under the CICCP fall under two broad categories: contour farming, and conservation agriculture.

Contour farming involves planting across a slope along its contour lines, protected by barriers along the contour boundaries to protect against soil erosion. The barriers could either be based on an engineering solution such as stone walls, or could be a live system formed by hedges of soil retaining plants, such as vetiver grass.

Conservation agriculture is based on the maintenance of a permanent or semi-permanent soil cover, such as a live crop or dead mulch, which protects the soil from sun, rain and wind, and feed soil biota. The resulting increased microbial activity and protection of the soil surface helps to promote soil stabilisation and guard against soil erosion.

Results

- Contour farming is expected to yield a benefit cost ratio (BCR) of 5.5, a payoff of SB$5.5 for every dollar invested.
- Conservation agriculture is expected to yield a BCR of 3.7.
- Based on this, contour farming is preferred over conservation agriculture where both options are viable.
- Sensitivity analysis results indicate that the BCR ranges between 2.1 and 6.5, indicating that we can have a high level of confidence that these adaptation measures will yield positive net benefits.

Parameters	Estimated Value	Alternative values
Population growth induced crop yield declines	5%	3%, 10%
Probability of extreme weather event under current conditions	50% flooding – 60% crop loss 40% drought – 50% crop loss	N/A
Probability of extreme climate change event from 2020	50% flooding – 80% crop loss 20% drought – 60% crop loss	N/A
Residual impact with improved agroforestry farming without climate change	10%	N/A
Residual impact with improved agroforestry farming with climate change	25%	N/A
Incremental impact of adaptation initiative	50% increase in crop output	100% increase
Discount rate	5%	3%, 10%

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