



Towards efficient and sustainable food and bio-energy security in Thailand

Agro-economic zoning in support to optimum land use, conservation of natural resources and improved farmers' livelihoods

Context

The agricultural sector is a backbone of the Thai economical development, representing 8 percent of the GDP in 2020 and employing about 12 million farmers. Agricultural production has significantly increased over the period from 1960–1990. However, productivity of most crops has decreased due to the negative impacts of climate change, thereby affecting the livelihoods of people dependent on these systems.

The Government has therefore stressed the need to improve land use planning, increase bio-fuel crops¹ and increase agricultural production through several schemes which aim to provide more secure income to farmers and increasing crop productivity through research and development, technologies, pest and disease resistant varieties, knowledge transfer and a household registration system. The project National Agro-Economic Zoning for Major Crops in Thailand (NAEZ) contributes to strengthening the national food and bio-energy security while conserving the natural resources to improve the economic conditions of the Thai farmers.

Actors and stakeholders

The Office of Agricultural Economics (OAE) and Ministry of Agriculture and Cooperative working with Land Development Department (LDD), Department of Agriculture (DOA), Rice Department (RD), Department of Agricultural Extension (DOAE), National Statistics office and the Bank for Agriculture and Agricultural Cooperatives (BAAC) jointly implemented the project.



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Replicability and upscaling

A standardized data format and a central information website were developed to facilitate data access and knowledge exchange between the various ministries and organizations concerned with the optimum use of land resources.

Objectives

- Support the Government policy under the Alternative Energy Development Plan (AEDP).
- Provide access to the most current, consistent, documented and reliable information on agro-economic suitability of crops, agro-ecological zoning potential, sustainable land management at national level and to high-resolution disaggregated information.
- Strengthened national capacity for addressing issues of land use and land planning and the sustainable management of natural resource use through the establishment of agro-economic zones
- Map the comparative advantage of eight major economic crops and to compare their economic performance with regard to current land use patterns.
- Support the planning, implementation and monitoring of multi-objective land and water management and development activities.

Challenges

- Limited availability of regularly updated, accessible and accurate data for crop related information; limited technical and financial resources.
- Availability of statistical information on production costs and net revenues by soil types and geographic regions would be another to strengthen the reliability of the assessed spatial economic performance of crops.

¹ Government policy under the Alternative Energy Development Plan (AEDP) that has as target to increase the share of alternative energy in the country to 20 percent by 2022

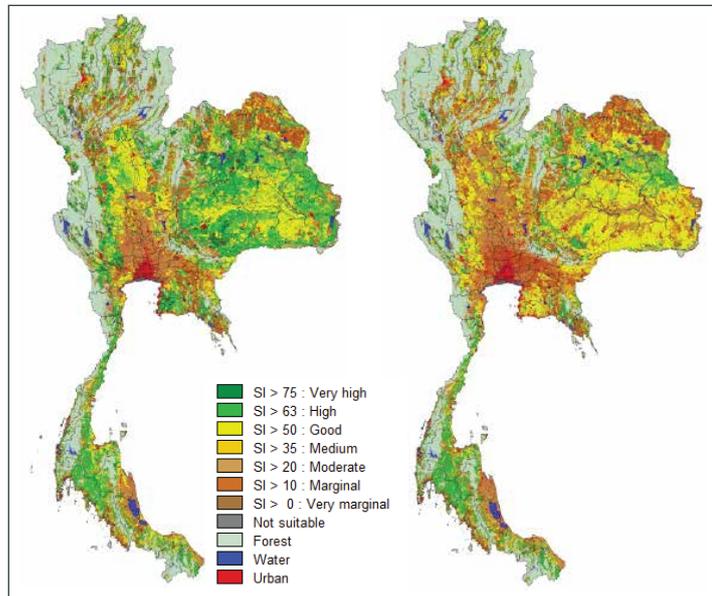
Key results

Reduction of crop suitability and production potential

Based on climate projections of five major climate models, the assessment indicates for future decades a gradual worsening of soil moisture supply to crops under rain-fed conditions. The results show that the annual balance of incoming precipitation to evaporative demand of vegetation (i.e. potential evapotranspiration) is likely to deteriorate by the 2050s (period 2041–2070) and beyond compared to reference period 1981–2010. Results highlight the importance of improved water management and infrastructure and the need to adapt agricultural development, in particular regarding rain-fed agriculture. Safeguarding yields of major economic crops will require supplementary irrigation to be installed. Even with irrigation some negative impacts will likely occur due to the higher temperatures.

While rain-fed maize is expected to have moderately improved conditions, most crops will face negative impacts regarding suitable extents and potential production. For perennial crops, the projected drier future conditions are likely to depress rain-fed yields (e.g. rubber, oil palm) and will reduce extents of suitable areas, especially so in the dryer regions of central and northeast Thailand. Crops occupying narrow ecological niches or requiring cooler conditions for high quality yields (e.g. arabica coffee or sugarcane) will be negatively affected by both warming and drying.

Suitability of rain-fed cassava in 1981–2010 (left) and ensemble mean of RCP6.0 in 2041–2070 (right)



Source: National Agro-Economic Zoning for Major Crops in Thailand (NAEZ), 2017 modified to comply with UN. 2020. Map of the World [online]. [Cited May 2021]

Reduction of crop suitability and production potential

Results were used to map the comparative advantage of eight major economic crops (rice, maize, soybean, cassava, sugarcane, oil palm, rubber and coffee) and to compare their economic performance with regard to current land use patterns as derived from high resolution spatial data. The crop suitability and potential production of the crops giving the highest revenue is expected to generally reduce by about 9.6 and 23.7 percent with and without CO₂ fertilization respectively.

Impact of climate change on crop suitability and potential production

	Reference 1910–2010		Potential production (Δ %), 2050s
	VS+S Mill. Ha	VS+S+MS Mill. Ha	With
Rice	10.1	17.9	-10
Maize	8.9	15.6	8.1
Soybean	5.8	16.7	-1.1
Cassava	8.8	17.5	-19.9
Sugarcane	1.1	11.8	-32
Oil palm	2.6	3.2	-49
Rubber	1.7	2.9	-55
Coffee	0.5	2.4	-97.5
All eight crops*	16.9	19.9	-9.6

Note: VS=very suitable, S=suitable, MS=moderately suitable; * ‘Umbrella’ of crops giving highest net revenue in each grid cell and period

Impact

- This is the first attempt to combine a spatial agro-ecological assessment with economic conditions affecting farmers’ choices of the crops to grow and practices that would increase land productivity and income, even under conditions of projected climate change.
- The agro-economic zonation permits detection of locations where current land use deviates from assessed agro-ecological suitability or produces poor agro-economic results in comparison to best available options.
- NAEZ contributes to the national climate change adaptation plan as well as to redistribution of crop areas to uses most suited to the natural and economic conditions while preserving the land resources and improving farmers’ livelihoods.

Related resources

National Agro-Economic Zoning for Major Crops in Thailand (NAEZ) (Project TCP/THA/3403)

<http://www.fao.org/3/i7077e/i7077e.pdf>

FAO and IIASA. Global Agro Ecological Zones version 4 (GAEZ v4) <http://www.fao.org/gaez/>

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